THE NEW INTERNATIONAL ENCYCLOPÆDIA

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KEY TO PRONUNCIATION.

ā as in ale, fate. Also see ǎ, below.
ȧ " " senate, chaotic. Also see ǎ, below.
â " " glare, care.
ă " " am, at.
ä " " arm, father.
à " " ant, and final *a* in America, armada, etc. In rapid speech this vowel readily becomes more or less obscured and like the neutral vowel or a short u (ŭ).
a " " final, regal, where it is of a neutral or obscure quality.
a " " all, fall.
ē " " eve.
ė " " elate, evade.
ĕ " " end, pet. The characters *ĕ*, *ä*, and *ȧ* are used for *ä* in German, as in Gärtner, Gräfe, Hähnel, to the values of which they are the nearest English vowel sounds. The sound of Swedish *ä* is also indicated by *ĕ*.
ẽ " " fern, her, and as *i* in sir. Also for *ö*, *oe*, in German, as in Göthe, Goethe, Ortel, Oertel, and for *eu* and *oeu* in French, as in Neufchâtel, Crèvecœur; to which it is the nearest English vowel sound.
e " " agency, judgment, where it is of a neutral or obscure quality.
ī " " ice, quiet.
i " " quiescent.
ĭ " " ill, fit.
ō " " old, sober.
ȯ " " obey, sobriety.
ô " " orb, nor.
ŏ " " odd, forest, not.
o " " atom, carol, where it has a neutral or obscure quality.
oi " " oil, boil, and for *eu* in German, as in Feuerbach.
o͞o " " food, fool, and as *u* in rude, rule.
ou " " house, mouse.
ū " " use, mule.
u̇ " " unite.
ŭ " " cut, but.
u̩ " " full, put, or as *oo* in foot, book. Also for *ü* in German, as in München, Müller, and *u* in French, as in Buchez, Budé; to which it is the nearest English vowel sound.
û " " urn, burn.
y " " yet, yield.
B " " the Spanish Habana, Cordoba, where it is like a *v* made with the lips alone, instead of with the teeth and lips.
ch " " chair, cheese.
D as in the Spanish Almodovar, pulgada, where it is nearly like *th* in English then, this.
g " " go, get.
G " " the German Landtag, and *ch* in Feuerbach, buch; where it is a guttural sound made with the back part of the tongue raised toward the soft palate, as in the sound made in clearing the throat.
H as *j* in the Spanish Jijona, *g* in the Spanish gila; where it is a fricative somewhat resembling the sound of *h* in English hue or *y* in yet, but stronger.
hw " *wh* in which.
K " *ch* in the German ich, Albrecht, and *g* in the German Arensberg, Mecklenburg; where it is a fricative sound made between the tongue and the hard palate toward which the tongue is raised. It resembles the sound of *h* in hue, or *y* in yet; or the sound made by beginning to pronounce a *k*, but not completing the stoppage of the breath. The character K is also used to indicate the rough aspirates or fricatives of some of the Oriental languages, as of kh in the word Khan.
n̄ as in sinker, longer.
ng " " sing, long.
N " " the French bon, Bourbon, and *m* in the French Etampes; where it is equivalent to a nasalizing of the preceding vowel. This effect is approximately produced by attempting to pronounce 'onion' without touching the tip of the tongue to the roof of the mouth. The corresponding nasal of Portuguese is also indicated by N, as in the case of São Antão.
sh " " shine, shut.
th " " thrust, thin.
TH " " then, this.
zh as *z* in azure, and *s* in pleasure.

An apostrophe ['] is sometimes used to denote a glide or neutral connecting vowel, as in tā'b'l (table), kăz''m (chasm).

Otherwise than as noted above, the letters used in the respellings for pronunciation are to receive their ordinary English sounds.

When the pronunciation is sufficiently shown by indicating the accented syllables, this is done without respelling; as in the case of very common English words, and words which are so spelled as to insure their correct pronunciation if they are correctly accented. See the article on PRONUNCIATION.

A PARTIAL LIST OF THE LEADING ARTICLES IN VOLUME XVIII.

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TABOO.
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TACTICS.
Major John P. Wisser and Lieutenant-Commander Lewis Sayre Van Duzer.

THE NEW INTERNATIONAL ENCYCLOPÆDIA

SERVICE-BERRY (extended form of *serve*, from Lat. *sorbus*, service-tree; influenced by popular etymology with *service*), *Pyrus Sorbus*. A slow-growing but long-lived tree of the natural order Rosaceæ, native of Europe, Africa, and Asia. It grows about 50 feet tall and bears small pear-shaped fruits, for which it is cultivated in Central and Southern Europe. The



SERVICE-BERRY.

heavy, fine-grained, strong, durable timber, which can be highly polished, is valued for machine-making. In the United States the name is often applied to the shadbush (q.v.). See AMELANCHIER.

SERVICE OF PAPERS AND PROCESS (OF. *servise, service*, Fr. *service*, from Lat. *servitium*, service, servitude, from *servire*, to serve). It is a fundamental principle of law that no final judicial action shall be taken against a person unless he is notified of the proposed steps to be taken against him and given an opportunity to present his side of the matter. This doctrine applies to both civil and criminal proceedings. In some jurisdictions the summons or other primary process is served personally on the defendant, and the subsequent pleadings and other papers in the action are filed with the clerk of the court. This is true generally under the common-law system. Modern codes, however, generally require that each pleading, notice, or other paper relating to the action shall be served upon the attorney for the opposite party or the latter himself, even though they must also be filed.

Criminal process must be served by an authorized person, usually a representative of the sheriff or prosecuting attorney, or an officer of the court. However, in most States, civil process may be served by any person not having an interest in the action, but in a few jurisdictions a private individual must be specially authorized in order to make a valid service.

The time of service of papers is governed by the practice acts and rules of court in each State. Papers or process cannot be served on a day which is strictly a *dies non* (q.v.). However, unless the service of papers on holidays is prohibited by statute, it will be deemed valid. In New York and a few other States service of papers on Saturday upon persons who observe that day as a holy day is prohibited. In the computation of time within which papers must be served Sunday is included, unless it falls on the last day of the time allowed, in which case the next succeeding legal day is added to the time.

Service must be made within the territorial jurisdiction of the court. Where an action is to be commenced against a non-resident, or where a resident of the State leaves it to evade service of process, or secretes himself with like purpose, most jurisdictions provide that service may be made by publication. This is done by order of the court; the summons or other process is published in designated newspapers in the county in which the action is commenced, and also mailed to the defendant's last known address, or tacked on his door if he reside within the county. The plaintiff is usually allowed the alternative of making 'substituted service,' that is, serving the defendant personally without the State. Service by publication, or without the State, will not give a court such jurisdiction as is necessary to support a personal judgment in the sense of obliging courts in other States to give 'faith and credit' to it. However, as a State has jurisdiction over all property within its limits, irrespective of whether it is owned by its own citizens or those of other States, it is held that a judgment obtained after such service will be good as against any property of the defendant within the State.

The requisites of proper service are also governed by the local acts in each State. The most common requirements are that the papers or process be handed to the person intended to be served, and often that their nature or contents be stated to him at the time. If the person thus served throws down the paper, the service is nevertheless complete, and, if he refuses to receive it, it should be laid on his shoulder or laid down in his presence and its nature explained to him, in which cases the service is deemed valid. Some practice acts require that certain judicial papers or orders be read to the person served, or the judge's signature exhibited to him. Where there are several defendants each one must be served individually, but where the action is against a copartnership service on one member is sufficient. Service is made on a corporation by serving one of its officers or a director, or, if it is a foreign corporation, a representative within the State.

Some codes provide that service of the pleadings and other papers after the first process may be made by mail on the attorneys for the respective parties. Ignorance of the effect of service will not avoid the consequence of non-compliance with the contents of the papers or the rules of court. See PLEADING; PROCEDURE.

SERVITES (ML. *servitæ*, from Lat. *servus*, servant, slave). A Roman Catholic monastic Order founded in Florence in 1240 by seven prominent merchants, who desired to advance the glory of the Virgin Mary. It is a contemplative Order, and for a time enjoyed great prosperity. Its rule was based on the Augustinian and was confirmed by Pope Alexander IV. in 1255. In 1288 it had some ten thousand members. In the lifetime of the founders it entered France and Germany, and in the next century Spain; but its introduction into England was not till 1864. Thence in 1870 the Order came into the United States, where in 1902 it had three monasteries with fourteen fathers and eleven lay brothers. Its membership has much decreased, and even in Italy it has now only 40 monasteries. Besides the monks there were nuns of this Order.

SERVITUDE (Lat. *servitudo*, from *servus*, servant, slave). In the Roman law, a right to use property which belongs to another. Servitudes are classified as 'prædial' and 'personal.' The former are annexed to land: the right belongs to the owner of a 'dominant' piece of land, and is exercised over a neighboring 'servient' piece of land. The prædial servitudes are further subdivided into rustic and urban. The former include rights of way and rights of drawing water from or over neighboring land. The urban servitudes are annexed to residential property: they include rights of support from an adjoining building, rights of discharging rainwater on adjoining premises, and restrictions upon the height of neighboring buildings. The prædial servitudes are of unlimited duration.

Personal servitudes are established in favor of a particular person, without reference to his ownership of land, and they may be exercised over immovable property or over movables. They are rights of more or less complete use and enjoyment, regularly limited to a single life. The most important personal servitude is a usufruct.

A very important restriction upon servitudes is that the owner of servient property need not do anything. His duty is confined to inaction or toleration. The only exception is found in the urban servitude of support from an adjoining building. This servitude obliges the owner to keep his building in repair.

Servitudes may be established by contract (accepted grant) or by testament or by judicial decree in a partition suit or by prescription. They may be extinguished by contract (accepted release), and by confusion or merger, when the ownership of the servient property and the special right conferred by the servitude are united in one person. Personal and rustic servitudes may be lost by non-user; urban servitudes are so lost only when the owner of the servient estates prescribes his liberty (see PRESCRIPTION), which means that he must maintain for 10 or 20 years a state of things inconsistent with the servitude.

In modern civil law it is possible to charge periodical payments upon land; but with this exception the modern European doctrine of servitudes is substantially like the Roman.

General restrictions imposed by law upon use of property, especially when in the interest of neighbors, are sometimes called 'legal servitudes.'

The term servitude was also applied to the status of transported laborers marked by temporary loss of liberty due to service obligations under contract. Developed chiefly in English and French seventeenth and eighteenth century colonies, negro, Indian, and white servitude was analogous to recent subject labor in Cuba, South America, South Africa, and Hawaii. For two centuries (1619-1819) in America servitude was an important social institution, serving the economic functions of immigration and a skilled labor supply. Its longest institutional duration was in agricultural Pennsylvania, Maryland, and Virginia, where it supplied high-grade labor a century after slavery replaced it as a general labor supply. Indented or indentured servitude started as a free personal relation based on voluntary contract for a term of service in lieu of transportation and maintenance or profit-sharing between poor British or Continental immigrants and individuals or corporations, like the Virginia Company, importing them. It tended to pass into a property relation (1) in which was recognized only the involuntary and sometimes indefinite service obligation enjoined by law in England or the colonies, or procured by force through the kidnapping of persons in Great Britain, called 'spiriting'; and (2) in which extensive control was asserted over the bodies and liberties of the person during service. The master's right to service of both voluntary and involuntary servants was supposed to be based upon contract, written or oral, in the form of court sentences, act of Assembly, or 'according to the custom of the country.' The status servitude was recognized by statute, as follows: Virginia, 1619; Massachusetts, 1630-36; Maryland, 1637; Connecticut, 1643; Rhode Island, 1647; North Carolina, 1665; Pennsylvania, 1682; Georgia, 1732. Important incidents added by law were: Master's alienation, by gift, sale, or will; rating in assets; seizure for debt; two to seven year additions to time of service, whipping, and fetters for control; consent to marriage, property ownership, trade, and assembly; servant's rights to freedom dues, certificate of freedom, suit and complaint by petition, commutation for punishment, free time, medical attention, and, if white, non-service to colored per-

sons and infidels. Servants ('kids,' 'redemptioners,' 'indented') included younger sons of nobility; political prisoners; religious malcontents; vagrants; convicts; German, Swiss, French, and Dutch peasants; negroes and Indians. Servitude declined as slavery developed; but a white-servant trade lasted until 1819. Consult authorities cited under CIVIL LAW.

SER'VIUS MA'RIUS (or MAURUS), HONORATUS. A Roman grammarian of the fourth century. His most celebrated work is his commentary on Vergil, which is derived largely from the works of earlier scholars, and contains copious notes on Greek and Roman history, religion, and mythology. It is now impossible to determine just how much of the work was prepared by Servius and how much was added by the later transcribers. The commentary was edited by Thilo and Hagen (1881-87). Consult Thomas, *Essai sur Servius* (Paris, 1880).

SESAME, sĕs'ā-mē. See SESAMUM.

SESAMOID BONE (from Gk. *σησαμοειδής, sēsamoeidēs*, like sesame, from *σήσαμον, sēsamon, σησάμη, sēsamē*, sesame + *εἶδος, eidos*, form). A small bone developed in the substance of a tendon near certain joints. In the human subject the patella is the best example. Sesamoid bones are much more abundant in the great majority of mammals than they are in man.

SESAMUM (Lat., from Gk. *σήσαμον, sēsamon*). A genus of about 12 species of African or Indian annual hairy herbs, called sesame, gingili, bene, til, etc., of the natural order Bignoniaceæ, or, according to some botanists, Pedaliaceæ. The species are so similar as to be sometimes reckoned mere varieties of one species, Sesamum indicum. The sweet oleaginous seeds are used in Central Africa for making pudding. In Egypt they are eaten strewed on cake. The bland, long-keeping, fixed oil obtained from them is used as



SESAMUM INDICUM.

a food, like olive oil, and by the women of Egypt as a cosmetic. From ancient times it has been cultivated in India, China, Japan, and many tropical and subtropical countries. It is one of the quickest plants to yield returns. The oil-cake, mixed with honey and preserved citron, is an Oriental luxury. The leaves of Sesamum abound in mucilaginous substance, which they readily impart to water, making a rich bland mucilage, used in the southern parts of the United States as a demulcent drink.

SESHA, shā'shà (Skt. *śēṣa*, remainder, serpent). In Hindu mythology, the king of the serpent race. Vishnu (q.v.) sleeps on him as he floats upon the primeval waters. He has a thousand heads, which serve as a canopy to the god; and he upholds the world, which rests on one of these heads. His yawn causes the earthquake, and by fire which comes from his body the world is destroyed at the end of each kalpa (q.v.).

SESI, or SESI DE LO ALTO. The market name in Havana of an excellent food-fish (*Neomænis*, or *Lutjanus, buccanella*), one of the pargos or snappers. It is prevailingly crimson and orange in color, marked by a jet-black spot at the base of the pectoral fin, whence its other names, 'oreille noire' (black ear) and 'black-fin snapper.' It is known in Martinique as 'buccanelle.'

SESOS'TRIS (Lat., from Gk. *Σέσωστρις*). The Greek name of a king of Egypt whose exploits are related by Herodotus, Diodorus, and other writers of antiquity. According to them the father of Sesostris, having learned by an oracle that his son was destined to attain universal empire, had him educated in all warlike accomplishments along with 1700 Egyptian boys all born on the same day with the prince. On his accession to the throne Sesostris fitted out a great army, officered by his 1700 comrades, and set forth to conquer the world. After conquering Ethiopia and marching to the farthest limits of India, he turned westward, subduing all lands in his progress through Asia, traversed Asia Minor, invaded Europe, and subjugated Scythia and Thrace. On his return to Egypt his brother, who had been Regent in his absence, plotted his destruction, but Sesostris escaped from the snare and punished its contriver. Now master of the known world, he devoted the rest of his reign to improving the condition of his country, and at the same time sought to perpetuate his fame by erecting magnificent buildings inscribed with his name and deeds. He divided Egypt into 36 nomes, constructed an extensive system of canals for irrigating the land, divided the population into castes, and fortified the country against invasion. He became blind in his old age and took his own life. It has long been recognized that Sesostris was not an historical personage. His name is apparently derived from the Egyptian name Senusert (i.e. Usertesen), and it is probable that one of the kings of the Twelfth Dynasty was the original hero of the legend. In later times, however, the boastful inscriptions of Rameses II. (q.v.), inscribed upon the walls of numerous temples, seem to have led to the identification of that monarch with the popular hero. Consult: Wiedemann, *Aegyptische Geschichte* (Gotha, 1884-88); Meyer, *Geschichte des alten Aegyptens* (Berlin, 1887); Sethe, *Sesostris* (Leipzig, 1900); Budge, *A History of Egypt* (New York, 1902).

SESSA AURUNCA, sĕs'sà ou-rŭn'kà. A city in the Province of Caserta, Italy, situated on an extinct volcano, 32 miles north-northwest of Naples (Map: Italy, H 6). It has an ancient cathedral and a seminary. There are ruins of an amphitheatre. The city is famous for its

wine. Other products are olive oil, fruits, grain, and cheese. Many cattle are reared. The ancient Suessa Aurunca became a Roman colony in B.C. 313. Population (commune), in 1881, 19,920; in 1901, 21,844.

SESTERTIUS, sĕs-tĕr'shĭ-ŭs (Lat., two and one-half, from *semi-*, half + *tertius*, third). A Roman coin. When silver coinage was introduced in Rome in B.C. 268 with the copper *as* as a unit, the silver *sestertius* was valued at 2½ *asses*. The standard *as* now weighed only one-fourth of its original weight; hence the *sestertius* was equivalent to the original libral *as;* and as accounts had formerly been made in terms of the libral *as*, so now they were made in terms of *sestertii*. After the end of the First Punic War (B.C. 241), however, the *sestertius* ceased to be coined. The weight of the *as* was many times reduced, and the *denarius* was made equal to 16 *asses*. With the reorganization of the coinage under Augustus a copper *sestertius* of four *asses* was coined under the control of the senate, equal to about 4 cents of our money. Sums of money were counted in *sestertii*, and large sums in *sestertia*, or thousands of *sestertii;* thus 10 *sestertia* equal 10,000 *sestertii*.

SES'TIUS, PUBLIUS. A Roman patrician, quæstor in B.C. 63. In that year he assisted Cicero in the suppression of Catiline's conspiracy, and in 57, as tribune, helped recall Cicero from exile. Through Albinovanus he was accused by his enemy Clodius in 56 of using illegal force during his tribunate. From this charge he was defended by Hortensius and Crassus, and by Cicero (whose speech is extant, urging the critical condition of the Republic as an excuse for his client), and was acquitted largely through the influence of Pompey. Sestius was prætor in 53. He sided with Pompey at the beginning of the Civil War, but afterwards joined Cæsar.

SES'TO, CESARE DA (c.1480-c.1521). A Lombard painter, known also as Milanese. He was born at Sesto Calende and became one of the best pupils of Leonardo da Vinci. Afterwards he fell under the influence of Raphael in Rome, and his work became eclectic and enfeebled. His pictures have not all been perfectly authenticated on account of his imitation of the two masters named. His, however, are thought to be the "Madonna of the Laurel Tree" (Brera), "The Adoration of the Magi" (Naples), and "The Madonna of the Girdle" (1521, Vatican).

SESTO FIORENTINO, fē-ō'rĕn-tē'nō. A town in the Province of Florence, Italy, five miles north-northwest of Florence (Map: Italy, F 4). The products of the district are fruit and grain, and there are manufactures of wine, straw hats, and perfumery. Population (commune), in 1881, 14,324; in 1901, 18,594. Near by is the village of Doccia, with a large porcelain factory.

SESTRI LEVANTE, sĕs'trē lā-vän'tā. A seaport in the Province of Genoa, Italy, 30 miles by rail southeast of Genoa (Map: Italy, D 3). It is a sea-bathing resort, and has an old castle, anchovy and oyster fisheries, and manufactures of lime and olive oil. Population (commune), in 1901, 12,039.

SESTRI PONENTE, pō-nĕn'tā. A seaport in the Province of Genoa, Italy, five miles by rail west of Genoa (Map: Italy, C 3). It has fine villas, a technical school, and a music school. It manufactures machinery, matches, and tobacco, and carries on shipbuilding. Population (commune), in 1881, 10,872; in 1901, 17,187.

SET (Gk. Σήθ, *Sēth*). An Egyptian deity, the son of Seb and Nut, and the brother of Osiris, Isis, and Nephthys, the latter being his wife. In the legend he endeavors to thwart the beneficent plans of Osiris, and failing in this, treacherously murders him. So implacable is his hatred that he even persecutes his brother's body, tearing it into pieces and scattering them far and wide. But Horus, the son of Osiris and Isis, is safely guarded by his mother from the evil designs of Set, and on attaining maturity he takes vengeance for his father's murder. According to the popular conception Set was the personification of evil and of darkness; hence he was the god of the inhospitable desert and of foreign countries hostile to Egypt. His sacred animals were the crocodile, the hippopotamus, and the ass, especially the latter. But Set was not always regarded as an evil deity. At Tanis, for example, he was held to be the solar deity who pierced with his lance the Apep serpent, and he was called 'the beloved of Re;' and at Ombos, where he was worshiped in very early times, he was revered as lord of the South and was occasionally identified with the crocodile god Sobk (q.v.). By the Greeks Set was called Typhon (q.v.), and was identified with the giant of that name. Consult: Meyer, *Set-Typhon* (Leipzig, 1875); Brugsch, *Religion und Mythologie der alten Aegypter* (Leipzig, 1888-90); Wiedemann, *Religion of the Ancient Egyptians* (trans., New York, 1897).

SET'EBOS. The god worshiped by Sycorax and her son Caliban in Shakespeare's *Tempest*, a Patagonian deity described in the account of Magellan's voyage in Eden's *History of Travayle* (1577). Browning analyzes Caliban's attitude toward him in "Caliban upon Setebos."

SETH, ANDREW. A Scotch philosopher. See PRINGLE-PATTISON, ANDREW SETH.

SETH, JAMES (1860—). A Scotch philosopher, brother of Andrew Seth Pringle-Pattison, born in Edinburgh and educated there and at Leipzig, Jena, and Berlin. He was assistant to Campbell Fraser in logic and metaphysics at Edinburgh (1883-85), professor in Dalhousie College, Halifax, N. S. (1886-92), in Brown University (1892-96), and in Cornell University until 1898, when he was elected professor of moral philosophy at Edinburgh. He wrote *A Study of Ethical Principles* (1894; 6th ed. 1902), and with Calderwood revised Fleming's *Vocabulary of Philosophy*.

SETHITES. The name given to an obscure Gnostic sect of the second century allied to the Ophites (q.v.); they belonged to that class of religionists who, in evolving their system, approached paganism. Accepting the Christian mode of thought and its terminology, they misunderstood the great facts of Scripture history and maintained that Seth, the first son of Adam after the expulsion from Eden, had been the ancestor of all the Old Testament saints and their own progenitor; in the person of Jesus he had again appeared in the world in miraculous manner to help his followers. They had a book bearing the name of Seth. See GNOSTICISM.

SETI, sā'tī (Gk. Σέθως, *Sethōs*, Egypt. *Setoy*). The name of two Egyptian kings of the Nineteenth Dynasty.—Seti I., the second King of this dynasty, was the son and successor of Rameses I. (q.v.), and reigned for some 10 years from about B.C. 1350. In the first year of his reign he made an effort to recover some of the Syrian possessions of Egypt which had been lost during the internal dissensions which marked the close of the Eighteenth Dynasty. Clearing the way by defeating the Bedouin tribes of the Sinaitic peninsula, he marched through the country as far as the northern border of Palestine, ravaging and plundering as he went. Here, however, he came in contact with the Hittite forces, and, though he claims a victory, his progress seems to have been effectually checked. On his return to Egypt he proceeded in triumph up the Nile, and later caused his exploits to be represented in sculpture on the walls of the great temple of Karnak. He also caused lists of the countries and cities which he claimed to have conquered to be inscribed upon his buildings and monuments in Egypt and Nubia. Later in his reign Seti successfully defended his western frontier against the Libyans. Among the many buildings erected by this monarch during his brief reign the most important are the Memnonium (q.v.) at Abydos, the memorial temple at Kurnah (q.v.), and the great hypostyle hall at Karnak (q.v.), which was completed by his son Rameses II. Seti's magnificent tomb in the Valley of the Kings, near Thebes, was discovered in 1817 by Belzoni, and is commonly called 'Belzoni's tomb.' It is nearly 350 feet long and consists of a number of halls, corridors, and chambers hewn out of the solid rock. The mummy of the King was found in 1881 at Deir-el-Bahri.—Seti II., the son of Meneptah (q.v.), was the fourth and last King of the Nineteenth Dynasty. He built a small temple at Karnak and caused his name to be inscribed upon the monuments of his predecessors in many parts of Egypt, but little is known of his reign. The celebrated Orbiney Papyrus, containing the well-known *Tale of the Two Brothers* (see Egypt), has a note stating that the manuscript was a copy prepared for the use of this prince. His mummy was found in 1898 in the tomb of Amenophis II. Consult: Wiedemann, *Aegyptische Geschichte* (Gotha, 1884-88); Budge, *A History of Egypt* (New York, 1902); Müller, *Die alten Aegypter als Krieger und Eroberer in Asien* (Leipzig, 1903).

SETO, sā'tō. A small village on the island of Hondo, Japan, situated about 15 miles from Nagoya. It is noted for its manufactures of porcelain, which are among the finest produced in Japan, and are known, like all similar Japanese pottery, as Seto ware. There are also a number of famous potteries in the vicinity.

SET-OFF. A claim which is due from a plaintiff to a defendant in an action, and which the latter is allowed to interpose as total or partial defense to the plaintiff's demands, and which may result in a judgment in favor of the defendant. The doctrine originated in equity practice and was not known to the common-law courts until the statute of 2 Geo. II., ch. 22, which provided that a defendant might reduce or defeat a plaintiff's demands by proving a just claim in his favor against the latter. The provisions of the above statute have been substantially followed in most of the United States.

The law authorizing a set-off to be pleaded is permissive and not mandatory, and it is, therefore, optional with a defendant as to whether he will exercise the right or reserve his claim for a separate action. A set-off is only permitted in actions arising out of contracts, and is limited to liquidated demands, or those which can be reduced to a certain amount merely by computation. Therefore a claim in tort, as for malicious prosecution, cannot be a set-off in an action, as it is necessarily unliquidated, and the amount of damages must rest in the discretion of the jury. At common law a set-off must be based upon a distinct claim. In most jurisdictions the claims must be mutual in order to allow a set-off, that is, they must be confined solely to the original parties to the action. However, in some States a claim existing in favor of defendant and another against the plaintiff may be a set-off against the latter's claims to the extent of defendant's interest, but an affirmative judgment cannot be obtained.

The facts constituting defendant's claim to a set-off must be specially pleaded with as much clearness as if they were the basis of an independent action. The jurisdiction of a court of equity to grant a set-off is independent of statutes. Consult: Waterman, *Law of Recoupment, Set-off, and Counter-claim* (New York, 1872); Barbour, *Law of Set-off* (Albany, 1841). See Pleading.

SETON, Elizabeth Ann (1774-1821). The founder of the Sisters of Charity in the United States. She was the daughter of Richard Bayley, and was born in New York City. She married William Seton (1794), accompanied him to Italy in 1803, and on his death at Pisa returned to New York and became a Roman Catholic in 1805. In 1809 with three others she established at Emmitsburg, Md., the first house of what afterwards grew to a widespread community. (See Brothers and Sisters of Charity.) She was elected the first superior of the Order and held that office until her death at Emmitsburg. Consult her autobiography (Elizabethtown, N. J., 1817); her *Life* by C. I. White (New York, 1853; 7th ed., Baltimore, 1872); and her memoirs, letters, and papers, edited by Mgr. R. Seton (New York, 1869).

SETON, Ernest Thompson (1860—). An American author and illustrator, born at Shields, England. He was educated at Toronto Collegiate Institute, and at the Royal Academy, London, England, and in 1891 served as naturalist to the Government of Manitoba. He became widely known through his cleverly written magazine stories about animals, based, according to his assertions, upon natural history as observed by himself, or obtained from what he considered trustworthy sources. This natural history, expressed or implied, has been sharply criticised by such veteran naturalists as John Burroughs (q.v.), and by experienced woodsmen, who say that Seton ascribes to animals mental and moral characteristics that are not evinced in real life, and that to this extent his stories are misleading. On the other hand, it may be said that they have served to stimulate interest in natural history, and to arouse sympathy for, and a desire to protect, the creatures of the woods and fields.

Most of Seton's works are illustrated by himself, usually with a fair degree of faithfulness to nature. His publications include: *Art Anatomy of Animals* (1896); *Wild Animals I Have Known* (1898); *The Trail of the Sandhill Stag* (1899); *The Biography of a Grizzly* (1900); *Lobo, Rag, and Vixen* (1900); *Lives of the Hunted* (1900); *Pictures of Wild Animals* (1901); *Krag and Johnny Bear* (1902); and *Two Little Savages* (1903).

SETON, ROBERT (1839—). An American Roman Catholic prelate. He was born (of American parents) at Pisa, Italy, and was educated at first privately in the United States, making his theological studies at Mount Saint Mary's College and in Rome. He entered the priesthood and was made private chamberlain to the Pope in 1866 and prothonotary apostolic a year later. His most important pastoral charge was Saint Joseph's Church, Jersey City, which he held from 1876 to the beginning of 1902, when he resigned it on account of advancing age. He then went to Rome, and was named titular Archbishop of Heliopolis in June, 1903. He was widely known as a public speaker and writer. Among his works are a memoir (1869) of his grandmother, Elizabeth Ann Seton (q.v.); *Essays on Various Subjects, Chiefly Roman* (1882).

SETON HALL COLLEGE. A Roman Catholic institution founded at Madison, N. J., in 1856 and removed to its present location in South Orange in 1860. The courses are classical and scientific and lead to the degrees of B.A. and B.S. The college had in 1902 144 students with 25 instructors and a library of 40,000 volumes. The college property embraces about 70 acres of land, with excellent buildings. The income in 1902 was $36,000.

SETTEMBRINI, sĕt'tĕm-brē'nē, LUIGI (1813-76). An Italian littérateur and patriot, born in Naples. He took an active part in the agitations of the Two Sicilies and was compelled to flee to Malta in 1847. He returned to Naples during the revolution of 1848, was imprisoned the following year and condemned to perpetual exile, but escaped to England. After the unification of Italy he returned to his native city and became professor of Italian literature at its university. His principal work was *Lezioni di letteratura italiana* (1867; many subsequent editions).

SETTER. A dog. See FIELD DOGS and Plate of DOGS.

SETTIGNANO, sĕt'tē-nyä'nō, DESIDERIO DA. See DESIDERIO DA SETTIGNANO.

SETTLE, ELKANAH (1648-1724). An English playwright, born at Dunstable. In 1666 he entered Trinity College, Oxford, which he left without a degree, and went to London to seek a living by his pen. In 1671 or earlier he made something of a hit by the production of his tragedy of *Cambyses;* and the Earl of Rochester and others, wishing to annoy Dryden, loudly proclaimed Settle the better dramatist. Through the influence of Rochester, Settle's next tragedy, *The Empress of Morocco,* was played at Whitehall by the lords and ladies of the Court (1671). In this way a great run was secured for it when it came before the general public (1673). Dryden was stung by the comparison between himself and Settle and a war of pamphlets followed. Solely because of this quarrel is Settle now remembered. In his great satire, *Absalom and Achitophel* (1682), Dryden scourged him severely under the name of Doeg. Settle at once replied with *Absalom Senior* (1682). After writing several bombastic tragedies Settle relapsed into obscurity. Having the post of poet laureate for the city of London, he continued for a time to compose pageants and pieces for Bartholomew fair. His last years were passed as a poor brother in the Charterhouse.

SETTLED ESTATE (from AS. *sahtlian,* to reconcile, from *saht,* reconciliation, settlement of a lawsuit, from *sacan,* to sue at law, fight, contend, Goth. *sakan,* OHG. *sahhan,* to contend, rebuke). An estate which is less than absolute ownership, and which is one of several estates created in the same property, all of which are governed as to duration and manner of enjoyment by one will or deed of settlement. The most common example is an estate given to a husband or wife for life by virtue of a marriage settlement. See ESTATE; SETTLEMENT.

SETTLEMENT. In the English law, a disposition of property whereby provisions are made for its successive enjoyment by designated persons for periods named in the will or deed by which the settlement is effected. Such provisions for successive enjoyment distinguish a settlement from other dispositions of property. The purpose of a settlement is to enable the settler or person disposing of the property to govern the extent and manner of its enjoyment and thereby to accomplish some purpose of his own, as to provide for his daughter after her marriage. Such ante-nuptial marriage settlements are very common. 'Family settlements' are also frequently made when an eldest son attains his majority, under which provisions are made for the disposition of the father's or grandfather's estate among all the members of the family.

In the United States settlements are not common, owing to the fact that in most States 'married women's acts' secure to wives their separate estates; and family settlements are almost unknown.

The term settlement is also applied to the residence or right to support gained by a pauper by reason of birth in or living for a certain time in a parish or county.

SETTLEMENT, ACT OF. See ACT OF SETTLEMENT.

SETTLERS AND DEFENDERS OF AMERICA. An hereditary patriotic society incorporated in New York City in 1899. It admits to membership both men and women eighteen years old or over, and lineally descended (1) from a settler in one of the thirteen original colonies during the first thirty-three years of its colonization; (2) from an ancestor who, between May 13, 1697, and April 19, 1775, inclusive, rendered civil or military service in such colony; (3) from an ancestor who, between April 19, 1775, and September 13, 1783, inclusive, rendered actual service to the cause of American independence, either as a military or naval officer, soldier, seaman, privateer, militia or minute man, associator, signer of the Declaration of Independence, member of a Continental, Provincial, or Colonial Congress, or Colonial or State Legislature, or as otherwise a recognized patriot, who performed or actually counseled or abetted acts of resistance to the authority of Great Britain. No

claim of eligibility through (1) or (2) is valid which does not also meet the requirements of (3).

SETUBAL, sâ-tōō'bâl (formerly called in English *Saint Ubes* and *Saint Yves*). An important seaport of Portugal, in the District of Lisbon, on the north shore of the Bay of Setubal, 18 miles southeast of Lisbon (Map: Portugal, A 3). It is the fourth city in size in the kingdom, and the third in commercial importance. The harbor is second only to that of Lisbon; it is defended by several forts and provided with broad and handsome quays. The shipping in 1899 amounted to 247,095 tons. The chief exports are wine, fruit, salt, and corks. Population, in 1890, 17,581; in 1900, 21,819.

SEUME, zoi'me, JOHANN GOTTFRIED (1763-1810). A German author and poet, born at Poserna, near Weissenfels, Prussian Saxony. Abandoning his theological studies at Leipzig, he set out for Paris, but was kidnapped by Hessian recruiting officers and sold to England to serve against her American rebels. On his return from Canada he fell again into the hands of the military authorities, but finally obtained his liberty and settled at Leipzig, whither he returned in 1796, having gone to Warsaw in 1792, acted there as secretary to General Tgelström, and experienced the terrors of the Polish insurrection of 1794. Employed in an editorial capacity by his friend Göschen, the publisher, at Grimma, he undertook during that time two extended journeys. The first was a pedestrian tour of nine months' duration, from December, 1801, through Austria and Italy to Sicily and back through Switzerland and via Paris to Leipzig, which he described in his well-known *Spaziergang nach Syrakus* (1803; new ed., 1868). In 1805 he made a similar trip to Russia, Finland, and Sweden, commemorated in *Mein Sommer im Jahre 1805* (1807), which gives a vivid picture of the Napoleonic era. Impaired in health since then, he died at Teplitz, during a watering cure. His autobiography, *Mein Leben*, was completed by Clodius (1813). A recent edition of his *Sämtliche Werke* appeared in Hempel's *Nationalbibliothek* (Berlin, 1879).

SEVANGA, syĕ-vän'gȧ. A lake of Transcaucasia. See GOKTCHA.

SEVASTOPOL, sĕ-vàs'tô-pōl. A seaport of Russia. See SEBASTOPOL.

SEVEN (AS. *seofon*, Goth., OHG. *sibun*, Ger. *sieben*, seven; connected with Lat. *septem*, Gk. *ἑπτά, hepta*, OIr. *secht*, OChurch Slav. *sedmĭ*, Lith. *septĭni*. Skt. *saptan*, seven). A mystical and symbolical number in the Bible, as well as among the principal nations of antiquity (the Persians, Indians, Egyptians, Greeks, Romans, etc.). The reason for the preference of this number for sacred use has been found in its consisting of three—the number of the sides of a triangle—and four—the sides of a square, these being the simplest rectilineal figures—or in other equally vague circumstances. In numerical symbolism, also, three stands for the spiritual (e.g. the Trinity) and four for the material (four elements), and the combination represents the medial or supernatural sphere. The original reason, however, seems to be astronomical, or rather astrological, viz. the observation of the seven planets and the phases of the moon—changing every seventh day. (See WEEK.) As instances of the use of this number in the Old Testament we find the creation completed in seven days, wherefore the seventh day was kept sacred; every seventh year was sabbatical, and the seven times seventh year ushered in the jobel-year. The three *regalim*, or pilgrim festivals (passah, festival of weeks, and tabernacles), lasted seven days; and between the first and second of these feasts were counted seven weeks. The first day of the seventh month was a 'holy convocation.' The Levitical purifications lasted seven days, and the same space of time was allotted to the celebration of weddings and the mournings for the dead. In Proverbs ix. 1 Wisdom builds her house with seven pillars. In the New Testament we have the churches, candlesticks, stars, trumpets, spirits, all to the number of seven; and the seven horns, and seven eyes of the Lamb. The same number appears again either divided into half (3½ years, Rev. xiii. 5, xi. 3, xii. 6, etc.), or multiplied by 10—70 Israelites go to Egypt, the exile lasts 70 years, there are 70 elders, and at a later period there are supposed to be 70 languages and 70 nations upon earth. To go back to the earlier documents, we find in a similar way the dove sent out the second time seven days after her first mission. Pharaoh's dream shows him twice seven kine and twice seven ears of corn. Among the Greeks the seven was sacred to Apollo and to Dionysus, who, according to Orphic legends, was torn into seven pieces; and it was particularly sacred in Eubœa, where the number was found to pervade, as it were, almost every sacred, private, or domestic relation. The Pythagoreans made much of this number, giving it the name of Athene, Hermes, Hephæstus, Hercules, the virgin unbegotten and unbegetting (i.e. not to be obtained by multiplication), Dionysus, Rex, etc. The 'seven sacraments,' the 'seven free arts,' the 'seven wise men,' and many more instances, prove the importance attached to this number in the eyes not only of ancient, but even of our own times. A learned article, based on Hammer-Purgstall, *Ueber die Zahl Sieben*, is contained in the *Essays* of James Hadley (1873).

SEVEN AGAINST THEBES, THE (Lat. *Septem contra Thebas*, Gk. Ἑπτὰ ἐπὶ Θήβας, *Hepta epi Thēbas*). A tragedy by Æschylus produced in B.C. 467 with the *Laius* and *Œdipus*. Its theme is the fulfillment of the curse pronounced by Œdipus on his sons Eteocles and Polynices. In the attack on the city the brothers find themselves opposed and each falls by the hand of the other. At the close of the play Antigone declares her intention of burying her brother Polynices in spite of the prohibition, and the scene paves the way for the *Antigone* of Sophocles.

SEVEN DAYS' BATTLES. A series of battles fought, June 25-July 1, 1862, during the Peninsular campaign of the Civil War in America, between the Federal Army of the Potomac under General McClellan and the Confederate Army of Northern Virginia under General Lee. They were fought a short distance east of Richmond, Va., between the Chickahominy River and the James River, much of the fighting occurring while McClellan was effecting his change of base from White House on the Pamunkey to Harrison's Landing on the James. The principal engagements during this period were those of Mechanicsville (June 26th), Gaines's Mill (June 27th), Savage's Station (June 29th), Frazier's

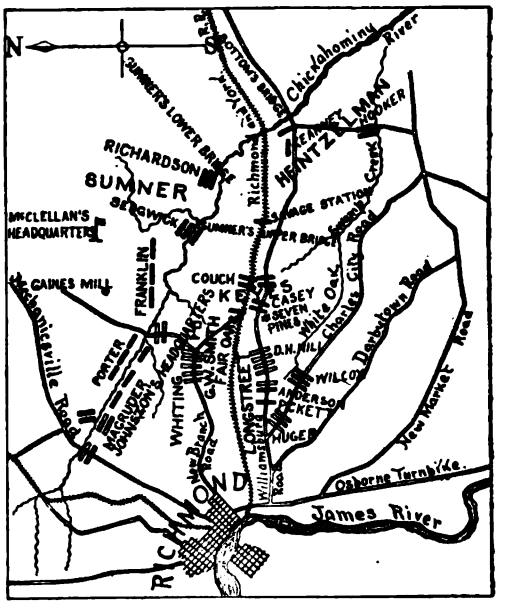
Farm (June 30th), and Malvern Hill (July 1st). The strength of the Federal army was about 91,000 effectives engaged, that of the Confederate army about 95,000. The Federals lost in killed, wounded, and missing about 16,000 men, the Confederates about 20,500. The series of engagements virtually closed the Peninsular campaign. See articles on the various battles, and references thereunder.

SEVEN DIALS. A locality in Saint Giles, London, midway between Trafalgar Square and the British Museum, formerly noted as the resort of the criminal and degraded classes in the city, and frequently appearing in the writings of Charles Dickens. Seven streets radiated from a circular area on which stood a pillar bearing a dial having seven faces. The pillar was removed in 1773, and the locality has been greatly improved.

SEVEN GODS OF HAPPINESS (Sinico-Jap. *Shichi-fuku-jin*). A group of divinities, forming a popular appendage to Japanese Buddhism of especial interest to the student of art. They are *Fukurokujiu*, the god of longevity or wisdom, with an amazingly high forehead; *Daikoku*, with a mallet in hand and seated on bags of rice, the patron of worldly prosperity; *Ebisu*, a fisherman, who provides for the daily sustenance; *Hōtéi*, the "Monk of the Hempen Bag;" *Bishamon*, the warrior or god of martial prowess; *Benten*, the goddess who governs matrimonial affairs; while *Jiurojin* lends aid to the aspirants after scholastic renown. They form no element of any serious religion, and neither by their attitudes nor their dress suggest things ecclesiastical. The separate elements of the little group are derived from no fewer than four different sources, Buddhism, Brahmanism, Taoism, and Shinto. There is no clue to either the authorship or period of this heterogeneous association, which has no claim to great antiquity, and is the creation of the artist rather than the priest, with a lay following larger than any other group in the pantheon of Japan can claim. Consult Anderson, *Descriptive and Historical Catalogue of Japanese and Chinese Paintings in the British Museum* (London, 1886).

SEVEN LAMPS OF ARCHITECTURE, THE. A treatise on architecture by John Ruskin (1849), showing the significance of the art as a record of national life and belief. The seven lamps or principles in art-works are Sacrifice, Truth, Power, Beauty, Life, Memory, and Obedience.

SEVEN PINES, BATTLE OF, also known as the **BATTLE OF FAIR OAKS.** A battle fought about seven miles east of Richmond, Va., on May 31 and June 1, 1862, during McClellan's Peninsular campaign against Richmond, between a part of the Federal Army of the Potomac, numbering about 42,000 effective men (actually engaged), under General McClellan, and an equal Confederate force (forming part of what was later known as the Army of Northern Virginia), under Generals Joseph E. Johnston and G. W. Smith. It takes its name from a tavern, known as Seven Pines, on the field of battle, and from the Fair Oaks station on the Richmond and York River Railroad. After the engagement at Williamsburg (q.v.) Johnston slowly withdrew to the vicinity of Richmond, and McClellan followed with great deliberation. Toward the end of May McClellan sent first the Third Corps and then the Fourth Corps of his army, under Keyes and Heintzelman, respectively, the latter being the ranking officer, to the south side of the Chickahominy River, retaining on the north side, for the purpose of coöperating, if necessary, with General McDowell's army, then expected as a reinforcement, and of protecting the base of supplies at White House on the Pamunkey, the Second, Fifth, and Sixth Corps under the command, respectively, of Sumner, FitzJohn Porter, and Franklin. Johnston quickly saw the weakness of McClellan's disposition of the Federal troops, and decided to attack in force the two corps, themselves widely separated, on the south side of the river, hoping to destroy them before reinforcements could arrive from Sumner, Porter, or Franklin. The attack was set for the morning of May 31st, and the plan provided for the concentration at Seven Pines, by the Nine Mile, Williamsburg, and Charles City roads, of a force greatly superior to the Federal force at that point, and for the defeat first of Keyes and then of Heintzelman. The positions of the opposing forces on the morning of the 31st are shown in the accompanying map:



SEVEN PINES.

On the afternoon and night of May 30th a rainstorm of unusual violence occurred, and the Chickahominy became so swollen as to render extremely difficult the crossing of Federal reinforcements from the corps north of the river to those south of it. Owing to a misunderstanding of Johnston's orders by Longstreet, who was charged with opening the battle, the attack was not delivered until after 1 P. M., but before dark Keyes, though reinforced by Kearny's division of Heintzelman's corps, had been driven back to a point about one mile and a half east of Seven Pines. Part of Keyes's troops, however, under Couch, were driven to Fair Oaks, whence they fell

back toward Sumner's bridges across the Chickahominy. At 2.30 P. M., under orders from McClellan, Sumner crossed the river with a division under Sedgwick and a battery under Kirby, at what later became known as Sumner's Upper Bridge, and at about 5 o'clock, after being delayed by the rough and muddy roads, reached the vicinity of the Fair Oaks station, just in time to intercept and force back Whiting's division (from the Confederate left, where G. W. Smith was in command), then on its way to reinforce Longstreet. In this part of the field some of the most stubborn fighting of the day occurred, and it was here about 7 P. M. that General Johnston was severely wounded, whereupon General Smith took command of the Confederate army. Early on the following day Longstreet again attacked the Federal left, which had been reinforced by way of Sumner's Lower Bridge, by Richardson's division of Sumner's corps, but he was repulsed and forced back for some distance. At 2 o'clock in the afternoon Gen. R. E. Lee, who had just arrived on the field of battle, superseded Smith in command of the Confederate army, and on the night of the 2d the army was withdrawn to the immediate neighborhood of Richmond. General McClellan did not appear on the field of battle until about noon on the 1st. The loss of the Federals in killed, wounded, and missing was about 5000, that of the Confederates about 5200. Consult the *Official Records*, vol. xi., parts i. and iii.; Johnson and Buel (ed.), *Battles and Leaders of the Civil War* (New York, 1887); Ropes, *Story of the Civil War*, vol. ii. (ib., 1898); Michie, *General McClellan* (ib., 1901), in the "Great Commanders Series;" Webb, *The Peninsula* (ib., 1881), in the "Campaigns of the Civil War Series;" Johnston, *Narrative of Military Operations* (ib., 1874); Hughes, *General Johnston* (ib., 1893), in the "Great Commanders Series;" McClellan, *McClellan's Own Story* (ib., 1887); and Longstreet, *From Manassas to Appomattox* (Philadelphia, 1896).

SEVEN SAGES, THE. A collective designation of a number of Greek sages who lived between B.C. 620 and 550. They were rulers, lawgivers, or counselors, distinguished for their practical wisdom, and were believed to be the authors of brief aphorisms expressing the results of their moral and social experiences. There was no unanimity among the ancients with regard to the names, the number, or the sayings of these famous sages. The number seven is as old as Pindar, but the earliest list of the seven is given in Plato's *Protagoras* (343 p.a.). Those usually included in the number are Solon, the famous law-giver of Athens; Thales of Miletus, the philosopher; Pittacus of Mitylene, the deliverer and magistrate of his native city; Bias of Priene; Chilon of Sparta; Cleobulus, tyrant of Lindus; and Periander, tyrant of Corinth. The sayings attributed to them were first collected by Demetrius of Phalerum. Various collections of the excerpts have been preserved to us by Stobæus (*Floril.* 3, 79) and others. On the different names of the sages, consult: Bohren, *De Septem Sapientibus* (Bonn, 1867); and Wulf, *De Fabellis cum Collegii Septem Sapientium Memoria Conjunctis Quæstiones Criticæ* (Halle, 1896). A Greek collection of these aphorisms in iambics was published by Wölfflin in the *Proceedings* of the Bavarian Academy (1886), and there are two Latin collections by Brunco (Bayreuth, 1885).

SEVEN SLEEPERS, THE. The heroes of a celebrated legend, which exists in several Syriac versions, the earliest being that of Jacob of Sarug (451-521). As given in the Latin version by Gregory of Tours they were seven Christians (brothers) of Ephesus, who, during the persecution of Decius in 250, took refuge in a cave near the city. Their retreat was discovered and the entrance walled up. A miracle, however, was interposed in their behalf, and they fell into a preternatural sleep. Two hundred years later, near the end of the reign of Theodosius II. (408-450), the cave was accidentally opened, and the sleepers awoke. They supposed they had slept for but a single night, and when one of their number went to the city stealthily to purchase provisions he was amazed to find his coin no longer current, and the Christian religion honored and accepted by rulers and people. When the wonderful history became known the sleepers were conducted in triumphant procession into the city, but they all died at the same moment. They are honored as saints by the Western and Eastern churches; in the former their day is July 27th, in the Greek Church August 2d or 4th, and with the Maronites March 7th. They are also honored by the Mohammedans, their story being found in the Koran (xviii. 8-24). Consult: Koch, *Die Siebenschläferlegende* (Leipzig, 1883); Baring-Gould, *Curious Myths of the Middle Ages* (London, 1881).

SEVENTEEN-YEAR LOCUST. See CICADA.

SEVENTH. See INTERVAL.

SEVENTH DAY ADVENTISTS. See ADVENTISTS.

SEVENTH DAY BAPTISTS. See BAPTISTS, SEVENTH DAY.

SEVEN WEEKS' WAR. The name given to the brief war in 1866 between Prussia and Italy on the one side and Austria and her German allies on the other. Bavaria, Württemberg, Baden, Saxony, Hesse, Hesse-Cassel, Hanover, and Nassau were on the side of Austria. The war was the culmination of Bismarck's plan for forcing Austria out of the German Confederation and making way for a new Germany under Prussian leadership. For an account of the preliminary events which led up to the struggle, see BISMARCK; GERMANY; PRUSSIA; and SCHLESWIG-HOLSTEIN.

On April 8, 1866, Prussia had concluded a secret alliance with Italy, and the issue of a federal execution by the Diet against Prussia on June 14th was followed by the declaration of war against Austria, Saxony, Hanover, and Hesse-Cassel. The invasion of Bohemia was immediately begun. The central (First) Prussian army, under Prince Frederick Charles (q.v.), entered from Eastern Saxony, crossing the frontier range of the Erzgebirge toward Reichenberg; the western or Elbe (Third) army, under General Herwarth von Bittenfeld, started from Dresden, and entered Bohemia by Neustadt and Schluckenau; while the eastern or Silesian (Second) army, under the Crown Prince, Frederick William (later the German Emperor Frederick III.) (q.v.), entered Bohemia from Silesia by the Trautenau and Nachod passes. As the Austrians expected the attack from Silesia, by far the greater portion of their army was sta-

tioned behind the Riesengebirge; so that when Von Bittenfeld and Prince Frederick Charles crossed the Erzgebirge (June 24th), they found themselves opposed by only the outlying brigades of Clam-Gallas, which they forced to retire toward Turnau and Münchengrätz, after defeating them in some insignificant combats and in a severe struggle at Podol. The First Prussian Army and the Elbe Army, now united, advanced leisurely, driving the enemy before them toward Münchengrätz, where Clam-Gallas was attacked on June 28th, and, after a brief but severe contest forced to retreat in haste. By several routes, the combined armies continued their onward march, routing the detached corps of Austrians and Saxons which attempted to bar their progress; and after a severe contest (June 29th) took possession of Gitschin and established communications with the Crown Prince. Clam-Gallas retired to join the main body under Benedek.

The army of the Crown Prince advanced in two divisions, the right wing by Landshut, toward Trautenau; the left by Glatz, toward Nachod and Skalitz; while the centre entered Bohemia by Braunau, all crossing the frontier on June 26th and 27th. The passes were traversed without opposition, but the Austrian forces under Gablenz opposed a determined resistance when the invaders emerged from them. Both sides were strongly reinforced, but victory remained with the Prussians in the encounters at Nachod, Skalitz, and Schweinschädel. The three Prussian columns, having effected a firm lodgment in Bohemia, moved steadily forward in lines converging to a point north of the Austrian army, which was concentrated between Josephstadt and Königgrätz; and King William I. of Prussia, who had arrived (July 2d) at the headquarters of the First and Third armies, hearing of Benedek's intention of attacking before the Crown Prince's army could come up, resolved to anticipate him, and ordered an attack on the Austrian position at 8 A. M. on July 3d, at the same time sending an urgent appeal to hasten the arrival of the Crown Prince. (See SADOWA, BATTLE OF.) The Austrians and their Saxon allies were utterly routed and only saved from annihilation by their admirable cavalry. All hope, however, of staying the advance of the Prussians with the army of Benedek was at an end; a truce was asked for, but refused; and the victorious Prussians pushed forward toward Vienna, whither Benedek had drawn his beaten forces. At the same time the southern Austrian army, which had been employed against the Italians, was summoned to the defense of Vienna, when, through the agency of the Emperor of the French, a truce was agreed to (July 26th), at Nikolsburg, which afterwards led to a treaty of peace.

A few days before this campaign began, the Italians, who had entered into an alliance with Prussia in order to secure the liberation of Venetia, assembled an army of 200,000 men, one-half of which, under General La Marmora (q.v.) was to cross the Mincio between Peschiera and Mantua, while the other half was stationed round Bologna to operate on the lower Po. To oppose this force, the Archduke Albert, the commander-in-chief of the Austrian forces in Italy, had about 90,000 men near Verona, besides the garrisons of the Quadrilateral and Venice, which were not available for field service. On June 23d La Marmora's army crossed the Mincio, unopposed by the Austrians. The Archduke, however, succeeded in drawing his opponent into an unfavorable position and attacked him (June 24th) at Custozza with his whole force. The Austrians achieved a decisive victory. The Italians fell back, in fair order, toward the Mincio, unpursued by their exhausted opponents.

While the Italian generals were deliberating on the renewal of the campaign, news came of the great defeat which the Austrians had sustained in the north, and of the cession of Venetia, by the Emperor of Austria, to the Emperor Napoleon. On July 20th the Italian fleet, under Persano, suffered a great defeat at Lissa at the hands of Admiral Tegetthoff, the Austrian commander.

In spite of her disasters, Italy was very loath to agree to the armistice signed by the two belligerent German Powers at Nikolsburg, on July 26th, and attempted to insist upon the surrender by Austria to her of the Trentino. Prussia, however, would not support this demand, and Victor Emmanuel gave way reluctantly, and agreed to the armistice, August 12th. The Peace of Prague was signed August 23d.

A third contest was, about the same time, in progress between Prussia and those States of Germany which had engaged in the struggle on the side of Austria. The Hanoverian army was compelled to surrender at Langensalza, June 28th. The operations against the forces of the South-German States (Bavaria, Württemberg, Baden, and the Grand Duchy of Hesse) in the valley of the Main and in the Lower Franconia (Kissengen) were speedily brought to a successful issue by Vogel von Falckenstein and other Prussian generals. For results of the war, see GERMANY; PRUSSIA; ITALY.

Consult: Hozier, *The Seven Weeks' War* (London, 1867); Lecomte, *Guerre de la Prusse et de l'Italie contre l'Autriche et la confédération germanique* (Paris, 1868); Fontane, *Der deutsche Krieg von 1866* (2d ed., Berlin, 1867); Knorr, *Der Feldzug des Jahres 1866 in West- und Süddeutschland* (Hamburg, 1867); also the official accounts of the general staffs.

SEVEN WISE MASTERS. A collection of stories of Oriental origin and of wide currency in Europe in the Middle Ages. Although the details vary, the general framework is the same in all the recensions, and is as follows: A king has his son by a former marriage reared by seven sages far from the Court. When the prince reaches manhood, his father summons him home, but a period of danger for the youth is foretold by the stars. To avert the peril, he is bidden by his teacher, without the King's knowledge, to keep silence for seven days. During this time his stepmother accuses him before the King in revenge for his refusal to return her proffered love. The Prince is sentenced to die. His death is delayed, however, by the seven sages, each of whom tells a story to the King of the craft of women and the danger of hasty judgment, while the Queen endeavors to offset this story by another, and urges immediate execution. This continues for seven days. At the end of this time the Prince breaks his silence, and proves his innocence, whereupon the Queen is put to death. The original of the collection is unknown. An analogue exists, however, in the Sanskrit *Śukasaptati* (q.v.), and, with a different

theme, in the *Vētālapañcavimśati* (q.v). In the *Arabian Nights* there is an almost exact parallel in the collection entitled *The Malice of Women* (nights 578-606). The course of the story-cycle is an interesting one. It was translated apparently from Sanskrit into Pahlavi, thence into Arabic, from which it came into Spanish, Hebrew, and Syriac, being translated from the latter language into Greek by Andreopulos. It reached the Occident apparently about the twelfth century. In 1184 or 1185 the monk Johannes de Alta Silva (the modern Haut-Seille, near Nancy) made a version entitled *Dolopathos, sive Historia de Rege et Septem Sapientibus* (edited by Oesterley, Strassburg, 1873). On this *Dolopathos* Herbert based his poetic version, *Li Romans de Dolopathos*, in the thirteenth century (edited by Brunet and Montaiglon, Paris, 1856), and closely related to this is the Old French *Roman des sept sages* (edited by Keller, Tübingen, 1836), based on a Latin recension now lost. A third Latin version, the *Historia Septem Sapientium* (edited from a manuscript of 1342 by Buchner, Erlangen, 1889), was the best known of all, and served as a basis for numerous translations in German, Dutch, French, Spanish, and English, passing from English into Armenian, Bohemian, Polish, and Russian. From a fourth Latin text (edited by Mussafia, Vienna, 1868) were derived two Italian versions.

SEVEN WONDERS OF THE WORLD. A group of famous works of antiquity. The cycle seems to have been formed in Alexandrian times and is mentioned in an epigram of Antipater of Sidon in the second century B.C. It was made the subject of a special treatise by a Sophist of the end of the fifth century of our era, which has come down in a somewhat mutilated condition, under the name of Philo of Byzantium. It is certainly not by the great engineer of that name. Antipater's list is: the walls of Babylon, the statue of Zeus by Phidias at Olympia, the hanging gardens at Babylon, the Colossus (q.v.) of Rhodes, the Pyramids of Egypt, the Mausoleum (q.v.) at Halicarnassus, and the Temple of Artemis at Ephesus. (See DIANA, TEMPLE OF.) Pseudo-Philo used a list which combined the walls and hanging gardens under one head, and added the Pharos (q.v.) of Alexandria. Others made still other substitutions, among which is found even the Temple at Jerusalem.

SEVEN YEARS' WAR (1756-63). Primarily a continuation of the contest between Frederick the Great of Prussia and Maria Theresa of Austria for the possession of Silesia, this war became of world importance, as in it France and England fought out their struggle for supremacy in North America and in India. All of the great European nations were involved in it. Frederick William I. of Prussia learned before his death in 1740 how fruitless was the traditional Hohenzollern policy of loyalty to the House of Hapsburg. His son, Frederick the Great, adopted a new policy of self-assertion for Prussia. In the first and second Silesian wars, 1740-42 and 1744-45, which formed part of the great European struggle known as the War of the Austrian Succession (see SUCCESSION WARS), he won Silesia, upon which the House of Hohenzollern had an old claim. His title to its possession was recognized in the Treaty of Aix-la-Chapelle (1748). Maria Theresa was bent upon the recovery of Silesia, and France and England had not by any means settled their differences. In 1754 the French and Indian War (q.v.) broke out in America, and in the spring of 1756 England and France were fighting in the Mediterranean. There had been effected, in preparation for a struggle, a new alignment of European alliances. Austria, whose foreign policy was directed by Kaunitz (q.v.), and France, whose King, Louis XV., was under the sway of Madame de Pompadour, had departed from the policy of antagonism which they had maintained for two centuries and had concluded a treaty of alliance at Versailles, May 1, 1756. Ten years before a defensive alliance against Frederick had been arranged between Austria and Russia. Great Britain in case of a European war had common interest with Prussia on account of Hanover, which would be exposed to the attacks of her old enemy, France. She, therefore, entered into an alliance with Prussia. On April 22, 1756, Russia proposed to Austria the partition of the Prussian territories. Frederick, well informed of the plans of his enemies, anticipated their actions, and, after a summary demand on the two powers as to their intentions, on August 29, 1756, invaded Saxony, which he knew to be friendly to Austria.

Frederick threw a column into Bohemia and met the Austrian advance under Browne in an indecisive battle at Lobositz, October 1st. The Saxon army, after a siege of some weeks at Pirna, capitulated on October 16th, and thereafter Saxony was used by Frederick as a base of operations, while her revenues were collected by Prussia. On January 17, 1757, the Diet of the German Empire declared war on Prussia, and in February Austria, Russia, and France completed a new treaty of offensive alliance. Sweden also joined the allies. At this time the English alliance promised little for Prussia, and it was not until Pitt (q.v.) was well established in control of the British foreign affairs that it gave promise of real utility for Frederick. The coalition against Frederick, whose subjects numbered only about 5,000,000, was the most powerful that Europe has ever witnessed. Surrounded by such powerful foes the Prussian King's policy was to concentrate his attacks and strike rapid and heavy blows. He made his first attack in Bohemia, defeated the Austrians under Charles of Lorraine and Browne before Prague, May 6th, in a desperate battle, laid siege to Prague, but lost the battle of Kolin against the Austrian Marshal Daun (q.v.), June 18th. This compelled the King to retire into Saxony. Meanwhile the French had obtained possession of much of North Germany west of the Elbe, which was defended by an insufficient English and Hanoverian force under the incompetent Duke of Cumberland. The latter retreated before the French, was beaten at Hastenbeck, July 26th, and signed the disgraceful convention of Kloster-Zeven, September 8th, in accordance with which the Hanoverian army was to be dispersed, Hanover being left in the hands of the French. This was a virtual surrender and the English Government repudiated it. Frederick turned next against the French and Imperialists, under the command of Soubise (q.v.), and at Rossbach (q.v.) won one of his most brilliant victories, November

5, 1757. A month later he inflicted a great defeat upon the Austrians under Daun at Leuthen (December 5th). This battle was followed by the surrender of Breslau and Liegnitz. Meanwhile in East Prussia the Prussians under Lehwaldt were defeated at Gross-Jagerndorf by the Russians under Apraxin (August 30th) and East Prussia was overrun. But Pitt had now taken hold of English affairs with a firm grasp and entered upon the fullest coöperation with Prussia. Ferdinand of Brunswick was placed in command of the Hanoverian forces and Frederick's resources were increased by a liberal subsidy from England.

In 1758 Frederick opened another year of aggressive campaigning. He recaptured Schweidnitz in Silesia, besieged Olmütz unsuccessfully, then turned upon the Russians who had invaded Brandenburg, and defeated them thoroughly at Zorndorf, August 25th. He then moved into Saxony, where he was attacked by Daun at Hochkirch, October 14th, and defeated, though not badly. He then passed around Daun's army and relieved Upper Silesia, which was in danger of falling into the hands of the Austrians. Prussia, however, was now almost exhausted. Hemmed in by the Russians and Austrians under Soltikoff and Laudon, Frederick met his worst defeat at Kunersdorf (q.v.), near Frankfort-on-the-Oder, on August 12, 1759, where almost his entire army was destroyed or dispersed. On November 21st one of his generals, Finck, was trapped at Maxen in Saxony and compelled to surrender with about 13,000 men. Prussia now seemed to be prostrate. In the west, however, conditions had changed with the change in commanders. Ferdinand of Brunswick signally defeated the French at Crefeld, June 23, 1758, and at Minden, August 1, 1759. The victory of Minden, with the brilliant success of the English against the French in Canada, where they took Quebec, the capture of Guadeloupe, and the naval victory of Admiral Hawke over the French in Quiberon Bay, November 20th, redeemed the year 1759 for the Anglo-Prussian alliance.

After 1759 Frederick fought on the defensive. In 1760 the Prussians were defeated at Landshut, June 23d, and lost Glatz, July 26th. Frederick himself won by hard fighting the battles of Liegnitz, August 15th, over Laudon, and Torgau, November 3d, over Daun, but in the meantime, in October, Berlin itself was raided by Russians and Austrians. In 1760 George III. succeeded to the English throne and in 1761 Pitt went out of office. With Pitt went England's grand designs. The Government failed to renew the convention with Prussia, which thus lost her one ally. This desertion Frederick never forgave. The death of the Empress Elizabeth of Russia, January 5, 1762, and the accession of Peter III., Frederick's ardent admirer, coming at this critical juncture, saved Prussia. The new Czar made an alliance with Frederick and the Russian arms were turned against Austria. Frederick was able to take the initiative again and defeated the Austrians at Burkersdorf, in Silesia, July 21, 1762, and on August 16th defeated Daun at Reichenbach. On October 29th Prince Henry, brother of Frederick, and Seydlitz were victorious at Freiberg. Peter was deposed July 9th by his wife, Catharine II., and the Russian troops were ordered home. Sweden also withdrew from the struggle. At the close of 1762 a truce was concluded between Austria and Prussia, both sides being exhausted.

France had drawn Spain into the struggle with England by the Bourbon family compact of August 5, 1761, which Choiseul had negotiated, and Bute, who had sought peace at any price, found himself compelled to follow tardily the course marked out by Pitt. In 1762 Martinique, Havana, and Manila fell into the hands of the English. The struggle in India was already decided in favor of England. On November 3, 1762, preliminaries of peace were signed at Fontainebleau between England, France, Spain, and Portugal (which had been attacked by the Bourbon coalition), and the definitive Peace of Paris was arranged on February 10, 1763. (See PARIS, TREATIES OF.) Austria and Prussia concluded the Peace of Hubertsburg on February 15, 1763. As Prussia retained Silesia, the war brought no changes territorially in Europe, but it placed Prussia among the Powers of the first rank. Outside of Europe it changed the aspect of the world, bringing about the downfall of France as a colonial Power and preparing the way for the British Empire in India.

Consult: Longman, *Frederick the Great and the Seven Years' War* (London, 1888), a reliable and comprehensive brief history; Carlyle, *History of Frederick the Great* (in several editions); Schäfer, *Geschichte des siebenjährigen Krieges* (Berlin, 1867-74), the principal history of the war; Von Ranke, *Der Ursprung des siebenjährigen Krieges* (Leipzig, 1871); Vast, "Guerre de sept ans," with excellent bibliography, in vol. vii. of Lavisse and Rambaud, *Histoire générale* (Paris, 1893-1900). See also authorities referred to under FREDERICK II., MARIA THERESA, and PITT, WILLIAM.

SEVERINUS, SAINT (c.400-82). A missionary of Latin birth, born either in Northern Africa or Southern Italy, often known as the Apostle of Noricum. In 454, after the death of Attila, he went among the Norici to establish the only partially recognized religion of Christianity. By his courage and good works he put the new religion on a firm footing. His body was taken to Italy by his follower, Lucillus, and eventually was buried on a small island near Naples.

SEVERN. One of the principal rivers of England. It rises on Plinlimmon, in Montgomeryshire, North Wales, flows first east and northeast, then crosses Shropshire in an easterly and southeasterly direction, and finally flows southward through Worcester and Gloucester, forming a large estuary, which widens into the Bristol Channel (q.v.) (Map: England, D 5). It is 210 miles long, and navigable for barges to Welshpool, 180 miles from its mouth. The chief affluents of the Severn are the Avon on the east and the Wye on the west. A canal, 18½ miles long, navigable for vessels of 350 tons, materially shortens the navigation from the upper portion of the estuary to Gloucester. Other canals connect the Severn with the Thames, Trent, Mersey, and the other important rivers of Middle England. The famous Severn railway tunnel, over four miles long, passes under the estuary near Chepstow.

SEVERN, JOSEPH (1793-1879). An English painter, born at Hoxton, Gloucestershire. While

a struggling young artist he became a friend of John Keats. In 1817 he won a gold medal from the Royal Academy, for his historical painting "Una." Afterwards he worked principally at miniatures. He went with Keats to Rome in 1820, and remained with him until his death. He painted several portraits of Keats, and after his return to London in 1841 did some literary work of little importance. From 1860 until 1872 he was consul at Rome, and he was buried in that city, beside the poet. Consult Sharp, *Life and Letters of Joseph Severn* (London, 1892).

SEVERO (sâ-vâ'rô) **CAPE**, NORTHEAST CAPE, or CAPE CHELYUSKIN. The northernmost point of the Asiatic continent (Map: Asia, K 1). It is a low, stony, and desert outrunner of the Taimur Peninsula and extends to latitude 77° 34′ north. After its discovery by the Russian officer Tchelyuskin in 1742 it was not again visited until Nordenskjöld reached it in 1878.

SEVE'RUS, ALEXANDER. See ALEXANDER SEVERUS.

SEVERUS, LUCIUS SEPTIMIUS (A.D. 146-211). A Roman emperor from 193 to 211, born near Leptis Magna, on the north coast of Africa. He was commander of a legion in Gaul, and governor successively of Gallia Lugdunensis, Pannonia, and Sicily. After the murder of Pertinax he was proclaimed Emperor, A.D. 193, at Carnuntum, and promptly marched upon Rome, where the puppet Julianus had by purchase obtained the Imperial purple. His arrival before Rome was the death signal for Julianus; and after taking vengeance on the murderers of Pertinax, and distributing an extravagant largess to his soldiers, Severus marched against Pescennius Niger, and conquered him at Issus, A.D. 194. A campaign in the East, and a three years' siege of Byzantium, which was finally taken, were followed by a desperate struggle with Clodius Albinus, whom, after an obstinate conflict at Lyons, he conquered in 197. Severus returned to Asia, and met with the most brilliant success in the campaign of 198 against the Parthians, and took and plundered their capital, Ctesiphon. He returned to Rome in 202, and gratified the popular taste by the exhibition of shows of unparalleled magnificence, also distributing another extravagant largess to the citizens and prætorians. A rebellion in Britain drew him to that country in 208, and at the head of an immense army he marched, it is said, to the extreme north of the island, encountering enormous hardships, to which no less than 50,000 of his soldiers succumbed. To safeguard the natives of Southern Britain from the incursions of the Meatæ and Caledonians, Severus began the wall which bears his name. He died soon after at Eboracum (York).

SEVERUS, WALL OF. See ROMAN WALL.

SEVIER (sê-vêr') **LAKE**. A salt lake lying among the Basin Ranges of western Utah, and surrounded by the Sevier Desert (Map: Utah, A 2). It has no outlet, but is fed by the Sevier River. It is a remnant of Lake Bonneville, which in Pleistocene times covered a vast area and made Sevier Lake continuous with the Great Salt Lake. Half a century ago the lake was 30 miles long, 10 miles wide, and 15 feet deep, but, since the river is now largely used for irrigation, the lake-bottom is dry for a great part of the year, and is covered with a vast deposit of salt.

SEVIER, JOHN (1745-1815). An American pioneer and political leader, born in Rockingham County, Va. Leaving school when sixteen years of age, he married in the following year, and in 1764 founded the village of New Market in the Shenandoah Valley. Here he became celebrated as an Indian fighter, and in 1772 removed beyond the Alleghanies to the Watauga settlements. He served as captain in Lord Dunmore's War, participating in the battle of Point Pleasant (q.v.), was a delegate for several years from Watauga to the North Carolina Legislature, conducted many expeditions against the Indians, gained a victory over them at Boyd's Creek (1779), and served with great gallantry at Kings Mountain (1780). He took part in the battle of Musgrove's Mills, and in 1781 fought under Marion, and was made brigadier-general. He was Governor of the "State of Franklin" in 1785-88, on the breaking up of which by North Carolina he was imprisoned, but soon escaped. In 1790 he was sent as a Representative to Congress. In 1793 he conducted the Etowah campaign against the Indians, and in 1796 became the first Governor of Tennessee, serving until 1801. He was again Governor from 1803 to 1809, and was a member of Congress from 1811 to 1815. He died on a mission to the Creek Indians. For his life, consult J. R. Gilmore (New York, 1887).

SÉVIGNÉ, sâ'vê'nyâ', MARIE DE RABUTIN-CHANTAL, Marquise de (1626-96). A French epistolary writer. She was born in Paris, February 6, 1626, of a military family known in Burgundy as early as the twelfth century. Her father, Baron de Chantal, was killed at the Isle of Rhé in 1627. Her mother, Marie de Coulanges, died in 1633. The little heiress was then cared for by her mother's parents, both of whom died within three years. Her uncle, Christophe de Coulanges, Abbé de Livry, was now chosen guardian. He lived till 1686, always her close friend and business adviser, and was frequently visited by her at his abbey. He gave his niece an excellent education; among her tutors were Chapelain and Ménage. Her earliest letters are in response to Ménage's professions of love. Among the close friends of her youth was the future Madame de la Fayette. The careful management of her guardian left her relatively rich at eighteen, when she married Henri, Marquis de Sévigné, a Breton gentleman, whom she loved better than he seems to have deserved. The Chevalier d'Albret mortally wounded him in a duel over Madame de Gondran and he died in 1651, leaving a son, Charles, who died childless, and a daughter, Françoise, who married, in 1669, François Adhémar, Count de Grignan, and had two children, who died without issue. To her children Madame de Sévigné devoted the rest of her life, especially to the daughter, who did not worthily requite her affection.

Her social tact, good looks, vivacity, and charm made her very popular and brought her the homage of many distinguished friends, among them Turenne and the Prince de Conti. It was not till her daughter's marriage (1669) that her letters became numerous. Count de Grignan was practically Governor of Provence, and Madame de Sévigné divided her time between Paris, Les

Rochers, and visits, not always welcome, to her daughter. In 1676 she visited Vichy. From 1677 to 1678 Madame de Grignan was chiefly in Paris and the correspondence lagged. It was afterwards resumed in quite its early volume. Mother and daughter were together also at Paris from 1691 to 1694, but it was at Grignan that Madame de Sévigné died, April 17, 1696. The disease was smallpox and she was unattended by her daughter at the last. But Madame de Grignan, by a certain poetic justice, died nine years later of the very malady whose infection she had apparently sacrificed her filial instinct to escape.

The letters of Madame de Sévigné are unrivaled for their fresh charm, shrewd wit, and easy gaiety of heart. They form an almost complete and familiar chronicle of the Court and high society of the time (1669-1695). Their vivacity scarcely ever flags, whether she is telling of Court life, of scenes at the baths of Vichy, or of country society and diversions. She writes spontaneously, sketches vivid pictures in a few rapid strokes, or gives in sparkling narrative the social happenings of the day, meanwhile unwittingly revealing her own character. Madame de Sévigné enjoyed some literary fame during her lifetime. Her letters, as edited by Regnier and others (Paris, 1862-68, 2d ed. 1887 et seq.), fill, with some other correspondence, fourteen volumes, of which the first contains a *Life*, and two others (vols. xiii., xiv.) a lexicon. This is supplemented by Capmas, *Lettres inédites de Madame de Sévigné* (Paris, 1876). There are many other editions complete and partial, the first in 1726, the most noteworthy, by Monmerqué, in 10 vols. (ib., 1818-19). Consult: Walckenaer, *Mémoires touchants la vie et les écrits de Madame de Sévigné* (ib., 1842-52); Puliga, *Madame de Sévigné: Her Correspondents and Her Contemporaries* (London, 1873); Miss Thackeray (Mrs. Ritchie), *Madame de Sévigné* in "Foreign Classics" (Edinburgh, 1881); Boissieur, "Madame de Sévigné," in *Les grands écrivains français* (Paris, 1887); Mason, *Women of the French Salons* (New York, 1891); Léon de la Brière, *Madame de Sévigné en Bretagne* (Paris, 1882); Saporta, *La famille de Madame de Sévigné en province* (ib., 1889); Sainte-Beuve, *Portraits de femmes* (ib., 1856); id., *Causeries*, vol. i. (ib., 1857-62); id., *Nouveaux lundis*, vol. ii. (ib., 1863-72); Scherer, *Etudes*, vols. ii. and iii. (ib., 1863-74); Reynaud, *Les défauts de la comtesse de Grignan* (ib., 1895).

SEVILLE, sē-vĭl′ (Sp. *Sevilla*, sā-vē′lyā). The capital of the province and of the former kingdom of Seville, in Andalusia, Spain, situated on the left bank of the Guadalquivir, 58 miles north-northeast of Cadiz, and 75 miles southwest of Cordova (Map: Spain, C 4). Although the city lies 60 miles from the mouth of the river, the tide ascends 12 miles above it. Large portions of it lie below the high-water level of the river, with the result that the city has frequently suffered from disastrous inundations. The climate is delightful, though the summers are very warm. The surrounding plain is exceedingly fertile and well cultivated. The city was formerly surrounded by a high wall, portions of which still remain. There is a wide and open strip of embankment along the river, and the latter is crossed by three bridges, one a railroad bridge, to the suburb of Barrio de Triana.

The city itself is a labyrinth of narrow, winding streets and lanes; it still preserves its old Moorish aspect, and the Moorish style of construction is seen here more characteristically, perhaps, than in any other Spanish city. The houses are generally of two stories and inclose the arcaded *patio* in the centre. Large sections of the city, however, especially the northern and western parts, have been encroached on by straight and regular streets. The principal squares within the city are the Alameda de Hercules in the north, adorned with statues and several rows of trees; the Plaza de San Fernando, faced by the city hall; and the Plaza del Triunfo in the south, on which stand three of the most interesting buildings in the city, the cathedral, the Alcázar, and the Casa Lonja or exchange.

The Cathedral of Seville is one of the largest and grandest Gothic structures in existence. It was begun in 1402 on the site of the old Moorish mosque which had formerly served as cathedral, and parts of which still remain as the Patio de los Naranjos or Orange Court. It measures 380 by 250 feet; the nave is 53 feet wide and 132 feet high. It contains a wealth of art treasures. In 1882 restorations were begun, as the vaulting had been weakened by earthquakes, but in 1888 the entire dome collapsed, destroying a great part of the interior. Adjacent to the cathedral and forming a part of the old mosque stands the remarkable tower of La Giralda, perhaps the most beautiful building in the city. It is a square tower 330 feet high, the upper 100 feet being a belfry and dome added in the sixteenth century. The top is surmounted by a bronze statue of Faith, 13 feet high, which moves in the wind like a vane (*giralda*). The Alcázar was the palace of the Moorish kings and later of the Spanish sovereigns. It originally included the now isolated Torre de Oro, which stands on the river bank, and contains several beautiful *patios* almost rivaling those of the Alhambra. Other interesting buildings in the city are the Casa de Pilatos; the magnificent Moorish-Renaissance palace of the Duke of Medinaceli; the Palacio de Santelmo, situated among the parks near the river; the immense Fábrica de Tabacos, covering more than 6 acres; the bull ring, which is the largest in Spain next to that of Madrid and capable of seating 12,000 spectators.

The educational establishments include a university founded in 1502, with faculties of law, philosophy, and science, a medical faculty situated at Cadiz, and about 1400 students. There are also a provincial school of art, the Seminary of Saint Francis Xavier, an institute for secondary education, a normal school, numerous minor academies, and the provincial library with 80,000 volumes. In the cathedral is installed the valuable Columbian Library of 30,000 volumes, formed by Fernando Colón, son of the discoverer, and including manuscripts of Columbus. The Indian archives, a collection of documents relating to the discoveries of the Indies, are installed in the Casa Lonja, and the city has also an interesting collection of municipal archives and a museum of archæology. The Museum of Paintings contains the largest and best collection of Murillo, who was born in Seville, and whose house is still to be seen there. A number of his works are also scattered through the various churches of the city. Among the charitable establishments



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the most notable is the Hospital Civil or de las Cinco Llagos, one of the largest in Europe.

The commerce and industries are of considerable importance. The tobacco factory employs 6000 hands, and there are iron foundries and machine shops, and manufactures of chocolate, soap, perfumes, beverages, corks, silks, and musical instruments, including pianos. The suburb of Triana is noted for its manufactures of pottery, and the large Convent of La Cartuja has since 1839 been used as a factory for ceramic products, employing 2000 hands and equipped with modern machinery. The imports of Seville in 1898 amounted to $2,364,900, and the exports to $7,190,510, more than half of which went to England. The chief exports are iron ore (381,573 tons in 1898), lead, copper, mercury, and other minerals, oranges, olives and olive oil, cork, grain, and wine. The population, in 1887, was 143,182; in 1900, 147,271.

The *Hispal* of the Phœnicians, the *Hispalis* of the Romans, was corrupted by the Moors into *Ishbilliah*, from which the Spanish name of the city was derived. Seville was a place of great importance in the latter period of Roman dominion; became the capital of Southern Spain during the ascendency of the Vandals and the Goths, and was the scene of two notable Church councils (590 and 619). It fell into the hands of the Arabs in the eighth century, under whom it prospered greatly, its population reaching 400,000. In 1026 it became the capital of the Moorish kingdom ruled by the Abadites (see ABAD), from whom it passed, in 1091, to the Almoravides, whose rule was supplanted in 1147 by that of the Almohades. In 1248 it was taken by Ferdinand III. of Castile, when 300,000 Moors left for Granada and Africa. From this time it was the capital of Castile, and when Spain was united it was for a while the seat of the Court until Charles V. made Valladolid his residence. The city rose to extraordinary prosperity after the discovery of the New World, when it became the residence of princely merchants, and the mart of the colonies, but its trade was afterwards transferred to Cadiz. In 1810 it was taken and ravaged by Soult. Consult: Wackernagel, *Sevilla* (Basel, 1870); Parlow, *Vom Guadalquivir. Wanderungen in Sevilla* (Vienna, 1888); K. E. Schmidt, *Sevilla* (Leipzig, 1902).

SÈVRES, sâ'vr'. A town in the Department of Seine-et-Oise, France, 7 miles southwest of Paris (Map: Paris and vicinity). It is celebrated for its Government porcelain factory, established in 1756. The public museum has specimens of pottery and porcelain wares representing every period and country, and exhibiting the various stages in the development of the industry. The town hall has a handsome collection of paintings and sculptures, and a normal school for females occupies the old porcelain factory building. Population, in 1901, 8216. Consult Lauth, *La manufacture nationale de Sèvres, 1879-87* (Paris, 1889).

SÈVRES, DEUX. A western inland department of France, between the departments of Vienne on the east and Vendée on the west (Map: France, F 5). Area, 2337 square miles; population, in 1896, 346,694; in 1901, 342,474. The department takes its name from two rivers, the Sèvre-Niortaise, which flows west into the sea, and the Sèvre-Nantaise, an affluent of the Loire. It is traversed from southeast to northwest by a chain of hills, called in the southeast the Monts du Poitou, and in the north the Plateau de Gatine. This ridge forms the water-shed between the Loire on the north and the Charente on the south. The climate is healthful, and the soil fertile. Cereals, the grape-vine, sugar beets, flax, and various fruits are cultivated. There are numerous coal and iron mines, and good quarries of freestone and marble. Capital, Niort.

SEWAGE (from *sew-*, the apparent base of *sewer*) **DISPOSAL.** The question of the best means for removing household wastes from individual premises was only beginning to receive general attention in 1850; but to-day collection and removal may be considered as no longer in question. The sanitary emancipation of hundreds of small and scores of large towns and cities followed the introduction of the separate system of sewers (see SEWERAGE AND DRAINAGE), with its relatively small, cheap, and self-cleansing pipe conduit system. But sewers, or the water carriage system of waste removal, sometimes proved to be only a temporary solution of the disposal problem, on account of the consequent pollution of public water supplies and the less important, but much more palpable, offense to the nostril and eye caused by the fouling of streams and other bodies of water. Thus, in many instances, the burden was merely shifted and the problem left unsolved.

It must be understood that in the long run practically all these household wastes must reach either the water or the soil, and that ultimately the bulk of the liquid portion reaches the water. Disposal of sewage on land is a recognized method of purification, but discharge into water, provided the volume of water be large enough, and not used for domestic supplies, may be just as effective and sanitary. Nature has abundant means for transforming all organic wastes into harmless and useful products. But the capacity for this in a given area of land, or body of water, is limited. Until the adoption of the water carriage system of sewerage, household wastes were deposited on or in the soil. With the concentration of peoples in cities the soil became overburdened and recourse was had to the nearest water. As soon as nuisances arose here, and particularly when it began to be seen that public water supplies were thus endangered, there was a return to land, only the disposal now was collective, instead of individual, and remote from, instead of upon, each man's premises. Through a lack of knowledge of the principles involved, or because of either a scarcity of proper land or of money to buy and prepare it, the sewage farms, or broad irrigation areas, thus established became oversaturated, clogged, and offensive, or 'sewage sick.'

It was then sought to relieve these areas by removing the solids from the sewage, a plan which had been and continued to be carried out in the case of water disposal. A further motive, where the sewage was discharged into water, was the desire to save the fertilizing material in the sewage. *Sedimentation*, or when this process was hastened, *chemical precipitation*, was the method employed. Some people went so far as to believe that chemical precipi-

tation, alone, would effect all the purification necessary, as well as recover fertilizing material of great value. Unfortunately, the process was only a partial one, and left the decanted liquid, or sewage effluent, in a condition which was likely to give rise to great offense. At the same time the precipitate, or *sludge*, as the solid matter is called, proved to be unavailable for plant food. The next step was to try to coax a given area of land to do more work than before. The means employed, *intermittent filtration*, was to apply the sewage at intervals, on specially prepared areas, called filter beds, with periods of rest between. The raising of crops was made quite secondary, or abandoned. In some cases the filter beds were supplementary to sewage farms, designed to receive the sewage when it would flood the crops; in others, effluent from precipitation works was applied to the beds.

Where suitable land is available intermittent filtration is all that could be desired, in degree of purification effected, but in many sections the proper sort of land (sandy and easily drained) cannot be had. The relatively high rates of application, as compared with sewage farming, clog the beds with the organic matter retained on and in the filtering material. Recourse to sedimentation, or to chemical precipitation, many times tried, revives the old sludge problem.

In the early days of sewage disposal no one dreamed that of the various systems in use, including disposal in water, all but one of the practicable processes depend upon bacteria for their efficiency; and that this single exception, chemical precipitation, would one day be held up as opposed to nature. Such has proved to be the case. The theory of intermittent filtration, when it was at last established on a scientific basis, was that the bacteria involved were ăerobic, or require an abundance of oxygen for their life processes. On this account, the sewage, which passes continuously through the beds while in service, was shut off at more or less frequent but regular intervals, depending on the character of the filtering material. As the sewage drained out of the beds air was sucked in to take its place, thus affording a new air supply for the bacteria in the beds, which, between dosings, could occupy themselves with the stored organic matter. In the latest filters, or so-called *bacteria beds*, or *contact beds*, the germs are given a longer period to work on the sewage, while in some of the recent bacterial processes another class of microbes are enlisted in the service of man. In the bacteria beds there is a sequence of filling, standing full, emptying and finally resting, each cycle requiring from 8 to 24 hours, according to the periods of rest, which vary with local conditions. If one bed does not effect a sufficient degree of purification, a second and finer one, and even a third, may be employed. In case the sewage is held so long in a bed that the oxygen is exhausted, the aërobic bacteria give place to the anaërobic, or those thriving in the absence of oxygen. Anaërobic action may be secured by employing a receptacle containing no filtering material, known as the *septic tank*, through which the sewage flows slowly, but in which the suspended matters are retained by sedimentation, to be acted upon by the bacteria.

The anaërobic action breaks down or liquefies the organic matter; the aërobic action nitrifies it, or converts it into stable mineral compounds, available for higher forms of life. The septic effluent may be discharged on to filter beds, or into water not used for domestic supply, if the latter is ample in volume; and the effluent from bacteria beds may be used.

DILUTION is the method of sewage disposal most commonly employed outside of England. As usually practiced it can scarcely be said to be a system of disposal, since the sewage is discharged into the nearest body of water with little regard to consequences. In Massachusetts, New York, New Jersey, and Ohio, all new disposal schemes must be approved by a central body, which is the State Board of Health in all States but New Jersey, and the State Sewage Commission in that commonwealth. In England all new disposal works involving loans must be approved by the Local Government Board The stringent legislation against water pollution renders the employment of dilution alone a less common practice there than in America. The first principle in disposal by dilution, indeed, in all sewage disposal, is never to endanger a public water supply; the second is not so to overload the stream or other body of water as to create a nuisance.

The best example in the United States of disposal by dilution was furnished, first by the city of Boston, and afterwards by Boston and other near-by towns united to form the Metropolitan Sewerage District. The various communities in the district have their individual sewerage systems. These all discharge into one or the other of two large trunk or outlet sewers, leading to carefully selected points of discharge. At one of the outlets, located at Moon Island, the sewage is stored in reservoirs and discharged at ebb-tide. At the other, or Deer Island outlet, it is discharged continuously. Pumping is necessary for each outlet sewer. A third outlet sewer, which will also discharge continuously in Boston Harbor, was under way in 1901. The other two were built in 1884 and 1895, respectively. At Milwaukee and Chicago huge pumping works and tunnels were built several years ago to pump lake water into rivers badly polluted by sewage, mitigating the nuisance by dilution. The Chicago flushing tunnel was put in use in 1880, and the one at Milwaukee in 1888. The Chicago Drainage Canal (q.v.) is by far the most notable work ever undertaken for the disposal of sewage by dilution. The capacity of the canal was based on a flow of 1 cubic foot of water per minute to each five inhabitants, some years hence, or 2160 gallons of diluted sewage per day for each future inhabitant.

BROAD IRRIGATION, or SEWAGE FARMING, does not differ essentially from ordinary irrigation (see IRRIGATION), except for the fact that sewage is used instead of normal water, and that the sewage is applied the year round, or as nearly so and in as large quantities as the land and crops will permit. See SEWAGE FARMING for detailed descriptions of methods and results.

SEDIMENTATION, alone, is so slow that very little work is accomplished thereby, or else the

tanks must be made so large that their expense is prohibitive. Small settling tanks are occasionally used to remove some of the heavier and rapidly subsiding particles, and when combined with screens for the retention of coarse floating matter they appreciably lighten the work of filter beds, or diminish water pollution.

CHEMICAL PRECIPITATION is little more than accelerated sedimentation, although under certain conditions some of the dissolved organic matter is removed. A chemical with the power of precipitating, or throwing down, the suspended matters is admitted to and mixed with the sewage by simple means, after which the sewage passes to the settling or precipitating tanks, which are generally rectangular and not very deep. The tanks are operated on either the continuous or intermittent plan. If continuous, the several tanks are connected by weirs, so arranged that the sewage has to flow the length of each tank before it is admitted to the next. The clarified sewage, or tank effluent, flows out in a thin sheet from the top of the last tank. When the solid matter, or sludge, has accumulated in the bottom of the tanks to such an extent as to make its removal necessary, valves are opened in the outlet pipes and the effluent is drawn down to a point above the sludge level. To avoid disturbing the sludge a hinged pipe is used, the upper end of which floats at and falls with the surface level of the liquid in the tank. In the intermittent system each tank is filled, stands full the required period, then has its effluent decanted as described. The sludge is either pumped to filter presses or is run on to drainage beds, the object in either case being to reduce the water contents. Where presses are used the resulting sludge cakes, as they are called, are some two inches thick and thirty inches in diameter, and still retain a large percentage of moisture. The final disposal of the sludge is often no easy task. It was originally supposed that it would sell readily, but as a rule managers of sewage works are fortunate if they can get farmers to remove it as a gift. Sometimes it is used to fill in land. In England sludge is not infrequently burned in refuse destructors, or garbage furnaces, with other town refuse. Another means of sludge disposal, available for seaboard cities, is dumping it at sea. The London County Council employs a fleet of sea-going vessels for this purpose, having a capacity of 1000 long tons, or 2,240,000 pounds of sludge each. Chemical precipitation will remove about 50 per cent. of the total organic matter in sewage and nearly all the matter in suspension. The chemical most commonly used is lime, and next to it stands sulphate of alumina. The two are frequently used together.

The first chemical treatment plant for town sewage seems to have been put in use at Manchester, England, in 1844. The use of lime was suggested by Dr. Thos. Clark, of Aberdeen, who, during the same year, invented the lime process for softening water. (See WATER PURIFICATION.) In the United States a small chemical precipitation plant was installed at the Brighton Beach Hotel, on Long Island, N. Y., in 1880, and the first town plant to treat sewage with chemicals was at Long Branch, N. J., where the works were put in operation in 1886. From 1887 to 1890 several additional chemical plants were built, the most notable one being installed at Worcester, Mass., in the latter year. During the year 1900 the Worcester precipitation plant treated an average of 13,000,000 gallons a day, using 1230 pounds of lime for 1,000,000 gallons of sewage as a precipitant, or an average of 8.61 grains per gallon. The cost of treatment per 1,000,000 gallons was $11.70, of which $6.48, or more than half, was for sludge pressing and allied work. The average purification effected, as indicated by the reduction of albuminoid ammonia, was 53.18 per cent. of the suspended organic matter. In 1900 the city of Providence, R. I., opened a still larger chemical precipitation plant. It includes 20 precipitation tanks, capable of holding collectively 11,133,000 gallons; a sludge well, sludge ejectors for lifting the sludge, five sludge storage reservoirs, and sixteen filter presses; besides which there are a large chemical storage building, a chemical laboratory, and various other accessories. The tanks are operated on the continuous flow plan. The sludge is forced from the sludge reservoirs to presses by compressed air. The sewers of Providence are on the combined system and provision is made for wasting some of the combined storm water and sewage of heavy rains.

INTERMITTENT FILTRATION marks a new era in sewage disposal. The principles involved in this and the later and more rapid bacterial processes have already been stated. The amount of sewage which can be treated on one acre of intermittent filter beds ranges from 20,000 to 100,000 gallons a day, according to the character of the material. Within these limits ordinary sewage may be brought to a high degree of purity. The best material for this process is a fairly coarse, angular sand, but with proper dosing either fine or very coarse sand may be used. Loamy earth is not suited for intermittent filtration, on account of the low rates which must be employed; clayey soils are out of the question. Crops may be grown on intermittent filtration areas, providing they are made secondary to the purification of the sewage.

BACTERIA BEDS are largely an English outgrowth, since 1891, of the Massachusetts work on intermittent filtration. There have been various modifications of these beds, such as the use of coal, burnt clay, and coke, for filtering material; placing the beds in tiers, or in terraces; and aiming to use the anaërobic and aërobic bacteria together, or the latter alone. But the essential feature of bacteria beds is the retention of the sewage a longer time in the beds than is possible with intermittent filtration, after which there is a resting period, similar to that in the older process, but shorter. The bacteria beds were evolved in England because of the scarcity of sandy land suitable for intermittent filtration. It being necessary to transport sand or some other filtering material, and make it up into wholly artificial beds, it was imperative that the more expensive beds should treat the sewage at a higher rate. This was found to be possible, but the purification not being sufficiently complete for all conditions, a second, or even a third bed was added where necessary.

There are many claimants for the introduction of bacteria beds, but it appears that the first and most practical early work was that begun in 1892 at the Barking chemical precipitation plant of the London sewerage system by W. J. Dibdin, chemist to the London County Council, aided by

George Thudichum, with a filter bed consisting of 3 feet in depth of coke, broken to small fragments.

In 1891 Sidney Lowcock constructed a novel sewage purification plant for a private residence at Ashstead, England, in which he embodied, probably for the first time, the principle that the bacterial treatment of sewage involved two distinct stages: the breaking down of the solid organic matter, or liquefaction, followed by nitrification. For the first stage he employed a closed tank, filled with broken stone. The sewage rose upward through this tank, then passed down through a series of nine perforated trays, each containing a thin bed of coke. The object of so many trays was to secure a more minute subdivision of bacterial labor.

It is too early to say what rate of filtration will prove feasible with bacteria beds, but it seems doubtful whether the 500,000 to 1,000,000 gallons or more per acre, claimed in England, can be practical for a series of years without either poor results or large outlays for replacing clogged filtering material.

THE SEPTIC TANK is designed to provide the first stage of bacterial action, mentioned just above, without the intervention of filtering material. The sewage first enters a small grit chamber, where sand and like heavy matter is speedily deposited on account of its relatively great weight. The sewage then goes on to a narrow and rather long and shallow tank, having a trapped inlet and outlet, the better to exclude the air. The bulk of the suspended organic matter is deposited and retained in this tank. The anaërobic bacteria seize upon and break up the sludge, which is transformed into dissolved and gaseous matter. The former passes out with the tank effluent. As any sludge left behind remains in the tank week after week, there is no lack of opportunity for complete bacterial reduction. The sludge accumulates by slow degrees. The tank effluent, as has been stated, is about as well purified as that from chemical precipitation tanks, but it is in far better condition for further treatment, while the sludge problem has been practically eliminated. Where further treatment is required to prevent water pollution the tank effluent is generally passed through bacteria beds, sometimes being preceded by aëration in order to establish more favorable conditions for the aërobic bacteria.

The septic tank system was put in use at Exeter, England, in August, 1896, by Mr. Donald Cameron, town surveyor. Since then many other septic tanks have been built. The Exeter tank, like others built under Mr. Cameron's patents, was tightly covered to exclude air and light. Covering, however, does not seem necessary.

It is asserted that the septic tank was developed independently at Urbana, Ill., in 1894, by Professor A. N. Talbot. Certainly he built a tank there and then, which acted in much the same way as the septic tank. In 1895 he designed a more pretentious one for Champaign, Ill., which was built in 1897. See Metcalf, "Antecedents of the Septic Tank," *Proceedings of the American Society of Civil Engineers* (New York, 1901).

MANUFACTURING WASTES may generally be discharged into town sewers. Occasionally they are of such a character as to demand separate treatment. Or the conditions may be such that proper treatment will result in the recovery of some product of commercial value. Much information on the subject will be found in the reports of the Massachusetts State Board of Health.

HOUSES NOT CONNECTED WITH SEWERS. Although, as now understood, sewage is limited to those household and industrial wastes which are removed by sewers, it will be convenient to consider, in addition, the disposal of excrementitious matters and fouled water from such houses and other buildings as are not connected with the sewers. In rural districts this is generally a simple matter. Privy vaults, whether adjoining or more or less remote from houses, are generally little more than holes in the ground, into which the wastes fall and where they remain until removed at frequent intervals. The occasional addition of small quantities of dry earth or ashes will do much to lessen the almost inevitable nuisances of these devices. The comfort and ease of the family demand that such conveniences be placed as near the living rooms as possible, and preferably under the same roof; while in densely populated districts the latter is imperative. Wherever decency and a due regard for health prevail this leads to the adoption of some portable receptacle, which can be kept in a sanitary condition. The two chief means employed to meet this demand are the earth-closet and the pail system. The former is said to have been invented in 1858, by the Rev. Henry Moule, Vicar of Fordington, England. He utilized the deodorizing powers of common soil and devised a mechanism for automatically dumping some of it into the closet when needed, somewhat on the same principle as the flushing arrangement for a water-closet. In the earth-closet a bucket, or some larger receptacle, may be used for the reception and removal of wastes. The pail system is not much different from the earth-closet, except that no earth or other deodorizer is necessarily used. The pails should be made of metal, or some other non-absorbent material. Tight-fitting covers should be provided. With the introduction of the water-closet, with its flushing tank and its pipe for the removal of wastes from the houses, a new problem arose in the way of final disposal. If no cesspool had been provided for sink and bath wastes, one was built somewhere in the yard. These, also, are generally mere holes in the ground, walled up roughly to prevent the caving in of the earth, but not made water-tight. In sandy soils the liquid soaks away. The solid matters are decomposed in the manner explained in the paragraph on septic tanks. In clayey or wet soils cesspools are sure to overflow. Theoretically all cesspools should be water-tight, but practically only a very few are.

The contents of earth-closets may be utilized as fertilizing material with but little difficulty, either by composting or by direct application to the land. The utilization of pail-system wastes is not so easy, since they contain a large percentage of moisture. An absorbent may be used to reduce the moisture, or the pails may be emptied where their contents can drain out. Still another way is to reduce the stuff to a powder in some form of drier. Occasionally night soil from the pail system, and possibly from privies, is burned in garbage furnaces, care being taken to mix it with the driest material available. One of the best means of disposing of all night soil and allied matter is to bury it in trenches.

BIBLIOGRAPHY. Rafter and Baker, *Sewage Disposal in the United States* (New York, 1893),

an exhaustive discussion of both principles and methods; Waring, *Modern Methods of Sewage Disposal* (New York, 1894), a popular review of principles and methods; Kiersted, *Sewage Disposal* (New York, 1894), a brief discussion with particular reference to disposal by dilution; Baker, *Sewerage and Sewage Purification* (New York, 1896), brief and popular; Rideal, *Sewage and the Bacterial Purification of Sewage* (New York, 1900), a pretty thorough and rather scientific discussion of the bacterial phases of sewage treatment, written by an Englishman and almost wholly from the English point of view; Dibdin, *Purification of Sewage and Water* (London, 1903), also relates chiefly to the bacterial aspects, almost wholly English, but less technical than Rideal; Thudicum, *The Bacterial Treatment of Sewage* (London, 1900), a brief, popular review of recent bacterial studies and results; Barwise, *The Purification of Sewage* (New York, 1899), another English author, fairly popular in style and more general in range than the three preceding; Crimp, *Sewage Disposal Works* (2d ed., London, 1894), the standard English engineering treatise, including principles, methods, and descriptions of works, but has nothing on the recent bacterial studies; Corfield, *The Treatment and Utilization of Sewage* (3d ed., London and New York, 1887), somewhat similar to but less comprehensive than Crimp; Slater, *Sewage Treatment, Purification, and Utilization* (London, 1888), brief, semi-popular, controversial, and not up-to-date, but valuable on account of a descriptive chronological list of 456 English patents on methods of treating sewage, issued from 1846 to 1886, inclusive; Bailey-Denton, *Sewage Purification Brought Up to Date, 1896* (London and New York, 1896), by one of the chief exponents of intermittent filtration, written after the earlier announcements of the more recent bacterial studies, and describing eight land-filtration systems; Tidy, *The Treatment of Sewage* (New York, 1887), brief, comprehensive, semi-technical; Burns, *Utilization of Town Sewage, Irrigation, and Reclamation of Waste Land*, being vol. v. of *Outlines of Modern Farming* (6th ed., London, 1889), a semi-popular discussion of sewage farming, from the agricultural point of view, a number of years back; United States Consular Reports (special, vol. xvii.), *Disposal of Sewage and Garbage in Foreign Countries* (Washington, 1899), mostly popular, and generally meagre in detail, but containing some excellent descriptive matter. See FILTER PRESSES; FILTER AND FILTRATION, IRRIGATION; SEWERAGE AND DRAINAGE; WATER SUPPLY.

SEWAGE EARTH-CLOSET. See SEWAGE.

SEWAGE FARMING. The utilization of sewage in the growth of field, orchard, and garden crops. The most noted farms are at Paris, Berlin, Danzig, Breslau, and Birmingham, in Europe, and at Pullman, Ill., Los Angeles, Cal., South Framingham, Mass., and Plainfield, N. J., in the United States. Sewage farming, which is largely a development of the last third of the nineteenth century, is an attempt to combine crop-growing with sewage purification. Where intelligently managed a high degree of purification is attained without creating a nuisance in the neighborhood, and the excellent crops which are grown may be used without menace to health in spite of popular prejudice to the contrary. Aside from the irrigation value of the water, sewage is of some importance agriculturally on account of the fertilizing elements it contains. Analyses show that less than 2 parts in 1000 of average sewage is solid matter, and that a ton of sewage contains from 0.15 to 0.25 pound of nitrogen, from 0.045 to 0.065 pound of phosphoric acid, and from 0.025 to 0.040 pound of potash. These would have a cash value of 3½ to 5 cents. Since, however, in actual operation much of the nitrogen is lost, the real value of sewage will not exceed 3 cents per ton and one to two cents per ton is more nearly its true manurial value. The recognized greater agricultural value of sewage over river water for irrigation is accountable for the 25 to 50 per cent. increase in rent per acre for land irrigated with sewage. Unless care be taken to prevent the sewage from coming in direct contact with crops intended for consumption in the raw state, the methods of applying sewage do not differ from those of irrigation (q.v.). Sewage farms are located preferably on open soils with a sandy or gravelly subsoil. Clay soils are less satisfactory.

Since experience indicates that the best crops are secured when the sewage is applied only as needed, arrangements should be made for the disposal of surplus sewage that may accumulate when the crops cannot use it. This is usually done by making separate filtration areas or by growing crops capable of withstanding large quantities of water, such as Italian rye grass, orchard grass, perennial rye grass, and blue grass. With a controllable supply of water practically all crops suitable for the climate can be grown to perfection. In Southern California orchards are very successfully irrigated with sewage. From the standpoint of sewage disposal the primary object of sewage irrigation is to purify the sewage so that it may not contaminate the underground water or streams. Experience on sewage farms, both in Europe and America, shows that every essential requirement of sewage purification is present in sewage farming, and that when sewage is rightfully used the water flowing from these farms is clear and sparkling.

Consult: United States Geological Survey Water Supply and Irrigation Papers Nos. 3 and 22 on *Sewage Irrigation* (1897, 1899); Rafter and Baker, *Sewage Disposal in the United States* (New York, 1894); Waring, *Modern Methods of Sewage Disposal* (ib., 1894); Kiersted, *Sewage Disposal* (ib., 1894); *Birmingham Sewage Inquiry Report*, 1871.

SEWALL, sū'al, MAY (WRIGHT) (1844—). An American educator, lecturer, and author, born in Milwaukee, Wis. She graduated at Northwestern University in 1866, and in 1880 married Theodore L. Sewall, who died in 1895. She was for many years prominently identified with the woman's suffrage movement and with the education of women, was member and officer of many women's clubs and delegate to numerous women's congresses, both in the United States and abroad. She was one of the lady managers of the Columbian Exposition at Chicago in 1893, and in 1900 she was appointed a commissioner to the Paris Exposition. For a long time she was principal of a girls' classical school in Indianapolis, Ind., founded by her husband. She wrote several works on woman suffrage and kindred topics, and edited *The Historical Résumé of the World's Congress of Representative Women.*

SEWALL, SAMUEL (1652-1730). A colonial jurist, born at Bishopstoke, England. He emigrated with his parents to Massachusetts in 1661, and graduated at Harvard in 1671. He was a member of the Executive Council of Massachusetts Bay from 1692 to 1725; was a probate judge from 1692 to 1718, and was Chief Justice of Massachusetts from 1718 to 1728. He presided over some of the trials at the time of the famous witchcraft delusion, but later became convinced of the worthlessness of the testimony upon which the victims had been convicted, and in 1697 prepared a confession of his error, which was read, in his presence, before the congregation of the Old South Church. He was widely known as a philanthropist, and in 1700 wrote a pamphlet against slavery, entitled *The Selling of Joseph.* He also wrote *An Answer to Queries Respecting America* (1690), *The Accomplishment of Prophecies* (1713), *A Memorial Relating to the Kennebec Indians* (1721), and *A Description of the New Heaven* (1727). His *Diary* (from 1764-1729) and his letter books, both published in the *Collections* of the Massachusetts Historical Society, are invaluable for the light they throw on the social history of early New England.

SEWANEE (sē-wą'nē) **UNIVERSITY.** See SOUTH, UNIVERSITY OF THE.

SEWARD, sū'ērd, ALBERT CHARLES (1863—). An English botanist, born in Lancaster and educated at Saint John's College, Cambridge. He studied paleobotany under Williamson at Manchester and in European museums, became university lecturer in botany at Cambridge in 1890, and in 1899 was appointed fellow and tutor of Emmanuel College. He wrote *Fossil Plants as Tests of Climate* (1892), *The Wealden Flora* (vols. i. and ii. in the British Museum Catalogues, 1894-95), *Fossil Plants for Students of Geology and Botany* (1898 et seq.), and *Jurassic Flora* (in British Museum Catalogue, 1900 et seq.).

SEWARD, ANNA (1747-1809). An English author, a daughter of Thomas Seward, who became Canon of Lichfield. She was the author of a collection of sonnets (1799) and other verses, and of elegies on Major André and Captain Cook, for which she was styled the "Swan of Lichfield." She also wrote a poetical novel called *Louisa* (1782), and a *Memoir of Dr. Darwin* (1804), in which she laid claim to the exordium of *The Botanic Garden.* Miss Seward was a woman of great beauty. Her *Poetical Works and Correspondence* (3 vols., 1810) was published under the supervision of Scott, and Constable brought out her whole literary correspondence (6 vols., 1811).

SEWARD, CLARENCE ARMSTRONG (1828-97). An American soldier and lawyer, born in New York City. He graduated at Hobart College in 1848, studied law, and practiced it, after 1854, in New York City. From 1856 to 1860 he was Judge Advocate General of New York State. In 1860 he went to Virginia to protest against its secession from the Union. He entered the Civil War as colonel of the 19th New York Volunteers. In 1865, after the assault upon Secretary Seward and his son, Frederick William, he was called to Washington to act as Assistant Secretary of State. At the time of his death he was president of the American Express Company.

SEWARD, FREDERICK WILLIAM (1830—). An American lawyer and diplomat, the son of William H. Seward. He was born in Auburn, N. Y., graduated at Union College in 1849, was admitted to the bar in 1851, and in the same year became assistant editor and part owner of the *Albany Evening Journal,* then controlled by Thurlow Weed. From 1861 until 1869 he was Assistant Secretary of State under his father. On April 14, 1865, he was severely wounded while defending his father against an assassin. In 1867, with Admiral David D. Porter, he was sent to the West Indies, where the two negotiated a treaty with Santo Domingo, and he also took a prominent part in the negotiations for the purchase of Alaska. In 1875 he was a member of the New York State Legislature, and from 1877 to 1881, during the Presidency of Rutherford B. Hayes, was again Assistant Secretary of State. In addition to numerous articles in magazines and reviews, he published *The Life and Letters of William Henry Seward* (1891).

SEWARD, GEORGE FREDERICK (1840—). An American diplomat, born in Florida, N. Y., son of W. H. Seward. He was educated at Seward Institute and Union College. In 1861 he was appointed United States consul at Shanghai, and cleared the Yang-tse-Kiang of pirates claiming American citizenship. From 1863 to 1876 he was Consul-General, introducing many reforms into the conduct of the office and suggesting others regarding the American judicial establishment in China. He was appointed Minister to China in 1876. As he opposed the restriction of Chinese immigration, he was recalled in 1880, and engaged in business in New York City. He became president of the Fidelity and Casualty Company in 1893. He published *Chinese Immigration in Its Social and Economic Aspect* (1881).

SEWARD, WILLIAM HENRY (1801-72). An eminent American statesman, born in Florida, Orange County, N. Y., May 16, 1801. He attended an academy at Goshen, N. Y., graduated at Union College in 1820, studied law in New York City and also at Goshen, was admitted to the bar at Utica in 1822, and in 1823 settled in Auburn for the practice of his profession. A short time afterwards he married the daughter of his partner, Judge Elijah Miller. In 1830 he was elected to the State Senate by the Anti-Masonic Party, to whose first national convention he had been sent as a delegate. As a Senator he won distinction by the industry and ability with which he advocated internal improvements, support of the common schools, and political reforms of various kinds. As the agent of the Holland Land Company, he laid the foundation of a comfortable fortune. In 1838 he was elected Governor of New York as a Whig. His administration was signalized by notable improvements of the common school system, reform of prison discipline, judicial reforms, and internal improvements, while he gave much attention also to the extension of the franchise, the reform of the banking laws, the geological survey of the State, and the improvement of the militia. His term was marked by the anti-rent troubles (see ANTI-RENTISM) and the controversy over the McLeod affair. (See CAROLINE, THE.) In 1840 he was

reëlected. For several years after the expiration of the term he gave his whole time to the practice of his profession, at Auburn, and appeared as counsel in a number of important criminal cases. In 1849 he was elected to the United States Senate, and at once took a prominent place among the leaders of the Whig Party and became the most intimate Senatorial counselor of President Taylor. In the debate on the Compromise Measures of 1850 (q.v.) he delivered, on March 11th of that year, an able speech in which he vigorously denounced slavery, and startled the opposition by declaring that "there is a higher law than the Constitution." He supported the French Spoliation Bill and a protective tariff, spoke on the American fisheries, the Texas debt, the Hungarian Revolution, and other subjects, and vigorously opposed the Kansas-Nebraska Bill (q.v.). In 1855 he was reëlected to the Senate, in spite of the opposition of Know-Nothings and Whigs of Southern sympathies. He was an influential factor in the organization of the Republican Party, and for the first few years was generally regarded throughout the Union as preëminently its leader. In October, 1858, he made a notable speech at Rochester, in which he spoke of the antagonism between freedom and slavery as an 'irrepressible conflict,' which could only terminate by the United States becoming entirely a slave-holding nation or entirely free. Prior to the National Republican Nominating Convention at Chicago he was the most conspicuous candidate for the Republican nomination for President in 1860, and on the first ballot received 173½ votes, but was finally defeated by Abraham Lincoln. After Lincoln's election Seward became Secretary of State, and in this capacity rendered services of almost inestimable value to the nation, holding the office during the Civil War and the four years of Johnson's administration. He negotiated a large number of treaties with foreign governments and conducted the foreign relations of the United States during these critical times with remarkable tact and success. Notable instances of this were the case of the *Trent* affair (q.v.), the question arising out of the French intervention in Mexico, and the negotiations concerning Great Britain's obligations as a neutral nation. (See ALABAMA CLAIMS.) He also negotiated with Russia, in 1867, the treaty for the purchase of Alaska. His State papers are models of clear and vigorous style. During the war he supported President Lincoln in all his efforts to raise and equip the armies, and gave his approval to the emancipation proclamations. On the evening of April 14, 1865, the same day on which President Lincoln was assassinated, an assassin named Paine entered Seward's room and inflicted dangerous wounds upon him as well as upon his son Frederick. He gradually recovered, however, and continued as Secretary of State in the Cabinet of President Johnson until the end of his term. He entertained moderate views of reconstruction and supported the plan of President Johnson, thus alienating from himself the more radical wing of his party. Upon his retirement from office in 1869, he made a journey to Alaska, and in the following year set out upon a tour of the world, visiting the principal countries of Europe, Asia, and Africa, and being received everywhere with great honor. He died at Auburn on October 10, 1872. His speeches and orations appeared in five volumes, and his official correspondence was published by order of Congress. For his life, consult: Baker, (New York, 1855); Frederick W. Seward (ib., 1877); and especially Frederick Bancroft (ib., 1900); also *William H. Seward's Travels Around the World* (New York, 1873), by his adopted daughter, Olive Seward.

SEWEL, sū'el, WILLIAM (1654-1720). A Quaker historian and scholar. He was born and lived all his life in Amsterdam. His *History of the Rise, Increase, and Progress of the Christian People Called Quakers,* published in Dutch at Amsterdam in 1717, and in English translation (by himself) at London in 1722, is a standard work of unquestionable accuracy. Consult his *Life* in the edition published at New York (1844).

SEWELL, JONATHAN (1766-1839). A Canadian jurist, son of Jonathan Sewall (1728-96). He was born in Massachusetts, was educated in England, and in 1785 went to New Brunswick and studied law. He was appointed Solicitor-General in 1793, Attorney-General in 1795, and from 1808 till 1838 was Chief Justice of Lower Canada. He published a *Plan for a General Federal Union of the British Provinces in North America* (1815), and is sometimes credited with having been the first to propose Canadian federation.

SEWELL, MARY (1797-1884). An English authoress, daughter of a gentleman farmer named Wright. In 1819 she married Isaac Sewell, a banker. She wrote verses for children and young people, which had an enormous sale. *Homely Ballads* (1858) reached the fortieth thousand, *Mother's Last Words* (1860) passed beyond a million copies, and *Our Father's Care* (1861) exceeded three-quarters of a million. Besides these and other poems she wrote *Patience Hart's Experiences in Service* (1862), and other popular short tales. All her work was simple in style and ethical in theme. Consult *Poems and Ballads,* edited with memoir by Mrs. Bayly (London, 1886).

SEWELLEL (Chinook Indian *she-wal-lal,* robe made of sewellel hide, the animal itself being called *o-gwool-lal* in Chinook, *squallal* in Yakima, and *showt'l* in Nisqually), or MOUNTAIN BEAVER. A curious little beaver-like rodent (*Haplodon rufus*) of the mountains from northern California to British Columbia, which lives in wet places overgrown with vegetation, where it makes extensive burrows and runways often kept wet by running water. They usually live in colonies, and hibernate, preparing for the winter by cutting and collecting great quantities of woody plants and ferns, which they carry to places near their burrows and spread out to dry thoroughly before taking them into their burrows as stored food. The Indians ate them and made much use of their soft fur. A second species (*Haplodon major*) has been described from California. The many structural differences from the beaver have led to placing the sewellels in a family (Haplodontidæ) by themselves. They are regarded as most nearly representing the ancestral type of the squirrels.

SEWERAGE (OF. *seuwiere,* canal, from ML. *exaquatorium,* drainage-canal, from Lat. *ex,* out + *aqua,* water) AND **DRAINAGE** (from AS. *drehman, dreahnian, drēnian,* to drain, from AS.,

Goth. *dragañ*, to draw, OHG. *tragan*, Ger. *tragen*, to carry). The removal and disposal of liquid and water-borne solid household wastes, the freeing of towns and cities from surface water, and the lowering and removal of subsoil water.

The two fundamental principles in the design of sewerage systems are (1) the removal of sewage before offensive decomposition sets in, which may be effected by providing sewers of ample capacity, uniform and sufficient slope, and smooth interiors; and (2) the disposal of sewage in such a manner that neither water, soil, nor air will be polluted thereby. Sewerage systems are generally divided into two portions: the collecting sewers and appurtenances and the outfall sewer or sewers. In addition there may be disposal works, including either a pumping or a purification plant, or both. The aim always is so to design the collecting and outfall sewers that the discharge may be by gravity, thus avoiding the expense of a pumping plant.

Sewerage systems, as now understood, date chiefly from the middle of the nineteenth century. A few ancient cities had sewers for the removal of fouled liquids, as well as for drainage. The most notable instance of this was Rome. (See CLOACA.) But the Roman sewerage system did not serve the whole population, by any means. The drainage of London was the subject of legislation as early as 1225, but down to 1815 it was a penal offense to discharge excrement or other offensive matter into the drains of that city. In 1847 the first act was passed making it compulsory to drain London houses into the sewers, and in 1859 work was begun on a system of intercepting sewers and storage tanks to cut off the discharge of sewage into the Thames within the city.

Paris had drains prior to 1536, but in 1663 their total length is said to have been only about six miles, of which one and one-half miles were closed and the remainder open channels. In 1820 Paris made the use of cesspools obligatory, but permitted the liquid overflow to be discharged into the sewers. In 1880 a move was made to permit the discharge of all house sewage into the sewers, but up to the close of 1893, or just before the full adoption of the sewerage plan, of 266,044 houses in the city, only 10,934 were directly connected with the sewerage system.

In the United States, Boston had drains as early as 1701. After the adoption of a city charter in 1823 Boston assumed the ownership and control of all the drains and sewers which had been built by private parties. The date on which the sewers were opened for the reception of water-closet matter generally is not available; but presumably it followed shortly after the introduction of an ample public water supply, in 1848.

It may be said of all cities that a sanitary sewerage system, as now conceived, is out of the question until a copious water supply has been provided. In most of the larger cities provisions for surface drainage preceded the introduction of sanitary sewers. Convenience gradually led to the use of these surface or storm sewers for the disposal of liquid, and then of solid house wastes, the connections for the latter purpose often being surreptitious at first. As public water supplies were introduced and the per capita water consumption greatly increased, the disposal of the water thus brought into the houses often became even more serious a matter than the removal of surface and ground drainage. This led to the construction of sewers on the combined plan. The expense involved in building sewers large enough to carry off the rainfall was almost or quite prohibitive for all but the larger, closely built cities, so as the need for house sewerage systems increased sewers were built more and more frequently for this purpose alone.

About 1850 the separate system was introduced in several English towns. In 1875-76 a separate system of sewerage was built at Lenox, Mass., and in 1880 a more extensive one was constructed at Memphis, Tenn. Both these were designed by the late Col. Geo. E. Waring, Jr. The Memphis system attracted great attention, owing largely to the yellow fever epidemic which preceded and led up to its adoption. Nevertheless, the separate system, often but not always slightly modified to avoid controversy, has been widely adopted in the United States.

Designing a sewerage system necessitates first of all an accurate and complete topographical map of the city or town. The next step is to divide the city into its natural drainage areas, particularly if storm-water sewers are to be built. This done, the location of the main sewer for each district is determined and the tributary population estimated. The grades, or rate of fall per 1000 feet, should be so adjusted as to give self-cleansing velocities. At the same time, economy in construction will keep the sewers as near the surface as is consistent with proper grades and serving the lowest plumbing fixtures in the houses.

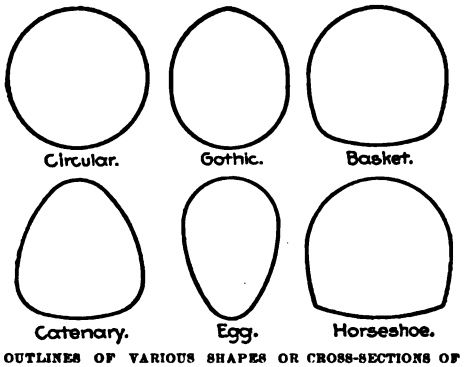
The relative advantages of the combined and separate systems of sewerage will depend largely upon the size of the city and whether either pumping or purification is necessary. If either of the latter, and particularly if both, are required, it is highly desirable that the separate system be installed, both on account of the extra cost involved in handling the surface water and of the great disadvantages and difficulties incident to sudden and marked changes in the volume of sewage to be treated at purification works. Another advantage of separate sewers is that they render it unnecessary to place the storm sewers deep enough to serve the bottom of the cellars, thus often saving very heavy deep trenching. The smaller cities and towns find it highly advantageous to adopt the separate system of sewerage, and to construct the sanitary sewers, only, at the outset.

The *volume of sewage* for which provision must be made is dependent on water consumption and rainfall. In the separate system of sanitary sewers rainfall need not be considered, since it is excluded, but some allowance must be made for the leakage of ground water into the sewers. In fixing the capacity of the combined system of sewers the house sewage scarcely needs be considered except on the laterals serving single short streets, since the maximum surface or storm water to be carried is so far in excess of the house wastes. Ordinarily it is safe to assume that the maximum water consumption is double the average flow, and that 75 per cent. of the latter reaches the sewers, the remainder being used for lawn-sprinkling and for houses not connected with the sewers. On this basis, a city with an average daily water consumption of 100 gallons per capita would have a maximum con-

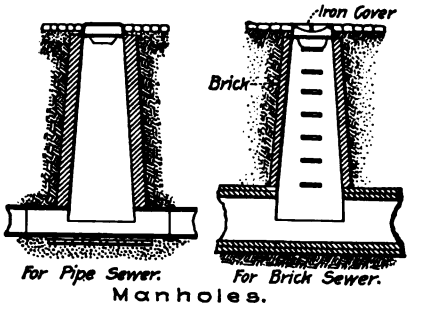
sumption of 200 gallons, of which 150 gallons would reach the sewers. Under very unfavorable circumstances infiltration of ground water has been estimated as equal to the flow of sewage proper, but design and construction permitting such a condition should never be tolerated. Under normal conditions of both consumption and infiltration the extra volume on the latter account may be taken at 15 per cent. of the assumed sewage flow. In round numbers, then, the capacity of separate sanitary sewers should be 175 gallons per capita per day.

The amount of rainfall for which provision must be made is a more difficult problem than might appear at first thought. There must be determined, first of all, the maximum rate of rainfall during comparatively brief periods, and next the percentage of the total which will reach the sewers at the same moment. As to the percentage of rainfall reaching the sewers in a given time much will depend upon the permeability of the soil, the proportion of roofed and paved to the total area of the district, and the slopes of the area. The general practice is to base the calculations on the rate of rainfall per hour. An old rule for populous districts was to make the sewers large enough to carry away a rainfall of one inch per hour. The more recent short-period observations show that far higher rates may reach the sewers.

MATERIAL, SIZE, AND SLOPE OF CONDUITS depend largely upon whether the separate or combined system is adopted. Vitrified clay or terra-cotta sewer pipes (see PIPE) are now almost universally used for all sewers up to 24 inches, and sometimes up to 30 inches in diameter, whether the system be separate or combined, but in the combined system there is comparatively little opportunity for using the smaller sizes of conduit. Cement pipe is also used in a few cities. Where vitrified clay pipe cannot be used, and iron pipe is not required for its greater strength or tighter joints, brick is the material most commonly employed. The size of pipe sewers, in the separate sanitary system, ranges from 6 to 30 inches, but 8 to 24 inches is a more common range. The 6 or 8 inch pipe is used for laterals and for conduits receiving the sewage from a few laterals. Iron sewers may be used up to 5 feet or more in diameter, but they rarely go above 3 feet, and are not often employed in any size, because of cost. There is practically no limit to the size of brick sewers. In the large combined sewers stone masonry is occasionally and concrete frequently substituted for brick, particularly in the lower part, or invert, of the sewer, and on heavy grades, where the scour due to high velocities and street sand and other dirt is likely to wear the brick. Both wood and steel have been used for large outfall sewers, especially for submerged pipe. Crossings beneath streams are frequently made by means of so-called inverted siphons.



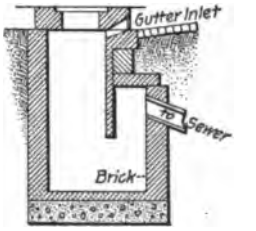
OUTLINES OF VARIOUS SHAPES OR CROSS-SECTIONS OF SEWERS AND DRAINS.



Manholes.

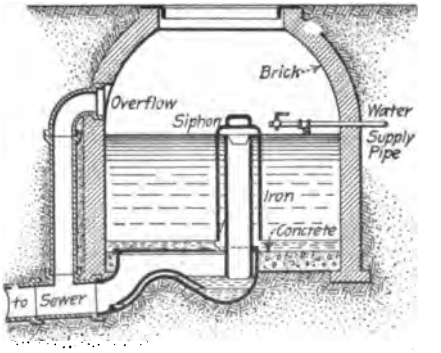
Terra-cotta, iron, and wooden pipe are generally round; brick and concrete are given various shapes, depending largely upon the available grade. Where feasible, all large sewers, other than iron, are smaller at the bottom than the top, in order to concentrate the dry-weather flow and diminish the chances for stoppage.

ACCESSORIES include manholes, or chambers giving access to the sewers from the street; lampholes and handholes, for inspecting and cleaning separate sanitary sewers; flush tanks for suddenly releasing a supplementary volume of water; catch or inlet basins, for the admission of surface drainage to combined or storm sewers. The latter are generally at the curb line. Such deposits as cannot be flushed out of the sewers must be removed from time to time by passing a ball, scraper, or other device from manhole to manhole.



Catch or Inlet Basin.

AUTOMATIC FLUSH TANKS are provided in many sewers of the separate type. They are chambers for the storage of water, with means for its sudden discharge down the sewer. The discharge is generally effected by means of a



AUTOMATIC FLUSH TANK.

siphon, which comes into action when the water in the tank reaches a certain level. Another kind of automatic arrangement is an irregularly shaped bucket, or tank, so arranged that when it has been filled by the supply pipe its centre of gravity is disturbed and the water discharged by tilting. Automatic flush tanks should discharge at least once in twenty-four hours, and liberate some 200 or 250 gallons of water at each action. In the combined system of sewers all these methods of flushing are liable to be inadequate, except on the smaller sewers. Cleaning by hand or otherwise then becomes necessary.

VENTILATION OF SEWERS is a thing which has given rise to much discussion. The simplest means are generally the best, and it is rarely the case in sewers that any improvement can be made over thoroughly good design and execution in the way of grade, alignment, and smooth interiors. In some English cities ventilating shafts have been provided, but this has rarely if ever been done in America. Perforated manhole covers are about all the specific provision for ventilation made in the United States. The omission of traps at the foot of the house soil pipes will contribute no small amount of ventilation, and is sometimes practiced. Objection to this plan is offered by some on the ground of danger to the inmates of houses if the soil pipes are converted into as many ventilating shafts, but in properly designed and constructed sewers, having such ample ventilation as is thus afforded, there is a growing belief that no reason for apprehension will follow the practice. The 'sewer gas' of which so much was said some years ago does not exist—as a specific gas. Sewers, and particularly those retaining deposits of organic matter for considerable periods, may yield various gases of decomposition, and under extreme conditions these gases may be positively and immediately dangerous. Numerous careful studies have shown that the bacterial contents of the air in sewers resemble those of the outer air above, rather than the bacteria in the sewage, and that they are comparatively few in numbers. In fact, the air in anything approaching a model sewer is better than that in overcrowded theatres and churches. The menace of sewerage systems is the pollution of public water supplies, not the air of either streets or buildings. Nevertheless, great care should be taken to prevent the accumulation of bad air in sewers and to reduce to a minimum the access of any sewer air to houses or other buildings.

PUMPING WORKS for sewage do not necessarily differ much from those for water, except that they generally lift the sewage but a few feet, and should be of a type not readily damaged by foreign matter. Centrifugal pumps are often used to lift sewage, as being economical, with low lifts, and having no valves likely to get out of order. Other kinds of steam pumps are used; also air displacement pumps, known as Shone ejectors, and pumps driven by the sewage itself, known as sewage lifts. In the Liernur system of sewerage the sewage is drawn or sucked to a central station through iron pipes, from which the air is exhausted by proper pumping machinery. This system was introduced in Holland about 1880, but gained comparatively little foothold in Continental Europe and none in England or America. One of the leading features of the Liernur system was keeping the excrement largely free from water and manufacturing it into a fertilizer. The iron pipes and the construction and operation of the machinery required for the system entailed a large outlay for fixed and current expenses.

BIBLIOGRAPHY. Folwell, *Sewerage* (New York, 1900), a readily comprehensible discussion of the design, construction, and maintenance of sewers; Ogden, *Sewer Design* (New York, 1899), discusses rainfall, population, and other factors of sewer design; Staley and Pierson, *Separate System of Sewerage* (3d ed., New York, 1899); Goodell's translation and adaptation from the German of Baumeister's *Cleaning and Sewerage of Cities* (2d ed., New York, 1895), a condensed account of European and American practice; Waring, *Sewerage and Land Drainage* (3d ed., New York, 1891), largely but not wholly devoted to the author's methods and executed works along the lines of the strictly separate system of sewerage; Moore, *Sanitary Engineering* (London and New York, 1898), an extensive treatise, chiefly from the English standpoint, and devoted almost wholly to sewerage. See also list of works under SEWAGE DISPOSAL, which read in this connection.

SEWING MACHINE (from *sew*, AS. *seowian*, Goth. *siujan*, OHG. *siuwan*, *siwan*, to sew; connected with Lat. *suere*, OChurch Slav. *shiti*, Lith. *siuti*, Lett. *shūt*, Skt. *siv*, to sew). It is probable that the first sewing machine was made by an Englishman named Thomas Saint, and was patented July 17, 1790. Though made of wood, it resembled the later successful machines in that it had an overhanging arm, vertically reciprocating needle, continuous thread, and automatic feed. This machine had a notch instead of an eye in the needle, for the thread to pass through, and a hole was punched by an awl for the needle to pass through. It produced a single-thread chain-stitch. In 1830 Barthélemy Thimonier produced a sewing machine which was patented first in France and some time afterwards in the United States. This machine was so far successful as to be employed to make clothing for the French army, and it thereupon was destroyed by an ignorant and furious mob. Thimonier's first machine was also of wood, but he afterwards constructed one of metal, driven by a cord and treadle. It had the overhanging arm, flat cloth plate, vertical post, vertical reciprocating needle, continuous thread, and presser-foot of the modern machine. The needle was hooked and had to be passed backward and forward through the cloth twice to complete a stitch. In 1841 Newton and Archbold patented in England a machine using an eye-pointed needle and producing a chain-stitch.

About the same time that the French machine was being perfected, Walter Hunt is said to have made a sewing machine having the double thread and lock-stitch which was characteristic of the Howe machine. Hunt, however, failed to perfect or patent his invention for so many years after it was first put upon the market that when at length he applied for a patent it was denied him.

In 1846 Elias Howe (q.v.) patented a sewing machine containing most of the essential features of the modern machine. The needle was curved and moved back and forth horizontally instead of vertically. The machine, crude as it was, included the grooved, eye-pointed needle and

the automatic feed and produced a lock-stitch by means of a shuttle operating on the opposite side of the cloth from the needle. Howe was for many years engaged in suits for infringement upon his patents. In these he was successful, and, unlike most of the earlier inventors, he received a large fortune from royalties.

In 1849 John Bachelder patented a machine which was the first to combine the horizontal table and the continuous feed device. The latter consisted of an endless band of leather set on to small steel points. These points projected up through the table and, penetrating the material, carried it to the needle.

A. B. Wilson invented in 1852 the vibrating double-beak shuttle, and in 1854 the four-motion feed. The latter invention—the serrated metal bar covered with forward pointing saw teeth—is the familiar feed-plate now used on almost all machines. This toothed bar (1) rises through a slot in the table, (2) moves horizontally forward to advance the cloth, (3) drops below the table, (4) moves horizontally back again to its starting point below the table.

In 1851 Isaac M. Singer patented a sewing machine having a fixed, overhanging arm and a vertical needle. He also introduced the foot treadle, previous American machines having been operated by turning a crank with the hand. The most important invention which he contributed was the presser foot, with a yielding spring.

There are two types of domestic sewing machines: those making a lock-stitch and those producing a chain-stitch, or the double and single thread machine. Some double-thread machines produce a chain-stitch. Each type has its adherents among seamstresses. The lock-stitch resembles weaving in its formation, while the chain-stitch resembles knitting, and is easily raveled. According to the census for 1900, 90 per cent. of the machines built for household use have the lock-stitch.

Among the sewing machines for doing special kinds of work or work on special materials are the shoe and leather sewing machines, the carpet-sewing machine, and the button-hole machine. By far the most important of these, in practical results attained, is the shoe-sewing machine. The McKay machine was the result of three years of patient labor and of an expenditure of over $130,000 before practical results were attained. In using this machine the inner sole is first placed on the last and then the upper is lasted and fastened to the inner sole. The outer sole is then placed above the lower sole, to which it is tacked, and the shoe is placed on a horn or rotary support which brings the shoe up to the needle of the machine. A waxed thread wound on a spool is contained on a spool within the horn and is carried up to the whirl or small ring at its upper end, where there is an opening for the needle, which comes down from above, piercing the sole. The waxed thread, which is kept soft by the heat of a lamp, is caught by a barb or hook on the needle as it descends through the hole, and is pulled back through the sole on its upward passage. This machine attended by a single operator can sew 900 pairs of shoes in a day of ten hours, while a usual rate by an average workman is from 500 to 600 pairs in a similar time. It was used extensively both in the United States and in Europe, but it possessed the disadvantage that the shoes, though strong and comfortable when first made, could not be resoled except by pegging or nailing, and possessed in addition soles stiff and lacking in flexibility. In the Goodyear welt machine, for which patents were granted in 1871 and 1875, a welt was sewed to an upper and this welt in turn was fastened by an external row of stitches to the sole. Shoes made in this way were much more flexible and could be half-soled by the shoemaker by the ordinary process of hand sewing. This machine at once found application to the manufacture of fine boots and shoes, and on it at the present time are made nearly all of the finer grades of men's shoes.

The first machine for sewing leather and other heavy materials was patented by J. J. Greenough in 1842, but did not come into extended use. The following year a similar machine was patented by George H. Corliss, the inventor of the Corliss engine. It had two needles with eyes near their points, which worked horizontally through holes previously punctured by awls. The movements were derived from cams on a revolving shaft and the feed was automatic. Leather-sewing machines are now used in all branches of the leather industry, including the sewing of the uppers of shoes and the different kinds of stitching required in the manufacture of gloves.

A button-hole machine was first patented by Humphrey in 1862, but the Reece button-hole machine, patented nearly twenty years later, first brought the art of making button-holes by machinery to its present state of perfection. There are several styles of these machines now on the market and a button-hole attachment is sold with ordinary sewing machines.

An invention patented in 1894 is a machine for sewing the breadths of carpeting. It differs from other sewing machines in that it, and not the material, moves along as the process of sewing advances.

In the manufacture of sewing machines America leads the world. Not only are great numbers of machines exported, but several of the leading manufacturers have branch factories in Europe.

STATISTICS. The value of the export trade of the United States in sewing machines for the last ten years of the nineteenth century was as follows: 1891, $2,883,577; 1892, $3,133,992; 1893, $2,476,446; 1894, $2,347,354; 1895, $2,260,139; 1896, $3,139,249; 1897, $3,340,241; 1899, $3,136,364; 1899, $3,264,344; 1900, $4,541,774. According to the United States Census for 1900 there are 65 establishments in this country engaged in the manufacture of sewing machines. These factories have a combined capital of $20,072,800, and the value of their annual product is $21,129,561. This product includes 747,587 machines for household use and 55,227 machines for use in factories. In 1860, when statistics of the industry were first collected, there were 88 factories, or 23 more than in 1900; but the total amount of capital invested was only $1,494,450, and the annual product was $4,403,206. The popularity of this industry seems to have been at its height in 1880, when 124 factories were in operation. This is accounted for by the fact that in 1877 the disorganization of the sewing-machine combination, which controlled patents covering several of the essential features of the sewing machine, was effected, and thus the field was opened to numerous small manufacturers. Consult: Section on "Sewing Machines," *Twelfth Census of the*

United States, vol. x., part iv., "Manufactures" (Washington, 1902); Byrn, *Progress of Invention in the Nineteenth Century* (New York, 1900).

SEX (OF. *sexe*, from Lat. *sexus*, *secus*, sex, from *secare*, to cut; connected with OHG. *saga*, *sega*, Ger. *Sage*, AS. *saga*, Eng. *saw*) (in animals). The capacity, in all but the lowest organisms, of each individual producing either eggs or sperm cells (or both), i.e. germ cells which are either female or male. In the lowest or unicellular animals, reproduction (q.v.) is by self-division or by germs, which so far as we know are devoid of sexuality; such forms are said to be *'asexual.'* The next step, one suggesting sexual reproduction, is the phenomenon of conjugation. In all animals from sponges to man reproduction is by male and female cells.

The ovary and testis are sexual glands (gonads), and may be regarded as the primary sexual organs. In nearly all animals, from the flatworms to man, there is a passage or outlet for the expulsion of the sexual products, and accessory organs for the dilution and expulsion of the seminal fluid, or for secreting the egg-shell; also external appendages of less or greater complexity in those forms which pair; and egg-laying organs, as the ovipositors of insects, brood-pouches, and different forms of uteri. Judging by the lowest forms, animals were probably at first hermaphroditic, growing out of a unisexual condition. Hermaphroditism is a condition in which both male and female organs are developed in the same individual. There are two kinds of hermaphroditism, the true and the spurious; in the former the germ glands contain both male and female germ cells; in the latter the accessory organs are of an ambiguous character. Hermaphroditism is normal in some species and abnormal in others. Spurious hermaphroditism is met with in all diœcious groups. In insects it has been repeatedly noticed. Thus one wing may have the male coloration and the one on the opposite side female coloration; or the anterior and posterior parts of the animal may have opposite secondary sexual characters; or the sexual characters may be intermingled, or, more rarely, blended.

Among vertebrates abnormal hermaphroditism is rare. Fishes have, however, been described with an ovary on one side and a testis on the other, and birds have been repeatedly described with ambiguous secondary characters. These phenomena usually appear late in life, but they may occur in young birds, which are then usually sterile. A similar tendency to gain characters of opposite sex is seen in old persons, in whom the germ glands are no longer functional. Concerning the interpretation of abnormal hermaphroditism it may be said that at an early stage of development all animals are sexless, but their germ glands seem to possess the potentiality of both sexes; typically, in diœcious organisms only one of these potentialities is realized, but exceptionally both of them may be to a greater or less complete degree.

ORIGIN OF SEX. This is an unsettled problem. We do not understand how, from being at first hermaphroditic or asexual, as was probably the case, the male and female characteristics became gradually established. What in the higher animals determines sex is also an unsolved problem. Hundreds of theories have been proposed as to the epoch at which the sex of the embryo is finally determined. Food or nutrition is as important a factor as any in determining what the sex of the future animal may be. Certain experiments throw light on the subject in the case of animals. Yung divided a batch of tadpoles into three lots, the proportion being 54.46, 61.39, and 56.44. The average number of females was thus about 57 in 100. In the first brood by feeding one set with beef he raised the percentage of females from 54 to 78; in the second lot, fed with fish, the percentage rose from 61 to 81; while in third lot, when the especially nutritious food of frogs was supplied, the percentage rose from 56 to 92; thus in the last case the result of high feeding was that there were 92 females to 8 males. In the honey bee the queens are fed with richer, more nitrogenous food than the workers; hence in the latter the ovaries are undeveloped; it is so with the white ants and ants. In the wasps when both males and females arise from fertilized eggs, Siebold's observations tend to show that predominance of females is due to better nutrition. Giron divided a flock of 300 ewes into equal parts, of which one-half were extremely well fed and served by two young rams, while those of the other half were served by two mature rams and kept poorly fed. The proportion of ewe lambs was 60 per cent. and 40 per cent. Dusing's experiments leave little doubt that abundant moisture and food tend to produce females, while high temperature produces males; he found that the heavier, well-fed ewes produced ewes, while the lighter, under-fed ewes brought forth males.

SEXUAL DIMORPHISM. This is due to the rise of secondary characters. Such features are the male lion's mane, the horns of the buck, the gay plumage which distinguishes the cock from the hen, and the plumes, colored combs and wattles, top-knots, brilliant, conspicuous bands and spots, spurs, and those markings or new plumage especially developed during the breeding season. Males tend among vertebrates to be larger, they lead the flock, guard the females and young; in character they are more jealous and pugnacious. This is the case not only with mammals and birds, but with reptiles and frogs. The vociferous cries in spring of frogs and toads are mainly from male throats, the females being much less noisy. Certain fishes, as the salmon, during the breeding season are distinguished by bright colors and ornamental appendages. Of the invertebrates only insects, spiders, and crustacea afford examples. Among coleoptera the stag-beetles (Lucanidæ) are remarkable for their size and the enormous jaws and horns of the males, and there are two sets of males, those which in lack of armature approach the females, and those which are much larger and remarkably aberrant. In certain spiders the males are gaily colored and their legs greatly modified in shape. Darwin has explained sexual dimorphism by his theory of sexual selection (q.v.). Sexual dimorphism reaches its acme in the males of certain solitary barnacles; they are minute, very much reduced in structure, living inside the mantle-cavity of the female, where they are anchored by their antennæ.

IN PLANTS. The simplest plants give no indication of any sexual process, but reproduce by cell division or by non-sexual spores. The gradual transition from the sexless to the sexual condition is clearly shown in several groups of algæ. For

example, Ulothrix, a green alga, consists of a single row of cells, each of which has ordinary vegetative powers. In some cells a few large ciliated swimming sexless spores are developed by cell division. Other cells produce numerous smaller similar bodies. Both sorts when discharged swim about and either directly form filaments, or they may fuse in pairs, thus producing a new cell, capable of developing a new vigorous individual. Since this fusing is the essence of the sexual process, botanists conclude that sexual cells have been derived from sexless swimming spores.

The sexual cells (gametes) are at first alike, a condition distinguished by special terminology from that in which two sexes are distinct. Thus, the mother cell within which the gametes are developed is called a gametangium; the condition of having similar pairing gametes is isogamy; the act of fusion is conjugation, and the resulting sexually formed spore is a zygospore or zygote. Only the lower algæ and fungi are isogamous. Very early in the history of the evolution of sex in plants the pairing gametes began to differentiate. In one series the gametes became gradually larger and proportionately less active, until a relatively large and absolutely passive cell, the female gamete, egg, or oösphere, was formed. In the other series activity was increased, and size perhaps diminished, resulting in the formation of the male gamete, sperm, antherozoid, or spermatozoid. This differentiation of sex continues from the higher algæ throughout the plant kingdom, with the following special terminology. The gametangium which develops the sperms is called an antheridium (q.v), and that which develops the usually single egg an oögonium among the algæ and fungi and an archegonium in the higher groups. The condition of having dissimilar gametes is heterogamy; the process of fusion is fertilization; and the resulting sexually formed spore is an oöspore or fertilized egg.

Although isogamy and heterogamy may be regarded as the normal stages in the evolution of sex among plants, there is a special form of sexuality among the red algæ (Rhodophyceæ, q.v.) that deserves mention. In this group, although a male cell or sperm is developed, as in cases of ordinary heterogamy, the female organ (procarp) develops no distinct egg, but is differentiated into two regions, namely a bulbous base (carpogonium) with a hair-like prolongation (trichogyne) with which the male cell fuses, and thus fertilizes the carpogonium, by which, more or less directly, spores are developed. In this case, therefore, there is a sexual act involving a sperm or its equivalent, but no egg. This sexual union does not result in a distinct spore, but in the final formation of a fruit-like structure (cystocarp) containing spores. This peculiar modification of heterogamy may be called carpogamy, which is fertilization of a carpogonium rather than of an egg.

With the development of heterogamy, which is the prevailing method in the plant kingdom, the development of sex in plants is practically complete. Certain resulting conceptions, however, should be considered. Among the bryophytes alternation of generations (q.v.) is established. The sexual plant (gametophyte), which is the ordinary leafy plant of popular conception, usually develops both sex organs upon the same individual, and is said to be monœcious (bisexual or hermaphrodite). In some cases, however, antheridia and archegonia are borne upon different individuals (diœcious or unisexual). Among the pteridophytes, which is the lowest group to exhibit heterospory (q.v.), the sexual plant (prothallium), which may be either monœcious or diœcious, is very inconspicuous, but the leafy sexless plant is conspicuous.

By overlooking the homologies with pteridophytes, great confusion has arisen among the spermatophytes in reference to sexuality and a sex terminology has been applied to certain sexless organs. In this highest group the sexual plants are so inconspicuous that they can be seen only with the special appliances of the laboratory. All the visible organs of a flowering plant, including the flowers, are sexless. Confusion has arisen because the stamens and pistils have been regarded, respectively, as male and female organs, an idea extended by the terms ovary for a part of the pistil, and ovule for the contained structure which becomes a seed. The terms monœcious and diœcious are misapplied when used to describe plants which bear stamens and pistils respectively upon the same or distinct individuals.

While the sexual structures of plants are very conspicuous, therefore, among the lower forms, they gradually become more and more inconspicuous, until in the highest group they are beyond the reach of ordinary observation, and everything seen by the naked eye is sexless. There is thus a gradual increase in the prominence of the sexless phase, and a gradual reduction of the sexual phase. Consult: Geddes and Thompson, *The Evolution of Sex* (New York, 1902), where will be found further references. See METAZOA; REPRODUCTION; SEXUAL SELECTION.

SEX, AS A FACTOR IN EVOLUTION. As has been elsewhere stated (see SEX), the male is the more active, more variable and specialized sex, while the female is passive, conservative, and departs least from the normal standard. It would be a natural result that the offspring would tend to vary. Weismann goes so far as to claim that the intermingling of the sexual elements in fertilization is the only cause of variation. Before him Treviranus, Brooks, and Galton claimed that sexual reproduction provokes variation. On the other hand, the sexless Foraminifera are exposed to great variation, and we know that variation in general is due to the changed conditions of life, and the reproductive activities are generally acknowledged to be of secondary importance.

Mutual sterility, by which physiological barriers are erected, is supposed by Romanes to result in the origination of new species. Among the higher animals, as the social insects, birds, and mammals, which build nests, care for their young, and where love, coöperation, self-sacrifice come into play, sex becomes increasingly important in evolution, and becomes a factor in the differentiation of sexual forms, and in social evolution. See EVOLUTION.

SEXAGESIMAL SYSTEM. See SCALES OF NOTATION.

SEXTANT (from Lat. *sextans*, sixth part, from *sextus*, sixth, from *sex*, six). An instrument used for measuring angles between distant objects. The sextant finds its greatest field of usefulness in navigation, but it is also employed in marine surveying. It consists of a frame in

the form of a sector embracing somewhat more than one-sixth (usually about one-fourth) of the whole circle; two mirrors (one wholly silvered and one silvered over one-half its surface); a movable arm pivoted at the centre of the sector and carrying the fully silvered mirror and a vernier; an arc along the circumference of the sector graduated into degrees, minutes, and seconds; and an eye-piece. The common form of the instrument is shown in Fig. 1.

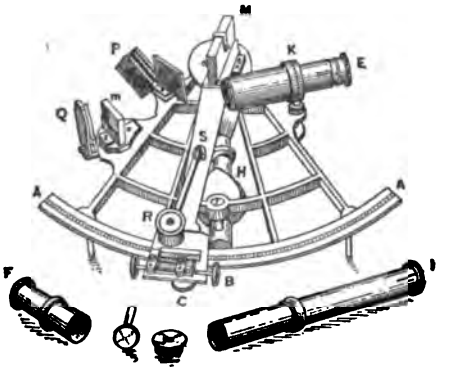


FIG. 1.

The frame is of brass. AA is the limb in which is inlaid a strip of silver on which are the graduations of circular measure; the smallest divisions are usually 10′ to 30′, and the vernier enables angles to be read to at least 1′ and usually to 10″. The handle H by which the instrument is held in the hand is of wood. The mirrors M and *m* are of plate glass. The former has all its surface, while the latter has but the lower half silvered. Both are fitted with small screws for adjusting them in perpendicularity to the plane of the front face of the frame and in parallelism to each other when the index arm is set at 0°. E is the eye-piece of the telescope, which is

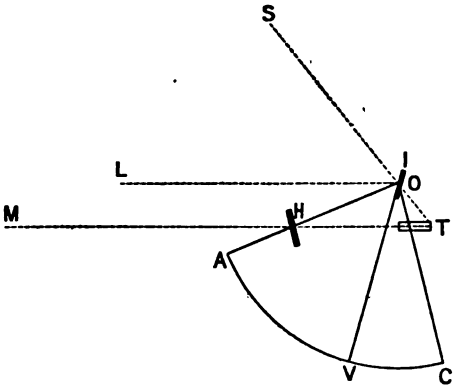


FIG. 2.

held in position by the adjustable clasp K. The mirror M is secured to the index arm S, which is pivoted beneath the centre of M and carries a vernier on its other end. R is a small magnifying glass for reading the vernier. C is the clamp for holding the index arm to the limb. B is the tangent screw for moving the arm slightly to perfect the angle; it only acts when the clamp screw C is set up. P and Q are colored shade glasses for use when observing the sun. Besides the ordinary telescope the instrument is usually provided with an inverting telescope, I, and a tube without glasses, F; also colored eye-pieces to use in place of the colored shade glasses, P and Q, and an adjusting wrench or screw-driver. The theory of the instrument is shown in Fig. 2. AOC is the frame of the instrument in the form of a circular sector. VO is the index arm carrying the index glass, I, and the vernier, V, and is pivoted at O on the frame. H is the horizon glass, which is set in a clasp securely attached to the frame in a position parallel to OC (the position of the index arm when set at 0° of the arc), but is susceptible of adjustment if thrown out of position. LO is parallel to MHT. To determine the angle at the eye (STM) between two distant objects, S and M, the procedure is as follows: Turn the instrument until one object (M) can be seen through the telescope and the unsilvered half (which is the half farthest away from the plane of the instrument) of the horizon glass (H). Then turn the instrument until its plane coincides with that passing through both M and S. Now move the index arm until the reflection of S appears in the silvered half of H. By slightly turning the instrument both objects will be brought together—one just on and one just clear of the edge of the silvered surface of H. Perfect the coincidence of the two objects and the reading of the vernier at V will give the angle. For purposes of navigation the angle commonly measured is that be-

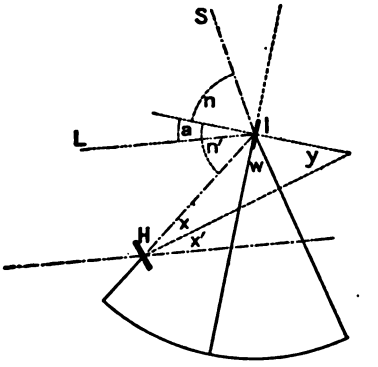


FIG. 3.

tween the sea horizon and the sun, moon, star, or planet. The angle is called the altitude of the heavenly body; in the case of a star it can only be taken at twilight or when the moon is up, because the stars are not plainly seen by daylight and the horizon is not clearly visible at night. From an inspection of the sketch (Fig. 3) it is readily seen that the angle through which the index arm moves is one-half that of the angle measured.

For n = angle of incidence and n' = the angle of reflection at the surface of the mirror I and x and x' the same at the mirror H; let LI be drawn parallel to HT. Then the angle measured is SIL $= n + a$; $n' - a = n - a = x + x' = 2x$; $n = x + y$; $2n = n - a + 2y$; $n + a = 2y$; $y = w$ $\therefore$ $n + a = 2w$.

The arc, or limb, of the sextant has a graduated scale cut in an inlaid silver strip. The fineness of the graduation varies; in high-grade instruments the smallest division of the scale is 10 minutes; in some cheaper instruments the

smallest division is one degree. To read the angle with great closeness sextants, like other similar instruments, are fitted with verniers. In the ac-

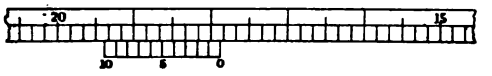


FIG. 4.

companying figures the smallest division of the limb of the sextant is 10 minutes, and the least count of the vernier is 1 minute. To effect this 10 divisions of the vernier are made equal to 9 of the limb. If the 0 of the vernier rests on the zero of the limb then the first division of the vernier will fall short of the first division of the limb by 1 minute, the second division of the vernier will fall short of the second division of the limb by 2 minutes, and so on. If Fig. 4 represents the position of the vernier after measuring a certain angle we proceed to read it as follows: First we note that the zero of the vernier is between 17° 50′ and 18° 0′. Next we find that the third divsion of the vernier is in coincidence with a division of the limb. Therefore, we add 3′ to 17″ 50′ and find the angle to be 17° 53′.

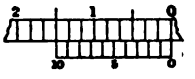


FIG. 5.

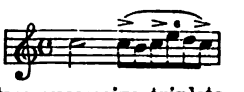
When used on shore and the sea horizon cannot be seen an 'artificial horizon' is used. This consists of a shallow tray filled with mercury and protected by a gable-roofed cover of thin plate glass framed in brass. The angle measured is that between the sun (or other heavenly body) and its reflection from the level surface of the mercury. As is readily seen, this angle is double the altitude of the body. In place of the tray of mercury, silvered glass, laid horizontal by means of a set of levels and screws, is sometimes used.

As stated in the article on NAVIGATION, the sextant is a development of the cross-staff and astrolabe. The former consisted of a staff on which a cross was fitted so as to slide along, its axis being perpendicular to that of the staff. The observer would sight from one end of the staff at the distant object and then move the cross until its end was in line with it and the eye. The angle was first measured by laying the instrument on paper and constructing the angle. Later the angles were marked on the staff and crosses of various lengths were used. The astrolabe, which was constructed in several forms, consisted of a ring or disk with graduated scale and was provided with sights through which the navigator could view the sun or other heavenly bodies he was observing. The line of sight was usually a diameter of the circle and a pointer was supplied by which the angle could be read.

In 1594 the celebrated navigator John Davies published in his pamphlet, *The Seaman's Secrets*, a description of his improved cross-staff. In using this instrument the observer stood with his back to the sun and looked at the horizon through a sight at the end of the staff while the shadow of a movable projection fell on the sight box. In 1729 Pierre Bouguer devised an improved form of the Davies instrument, and this was immediately followed by the appearance of the sextant. John Hadley described a double-reflecting octant in a paper dated May 13, 1731, and a few days later exhibited the instrument. About a year earlier, Thomas Godfrey, of Philadelphia, designed a sextant. He made an instrument about November, 1730, and it was in actual use at sea before the end of the year. Hadley's instrument may have been the outcome of Bouguer's improved cross-staff, but Godfrey's seems to have been quite an independent invention. It may be noted also that Newton designed a double-reflecting instrument, similar to the sextant, and a description of it was found in Newton's own handwriting among Hadley's papers in 1742. Hooke also devised a similar one as early as 1674. It does not apear that any actual instruments were ever made on Hooke's or Newton's plans.

SEXTET (from Lat. *sextus*, sixth). In music, a composition for six voices or instruments, or for six obligato voices with instrumental accompaniment. Instrumental sextets are generally cyclical compositions in sonata form.

SEXTUPLET (from Lat. *sextus*, sixth + *-plus*, -fold). In music, a group of six equal notes to be performed in the time of four. The true sextuplet is composed of three groups, of two notes each, being, in fact, a triplet (q.v.), with each of its notes subdivided into two:



But a group composed of two successive triplets is sometimes also called a sextuplet and written as such, though it is more correct to divide it into its component triplets thus:



SEX'TUS EMPIR'ICUS. A Greek physician of the first half of the third century A.D. He was a pupil of Herodotus of Tarsus, who was probably contemporary with Galen. Nothing is known concerning his life, except that he was a physician, and of the school of the Empirics, whence his cognomen; but in his writings his philosophical opinions are sufficiently clear. His first work, the celebrated *Pyrrhonic Sketches*, is a repository of the doctrines of the Skeptics; his second, in eleven books, attempts to refute every item of positive knowledge that man has ever acquired. Both works combined furnish the best account extant of ancient skepticism and its methods of assailing all manner of opinions. His works are edited by Fabricius (Leipzig, 1718, with a Latin translation), and by Bekker (Berlin, 1842). Consult: Brochard, *Les sceptiques grecs* (Paris, 1887); Jourdain, *Excursions historiques et philosophiques* (Paris, 1888); Patrick, *Sextus Empiricus and the Greek Sceptics* (Cambridge, 1899, with translation of book i. of the *Pyrrhonic Sketches*).

SEXUAL SELECTION (Lat. *sexualis*, relating to sex, from *sexus*, *secus*, sex). This principle depends, as Darwin states, not on a struggle for existence, but on a struggle between the males for possession of the females. The result is not death to the unsuccessful competitor, but few or no offspring. In many cases, however, victory depends not on general vigor, but on the possession of special weapons confined to the male sex, as the spurs of the cock or the horns of the stag.

The war is perhaps severest between the males of polygamous animals, and these seem oftenest provided with special weapons of offense. Among birds the contest is often less gross and fierce, the males rivaling each other in attracting the

females by their powers of song or display of plumage. Darwin concludes "that when the males and females of any animal have the same habits of life, but differ in structure, color, or ornament, such differences have been mainly caused by sexual selection; that is, by individual males having had, in successive generations, some slight advantage over other males, in their weapons, means of defense, or charms, and having transmitted these advantages to their male offspring." Although Wallace does not accept the theory of sexual selection, claiming that bright colors were originally normal in both sexes, but have been eliminated in the females, yet the facts seem to substantiate the views of Darwin. As observed by Romanes, it is "a theory wholly and completely distinct from the theory of natural selection."

BIBLIOGRAPHY. Darwin, *Origin of Species* (6th ed., London, 1882); *The Descent of Man and Selection in Relation to Sex* (2d ed., London, 1874); Wallace, *Darwinism* (London, 1889); G. W. and E. G. Peckham, *Sexual Selection in Spiders* (Milwaukee, 1890).

SEYCHELLES (sā'shĕl') **COCOANUT**, or DOUBLE COCOANUT (*Lodoicea callipyge*). A palm whose fruit somewhat resembles a cocoanut, but which belongs to a different tribe, being allied to the Palmyra palm. It is found only in the Seychelles Islands, and was known for many years only by the fruit, which, found floating in the Indian Ocean or upon the shores of the Maldive Islands, was long the subject of many ridiculous fables, and is still an object of interest and curiosity, and as such is one of the minor articles of commerce. The slender tree grows to the height of 100 feet with a tuft of immense leaves. The 'cabbage' or terminal bud is eaten. The melon-shaped fruit, which it is said requires ten years to ripen, sometimes weighing as much as forty pounds, is often a foot or a foot and a half long. Its outer husk is green, the interior near the base divided into two parts, at first filled with a white sweet jelly, which changes into a white horny kernel. The shells are used for making vessels of various kinds, and are often beautifully carved and ornamented.

SEYCHELLES ISLANDS. A group of small islands belonging to Great Britain, and situated in the Indian Ocean 650 miles northeast of Madagascar, between latitudes 3° 38′ and 5° 45′ S., and between longitudes 52° 55′ and 53° 50′ E. (Map: Africa, K 5). With the dependent groups, the Amirante, Cosmoledo, and Aldabra Islands lying to the southwest, this archipelago numbers 74 named islands, with a total area of 148 square miles. The largest is Mahé, whose area is 55 square miles. The Seychelles are the summits of a submarine mountain range. They are themselves mountainous, Mahé having a height of 2998 feet, are composed mainly of granite, with basaltic intrusions, and are surrounded with coral reefs. The climate, tempered by the surrounding ocean, is very equable, the extreme minimum and maximum temperatures for the year being 74° and 88° respectively. The rainfall is very abundant, averaging nearly 100 inches per year, and the islands are covered with luxuriant forests. The flora, though resembling that of tropical Africa, is largely composed of species peculiar to the islands; the fauna is related to that of Madagascar, and mammals, with the exception of bats, are wanting. The soil is fertile, and cotton, rice, and tobacco are cultivated. The exports, chief of which are cocoanut oil, soap, vanilla, guano, salt fish, tortoise shells, coffee, and cacao, amount to about $500,000 annually (1901, 1,417,515 rupees). The islands were administered from Mauritius until 1888, when an administrator was appointed, who in 1897 received the powers of Governor. The capital is Port Victoria on Mahé. Only four of the Seychelles proper are inhabited, and the total population of the combined groups, in 1901, was 19,237, chiefly French creoles, Indian coolies, and negroes.

The Seychelles were discovered by the Portuguese in the beginning of the sixteenth century. They were colonized by the French in the middle of the eighteenth; in 1794 they were taken by the English, to whom they were formally ceded in 1815. Consult Hartmann, *Madagascar und die Inseln Seschellen* (Leipzig, 1886).

SEYDLITZ, zīt'lĭts, FRIEDRICH WILHELM VON (1721-73). A brilliant Prussian cavalry officer, born at Kalcar, near Cleves. For gallantry at the battle of Hohenfriedberg, he was made major of hussars, and by 1755 had received the rank of colonel. As the result of his distinguished services in the Seven Years' War he became known as the first cavalry officer of the period, and for a brilliant charge at Kolin, in 1757, he was made a major-general of cavalry by Frederick II. At Rossbach he gained much glory and the rank of lieutenant-general. He took part in the battles of Zorndorf and Hochkirch, and at Kunersdorf was severely wounded. After the last-named battle he was for some time in disfavor with Frederick, and was not permitted to take part in active operations, but in 1762 he was once more in the field and won new renown at the battle of Freiberg. In 1767 he was made a general of cavalry. A marble statue was erected in his honor in the Wilhelmsplatz at Berlin. Consult: Varnhagen von Ense, *Biographische Denkmale* (Berlin, 1834; 3d ed., Leipzig, 1872); and Buxbaum, *Friedrich Wilhelm, Freiherr von Seydlitz* (new ed., Rothenow, 1890).

SEYFFARTH, zī'fârt, GUSTAV (1796-1885), A German-American Egyptologist, born at Uebigau, in Saxony. He studied at the University of Leipzig, where he became associate professor of philosophy in 1825, and professor of archæology in 1829. From 1826 to 1829 he visited the principal museums of Germany, France, England, and Holland, and made an extensive collection of copies of Egyptian inscriptions and Coptic manuscripts. In 1856 he came to America, and in the same year became professor of Church history and archæology in Concordia College, Saint Louis. He died in New York, where he had resided since 1859. Seyffarth was an earnest student of Egyptology, but proceeded upon an erroneous theory, holding that the hieroglyphic characters, with scarcely an exception, were pure phonograms, and even reading the determinatives as separate words. Among his principal works are: *Rudimenta Hieroglyphica* (1826); *Systema Astronomiæ Ægyptiacæ* (1826-33); *Unser Alphabet ein Abbild des Tierkreises* (1834); *Alphabeta Genuina Ægyptiorum et Asianorum* (1840); *Die Grundsätze der Mythologie und der alten Religionsgeschichte* (1843); *Grammatica Ægyptiaca* (1855).

SEYMOUR, sē'mōr. A city in Jackson County, Ind., 60 miles south of Indianapolis, on the Baltimore and Ohio Southwestern, the Pittsburg, Cincinnati, Chicago and Saint Louis, and the Southern Indiana railroads (Map: Indiana, D 4). It is of considerable industrial importance, having woolen mills, a hub and spoke factory, flouring mills, planing and saw mills, and manufactories of furniture, brooms, sucker rods, harness, and advertising novelties. Repair shops of the Baltimore and Ohio Southwestern also are here. There is a public library. Seymour was settled in 1852, and was incorporated in 1865. Population, in 1890, 5337; in 1900, 6445.

SEYMOUR. A noble English family of Norman descent, originally settled at Saint-Maur in Normandy. In 1497 the head of the family, Sir John Seymour, was employed in suppressing the insurrection of Lord Audley and the Cornish rebels, and subsequently accompanied King Henry VIII. on his wars in France, and to the Field of the Cloth of Gold. One of his daughters, Lady Jane, became the wife of Henry VIII., and mother of Edward VI. His fourth son, Thomas, rapidly rose into favor. He was sent on important missions, given command of a portion of the fleet, made a Privy Councilor, and after Henry VIII.'s death, according to the wish of the monarch, was created Baron Seymour of Sudeley and Lord High Admiral. He then endeavored to win the hand of Elizabeth, but, failing in his attempt, he secretly married Henry's widow, Catharine Parr. A rivalry at once sprang up between him and his eldest brother, Edward, the Lord Protector Somerset, whom he wished to supplant. His machinations at length gave color to a charge of treason brought against him by the council; a bill of attainder was passed by the Lords and Seymour was executed March 20, 1549. His brother, Edward, who held many high positions in the Court of Henry, was created Viscount Beauchamp of Hache in 1536, and Duke of Somerset in 1546-47. He secured the confidence of the King so far that he was left by him one of his executors and one of the council of the young Prince Edward. He was subsequently made Lord High Treasurer, and eventually 'Protector and Governor of the King and his realms.' (See EDWARD VI.) His fall, after a two years' tenure of power, was followed by an attainder of his honors. A son of the Protector by his second marriage was created by Elizabeth Earl of Hertford. The grandson of the latter William, who succeeded him in the Earldom of Hertford, was also sent to the Tower of London for marrying Lady Arabella Stuart (q.v.), cousin of James I. of England, but subsequently played a conspicuous part in the royal cause in the civil wars and obtained in his own favor a reversal of his ancestor's attainder. His ducal title passed to a cousin, on whose death it was inherited by Charles Seymour, known in history as the 'proud Duke of Somerset,' a nobleman who filled several high posts in the courts of Charles II., William III., and Anne.

SEYMOUR, EDWARD HOBART, Sir (1840—). An English naval officer. He was educated at Radley, and entered the navy in 1852. He served in the Black Sea during the Crimean War, in the war with China (1857-60), was wounded while serving in West Africa in 1870, and was captain of the *Iris* in the Egyptian War of 1882. He was advanced to the rank of rear-admiral in 1889, and to that of vice-admiral in 1895. In 1898 he was put in command of the China station, and took an active part in the Boxer War of 1900. In June of that year he led an expedition from Tien-tsin for the relief of the foreigners besieged in Peking, but was opposed by such overwhelming forces that he was obliged to return without effecting his purpose. As a reward for his services in this war he received the K. C. B.

SEYMOUR, FREDERICK BEAUCHAMP PAGET, Baron Alcester. See ALCESTER.

SEYMOUR, GEORGE FRANKLIN (1829—). An American Episcopalian bishop. He was born in New York City; was educated at Columbia and at the General Theological Seminary in New York. He was ordained priest in 1855. Soon afterwards he founded Saint Stephen's College, Annandale, and was its warden until 1861. Besides several parochial charges, he held the professorship of ecclesiastical history at the General Theological Seminary from 1865 to 1879. In 1874 he was elected Bishop of Illinois, but in the bitterness of theological controversy at that time, failed of confirmation. In 1878, however, he was elected first Bishop of Springfield, a diocese formed out of that of Illinois, and consecrated without opposition. He was known throughout the United States as an accomplished theologian and an acute and forcible controversialist. An example of his work in the latter department is *What is Modern Romanism?* (1888).

SEYMOUR, HORATIO (1810-86). An American political leader, the son of Henry Seymour, a colleague and supporter of De Witt Clinton. He was born at Pompey Hill, Onondaga County, N. Y., was educated at Geneva Academy (later Hobart College) and at Middletown (Conn.) Military Academy, studied law at Utica, and in 1832 was admitted to the bar. In 1841, as chairman of the Canal Committee in the State Legislature, he prepared an elaborate report, which served for many years as the basis of all legislation in connection with the State canals. In 1842-46 he was Mayor of Utica, and in 1852 he was elected Governor of New York. The period of his Governorship was marked by bitter factional strife within the party, and by a powerful temperance movement which, in the end, resulted in his defeat for reëlection. The State Legislature passed a prohibition law which he vetoed, and in 1854 he was defeated for reëlection by Myron H. Clark, the Whig and Temperance candidate. The identical law which was again passed was subsequently held to be unconstitutional. When the election of Lincoln made civil war seem inevitable he exerted every effort to effect a compromise, but eventually gave his support to the Lincoln Administration. In 1862 he was again elected Governor of New York. He advocated the vigorous prosecution of the war, but protested against the extensive use of the war powers by President Lincoln. He was unremitting in his endeavors to keep New York's full quota of troops in the field. His attitude in regard to the draft riots in New York City in the middle of July, 1863, was the cause of much harsh criticism at the time, but his measures proved efficacious, and within a year a Republican Legislature had passed resolutions thanking him for his action. In 1868 he

was president of the Democratic National Convention which met in New York City and by which he, himself, was nominated for the Presidency. He received only 80 electoral votes to 214 for General Grant. The popular vote was: For Grant, 3,012,833; for Seymour, 2,703,249. After this defeat he took no further part in political affairs. Consult: Hartley, *Horatio Seymour* (Utica, 1886); and Croly, *Seymour and Blair; Their Lives and Services* (New York, 1868).

SEYMOUR, Lady JANE (c.1509-37). The third Queen of Henry VIII. She was the eldest child of Sir John Seymour and sister of Edward, Duke of Somerset and Protector of England. She was lady-in-waiting to her two predecessors, Catharine of Aragon and Anne Boleyn (qq.v.), and was married to the King shortly after the execution of Anne in 1536. The following year she gave birth to a son, afterwards Edward VI., and died 12 days later. See SEYMOUR.

SEYMOUR, THOMAS DAY (1848—). An American Greek scholar, born in Hudson, Ohio. In 1870 he graduated from Western Reserve College, and continued his studies during the two following years at the universities of Leipzig and Berlin. From 1872 to 1880 he was professor of Greek in Western Reserve College, and in 1880 became professor of Greek in Yale University. He was made chairman of the managing committee of the American School of Classical Studies at Athens in 1887, was editor-in-chief of the College Series of Greek Authors, and one of the American editors of the *Classical Review.* His publications include *Selected Odes of Pindar* (1882), *Introduction to Homeric Language and Verse* (1885), *Homer's Iliad* (i.-iii., 1887; iv.-vi., 1890), *School Iliad* (1889).

SEYMOUR, THOMAS HART (1808-68). An American political leader, Governor of Connecticut. He was born in Hartford, Conn., and continued to live there until his death. After his admission to the bar he was for a short time judge of probate, and editor of a Democratic paper, *The Jeffersonian.* In 1843 he was chosen a member of Congress. At the opening of the Mexican War he was commissioned major and subsequently became colonel. He acquired distinction at Chapultepec by scaling the heights at the head of his troops and capturing the fortress. Four times he was chosen Governor of Connecticut, in 1850, 1851, 1852, and 1853, and in the last-named year he became United States Minister to Russia, where he remained four years. During the Civil War his sympathies were Southern, and he was defeated in 1863 as candidate for Governor by William A. Buckingham.

SEYMOUR, TRUMAN (1824-91). An American soldier, born at Burlington, Vt. He graduated at West Point in 1846, entered the artillery, and served through the Mexican War. He participated in the hostilities against the Seminole Indians in Florida, and in 1861 he was one of the officers at Fort Sumter, where he earned the brevet of major. He was commissioned brigadier-general of volunteers and participated in the Peninsular campaign, and was brevetted colonel for gallantry at Antietam. He bore a conspicuous part in the operations along the Atlantic Coast, leading the second assault on Battery Wagner (July 18, 1863), where he was severely wounded, and commanded the unfortunate expedition into Florida which was defeated at Olustee on February 20, 1864. The following spring he took part in the Richmond campaign until the battle of the Wilderness, where he was captured. After his exchange he commanded a division in the Shenandoah Valley, at the siege of Petersburg, and at the battle of Sailor's Creek. He was mustered out of the volunteer service with the brevet rank of major-general in 1865, and the next year was commissioned colonel of the Fifth regular artillery. He retired from the service in 1876 and spent most of the remainder of his life in Europe.

SEYMOUR, WILLIAM, first Marquis of Hertford and second Duke of Somerset (1588-1660). See SEYMOUR.

SEYNE-SUR-MER, sān'sŭr'mâr', LA. A seaport in the Department of Var, France, three miles southwest of Toulon (Map: France, M 8). It has extensive ship yards, manufactures olive oil and soap, and is the seat of a considerable trade. Oyster culture also is a growing industry. Population, in 1901, 21,002.

SFAX, sfäks. A fortified seaport of Tunis, situated on the Gulf of Cabes, opposite the islet of Kerkenna (Map: Africa, F 1). The Mohammedan or upper town is surrounded by walls and extensive gardens and contains a fine mosque. The lower city along the water is devoted to trade. There is a European quarter. The roadstead is good and the town carries on an extensive trade in fruit, sponges, essence of flowers, oil, woolens, and camels. Sfax was occupied in 1881 by the French. Population, about 15,000.

SFORZA, sfôr'tsȧ. A celebrated Italian family. The founder of the fortunes of the family was a peasant of Cotignola, in the Romagna, by name Giacomo or Muzio (sometimes combined by historians into Giacomuzzo) Attendolo. He was born June 10, 1369, and followed the trade of wood-cutting, but left it to become a member of a band of *condottieri,* and by his intelligence and courage rose to a high position. Joanna II. of Naples made him constable of that kingdom, and as such he fought bravely against the Aragonese. He afterwards entered the service of Pope Martin V. and became a Roman count. His natural son, FRANCESCO SFORZA (1401-66), succeeded him in command of the band of mercenaries, devised an improved system of tactics, and won a widespread reputation for success. His greatest patron, Filippo Maria Visconti, Duke of Milan, conferred upon him the hand of his daughter Bianca, with Cremona and Pontremoli as a dowry, and the promise of the succession to the duchy itself. (See VISCONTI.) Sforza, by a judicious combination of force and stratagem, obtained his elevation to the Dukedom of Milan (1450), three years after the death of his father-in-law. He established his authority over all Lombardy, and several districts to the south of the Po, and even Genoa came under his sway. His son, GALEAZZO MARIA SFORZA (1444-76), a monster of cruelty and debauchery, was assassinated (December 26, 1476) at the porch of the Cathedral of Milan. Galeazzo's son, GIANGALEAZO SFORZA (1469-94), succeeded under the regency of his mother, Bona of Savoy, who held the reins of government with a firm hand. In 1481 her brother-in-law, LODOVICO, surnamed 'the Moor,' banished the Regent and assumed power himself. Lodovico summoned Charles VIII. of France to his aid in 1494, but found his own

power threatened and joined the league against the French. In 1499 he was driven from his duchy by the troops of Louis XII. The following year he made an ineffectual attempt to recover his possessions, was made prisoner, and carried to France, where he died in the Castle of Loches in 1508. Lodovico was a patron of the arts and sciences. He gave his niece Bianca in marriage to the Emperor Maximilian I. Lodovico's eldest son, MASSIMILIANO SFORZA, regained the Duchy of Milan in 1512, but after the battle of Melegnano (1515), in which his Swiss auxiliaries were overwhelmed by Francis I., he abandoned his rights to the French for a pension of 30,000 ducats. His brother, FRANCESCO MARIA SFORZA (1492-1535), was put in possession of Milan after the defeat of the French at La Bicocca in 1522. His death marked the extinction of the main line of the House of Sforza, and the duchy was taken into the possession of Charles V. Consult: Magenta, *Gli Visconti e gli Sforza* (Milan, 1883); Litta, *Famiglie celebri d'Italia*, vol. i. (Milan, 1819).

SFORZATO, sfôr-tsä'tô, or SFORZANDO (It., forced). In music, a term often abbreviated *sf*, used to indicate that the note or chord over or under which it is placed is to be played with strength and emphasis.

SGAMBATI, zgàm-bä'tê, GIOVANNI (1843—). An Italian pianist and composer, born in Rome. He studied under Barbieri, Natalucci, and Aldega; subsequently the attention of Liszt was drawn to him and he undertook to superintend the perfecting of his musical education. His first composition, a pianoforte quartet, was heard in 1866. His fame by this time had spread to Germany as well as throughout Italy, and in 1877 he was appointed principal professor of the pianoforte at the Academy of Santa Cecilia, Rome. In 1896 he founded the Nuova Società Musicale Romana. He was devoted to Wagner and his works, and was rewarded by the unqualified admiration of the latter. His compositions are strongly German in character and include a *Requiem Mass* (1896), three symphonies, overtures, piano concertos, chamber music, salon music, and several pieces for the organ.

SGANARELLE, zgà'nà'rĕl'. A character frequently appearing in Molière's comedies. In the *Cocu imaginaire* he is the title character, involved in the misconceptions of the comedy through finding Lélie's portrait in his wife's possession. In the *Ecole des maris* he is the surly dupe of the play, cajoled by his ward, Isabelle. He is the aged hero of the *Mariage forcé* (q.v.); the father of Lucinde in *L'Amour médecin;* the valet of Don Juan in *Le festin de Pierre;* and the hero of *Le médicin malgré lui.*

SGRAFFITO, zgrà-fē'tô (It., decoration by scratches). A form of decoration which has existed in Central Italy at least since the fifteenth century. The plastering on a wall is colored black or dark brown, and then a thin coat of lighter colored plaster is spread over this, and while the new coat is still damp it is scored deeply in scroll patterns and arabesques, which show dark on the light ground. The term is extended to denote imitations in painting of this process; and in Italy many house fronts have been decorated in this way since the middle of the nineteenth century. Scratched decoration of rough and soft pottery is also included under this head. It was common in the prehistoric ages in all the Mediterranean lands, as many pieces so adorned have been found in Syria, Cyprus, and elsewhere; also in Peru and Central America at an undetermined epoch.

'SGRAVENHAGE, sgrä'ven-hä'ge. The Dutch name for The Hague (q.v.).

'SGRAVESANDE, sgrä've-sän'de. See GRAVESANDE.

SHABATZ or **ŠABAC**, shä'bàts. A town of the District of Podrinye, Servia, on the Save, 38 miles west of Belgrade (Map: Balkan Peninsula, B 2). The town has an old castle dating from the fifteenth century, a college, and a library. Its exports are honey, cereals, prunes, and live stock. Population, in 1900, 12,072.

SHAD (AS. *sceadda*, dialectic Ger. *Schade*, shad; connected with Ir., Gael. *sgadan*, Welsh *ysgadenyn*, herring). An important anadromous fish of the herring family (Clupeidæ, q.v.) and genus Alosa. Shad grow to a larger size than herring and differ from them in the absence of teeth in the jaws and in the form of the cheek, this being deeper than long in the shad. Shad live in the sea, but ascend rivers in the spring to spawn. They have their spawning beds, but the eggs may be extruded anywhere promiscuously in the water. One female averages about 30,000 eggs, though as many as 156,000 have been obtained. The eggs sink to the bottom, where they hatch in from three to five days, varying with the temperature. During their stay in the rivers shad take very little if any food. In the sea they swim with their mouths open, straining the minute organisms from the water which passes through their gills. In early days these fish were extremely abundant, but their popularity as a food-fish, together with the disturbance of their natural spawning grounds and the pollution of the rivers by factory refuse, have made great reductions in their number. Because they are so prolific, however, and because of the artificial incubation of the eggs by Government hatcheries, the supply has been fairly maintained. The catch along the Atlantic coast of the United States in 1896 amounted to 50,000,000 pounds, with a value to the fishermen of $1,600,000. (See FISHERIES; FISH CULTURE.) The common shad of our Atlantic coast is *Alosa sapidissima*. It attains a weight of three pounds on the average, but sometimes weighs from 12 to 14 pounds. Since about 1885 shad have been planted in streams of California, where they have become abundant and now extend northward to southern Alaska. The common shad of Europe is *Alosa vulgaris*, and an important species in Chinese waters is *Alosa Reevesii*. See ALLICE. Consult Goode, *Fishery Industries* (sec. i., Washington, 1884), and the publications of the United States Commission of Fish and Fisheries. See Plate of HERRING AND SHAD; and of FOOD FISHES, accompanying article FISH AS FOOD.

SHADBUSH, JUNEBERRY, or SERVICE-BERRY (*Amelanchier Canadensis*). A shrub or small tree of the natural order Rosaceæ, common to Canada and the Northern United States, which bears a sweet red or purple fruit, varying in size from that of a currant to a morello cherry and ripening from June to August. The larger grow-

ing forms are seldom cultivated, although dwarfs are common. It is also cultivated for its early appearing flowers. It is easily propagated from cuttings or layers in the fall, or by seeds or grafts in the spring. The name shadbush is said to be applied because the blossoms appear about the time shad ascend the rivers of the Eastern United States. See SERVICE-BERRY, and for illustration, Plate of SPIRÆA, ETC.

SHADDOCK (*Citrus decumana*). A tree of the natural order Rutaceæ, native of the Malayan and Polynesian islands, and extensively cultivated. It is said to derive its English name from a Captain Shaddock, by whom it was introduced into the West Indies. It has large pale yellow fruit with thick rind, spongy, bitterish, greenish-white, subacid pulp. The tree is tenderer than the orange. Florida, California, and the West Indies supply the American markets. See GRAPE-FRUIT and Colored Plate of CITRUS FRUITS.

SHADOW (AS. *sceadu, sceado,* Goth. *skadus,* OHG. *scato,* Ger. *Schatten,* shadow; connected with OIr. *scath,* shadow, probably with Gk. *σκότος, skotos,* darkness). See LIGHT.

SHADOW PLAY. A dramatic representation by means of shadows cast by puppets upon a screen. It is, therefore, a modification of a puppet show (see PUPPET), though the same thing in principle has sometimes been accomplished by shadows of living persons moving behind a screen or by the shadows of their hands upon the wall. The usual essentials for a shadow play consist of an opening like that of a doorway to serve as a scene, covered with a thin white screen upon which a light from behind casts the images of the puppets. These are worked by concealed persons, who also supply the dialogue. The earliest evidences of this kind of entertainment are in China; it is known also in Japan, in Java, and especially in Mohammedan countries, *Karakus* (Black-eye) being among the Turks a well-known conventional character in this miniature drama. Southern Germany was one of the early homes of this as of other puppet shows. Introduced into France in the eighteenth century, shadow plays became a recognized amusement of the royal children at Versailles, and later a little theatre was established in the galleries of the Palais Royal in Paris in which, with its successors, down to the end of the Second Empire, pieces continued to be given in this way. In more recent years the shadow play has been revived on an elaborate scale in some of the cabarets of the Montmartre quarter in Paris. At the Chat Noir, particularly, under the direction of Henri Rivière, several very complicated dramas have been presented, among them being *L'Epopée* of Caran d'Ache and *La marche à l'étoile* of George Fragerolle. Consult: Pisko, *Licht und Farbe* (Munich, 1876); Champfleury, *Le musée secret de la caricature* (Paris, 1888); Jacob, *Schattenspiel-Bibliographie* (Erlangen, 1901).

SHADRINSK, shä'drênsk. A district town in the Government of Perm, East Russia, situated on the River Isset, 383 miles southeast of Perm (Map: Russia, K 3). It has a number of distilleries and exports grain, animals and animal products, and cloth. Population, in 1897, 11,686.

SHADWAITER. The round or Menominee whitefish. See WHITEFISH.

SHADWELL, THOMAS (c.1640-92). An English dramatist and poet laureate, now little remembered except as the MacFlecknoe of Dryden's satire. He was born in Norfolk and was for a time a student at Cambridge. Entered at the Middle Temple in London, he found the law little to his taste and left it for a period of foreign travel and the pursuit of literature. In 1668 he brought out his first comedy, *The Sullen Lovers.* This was a success, and was followed by a series of similar ones, many of them written either in avowed imitation of Ben Jonson or in more or less free adaptation from the French. Perhaps his best-known piece is *The Squire of Alsatia,* which was produced in 1688. His collected plays were brought out in four volumes by his eldest son in 1720. With Dryden he was at first on friendly terms, but an unfortunate satiric effort of Shadwell's brought down upon him the scathing ridicule of *MacFlecknoe,* where his name is forever fixed in the judgment of old Flecknoe:

> "Shadwell alone, of all my sons, is he
> Who stands confirmed in full stupidity.
> The rest to some faint meaning make pretense,
> But Shadwell never deviates into sense."

He is the Og, too, of *Absalom and Achitophel.* Nevertheless, when Dryden had to resign the laureateship in 1688 Shadwell was his successor, and his comic wit, though coarse, was often vigorous and effective. He died on November 19, 1692; according to report, from an overdose of opium. Consult the biography prefixed to the edition of Shadwell's *Works* (already referred to); also, Ward, *History of English Dramatic Literature* (London, 1875); Austin and Ralph, *The Lives of the Poets Laureate* (ib., 1853).

SHAFIITES. See MOHAMMEDAN SECTS.

SHAFT (AS. *sceaft,* OHG. *scaft,* Ger. *Schaft,* shaft; probably from AS. *sceafan,* Goth. *skaban,* OHG. *scaban,* Ger. *schaben,* Eng. *shave,* and connected with Lat. *scapus,* stem, stalk, shaft, Gk. *σκῆπτρον, skēptron,* staff). In architectural construction, the body of a column (q.v.) extending between the base and capital, though the term is often popularly used to include them. In Greek architecture the shafts were built up of several drums, but the Romans favored monolithic shafts, as did also the early Christian and Byzantine architects. Mediæval builders returned to built-up shafts, except in the case of small columns. The use of such small shafts appears to have originated with Byzantine architecture of the time of Justinian, the addossed shafts being somewhat later. They formed one of the most decorative features of mediæval architecture. In Gothic architecture the term is applied to the small columns clustered around piers or in the jambs of doors and windows. In the early styles the shafts are frequently of finer material than the pier, polished and banded. In later examples the shaft is generally attached, and of the same piece as the pier.

SHAFT. An opening of varying cross-sections carried down into the earth, usually for the purpose of hoisting ore or other mineral products to the surface. In addition the shaft may also serve the purpose of ventilation, pumping, or ladder way. Where the rock is soft and treacherous it is necessary to support the walls of the

shaft with brick, wooden timbers, or iron. In some mines the shaft is divided into several sections, one to hoist the ore, a second to convey the pumping and compressed-air pipes, and a third for the ladders. Shafts are usually vertical or nearly so; when an opening is inclined at a low angle from the horizontal it is termed a slope.

SHAFTER, William Rufus (1835—). An American soldier. He was born at Galesburg, Mich., and was at first a farmer. Soon after the outbreak of the Civil War he enlisted. He was made colonel of volunteers in April, 1864, and in March, 1865, was brevetted brigadier-general. In July, 1866, he entered the regular service. In 1897 he was promoted to be brigadier-general and commanded the Department of California until the beginning of the Spanish-American War, when, as major-general of volunteers, he was put in command of the first expedition to Cuba. At the head of about 16,000 men he landed at Daiquiri, Cuba, June 21, 1898, and advanced toward Santiago. On July 1st his forces carried the heights of El Caney and San Juan, but the Spaniards continued to offer a stubborn resistance. On July 3d Cervera's fleet, attempting to escape from Santiago, was destroyed by the American battleships, and this event was followed two weeks later by the surrender of Santiago. After the war Shafter commanded the Department of the East until 1899, when he resumed his old post as commanding general of the Departments of California and Columbia. In 1901 he was retired with the rank of major-general in the Regular Army.

SHAFTESBURY, shăfts'bĕr-ĭ, commonly called Shaston. A very ancient town of England, a municipal borough in Dorsetshire, 19 miles southwest of Salisbury (Map: England, D 6). It was the Caer Palladwr of the Britons, and was famous as the seat of a Benedictine abbey, founded by King Alfred in 880, whither Edward the Martyr's body was translated in 980 and where Canute died (1035). Population, in 1901, 2000. Consult Mayo, *Municipal Records of Shaftesbury* (Sherborne, 1891).

SHAFTESBURY, Earls of. A noble English family. Anthony Ashley Cooper, the first Earl (1621-83), was born at Wimborne Saint Giles, Dorsetshire, July 22, 1621. His father was John Cooper and his mother was Anne Ashley, daughter and sole heiress of Sir Anthony Ashley. Young Anthony entered Exeter College, Oxford, in 1637, but took no degree. He had a seat in the Short Parliament, though he was not yet of age, and at first espoused the cause of royalty; he then became one of the most eminent of the Parliamentary leaders and not the least active in the field. When he saw that the Restoration was inevitable he took so prominent a part in bringing back Charles II. that he was raised to the peerage as Baron Ashley. He was a member of the 'Cabal' Ministry, and in 1672 was made Earl of Shaftesbury and Lord Chancellor. The next year he supported the Test Act in favor of Protestantism, and lost his office, delivering up the Great Seal with a threat: "It is only laying down my gown and putting on my sword." The King soon tried to get him to resume his office, but he politely declined, and instead placed himself at the head of the Parliamentary opposition. In 1677 he protested against the prorogation of Parliament and was imprisoned in the Tower for a year. Upon his release he took unscrupulous advantage of the false affidavit of Titus Oates and made use of the panic thus caused to initiate a persecution against the Catholics. He had five Catholic peers sent to the Tower charged with implication in a Jesuit conspiracy and had 2000 other persons imprisoned. This was but the beginning of a "series of judicial murders" (Green), of which Stafford was later a victim (1680). Upon the fall of Danby, Shaftesbury became president of the Council and introduced an exclusion bill in Parliament. When it became known that he wished to give the succession to the King's bastard son, the Duke of Monmouth, he was deserted by his colleagues and Parliament was prorogued. It was in this session that he secured the passage of the Habeas Corpus Act. Shaftesbury was dismissed from the Council (1679). In 1681 he was arrested and thrown into the Tower on a charge of high treason. The charge was thrown out by the grand jury and he was released. He threw himself further into the conspiracies until in December, 1682, he had to flee to Holland, where he died in a few months. Consult his *Life*, by Christie (London, 1871), and by Traill in the series of "English Worthies" (London, 1886).

Anthony Ashley Cooper, third Earl of Shaftesbury, philosopher and moralist, grandson of the first Earl, was born in London, February 26, 1671. In 1683 he was sent to Winchester School, and three years later he traveled in Germany, France, and Italy. After an absence of three years he returned to England and devoted himself to the study of philosophy. In 1711 he went to Naples on account of his health and died there February 15, 1713. His important writings were collected by himself and published under the title *Characteristics of Men, Manners, Opinions, Times* (1711; enlarged ed. 1714). The enlarged edition contains, among other things: *A Letter Concerning Enthusiasm* (1708); *Sensus Communis, an Essay Concerning Wit and Humour* (1709); *The Moralists; a Philosophical Rhapsody* (1709); and *A Soliloquy* (1710). Shaftesbury is one of the most important of English moralists. His significance lies in the emphasis he placed on the social feelings and instincts. Against Hobbes he emphasizes the important part played by the 'natural affections' (= social and benevolent impulses) in securing happiness for the individual. Virtue consists in the harmony between the natural and the self-affections, while the unnatural affections tend to the good (= happiness) neither of the individual nor of the race. Virtue is a matter of our own instincts; it is independent of religion. For his life and a popular sketch of his views, consult: Fowler, *Shaftesbury and Hutcheson* (London, 1882); also Gizycki, *Die Philosophie Shaftesburys* (Leipzig, 1876); Martineau, *Types of Ethical Theory* (3d ed., Oxford, 1898); Stephen, *Essays on Freethinking and Plain Speaking* (London, 1873).

Anthony Ashley Cooper (1801-85), seventh Earl of Shaftesbury, was one of the most eminent philanthropists of the nineteenth century. He was born in London, was educated at Harrow and Christ Church, Oxford, and entered the House of Commons in 1826, remaining a member of the House until 1851, when he succeeded his father in the peerage. In 1834 he was made a Lord of

the Admiralty, but political office had little attraction for him, and very soon after his election to Parliament he entered upon what was to be his life's work—the reform of social and legal abuses. He first devoted himself to the question of the insane, whose pitiful condition under the barbarous mode of treatment then in vogue stirred him to unceasing activity until a complete reform of the Lunacy Acts had been effected. He next gave his attention to the passage of a ten-hour factory bill. This was not accomplished until after fourteen years of agitation (1847), in the course of which Shaftesbury eloquently pleaded the cause of the unhappy Lancashire operatives, of whose life he made a personal study. The revelation of the fearful conditions of employment prevailing in the coal mines led to the act of 1842, advocated by Shaftesbury, which abolished the iniquitous system of apprenticeship and forbade the employment of women and children under thirteen in the coal pits. Shaftesbury interested himself also in the condition of the London chimney sweeps, in whose behalf he carried the celebrated Climbing Boys Act. He devoted much time to studying conditions in the slums of London, was chiefly instrumental in the erection of the so-called Ragged Schools, and was for thirty-nine years chairman himself of the Ragged School Union. His Lodging House Act of 1851 was a great step forward in improving the housing of the poor. He caused the construction of a large number of model tenements at Battersea, and erected model cottages on his own estate. With the masses of the people Shaftesbury enjoyed immense popularity. He died October 1, 1885. His speeches, with an introduction by himself, were published in 1868. Consult Hodder, *Life and Work of the Seventh Earl of Shaftesbury* (3 vols., London, 1886).

SHAFTING. A mechanical device to transmit power from one part of a mill to another and sometimes employed for external transmission to distances of a few hundred feet. Beyond distances of 300 or 400 feet it becomes too expensive as compared with other means of power transmission. Shafting consists of a line of round iron or steel bars resting in bearings and rigidly fastened together. The component bars are usually from 12 feet to 24 feet long, and they are fastened together by couplings of various forms, the most usual of which consists of two circular plates connected by bolts. The material used for shafting is usually steel, which is rolled to cylindrical form and turned smooth at the points where the various pulleys and gear wheels are attached.

SHAG. A cormorant (q.v.), especially Phalacrocorax carbo. See Plate of FISHING BIRDS.

SHAG-BARK. See HICKORY.

SHAGREEN (Fr. *chagrin*, from Venetian It. *zagrin*, It. *zigrino*, from Turk. *sāghri*, shagreen, back of a horse). A variety of leather made from the skin of the shark or some related selachian, or from portions of the skins of horses, asses, camels, and oxen. These strips are prepared by soaking in water and currying; and when in the proper condition they are laid on the ground, and the seeds of Chenopodium album are sprinkled over them; a board or piece of felt is then placed on the seeds, and by pressure the hard seeds are forced deeply into the skin, which is then hung to dry. When dry, the seeds are removed by shaking, and the skin pared down with a proper knife nearly but not quite as low as the bottom of the depressions caused by the seeds. After this the skin is again soaked, and the parts compressed by the seeds now rise up and form elevations, which are increased by washing in a solution of salt. The last operation is dyeing them various colors, green being the favorite one. Owing to the difference of texture produced by the operations of compressing by the seeds, paring, etc., the color is taken irregularly; and when dyed green, the material somewhat resembles malachite in appearance when dried and polished.

SHAHAP'TIAN STOCK. A group of cognate tribes formerly occupying the country upon the waters of the Snake River and the Middle Columbia in Idaho, Washington, and Oregon, from the Bitter Root Mountains to the Cascade range, and from about the 45th to the 47th parallel. The principal tribes are the Nez Percé or Shahaptin, Klikitat, Palûs, Tenino, Umatilla, Wallawalla, Warmsprings, and Yakima (qq.v.). The general migration seems to have been westward and southward down the Columbia. In consequence of their central position and their natural enterprise, the Shahaptian tribes became the recognized trading intermediaries between the Plains tribes east of the Rocky Mountains and fishing tribes of the Lower Columbia and coast. Two of the most famous Indian leaders in the history of the Columbia region, Joseph and Smohalla (q.v.), are of this lineage. They number now in all about 4000 on reservations in Idaho, Washington, and Oregon, the Nez Percé leading with 1700.

SHAHJAHANPUR, shä'jū-hän'pōōr. The capital of a district of the same name in the United Provinces of Agra and Oudh, India, 102 miles north by west of Lucknow on the Deoha River (Map: India, C 3). It has a military post, several old mosques, and mission schools. The city is surrounded by an agricultural district and is engaged in sugar refining and distilling. Population, in 1901, 76,458. Shahjahanpur dates from 1647, and came under English control in 1801.

SHAH JEHAN, je-hän' (Pers., king of the world) (?-c.1665). The fifth of the Mogul emperors of Delhi. He was the third son of Jehangir, and before his accession to the throne distinguished himself by victories over the Rajputs, the Mohammedan States of the Deccan, and the Afghans in the neighborhood of Kandahar. In 1623 Shah Jehan rebelled against his father when the latter, after the sudden death of his elder son Khusru (who was supposed to have been murdered by Shah Jehan), declared Bulaki, Khusru's son, heir to the throne. He sacked Agra and ravaged Bengal, but was defeated by Jehangir and forced to seek refuge in the Deccan (1625). On the death of the Emperor in 1627 Shah Jehan returned, outwitted Bulaki, whose fate is a mystery, and was proclaimed Padishah at Agra (1628), marking his accession by the murder of all the princes of his house whom he could seize. His reign was a stormy one, marked by intrigue and treachery. He alienated the native Hindu rajputs from himself, and destroyed the Portuguese settlement of Hugli, near the present Cal-

cutta. He lost Kandahar and most of the Kabul territory, but, on the other hand, he gained the State of Ahmednagar, and made Bijapur and Golconda in the Deccan pay him tribute. This period was the zenith of the Hindu Mohammedan architecture. Shah Jehan built at Agra the Moti Masjid or Pearl Mosque, as well as the famous Taj Mahal (q.v.), and founded the modern city of Delhi, which is still called Shahjehanabad by the Indian Mohammedans. He also constructed the celebrated peacock throne at Delhi. The closing years of his reign were embittered by the struggle of his four sons for the throne. Two of them, Aurungzebe (q.v.) and Murad, made common cause, marched on Agra, and, in 1658, imprisoned Shah Jehan, who died about 1665.

SHAH NAMAH, nä'mȧ (Pers., Book of Kings). The title of several Persian works, the most celebrated of which is the one by Firdausi (q.v.). Another work, in Turkish, under the same name, comprises the history of all the ancient kings of the East, and was written by Firdausi at Thauil.

SHAHRASTANI, shä'rȧs-tä'nê, ABU AL-FATḤ MUHAMMAD IBN ABDALKARĪM ASH-SHARASTĀNĪ (1071-1153). The compiler in Arabic of a philosophic history of the religious sects of the world. He was born at Shahrastan, Persia, and, after traveling, returned home about 1120 and died there. His great work is scientifically arranged, and is an impartial and careful study of all the various sects and religions known to him, including Judaism and Christianity and the Asiatic neighbors of Islam. His account of the perplexing Mohammedan sects is especially valuable, while his observations upon alien religions, such as Christianity and Zoroastrianism, are based upon exact information. The text was edited by Cureton, *Book of Religious and Philosophical Sects* (London, 1846), and was translated by Haarbrücker (Halle, 1850-51).

SHAIRP, shârp, JOHN CAMPBELL (1819-85). An English teacher and author, born at Houstoun, Scotland. He was educated at Glasgow University and at Balliol College, Oxford. He was master of Rugby (1846-57), assistant to the professor of Latin at Saint Andrews (1857), and professor of Latin (1861-68), principal of the United College, Saint Andrews (1868-77), and was appointed in 1877 and again in 1882 professor of poetry at Oxford. Among his stimulating books are: *Studies in Poetry and Philosophy* (1868), which discusses Coleridge, Wordsworth, and Keble, and shows Shairp as a critic of breadth and discrimination; *Culture and Religion* (1870), a work of considerable popularity, in which a spiritual nature in man is insisted upon to render his life intelligible; *The Poetic Interpretation of Nature* (1877), which deals with the varied treatment of nature in poetry, and acutely sets forth the respective limitations of poetry and science; *Life of Burns* (1879), wherein a sharp distinction is made between the poet's character and his literary work; *Aspects of Poetry* (1881), treating several poets, from Burns to Newman; *Sketches in History and Poetry* (posthumous, 1887). In 1864 he published a volume of poems entitled *Kilmahoe and Other Poems*. Consult Knight, *Professor Shairp and His Friends* (London, 1888).

SHAKE. See TRILL.

SHAKERS. The name commonly applied to the members of 'the Millennial Church,' or 'the United Society of Believers,' a communistic society having branches in New York, Massachusetts, New Hampshire, Connecticut, Maine, Ohio, Kentucky, Georgia, and Florida. They say that they were originally a sect of Quakers and were derisively called Shaking Quakers because of their movements of the body in religious meetings. The Shaking Quakers appeared in England about 1747, were organized under the leadership of Jane and James Wardley, and were joined later by Ann Lee (q.v.) of Manchester, who claimed to be Christ in His second reincarnation, and who came to America in 1774 with seven of her converts and established a small church at Niskayuna, near Watervliet, N. Y. Ann Lee died in 1784 and the society was placed upon a communistic basis in 1787. A religious revival in 1779-80 brought to the society a large number of converts, and it grew steadily in wealth and importance. The Shakers now have 17 communities, the larger divided into several 'families,' the members of which vary from only a few to 100 or more. In 1887 they numbered about 4000 members; an estimate for 1902 is 1000. From the economic standpoint they have been unusually successful, but seem less so in recent years.

In origin the society is a religious community and may be said to rest upon 'the belief in the revelation of Christ's second appearance in Ann Lee.' The fundamental principles of the sect, that the root of human depravity is found in the 'disorderly' or natural relation of the sexes, and that in God exists the maternal as well as the paternal nature, are believed to have been revealed to Ann Lee. She also foretold and sanctioned the communistic order of living, which has now become of equal importance with celibacy, non-resistance, and the equal rights of women in the simple creed of the Shakers. They neither condemn nor oppose marriage for the ordinary or 'generative' world, and they "freely admit that the private family is necessary and must always exist," but they assert the possibility of attaining a higher or angelic order of existence to which virginity is a prime requisite, and they further hold that the virgin life is indispensable in organized communism, because the family relationship necessarily implies private centres of affection and economic interest incompatible with successful communism. In their religious ceremonies they worship neither Christ, Ann Lee, nor any other person, but "the highest good, wherever it may be found;" and they hold that the Bible, while of incalculable value to the human race, contains traditional biographies and records which are purely secular. Their form of worship is thus described in an official pamphlet: "We sing and march to times of different measure, and move our hands in a gathering form, expressive of one's desire to obtain the treasures of the spiritual realm. Sometimes we are led to go forth in the dance, which seems to quicken body and soul and kindle anew the fire of truth. We use some stronger means to banish the elements of worldly bondage by shaking, as an expression of our hatred to all evil; are bold in denouncing idolatry, pride, deceit, dishonesty, and lust. Unlike the outside churches, all the members are free to speak their religious convictions, and to exercise in any good gift. Our songs, hymns, and anthems are original, most

of them written under the power of inspiration; they are the simple expressions of an earnest hope and a living faith, and are well adapted to our manner of devotional exercises." A fundamental part of their religious creed and practice is the confession of sin in the presence of a witness, men and women confessing to an elder of their own sex. They believe in a 'continuous revelation,' and this makes their doctrine as well as their practice plastic and adaptable to changing conditions, and has enabled them to indorse and defend land nationalization, spiritualism, and other modern radical movements. Except in the fundamental doctrines mentioned above they are tolerant and broad-minded. "Our only demands," says the *Plain Talks Upon Practical Christian Religion*, "are the successful prosecution of a pure life after the Christ pattern; believing and realizing that all other features of Christian communism will immediately succeed."

The Shakers regard ostentation, luxury, and private property as sinful and unchristian. They live in groups or 'families.' The government of the family is parental. The supreme authority is vested equally in an elder and eldress, or two of each sex when the order is full. Temporal affairs are managed by an equal number of deacons and deaconesses acting in counsel with the elders. The two sexes eat in the same halls, and social intercourse is free and open. Healthful living is regarded as a religious duty, and much attention is given to hygiene; the result is a low death-rate and a large proportion of centenarians. Their income is derived from farming, small manufactures, and the education of children. The latter, however, is in many cases gratuitous and undertaken in the hope of replenishing their membership.

The Shakers were the first to establish a communistic settlement in the United States, and their historical significance rests upon the fact that for more than a century these settlements have been successfully maintained. The oldest and largest community is situated at Mount Lebanon, N. Y., 25 miles southeast of Albany, and is recognized as "the central executive of all the Shaker societies."

BIBLIOGRAPHY. The following are regarded by the Shakers as their most important publications: *Christ's First and Second Appearing and Millennial Church* (Albany, 1856); *Dunlavy's Manifesto* (New York, 1847); Green and Wells, *Summary View of the Millennial Church* (Albany, 1848); Eads, *Shaker Theology* (ib., 1879); *Precepts of Mother Ann and the First Elders;* Evans, *Shakers' Compendium* (New York, 1859); id., *Autobiography of a Shaker* (Mount Lebanon, 1869); Blinn, *Concise History of the Shakers* (East Canterbury, N. H., 1894); McNemar, *The Kentucky Revival* (New York, 1846); Hollister and Green, *Pearly Gate* (Mount Lebanon, 1894); Robinson, *Concise History of the Shakers* (East Canterbury, N. H., 1893). Most prominent among periodical publications, all of which have ceased to appear, are the *Shaker Manifesto* (1871-90) and the *Shaker and Shakeress*. Consult also: Noyes, *History of American Socialisms* (Philadelphia, 1870); Nordhoff, *The Communistic Societies of the United States* (New York, 1875); Ely, *Labor Movement in America* (New York, 1886); Hinds, *American Communities* (Chicago, 1902).

SHAKESPEAR, shāk'spēr, JOHN (1774-1858). An English Orientalist, born at Lount, Leicestershire. He was educated in the schools of the vicinity and then sent by Lord Rawdon (afterwards Marquis of Hastings) to London to study Arabic. In 1805 he was appointed to an Oriental professorship in the Royal Military College, Marlow, and upon the institution at Addiscombe of a training school for cadets by the East India Company he was given the post of professor of Hindustani there. He wrote a *Hindustani Grammar* (1813; 6th ed. 1855), a *Dictionary of Hindustani and English* (1817; 4th ed. of 1849 enlarged by an English-Hindustani dictionary), *Muntakhabat-i-Hindi: Selections in Hindustani* (1817-18), and an *Introduction to the Hindustani Language* (1845).

SHAKESPEARE, shāk'spēr, WILLIAM (1564-1616). An English poet and dramatist, born at Stratford-upon-Avon, in the County of Warwick, in April, 1564. He was baptized on April 26 (Old Style); and, as it was a common practice to christen infants when three days old, the tradition which makes his birthday the 23d (May 3d as dates are now reckoned) is generally accepted. Of a family of four sons and four daughters, William was the third child, but eldest son. His father, John Shakespeare, who had been a farmer in the neighboring village of Snitterfield, came to Stratford about 1553 and adopted the trade of a glover. His mother, Mary Arden, belonged to a younger branch of a good old Warwickshire family, and inherited a considerable estate from her father. John Shakespeare was evidently shrewd, energetic, ambitious, and public-spirited. He made money and was popular with his fellow townsmen. After passing through the lower grades of office he was elected alderman, and in 1568 became high bailiff or mayor. In 1556 he bought two houses in Stratford. John Shakespeare, like his fellows in the town council, appears to have been a lover of the drama. When he was high bailiff in 1569 licenses for local performances were granted to two companies of traveling players. John very likely took the five-year-old William to see them act.

When William was seven years old he doubtless entered the Stratford Grammar School. The masters of the school in Shakespeare's boyhood were university men of at least fair scholarship and ability, as we infer from the fact that they rapidly gained promotion in the Church. The studies were mainly Latin, with writing and arithmetic, and perhaps a mere smattering of other branches. A little Greek was sometimes taught in the grammar schools, and this may have been the case at Stratford. Ben Jonson credits Shakespeare with "small Latin and less Greek," which some critics interpret as equivalent to "no Greek;" but Ben was not inclined to overstate Shakespeare's classical attainments. Whatever the boy may have learned in the Stratford school during the six or seven years he probably spent there, we may be quite certain that it was all the regular schooling he ever had; and we have no reason to suppose that he kept up his classical studies after leaving school. Attempts have been made to prove Shakespeare a scholar, but a careful examination of his works proves the contrary. His quotations from Latin authors are confined to those then

read in school, and are such as a schoolboy might make. In one instance at least the form of the quotation shows that it was taken from Lilly's Latin Grammar (then used in all English schools) and not from the original play of Terence. He makes frequent mistakes in classical names, which a learned man like Bacon, for instance, could never have been guilty of. Bacon, indeed, gives some of these very names correctly in passages that have been quoted to illustrate the resemblance between his works and Shakespeare's; they really show that the dramatist was ignorant of what the philosopher was familiar with. The training in the grammar school was, however, an insignificant part of Shakespeare's education in the broader sense. The poet is born, not made, says the ancient saw; but the development of his genius largely depends upon where and under what influences he lives in his childhood and in later years. Shakespeare's life was almost entirely spent in Stratford and London; and in both homes he was eminently fortunate. He was born and lived for twenty years in the country—in the heart of rural England. His manhood was passed in the city—in what was then, as now, the greatest of cities. Stratford was within the limits of the Forest of Arden, which still retained enough of its primitive character to render the youth familiar with woodland scenery and life and to cultivate his love of nature, which was that of a child for its foster-mother. It was here also that he got the minute knowledge of the practical side of country life which appears in his works. Volumes have been written on the plant-lore and garden-craft of the dramatist; and they prove his love of the country and his keen observation of natural phenomena and the agricultural practice of the period. Others have shown that he understood hawking and hounds, and had a very wide and loving knowledge of many English birds and other animals. His acquaintance with angling is apparent in some of his works.

For its historical associations Warwickshire was no less the fitting region for the education of a great national poet. From the time of the Roman occupation it had played an important part in the national history. Several Roman roads traversed the district, and Stratford got its name from the *ford* where one of these *streets* (as they were called) crossed the Avon. The sites of several Roman camps, or fortified stations, were in the neighborhood, one of these, Alcester, being only five miles from Stratford. In Anglo-Saxon times Warwickshire formed part of the Kingdom of Mercia, which was for a while the dominant power of the country. Later, from its central position, it was traversed and occupied by the rival armies in the civil wars. The decisive battles that ended the Barons' War in the thirteenth century and the Wars of the Roses in the fifteenth were fought on the borders of Warwickshire, at Evesham and Bosworth Field. The castles of Kenilworth and Warwick, both in the same county and within fifteen miles of Stratford, were, during these wars, the main centres of military and political interest in England. Queen Elizabeth's famous visit to Robert Dudley at Kenilworth in 1575, and the holiday pageant in her honor, which lasted from July 9th to the 27th, occurred when Shakespeare was eleven years old. His father, as a well-to-do citizen and prominent magistrate of Stratford, probably saw something of the stately show, and may have taken William with him. Certain passages in the *Midsummer Night's Dream* (ii. 1) appear to be reminiscences of the Kenilworth festival, of which the boy must have heard much, even if he saw nothing of it.

The legendary lore of the district was equally stimulating and inspiring to a poet. Warwickshire was eminently a field of romance and old heroic story and the scene of many an ancient ballad. Guy of Warwick was a foremost hero in this popular poetry, and his gigantic spectre still haunts the scenery of his traditional exploits. Shakespeare in his boyhood was familiar with the stories about this half-mythical personage, and he recalled them in later life when he put allusions to Colbrand, the big Saracen whom Guy conquered and slew, into the mouths of certain characters in his plays. Warwickshire was also prominent in the history of the English drama. Coventry was renowned for the religious plays performed by the Grey Friars of its great monastery, and kept up, though with less pomp, even after the dissolution of their establishment. It was not until 1589 that these pageants were entirely suppressed; and Shakespeare, who was then eleven years old, may have been an eyewitness of the latest of them. His allusions to characters in these old plays (as, for instance, to Herod in *Hamlet* and *The Merry Wives of Windsor*, and to the 'lost souls' in *Henry V.*) prove that he knew them by report, even if he had not seen them. Historical plays, not biblical in subject, were also common in Coventry before the dramatist was born. *The Nine Worthies*, which he burlesques in *Love's Labour's Lost*, was acted there before Henry VI. in 1455. The original text of the play has been preserved, and portions of Shakespeare's travesty seem almost like a parody of it. The play performed at Stratford in 1569, which must have been of this religious or historical type, was the beginning, so far as the town records show, of theatrical performances in Stratford, but in succeeding years they were frequent. Of course the young Shakespeare witnessed them; and we can surmise how they fired his imagination and fostered his inborn taste for the drama.

We see, then, that all outward conditions in Stratford and its neighborhood were peculiarly favorable to the awakening, stimulating, and developing of Shakespeare's genius; and in his second home, where he spent more than twenty-five years, including his entire career as an actor and author, he was equally fortunate. London was then, as now, the metropolis of the kingdom, the capital of arts and letters, no less than of the National Government. It was the centre of the literary activity and brilliancy that made 'the spacious times of great Elizabeth' forever memorable. What stimulus, what inspiration must Shakespeare have found in its life and society! We see then that, though so far as schooling properly so called was concerned Shakespeare's education was inferior to what a boy of thirteen or fourteen would get nowadays, it was in the broader sense far from inadequate as a preparation for the work he was to do as a poet and dramatist.

For some time after leaving school the boy may have helped his father in his trade. In 1577 John Shakespeare was beginning to have bad luck in his business, and William, then thirteen

years old, may have been taken from school for work of some kind. The tradition that he was bound apprentice to a butcher and later ran away to London is improbable. Another tradition makes him an attorney's clerk for a time, and the many references in his works to the technicalities of the law have led Lord Campbell and other specialists to believe that he must have studied law somewhat thoroughly. But Judge Allen, of the Supreme Court of Massachusetts, in his *Notes on the Bacon-Shakespeare Question* (1900), has shown that such legal allusions are equally common in contemporary dramatists, and that Shakespeare, instead of being uniformly accurate in these matters, as Lord Campbell and others have assumed, is often guilty of mistakes which a lawyer or student of law would never make. This may be regarded as the final word on the question of the supposed legal attainments of the dramatist.

The first indisputable fact in Shakespeare's life after leaving school is that of his marriage, which occurred when he was between eighteen and nineteen years old. The bride, Ann Hathaway, was about eight years older, as she died August 6, 1623, at the age of sixty-seven. She was the daughter of a farmer in Shottery, a village about a mile from Stratford. The house in which he lived was bought in 1892 for preservation as a memorial of the poet. The house in Stratford in which he was born had been similarly secured as a public trust in 1848. The marriage was probably solemnized early in December, 1582, and in one of the neighboring parishes, the records of which have been lost. The date is approximately fixed by a bond authorizing the marriage "with once asking of the bans," which is still extant in the Episcopal archives of Worcester, the diocese to which Stratford and Shottery belonged. This bond is dated November 28, 1582. A daughter was born to the young couple the next May. She was baptized with the name Susanna on Sunday, May 26, 1583; and twin children, Hamnet and Judith, followed early in 1585 (baptized February 2, 1585), or about two months before their father was twenty-one.

Of his life from the date of his marriage to his departure for London nothing further is positively known, and the most important tradition of the period is that of his poaching in Sir Thomas Lucy's park at Charlecote, near Stratford. The strongest argument in its favor is based on the evidence in the plays that Shakespeare had a grudge against Lucy, and caricatured him as Justice Shallow in *2 Henry IV.* and *The Merry Wives of Windsor*. The reference to the 'dozen white luces' in the latter play (i. 1, 16-22) is palpably meant to suggest the three luces, or pikes, in the arms of the Lucys; and the manner in which the dialogue dwells on the device indicates that some personal satire was intended. How Shakespeare managed to support his family at this time is doubtful. His father's fortunes were still dwindling, and there were four younger children to be taken care of: Gilbert (born 1566), Joan (1569), Richard (1573), and Edmund (1580). Anne, born in 1571, had died in 1579. The waning of John Shakespeare's fortunes was probably due to the general depression in business that seems to have affected Stratford at that time.

The date of Shakespeare's leaving Stratford for London cannot be definitely fixed. The poaching adventure is supposed to have occurred in 1585, and if it drove him from Warwickshire, it was probably in the autumn of that year. The birth of the twins in January, 1585, and the difficulty he must have had in supporting his increasing family are also in favor of that date. It was in that year, moreover, that he came of age, which may have led him to take this serious step in the hope of bettering his fortunes. It is generally agreed that he left Stratford in 1585 or 1586. What friends or what employment he found on reaching London we do not know. According to a tradition that cannot be traced further back than 1750, though it is said to have been originally related by Sir William Davenant a century earlier, his first employment in the metropolis was in holding horses at the door of the theatre. Whether it is true or not, we know that the young man soon got into one of the two theatres then established in London—perhaps, as tradition says, in the humble capacity of "prompter's attendant, whose employment it was to give the performers notice to be ready to enter" on the stage. Doubtless his abilities were soon recognized and led to something higher. It could not have been long before he had begun his career as an actor in small parts and had worked his way up more or less rapidly, but for seven years after he went to London, or from 1585 to 1592, we have no information whatever about him, and tradition is silent except with reference to the very beginning of the period. At last, in 1592, we get a definite reference to him in the literature of the time; and we are indebted for it to the envy and spite of a disappointed and dying playwright, Robert Greene, who, in the autumn of that year, published a little book entitled *Greens Groats-worth of Wit, bought with a Million of Repentance*. After referring to certain dramatists of the day, Greene turns to the actors, and says: "Yes, trust them not, for there is an upstart crow, beautified with our feathers, that, with his *Tygers heart wrapt in a Players hide*, supposes he is as well able to bombast out a blanke verse as the best of you; and being an absolute *Johannes Factotum*, is in his owne conceit the only Shake-scene in a countrie." The epithet of 'Shake-scene' obviously refers to Shakespeare, and the passage implies that he was both actor and author, and perhaps, as some believe, plagiarist also. The italicized quotation is obviously a parody of 'O tiger's heart wrapp'd in a woman's hide,' in *3 Henry VI.* (i. 4, 137), an old play in which Greene is assumed to have had a hand, and which was revised by Shakespeare. In December, 1592, Henry Chettle, who had published Greene's pamphlet for him, brought out his own *Kind Harts Dreame*, in which he refers to Shakespeare thus: "Myselfe have seene his demeanor no less civill than he excelent in the qualitie he professes; besides, divers of worship have reported his uprightness of dealing, which argues his honesty, and his facetious [felicitous] grace in writing, that approves his art." It is evident from Greene's sneer and Chettle's apology that Shakespeare in 1592 was already an actor of some prominence; that he had begun his career as an author by revising old plays for a new lease of life on the stage; and that he was gaining reputation and making friends.



SHAKESPEARE

FROM AN ETCHING, BY LEOPOLD FLAMENG, OF THE CHANDOS PORTRAIT IN THE NATIONAL PORTRAIT GALLERY, LONDON

All three parts of *Henry VI.* were plays that Shakespeare retouched for the stage at the very beginning of his dramatic career; but the second and third parts have unquestionably a larger proportion of his work than the first. *Titus Andronicus* is another play which probably has a similar history, and which bears some slight traces of his hand. If he was the author of this bloody and revolting tragedy, as a few critics have assumed, it must have been written before he had found his true self. It is far more probable that when he first attempted entirely original work it was in comedy, and that *Love's Labour's Lost* was the play. It was doubtless written as early as 1591, if not two or three years earlier. The first extant edition appeared in 1598, when the title page informs us that it had been "newly revised and augmented." *The Two Gentlemen of Verona* and *The Comedy of Errors* appear to have followed immediately; and the first draft of the poet's first tragedy, *Romeo and Juliet* (excluding *Titus Andronicus*), belongs to the same period, the play in its present form being a revised and enlarged edition. *Richard III.*, the first of the English historical plays which was entirely the work of Shakespeare, naturally follows the trilogy of *Henry VI.* and was probably written in 1592 or 1593. *Richard II.* was produced soon after *Richard III.*, though, like that play, it was not printed until 1597. Both plays appeared without the author's name, which was added the next year in second editions of both. *A Midsummer Night's Dream* belongs in this group of early comedies, of which it was in all probability the last, 1594 being the date generally accepted.

The breadth of Shakespeare's literary tastes and aspirations in this 'prentice period' of his career is shown by the fact that, just when his reputation as an actor and a dramatist was becoming established, he published two long narrative poems, *Venus and Adonis* and *Lucrece*, the former in 1593 and the latter in 1594. The popularity of the *Venus and Adonis* led to the issue of a second edition in 1594; and at least ten more editions appeared in the next sixteen years. Probably there were others, as only single copies are extant of several of the known issues. Nothing was known of the fourth edition until a copy was discovered in 1867, and a single copy of the twelfth has come to light more recently. Of the *Lucrece*, eight editions are known, but it is unlikely that these complete the list. Both poems are dedicated to the young Earl of Southampton, who was a liberal patron of men of letters and particularly interested in the drama.

In the dedication of *Venus and Adonis* Shakespeare calls the poem "the first heir of my invention," that is, the first product of his imagination. This does not prove that it was written before any of the plays, but may only mean that it was his first distinctively *literary* work, plays being then regarded as not included in literature properly so called. Some critics, however, take the expression in its literal sense, believing that the poem was first written when the author was a very young man, perhaps even before he went to London. If Shakespeare did not become an author until 1590, the period of his literary apprenticeship covers at most five years, or until the end of 1594; and during this time he revised more or less thoroughly *Titus Andronicus* and the three parts of *Henry VI.*, and wrote at least the seven original plays already enumerated and two long poems. And all this time he was actively engaged in his profession as an actor. The earliest definite notice of his appearance on the stage is of his playing in two comedies before Elizabeth at Greenwich Palace, in December, 1594. During the next six years (1595-1600) Shakespeare completed the series of English historical plays (not including *Henry VIII.*, his part in which was done at least ten years later), and wrote most of his best comedies and *Julius Cæsar*. All or nearly all the *Sonnets* are probably to be included in this period. *King John* is generally assigned to 1595, internal evidence indicating that it immediately followed (if it did not precede) *Richard II.* The two parts of *Henry IV.* followed in 1596 or 1597, and *Henry V.* in 1598. *The Merry Wives of Windsor*, which tradition says was written at the request of Elizabeth, who desired to see Falstaff in love, appears to have come between *2 Henry IV.* and *Henry V.* *The Merchant of Venice* is mentioned in a list of Shakespeare's plays in Francis Meres's *Palladis Tamia*, published in September, 1598; it was written probably in 1596 or 1597. The same list includes all the plays mentioned above, except the trilogy of *Henry VI.* It does not include *The Taming of the Shrew* (an adaptation of an anonymous play called *The Taming of a Shrew*, published in 1594), which in its present form cannot well have been later than 1597, and may be a year or two earlier. Some good critics identify it with the *Love's Labour's Won*, mentioned by Meres, which the majority believe to have been an early draft of *All's Well that Ends Well*. In the closing years of the century, between the summer of 1598 and the end of 1600, Shakespeare, after finishing the English historical plays (except *Henry VIII.*), returned to comedy, and wrote his three most brilliant works in that line, *As You Like It*, *Much Ado About Nothing*, and *Twelfth Night*. The order of their composition is uncertain, but *Twelfth Night* is almost unanimously reckoned the last of the series. *Julius Cæsar* is alluded to in Weever's *Mirror of Martyrs* (printed in 1601, but written two years before) and other evidence leaves little doubt that the play was produced in 1599. It was very popular, and many allusions to it are found in the literature of the time, according to one of which it was far more successful than Ben Jonson's Roman plays, *Catiline* and *Sejanus*.

Of Shakespeare's personal history between 1592 and 1600 few facts are known. In 1596 his only son, Hamnet, died and was buried on the 11th of August at Stratford. During the Christmas holidays his theatrical company performed twice before Elizabeth at Whitehall. In the spring of 1597 he made his first investment in real estate by the purchase of New Place, a mansion with about an acre of land in the centre of Stratford. In 1596 John Shakespeare, doubtless by his son's advice and at his expense, applied to the College of Heralds for a coat-of-arms; but, though the petition was approved in October of that year, the negotiations were not then concluded. In 1599 John made a new application to the College of Heralds, in which he refers to the action taken on that of 1596, and also requests that he and his son may be allowed to quarter on the coat the arms of the Ardens of Wilmcote, his wife's family. The heralds granted the coat, but sub-

stituted the arms of the Ardens of Alvanley in Cheshire, apparently because these belonged to a younger branch of the family, from which Mary Arden was descended. John Shakespeare died in 1601, two years afterwards, and there is no evidence that either he or his son used the Arden arms. William did use the Shakespeare arms as tricked by the heralds, and he may have felt that they had become honorable enough without displaying the connection with the Ardens. By 1599 William Shakespeare had made a name for himself that needed no lustre borrowed from ancestral rank. He went to London in 1585 or 1586 a penniless adventurer, but in 1597 he had gained reputation and made money as actor and author, and could invest his surplus income in the purchase of the best house in Stratford. Besides defraying the expenses in obtaining the coat-of-arms, there is evidence that he helped to restore the fallen fortunes of his father. He repaired New Place, and added other lands to the estate. In 1602 he spent the large sum of £320 in the purchase of 107 acres of land near Stratford, and also bought a cottage and garden in the town.

The actor's business was then lucrative enough to excite the envy of pamphleteers; and if the actor got a share in the theatre or its profits, as Shakespeare did in 1599 when the Globe Theatre was built, it added materially to his income.

Shakespeare's receipts as an actor before 1599 were probably £100 a year, to which perquisites from Court performances might add £15 or so. His returns from his work as a dramatist would be much smaller. Before 1599 the prices paid for plays ranged from £6 to £15, the most that is known to have been paid. To this a slight gratuity was added if the play was very successful, and the author sometimes had a share in the receipts of a 'benefit' on a second production. Shakespeare's income from the revision and writing of plays up to 1599 can hardly have been more than £20 a year, which, added to £110 or £115 from acting, would make his entire income £130 or £135, equal to from seven to ten times that amount in modern money. The quarto editions of his plays published at this time and afterwards were evidently all piratical ventures which yielded him nothing. From the successive editions of his poems—the only works printed under his personal supervision—he may have received something, but we have no means of estimating how much. According to Rowe's biography (1709), Shakespeare once received a gift of £1000 from his generous patron, the Earl of Southampton. The amount (equal to at least £7000 or $35,000 now) is undoubtedly exaggerated; but Southampton would be likely to make some substantial acknowledgment of the compliment paid him in the dedications of the *Venus and Adonis* and *Lucrece*. The only epistolary correspondence now extant in which Shakespeare was a party and the only letter addressed to him have reference to business matters. In January, 1598, Abraham Sturley writes from Stratford to his brother-in-law, Richard Quiney, who was in London, where the poet then was, suggesting that he obtain help from Shakespeare in certain business for the town; and later Quiney himself wrote to Shakespeare, asking the large loan of £30. This letter somehow got into the Stratford archives. Thomas Quiney, who married the poet's daughter, Judith, was a son of Richard Quiney.

We do not know in which of the London playhouses of 1585 (the Theatre and the Curtain) Shakespeare found employment. In 1592 the Rose was opened on the Bankside, and that was doubtless the scene of his early successes as actor and dramatist. In 1594 he was connected with another new theatre at Newington Butts; and afterwards he returned to the Theatre and the Curtain. The Theatre was torn down in 1599, and most of the materials were used in the erection of the Globe on the Bankside, which from that time appears to have been the only house with which he was regularly connected. At the Blackfriars Theatre (established in 1596) Shakespeare played a leading part in Jonson's *Every Man in His Humour*, in September, 1598, after having secured the acceptance of the play, which the manager was on the point of refusing (Rowe). On Twelfth Night and Shrove Sunday, 1600, the Globe company acted before Elizabeth at Richmond Palace, and on December 26th at Whitehall. In the following March they played at Somerset House before Lord Hunsdon and some foreign ambassadors. At Whitehall in the Christmas holidays of 1601-02 they presented four plays before the Queen. They also acted at Richmond on Candlemas Day, February 2, 1603, less than two months before the death of Elizabeth (March 24, 1603). James arrived in London on the 17th of May, and ten days afterwards he granted a license to Shakespeare and his company to perform in London and the provinces. In December, 1603, when the King was visiting the Earl of Pembroke, one of Shakespeare's patrons, at Wilton, the company played before the distinguished party there assembled; in the following Christmas holidays they acted several times at Hampton, and on Candlemas Day in the same palace before the Florentine ambassadors. On the 15th of March, 1604, when James made his formal passage from the Tower to Westminister, Shakespeare and the eight other actors to whom the royal license had been granted in 1603 marched in the royal train, and each was presented with four and a half yards of scarlet cloth, the usual dress allowance of players belonging to the household. They were now termed the King's servants, and took rank at Court among the grooms of the chamber.

Of the parts played by Shakespeare himself we have little information. According to a credible tradition, he personated Adam in *As You Like It;* and Rowe says that he acted "the Ghost in his own *Hamlet*." John Davies of Hereford says that he "played some kingly parts in sport." In the list of "the principal actors in all these plays," prefixed to the Folio of 1623, his name is placed first, but perhaps only because he was the author of the plays. There is no reason to suppose that he was ever a 'star' in the histrionic firmament of the period.

If Shakespeare's *Sonnets* are entirely or largely autobiographical, as the great majority of critics and commentators believe, they belong in all probability to this period (1595-1600) in his literary and his personal history; and of all the puzzles concerning the man and his works none has been the subject of more speculation and controversy. What we really know about the *Sonnets* can be stated in a few sentences. The

earliest known reference to them is in Meres's list of the poet's works already mentioned, in which they are called "his sugred Sonnets among his private friends." The next year (1599) two of them (138 and 144) were printed in *The Passionate Pilgrim*, a piratical booklet containing a few other poems known to be Shakespeare's, with some falsely attributed to him. In 1609 the entire collection of 154 sonnets was published by Thomas Thorpe, with the following dedication:

TO . THE . ONLIE . BEGETTER . OF .
THESE . INSVING . SONNETS .
MR. W. H. ALL . HAPPINESSE .
AND . THAT . ETERNITIE .
PROMISED .
BY .
OVR . EVER-LIVING . POET .
WISHETH .
THE . WELL-WISHING .
ADVENTVRER . IN .
SETTING .
FORTH .

T. T.

At the end of the volume *A Lover's Complaint* was printed for the first time. In 1640 the *Sonnets* (except 18, 19, 43, 56, 75, 76, 96, and 126), rearranged under various heads, were reprinted, with the pieces in *The Passionate Pilgrim* and other poems. The first complete reprint of the *Sonnets*, after the edition of 1609, was in the collected edition of Shakespeare's poems, published by Lintott in 1709. So much for facts about which there is no dispute. The question whether the edition of 1609 was authorized or supervised by Shakespeare has been much discussed; but it appears to have been definitely settled (by Dr. Rolfe) by one little peculiarity in the printing of the 126th Sonnet, if sonnet it be called. It has but twelve lines, and Thorpe (or his editor), assuming that a couplet had been lost, completed the normal fourteen lines by two blank ones inclosed in marks of parenthesis, thus:

( )
( )

Shakespeare could not have done this, and Thorpe would not have done it if he had been in communication with Shakespeare or any agent of his. The piece is not an imperfect sonnet of Shakespeare's pattern, but consists of six rhymed couplets, and the sense is apparently complete. Another important question, not so easily settled, is whether the *Sonnets*, entirely or in part, are autobiographical or are merely 'poetical exercises' dealing with imaginary persons and experiences. Editors and critics generally believe that most if not all of the poems, to quote what Wordsworth says of them, "express Shakespeare's own feelings in his own person;" or, as he says in his sonnet on the sonnet, "with this key Shakespeare unlocked his heart." Browning, quoting this, asks: "Did Shakespeare? If so, the less Shakespeare he;" to which Swinburne replies, "No whit the less like Shakespeare, but undoubtedly the less like Browning."

To whom is the dedication addressed and what does it mean? If Shakespeare had nothing to do with Thorpe's venture, the dedication is Thorpe's own, as it purports to be. But in what sense was "Mr. W. H.," whoever he may have been, "the onlie begetter" of the *Sonnets*? *Begetter* may mean, in the language of the time, either the person to whom the poems owed their birth and to whom they were originally addressed, or the one who collected and arranged them for Thorpe. Most critics take the word in the former and more familiar sense, but others argue plausibly for the second meaning. If the latter view be correct, the identity of "Mr. W. H." is of slight interest; but if he was the poet's patron and involved in the supposed personal revelations, the question is very important. The only theories concerning him that are worthy of serious consideration are that he was William Herbert, Earl of Pembroke, and that he was Henry Wriothesley, Earl of Southampton, to whom Shakespeare dedicated *Venus and Adonis* and *Lucrece;* and to Herbert and his brother Philip, Earl of Montgomery, as two patrons of the dramatist, the Folio of 1623 was dedicated by the player editors. The weight of critical authority in favor of the two theories is now (1903) about equal. According to both, the great majority of the *Sonnets* are personal and were not intended for publication. The first 126 (or such of these as are personal) are supposed to be addressed to one man ("Mr. W. H."), and the remainder to one woman, the 'dark lady,' with whom the poet and that man were entangled. This woman cannot be positively identified. Various attempts have been made to find an allegorical, mystical, or philosophical meaning in the *Sonnets;* and "Mr. W. H." has been supposed to represent the poet's Ideal Self, or Ideal Manhood, or the Spirit of Beauty, or the Reason, or the Divine Logos; and the 'dark lady' to be Dramatic Art, or the Catholic Church, or the Bride of the Canticles, 'black but comely.' More than one critic has assumed that "W. H." stands for "William Himself;" and the entire series has been supposed to be addressed to Queen Elizabeth.

A Lover's Complaint, published with *Sonnets* in 1609, is written in the same seven-lined stanza as *Lucrece*, but internal evidence indicates that it was later than that poem. The title-page of the 1709 edition of the *Poems* refers to it as "A Lover's Complaint of His Angry Mistress;" but the 'lover' is a girl who has been betrayed by a deceitful youth. *The Phœnix and the Turtle* is the only other poem by Shakespeare not already mentioned. It must have been written before 1601, when it was printed with Chester's *Love's Martyr*, together with poems by Marston, Chapman, and Ben Jonson.

After the plays already considered we come to a group of comedies so called, that are comedies only in name, or because they have not a tragical ending. They are *All's Well that Ends Well*, *Measure for Measure*, and *Troilus and Cressida*—"one earnest, another dark and severe, the last bitter and ironical" (Dowden). If *All's Welt* is a later form of the *Love's Labour's Won* in Meres's list of 1598, the revision was probably made in 1601. *Measure for Measure* is supposed to have been written in 1603 or early in 1604. *Troilus and Cressida*, first published in 1609, may have been written about the same time, and revised between 1606 and 1609. These plays appear to form a natural group, and indicate that Shakespeare's interest was changing from comedy to tragedy, but it is not necessary to assume that they were written or revised in immediate succession and apart from other work. Although in

a sense they lead up to the period of the great tragedies, they partly belong to it. Of these tragedies *Hamlet* was undoubtedly the first, the earliest quarto edition having appeared in 1603. The next year a second quarto was published, claiming to be "newly imprinted and enlarged to almost as much again as it was." At least three other editions were printed before the publication of the Folio of 1623, in which the text varies considerably from that of the quartos. The precise relation of the texts to one another is a perplexing question. *Othello* was performed on the first of November, 1604, before King James, and was probably then a new play. *Macbeth* is mentioned in the manuscript *Diary* of Dr. Simon Forman, who saw it "at the Glob, 1610, the 20 of Aprill;" but it is supposed to have been written in 1606 or 1607. *King Lear* was produced about the same time, and may possibly have preceded *Macbeth*. *Antony and Cleopatra* and *Coriolanus* must have followed at no long interval, the date generally accepted for both being 1607 or 1608.

The transition from the tragedies to the plays that follow is most remarkable. From that period of gloom and horror the poet emerges into the genial sunshine of *Cymbeline*, *The Tempest*, and *The Winter's Tale*. Inexorable retribution for sin is no longer the keynote of his dramas, but charity, forgiveness, reconciliation, benignity almost divine. Dowden aptly calls these last plays 'Romances,' and other critics have accepted the designation. "The dramas have a grave beauty, a sweet serenity, which seems to render the name 'comedies' inappropriate; we may smile tenderly, but we never laugh loudly as we read them." *Cymbeline* was probably a new play when Dr. Forman, as we learn from his *Diary*, saw it in 1610 or 1611, the undated entry certainly belonging to one of those years. *The Tempest* was believed by Campbell, the poet, to be the last of Shakespeare's plays, and Lowell also thought that in it "the great enchanter" was "bidding farewell to the scene of his triumphs;" but most critics think that *The Winter's Tale* followed rather than preceded it, though both must have been written in 1610 or 1611. *The Tempest* was acted before King James at Whitehall on the 1st of November, 1611. *The Winter's Tale* was also performed there four days afterwards; but Dr. Forman had seen it at the Globe on "the 15 of Maye" the same year, and there is evidence that the play was originally licensed in the latter part of 1610.

It is now generally agreed that certain of the plays included in the standard editions of Shakespeare are partly the work of other dramatists. The earliest plays of this class belong to the period of his dramatic apprenticeship, when he was employed by theatrical managers to revise or touch up old plays for reproduction on the stage. *Titus Andronicus* and the three parts of *Henry VI.* have been already considered, as well as the somewhat later *Taming of the Shrew*, in which there is more of his own work. To these are to be added three plays of the latter part of his career—*Timon of Athens*, *Pericles*, and *Henry VIII.*, in all of which he had a considerable share, though the critics differ in their explanations of the divided authorship. *The Two Noble Kinsmen* is another play which some good critics believe to be partly Shakespeare's, and which is included in several of the more recent editions of his works. The title-page of the earliest edition (1634) asserts that it was "Written by the memorable Worthies of their time; Mr. John Fletcher and Mr. William Shakespeare." There can be no doubt of Fletcher's share in it, but the authorship of the other portions is uncertain. The critics are almost unanimous in deciding that *Timon of Athens* is partly Shakespeare's, but they disagree as to its probable history. Most of them believe that he laid the play aside or left it unfinished, and that it was completed by an inferior writer. Others think that he revamped an earlier play, parts of which he retained with slight alteration. Internal evidence indicates that his share of the work was done between 1606 and 1608. *Pericles, Prince of Tyre*, was first published in 1609, with Shakespeare's name on the title-page. It was not included in either the first or the second (1632) folio, but was reprinted with six plays wrongly attributed to Shakespeare in the third folio (1664) and the fourth (1685). Rowe put it in his editions (1709, 1714), but it was rejected by all other editors down to the time of Malone (1778, 1790), when it was restored, and it has kept its place ever since. The general opinion is that the first two acts and the prose scenes of the fourth act are not Shakespeare's. Whether he enlarged and reconstructed an earlier play, or some other writer or writers filled out an unfinished work of his, is a disputed question; but the latter seems to be the more reasonable hypothesis. The date of the play in its present form is probably 1607.

The Globe Theatre was burned on the 29th of June, 1613, when "filled with people to behold the play, viz., of Henry the Eighth," and the cause of the fire was a "peale of chambers"—that is, a discharge of small cannon. There can be little doubt that the play was Shakespeare's *Henry VIII.*, in which, according to the original stage-direction (iv. 1), we have "chambers discharged" at the entrance of the King to the "mask at the Cardinal's house." It was probably written or finished in 1612 or early in 1613. From the internal evidence of metre and style it is quite clear that portions of the play are John Fletcher's. The peculiarities of the metre were noted by Roderick as early as 1765; and about 1850 Spedding and Hickson, working independently, divided the play between Shakespeare and Fletcher in the same manner. Several years earlier Tennyson had pointed out to Spedding the resemblance to Fletcher's style in parts of the play; and it is an interesting fact that Ralph Waldo Emerson, in his lecture on Shakespeare (written several years before it was published in 1850), also noted the metrical evidences of two hands in *Henry VIII.*, and assumed that Shakespeare had worked upon an earlier play, written by a man "with a vicious ear." He adds: "See Wolsey's soliloquy and the following scene with Cromwell, where, instead of the metre of Shakespeare, whose secret is that the thought constructs the tune, so that reading for the sense will best bring out the rhythm, here the lines are constructed on a given tune, and the verse has even a trace of pulpit eloquence. But the play contains, through all its length, unmistakable traits of Shakespeare's hand, and some passages are like autographs." The passages that Emerson mentions are among those which Spedding and others decide to be Fletcher's. In ex-

plaining the double authorship the critics differ, as in other cases of the kind; but the majority believe that Fletcher completed an unfinished play by Shakespeare.

Besides the six spurious plays in the third folio, sundry others were ascribed to Shakespeare during his life by unscrupulous publishers, or afterwards by injudicious critics. With somewhat better reason he has been supposed to have had a hand in the anonymous *Edward III.*, and a few German critics think it is entirely his. It is difficult to ascribe the best portions of the play to any other dramatist of the time; but, as Furnivall says, "there were doubtless one-play men in those days, as there have been one-book men since."

During the latter half of 1606 the King's Company were playing in the provinces; but in December they had returned to London, and in the Christmas holidays performed *Lear* before King James at Whitehall. The year 1607 was an eventful one in the poet's domestic annals. On the 5th of June his eldest daughter, Susanna, then twenty-four years of age (baptized May 26, 1583), was married at Stratford to Dr. John Hall, who attained to considerable eminence as a physician. In his early days Hall had traveled on the Continent, and had become proficient in the French language. After he settled in Stratford his services and advice were sought by the best people there and elsewhere. He was summoned several times to attend the Earl and Countess of Northampton, at Ludlow Castle, more than forty miles off—no trifling journey in those days. After his death, his medical case-book, written in Latin, was translated and published in London (1657), and other editions appeared in 1679 and 1683. Dr. John Bird, the Oxford professor, says of the book: "The learned author lived in our own times, and in the County of Warwick, where he practiced many years and in great fame for his skill, far and wide. Those who seemed highly to esteem him, and whom, by God's blessing, he wrought those cures upon, you shall find to be, among others, persons noble, rich, and learned. And this I take to be a great sign of his ability, that such who spare not for cost . . . nay, such as hated him for his religion [he was an earnest Puritan] often made use of him." He died November 25, 1635, at the age of sixty. In December, 1607, Shakespeare's brother, Edmund, died in London, and was buried in the Church of St. Saviour's, Southwark, "with a forenoone knell of the great bell." His burial in the church was a mark of respect seldom paid to an actor, and the service in the morning was probably arranged in order that the members of the Globe Company might be able to attend it. Edmund was in his 28th year when he died. He had doubtless come to London and entered that theatre through his brother's influence, but of his record as an actor nothing is known. Elizabeth, the only child of the Halls, was baptized on the 21st of February, 1608, the poet thus becoming a grandfather about two months before he was forty-four. She appears to have inherited his shrewd business ability, and she lived to be his last lineal descendant. She was married in 1626 to Thomas Nash, a citizen of Stratford, who had been a student of Lincoln's Inn, London. He died in 1647, and two years afterwards his widow married Sir John Barnard, of Abington Manor, near Northampton. She had no children by either husband. She died and was buried at Abington, February 17, 1669; but no monument of any kind preserves her memory. In September, 1608, Shakespeare lost his mother, her burial being recorded on the 9th of the month in the parish register thus: "Mayry Shaxpere, wydowe." He was probably in Stratford at the time of the funeral, and may not have returned to London until after the 16th of October, when he was the principal godfather at the baptism of the William Walker (son of a local alderman) to whom, in 1616, he bequeathed "twenty shillings in gold."

In 1610 Shakespeare bought twenty acres of pasture land, adding them to the 107 acres bought in 1602. In February, 1612, the town council of Stratford resolved that plays were unlawful "and against the example of other well-governed cities and boroughs." Ten years later (1622) the King's Company were actually bribed by the council to leave the town without playing; the town records showing that six shillings were "payd to the Kings players for not playinge in the hall." This was doubtless out of deference to the King, and not because it was Shakespeare's old company. In the neighboring town of Henley-in-Arden, in October, 1616, an order was unanimously passed that no other actors should have the use of the town hall. In the Stratford parish register, under date of February 3, 1612, we find the record of the burial of "Gilbertus Shakespeare, adolescens." It probably refers to the poet's brother, Gilbert, though (having been baptized October 13, 1566) he would have been at the time more than forty-five years old. In 1597 he was a haberdasher in London; but in 1602 he was in Stratford, acting for his brother, William, in a conveyance of land, and in 1609 he was a witness to a local deed. There is no record of his marriage or of the birth of a son; and no son of Gilbert is mentioned in the poet's will. It is probable, therefore, that the 'adolescens' was a slip of the scribe who made the entry from the sexton's notes. In February, 1613, Richard. probably the poet's last surviving brother (baptized March 11, 1574), also died. Joan (baptized April 11, 1569) was the only child of John and Mary Shakespeare, except William, who was now left. She married William Hart, and survived her famous brother thirty years. Her husband died in April, 1616, his burial taking place on the 17th, only eight days before that of the dramatist. In March, 1613, Shakespeare bought a house in London, near the Blackfriars Theatre, for £140, of which £60 remained on mortgage. He soon leased it to John Robinson, one of the persons that had violently opposed the establishment of the theatre.

The precise date of Shakespeare's return to Stratford to take up his residence at New Place is unknown; but it was probably as early as 1611, when his name appeared in a list of leading inhabitants of the town who raised a fund to promote the passage of a bill in Parliament "for the better repair of the highways." In the spring of 1614 we find that a Puritan preacher, who had been invited to the town by the corporation, was hospitably entertained at New Place. The town records read: "For one quart of sack and and one quart of claret wine given to a preacher at the New Place, xx. d." Dr. Hall may have been living with Shakespeare at the time, and the

preacher may have been invited to the house through his influence. On the 9th of July, 1614, a fire at Stratford destroyed fifty-four houses, besides barns and other buildings. Fortunately New Place and the Shakespeare birthplace in Henley Street escaped the conflagration. In that same summer John Combe of Welcombe died, leaving £5 to Shakespeare in his will. In the autumn of 1614 the good people of Stratford were greatly excited by the attempt of William Combe, the squire of Welcombe, to inclose a large portion of the common fields near the town. The design was resisted by the corporation as likely to injure the agricultural interests of the town and materially to diminish the tithes. For this latter reason, if for no other, Shakespeare would naturally have been opposed to the scheme; but it seems probable that he was finally induced to favor it, being assured by Combe that his personal interests should suffer no detriment. It does not appear, however, that he took any active part in promoting the inclosures, which were finally prohibited by an order issued by Chief Justice Coke on the 27th of March, 1615.

On the 10th of February, 1616, Judith, the poet's younger daughter, so charmingly idealized in Mr. Black's novel bearing her name, was married to Thomas Quiney, who was nearly four years her junior, having been baptized on the 26th of February, 1589. He was an accomplished penman, and we may infer that he was acquainted with French from a motto in that language which he inserted in an official document. At the time of his marriage he was in business as a vintner, and was patronized by the corporation and the leading citizens. In 1617 he was elected a burgess, and in 1621-23 acted as chamberlain. In 1630 he retired from the council, and, his business having fallen off, he removed in 1652 to London, where he died a few years later. He had three sons, two of whom died in infancy and the third when twenty years old. Judith Quiney lived to the age of 76, surviving all the members of her family except her aunt, Joan Hart. Judith's marriage took place without a license, an irregularity for which a fine was imposed by the ecclesiastical court at Worcester. As no other cause is known or suspected, it is supposed that the nuptials were hastened on account of the failing health of her father.

He had made his will in the latter part of January, and from the original date and some other erasures in the document it appears to have been a corrected draft for the engrossed copy that was to be signed on the 25th of the month, but for some reason this was postponed. The draft was therefore laid aside until Shakespeare's condition became suddenly worse, when his lawyer was hurriedly summoned from Warwick, and, without waiting to make a regular transcript of the will, it was signed after a few more alterations had been hastily made. The most peculiar interlineation in the document, and one which has been much discussed as perhaps bearing on the question whether the poet was happy in his domestic relations, is that in which he leaves his widow his "second best bed, with the furniture." The first best bed was the one generally reserved for visitors, and, being perhaps a family heirloom, would have descended to his eldest daughter as 'undevisable property.' There is no other reference to Mistress Shakespeare in the will; but she was amply provided for by virtue of her rights of dower, and such omission in a case of this kind was by no means uncommon in wills of the time. The gift of the bed, like many similar bequests in those old wills, was doubtless prompted by love and tender associations, and not the insult it would otherwise have been—an insult which William Shakespeare on his death-bed could never have inflicted on the mother of his children. We have seen, moreover, that as soon as he began to be prosperous in London he bought the dilapidated New Place, and, as fast as his means allowed, repaired the house, enlarged and improved the estate, and gradually made it the elegant and delightful home which must have been his ideal from the first, and which he kept steadily in view for the fourteen or more years before he returned to Stratford to enjoy it. That during all that time he looked forward to sharing that home with a wife whom he did not love is inconceivable.

Shakespeare died on Tuesday, April 23, 1616. According to a tradition of which no mention occurs until about fifty years later, the poet in the latter part of March was visited by his friends Drayton and Ben Jonson; and at a "merry meeting" in a Stratford tavern, the three "drank too hard, for Shakespeare died of a feavour there contracted." But the story probably had no other foundation than the popular notion of the time that fevers were generally due to some excess in eating or drinking. It is more likely, as Halliwell-Phillipps suggests, that Shakespeare's disease was induced by the wretched sanitary conditions of the immediate neighborhood of New Place—an explanation that would not have occurred even to the medical men of the time.

The funeral of "Will. Shakespeare, gent.," according to the parish register, occurred on the 25th of April. His remains were deposited in the chancel of the church, that being the legal place for the interment of the owners of the tithes. The grave is covered with a slab bearing this inscription:

> Good frend, for Iesus sake forbeare
> To digg the dust enclosed heare;
> Bleste be the man that spares thes stones,
> And curst be he that moves my bones.

According to a tradition that dates back only to 1693, the lines were composed by the poet himself "a little before his death;" but neither Dugdale in 1656 nor Rowe in 1709, when referring to the tomb, ascribes them to him. If he desired that the verses, or something to the same effect, should be put on the stone, it was doubtless from fear that his bones might be removed at some time to the ancient charnel house that adjoined the chancel wall near his grave. The monument to Shakespeare in the chancel was erected before 1623, when it was mentioned in the verses by Leonard Digges in the folio published that year. It consists of an ornamental niche in which is a life-sized bust supposed to have been copied from a posthumous cast of the poet's face. It has no merit as a work of art, but as a portrait it must have been considered tolerable enough to be accepted by the surviving relatives. It was originally painted, the eyes being hazel and the hair and beard auburn; but in 1793, at Malone's instigation, it was covered with a coat of white paint, which remained until 1861, when the former coloring was restored. The only other portrait of the poet the authen-

ticity of which is indisputable is the engraving by Martin Droeshout in the Folio of 1623; but though it has a general resemblance to the bust, it is equally poor in execution. A painted portrait in the Shakespeare Memorial Gallery at Stratford is believed by some experts to be the orignal of the Folio engraving, but it may have been copied from the latter. Shakespeare's widow survived him for more than seven years, the record of the burial being dated February 8, 1623. Tradition says that she earnestly desired to be buried in the same grave with her husband, and her tombstone is beside his.

The Folio of 1623, the first collected edition of Shakespeare's plays, was nominally edited by John Heming and Henry Condell, two of his friends and fellow-actors, and was brought out by a syndicate of five publishers and printers. It contained thirty-six of the thirty-seven plays commonly ascribed to the poet (*Pericles* being omitted), arranged as in many modern editions under the head of "Comedies," "Histories," and "Tragedies." Twenty plays appear in it for the first time, the other sixteen having been previously printed in quarto form.

The typographical execution of the volume demands particular attention on account of the confused and contradictory descriptions given by some editors and commentators and the use that the Baconian heretics have made of it. According to the latter, the Folio was edited by Bacon, being a collection of his plays carefully revised, corrected, and put into the shape in which he desired to hand them down to posterity. Shakespearean critics, on the other hand, assume that the Folio is just what it purports to be—a collection of plays by William Shakespeare, made seven years after his death by persons who had no skill in editing, and who did little except to furnish the publisher with the best copies of the plays they could get; these being partly manuscripts used in the theatre, and partly the earlier quartos that had also been used by the actors in learning their parts. These critics believe that internal evidence shows, beyond a doubt, that the Folio could not have had editor or editing in any proper sense. That the 'copy' came from the theatre is proved by the fact that the names of actors are often found prefixed to speeches instead of the proper *dramatis personæ;* as, for instance, "Kemp" nine times and "Kem." thrice before Dogberry's speeches, and "Cowley" twice and "Couley" once before those of Verges, in *Much Ado* (iv. 2). William Kemp and Richard Cowley were actors of the time in London. Some of the plays are divided throughout into acts and scenes; some only into acts; some partly divided, or inconsistently divided; some not divided at all. Only seven plays have lists of *dramatis personæ*—in every instance at the end of the play. Words and phrases from foreign languages are wretchedly corrupted. Latin is printed with tolerable accuracy, though sometimes editors have been in doubt whether a phrase was Latin or French; but French, Spanish, and Italian are almost invariably misprinted, and often ridiculously so. In the *Merry Wives* (i. 4), for instance, "Ma foi, il fait fort chaud: je m'en vais à la cour—la grande affaire" (as corrected by Rowe) appears thus: *"mai foy, il fait fort chando, Je man voi a le Court la Grand affaires;"* and "un garçon" as *"oon garsoon."* Verse is often printed as prose, and prose as verse; stage directions are made parts of the text, and vice versa. The punctuation is careless throughout, and often absurd. In short, there is hardly a possible typographical blunder or perversion of which we do not find frequent examples. Heming and Condell doubtless did the work as well as they could, but not as Shakespeare, if he had lived, would have done it, or as Bacon, if the book had been his, would have done it. The player-editors, indeed, seem to think that their task has been performed very creditably. In their preface, after referring to the quartos as "diverse stolne, and surreptitious copies, maimed and deformed by the frauds and stealthes of injurious impostors," they add: "even those are now offered to your view cur'd, and perfect of their limbes; and all the rest, absolute in their numbers [metre], as he conceived them." It has nevertheless been shown by careful examination and computation that the number of 'readings' in the volume that are either clearly wrong or in the highest degree suspicious is about twenty thousand, and the number of typographical errors of all kinds in those readings and elsewhere must be many times twenty thousand. The second folio (1632) was a reprint of the first, with few changes for the better except (as Professor C. Alphonso Smith, of the Louisiana State University, has shown in the Leipzig *Englische Studien* for December, 1901) in syntactical corrections. The third folio, a reprint of the second, with few variations of any value or interest, was first published in 1663. It was reissued the next year with seven plays added: *Pericles; The London Prodigal; The History of Thomas Lord Cromwell; Sir John Oldcastle; The Puritan Widow; A Yorkshire Tragedy;* and *Locrine.* The fourth folio (1685) was a reprint of that of 1664 (including the seven plays just mentioned) with the spelling somewhat modernized, but no other change. After the publication of the fourth folio, no collected edition of Shakespeare's works appeared until 1709, when Rowe's (6 vols., octavo) was brought out. It was based on the text of the fourth folio. The poems were not included until the second edition (9 vols.) was issued in 1714. Rowe made some corrections in the text, and modernized the spelling and pointing, besides inserting lists of *dramatis personæ.*

Among other complete editions of the eighteenth century and the early part of the nineteenth that have any critical value, the following may be mentioned: Pope's (6 vols., 1723-25; other editions appeared in 1728, 1735, and 1768); Lewis Theobald's (7 vols., 1733; other eds. in 1740, 1752, etc.); Sir Thomas Hanmer's (6 vols., 1744); Bishop Warburton's (8 vols., 1747); Dr. Samuel Johnson's (8 vols., 1765); Edward Capell's (10 vols., 1768); George Steevens's revision of Johnson's ed. (10 vols., 1773; 2d ed. 1778); Isaac Reed's revision of the preceding (10 vols., 1785); Edmund Malone's (10 vols., 1790); Steevens's, with Boydell's illustrations (9 vols., 1802; in parts, 1791-1802); Reed's first ed. with his name (21 vols., 1803; 2d ed. 1813); Alexander Chalmers's (10 vols., 1805); the "Variorum of 1821," edited by James Boswell, from a corrected proof left by Malone (21 vols.). Since 1821 editions have rapidly multiplied, and the bulk of Shakespearean literature has immensely increased. For the bibliography of the subject, consult: Lowndes, *Library*

Manual (Bohn's ed.); Franz Thimm, *Shakespeareana* (1864 and 1871), the *Encyclopædia Britannica* (9th ed.), and the *British Museum Catalogue*, the Shakespeareana of which were published separately in 1897. The *Catalogue of the Barton Collection* (Boston Public Library) is also valuable for reference. Consult: Dowden, *Shakspere: His Mind and Art* (1875); Corson, *Introduction to the Study of Shakespeare* (1889); Hudson, *Life, Art, and Characters of Shakespeare* (1872); Halliwell-Phillipps, *Life of Shakespeare* (7th ed. 1887); Lee, *Life of William Shakespeare* (1898); and the biographical and critical introduction, by Furnivall, in the Leopold edition, and the commentary in Furness's New Variorum edition.

SHAKESPEARE SOCIETIES. Down to about the middle of the nineteenth century the criticism of Shakespeare had been mainly æsthetic and philosophical. For the purpose of illustrating Shakespeare and the literature of his time, J. O. Halliwell (afterwards Halliwell-Phillipps) (q.v.), John Payne Collier (q.v.), and their friends founded in 1841 the first Shakespeare Society. Before its dissolution in 1853, it published forty-eight volumes. In spite of much careless editing, these publications are of very great value. In 1874 F. J. Furnivall (q.v.), aided by a group of English scholars, set on foot the New Shakespeare Society, whose first publications on verse-tests were epoch-making in the history of Shakespearean scholarship. On the celebration of the three hundredth anniversary of Shakespeare's birth at Weimar (April 23, 1864) the German Shakespeare Society (the *Deutsche Shakespeare-Gesellschaft*) was established. Since 1865 it has issued a year book (*Jahrbuch*), representative of the best German criticism. In 1885 the Shakespeare Society of New York was organized, with J. Appleton Morgan as its first president. Besides publishing its transactions, it has issued, under Mr. Morgan's supervision, the *Bankside Shakespeare* (20 vols., 1888-92). The text of the quartos is printed by the side of the text of the first folio (1623).

SHALE (Ger. *Schale*, OHG. *scala*, AS. *scealu*, shell, husk, scale; connected with OChurch Slav. *skolika*, mussel, Lith. *skelti*, to split). An indurated clay consolidated chiefly by the pressure of overlying sediments. It often forms heavy beds in many geological formations. In the Carboniferous formation shale beds of slaty appearance are frequently associated with the coal and are erroneously termed slate by the miners. Shale varies considerably in composition and color, and this variation exerts an important influence on its uses. When ground and mixed with water many shales become as plastic as ordinary surface clays. Some approach kaolinite in composition, and are very refractory, being used in the manufacture of fire-brick. Others contain an abundance of impurities such as iron oxide and lime carbonate. The former are mostly employed in the manufacture of common brick, unless the percentage of iron oxide is high, when they lend themselves more readily to the manufacture of mineral paint. Calcareous shales are often valuable as an ingredient of Portland cement. The gray or black color of shale is usually caused by the presence of carbonaceous matter, and there may be a notable quantity of bitumen. When there is sufficient bitumen present so that the mineral crackles and blazes in the fire, emitting a black smoke and bituminous odor, it is known as bituminous shale. This variety sometimes passes into coal. When shale is metamorphosed it changes to slate, or by more intense metamorphism into schist. The slate splits along its cleavage planes, and not along the planes of stratification as in the case of the shale. By an increase in sandiness shale may pass into sandstone, or (by an increase of lime carbonate) into limestone.

The value of certain decomposed shales, through which iron sulphide is disseminated for the manufacture of alum, has been long recognized. Such shales are known as *alum shales*. Shales of this kind are worked in Great Britain, France, and Germany.

Bituminous shales have, in recent years, attracted much notice as sources of oil for illuminating purposes. Such shales, which commonly occur in beds of Carboniferous age, have been found upon trial to yield from 30 to 50 gallons of crude oil per ton. A large industry based upon the distillation of shales has been established in Scotland. See PETROLEUM; CLAY.

SHALE OIL. A mineral oil obtained from carbonaceous shale. The oil is similar in general character to petroleum and is produced by the simple process of distilling in retorts shale that is rich in bituminous matter, whereby the volatile hydrocarbons that pass off are recovered by condensation. The crude oil by refining is made to yield naphtha, paraffin, and an illuminating product or kerosene, all of which are identical with the products obtained from the refining of American or Russian petroleum. In the distillation process a considerable quantity of ammonia water is condensed, forming a valuable by-product. The shale-oil industry is limited to certain districts of Scotland, more especially Linlithgowshire and Edinburghshire, where large supplies of oil shale are found in the Carboniferous rocks. One ton of shale yields about forty gallons of oil distillate. It is only by practicing the utmost economy that the industry has been able to survive the competition of American petroleum. The present output of the Scottish industry is about 500,000 barrels of petroleum and 400,000 barrels of naphtha and heavy oils.

SHA'LER, NATHANIEL SOUTHGATE (1841—). An American geologist, born in Newport, Ky. He graduated in 1862 at the Lawrence Scientific School of Harvard University, and afterwards served for two years in the Federal Army as captain of a Kentucky volunteer battery. In 1864 he was appointed an assistant in paleontology at Harvard, and in the following year became an instructor in geology in the Lawrence Scientific School. He was professor of paleontology in Harvard University from 1868 until 1887, when he became professor of geology. In 1891 he became dean of the Lawrence Scientific School. From 1873 to 1880 he was director of the Kentucky Geological Survey, and in 1884 became geologist for the Atlantic Coast division of the New York Geological Survey. In addition to numerous memoirs and magazine articles, and official reports, he published: *Thoughts on the Nature of Intellectual Property and Its Importance to the State* (1878); *Illustrations of the Earth's Surface: Glaciers* (1881), with Prof. W. M. Davis;

First Book in Geology (1885); *Kentucky* (1885), in the "American Commonwealth Series"; *The United States of America: A Study of the American Commonwealth* (1894); *The Interpretation of Nature* (1895); *Domesticated Animals* (1895); *Nature and Man in America* (1895); *American Highways* (1896); *Outlines of the Earth's History* (1898); and *The Individual: A Study of Life and Death* (1900).

SHALLOT (OF. *eschalote, eschalotte*, Fr. *échalote*, from OF. *eschalone, escalogne, escalone*, scallion, from Lat. *Ascaloneus*, relating to Ascalon, from *Ascalon*, from Gk. Ἀσκαλών, *Askalōn*, Ascalon, a city of Palestine), *Allium ascalonicum*. A perennial herb of the natural order Liliaceæ, a native of the East, introduced into Europe, it is said, from Ascalon, by the Crusaders, and much cultivated for its bulbs and leaves, which are used respectively like those of onion and chive. The shallot is generally propagated by the cloves, which, if planted in spring, produce a crop by July or August. The flavor resembles but is milder than that of garlic.

SHALLOW. An empty-headed country justice in Shakespeare's *Merry Wives of Windsor* and *Second Part of Henry IV.*, fond of boasting of his youthful pranks, and probably a satire on Sir Thomas Lucy, Shakespeare's enemy.

SHALMANESER, shăl'mân-ē'zēr (Heb. *Shalĕmaneser*, from Assyr. *Shulmanu-asharidu*, Shulman is first). The name of several famous kings of Assyria. (1) SHALMANESER I. (about B.C. 1300) was the first Assyrian monarch to attempt successfully dominion in the west. He seems to have crossed the Euphrates and to have conquered the Musri, a people north of Syria. He removed the capital from Asshur to the more central Calah, south of Nineveh, the modern Nebi-Yunus (cf. Gen. x. 11; see NINEVEH). (2) SHALMANESER II. (B.C. 860-825) continued the western conquests of his father, Asurnazirpal III., who had pressed as far as Lebanon. No Assyrian king excelled him in the number of his campaigns, which amounted to twenty-six; twenty-five times he crossed the Euphrates, and five times he invaded Syria. In B.C. 854 he met Benhadad II. of Damascus, who was supported by most of the South-Syrian States, including the forces of Ahab of Israel, and also by contingents from Cilicia and Arabia, in a great battle at Karkar; although he inflicted defeat upon the allies and ravaged the territory of Damascus, he was not able to crush that city. In B.C. 842 he defeated Hazael of Damascus near Mount Hermon and received the tribute of Jehu of Israel. He also had wars with Urartu, to the north of Assyria, and made a successful campaign through Babylonia, which he brought under his protectorate. His western campaigns seem, however, to have added little of solid result to his father's work. (3) SHALMANESER IV. (B.C. 727-722) succeeded Tiglathpileser, but his relation to the latter is not known. Most scanty notes of his reign have come down to us in the Assyrian annals, and the Old Testament is almost the sole source (II. Kings xvii.-xviii.). At the beginning of his reign he had a campaign in the neighborhood of Damascus. In B.C. 725 Hoshea of Israel refused tribute, relying upon Egyptian aid, and Shalmaneser proceeded to destroy the little State. He laid siege to its capital, Samaria, which held out stubbornly for three years and was finally captured by his successor, Sargon (or possibly by Shalmaneser himself shortly before his death). Josephus also refers to a five years' siege of Tyre, but this is not corroborated. No historical inscriptions of Shalmaneser I. have been found. The elaborate inscriptions of Shalmaneser II. have been frequently published, especially those portions, such as the so-called 'Black Obelisk,' bearing upon Bible lands. Consult: Winckler and Peiser, in *Keilinschriftliche Bibliothek*, i. (Leipzig, 1889); Scheil, in *Records of the Past*, new series, iv. (London, 1888).

SHAMA, shä'mȧ (Hind. *shāmā*). A thrush-like bird (*Copsychus macrura*) of India, where it is regarded as the finest of local song-birds, and is constantly caught and caged. Its colors are in the male black and chestnut, but those of the female are paler. One species inhabits the Philippines. Consult *English Illustrated Magazine*, May, 1893.

SHAMANISM, shä'man-ĭz'm (Pers. *shaman*, idolater). The name applied to the religion of certain Ural-Altaic peoples, as Finns, Hungarians, Turks, Mongolians, and Tunguses, but chiefly those of Northwestern Asia. At present, Shamanism is best represented by the practices of the Tunguses. According to them there are three spiritual realms, heavenly, earthly, and subterranean. The earthly realm is on the surface of the earth; the other two consist of stories above and below the earth's surface. The good spirits live above or on the earth; the evil, below (within) it. The upper world of light is composed of seventeen such stories or heavens; the lower world of darkness, of seven (or nine) hells. Above live the greatest lords, *kans*, gods, good spirits, and blessed ghosts; below, devils, demons, kobolds, goblins, gnomes, swan-maidens, and the damned. These were the first creations. The world was created by Kaira Kan, the highest god. The first man had evil designs and consequently lost his ethereal nature, but Kaira, out of compassion, created earth for him, till his continued impiety caused him to be banished into the darkness. This man was Erlik, who became the lord of hell. But Kaira made other men to live on the earth, thus creating the nine ancestors of the nine races of men. Erlik, however, misled them, so that Kaira resolved to leave men to themselves hereafter; but the god again condemned Erlik to live in the under world, while he made for himself the upper world of seventeen heavens. Seeing this, Erlik made a last effort to be as great as Kaira, and also created a heaven; but Kaira shattered it and this time thrust Erlik down to live forever in the next to the lowest world of darkness, ascending himself to his permanent abode in the seventeenth heaven. From Kaira came as emanations the three highest gods, Bai Uelgän, who lives in the sixteenth heaven, Kysagan, in the ninth heaven, and Mergen, in the seventh heaven, where also lives the mother sun, while the father moon lives in the sixth heaven. The demiurge creator dwells in the fifth heaven, and Bai Uelgän's two sons in the third heaven. Here, in the third heaven, is the spring of all life, 'the sea of milk,' the mountain of the gods, and the paradise to which go the souls of the virtuous and the blessed.

Beneath this realm is that of Jersu, earth itself, conceived as an animate spiritual crea-

tion. There are seventeen lords of Jersu, each like a god. One is the lord of the Seventeen Seas; another, the highest, is Jo Kan, who inhabits the navel of earth and has power equal to that of the gods of heaven; and a third is the national god Altai Kan.

All the gods and demi-gods of heaven and earth are favorable to man and do him no harm; but only the Jersu Kans may be approached directly by common men. The spirits of the upper world and of the under world must be approached through the mediatory spirits of the dead; in the case of good gods through the *Somo*, that is, the nine guardian ancestors of man. But, again, only certain families of men now living can control the *Somo* and other Manes. The power to move the spirits is inherent in certain families. This power manifests itself by ecstasy, and by inspiration shown in trembling, sweating contortions, ravings, and fits. When thus inspired, one can act as mediator between men and the spirits, and he who does this is a wizard and a Shaman or Kam, his function being called *kamlanie*. The Shaman seems to mediate with the Manes and the latter with the spirits, but in reality the Shaman is infused with Manes and so possessed by them that all he does at a sacrifice or in prophesying is really done by the ancestor who is in possession of the Shaman's soul.

The evil ones in Erlik's realm occupy various hells, and below his own hell is that of the damned, the lowest of all, Kasyrgan by name, in which the victims are boiled in a pot out of which they can come according to their virtue or by the help of the good spirits. Erlik is the foe of man, but he is called Father Erlik, "because all men belong to him and at the end he takes the lives of all." For Erlik is the cause of death, as he is of sickness, malformation, poverty, and all other misfortunes. Hence, men honor Erlik first of all, call him father and guide, and make him rich offerings, for although the spirits of light are more powerful than those of darkness, they require little attention. When a human being is born, a good spirit is sent down by Bai Uelgän to supply it with life from the sea of milk and ever after to keep watch at its right hand, guiding it aright. But simultaneously Erlik sends a devil from below to stand at the man's left hand and mislead him. After death the soul goes to Erlik, who judges it. If its virtues predominate Erlik has no power over it, it goes to the third heaven; but if its evil is greater than its good, it is damned and dropped in the boiling hell below. Yet human virtue is not enough to save a soul, for all spirits are envious and desire a man's goods, and it is safest to satisfy both kinds of spirits with gifts. To keep on good terms with these a Shaman is requisite, whose office is to sacrifice, give oracles, and purify a house from the spirits of the dead. Consult Radloff, *Aus Sibirien* (2d ed., Leipzig, 1893).

SHA'MASH (Babylonian *shamshu*, sun). The Sun-god in the Babylonian-Assyrian pantheon, this word of the Semitic invaders replacing the Sumerian *Utu*. While other deities, e.g. Nergal (q.v.), represent particular phases of the sun, Shamash is the solar deity without limitation. The theology represents him as son of Sin, the Moon-god, in accordance with the original preeminence of the moon over the sun in ancient thought, but Shamash attained a rank of first-rate importance. The chief seats of his worship were Larsa and Sippar, in South and North Babylonia respectively. He was the beneficent deity of light and warmth, being invoked in healing, and as the chief god of oracles, he became the judge *par excellence*. His two children present this idea allegorically in their names, *Kettu* (right) and *Meshar* (equity). He is also described as riding in his chariot, which is guided by Bunene—an idea suggestive of Greek mythology. The Sun-deity also appears in a feminine form in South Arabia, while local names, like Beth-shemesh, indicate the same cult in Syria. Consult: Jastrow, *Religion of Babylonia and Assyria* (Boston, 1898); Zimmern and Winckler, in Schrader's *Keilinschriften und das Alte Testament* (3d ed., Berlin, 1902).

SHAMMAI, shăm'mâ. The vice-president of the Sanhedrin during the reign of Herod. His teachings are marked by great severity and insistence upon details. The results of the rigor of the school appear in the doctrines of the Zealots (q.v.), who were nearly all followers of Shammai. Shammai is supposed to be identical with Sameas, mentioned by Josephus (*Ant.* xiv., 9, 4), who opposed Herod on his appearance before the Sanhedrin in B.C. 47. No details are known concerning his life.

SHAMO, shä'mō'. A desert region of Central Asia. See GOBI.

SHAMOKIN, shâ-mō'kĭn. A borough of Northumberland County, Pa., 40 miles north by east of Harrisburg; on the Lehigh Valley, the Northern Central, and the Philadelphia and Reading railroads (Map: Pennsylvania, E 3). It is the centre of an extensive anthracite coal-mining industry, and has also silk and knitting mills, stocking and shirt factories, wagon shops, iron works, and brick yards. Shamokin was laid out as a town in 1835, and was incorporated as a borough in 1864. Population, in 1890, 14,403; in 1900, 18,202.

SHAMROCK (Ir. *seamrog*, diminutive of *seamar*, trefoil). A national emblem of Ireland, said to have been first assumed as the badge of Ireland from the circumstance that Saint Patrick made use of it to illustrate the doctrine of the Trinity. The *Trifolium minus*, a hop clover, is the generally accepted modern shamrock, but the wood sorrel, the bird's-foot trefoil or medick, and the small-leaved clover (*Trifolium repens*), which has had a superstitious respect attached to it from early times, have also claims to be associated with the national emblem. See LOTUS.

SHAMROCK I., II., AND III. Three racing yachts owned by Sir Thomas Lipton, designed and built to compete for the America's Cup in the international yacht races off Sandy Hook, N. Y. The first *Shamrock* competed in the 1899 cup races and was defeated by the American yacht *Columbia* in the first three races of the series as follows: First race, October 16, lost by 10 minutes and 8 seconds; second race, October 17th, disabled, *Columbia* had a walk-over; third race, October 20th, lost by 6 minutes and 34 seconds. Her length over all was 132 feet 2 inches; beam, 24 feet 6 inches, with a draught of 20 feet. She had a displacement of 147 tons,

and a sail area of 14,125 square feet. She was designed by William Fife, Jr., built on the Clyde, and sailed by Captain Hogarth. *Shamrock II.* was the challenger in 1901, and although defeated in the first three races, came nearer to actual victory than any of her predecessors. She was 137 feet in length over all, 89.25 feet water line, 24 feet beam, 20 feet draught, and had a sail area of 14,027 square feet. The first race took place on September 28th, 1901, *Columbia*, the victor of the 1899 races, again defeating the challenger by 1 minute and 20 seconds. The second race, on October 3d, resulted in another defeat of the challenger, by 3 minutes and 35 seconds; in the third and last race *Shamrock II.* came in first, but lost on the time allowance of 43 seconds, the decision leaving *Columbia* winner by 41 seconds. *Shamrock II.* was built by Messrs. Denny, of Dumbarton, and designed by Watson. *Shamrock III.* was designed by Fife. Her measurements were: Length over all, 134.42; water line, 89.78; beam 23 feet; draught 19 feet; sail area, 14,154 square feet. Captain Wringe, the skipper of *Shamrock II.*, held the wheel. The first race was held on August 22, 1903, and resulted in a victory for the American boat, *Reliance* (q.v.), by 7 minutes and 3 seconds. The second and third races had a similar ending, the *Shamrock III.* losing on August 26th by 1 minute and 19 seconds in the second attempt, and on September 3d, in the third and final race, she got lost in the fog and did not complete the race. See YACHT AND YACHTING.

SHAMYL, shä'mĭl (1797-1871). A celebrated leader of the independent tribes in the Caucasus. He was born at Aul-Himry, in Daghestan, and belonged to a wealthy Lesghian family of rank. He was a disciple of Kasi-Mollah, the great apostle of Muridism, and seconded his endeavors to do away with the feuds of the Caucasian tribes and unite them against the Russians. He was in the rebellion which broke out in 1824, and distinguished himself in the defense of Himry against the Russians in October, 1831. After the assassination of Hamzad-Bey, the successor of Kasi-Mollah, in 1835, Shamyl was elected *imaum*. He made numerous changes in the religious creed and political administration of the mountaineers of the Eastern Caucasus for the purpose of more fully concentrating in himself the whole power. Shamyl's change of military tactics, from open to guerrilla warfare, brought numerous successes to the arms of the mountaineers. In 1839 Shamyl, after being twice defeated, was trapped in Akulgo, which was stormed, and his followers were put to the sword, but the leader escaped. He waged successful campaigns in 1843 and 1844, and gained over to his side the Caucasian tribes which had hitherto favored Russia. A civil and a criminal code were promulgated, a regular system of taxation was established, and Dargo was made the capital of the principality thus created, the population of which exceeded 1,000,000. For a number of years the fortunes of war alternated, but after the conclusion of the Eastern War (1853-56) the Russians resumed their attacks with great energy, advancing in several columns, establishing forts, and forcing the mountain tribes to detach themselves from Shamyl. On April 13, 1859, Shamyl's chief stronghold, Veden, was taken after a seven weeks' siege, and he became a mere guerrilla chief. He was finally captured, with the remnant of his followers, at Cunib, September 6, 1859, was sent to Saint Petersburg, and a few days afterwards he was assigned a residence at Kaluga, with a pension of 10,000 rubles. He went in 1870 to Mecca, remaining a parole prisoner of the Russian Government. He died at Medina in March, 1871.

SHANGHAI, shăng'hī' (Chin., above the sea). A city and treaty-port in the Province of Kiang-su, China, situated at the junction of the Hwang-p'u with the Wu-sung-kiang (here known to foreigners as Soochow Creek), 12 miles above the entrance of the united stream (which bears the name of the smaller constituent, the Wu-sung) into the estuary of the Yang-tse (Map: China, F 5). It stands in latitude 31° 14′ N., longitude 121° 28′ E., on the eastern edge of the great alluvial tract known as the 'Great Plain of China.' The surrounding country is low-lying, and intersected by countless creeks and watercourses, which furnish easy means of communication, and are invaluable for irrigating purposes. The climate is generally healthful. The mean annual temperature is 59° F. The native city is a *hien*, or district city, and is surrounded with walls, which have a circuit of 3½ miles and are pierced with 7 gates. Its streets are narrow and filthy, and as regards its shops, temples, dwellings, and institutions, it differs little from any other city of the same class. It was at one time noted for its cotton industry, but its chief distinction now consists in giving name to and sharing the prosperity of the great cosmopolitan town, called the 'Model Settlement of the East,' which has grown up outside its walls on the north since 1842, when this spot was chosen by the British Government as one of the five ports to be opened to foreign residence and trade in accordance with the Treaty of Nanking. The nucleus of this important town was the 'British Concession,' then chiefly a marsh, laid down by the British consul in 1843. It stretches along the Hwang-p'u for three-fifths of a mile, is bounded on the north by Soochow Creek, and on the south by the Yang-king-pang, a narrow creek parallel with the northern boundary. At an early date this was thrown open by the British Government to all treaty nations, but in 1849 the French obtained a separate 'concession,' which lies to the south of the British settlement and reaches to the walls of the native city. The United States never obtained by treaty any exclusive concession, but the Hong-kew district, to the north of Soochow Creek, is popularly known as the 'American Concession,' because the first United States consul took up his abode there. In 1863 this was surveyed and incorporated with the British settlement for municipal purposes. The French settlement has its own municipal government, but, as in the other settlements, there is no restriction as to the nationality of residents, or of land-renters, who are the voters. The settlements now have a combined area of 8.35 square miles, and the harbor has been extended up the river 6 miles, in order to provide adequate wharf accommodation. The chief native suburb lies between the east gate of the native city and the river (above the

French settlement), and here the junk trade concentrates.

The river bank, originally a tow-path, was reserved for a *bund* or esplanade. The streets parallel with it are named after Chinese provinces; the cross-streets after Chinese cities. They are all well made, well kept, watched, and lighted, and are lined with imposing foreign establishments — commercial, residential, and public. Here are hospitals, schools, colleges, dispensaries, club-houses, theatres, reading-rooms, libraries, the chambers of commerce, Trinity Cathedral, a fine Roman Catholic church, a Union church, Masonic Hall, the buildings of the Mixed Court, etc. There is a small park on the *bund* opposite the British consulate, and there are several monuments. In the western part of the settlements there is a very large native population, numbering several hundred thousand, and steadily growing. In 1901 the total population of the port was estimated at 620,000. The foreign population of the settlements was 6774. As elsewhere in China, under the 'exterritoriality' clauses of the treaties, all foreigners are subject to the jurisdiction of their own consuls in civil, criminal, and political matters. Great Britain and Germany, however, have provided special courts, to which persons of other nationalities sometimes resort by agreement.

In P'u-tung, the district on the east bank of the river, are the shipyards, dry docks, foundries, engineering establishments, machine shops, etc., and the river bank is lined with wharves and great warehouses and stores. The manufacturing establishments include a number of extensive cotton mills, silk factories, ginning factories, packing houses, a paper mill, match factories, flour mills, and many others. A considerable number of these establishments are owned by native companies.

In 1901, 4182 vessels (5,395,925 tons) entered, and 4719 (5,385,200 tons) cleared, and the gross trade of the port (as given by the Imperial Maritime Customs) was 298,454,780 haikwan taels, or about $220,000,000.

The principal imports are cotton yarn and cotton goods, opium, kerosene oil, metals, sugar, coal, and woolen goods. The native exports are composed chiefly of silk, tea, raw cotton, rice, wool, beans, cereals, paper, and oils.

Shanghai played a prominent part during the Tai-ping rebellion. The native city was taken by the Triad rebels in 1853 and held by them for seventeen months. Owing to the presence of a British squadron, however, the foreign settlements were unharmed, and multitudes of native refugees flocked into them for protection. In 1860 British and French troops were landed, cleared the country of rebels within a circle of 30 miles, and remained in possession for five years, until the rebellion came to an end.

The first railway in China—6 miles in length —was constructed here in 1876. After running successfully for a time it was purchased by the native authorities, torn up, and the plant shipped to Formosa, and there allowed to rust.

SHAN-HAI-KWAN, shän'hī'kwän' (Chin., mountain-sea-barrier). A fortified town of the Province of Chih-li, China, situated at the eastern end of the Great Wall, where it enters the Gulf of Pe-chi-li (Map: China, F. 4). It consists of three towns separated by strong walls, the whole surrounded by one wall. The inner town, which is the largest of the three, is devoted to business, the one on the east is occupied by soldiers and officials, and that on the west by soldiers and tradespeople. It is a station on the railway leading from Tien-tsin to Mukden (q.v.), now completed as far as Sin-ming-t'ing, 35 miles west of Mukden. There are large railway shops here. Ching-wang-tao, in the immediate vicinity of Shan-hai-kwan, with a pier 2000 feet long, was opened to foreign trade December 15, 1901.

SHAN'NON. The longest river in Ireland and in the United Kingdom. It rises in the Cuilcagh Mountains, County of Cavan, and after a southwest course of 254 miles, falls into the Atlantic Ocean, between the headlands of Loop and Kerry (Map: Ireland, B 4). It passes through Loughs Allen, Boderg, Ree, and Derg, and below Limerick it widens into an estuary 56 miles long and 2 to 10 miles wide. It is canalized between Limerick and Athlone, making an accessible waterway of 158 miles almost midway between the east and west coasts of Ireland. It connects with Dublin by the Grand and Rogel canals. Vessels of 1000 tons reach Limerick and small steamers ply to Athlone, but the number of canal locks (21) impair the utility of the river for navigation. Consult Harvey, *The Shannon and Its Lakes* (London, 1896).

SHANNON, James Jebusa (1862—). An English portrait painter. He was born at Auburn, N. Y., but passed his boyhood in Canada. At the age of fifteen he entered the South Kensington Art Schools (London), in which he achieved high distinction. His powerful and firmly painted likenesses soon made him one of the most popular English portrait painters, and he was admitted to the Royal Academy in 1897. His most celebrated portrait is the full-length figure of Henry Vigne, which took first class medals at Paris, Berlin, and Vienna. Well known also are his pictures of his wife as "Iris" and a "Madonna and Child."

SHANNON, Wilson (1802-77). The second Governor of Kansas Territory. He was born at Saint Clairsville, Ohio, was educated in the college at Athens in that State and at Transylvania University, Kentucky, and later began the practice of law in Saint Clairsville. In 1838 he was elected Governor of Ohio, as a Democrat. At the end of a second term he was sent as Minister to Mexico, where he remained until war began with that country. In 1855 he was appointed Governor of Kansas Territory to succeed Andrew H. Reeder (q.v.). During his administration occurred the 'Wakarusa War,' the arrest of Governor Charles Robinson (q.v.) and others of the free-State Government, the capture of Lawrence, the dispersal of the free-State Legislature at Topeka, the Pottawatomie Massacre, and the events leading up to the 'Treaty of Lawrence.' In the early days of his administration Governor Shannon affiliated almost entirely with the Pro-Slavery Party, but he later gave great offense by refusing to act as its leaders desired. At length, after having been threatened with assassination, he resigned in August, 1856, a little less than a year after taking office. He settled in Lecompton, and later in Lawrence, where he died. Consult: Spring, *Kansas* (Boston, 1885), in the "American Commonwealth Series;" and Robinson, *The Kansas Conflict* (New York, 1892).

SHANS, shänz. A numerous group of tribes on the frontiers of China, Burma, and Siam, extending considerably to the south. Physically and linguistically they belong, together with the Laotians, the Thos-Muong tribes of the Chinese-Tongking frontier, and the civilized Siamese of the southwest, to the Thai, one of the great stocks of Farther India. The Shans are distributed among several semi-independent States subject to Burma, Siam, and China. Their own method of government is more or less democratic, the chiefs being not at all absolute, while the women have practically the same privileges as the men, something noteworthy in Indo-China. Situated as they are in the upland river valleys, half-way between the cities of Southern China and the commercial ports of Burma and Siam, the Shans take part in the extensive trade. The culture of the Shans varies from the condition of the wild Palungs to that of the people of Zimme and some of the other States who are little inferior to the other civilized and semi-civilized tribes of Indo-China. Many of the Shans are mountainous hunter-tribes of great courage and honesty; others are agriculturalists of a rather high order, and cattle-breeders. Tea is a chief object of cultivation. Others are timber-cutters and wood-workers; others again skillful workers in iron, gold-beaters, etc. The religion of many of the Shan tribes is Buddhism, but the more independent tribes retain their ancient customs to a very large extent. In the period from the twelfth to the sixteenth century the greater part of the peninsula was under the rule of the Empire of Mau, developed from one of the northern Shan States. Another remarkable Shan State was Zimme, famous in the sixteenth century, subdued by Siam in the latter part of the eighteenth century, and still subject to that empire. The numerous ruins of cities and towns existing in the Shan country are thought to indicate great political activity in the period noted above, and perhaps long before then. Consult: Anderson, *Mandalay to Moulmein* (London, 1876); Colquhoun, *Amongst the Shans* (ib., 1885); Fournereau, *Le Siam ancien* (Paris, 1895).

SHAN-SI, shän'sē' (Chin., mountain, or mountains, west). An inland province of China, originally bounded on the north by the Great Wall, but now including that portion of Southern Mongolia which lies south of the In or Yin Mountains (Map: China, D 4). Its greatest length is from north to south. Area, 56,268 square miles. The province is mountainous, especially in its northern half, with ranges (some of them of great height) having a general southwest to northeast trend, forming seven great basins, the more northerly of which drain toward the plain of Peking, some to the east and southeast to the Great Plain, and the others southwest to the Hoang-ho. These basins vary in height above sea-level from 4500 to 5000 feet in the north to about 1200 toward the southeast.

The highest mountain peaks are found in the Tai-ho range (8000 feet) in the south-central part of the province, and the sacred Wu-tai Mountains (10,000 to 12,000 feet) farther north, about latitude 39° and near the border of Chih-li, noted for their wild grandeur, and for the 360 great Buddhist temples which crown their peaks or nestle in their recesses and which are annually visited by tens of thousands of pilgrims.

Shan-si is rich in minerals. Coal, both bituminous and anthracite and of the finest quality, is found everywhere; iron of the best quality, usually associated with coal, abounds, and is worked; copper has been found in over one hundred localities; tin near Mount Ki and elsewhere; and silver north of Tai-yuen, the capital. Salt lakes and springs are numerous, and near the great walled village of Lu-tsun, in the southwest, are extensive salt works, the oldest in the Chinese Empire, dating back nearly 5000 years.

A notable feature of the province is the exceedingly fertile loess, or 'terrace deposit,' varying in thickness from one foot to a thousand feet, and cut up in many places by the rains and rivers into an intricate network of deep gullies which render travel impossible except along well-traced tracks. The agricultural belt is comparatively small, and the soil does not produce sufficient for home consumption. Hence, while large quantities of coal, iron, and salt are exported, opium, wheat, rice, and other foodstuffs have to be imported as well as cotton and cotton cloth. Tobacco is grown in the south; in the southwest between Kiai-chow and Tung-kwan the country is a continuous orchard, producing apples, pears, plums, persimmons, jujubes, etc., and in the plain of Tai-yuen-fu (the capital), besides other fruits, the best grapes in China are raised. Shan-si is a wealthy province. The houses are substantially built of brick, frequently two to three stories high, and in a style of architecture different from that found elsewhere in the country. In the loess region the majority of the people live in caves, sometimes two or more stories high, cut into the deposit and faced with brick, with well-built stairs leading to the upper stories. The inhabitants as a rule are civil and friendly to foreigners, are characterized by an enterprising commercial spirit, and the Shan-si men are well known as the bankers and pawnbrokers of the Empire. Population, about 13,000,000.

The great highway of the province runs from southwest to northeast, connecting the fortress of Tung-kwan at the point where the provinces of Shen-si, Shan-si, and Ho-nan come together, with Kalgan (q.v.), a branch running northeast from Tai-yuen-fu to Ching-ting-fu, Pao-ting, Peking, etc., and another from Ta-tung, about latitude 40° N., northwest to Kwei-hwa Ch'ing and west Mongolia. Railway extension will be along these lines.

SHAN (shän) **STATES.** A name applied to a number of semi-independent States in Southeastern Asia, occupying the region between Burma, China, Siam, and Tongking (Map: Burma, C 2). They derive their name from their inhabitants, the Shans (q.v.).

SHAN-TUNG, shän'tōōng' (Chin., mountain east). A maritime province of China, a considerable portion of which consists of a mountainous promontory 100 miles wide, which projects eastward from the mainland into the Yellow Sea for 200 miles, and is distant from the peninsula of Korea less than a day's sail (Map: China, E, 4). Area, about 65,104 square miles. The central portion is occupied by massive limestone mountains, culminating in Mount Tai (4111 feet), famous in history and considered sacred by the people. West, southwest, and north

of these mountains lie the Shan-tung portions of the great alluvial plain of North China; while east and southeast of the mountains, and throughout the promontory, are many fertile valleys and small plains. As a rule these mountains are destitute of forests. The province is well watered, though its lakes are few and small, and there are no rivers of importance except the Hoang-ho, which traverses the great plain in the west and north. The Grand Canal runs through the whole province from north to south. The fertile loess deposit is found in several places, and agriculture flourishes. The crops include some cotton, very little rice, but much tobacco, indigo, wheat, barley, maize, millet, pulse, peanuts, and vegetables. The fruits are of almost all kinds. Silk is an important product, the chief seat of which is Yen-chow, on the great plain; and pongee, the spun-silk fabric derived from the cocoons of the wild silkworm, is much exported to foreign countries. The finest brocaded silk is woven near Tsi-nan-fu, the capital. Straw-plaiting is an important industry, and much insect wax is produced.

The fauna includes wolves, badgers, foxes, several species of poisonous snakes, scorpions, etc., and among the birds pheasants, partridges, wild ducks and turkeys, Manchurian cranes, etc. The surrounding waters as well as the rivers teem with fish. Shan-tung is especially rich in minerals. Coal and iron abound, and gold, galena, copper, antimony, marble, granite, asbestos, and sulphur are abundant. There are four great coal-fields. The coast line is about 750 miles. There are many good harbors. The chief are: on the north coast, Yang-kia-k'ow, at the mouth of the Little Tsin River (canalized in 1891 and extended westward to Tsi-nan-fu), a few miles south of the mouth of the Hoang-ho (which now occupies the channel of the Great Tsin River); Chi-fu (q.v.), a treaty port; Wei-hai-wei, now controlled by Great Britain, and on the south coast Shi-tao and Tsing-tao on the southwest corner of the Lao-shan peninsula, now controlled by Germany. (See KIAO-CHAU.) The climate is healthful throughout. The rainy season lasts six weeks, and occurs in June and July. The snowfall is heavy, and the harbors on the north coast are frequently blocked with ice. The temperature ranges from 20° F. below zero to 60° F. above.

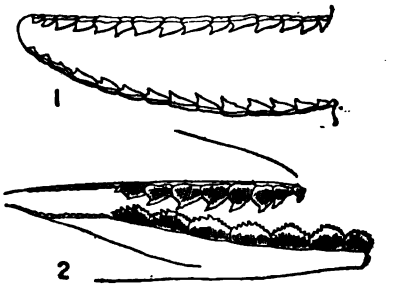
Shan-tung is noted as containing the birthplaces of both Confucius and Mencius (qq.v.) and has played an important part in the history of the country. Population, 30,000,000.

Railways have been introduced by the Germans and extend from the new port of Tsing-tao northward to Wei-hien, and westward toward Tsi-nan-fu (q.v.), and beyond, meeting at two different points the projected Anglo-German line from Tien-tsin to Chin-kiang-fu (q.v.).

SHAREHOLDER. See STOCKHOLDER.

SHARI, shä'rē. A river of North Central Africa, the principal feeder of Lake Chad. Its numerous headstreams drain an extensive but largely unexplored region of the Sudan. The chief of these is the Bamingi. Its largest tributary is the Logone, which enters the main stream from the left. In its lower course the Shari forms the boundary between Kamerun and Bagirmi, and is navigable from Maffaling to Gulfey, a distance of 186 miles.

SHARK (probably from Lat. *carcharus*, from Gk. *καρχαρίας*, *karcharias*, sort of shark, from *κάρχαρος*, *karcharos*, jagged; connected with *καρκίνος*, *karkinos*, Skt. *karkaṭa*, crab, *karkara*, hard). The name given to such elasmobranch



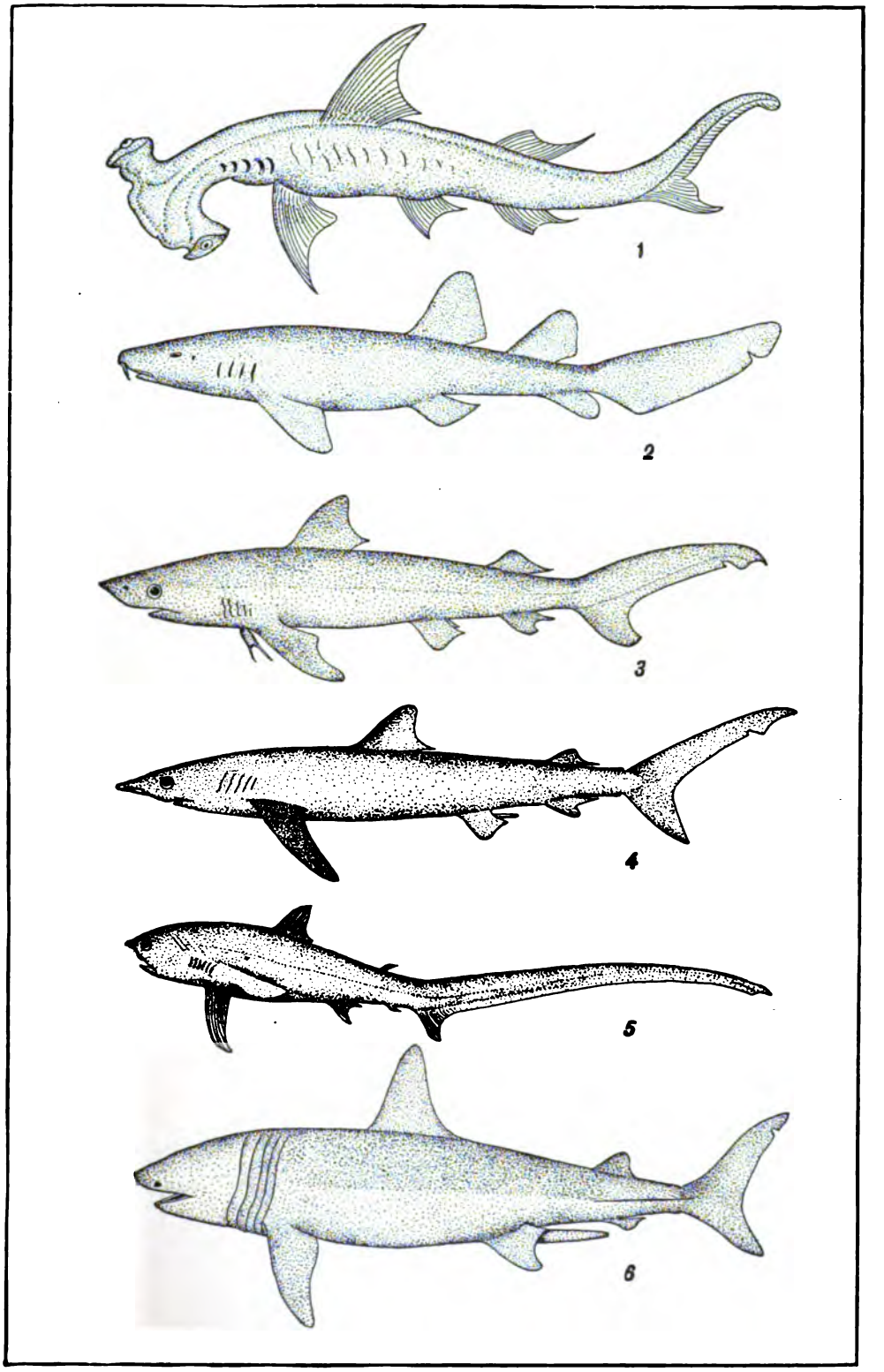
TYPES OF SHARK TEETH.
1, plain-edged cusps; 2, serrated cusps.

fishes (see ELASMOBRANCHII) as have their gill-openings lateral instead of ventral, as in the skates (Batoidea). The body is nearly always elongate, tapering gradually to the tail and not much thickened in the middle. The muzzle projects over the mouth; the nostrils are situated on the under side of the muzzle. The males have claspers. There are usually two dorsal fins, but in the small order of notidanoid sharks there is only a single one. The gill-openings are five, excepting in the cow sharks where there are six or seven. The skin has no scales, but minute denticles, much resembling teeth in their development and structure. The teeth are generally large, sharp, and formed for cutting, with the edge often serrated. In the cestracionts (q.v.) they are pavement-like, and in some genera are small and numerous. As the rows of teeth on the ridge of the jaw are worn away they are continually replaced by new series.

The teeth of sharks are dermal structures never ankylosed to the jaw or to any other skeletal part, but are imbedded in a tough fibrous membrane and are arranged in concentric rows. The row of denticles that occupies the border of the jaw is erect. Adjacent rows are only partially erect, while those behind lie recumbent. The fibrous gum moves up and outward over the surface of the jaw and carries each successive row of teeth to a functional position on the jaw. When a row of teeth has passed this point the teeth fall out. This fact accounts for the great number of shark's teeth which are preserved in geological deposits, for each shark during its life casts off a great many teeth. Both in form and structure the dermal spines on the external skin of certain sharks cannot be distinguished from the spines that occur in the mouth and function as teeth.

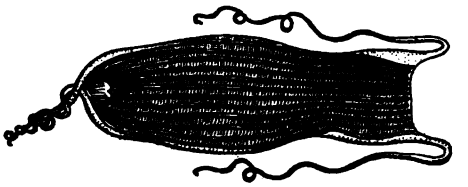
Most sharks are carnivorous and voracious, some of them taking objects as large as man. Some live on small marine organisms and a few are herbivorous. Some species are ovoviviparous; others lay eggs. The eggs are large in comparison with those of osseous fishes, and are square or oblong in form, with a tough horny coat, each corner prolonged into a tendril, apparently of use for their entanglement among seaweeds to prevent being thrown about. In some of the viviparous species the embryo is attached to the walls of the uterus by a sort of placenta. Sharks

GREAT SHARKS



1. HAMMERHEAD (Sphyrna tiburo).
2. NURSE SHARK (Gingiymostoma cirrata).
3. REQUIEM SHARK (Carcharinus lamia).
4. GREAT BLUE SHARK (Prionace glauca).
5. THRESHER (Alopias vulpes).
6. BASKING SHARK (Cetorhinus maximus).

are found in all seas, but are most abundant in the tropics. They are nearly all marine, a few entering fresh water, and one species living continually in Lake Nicaragua.



A TYPICAL SHARK'S EGG.

The rough skin of sharks is employed by joiners for polishing fine-grained wood, and for covering the hilts of swords, tools, and the like, to make them firmer in the grasp. (See SHAGREEN.) The flesh is coarse, but is sometimes eaten. The fins abound in gelatin, and are much used by the Chinese for making a rich gelatinous soup. The liver yields a large quantity of valuable oil. See OIL-SHARK.

The sharks embrace several families, among which prominent ones are the Hexanchidæ (cow-sharks), Cestraciontidæ (Port Jackson sharks), Heterodontidæ (bull-head sharks), Ginglymostomatidæ (nurse-sharks), Galeidæ (dog-sharks, topes, tiger-sharks, man-eaters, requiems, etc.), Sphyrinidæ (hammer-heads), Alopiidæ (thresh-ers), Carchariidæ (sand-sharks), Lamnidæ (or beagles), Cetorhinidæ (the basking-sharks), and Squalidæ (dog-fishes). Most of these will be found described under their common names. Consult the authorities mentioned under FISH. See Plates of GREAT SHARKS; LAMPREYS AND DOGFISH; PHILIPPINE FISHES.

FOSSIL SHARK. Fossilized remains of sharks occur from the Lower Devonian upward, and even in the Upper Silurian detached fin-spines, teeth, and dermal denticles resembling those of elasmobranchs are found, being thus among the earliest known remains of vertebrates. The relationships of these Silurian forms are doubtful, however, and some of them (the Cœlolepidæ, including Lanarkia and Thelodus) possibly have closer affinities with the remarkable group of ostracoderms than with elasmobranchs. From the Devonian upward undoubted sharks are met with, many known only from fragments of the dermal structures—teeth, shagreen denticles, and fin-spines. These spines, when not definitely assignable to any genera, are termed 'ichthyodorulites.' In a few cases the cartilaginous endoskeleton is hardened by deposition of phosphate of lime—calcified—so that jaws, vertebræ, fin-structure, etc., are readily fossilized. Elasmobranch paleontology, which may be said to have originated in the work of Louis Agassiz, has demonstrated that the sharks and rays of the present time represent but an insignificant remnant of a group which attained its maximum degree of differentiation and specialization as early as the Carboniferous. The characteristic forms of the Paleozoic, however, the primitive as well as the highly specialized, died out in the Permian, and their descendants of the Mesozoic have persisted to the present with little change.

The most primitive of fossil elasmobranchs are included in the order Pleuropterygii (side-fin) of which the most typical genus is Cladoselache from the Upper Devonian or Lower Carboniferous of Ohio. In this form the paired fins are mere horizontal lappet-like folds along the sides of the body, supported by two rows of cartilaginous rods, the 'basals,' imbedded within the body, and the 'radials' within the fin-lappet and extending outward to its edge. According to the commonly accepted fin-fold theory of paired limbs, this is the most primitive known type of paired fin, and the lappets are to be regarded as persistent portions of a former continuous lateral fold, possessed by some unknown ancestor. Since these lappet-fins, or 'pleuropterygia,' were capable of but very slight motion, their function was chiefly that of balancing-organs, while the powerful turned-up or 'heterocercal' tail served as the organ of propulsion. Other primitive characters of this fish are the terminally placed mouth, the unconstricted notochord, and simple dermal skeleton. Clodoselache, judging from its many primitive characters and lack of specialization, probably stands structurally very near the ancestral form which gave rise to the more specialized sharks, to the bony fishes, and through these to the higher vertebrates. Several cladoselachids are known, and the most generalized of these may be regarded as the most primitive true fish. None of them exceeds six feet in length. The spiny sharks (commonly ranked as an order Acanthodii) comprise a number of Paleozoic forms which resemble the cladoselachids in many respects, but differ from them in that the blade of the fins, except the caudal, is almost entirely dermal, the skeletal fin support being reduced to a stiff spine at the anterior border; genera Acanthodes and Mesacanthus. In one family, represented by Climatius, a series of spines along the side of the body suggests the continuous lateral fin-fold. The acanthodians have the dermal skeleton highly developed, especially in the region of the skull and shoulder girdle. Some ichthyologists place the group among the pleuropterygians. A widely different order of Paleozoic sharks is that termed Ichthyotomi or Pleuracanthea, represented by Pleuracanthus of the Carboniferous and Permian of Europe. Of the many distinguishing features of this group, the most noteworthy is the possession of pectoral fins of the 'archipterygium' type, which many morphologists (Gegenbaur and his school) maintain to be the fin-form from which are evolved all other types of paired fins, and even the five-toed limbs of higher vertebrates. In the perfect archipterygium the basals form an axis projecting from the body, while the radials are ranged along this axis in two rows, like the veins of a leaf along the midrib. This type of fin is also common to the lung-fishes and some of the most primitive bony fishes. There is strong reason to believe that it is derived from the lappet-like type of the Pleuropterygii. (See FIN.) The elasmobranchs thus far mentioned did not survive beyond the Paleozoic, but it is these early types only which are sufficiently primitive to be of importance in tracing the ancestry of higher vertebrates.

The order Selachii, comprising all the modern sharks and rays, appeared in the Lias, though one family, the cestracionts, may be traceable to the Permian. The basals of the pectoral fin are reduced to two or three pieces, and the blade of all the fins is chiefly dermal. The males are provided with claspers on the pelvic fins. The vertebral centra, with few exceptions,

are well developed, and the form of calcification of the vertebræ, i.e. whether radial, in a single ring, or several concentric rings, has been made by Hasse (1879) a criterion for subdivision of *Selachii* into *Asterospondyli*, *Cyclospondyli*, and *Tectospondyli*, but, like most systems based upon a single character, it is not very satisfactory. A more practical division into suborders is the following: (1) *Protoselachii*, sharks with more than five (6 or 7) gill-arches, and a number of primitive skeletal characters—extending from Upper Jurassic to recent, and including Heptanchus and Chlamydoselache; (2) *Squalida*, all five-gilled true sharks; most families appear in the Mesozoic, but the Port Jackson sharks (cestracionts), which have large crushing teeth, possibly originate in the Carboniferous; (3) *Rajida*, the rays and skates—Mesozoic to recent.

BIBLIOGRAPHY. Dean, *Fishes, Living and Fossil* (New York, 1895); Woodward, *Vertebrate Palæontology* (London, 1898); Von Zittel, *Textbook of Palæontology* (Eng. trans., London, 1902).

SHARKING. Fishing for shark. There are many methods of fishing for shark, varying according to the size or family of the fish and the resources of the fisherman. In some American waters, and particularly along the east coast of Florida, fishing for tarpon and shark is common, and while it is not unattended with danger, it offers the most exciting sport. The white shark (*Carcharis vulgaris*) is probably the most ferocious of all fish, and is found in the Mediterranean and other seas of the warmer parts of the world. The white shark is caught by means of a great hook, baited by a piece of meat and attached to a chain. In the South Sea Islands the method is to set afloat a log of wood which has a long rope attached to it at the end of which is a noose. It is expected that some curious shark will get his head into the noose and finally be wearied out by the log and thus be forced ashore. The blue shark, which seldom exceeds 8 feet in length and is common in the Mediterranean and the warmer parts of the Atlantic, is caught with a hook and line in the ordinary manner. The basking shark, which sometimes attains the enormous length of 36 feet, is of a mild disposition and is easily approached by a boat. It is caught whale-fashion with a harpoon.

SHARK-SUCKER. A common sucking fish of the remora family (Echeneididæ), found in all warm seas attached to sharks and other large fishes, turtles, and the like, and known in Spanish America as 'pega' or 'pegador.' It is named



THE SHARK-SUCKER.

Echeneis naucrates, and differs from the related remora (q.v.) in its more slender form, more elongated sucking-disk, and the fact that the body is ornamented by a broad, dark, white-edged stripe on each side. This species is very common in the tropics, where few large fish escape them. They readily take a hook, and are good to eat.

SHARON, shâr'on (Heb. *shârôn*, probably plain). The broad and uneven plain lying between the hills of Palestine and the Mediterranean and extending from Cæsarea to Joppa. It was once the site of extensive forests, which existed as late as the time of the Crusades and some remains of which still survive. The Greek version (Isa. lxv. 10) calls it 'the forest.' It was prized for its pasturage (I. Chron. xxvii. 29, Isa. lxv. 10), and ranked with Carmel and Lebanon for the luxuriance of its vegetation (Isa. xxxv. 2). Its wealth of flowers, for which it is still noted, is celebrated in 'the rose of Sharon' (Song of Songs, ii. 1), which is now understood to be a narcissus or crocus. Consult George Adam Smith, *Historical Geography of the Holy Land* (New York, 1901).

SHARON. A borough in Mercer County, Pa., 75 miles northwest of Pittsburg, on the Shenango River, and on the Pennsylvania, the Lake Shore and Michigan Southern, and other railroads (Map: Pennsylvania, A 2). It has the Hall Institute, a secondary school under Baptist control. There is a considerable trade in coal, which is extensively mined in the vicinity, and Sharon is also noted for its steel and iron interests. There are rolling mills, boiler and machine shops, furnaces, flour mills, and manufactories of nails, horse collars, spokes, chains, stoves, and lumber products. Sharon was settled in 1795 and was incorporated as a borough in 1841. Population, in 1890, 7459; in 1900, 8916.

SHARP (AS. *scearp*, OHG. *scarf*, Ger. *scharf*, sharp; connected with AS. *screpan*, to scrape). A sign (♯) in music, which, when prefixed to a note, elevates it by a chromatic semitone. If the note occurs again within the same bar it is again played sharp, unless it is preceded by a natural sign. When the original tone is to be played in the following bar, it is customary to mark it with a natural sign. A double sharp (♯♯) raises the pitch of a note by two chromatic semitones.

SHARP, ABRAHAM (1651-1742). An English astronomer and mechanist, born at Little Horton, near Bradford. He first became a business apprentice, but gave this up and moved to Liverpool, where he devoted himself to mathematics. From 1676 to 1690 he was employed in Greenwich Observatory, where he assisted in mounting instruments, perfecting hand-graduation, and constructed a mural circle. After 1690 he taught mathematics for some time in London, but later retired to Little Horton, calculating and making astronomical instruments and models, for which he became famous. He was joint publisher with Grosthwait of the *British Catalogue*. He wrote *Geometry Improved* (1717).

SHARP, BECKY. The principal character in Thackeray's *Vanity Fair*, an attractive but thoroughly unscrupulous adventuress, who, by her cleverness and boldness, worked her way up in the world. She married Rawdon Crawley, and, after the scandal with Lord Steyne, lived on the Continent and became Joseph Sedley's mistress.

SHARP, DALLAS LORE (1870—). An American author and naturalist, born at Haleyville, Cumberland County, N. J. He graduated at Brown University in 1895, and at the Boston University School of Theology in 1899. As a writer he became known through his charming magazine articles on native birds and small mammals, and his book, *Wild Life Near Home* (1901), which treats these subjects with truthfulness, sympathetic insight, and literary felicity.

SHARP, GRANVILLE (1735-1813). An English philanthropist, author, and negro emancipa-

tor. He was born and educated at Durham; taught himself Greek and Hebrew; and in 1758 was given an appointment in the Ordnance Office. He came into special prominence by his interest in the emancipation of the negro slave. In 1772 Sharp obtained the decision of the English judges in the famous case of the negro Somerset, that as soon as a slave sets his foot on English ground he becomes free. He resigned his office in the Ordnance Department in 1777, as a protest against the prosecution of the war against the American colonies, and for his efforts in the establishment of the Episcopal Church, when the States became independent, received the honorary degree of LL.D. from Harvard University and other American colleges. The rest of his life was devoted to the abolition of slavery and the slave trade, and to authorship. He was chairman of the meeting in 1787 which formed the 'Association for the Abolition of Negro Slavery;' was one of the founders of the colony of Sierra Leone; opposed impressment of seamen, and advocated Parliamentary reform. He died at Fulham. A medallion portrait to his memory is in Westminster Abbey. Consult Hoare, *Memoirs of Granville Sharp* (London, 1820), which contain a bibliography of his complete works, sixty-one in all.

SHARP, JAMES (1613-79). A Scotch ecclesiastic. He was born at Banff, Scotland, and was educated at King's College, Aberdeen (M.A. 1637). He became professor of philosophy in Saint Leonard's College, Saint Andrews (1643), and some five years later minister of Crail, an office which he held during the life of Cromwell. In 1656 he was sent to London to plead the cause of the moderate Presbyterians against James Guthrie, the leader of the Radical faction. Again, in 1660, when negotiations were pending for the restoration of Charles II., Sharp became the representative of his party in Scotland. His course during this period was doubtless marked by duplicity and double-dealing. The Presbyterians were apparently led by him to believe that Charles II. was ready to make, in fact had made, adequate guarantees to protect them in their rights and position, yet Sharp had advised and accepted conditions which secured Scotland to episcopacy. In a short time he became Archbishop of Saint Andrews. He was assassinated on Magus Muir by a band of Covenanters. For an account of Sharp, consult: Stephen, *Life and Times of Archbishop Sharp* (London, 1838); Keith, *Scottish Bishops* (Edinburgh, 1755); Dodd, *Fifty Years' Struggle of the Scottish Covenant* (London, 1860).

SHARP, WILLIAM (1856—). An English poet and essayist, born at Garthland Place, near Paisley, Scotland. From school he proceeded to the University of Glasgow, and afterwards traveled in Australia. In 1879 he settled in London, where he became acquainted with D. G. Rossetti, whose biography he wrote (1882). Though an ardent admirer of Rossetti, he believed modern romantic verse too literary, and sought to bring it back to a direct inspiration from nature. *The Human Inheritance; Transcripts from Nature and Other Poems* (1882) was followed by *Earth's Voices*, with the same explanatory title (1884); *Romantic Ballads and Poems of Phantasy* (1886); *Sospiri di Roma* (1891); *Flower o' the Vine* (1892); *Vistas*, poetic dramas (1894); *Lyrical Poems* (1901); and *Sospiri d'Italia* (1903). He also wrote his lives of Shelley (1887), Heine (1888), Browning (1890), and Joseph Severn (1892), besides which there are various works of fiction, as a *London Romance* (1903), and several anthologies; a monograph on Philip Bourke Marston (1887), and many essays, as *Ecce Puella and Other Prose Imaginings* (1895) and *Studies in Art* (1901). A part of his immense literary production has been in collaboration. His wife, ELIZABETH AMELIA, edited in 1887 *Sea-Music*, an anthology of poems and passages descriptive of the sea, and *Women Poets of the Victorian Era*, in 1890.

SHARPE, SAMUEL (1799-1881). An English Egyptologist and translator of the Bible, born in London. In 1814 he was taken into the London banking house of his uncles, Samuel and Henry Rogers, was made a partner in 1824, and retained his connection with the firm until 1861. His interest in Egyptology was excited through the works of Thomas Young and Champollion, and he soon became proficient in hieroglyphic studies, as well as in Coptic, in Hebrew, and in Greek. He also paid much attention to biblical studies, and published revised translations of both the Old and the New Testament—the former in 1840, the latter in 1865. Sharpe was a conscientious student and possessed much acuteness, but the lack of systematic philological training detracts from the value of his work. Of his numerous works the following are the most important: *Early History of Egypt* (1836); *Egyptian Inscriptions from the British Museum and Other Sources* (1837-55); *Rudiments of a Vocabulary of the Egyptian Hieroglyphics* (1837); *History of Egypt Under the Ptolemies* (1838); *History of Egypt from the Earliest Times till A.D. 640* (1846; 6th ed. 1876); *Texts from the Holy Bible Explained by the Help of the Ancient Monuments* (1866; 3d ed. 1880). Consult Clayden, *Life of Samuel Sharpe* (London, 1883).

SHARP'LESS, ISAAC (1848—). An American educator, born in Chester County, Pa. He graduated at Harvard in 1873, was a tutor in Haverford College from 1875 to 1879, professor of mathematics and astronomy from 1879 to 1885, and dean from 1885 to 1887, when he was made president. He wrote text-books on geometry and astronomy, *English Education in the Elementary and Secondary Schools*, in the "International Educational Series" (1892); *A Quaker Experiment in Government* (1898-99), and numerous essays on municipal government and education.

SHARPS, CHRISTIAN (1811-74). An American mechanic and inventor, born in New Jersey. He became a scientific machinist, was the inventor of the Sharps breech-loading rifle for military and sporting uses, and made many improvements in other firearms. After many failures he established a manufactory for his firearms at Hartford, Conn., where he accumulated a large fortune.

SHARPS'BURG. A borough in Allegheny County, Pa., 5 miles northeast of Pittsburg; on the Allegheny River, and on the Pennsylvania and the Pittsburg and Western railroads (Map: Pennsylvania, B 3). It is situated in a coal and iron mining section, and has a rolling mill, foundries, machine shops, and manufactories of varnish, brick, glass, lumber products, and lubricating oil. Sharpsburg was settled in 1826, and

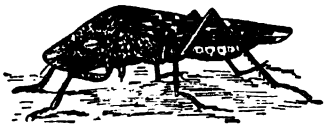
was incorporated in 1841. It was named in honor of its founder, James Sharp. Population, in 1890, 4898; in 1900, 6842.

SHARPSBURG, BATTLE OF. See ANTIETAM.

SHARP-SHINNED HAWK. See HEN-HAWK.

SHARPSHOOTER. A military expert rifle-shot. The great improvements in the accuracy of small arms, due to the introduction of rifling and elongated conical bullets, led to the formation of organizations of sharpshooters, who were assigned to such positions as would best avail them in the harassing of the enemy. They were at first selected from the best shots of such regiments as were armed with the rifle. (See RIFLEMAN.) The term sharpshooter is used in the United States in the army and militia to designate the grade between marksman and expert. See TARGET AND TARGET PRACTICE.

SHARPSHOOTER. A name in the Southern United States for certain heteropterous insects which puncture the young bolls and squares of cotton, causing them to wilt; the boll looks as though pierced by a minute bullet. The most



GLASSY-WINGED SHARPSHOOTER.

abundant of these species is the glassy-winged sharpshooter (*Homalodisca coagulata*), a leaf-hopper of the family Cercopidæ, which secretes an abundant supply of honeydew which it ejects from its body in the form of small drops or a spray, and is one of the insects frequently associated with the phenomenon called 'weeping trees.'

SHARSWOOD, shärz'wụd, GEORGE (1810-83). An American jurist, born in Philadelphia, Pa. He graduated at the University of Pennsylvania in 1828, and was admitted to the bar in 1831. In 1845 he was appointed judge of the Philadelphia District Court, and was the president of that court from 1848 until 1867, when he became associate judge of the State Supreme Court. From 1878 until 1882 he was Chief Justice of Pennsylvania. From 1850 till 1867 he was senior professor of law in Pennsylvania University. He published: *Professional Ethics* (1854); *Popular Lectures on Common Law* (1865); an edition of Blackstone's *Commentaries* (1859); numerous editions of texts by other English law writers; and *Lectures Introductory to the Study of Law* (1870).

SHA-SHI, shä'shē', **SHA-SI** or **SHA-SZE.** A river port in the Province of Hu-peh, China, on the left bank of the Yang-tse, 110 miles below I-chang (q.v) (Map: China, D 5). It stands on a sand bank 1 to 1½ miles wide, which separates it from the great swampy depression of Hu-peh (q.v.), and is protected from the floods of the Yang-tse by a great embankment many miles in length, begun in the sixth century. Much cotton is grown in the district; spinning and weaving are important home industries, and Sha-shi is the largest market in Central China for native cotton cloth. In 1896 it was opened by treaty to foreign residence and trade. Population, 80,000.

SHAS'TA, MOUNT. A peak of the Sierra Nevada, in California, situated 40 miles from the northern boundary of the State (Map: California, B 1). It is an extinct volcanic cone rising to a height of 14,380 feet. About 1400 feet below the summit is a crater three-fourths of a mile in diameter and 2500 feet deep; evidences of volcanic activity, such as hot springs, still exist in the neighborhood. The summit is covered with snow, and on the north slope are several glaciers of considerable size.

SHAS'TON. An ancient town of England. See SHAFTESBURY.

SHAVLI, shäv'lyê. A town in the Government of Kovno, Russia, situated 114 miles northwest of Kovno (Map: Russia, B 3). Its chief manufactures are spirits, flour, and tobacco. Population, in 1897, 15,914, mostly Jews.

SHAW, ALBERT (1857—). An American economist and editor, born at Shandon, Butler County, Ohio. He was educated at Iowa College and at Johns Hopkins University. His first important work was his thesis, *Icaria: A Chapter in the History of Communism* (1883). After editorial work and foreign study, he was made in 1890 professor of international law at Cornell University, but resigned his position to take the editorship (1891) of the American *Review of Reviews*. He published *Municipal Government in Great Britain* (1895), *Municipal Government in Continental Europe* (1895), and an account of the Spanish-American War.

SHAW, BYAM (1872—). An English figure painter, born in Madras. His family removed to London in 1879, and young Shaw studied under J. A. Vinter and at the Royal Academy schools, and first exhibited in 1893. His subjects are usually mediæval and romantic; his work, powerfully influenced by the Pre-Raphaelite School, is imaginative and decorative and rich in detail, and he is a fine colorist. His pictures include: "Rose Mary" (1893); "Love's Baubles" (1897, bought by the Corporation of Liverpool); "The Queen of Hearts," and "The Queen of Spades," and portraits.

SHAW, GEORGE BERNARD (1856—). A British critic, essayist, and dramatist. He was born in Dublin. In 1876 he settled in London and became known as a brilliant writer. Besides the criticism of the fine arts with which he began his journalistic career, he soon took an active part in politics, as a platform speaker and pamphleteer, from the Socialist point of view. He was an early member of the Fabian Society (q.v.). At different times he contributed weekly articles to the *Star* and the *World*, and on the drama to the *Saturday Review*. After moderate success with four novels—*The Irrational Knot*, *Love Among the Artists*, *Cashel Byron's Profession*, and *An Unsocial Socialist*—he began writing plays which aroused much discussion. They are included in *Plays Pleasant and Unpleasant*, numbering seven (2 vols., 1898); *Three Plays for Puritans* (1901); and *The Admirable Bashville* (1901). In 1889 he edited *Fabian Essays*, contributing two to the collection, and his writings include many socialistic pamphlets. Among his miscellaneous essays are *The Quintessence of Ibsenism* (1891) and *The Perfect Wagnerite* (1898). Shaw's invincible love of paradox has often prevented even those who most fully recog-



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MT. SHASTA

nized the cleverness of his writings from taking him seriously.

SHAW, HENRY WHEELER (1818-85). An American humorist, better known as Josh Billings, born at Lanesborough, Mass. He entered Hamilton College, but soon went West, where he remained for twenty-two years, working on steamboats and farms and finally becoming an auctioneer. Then he settled in Poughkeepsie, N. Y., to pursue his latest calling, and began to write humorous sketches for the newspapers. He adopted an amusing phonetic spelling, and over the pen name of 'Josh Billings' won great favor in the early sixties. His *Farmers' Allminax*, published annually (1870-80), sold widely, and he also increased his reputation by lectures in which he affected awkwardness. Afterwards he contributed to the *Century* under the pen name 'Uncle Esek,' and collected his works in 1877. Among American humorists Josh Billings ranks high in pith and point, and is regarded by many as a true moralist.

SHAW, LEMUEL (1781-1861). An American jurist, born in Barnstable, Mass. He graduated at Harvard in 1800, studied law, and in 1804 was admitted to the bar. The next twenty-six years he spent in private practice in Boston, rising by slow degrees to a commanding position at the Boston bar. He was actively interested in public affairs. He succeeded Chief Justice Isaac Parker, of the Massachusetts Supreme Judicial Court, in 1830. His service on the bench, covering a period of thirty years, won for him rank as one of the greatest of New England jurists. His decisions in greatly differing fields of law had a remarkable influence on the application of the English common law to American conditions. As an interpreter of constitutional law, too, he rendered services of great value. Although an ardent anti-slavery man, his respect for the law was such as to cause him, in the famous Sims case, to uphold the constitutionality of the Fugitive Slave Law, the passage of which he had in private vigorously opposed.

SHAW, LESLIE MORTIMER (1848—). An American lawyer, banker, and Cabinet officer, born in Morristown, Vt. He removed to Iowa in 1869, and was educated at Cornell College and at the law school of the University of Iowa. He practiced law at Denison, Ia., where he subsequently became interested in banking. In 1896 he became prominent as a Republican campaign speaker and an earnest advocate of the gold standard. In 1897 and again in 1899 he was elected Governor of Iowa, and in January, 1902, he entered the Cabinet of President Roosevelt as Secretary of the Treasury to fill the vacancy created by the resignation of Lyman J. Gage.

SHAW, ROBERT GOULD (1837-63). An American soldier. He was born in Boston and was educated in Switzerland and Germany and at Harvard. Upon the outbreak of the Civil War he obtained a commission as second lieutenant in the Second Massachusetts Volunteers. With this regiment he participated in the campaigns of the Army of the Potomac, was an aide on General Gordon's staff at the battle of Cedar Mountain, and distinguished himself at the battle of Antietam. He was promoted captain in August, 1862, and in January, 1863, was offered by Governor Andrew the colonelcy of the Fifty-fourth Massachusetts Volunteers, the first regiment of negro troops to be organized under State authority in the North. This commission, although he doubted his capacity, and realized the criticism and censure he would have to face for taking command of a negro regiment, he felt it his duty to accept, and at once returned to Massachusetts, where he organized the regiment and left Boston with it for the South, May 28, 1863. The regiment was sent on transports to Hilton Head, and its first participation in the war was as part of an expedition to Florida early in June, in the course of which the town of Darien was burned, contrary to the wishes of Colonel Shaw. In July the regiment was attached to General Strong's brigade and took part in the futile and disastrous attack on Fort Wagner. There on the evening of July 18th the Fifty-fourth Regiment, weary and worn from all night marching and exposure, formed the centre of the attacking column. Against the well-intrenched Confederates, Colonel Shaw gallantly led his negro troops in the face of a withering fire, and himself fell dead, sword in hand, on the parapet. Colonel Shaw was a man of particularly pure and noble character, and of great ability as a soldier, and his death was a severe loss to the Union. A splendid monument to him, the work of Augustus Saint Gaudens (q.v. for illustration), was erected at Boston. Consult *Harvard Memorial Biographies* (Boston, 1866).

SHAW, WILLIAM NAPIER (1854—). An English physicist, born in Birmingham and educated at Emmanuel College, Cambridge, and at the University of Berlin. In the Cavendish laboratory he was demonstrator of physics in 1880-87, and assistant director in 1898-99, and from 1890 to 1899 was senior tutor of Emmanuel. He contributed articles on electrolysis and the pyrometer to the *Encyclopædia Britannica*, and wrote, with Glazebrook, *A Text-Book of Practical Physics* (1884).

SHAWANO, shą'vȧ-nō, or **SHAWNEE** (from *shawan*, south, or *sewan*, pungent, salty). One of the most important tribes of the Algonquian stock (q.v.). The Shawano were formerly noted salt-makers. They carried on an extensive manufacture at the salt springs of southwestern Virginia and traded the product to other tribes. They have thirteen clans, the clan of the individual being indicated by his name. They are also organized into four divisions, which may have been originally distinct, allied tribes—Piqua, Mequachake, Kiscopocoke, and Chillicothe. To the second of these belonged the hereditary priesthood, but the first was most prominent and apparently most numerous.

The Shawano were of wandering and warlike habit. They appeared first in history about 1670 under the name of Sacannahs, and lived upon the middle Savannah River in South Carolina, with their principal village nearly opposite the site of Augusta, Ga., but before the end of the seventeenth century we find a portion of them, apparently the main body, occupying the basin of the Cumberland River in Tennessee and Kentucky.

The Shawano of Carolina for some time kept on friendly terms with the whites, giving them efficient aid against the hostile Westo in 1680, but finally, wearied by the encroachments and oppressions of the settlers, were forced to withdraw northward. In 1694 almost the whole body of the Carolina Shawano removed north-

ward and settled upon the Upper Delaware River in the neighborhood of their relatives and friends, the Delaware and Mohican. About thirty years later they again removed to the Susquehanna River, in the neighborhood of the present Wyoming, Pa., where they were joined in 1742 by the Delaware and Munsee, who had been dispossessed by the 'Walking Treaty.' By 1756 the Shawano had made another westward move and joined their brethren on the Upper Ohio, who had come up in the meantime from Tennessee. Up to about 1730 they had still kept up their old village near Augusta, on the Savannah, from which they were finally driven by the Cherokee.

The western Shawano, of the Cumberland region, are first definitely mentioned in the *Jesuit Relations* of 1648 under the name of *Ouchaouanag*. In 1670, as *Chaouanon*, they are described as living some distance southeast from their friends, the Illinois. From that time their name appears frequently in the records until their expulsion and removal from the Cumberland between 1705 and 1715 in consequence of a war with the Chickasaw and Cherokee. They retired to the Ohio country, where they united with those who had originally come up from Carolina, establishing their principal villages near the present Piqua and Chillicothe, Ohio. The Shawano took a leading part against the English in the French and Indian War and Pontiac's War, and afterwards against the Americans in the Revolution, the Tippecanoe campaign, and the War of 1812. In 1793 a considerable body settled in Missouri on lands granted by the Spanish Government. The death of Tecumseh broke the spirit of the Ohio tribes, and the war period closed for them with the treaty of peace in 1815. By a rapid series of treaty sales and removals the Shawano were shifted successively, in different bands, to Missouri, Texas, Kansas, and the Indian Territory. Those in Missouri removed to Kansas in 1825 and were joined there by the main body from Ohio in 1831. Some of these, known now as Absentee Shawnee, removed to the Indian Territory about 1845, others followed, and in 1867 the main tribe removed bodily and became incorporated with the Cherokee Nation.

The Shawano have always been noted for their strong conservatism, high courage, and superior intellectuality, as exemplified in the life of the great Tecumseh and his brother, the prophet Tenskwatawa. Under the new conditions of civilization they are somewhat behind their Indian neighbors. They probably never numbered more than 2500. They number now altogether about 1600 souls, all in the Indian Territory or Oklahoma, viz.: In Cherokee Nation, about 800; Absentee Shawnee, 500; Big Jim's Band, 180; Eastern Shawnee, Quapaw Agency, 90, with a few others scattering. See TECUMSEH; TENSKWATAWA.

SHAWL (Pers. *shāl*, mantle). An outer garment, usually in the shape of a square or double square, folded in the middle, worn usually by women, but not infrequently by men.

The most famous and beautiful shawls are those made from the inner wool of the Cashmere goat. They are produced on hand looms and their patterns, which have remained unchanged for ages, are produced either by weaving or embroidery. Toward the beginning of the nineteenth century the manufacture of imitation Cashmere shawls was begun in Europe and particularly at Paisley, Scotland, where a pure wool shawl was made at a low price, rivaling in beauty the true Cashmere shawl. Shawls have been made of nearly all the textile materials. The plaid, which is worn by the Scottish Highlanders, is a kind of shawl whose pattern has given the name plaid to all checkered designs. A beautiful crepe shawl is made by the Chinese from a hand-spun silk from which the gum has not been removed. The Barèges shawl, a woolen fabric made at Barèges, France, is highly valued. Within recent years, however, the custom of wearing shawls has almost completely passed away in Europe and America, and their manufacture has correspondingly declined.

SHAW-LEFEVRE, le-fē'vĕr, GEORGE JOHN (1832—). An English politician. He was educated at Eton and at Trinity College, Cambridge; studied law and was called to the bar in 1855. He was returned to Parliament for Reading from 1863 until defeated in 1885. In 1868 he carried the vote in the House of Commons for arbitration of the Alabama claims. He was secretary of the Board of Trade under Mr. Bright (1869-71); Under Secretary in the Home Office (1871); Postmaster-General (1883-84); member of Parliament for Central Bradford (1885-95); and was chairman of many important committees in the House of Commons. In 1897 he was elected a member of the London County Council. He is the author of *The Game Laws* (1874); *Freedom of Land* (1880); *English and Irish Land Question* (1881); *Peel and O'Connell* (1887); *Incidents of Coercion* (1888); *Agrarian Tenure* (1893).

SHAWM (OF., dialectic Fr. *chalemie*, pipe, flute, from Lat. *calamellus*, little pipe, diminutive of *calamus*, pipe, reed, from Gk. *κάλλαμος*, *kallamos*, reed; connected with AS. *healm*, Eng. *haulm*). An old wind instrument, the precursor of the oboe. It had a double reed set in a cupped mouthpiece. By leaving off the cup and taking the reeds directly between the lips the oboe originated.

SHAWNEE, shą-nē. A North American Indian tribe of Algonquian stock. See SHAWANO.

SHAYS, DANIEL (1747-1825). The leader in Shays's Rebellion (q.v.). He was born in Hopkinton, Mass., attained the rank of captain in the Revolutionary War, and after settling in Pelham (now Prescott) was the leader in the western Massachusetts agitation against the State Government. (See SHAYS'S REBELLION.) After the dispersion of the insurgents Shays removed to Sparta, N. Y., and was granted a pension for his Revolutionary services.

SHAYS'S REBELLION. An uprising in Massachusetts in 1786-87. The Revolutionary War had left the country in great economic distress. Especially was this the case in western Massachusetts, where the people were weighed down with private debts and burdensome taxes, and suffered greatly from the inevitable effects of a depreciated currency. The courts were overcrowded with lawsuits. The malcontents, gathered in county and district conventions, soon began to draw up demands and grievances; while committees of correspondence endeavored to rouse the general public to action. It was asserted that the merchants were rapidly drain-

ing the State of specie; that the taxes were unnecessarily high; that the State Senate was grievously aristocratic; that the salaries of State officials were too large; that lawyers' fees were exorbitant; and that the courts were used as instruments of oppression. The complainants therefore clamored for the issue, in large quantities, of paper money, for salary retrenchment, for the abolition of the Court of Common Pleas, and for a radical reduction of taxes, and insisted that the General Court should no longer sit amid the baleful influences of a merchant-and-lawyer-infested Boston. In the summer of 1786 the situation became critical, and the malcontents, headed by Daniel Shays (q.v.), everywhere threatened violence. At Northampton, Worcester, Great Barrington, and Concord, armed mobs prevented the sitting of the courts, and, in spite of General Shepard and 600 militia, Shays with 600 followers broke up a session of the Supreme Court at Springfield (September, 1786). Notwithstanding concessions made by the General Court, the disturbances continued, and Governor Bowdoin, now fully aroused, organized a force of 4400 militia, which he put under the command of Gen. Benjamin Lincoln. On January 25, 1787, Shays, with about 2000 men, marched into Springfield to seize the Federal arsenal there, but was confronted by Shepard with a force of 1200. At the first serious fire, the insurgents lost courage and fled, passing through Ludlow, Amherst, and Pelham to Petersham, where they were overtaken and dispersed by Lincoln. Subsequently, several minor skirmishes occurred in Berkshire, notably the one at Sheffield, February 26, 1787, but the insurgents soon disbanded, and, for the most part, took refuge in adjacent States. On trial, fourteen of the leaders were sentenced to death for treason, but were subsequently pardoned by Governor Hancock. Consult: Minot, *History of the Insurrections in Massachusetts in 1786, and the Rebellion Consequent Thereon* (Boston, 1810); and Holland, *History of Western Massachusetts* (Springfield, 1855).

SHEA, shā, JOHN DAWSON GILMARY (1824-92). An American historian. He was born in New York, educated at the Columbia Grammar School, and admitted to the bar. He gave himself chiefly to historical research, mainly in connection with French colonization and Jesuit missions in America. He published prayer-books, school histories, the *Catholic Almanac*, and edited the *Historical Magazine* (1859-65). Among his scholarly historical treatises may be named: *The Discovery and Exploration of the Mississippi Valley* (1853); *History of the Catholic Missions Among the Indian Tribes of the United States* (1854); *Early Voyages Up and Down the Mississippi* (1862); *Novum Belgium: An Account of the New Netherlands in 1643-44* (1862); *The Operations of the French Fleet Under Count de Grasse* (1864). Mention should also be made of the three volumes of his unfinished *History of the Catholic Church in the United States*, as well as of his Indian grammars, translations of Charlevoix and similar writers, and his editions of early American historical tracts.

SHEA (shē-ä) BUTTER TREE. See BUTTER TREE.

SHEARING MACHINE. See METAL-WORKING MACHINERY.

SHEARMAN, shēr'mȧn, THOMAS GASKELL (1834-1900). An American lawyer and political economist. He was born in Birmingham, England, emigrated with his parents to New York in 1843, settled in Brooklyn, and was admitted to the bar in 1859. At first he devoted himself almost exclusively to writing books on law. In 1868 he entered the law office of David Dudley Field and was successful in practice. In 1874 he undertook the defense of his friend Henry Ward Beecher in the celebrated suit brought by Theodore Tilton. In politics Shearman was a Republican except in the period from 1884 to 1896. He was, however, an ardent supporter of free trade and an opponent of all indirect taxation. With Mr. Tillinghast he wrote *Practice, Pleading, and Forms* (1861-65); and with Mr. Redfield, *Treatise on the Law of Negligence* (1869 and 1888). Among his other books are: *Talks on Free Trade* (1881); *Distribution of Wealth* (1887); *Owners of the United States* (1889); *The Coming Billionaire* (1890); *Crooked Taxation* (1891); *Taxation of Personal Property* (1895). For the New York Code Commissioners he prepared the *Book of Form* (1860), and most of the *Civil Code* (1862-65).

SHEARWATER, or HAGDEN. A petrel of the genus Puffinus, differing from other petrels in having the nostrils opening separately and divided by a very thick partition. Shearwaters spend their lives mostly on the ocean, skimming the waters with very rapid flight and plunging into them for their food. They rarely visit the shore except for the purpose of incubation. All are sooty brown above and white below with various specific markings. The greater shearwater (*Puffinus major*), about 18 inches long, wanders over the whole Atlantic Ocean and is abundant on the coasts of Newfoundland. The Manx shearwater (*Puffinus puffinus*) is found also in more northern regions, but is very rare on the coasts of North America. It is about 14 inches long, grayish black, the neck mottled with gray, the throat and all the under parts white. Like all the others, it breeds on islets, in rabbit-burrows, or in crevices of the rocks, and lays one or two white eggs. There are numerous other species in various parts of the world, one of which (*Puffinus brevicaudus*) is well known about Australia as 'mutton-bird.'

SHEATFISH (probably from *sheat*, variant of *shote*, from AS. *scēota*, trout, from *scēotan*, to shoot, OHG. *sciozan*, Ger. *schiessen*, to shoot; probably connected ultimately with Skt. *skand*, to jump, Lat. *scandere*, to climb), or SHEATH-FISH. The great catfish, 'wels' or 'silurus' (*Silurus glanis*), of the rivers and lakes of Northern Europe, east of the Rhine, sometimes 12 feet long. It is bluish black above, spotted with olive-green, and the under parts are dull white with black markings. It feeds on aquatic animals, and will pull down ducks and other swimming birds. It is the largest fresh-water fish in Europe. Compare CATFISH and see Plate accompanying that article.

SHEATHBILL. A curious Antarctic bird of the family Chionidæ, which looks like a pigeon, but is now decided to be limicoline. The thick, fowl-like beak is covered by a horny sheath, extending up to the eyes, and is bare and caruncu-lated, but the forehead is densely feathered. Two species are known, *Chionis alba* of the Falkland and other Antarctic islands, with the sheath of

the bill yellowish, and *Chionis minor* of Kerguelen Island, smaller and with the sheath black. Both have white plumage, and feed upon mollusks, crustaceans, and animal substances found along the beach, and both are called 'sore-eyed pigeons' by sailors.

SHEATHING (from *sheath*, AS. *scæþ*, *scēþ*, *scēa þ*, OHG. *sceida*, Ger. *Scheide*, sheath; probably connected with AS. *scēadan*, *scādan*, Goth. *skaidan*, OHG. *sceidan*, Ger. *scheiden*, to separate, Lat. *scindere*, Gk. σχίζειν, *schizein*, to split, Lith. *skedzu*, *skedu*, I separate, Skt. *chid*, to split). The covering of a ship's hull, usually of metal. In the days of wooden ships it was found that barnacles and other marine parasites attached themselves so firmly to the bottom as to necessitate injury to the wood in dislodging them; moreover, some marine animals (e.g. the teredo) bored into the wood and destroyed it. Sheathing with very hard wood was first resorted to. Lead sheathing seems to have been used as early as 1620 at least, and was probably used to cover the wood along the water-line several centuries before. A Japanese junk of about 800 tons sheathed with iron was seen in 1613. In 1761 copper was first used as sheathing, and in course of time copper or a copper alloy displaced all the other metals except zinc, which is still, though rarely, used. When iron ships were built it was noticed that their bottoms became foul very quickly. The best remedy found was paint, and it was only a partial one. To avoid excessive fouling, many iron and steel vessels of war have their bottoms sheathed with wood and coppered as in the days of wooden ships. Iron merchant vessels have rarely been sheathed, and the wisdom of sheathing and coppering any iron or steel vessel is doubted. Zinc sheathing has been used to some extent because in the battery formed by zinc and iron it is the zinc which is eaten away. The bottoms of ships are generally cleaned every year or oftener (once in six months is desirable) and coated with two kinds of paint. The first is anti-corrosive and is designed to protect the metal against rusting. The other is anti-fouling. It is much softer than the other paint, is poisonous to marine growths, and if any adhere to it they are apt to be washed off together with a thin film of the paint. No paint yet devised is regarded as fully satisfactory, but several varieties give fairly good results for five or six months. See PAINTS.

SHEAVE. See BLOCK; and TACKLE.

SHE'BA (Heb. *Shĕbā*, Ar. *Saba*, Assyr. *Sab'u*). Hebrew eponym of the Sabæan people, represented in Gen. x. 28 as one of the thirteen (originally twelve) sons of Joktan, Eber's son; in Gen. xxv. 3 as a son of Jokshan, Abraham's son by Keturah; in Gen. x. 7, as a son of Raamah, Ham's grandson. That some Sabæans were made Hamites by the priestly redactor may be due to the knowledge of Sabæan settlements along the caravan route from Meroë to the Erythræan Sea in the Persian period. The desire to make Abraham the father of a multitude of peoples accounts for the divergent genealogy in Gen. xxv. 3. Sheba is correctly associated with southwest Arabian tribes in the oldest documents. In I. Kings x. 1 et seq. there is a story of a visit to Solomon by a queen of Sheba not mentioned by name. While it is difficult to account for a queen on the throne of Sheba in the tenth century B.C. (see SABÆANS), it is conceivable that such a queen, cherishing designs to wrest the ancestral home in Yemen from the Minæans (q.v.), should have sought alliance with Solomon, who on the Elamitic Gulf was the neighbor and rival of the Kingdom of Main. In this way a nucleus of historic fact may be assumed. Legendary embellishments naturally began at an early date, and the notion of the riddle may go back to Hebrew antiquity. According to the late Arabic version of the story the queen's name was Bilkis, and it was Solomon who visited her in Yemen, where she tried him with many riddles. From the Hebrews or the Arabians the Abyssinians learned the story. They give the name of the queen as Makeda, and maintain in their lists of kings that Ibn al-Hakim was the son of Makeda and Solomon, and that consequently the legitimate rulers of Abyssinia are Solomonitic. Frankincense from Sheba is referred to in Jer. vi. 20 and Job vi. 19. Sabæans appear in caravans; in Ezek. xxv. 22 they are mentioned with Raamah as traders in jewels, balms, and gold; in Isa. lx. 6 they bring gold and incense. Consult: Gunkel, *Genesis* (Göttingen, 1901); Glaser, *Geschichte und Geographie Arabiens* (Berlin, 1890); Stade, *Geschichte des Volkes Israel* (ib., 1889); Winckler, *Geschichte Israels*, vol. ii. (Leipzig, 1900). For the story of Bilkis, consult Brünnow, *Chrestomathy of Arabic Prose Pieces* (Berlin, 1895); for the story of Makeda, Prætorius, *Fabula de Regina Sabæa apud Æthiopes* (Halle, 1870); on the occurrence of the name Shabat in Egyptian inscriptions of the Persian and Greek period, consult W. Max Müller, in *Mittheilungen der vorder-asiatischen Gesellschaft* (Berlin, 1898). See SABÆANS.

SHEBOYGAN, shĕ-boi'gan. The county-seat of Sheboygan County, Wis., 52 miles north of Milwaukee; at the mouth of the Sheboygan River, on Lake Michigan, and on the Chicago and Northwestern Railroad (Map: Wisconsin, F 5). It has a public library and a handsome Federal building. Other features are the Sheboygan County Chronic Insane Asylum, Saint Nicholas Hospital, and the Sheboygan Home for the Friendless. The shipping point for a farming and dairying section, Sheboygan also has important fishing and industrial interests. There are large cheese warehouses, and large coal and salt docks. In the census year 1900 the various manufactories had an invested capital of $7,766,616, and an output valued at $7,469,202. The principal establishments are chair, furniture, and toy factories, foundries and machine shops, bottling works, brick yards, breweries, and manufactories of excelsior wrappers, carriages, leather, beehives and bee-keepers' supplies, leather gloves and mittens, knit goods, etc. Population, in 1890, 16,359; in 1900, 22,962.

SHECHEM, shĕ'kĕm (Heb. *Shĕkem*, the back, hence, perhaps, applied to a watershed). An ancient city of Palestine, in the centre of Mount Ephraim, the modern Nabulus (Map: Palestine, C 3). It lay between the mountains of Ebal and Gerizim, in a fair and well-watered valley, which is the meeting-place of several natural lines of roads. Mentioned in an early Egyptian papyrus, it constantly appears in the Old Testament. It is connected with the traditions of Abraham (Gen. xii. 6) and Jacob, the latter's sons taking it with the sword (Gen.

xxxi.). In the Hebrew invasion the Joseph tribes and Joshua move immediately upon Shechem, which becomes the first Israelite centre and is made a city of refuge (Josh. xxiv. 1; xx. 7). These traditions mention a certain holy tree, doubtless an ancient sanctuary, which was adopted by the Hebrews, as were also the sacred traditions connected with Ebal and Gerizim (q.v.). Shechem appears in the story of Abimelech (Judith ix.), but suffered eclipse through the Philistine wars and the rise of Jerusalem. Upon Jeroboam's revolt it was the centre of insurrection, but was soon deserted as a capital for other places strategically fitter, finally yielding to Samaria. It rose again into prominence through the Samaritan schism in the fifth century B.C., becoming the centre of that sect, which erected a temple upon Gerizim as a rival to that in Jerusalem. (See SAMARITANS.) It suffered in the later Jewish wars, and was rebuilt by Vespasian as Flavia Neapolis; hence its modern name Nabulus (q.v.). Consult the *Palestine Exploration Fund Memoirs*, vol. ii. (London, 1881); Baedeker, *Palestine* (Leipzig, 1898); George Adam Smith, *Historical Geography of the Holy Land* (New York, 1901).

SHECHINAH, shê-ki'nâ. See SHEKINAH.

SHEDD, WILLIAM GREENOUGH THAYER (1820-94). An American theologian, born at Acton, Mass. He graduated at the University of Vermont in 1839, and at Andover Seminary in 1843. He was pastor of a Congregational church at Brandon, Vt., in 1844-45; professor of English literature in the University of Vermont in 1845-52; of sacred rhetoric and pastoral theology, Auburn Seminary, in 1852-53; and of ecclesiastical history, Andover Theological Seminary, in 1853-62. He was pastor of the Brick Presbyterian Church, New York, in 1862-63; professor of biblical literature, Union Seminary, New York, in 1863-74; professor of systematic theology there in 1874-90, when he became professor emeritus. His works include: *History of Christian Doctrine* (1865; 8th ed. 1884); *Homiletics and Pastoral Theology; The Doctrine of Endless Punishment* (1886); *Dogmatic Theology* (1889-94); *Orthodoxy and Heterodoxy* (1893); *Calvinism Pure and Mixed* (1893).

SHEE, Sir MARTIN ARCHER (1769-1850). An English portrait painter and author. He was born in Dublin, and studied art there under Robert Lucius West, and in London under Sir Joshua Reynolds. In 1800 he was made a member of the Royal Academy, of which he became president in 1830. He was a portrait painter of great popularity, though inferior in genius to his rival, Lawrence, and is especially well represented in the National Portrait Gallery. Among his sitters were the members of the royal family. He published, in 1805, *Rhymes on Art*. His harmless tragedy, *Alasco*, published in 1824, was refused a license as treasonable. Consult his *Life* by his grandson (London, 1860).

SHEEP (AS. *sceap, scēp*, OHG. *scāf*, Ger. *Schaf*, sheep; of unknown etymology). A hornless or hollow-horned ruminant belonging to the genus Ovis, and covered with a fleece of wool varying in color, length, fineness, and strength of the fibre. The male is designated a ram (or wether when castrated), the female a ewe, and the young a lamb. The principal products are wool, meat, and sheepskin. The entrails are used for sausage casings, or, when dried and twisted, for musical instrument strings (catgut); the fat yields tallow and suet; and the milk in some countries is used, either alone or with cows' milk, for making cheese (q.v.). Flocks of special milk breeds are kept primarily for their milk. In mountainous parts of India sheep are used as beasts of burden.

The sheep is one of the oldest of the domesticated animals, and is mentioned in many of the most ancient writings. It was especially adapted to the modes of life and the needs of primitive peoples, whose wealth was measured mainly by their flocks. The offspring were much used for sacrificial purposes.

Sheep have contributed largely to the wealth and development of every country where man has introduced them as adjuncts of settled agriculture. Although they flourish best in temperate climates, they readily adapt themselves to changed climatic and other conditions, and breeds have been developed which thrive from the sea level to the mountain heights and upon a great variety of soils and vegetation.

Sheep are supposed to have been developed from wild forms to which they are related, but opinions differ widely as to which ones; nay, further, controversy has not settled that their progenitors still exist in the wild state. They are most commonly thought to have descended from the mouflon, the musimon, or the argali. No domesticated sheep were found in North America by the early explorers. The wild Rocky Mountain sheep has neither been successfully domesticated nor crossed with the domestic sheep. Under domestication, due partly to differences in altitude, climate, feed, etc., and partly to man's intervention, many breeds and varieties of sheep have been produced; and domesticated sheep furnish some of the best illustrations of the great diversity in characters and adaptation to the needs of man which may be brought about by intelligent breeding.

BREEDS OF SHEEP. Sheep are commonly classified according to their fleece into long-wooled, middle or medium-wooled, and short or fine-wooled breeds. (See WOOL.) The names of the breeds or varieties within these general divisions are often derived from the habitat of the sheep or the name of the breeder who has been prominently identified with their development. The long-wooled breeds, e.g. Leicesters, Lincolns, and Cotswolds, are usually white-faced, somewhat coarse fleshed and lethargic, and are of English origin. The Leicester is of special historic interest because it was the first breed to be improved by skillful selection and breeding, and because it has been used in improving all the other long-wooled breeds. This breed, whose progenitors were the long-wooled sheep of the Midland counties of England, owes its origin to Robert Bakewell, who developed it purely by selection with reference to a definite mental standard, and apparently without resorting to crossing with other kinds or breeds. This Improved Leicester, which has persisted practically as Bakewell developed it, is a hornless sheep, with a somewhat 'lashy' wool, seven or eight inches long, terminating in a short twist which gives it a fine curly appearance. The animal is somewhat smaller than the original type, but is more symmetrical, thicker, deeper, of better

fattening qualities and earlier maturity. Bakewell made no attempt to improve the wool, and the pure-bred stock tends to produce a very fat mutton, which is not now in demand. The great value of the breed lies in its use for crossing purposes. The Border Leicesters, regarded as a separate breed, differ from the Leicesters chiefly in the shape of the head, which is bald, the Leicesters usually having a tuft of wool on the head. The Lincoln resembles the Leicester in general form and might almost be mistaken for it, although it is larger, being the heaviest sheep in the British Isles. The bright, lustrous wool, which masses in characteristic flakes or strands, is extraordinarily long, samples measuring 21 inches. The breed is the product of Leicester crosses upon the old Lincoln stock. As a mutton sheep it is considered by many inferior to the Down breeds, but for crossing purposes it is in great demand, especially on the sheep ranges of the Northwest United States. The Cotswold, one of the most ancient, best known, and most popular of the recognized English breeds, originated on the bleak hills and uplands, where it developed a hardihood and an ability to 'rustle' less evident in other long-wooled breeds. The head is wedge-shaped, without horns, the face covered with white hairs, the lips black, the ears long and pendulous, and the forehead covered with a flowing top-knot—one of the most characteristic features of the face. The fleece is long and heavy, although inferior in both respects to that of the Lincolns. The breed has been used in establishing several cross-breeds. The Black-faced sheep and the Herdwicks are mountain breeds, often horned, having long, rather coarse or hairy wool. They are not, however, commonly classed with the long-wooled breeds.

The medium-wooled breeds include the Down sheep, which inhabit the chalk hills of Southern England, the Shropshires, and the Dorset Horned. All except the last are hornless, and the face in several breeds is dark brown to black. The Southdown, or Sussex, one of the purest of the English breeds, antedates William the Conqueror. It has been developed by selection and not by crossing with other breeds, and has been used to improve the dark-faced Down breeds. The horns, which it originally had, have long since disappeared. It has fine short wool, which extends to the forehead and face, and has long been renowned for its mutton, which is close-grained, tender, dark, and juicy. It is a rather small sheep, but its size has been increased by selection. On account of its beauty and high-bred appearance, it is a favorite for country estates and parks, especially in England. The Shropshire is a cross-bred sheep. The original stock was small, horned, and had a black, brown, or spotted face. The improvement consisted in crossing with the Leicesters, the Cotswolds, and the Southdowns. The breed to-day is a striking illustration of the stage of perfection which can be attained by judicious crossing and selection. The carcass is large, covered with a dense elastic fleece of good length and medium fineness; the face is rich brown, and the head covered with a close-fitting cap of wool. The breed is a very popular one, and readily adapts itself to various climates and scanty pastures. The Improved Hampshire Down is the heaviest of all the Down breeds, the Oxfordshire Downs vying with it in this respect. The face is dark, the lips black, the ears rather long, often falling slightly forward; the shanks rich dark brown; the fleece white, thick, covering the top of the head, and made up of fine strong fibres. The animals mature early, and the lambs make very rapid growth and fatten early. They respond to good feeding and stand close folding, being in their native country very often hurdled upon pasture crops. The Oxfordshire Down originated about 1833 by crossing the Cotswold on the Hampshire Down, and was known prior to 1859 as the Down-Cotswold. By careful breeding it has become a distinct race. These sheep have dark-brown faces, long, thin ears, and a comparatively close fleece, the wool, which covers the head, being longer and more flowing than upon the Shropshire, which it resembles somewhat closely. The Suffolk Downs resemble the preceding, but have very black faces and lack wool between the ears. They were derived from the small and hardy horned Norfolk and Suffolk sheep, and have been greatly improved by the Southdown. The Dorset, or Dorset Horned, an English breed, is a survival of a white-faced, horned, short-wooled race, which has descended unmixed from a remote period. It is rather larger and longer in the legs than the Southdown. These sheep are unusually prolific and produce their young so early that the lambs may be sent to market before those of most other breeds. They are hardy, quiet, good feeders, and readily adapt themselves to new conditions. The Cheviot is an ancient, white-faced, hornless, short-wooled sheep, reared in the Cheviot hills and belonging to the mountain breeds, in which class it is unexcelled. It contrasts strongly with the sheep of the downs, having a longer body and rather light fore quarter—true also of most other mountain breeds.

The foundation of the present fine-wooled sheep of all countries is the Spanish Merino, a type which antedates the Christian Era. These sheep were held in Spain by the kings, the nobles, the clergy, and others, and since their exportation was prohibited, and extreme care was bestowed upon the fleece, Spain long controlled the fine-wool trade of the world. Among the families of the Merinos were the Escurial, Infantado, Paular, Negretti, Guadaloup, and Aguirres, which for years contributed largely to the support of the Spanish Government. Until the nineteenth century, it is said, none were exported except by royal favor or by smuggling. In 1765 three hundred, introduced into Saxony by royal courtesy, became the foundation of the Saxon Merinos. During the first quarter of the nineteenth century Spanish Merinos were introduced into the United States, and from these the American and the Delaine Merinos have been developed. The moist climate of Great Britain is unfavorable to the growth of the finest wools, and hence the Merino has never been successfully propagated there. It formed the basis of the vast flocks of Australia and New Zealand. The fleece covers the whole body, down to the hoofs and nearly to the tip of the nose. The rams have wide, wrinkled horns. The short, full neck is covered with heavy folds of skin in both males and females. Merino mutton is of inferior quality. The Rambouillet, or French Merino, which originated from the Spanish stock imported by Louis XVI. and is named from his estate, is regarded as a distinct breed. It is a large,

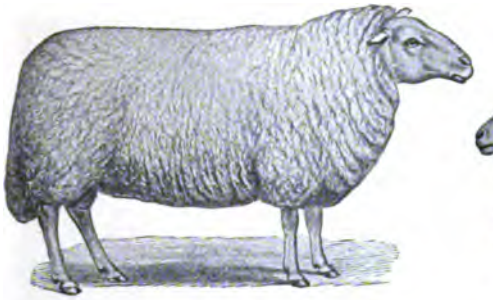
SHEEP



1



2



3



4



5



6

1. SHROPSHIRE RAM.
2. SOUTHDOWN RAM.
3. CHEVIOT RAM.
4. LINCOLN RAM.
5. RAMBOUILLET RAM.
6. COTSWOLD RAM

heavy-fleeced sheep and has many admirers in Europe and America.

Various other types of sheep not included in the above classification are of local importance. The Iceland sheep are remarkable for frequently having three, four, or five horns, as do also some sheep of Northern Russia. The broad-tailed or fat-tailed sheep, found in many parts of Asia, are chiefly characterized by the enormous accumulation of fat on each side of the tail bone. The tail is esteemed a great delicacy, and to protect it from being injured by dragging on the ground it is sometimes supported by a board or small pair of wheels. The fat of the tail is often used in place of butter. The fat-rumped sheep of Tartary have similar accumulations of fat on the rumps, falling down in two masses behind and often concealing the short tail. The Astrakhan or Bokharian sheep have very fine wool twisted in spiral curls. The specially beautiful pelts of very young or still-born lambs of this variety are known as Astrakhan fur and are used for trimming garments.

SHEEP-RAISING was originally and to a large extent has continued a pastoral industry; and because sheep can thrive upon scanty vegetation and succeed best when given free range, they are popular in countries where land is cheap and pastures abundant, and where the industry can be carried on extensively, as in South American countries (notably Argentina), Australia, New Zealand, the Western United States, portions of Russia, and South Africa. These are now the leading sheep-raising countries of the world, although the industry is still prominent in Great Britain, France, and Spain.

In the United States sheep-raising has undergone many changes, due to the prices and demands for certain qualities of wool (q.v.) and mutton, the tariff, and other conditions. As an industry it now flourishes mainly in the middle and far West, where it is at its height and is considered one of the most profitable branches of agriculture. The census of 1900 showed a total of nearly sixty-two million sheep in the United States, nearly 55 per cent. of which were on farms and ranges in the western division of the country. Montana headed the list, with over six million head, followed by Wyoming, New Mexico, Ohio, Utah, Idaho, Oregon, etc.

The growing appreciation and the increased demand for lamb and mutton in the United States has increased the revenue from flocks, and has resulted in changes in the kind of sheep kept. As an indication of the increase in lamb and mutton consumption, the reports of the Union Stock Yards at Chicago may be cited. In 1885 about 1,000,000 sheep were received for slaughter; in 1890 a little over 2,000,000; in 1900 about 3,500,000; and in 1902 over 4,500,000, valued at over $19,000,000. Of those received in 1902 more than 3,500,000 were slaughtered there, the largest record for any year. A large proportion of these came originally from the sheep ranches of the West, although many were fattened farther east. In 1870 more than four-fifths of the sheep in the United States were either pure-bred or grade Merinos. During the closing decade of the nineteenth century there was a marked tendency to increase the mutton breeds or crosses having better mutton qualities. In the States east of the Mississippi River the coarse or medium-wooled mutton breeds have gradually gained prominence because, as population has increased, meat has become more important than wool. In the Southwest the Merinos still predominate, being held by some to be better 'rustlers;' but in the Northwest the aim of the majority of sheep-raisers is to breed a general-purpose animal, with wool of medium fineness, shearing 7 to 8 pounds, and of good mutton qualities. This is usually brought about by crossing the Merino or Rambouillet with the Cotswold or Lincoln, thoroughbred stock, especially bucks, being the foundation of the flocks on the better ranches.

The management of sheep under range conditions differs widely from that adopted in the Eastern States or in older countries. The natural conditions and environment in the Western States, the extensive scale upon which the sheep industry is conducted, the high price of labor, and the comparative inaccessibility of some of the larger ranges, have resulted in a tolerably uniform system of management, somewhat modified, however, by climatic and other conditions. Formerly the sheep were kept almost entirely upon the public domain, but with the increasing competition for this open range and the settling of the country, the practice of owning or leasing land has become very common, although there are still 'tramp' bands which rove from south to north and back with the season. In many cases immense tracts of land are acquired by lease or purchase, and this usually means the control of a much larger tract. The leased tracts are inclosed with fence, and are supplied with facilities for watering the stock. Generally, however, the sheep-raiser does not own or lease all the land required for range, but relies upon the open ranges and the forests in the mountains for summer grazing. The land which he controls is the winter range, and is usually located in proximity to the headquarters of the ranch. On the range the bands number from 1800 to 3000 sheep, depending upon the character of the country. Each band is in charge of a herder, assisted by dogs which prevent the sheep from straying away and guard them at night. Camp tenders supply the herders' wants and maintain a lookout for good range. In the fall the sheep are brought to the winter range, which is more protected from the snow and has not been fed down during the summer. Where no provision is made for feeding when storms prevent ranging heavy losses are likely to occur. The best sheep men, however, put up alfalfa (q.v.) or prairie hay for such emergencies, and some even plan to fatten the sheep somewhat during winter by this extra feeding, to prepare them for the market. On some of the ranches several hundred acres of alfalfa are raised (costing from 75 cents to $1.25 a ton), and as several crops are cut during the season, a hay gang is kept employed throughout the summer.

In the early days buildings were rarely used, but experience has shown that while they are not absolutely essential, increased profits are secured and the business made more certain by providing protection for the sheep, especially during lambing time. This protection usually consists of rough sheds 50 or 75 feet wide and often 200 feet long. Corrals, usually without cover, are located at various points over the winter range, and the sheep are placed in these

over night. The more substantial feeding corrals are located near the ranch house. They are usually connected with open sheds in which the sheep may seek protection against snow and rain.

In the spring after lambing time the sheep are sheared, either by hand or with machine, and usually dipped as a precaution against ticks and disease, before they are taken out upon the summer range. In the Western States shearing is carried on by shearers who begin in early spring in Texas and Arizona, where two annual shearings are made. As the season advances they travel northward to Montana, where the work ends in early July. They become so expert, and shear with such rapidity, that an average of from 90 to 120 sheep a day is usual. The maximum record is about 250 sheep in a day. Since about 1895 machine shearing has progressed rapidly, because more wool, an evener fleece, and less injury to the sheep's skin are secured. The motive power is usually a gasoline engine, and shearing plants are constructed which contain from 10 to 40 clippers. No sorting of the wool is done on the ranch, except that the wool of black sheep is sacked separately, since it brings a higher price.

The cost of managing sheep under range conditions necessarily varies within rather wide limits. If the sheep-raiser makes use of the public lands without paying rental and taxes, and does not practice winter feeding, the business may be conducted at a cost of about 25 cents per head per year. On the other hand, sheep-raisers who maintain extensive plants, feed in winter, and rent or own much of their grazing land have found that the cost varies from 75 cents to $1.25 per head. The income under range conditions varies according to the locality and the skill and intelligence of the sheep-owner. In localities where the wool is comparatively free from sand, the income from the fleece in 1903 was from $1 to $1.50 per sheep. The lambs may be sold in the fall at $2 to $3 a head, depending upon their condition; and by feeding for a short time additional profit may be obtained. Some of the best sheep managers make a profit of $1.50 per head, but such high returns are above the average and cannot be realized every year.

Although sheep are well adapted to scanty vegetation and are capable of giving good returns on the semi-arid lands, they also respond to liberal feeding and can be made to return good profits under farming conditions. The high-priced agricultural lands of Great Britain maintain an average of 680 sheep per thousand acres; those of Scotland, in 1893, as high as 1380 sheep per thousand acres of agricultural land. In the leading agricultural States of the United States the number does not exceed 25 sheep per thousand acres. In the farming States, where mutton is the primary consideration and wool incidental, sheep-raising will usually return a satisfactory profit independent of the price of wool, as it has been demonstrated that the cost of producing a pound of mutton from good mutton sheep does not exceed that of producing a pound of beef. Practical feeders have found that surplus grain may be fed with profit, and the number of sheep in the grain-producing States seems to be increasing. Corn (see MAIZE) is one of the cheapest grain rations for lambs. It is often fed in a mixture with oats or peas, and, for fattening, a little oil cake added. Various green crops, especially rape (q.v.), are grown for sheep pasture, the sheep being hurdled upon the fields and a rotation of green crops provided. Roots are extensively used, especially in England and parts of the United States where corn cannot be grown. Corn silage is equal in feeding value to roots, and is much cheaper. See SILAGE.

BIBLIOGRAPHY. Armatage, *The Sheep, Its Varieties and Management in Health and Disease* (London, 1893); Coleman, *Cattle, Sheep, and Pigs of Great Britain* (London, 1887); Craig, *Sheep Feeding*, Farmers' Bulletin No. 49 (Washington, 1897); Curtiss, *Raising Sheep for Mutton*, Farmers' Bulletin No. 96 (Washington, 1899); Curtis, *Horses, Cattle, Sheep, and Swine* (New York, 1893); Dodge, *Sheep and Wool*, Department of Agriculture, Report 66 (Washington, 1900); Gibson, *History and Present State of the Sheep-Breeding Industry in the Argentine Republic* (Buenos Ayres, 1893); May, *Das Schaf* (Breslau, 1868); McIvor, *History and Development of Sheep Farming from Antiquity to Modern Times* (Sydney, 1893); Mentzel, *Schaftzucht* (Berlin, 1892); Randall, *Sheep Husbandry with an Account of the Different Breeds* (New York, 1860); Rushworth, *The Sheep* (Buffalo, 1899); Salmon, Carman, Heath, and Minto, *Special Report on the History and Present Condition of the Sheep Industry of the United States* (Washington, 1892); Sanson, *Les moutons, histoire naturelle et zootechnie* (Paris, 1885); Spooner, *History, Structure, Economy, and Diseases of the Sheep* (London, 1888); Stewart, *The Domestic Sheep, Its Culture and General Management* (Chicago, 1898); Wilcox, *Sheep Ranching in the Western States*, in Annual Report Bureau of Animal Industry (Washington, 1903); Wrightson, *Sheep, Breeds and Management* (London, 1895); Youatt, *Sheep, Their Breeds, Management, and Diseases* (London, 1837).

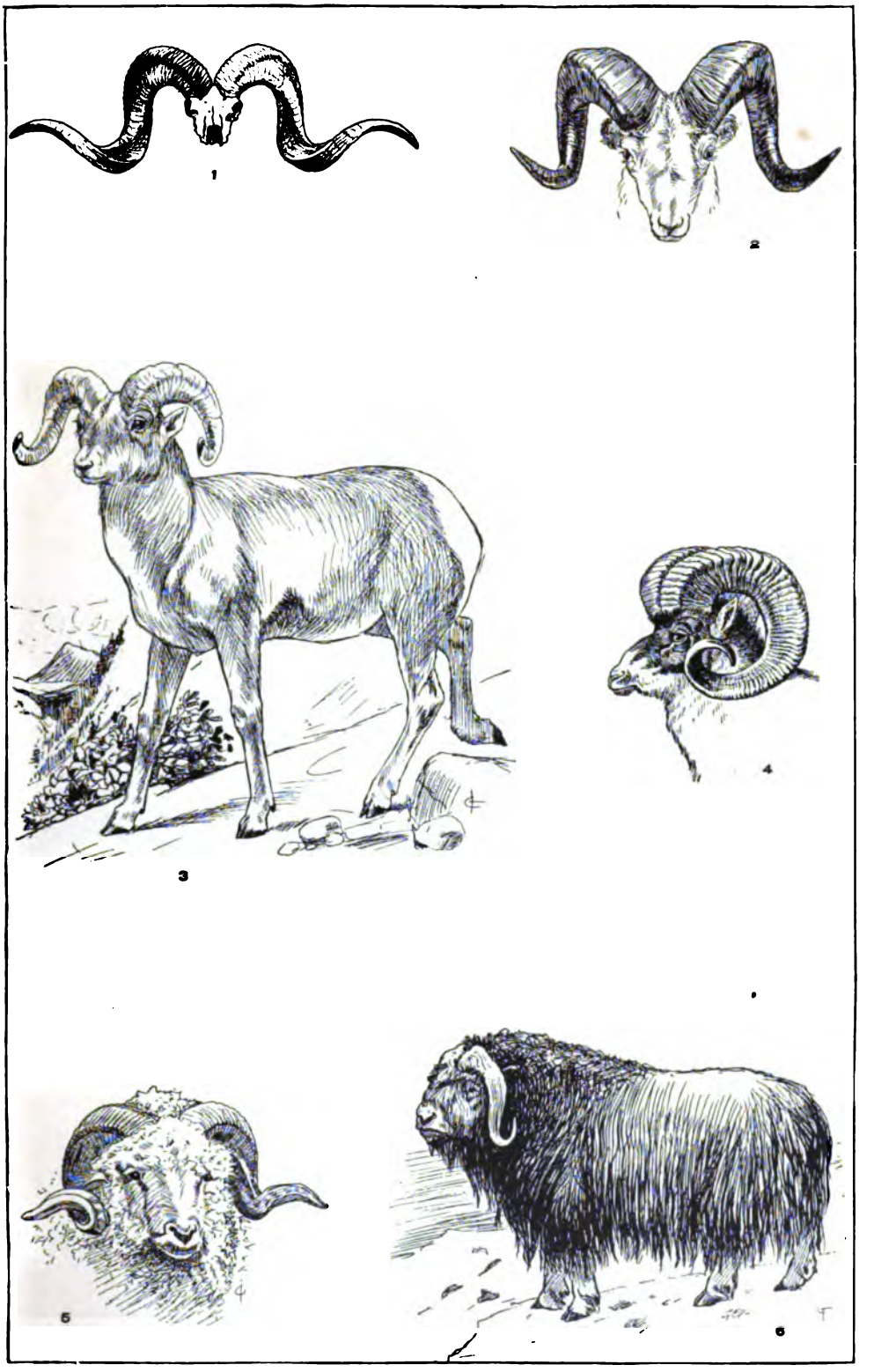
SHEEP-BOT. See BOT, BOT-FLY.

SHEEP-DOG, or COLLIE. Any of several kinds of dogs used to guard and control flocks of sheep or cattle. This kind of dog, which Buffon regarded as the most ancient breed of domestic dog, has existed in substantially its present large, hardy, long-haired form, characterized by a high degree of intelligence, since prehistoric times, and Buffon's claim may very well be true. The English-speaking world at the present is mainly interested in six varieties of sheep-dogs.

THE SCOTCH COLLIES. *The rough-haired variety* of the Scotch collies is the traditional and typical sheep-dog of the world. He stands from 22 to 24 inches high at the shoulder, has a skull quite flat, with a fine tapering muzzle, and brains that often act with better judgment than do those of his human master on the matters within the dog's range. The sheep become perfectly acquainted with their dog and evidently regard it as a friend. It knows the sheep of the flock it is required to attend, and even in a crowded market adroitly separates them from others. Its remembrance of places is obviously very accurate.

The standard qualities called for are a heavy coat, except on the head and legs, the outer coat harsh to the touch, the under coat soft, furry, and so close that it is difficult on parting it to see the skin; mane and frill round the neck very abundant; fore legs slightly feathered; hind legs below the hocks smooth, with a profusion of hair

WILD SHEEP AND MUSK OX



1. HORNS OF PAMIR SHEEP, front view. See No 4.
2. KAMTCHATKAN ARGALI (Ovis nivicola).
3. ROCKY MOUNTAIN BIGHORN (Ovis Canadensis).
4. PAMIR SHEEP (Ovis Poli).
5. MERINO RAM.
6. MUSK OX (Ovibos moschatus).

on the tail, and long and bushy on the hips. Color ranges from black and tan to tan and white, or all white; and the dog's weight varies from 45 to 65 pounds; females from 40 to 50 pounds. The ears are small and in repose are folded, but when alert thrown up and drawn together on the top of the skull. There being no brow on this breed, the eyes are necessarily placed obliquely. The general expression of the collie is that of great beauty in outline and pose, strength, activity, and attention. See Plate of HUNTING AND WATCH DOGS with article DOGS.

The smooth-coated collie has the general character of his more popular brother, with a dense, short, flat coat of good texture, with an abundance of overcoat, but not a particle of feathering on legs, tail, or ears. He varies in color, and in its distribution, more than the long-coated one. Before the days of the railroad he was essentially the cattle drover's dog.

THE WELSH BOB-TAILED COLLIE. This variety, long known in Wales, but rarely seen elsewhere, is the largest of the collies, being 25 inches high at the shoulder. It has a shaggy, blue-gray coat, and a tail inclined to be short, and invariably cropped in infancy.

THE OLD ENGLISH SHEEP-DOG. This race is akin to the Welsh collie in build and coat, and is bob-tailed. It is thick-set, has a shaggy iron-gray, white-marked coat, with a waterproof under-fur, and its ears are carried flat on the side of the head.

THE POMERANIAN SHEEP DOG. Though elsewhere bred as a house pet, small and useless, in its own home on the shores of the Baltic this dog is the local sheep-tender. He has a fox-like face and very long hair. In color he ranges over a wide scale, but black or white is most common, and the average weight is about eight pounds. It is better known as the 'Spitz dog.'

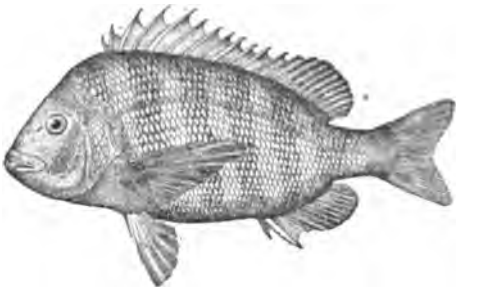
THE SCHIPPERKE (*schipper-kee*). This is to all intents and purposes a short-coated, bob-tailed Pomeranian, commonly kept by the boatmen of Holland and the Rhine as a guard-dog, and it is unapproachable in that capacity. The English and American standard for these dogs calls for a black coat, but in Holland fawns and whites are very popular. Two sizes are recognized, one from 9 to 12 pounds in weight, and another from 12 to 20 pounds.

Consult authorities cited under DOG.

SHEEP-LAUREL. See KALMIA.

SHEEP-LOUSE, or SHEEP-TICK, or (in Scotland) KAID. A reddish-brown fly (*Melophagus ovinus*) of the family Hippoboscidæ. It lives among the wool of sheep, and particularly of lambs, sucking the blood of the animal, and is most abundant in the early part of summer. It is wingless and somewhat resembles a tick, and where it fixes its head in the skin a large tumor is formed. The female hatches eggs and nourishes the five to eight larvæ within her own body, until just before they pass into the pupa state, when they are deposited, oval-shaped and shining, and fastened to the wool of the sheep. Farmers use various washes or 'dips' for the destruction of this pest, also pyrethrum powder.

SHEEPSHEAD. An American food-fish (*Archosargus probatocephalus*) of the porgy family (Sparidæ), considered one of the finest for the table found along the Atlantic or Gulf coast of the United States. It grows to a weight of 20 pounds, but the average is about seven pounds. It has a deep body, marked by seven or eight transverse bands, most evident in the young. The



SHEEPSHEAD.

mouth has prominent incisor teeth which help to give the head a fancied resemblance to that of a sheep. It is a bottom-feeder and lives on shell-fish and small crustaceans, especially barnacles, and also on seaweeds. The spawning period is from March to June. Artificial propagation of it is irregularly carried on by the United States Fish Commission.

The same name is given in the West to the fresh-water drum (*Aplodinotus grunniens*) of the Mississippi Valley, a large sciænid fish which in Texas and Louisiana is well liked, but in the North is not eaten. It reaches a weight of 50 or 60 pounds, and is silvery gray or dusky with obscure oblique streaks on the sides. It is also called 'gaspergou,' 'croaker,' 'white perch,' and by other local names. Consult Goode, *Fishery Industries*, sec. i. (Washington, 1884).

SHEEPSWOOL. A Florida commercial sponge (*Spongia gossypina*), regarded as the best of that region. See SPONGE.

SHEEP-TICK. See SHEEP-LOUSE; FOREST-FLY; TICK.

SHEERNESS'. A seaport and naval arsenal in Kent, England, in the northwestern part of the Isle of Sheppey, at the confluence of the Thames and Medway, 11 miles east-northeast of Chatham (Map: England, G 5). It consists of four divisions: Blue-Town, Mile-Town, Marine-Town, and Westminster. The dockyard was founded by Charles II. It covers 60 acres, comprising wet and dry docks, storehouses, official residences, and naval barracks. An extensive oyster-fishery is carried on in the vicinity. At Garrison Point is the residence of the port admiral. There are a coast guard station and military barracks. Grain, seeds, and oysters are exported. Sheerness was captured by the Dutch under De Ruyter in 1667, and here the mutiny of the Nore originated in 1798. Population, in 1891, 14,500; in 1901, 18,300.

SHEF'FIELD. A manufacturing city in the West Riding of Yorkshire, England, picturesquely situated on several hills that slope toward the confluence of the rivers Sheaf and Don, 165 miles north-northwest of London, and 41 miles east of Manchester (Map: England, E 3). It possesses many fine public buildings, such as the original parish church, erected in the reign of Henry I., 240 feet long by 130 feet broad; Saint Mary's Catholic Church, surmounted by a tower 200 feet high; the town-hall (erected 1891); cutlers'

hall; corn exchange; the market-hall, or Norfolk market, etc. There are extensive botanic gardens, and a fine cemetery about a mile from the town; numerous educational establishments, such as the free grammar school, the collegiate school, the Wesley College, a Lancasterian and many national schools, free writing-schools, school of art, free library, besides denominational schools, Saint George's Museum, founded by Ruskin, the Mappie Art Gallery, and a mechanics' institution, established in 1832. The mechanics' library (1828) is now merged into the free library, and there is also the Sheffield Library.

The Albert Hall, erected in 1873, is a commodious building, which seats 3000 people. The municipality was the first in England to operate its tramways; it also owns its electric lighting and power plant and markets, provides artisans' dwellings, baths, free libraries, and recreation grounds, and supports technical education. As far back as the time of Chaucer, Sheffield was noted for the manufacture of cutlery; an endless variety of articles of every description is produced. Knives, silver and plated articles, white-metal goods, coach-springs, spades, spindles, hammers, files, saws, boilers, stoves, grates, buttons, and bicycles are among the leading articles. After 1871 the introduction of the manufacture of armor-plates, railway springs, tires, and rails gave a remarkable impetus to the growth of the town. Although a very ancient town, its history is comparatively uneventful. It received a charter from Edward I. Mary, Queen of Scots, spent twelve years of her captivity in the castle. During the Civil War the town was seized by the Parliamentarians, abandoned to the Earl of Newcastle, recaptured, and the castle demolished in 1644. In 1893 Sheffield was constituted a city. Five members are returned to Parliament. Population, in 1891, 324,200; in 1901, 380,700. Consult Gatty, *Sheffield, Past and Present* (London, 1873).

SHEFFIELD, JOHN, Duke of Buckingham and Normanby (1649-1721). See BUCKINGHAM AND NORMANBY.

SHEFFIELD, JOSEPH EARLE (1793-1882). An American merchant, born at Southport, Conn. At the age of fifteen he entered commercial life at Newbern, N. C., and afterwards removed to Mobile, Ala., where he amassed great wealth and became one of the largest cotton shippers in the country. He returned to Connecticut in 1835, and became largely interested in the promotion and construction of new railroads. For many years he was president of the New Haven and Northampton Railroad, and he was one of the organizers of the New York, New Haven and Hartford line. Through his efforts and by means of his munificence the scientific department of Yale was reorganized and established on its own foundation as a separate school of the university under the name of the Sheffield Scientific School, to which he gave more than $1,000,000.

SHEFFIELD PLATE. See PLATE, SHEFFIELD.

SHEFTCHEN'KO, TARAS GRIGORYEVITCH (1814-61). The greatest poet of Little Russia. He was born in serfdom in the Government of Kiev. He was, upon his own urgent request, apprenticed to a house decorator, whom he accompanied to Saint Petersburg in 1833. Some young writers took a great interest in him and helped him in his struggle for an education. He became the pupil and comrade of Bryuloff at the Academy of Design, from which he graduated in 1843. In 1840 he published a collection of poems under the title of *Kobzár*. *Nikita Hayday* and *Haydamaki* followed in Russian. In 1843-47 he wrote *Naymitchka* ("The Hired Girl"), *Nevolnik* ("Prisoner"), *Ivan Huss*, etc., which made him famous. In 1846 he became instructor in drawing at the University of Kiev, but a year later was arrested for political reasons and sent to Orenburg as a private soldier. Pardoned after ten years, he was permitted to settle in the capital in 1858. He always used the vocabulary of his people, without the literary artificialities so common among his colleagues, and his poems, even more than those of Kolstoff (q.v.), are an artistic embodiment of popular songs. His complete works were published at Prague in 1876, in two volumes, with numerous biographical notices, one being contributed by Turgenieff. Consult: Obrist, *T. G. Szewczenko* (Czernowitz, 1870); *Westminster Review*, July, 1880.

SHE (or **SHIH**) **HWANG-TI,** shĕ'hwäng'-tē' (B.C. 259-210). The name by which Prince Ching (or Cheng), the putative son of Chwang Siang Wang, ruler of the feudal State of Ts'in, is known in Chinese history. In B.C. 246, when only thirteen, he succeeded to the throne of Ts'in, then all but paramount, and remained for several years under the tutelage of a wily adventurer named Lü Puh-wei, regarded by Chinese critics and historians as his father. Under his advice the subjugation of the feudal princes, who still remained faithful to the House of Chow, was continued with vigor, and succeeded so well that in B.C. 221, the 26th year of his reign, the ruler declared himself the sole master of China, assuming the title Shih Hwang-ti, or 'First Emperor,' with whom everything should begin and from whom everything should date. The feudal system was abolished, the whole country as it existed then was divided into 36 provinces, and Hien-yang, near the present Singan-fu, in Shensi, became his capital. He ordained, under penalty of branding and four years' service on the Great Wall, that all books except those on agriculture, medicine, and divination should be delivered up to be burned. Four hundred and sixty scholars, who protested, were buried alive. The Emperor constructed roads and canals, erected many fine buildings, and, to protect the country from the inroads of the Huns and other barbarians, he constructed the Chinese Wall (q.v.).

SHEIK, or **SHEIKH,** shāk *or* shēk (Ar. *shaikh*, old man). A title of respect among Mohammedans. It is applied to the chief of a Bedouin tribe, the head man of a village (*Sheikh-ul-balad*), or one of the higher order of religious preachers; also, in general, to men fifty years of age or older. The *Sheikh ul-Islam* is the Grand Mufti or head of the Mohammedan Church in the Turkish Empire. See MUFTI.

SHEIL, shēl, RICHARD LALOR (1791-1851). An Irish orator and dramatist. He was born near Waterford; graduated at Trinity College, Dublin; studied law and was called to the bar in

1814. In 1822 was printed the first of his *Sketches of the Irish Bar*, a keen and witty picture of the life and manners of the time. The next year he joined the 'Catholic Association,' and in 1825 was sent to oppose its suppression as joint advocate with Daniel O'Connell before Parliament. He soon became known as a political agitator and brilliant orator; was elected to Parliament in 1829; aided O'Connell in the Repeal agitation, but, changing his position, took office under the Melbourne Ministry, and in 1850 was sent to the Tuscan Court as British Ambassador. He died at Florence. He wrote several tragedies, of which the most successful were *The Apostate* (produced at Covent Garden in 1817) and *Evadne* (1819). Consult McCullagh; *Memoirs of Richard Lalor Sheil* (London, 1855).

SHEK'EL (Heb. *sheqel*, from *shāqal*, Ar. *thaqala*, Assyr. *shāqal*, to weigh). An ancient weight and monetary unit. According to the system employed by the Babylonians 60 shekels were equal to one mina, and 60 minas to one talent. The weight of the shekel in the 'common' standard was about 126 grains, or, according to a system in which double weights were used, 252 grains; and according to the 'royal' standard 130 or 260 grains. For weighing precious metals, a talent of 3000 and a mina of 50 shekels were employed; for silver, to adjust the ratio to gold, the shekel was taken as 168 or 336 grains. In Phœnicia a silver shekel of about 112 (or 224) grains was employed. Among the Hebrews the 3000-shekel talent and 50-shekel mina were used. (Cf. Ex. xxxviii. 25-26.) The shekel was subdivided as follows: a half shekel was called a *beha'*, a twentieth part of a shekel a *gērāh*. The Hebrew gold shekel had the same weight as the 'common' Babylonian shekel; the silver shekel was the same as the Phœnician silver shekel. The intrinsic value of the Hebrew (heavy) gold shekel was somewhere near $10, and of the silver shekel somewhat less than 75 cents. The Jews did not actually coin money before the time of Simon the Maccabee (died B.C. 135), to whom Antiochus VII. gave the power of so doing (I. Macc. xv. 6), and it has been doubted whether this right was actually exercised before the time of Simon's successor, John Hyrcanus. Consult: Madden, *Coins of the Jews* (London, 1881); the Hebrew archæologies of Nowack and Benzinger; and the article "Money," by Kennedy, in the *Hastings Bible Dictionary*, vol. iii. (New York, 1900).

SHEKINAH, shê-kī'nâ (Late Heb. *shĕkīnāh*, from *shākan*, to reside or dwell). A term that belongs to Jewish theology of the period after the close of the Hebrew canon and was adopted by early Christian writers, expressing the presence of the divine majesty in heaven, among the people of Israel, or in the sanctuary. The origin both of the term and of the idea is due to the tendency of post-exilic Judaism to avoid conceptions of God that seemed to attribute to Him human qualities or to apply limitations of any kind to His being. This led naturally to a view which removed the Deity from any direct contact with this world, and which kept Him, as it were, aloof—separated from mankind by a wide chasm, which, however, was in a measure bridged over by intermediary hypostases, such as the 'wisdom' in the Book of Wisdom and the Philonian Logos or 'Word of God,' as something distinct from God Himself. The Shekinah belongs to the same class of ideas. In its most specific sense, the Shekinah idea is derived from descriptions of Yahweh in the Old Testament, such as those which represent Him as manifesting His presence by the descent of a cloud over the tabernacle (Ex. xl. 34). Similarly, a cloud rests on Mount Sinai for six days, and it was from the cloud that Yahweh on the seventh day called to Moses to ascend (Ex. xxiv. 12). The term used to describe this Divine presence is *shākan*, 'to rest' ("the glory of Yahweh rested on Mount Sinai"), from which Shekinah is a direct derivative. Hence Shekinah became the term expressive of the Divine presence, and in the Jewish Targums (c. second century A.D.), where the term is first encountered, Shekinah is used as the equivalent of the Divine Being and served as a means of disguising such anthropomorphic expressions as Yahweh 'sitting upon the cherubim' (I. Sam. iv. 4, etc.), or Yahweh dwelling in a certain place. In all such passages the Targum introduces the term Shekinah. It was a natural process that led to the personification of the Shekinah, as something distinct from God Himself, and this meaning is implied in the Talmudical view which makes Shekinah the source of inspiration, a kind of spirit sent out by God and carrying out His orders. As an active force the province of the Shekinah extends to Sheol, and when the wicked ascend out of Sheol, the Shekinah is pictured as marching at their head. The Shekinah accompanies Israel to Babylon, and indeed, according to the current view, is inseparable from God's people, although, in contradiction to this idea, it is maintained that the Shekinah was not visible in the second temple, while others maintain that after the destruction of the temple by Titus the Shekinah rested behind the remaining western wall. Such contradictions illustrate at once the vagueness and variety of the conception regarding the Shekinah itself. In the New Testament and the later Apocryphal literature we find the Shekinah idea frequently introduced, the Greek word employed for it being *doxa*, literally 'glory.' The term is used for God Himself, while phrases like 'glory of the father' (e.g. Rom. vi. 4) and the 'spirit of glory' (I. Peter iv. 14) point likewise to the familiarity of the readers with the term and conception of the Shekinah. The conception lent itself likewise to mystical interpretations, and hence in the Cabbala the Shekinah, still more completely personified than in Rabbinical and early Christian writings, plays an important rôle. Consult: Weber, *Jüdische Theologie* (Leipzig, 1897); Langen, *Judenthum in Palästina zur Zeit Christi* (Freiburg, 1866); Gfrörer, *Urchristenthum* (Stuttgart, 1838).

SHEL'BURNE, WILLIAM PETTY FITZ-MAURICE, Earl of (1737-1805). An English statesman. He was born in Dublin; received his early education at Christ Church, Oxford (1753), but left without a degree, intending to follow a military life. He returned from the Continent, a colonel, to enter the Commons, in 1761, but his father's death in the same year transferred him to the House of Lords. He entered George Grenville's Administration in 1763, at the head of the Board of Trade. Before the close of the year he became a member of the opposition and a devoted follower of the elder Pitt. In Chatham's second Ministry (1766) Shelburne became Secretary of State for the Southern Department, but,

opposed to the measures of the Cabinet in regard to the American colonies—in 1765 the Stamp Act, the Regulating Act of the following year, and the coercive measures of 1768—hated by the King, denounced by his colleagues, he resigned in the latter year, and became a bitter opponent of the King's and Lord North's policy. He favored conciliation, was for withdrawing the troops from America, and, as late as 1781, said he preferred that the colonies should become free if the only way to restore them to English rule was by force of arms. Upon the fall of Lord North's Ministry in 1782, George III. sent for Shelburne, and proposed that he should form a Government. He declined, not being the head of a party, and was sent by the King to the Marquis of Rockingham with an offer of the Treasury, himself to be one of the Secretaries of State. Upon the death of Rockingham in the same year the King sent at once for Shelburne, and offered him the Treasury, which he accepted without consulting his colleagues. Fox thereupon resigned, and Shelburne introduced William Pitt, then only twenty-three, into office as his Chancellor of the Exchequer. Shelburne's Ministry, on the occasion of the King's announcement of his determination to concede the independence of the American colonies, found itself outvoted by the coalition between Fox and Lord North. Shelburne resigned, and never held office afterwards. After retiring from public life he indulged his tastes in the adornment of Lansdowne House. Here he collected a splendid gallery of ancient and modern pictures, together with a valuable library. Consult Fitzmaurice, *Life of William, Earl of Shelburne* (London, 1875-76).

SHEL'BY, Isaac (1750-1826). An American soldier, the first Governor of Kentucky, born near Hagerstown, Md. Before he was twenty-one he was elected deputy sheriff of Frederick County, Md., but in 1771 removed with his father to the site of the present Bristol, Tenn., and in 1774 served as a lieutenant at the battle of Point Pleasant. In 1776, during the Revolutionary War, he became a captain, and commissary-general of the Virginia forces; in 1780 was appointed colonel in the North Carolina militia, and on October 7th served with great distinction at the battle of King's Mountain, which action he seems to have planned. He was a member of the North Carolina Legislature in 1781-82, serving at the same time in the Southern campaign under General Greene. Settling within the present State of Kentucky in 1783, he was instrumental in effecting a separation from Virginia, sat in the State Constitutional Convention in 1791, and from 1792 to 1796 was the first Governor of the State, serving a second term from 1812 to 1816. With 4000 Kentucky volunteers, raised by himself, he joined General Harrison early in 1812, and rendered the greatest service at the battle of the Thames (q.v.). He retired to private life after the war.

SHEL'BYVILLE. The county seat of Shelby County, Ind., 26 miles southeast of Indianapolis, on the Blue River, and on the Cleveland, Cincinnati, Chicago and Saint Louis, and the Pittsburg, Cincinnati, Chicago and Saint Louis railroads (Map; Indiana, D 3). The high school building, the court-house, city hall, and the Carnegie Public Library are noteworthy. Forest Hill Cemetery and the bridges across Blue River are other features. Agriculture is the leading industry in the district. The city has extensive manufacturing interests, the products including furniture, flour, brick, carriages, glue, soda founts, baking powder, mirrors, novelties, and lumber. The government is vested in a mayor and a council, elected every two years. Population, in 1890, 5451; in 1900, 7161.

SHELBYVILLE. The county seat of Shelby County, Ky., 30 miles east of Louisville, on the Southern, the Louisville and Nashville, and the Chesapeake and Ohio railroads (Map: Kentucky, F 2). It has Science Hill School for girls and the Shelbyville Female College. This city is in a fertile agricultural country, and is the centre of a large tobacco trade and of important cattle-raising and horse-breeding interests. There are tobacco warehouses, grain elevators, and manufactories of flour and lumber products. Population, in 1890, 2679; in 1900, 3016.

SHEL'DON, Charles Monroe (1857—). An American clergyman, born at Wellsville, N. Y. He graduated at Brown University in 1883 and at the Andover Theological Seminary three years later. In 1889 he became pastor of the Central Congregational Church at Topeka, Kan. In 1900 he conducted a Topeka daily newspaper for one week in accordance with a policy which he conceived to be in keeping with the Christian religion. The undertaking gained very wide publicity. Among his numerous publications are: *Robert Hardy's Seven Days* (1892); *The Crucifixion of Philip Strong* (1893); *His Brother's Keeper* (1895); *In His Steps* (1896), which attracted widespread attention and aroused much criticism; *The Redemption of Freetown* (1898); and *Who Killed Joe's Baby?* (1901).

SHELDON, Gilbert (1598-1677). Archbishop of Canterbury. He was born at Ashbourne, Derbyshire. He graduated from Trinity College, Oxford, in 1617, and became fellow of All Souls', and was ordained in 1622. His earliest patron, the Lord Keeper, Thomas, Lord Coventry, whom he served as domestic chaplain, secured for him the prebendaryship of Gloucester (1632), and introduced him to the King, for whom he became chaplain after filling a number of minor vicarages. In 1634 he was elected warden of All Souls' College, Oxford.

He supported the Royalist cause throughout the Commonwealth period, at the beginning of which he was ejected from his wardenship and imprisoned with Dr. Henry Hammond (q.v.). He was released in a few months and spent the time of Cromwell's ascendency in retirement in Staffordshire and Derbyshire, whence he sent pecuniary support as well as admonition to the exiled Charles II. In 1659 he was reinstated in his wardenship, and at the Restoration was made dean of the Chapel Royal. In 1660 he became Bishop of London, and in 1663 succeeded Dr. Juxon as Archbishop of Canterbury. In 1667 he was made chancellor of Oxford, but was never installed, nor did he ever visit Canterbury for the ceremony of installation as Archbishop. He made many notable public gifts, among them the 'Sheldonian Theatre' at Oxford. He also built the library at Lambeth Palace, and contributed £2000 toward rebuilding Saint Paul's Cathedral after the great fire. Consult his *Life* in Wood's *Athenæ Oxonienses*, also Burrowes' *Worthies of All Souls'* (Oxford, 1874).

SHELDRAKE, or **SHIELDRAKE** (from *shield* + *drake;* so called in allusion to the coloration of its plumage). A large and handsome goose-like duck (*Tadorna cornuta*), known throughout all Europe and Asia, representing a genus containing many East Indian and Australasian species related to the tree-ducks. It nests in rabbit-burrows, or holes in soft soil, whence in some places the sheldrake receives the name of burrow-duck. The sheldrake is capable of being tamed, and breeds in domestication. Its note is a shrill whistle. Its flesh is coarse and unpalatable, but the eggs are usable. Consult Newton, *Dictionary of Birds* (London, 1893-96). In America the name is sometimes given to the merganser (q.v.).

SHELIFF, shĕl'ĭf *or* shē-lēf (ancient *Chinalaph*). The chief river of Algeria (q.v.). It rises in the Angad Desert, and after a course of 400 miles flows into the Mediterranean near Mostaganem.

SHELL. See PROJECTILES.

SHEL'LABAR'GER, SAMUEL (1817-96). An American Congressman, born in Clark County, Ohio. He graduated at Miami University in 1841, and was elected to the Legislature in 1851. In 1861 he became a member of the National House of Representatives, and he was returned to the Thirty-ninth, Fortieth, and Forty-second Congresses. He was especially active in the reconstruction debates, and made a remarkable reply to Raymond, who had upheld the reconstruction policy of President Johnson. Later Shellabarger introduced that section of the Reconstruction Act of March 2, 1867, which provided that the States recently in rebellion should, until restored by Congress to their normal relations with the Union, be governed provisionally under the paramount authority of the United States, and that no person should be deprived of the right to vote because of color. In 1871 he reported to the House and managed on the floor the bill which, in an amended form, was finally passed as the famous 'Ku-Klux Act.' In 1869 he served as Minister to Portugal, and he was a member of the Civil Service Commission appointed by President Grant.

SHELLAC. See LAC.

SHEL'LER, ALEXANDER MIKHAILOVITCH (1838—). A Russian author, born at Saint Petersburg, and educated in that city. Interested in popular education, he founded a school for the poor which was suppressed by the Government in 1863. He published his first verses in that year, in 1864 the novel *Gnilyia Bolota* ("Dank Marshes"), and afterwards many other works of fiction. The most successful are: *Bread and Amusements; When Wood is Cut Splinters Fly;* and *The Sins of Others.* He also published an important *History of Communism,* and in 1877 became editor of the *Zhivopisnoe Obozrenie.*

SHEL'LEY, HARRY ROWE (1858—). An American composer, born at New Haven, Conn. He studied with Gustav J. Stoeckel at Yale College, with Dudley Buck, Vogrich, and Dvořák, in New York, and subsequently completed his musical education in London and Paris. He occupied at different times the positions of organist of the First Church at New Haven, organist of Dr. Storr's church in Brooklyn, and organist of the Fifth Avenue Baptist Church of New York. In 1899 he took charge of the classes in theory and composition at the Metropolitan College, New York. Among his works are: songs, duets, ballets, mixed and male choruses; a sacred cantata, "The Inheritance Divine," a "Te Deum," and other church music; a pianoforte solo, "Dance of Egyptian Maidens," "Evening Prayer," "Romance," "March of the Centuries," and a number of selections for the organ.

SHELLEY, PERCY BYSSHE (1792-1822). An English revolutionary and lyric poet of the highest rank. Shelley was of old English stock. His grandfather, Bysshe, who was born in America and on his removal to England as heir to a small landed estate enriched the family by wealthy marriages, was made a baronet in 1806. Shelley, the eldest child of Timothy and Elizabeth (Pilford), was the hope of this new establishment. He was born at Field Place, Warnham, near Horsham, England, on August 4, 1792. He studied first under the Rev. Thomas Edwards, of Horsham, then in a middle-class school known as Sion House Academy, near Brantford, also kept by a clergyman named Dr. Greenlaw. At this school the sensitive boy was persecuted by his fellows to such an extent that he developed a fierce hatred of oppression. At the same time he began to love science ardently, although his temperament was romantic rather than scientific. At the age of thirteen he went to Eton, where he again showed his hatred of tyranny. In October, 1810, he went to University College, Oxford, where his father had been before him. The boy displayed literary precocity, and his family indulged him in a taste for early publication; at Eton he had published *Zastrozzi,* a wild romance, and at Oxford he wrote a second tale, *St. Irvyne,* and various ventures in verse. After a scant six months' residence he was expelled from the university on account of a tract, *The Necessity of Atheism,* which he had published and circulated. Though he was only a youth of eighteen, English radicalism of the stripe of Godwin's had declared itself in him in many ways; and before his faculty for verse had ripened or manifested itself with any distinctness, his mind was given to materialistic and individualistic ideas, projects of social and political reform, and to their advocacy in prose tracts. He carried his independence into his actions. At this youthful time his conduct was undisciplined by judgment, and his mind was unsettled in intellectual principles. He was by nature impulsive and by habit uncontrollable; his ardency showed itself by quick execution as well as by emotionalism. His home was never a comfortable abiding place for him, and disagreement with his family, stolid and conventional people, was an increasing factor until it brought about complete alienation. His expulsion from Oxford was followed the next summer by a romantic marriage, one rather of pity than of love, with the sixteen-year-old daughter of a retired London tavern-keeper, Harriet Westbrook, with whom he had become acquainted through his sister. They eloped and were married in Edinburgh, and thereafter lived a wandering and debt-harassed life in different parts of England and in Ireland, whither Shelley went in 1812 with a view to political agitation of which his *Address to the Irish People, Proposals for an Association,* and his public speech at Dub-

lin on O'Connell's platform are memorials. He became a subject of Government surveillance as a dangerous character. His position was improved by the financial arrangements made when he came of age in 1813, but his domestic life had become troubled and coldness had come to exist between husband and wife. In July, 1814, he eloped with Mary Godwin, putting in practice the principles he held and dealing openly with Harriet, for whom he made provision; but misfortune followed, and in 1816 Harriet committed suicide by drowning, and a few months later their two children were denied to Shelley's custody by the famous decision of Lord Eldon, on the ground that Shelley was an atheist. Shelley soon after left England and spent the remainder of his brief life in Italy, going from city to city, finally settling in the neighborhood of Pisa. July 8, 1822, he sailed from Leghorn to Spezia, where he had settled for the summer. A squall overwhelmed the little craft in which Shelley was, and he was drowned. The body, which was thrown up on the shore at Viareggio, was burned and the ashes, except the heart, which was unconsumed, were buried in the Protestant cemetery at Rome. He had several children, of whom one only survived him, Percy, who inherited the title on his grandfather's death.

Shelley's works contain two easily distinguished strains: one, the propagandism of opinion which is associated with his "passion for reforming the world"; the other, the expression of his personality, his essential being, in the creation of lyrical beauty by spontaneous and half-unconscious art. He adopted from early youth radical formulas of Anglicized French thought, certain beliefs regarding the perfectibility of man, the evil of social institutions like property and marriage, and the inviolability of the individual. He had an active philosophical mind and an active philanthropic spirit: to these two, and to the necessity for expression inherent in his powerful genius, his first works were chiefly indebted. Three times he did, in effect, utter his whole mind. In *Queen Mab* (c.1813), his first important poem and the one by which he was long the most widely known, he put forth all he had learned and thought. In it are amalgamated his first essays in verse and prose to make a whole view of the world and of society. In *The Revolt of Islam* (1817-18), a more imaginative and elaborate poem, setting forth the moral revolution of the world under the form of a romantic epic, he did the same thing again. In *Prometheus Unbound* (1820), though in forms of much higher poetry, he achieved the task still a third time. To say that in the social part of these great works he put Godwin's philosophy into verse is a very imperfect description. The principles of Godwin were no more than the chrysalis that released the butterfly; the poet transformed the philosophy of his teacher and it came forth as poetry with a different potency and meaning. Yet the intellectual units of his thought were to be found in English radicalism. Shelley, however, never stiffened into any formula, but constantly and increasingly responded to fresh knowledge. The most efficient new element in his earlier development was Greek. In *Queen Mab* and *The Revolt of Islam*, this is not felt; in *Prometheus Unbound* it is the soul of the poem. Philosophically the study of Plato changed him from a materialistic atheist, of a Lucretian type, to a pantheist, though the term as applied to him is a crude one; and under Æschylus he became a master of choral myth, and under the impulse of Greek imagination generally, a symbolic poet. In becoming less didactic and more imaginative in style, less Latin and French and more Greek and Italian in inspiration, less definitely dogmatic and more intuitive, prophetic, and personal in method, he changed from a respectable minor poet of intellectual and descriptive power and emotional abandon to a great lyrical master of the imagination. Mystery is a constantly increasing element in his work, and almost measures his growth; in thought it plunges him into depths which he describes as speechless, and in the sensuous world it fills the atmosphere of the verse with light, color, and fragrance, and embodies forms of nature and idealities of character which overpower and distract his readers. This presence of mystery is most obvious in the series of works which are more personal and disengaged from any preoccupation with the present world. In *Alastor* (1815) it is not sufficient to cloud the narrative or the picture, but is a mood; in such poems as *The Sensitive Plant* (1820), and *The Witch of Atlas* (1820), apparently simple in fable, the evasiveness of the meaning is constant, like a retreating echo in the woods; in *Epipsychidion* (1821) the mystery has made the poem one only for elect readers. In the *Adonais* (1821), which after *Alastor* and *Queen Mab* is probably most easily read in a popular way, the mystery, though deep and pervasive, goes naturally with the theme of early death, in which both Keats and Shelley are the answering chords. So, too, on the purely intellectual side, the prose *Defense of Poetry* (1821, pub. in 1840) discloses to a careful reader the ground of mystery in all Shelley's later thinking. Apart from the major works of the poet stand the brief lyrics and the odes, and the many fragments, which are also divided between a predominant social interest, as the *Ode to Liberty*, and a personal inspirational interest, as the *Lines to an Indian Air*. In his growth he never lost touch with the present world, of which fact *Hellas* (1821) and *The Masque of Anarchy* (1819, pub. in 1832) are capital examples. In his dramatic attempts, seeking objective artistic results by effort, he was off the line of his genius, and neither *The Cenci* (1819) nor *Charles I.*, of which only a few scenes exist, reaches an excellence comparable to that of his other achievements. The most obvious quality of his verse, melody, is so readily felt that he is placed without any division of opinion among the great lyrical poets of England with the first. In other respects, though his fame is now established for his century, in the minds of many he is regarded as vague in meaning, hysterical in feeling, loose and diffuse in style. He was the poet of abstract and ideal love, and set forth under that conception the concrete beauty and order of the universe as he saw it, and of man's life as he desired it to be.

His personal character was such as to draw about him many devoted friends, of whom some, as Leigh Hunt, Byron, Peacock, Trelawny, and Horace Smith, are well known; and he also attracted women, who are chiefly known by the verse in which, as in life, he idealized them. The charm he exercised is best seen in their own words. In fact, every one who knew him seems to have loved him. He was by nature generous, and gave

so liberally of his scanty means as to keep himself always poor. He was constant in friendly kindness to all associated with him, and he at all times went about doing charity among the poor. He was violent in indignation against actual wrong; but gentleness characterized him. His later years were full of sadness from one or another cause, and though he died young there was to him nothing premature in his death. His verse and prose have been published in eight volumes by Forman (London, 1876-80); the poems alone by W. M. Rossetti (ib., 1870, 1878, 1888), by Dowden (ib., 1899), and by Woodberry (Cambridge, 1892, 1903). Consult also: Dowden, *Life* (London, 1896); and for the view of his contemporaries, Hogg, *Life* (ib., 1858); Peacock, *Memoirs* (ib., 1847); Leigh Hunt, *Autobiography* (ib., 1860); Trelawny, *Records* (ib., 1858).

SHELLEY'S CASE, RULE IN. A rule of law relating to estates in real property, declared by the courts in an English case decided about 1591. The principle involved was known to the English law before that date. Briefly stated, the rule provides that where an estate of freehold is conveyed to a person, with a remainder to his heirs, the latter is a clause of limitation and not of purchase, that is, the ancestor takes the estate included in the cause, and the heirs take nothing. The rule became a part of the common law and prevailed at one time in the United States, but most of the States have abolished or modified it by statute, and give effect to an express remainder to heirs. Consult: Kent, *Commentaries;* Preston, *Essay on the Quality and Quantity of Estates* (Philadelphia, 1843).

SHELL MONEY. A primitive medium of exchange which consisted of certain sea-shells in their natural condition, or nearly so, or of pieces of sea-shells formed into beads, or otherwise shaped. In the former class fall the money cowry (see COWRY), the dentalium, and several other shells; and in the latter the wampum of the Eastern United States and currencies of the Pacific Coast. All money shells were first prized for their rarity and beauty, and only later became a medium of exchange. On the coast of Puget Sound and northward the tusk-shell (Dentalium) prehistorically served the purposes of money among the Indians of a large region, and maintained this value and function until very recent times.

The shell money of the second class was more nearly a true coinage, since it derived its value from the art and labor which had been expended upon it and the difficulty of counterfeiting. As late as 1882, at least, the local trade of the Solomon Islands was carried on by means of flat beads, made from certain small sea-shells which were ground to the proper shape by the women. As the proper grinding of these was a slow and skillful process, no more was made than was needed, and the recognized relative value was steadily maintained. Very similar to this was the wampum (q.v.), which was found in use among the tribes of the eastern half of North America at the time of its discovery by Europeans. Wampum circulated at well-understood rates of exchange throughout the interior as far as the Saskatchewan River and the Rocky Mountains. Certain coast tribes favorably situated (notably the Narraganset) made wampum as a regular occupation. The best and most was made between Cape May and Cape Cod. These beads were of two kinds—a more precious sort formed only from the violet-colored muscle-scar in the interior of the quahog (*Venus mercenaria*), and a white sort, or 'seawan' of inferior value, commonly made from the central column of one or the other of the large spiral winkles or conchs (q.v.). The inferiority of the latter kind lay in the greater ease with which it could be produced. The wampum, sometimes carried loose, but usually strung upon sinew threads in lengths of approximately six feet, was a true currency; the merchants and traders, both Dutch and English, at once adopted this native money, and for many years used it in preference to European coins not only in Indian trading, but in affairs between themselves. Seeing this new use, the Indians made an increased quantity, and, worse, the white man, using machinery, began to turn out cheaply great quantities of shell beads. The result was a rapid depreciation of values, so that frequent enactments by the local governments were required to keep a fathom of wampum at par with designated numbers of pence or stivers. It finally disappeared not only because the Indians ceased to make it, but because they hoarded all they could obtain.

In California several forms of shell money circulated, each piece of a definite shape and carefully made by grinding down for one inferior kind ('hawok') some clam-shell, as Saxidomus, and for the other more valuable kind ('ullo'), abalone-shells. A great amount of this shell money was in circulation among the aborigines of California and Oregon previous to 1850; and it long continued to be held at a high valuation, measured in gold, among the Indians, and is still hoarded by the old men.

Consult: Ingersoll, in *Country Cousins* (New York, 1884), and the many historical sources of information mentioned by him; also several papers by R. E. Stearns in the publications of the United States National Museum. For the Pacific Coast, consult Powers, *Contributions to North American Ethnology*, vol. iii. (Washington, 1877).

SHELTON, THOMAS (fl. 1612). The first translator of *Don Quixote* into English. He is thought to have been the Thomas Sheldon who was entered at Oriel College, Oxford, in 1581. Shelton was later connected in some way with Lord Howard of Walden. In 1607 he translated the first part of Cervantes's famous romance from the Spanish edition issued in that year at Brussels. In 1612 the translation appeared and met with instant success. The anonymous translation of the second part (1620) is also Shelton's beyond reasonable doubt. Shelton was thus the first to introduce to Englishmen a romance which has really become a part of English literature, through imitation and absorption. But Shelton was not so accurate in his scholarship as some recent translators have been. Consult the reprint of his translation edited by Kelly (in "Tudor Translations," London, 1896). This translation is valuable especially because its quaint Elizabethan English gives the same flavor as the now archaic Spanish of Cervantes.

SHEM (Heb., name, or possibly an abbreviation of *Shemuel*, name of God). According to the Book of Genesis, the eldest of the three sons of Noah, from whom the whole world was re-

populated after the flood. The genealogies in the Table of Nations (Gen. x.) and in the line of Abraham (ch. xi.) are compiled from strata of most different ages, and it is impossible to obtain a harmonious view of them, or to accommodate them to our ethnical and political points of view, although archæology is fast contributing to their elucidation. According to ix. 26 et seq. Shem stands in the line of the religion of Jehovah, and x. 21 makes him particularly the ancestor of the Hebrews; hence it is argued that Shem originally represented Israel and the other two sons races in or about Palestine, and that a later tradition has amplified these terms into a world-wide connotation. Consult the commentaries on Genesis, especially Dillman (Eng. trans., Edinburgh, 1897) and Gunkel (Göttingen, 1902); Budde, *Urgeschichte* (Giessen, 1883). See SEMITES; SEMITIC LANGUAGES.

SHEMAKHA, shĕ-mä-kä′, or **SHAMAKHA.** A town in the Government of Baku, Russian Transcaucasia, situated at an altitude of 2265 feet, 75 miles west of Baku (Map: Russia, G 6). Its many ruins testify to its ancient importance. Population, in 1897, 20,000. Shemakha is mentioned by Ptolemy as Kamachia, and was the capital of the Khanate of Shirvan. Shemakha has suffered terribly from earthquakes, the most recent having been in 1902.

SHENANDOAH, shĕn′an-dō′â. A borough in Schuylkill County, Pa., 105 miles northwest of Philadelphia; on the Pennsylvania, the Lehigh Valley, and the Philadelphia and Reading railroads (Map: Pennsylvania, E 3). It has a free library in connection with the public schools. The Greek Catholic church here was among the first of the denomination in the United States. Shenandoah owes its importance to its situation among the richest anthracite coal fields in the State. The government is vested in a burgess, elected every three years, and a unicameral council, and in administrative officials, the majority of whom are appointed by the council. There are two systems of water-works, one owned and operated by the municipality. Shenandoah was laid out in 1862, and was incorporated in 1866, the charter then received being still in operation. The vicinity of the Philadelphia and Reading Railroad station here was the scene of rioting during the coal strikes of 1900 and 1902. Population, in 1890, 15,994; in 1900, 20,321.

SHENANDOAH, THE. A Confederate privateer which sailed from England to Bering Strait, captured ten New England whalers, and set fire to eight of them on June 28, 1865. This act was the last hostility of the Civil War.

SHENANDOAH RIVER. A river of northwestern Virginia, flowing 170 miles northeastward into the Potomac, which it joins at Harper's Ferry (Map: Virginia, G 2). It affords immense water power, and passes through a beautiful and populous valley between the Blue Ridge and the central Appalachian ranges. This valley was the scene of numerous military operations during the Civil War, and was laid waste by General Sheridan in the autumn of 1864. See WINCHESTER; CEDAR CREEK; EARLY; SHERIDAN.

SHÊNG-KING. See SHING-KING.

SHEN-SI, shĕn′sē′ (Chin., west of the defile; referring probably to the natural barrier and fortresses of Tung-kwan). A northern province of China, bordering on Mongolia (Map: China, C 4). Area, 67,400 square miles. It is divisible into two physically distinct regions of unequal area by the Tsing-ling ranges, with peaks from 5000 to 11,000 feet above sea-level. The larger portion lies to the north of these mountains, and consists of a great sloping plateau of loess of great natural fertility, draining eastward to the Hoang-ho and producing immense crops of wheat —the staple product of this region—and cotton, as well as kao-liang, pulse, millet, maize, peanuts, rape seed, and opium. Hemp and tobacco are also extensively cultivated. Owing to the porousness of the loess, rice cannot be raised. Agriculture is the chief industry. The chief river of the region is the Wei, a broad but shallow stream flowing from west to east along the foot of the northern range of the Tsing-ling mountains into the Hoang-ho. Coal is found in several places. The southern division, which is only half the size of the northern, is mountainous and well wooded, with many deep valleys and small but fertile, well-sheltered and well-watered plains. It is drained chiefly by the Han-kiang (q.v.). It produces cotton, tobacco, silk, and the different grains. Iron is found near the source of the Han, and the manufacture of steel of specially fine quality is extensively carried on in several places. Population, about 8,500,000. Capital, Si-ngan-fu, where the Governor-General of the two provinces of Shen-si and Kan-su resides.

SHEN'STONE, WILLIAM (1714-63). An English poet, born in Halesowen, Worcestershire. In 1732 he was enrolled at Pembroke College, Oxford, but he never took a degree. While at the university he published a volume of *Poems on Various Occasions*, containing the first version of the *Schoolmistress*. In 1741 appeared anonymously *The Judgment of Hercules*, which was followed the next year by the *Schoolmistress* in its complete form. Other poems were published in Dodsley's *Collections of Poems by Several Hands* (1748, 1755, 1758). In 1745 Shenstone came into possession of the estate of Leasowes, near Halesowen, where he amused himself at landscape gardening. His grounds, on which he expended his income of £300 a year, became famed through England. The *Schoolmistress*, written in the Spenserian stanza, has gained for Shenstone a secure, if humble, place in English poetry. The *Pastoral Ballad* is also very graceful. Dodsley collected Shenstone's works in verse and prose (3 vols., 1764-69). In the second volume is a description of Leasowes. Consult also: Dr. Johnson, *Lives of the Poets* (London, 1805); Graves (in a series of letters to Shenstone's friend, W. Seward), *Recollections of Shenstone* (London, 1788); *Poems*, edited by Gilfillan (Edinburgh, 1854); and Beers, *English Romanticism* (New York, 1899).

SHE-OAK. See CASUARINA.

SHEOL, shē′ōl (Heb. *shĕ′ōl*). A Hebrew word of frequent occurrence in the Old Testament. In the Authorized Version it is rendered 'the grave,' 'hell,' or 'the pit.' In the Revised Version the American committee substitute the Hebrew term *sheol* for this rendering. A derivation from a stem signifying 'to hollow out' has been suggested. Another view connects the word with the verb *shā'al*, 'to ask,' and makes it signify the 'place of oracles.' An Assyrian word *shualu* has

been found which appears to be the equivalent of the Hebrew sheol, though this view has not been accepted by the scholars (cf. Jastrow in the *American Journal of Semitic Languages*, vol. xiv., Chicago, 1898). In poetical language *sheol* is used as a designation of the tomb, but in reality its signification is the general gathering place of the dead. For the different ideas current concerning it, and the development, see the article HADES.

SHEP'ARD, CHARLES UPHAM (1804-86). An American mineralogist, born in Little Compton, R. I. He was graduated at Amherst in 1824, and later studied chemistry and mineralogy under the elder Silliman at Yale. In 1845 he returned to Amherst, taking the chair of chemistry and natural history, which he held until 1852. For the following twenty-five years he lectured on natural history, and in 1877 was made emeritus professor. Meanwhile in 1854 he was made professor of chemistry in the Medical College of the State of South Carolina, which chair he held until 1861. Professor Shepard was the author of a *Treatise on Mineralogy* (1855), and a *Report on the Geological Survey of Connecticut* (1837).

SHEPARD, EDWARD MORSE (1850—). An American lawyer and political leader, born in New York City. He graduated at the College of the City of New York in 1869, and entered the law office of Man & Parsons, with the latter of whom he afterwards formed a partnership. He took a deep interest in local politics, was appointed a civil service commissioner, and was for some years counsel to the Rapid Transit Commission. In 1901 he was the candidate of Tammany Hall for Mayor of Greater New York, but was defeated by Seth Low, the Fusion candidate. He published a number of books and pamphlets, including: *Martin Van Buren* (1888), in the "American Statesmen Series;" *The Democratic Party* (1892); *The Work of a Social Teacher* (1884); and *Dishonor in American Public Life* (1882).

SHEPARD, ELLIOTT FITCH (1833-93). An American lawyer and journalist, born at Jamestown, N. Y. He was educated at the University of the City of New York and was admitted to the bar in 1858. At the outbreak of the Civil War he formed the 51st New York Volunteers, known after him as the Shepard Rifles. He himself served as aide-de-camp to Governor Morgan of New York and commanded the depot of State volunteers at Elmira. For twenty years after the war he was a conspicuous member of the New York bar, and in 1876 founded the New York Bar Association. He founded the American Sabbath Union and took control of the Fifth Avenue stage line in New York City, in order to put a stop to its Sunday traffic. In 1881 he was appointed, with E. B. Shafer, a commissioner to revise the ordinances of New York City. In 1888 he acquired control and became editor of the *New York Mail and Express*, and under his management the character and influence of that journal were greatly improved.

SHEPARD, THOMAS (1605-49). An English Puritan divine. He was born at Towcester, near Northampton; graduated M.A. at Emmanuel College, Cambridge, 1627; became a preacher; was silenced for non-conformity, and emigrated to Boston, 1635. In 1636 he became pastor of the church in Cambridge as successor of the Rev. Thomas Hooker, after whom he was esteemed the most learned theologian in New England. He took prominent part in founding Harvard College and was also interested in missionary work among the Indians. Among his writings, published during his life, are: *New England's Lamentation for Old England's Errours and Divisions* (1645); *The Sound Beleever* (1645); and *Theses Sabbaticæ* (1649). An edition of his works in three volumes, with memoir, was published in Boston, 1853.

SHEPARD, WILLIAM (1737-1817). An American soldier, born near Boston, Mass. Entering the army at the age of seventeen, he served as captain under Sir Jeffrey Amherst from 1757 to 1763, taking part in the battles of Fort William Henry and Crown Point. During the Revolutionary War he participated in as many as 22 engagements, and attained the rank of colonel. Subsequently he became brigadier-general of the Massachusetts militia, and as such was conspicuous during Shays's Rebellion, defending the Springfield arsenal against the insurgents. He afterwards became major-general of militia, was a member of the Executive Council in 1788-90, and served in Congress from 1797 to 1803.

SHEPHERD DOG, or COLLIE. See SHEEP-DOG.

SHEPHERD KINGS. See HYKSOS.

SHEPHERD'S CALENDAR, THE. A pastoral poem by Spenser (1579) in twelve eclogues, one for each month. In the dialogues of the Shepherds, among whom Spenser appears as Colin Clout, questions of the day are discussed. Several are paraphrases of the eclogues of Clément Marot, and all show the influence of the classical pastoral poets.

SHEPHERD'S-PURSE (*Capsella*, formerly *Thlaspi*). An annual, very variable, and troublesome weed of the natural order Cruciferæ, found almost throughout the world upon almost all soils and in all climates. It attains heights ranging from 3 inches to 2 feet, with more or less pinnatifid root-leaves which spread closely along the ground. The flowers are white and diminutive. The pouch, from which the English name seems to be derived, is laterally compressed, and somewhat heart-shaped. The plant usually begins to flower and fruit as soon as it is an inch or two in height, continuing throughout the season. It can be eradicated by clean culture. The young leaves and flower clusters are often used as pot-herbs.

SHEPHERD'S WEEK, THE. Six satirical pastorals by John Gay (1714), meant to parody the insipid verse of the imitators of Vergil and Spenser. They are, however, such racy descriptions of actual country life that they have a distinct literary value.

SHEP'LEY, GEORGE FORSTER (1819-78). An American soldier and jurist, born at Saco, Me. He graduated at Dartmouth in 1837, studied law at Harvard, and for a time practiced in Bangor. In 1844 he settled in Portland, and from 1853 until 1861 he was United States district attorney of Maine. He entered the Civil War as colonel of the Twelfth Maine Volunteers, and in February, 1862, was given command of the Third Brigade in General Butler's army. After the fall

of New Orleans he was appointed its military commandant and mayor, but resigned this office in June to accept that of military Governor of Louisiana, which he held until the inauguration of a civil government in 1864. He commanded the Twenty-fifth Army Corps during a brief absence of General Godfrey Weitzel, and in 1865 he became Military Governor of Richmond, Va. From 1869 until his death he was United States circuit judge for the First Circuit of Maine.

SHEPPARD, JACK (1702-24). A notorious English criminal. He was born at Stepney and was originally a carpenter, but became a highwayman in 1720. His adventurous career, which includes two daring escapes from Newgate, has been popularized by a painting by Thornhill, by pantomimes, in a history written by Defoe (1724), and by a novel by Ainsworth (1839). He was hanged at Tyburn.

SHERATON, THOMAS (1751-1806). An English cabinet-maker and designer of furniture, born at Stockton-on-Tees. Almost entirely self-taught, he became a well-educated man, an excellent draughtsman with a thorough knowledge of geometry, as proved by the wonderful drawings and the minute directions for perspective drawing given in his book *The Cabinet-Maker and Upholsterer's Drawing Book* (1791), published in London, whither he had removed about 1790. Not remarkable as a practical cabinet-maker, his fame rests chiefly on his designs, which tended to replace the characteristics of earlier English cabinet work by a severer taste in lines and ornament. Besides the above-named work he published *The Cabinet Dictionary* (1803); *Designs for Household Furniture* (1804); and *The Cabinet Maker, Upholsterer, and General Artist's Encyclopædia* (1807, unfinished). Consult: Litchfield, *Illustrated History of Furniture* (London, 1892); Heaton, *Furniture and Decoration in England During the Eighteenth Century* (ib., 1890-93); and Morse, *Furniture of the Olden Time* (New York, 1902).

SHERBROOKE, shĕr'brụk. The capital of Sherbrooke County, Quebec, Canada, at the junction of the Saint Francis and Magog rivers, and on the Boston and Maine, the Canadian Pacific, the Quebec Central, and the Grand Trunk railroads, 101 miles east of Montreal (Map: Quebec, D 5). It has saw and grist mills, cotton and woolen mills, and manufactures of paper, machinery, flannel, and worsted goods, etc. Population, in 1891, 10,110; in 1901, 11,765.

SHERBROOKE, Sir JOHN COAPE (1764-1830). An English general, born in Nottinghamshire. He entered the army as an ensign in 1780; served in Nova Scotia and South Africa; assisted in the storming of Seringapatam, where he was wounded; and in 1805 attained the rank of major-general. He was second in command in Wellesley's campaign of 1809; fought at the Douro, at Talavera, and elsewhere in Spain; and in 1811 was made a lieutenant-general and was appointed Lieutenant-Governor of Nova Scotia. In 1814 he led into Maine an expedition which captured Castine and Belfast, defeated an American force at Hampden and forced them to burn the frigate *John Adams*, took Bangor, and occupied a considerable part of eastern Maine. In 1816 he was made Captain-General and Governor-in-Chief of all Canada, but in 1818 suffered a paralytic stroke and shortly afterwards returned to England, where he died.

SHERBROOKE, VISCOUNT. See LOWE, ROBERT.

SHERE (shēr) or **SHER** (shēr) **ALI,** ä'lē (1825-79). Ameer of Afghanistan. He was a younger son of Dost Mohammed (q.v.), whom he succeeded in accordance with his father's will as Ameer in 1863. The neglect to recognize him and carelessness in cultivating his friendship on the part of the viceroys of India turned him against the English. His throne was contested by his brothers and his nephew, but he overcame them all by 1869. It had been the policy of Lords Lawrence and Mayo to keep out of Afghan affairs, but Lord Lytton in 1878 adopted a more aggressive policy on the reception of a Russian embassy by the Ameer, and demanded that an English resident be admitted to Kabul. This brought on the second Afghan war, in the course of which, in December, 1878, Shere Ali left his country and took refuge in Turkestan, where he died in February, 1879. See AFGHANISTAN.

SHERIDAN, FRANCES (1724-66). An English novelist, the wife of Thomas Sheridan, the actor, and the mother of Richard Brinsley Sheridan, the statesman and dramatist. Her father was Philip Chamberlaine, a prebendary and archdeacon. She married in 1747. When only fifteen years old, she wrote a romance entitled *Eugenia and Adelaide*, which was dramatized many years later by her daughter. Helped by Samuel Richardson (q.v.), she brought out *Memoirs of Miss Sidney Bidulph* (1761, 1767), which was reckoned one of the best novels of the time. It was turned into French by the Abbé Prévost, the translator of *Pamela*. An Oriental tale called *The History of Nourjahad* (posthumous, 1767) was likewise successful and honored by translation. Mrs. Sheridan also wrote three comedies: *The Discovery* (1763); *The Dupe* (1764); and *A Journey to Bath*, containing Mrs. Twyfort, prototypical of the famous Mrs. Malaprop (q.v.) of *The Rivals*. Consult Alicia Lefanu, *Memoirs of Mrs. Frances Sheridan* (London, 1824).

SHERIDAN, PHILIP HENRY (1831-88). A distinguished American soldier, born at Albany, N. Y. He graduated at West Point in 1853. In May, 1862, he was appointed colonel of the Second Michigan Cavalry, and participated, with success, in the operations in north Mississippi. In July he was appointed brigadier-general of volunteers and given command of the Division and the Army of the Ohio, and on October 8th took a distinguished part in the battle of Perryville. At the battle of Stone River (or Murfreesboro) he commanded a division of the Army of the Cumberland, and by his stubborn resistance was instrumental in saving the Federal army from being routed. He was appointed major-general of volunteers early in 1863, took part in the pursuit of Van Dorn, and aided in the capture of Winchester, Tenn., June 27, 1863. In the battle of Chickamauga he maintained his reputation for daring, and later took a conspicuous part in the battles around Chattanooga, where he came under the personal observation of General Grant. In April, 1864, General Sheridan was transferred by General

Grant to Virginia and placed in command of the cavalry corps of the Army of the Potomac, and during May, June, and July, besides protecting the flanks of the army and reconnoitring the enemy's position, was engaged in eighteen different actions, including the battles of the Wilderness, Spottsylvania Court House, and Cold Harbor. His reputation for dash and daring was further increased by a raid lasting from the 9th to the 25th of May, in which he destroyed the railroad communications of the Confederates, captured Beaver Dam, and at the battle of Yellow Tavern defeated the Confederates under Gen. J. E. B. Stuart (q.v.), who was killed in the action.

In August, 1864, General Sheridan was placed in command of the Army of the Shenandoah, which was soon constituted the Middle Military Division. With this command he defeated General Early at Opequon Creek, Fisher's Hill, and Cedar Creek (October 19, 1864), and captured 5000 of his men and several guns. His dashing ride of twenty miles from Winchester to Cedar Creek (q.v.), to save his army from defeat, was one of the most brilliant exploits of his career. On September 10th Sheridan was made brigadier-general in the Regular Army, and in November was promoted to the rank of major-general. An act for which Sheridan has been widely censured was his terrible devastation of the Shenandoah Valley as a means of weakening the resources of the enemy. During the remainder of the war he continued to serve under Grant in Virginia, doing great service as a raider and destroyer of bridges, railroads, etc. He fought the battles of Waynesboro, March 1, 1865; Dinwiddie Court House, March 31st; and Five Forks, April 1st, which compelled Lee to evacuate Richmond and Petersburg, in all of which he displayed his usual military skill and courage. He participated in various minor actions, and was present at the surrender of Lee. In July, 1865, he received the thanks of Congress. At the close of the war he assumed command of the Department of the Gulf, and upon the inauguration of the reconstruction policy was appointed commander of the Fifth Military District (Louisiana and Texas), where he was known for his stern and vigorous enforcement of the reconstruction acts. With the election of General Grant to the Presidency and the promotion of General Sherman to be commander of the Army, Sheridan was raised to the rank of lieutenant-general. In 1870 he visited Europe to witness the Franco-Prussian War, and later commanded military divisions in the West and Southwest. During the political disturbances of 1875 in Louisiana, he was sent to New Orleans to maintain peace and order, in which capacity he maintained his reputation for severity and rigor as a military ruler. Upon the retirement of General Sherman in 1883, he succeeded to the chief command of the Army. He died at Nonquitt, Mass., August 5, 1888. He published *Personal Memoirs* (New York, 1888).

SHERIDAN, Richard Brinsley (1751-1816). An English dramatist and statesman, born in Dublin. He was the son of Thomas and Frances Sheridan (q.v.). In 1762 he was sent to Harrow, where he remained till 1768. Having won no distinction at school, he continued his studies with more zeal under private tutors. Sheridan had fallen in love with Miss Elizabeth Linley, a professional singer. Disliking the attentions of a Major Mathews, this young and lovely person made up her mind to seek refuge in a French convent. Sheridan took ship with her as a guardian. The pair were married by a priest in a village near Calais. On returning to England Sheridan had a duel with the furious Major, whose ill luck it was to have to beg for his life and afterwards to publish an apology in the *Bath Chronicle*. In a second duel on July 2, 1772, Sheridan was gravely wounded. Both his father and Mr. Linley objected to the newly made union, so Sheridan was sent off to Waltham Abbey in Essex, to study undisturbed. For a while he worked hard, being especially eager to master French and Italian, though he meant to be a barrister. On April 6, 1773, he was entered at the Middle Temple, and a week later he married Miss Linley, with the consent of her father, but the elder Sheridan called the alliance a disgrace.

In conjunction with a friend at Harrow, Sheridan had already published a metrical translation of the epistles of Aristænetus, had written fugitive verse of his own, and a comedy called *Jupiter*, which was refused by Garrick. Settling in London with his wife, he now turned to literature for support. *The Rivals* was first performed at Covent Garden Theatre on January 17, 1775, and it failed. Carefully revised, it was again put on the stage eleven days later, and it succeeded. This fine comedy was followed at Covent Garden by a farce called *Saint Patrick's Day, or the Scheming Lieutenant* (May 2, 1775), and the comic opera called *The Duenna* (November 21, 1775), which ran for seventy-five nights, a popularity until them unprecedented. In 1776 Sheridan, helped by his father-in-law and a common friend, bought out Garrick's share in Drury Lane Theatre, and two years later the share of Willoughby Lacy, Garrick's partner. The money for these purchases was raised mainly on mortgage. On September 21, 1776, Drury Lane was opened under Sheridan's management. The next year he produced an adaptation of Vanbrugh's *Relapse*, under the title of *A Trip to Scarborough* (February 24th), followed by his greatest comedy, *The School for Scandal* (May 8th). His later plays are *The Critic* (October 29, 1779), and *Pizarro* (May 24, 1799), adapted from Kotzebue (q.v.). Though not wholly admirable in structure, *The Rivals* and *The School for Scandal* are among the best comedies in English since the Elizabethan age.

Sheridan's wit and attractive personality had long made him conspicuous in London society. In 1777 he was elected to the famous Literary Club of Johnson and Burke. Through the influence of Fox he began a Parliamentary career in 1780. For his services to the opposition during the first two years, he was appointed Under-Secretary for Foreign Affairs under the Rockingham Ministry (1782), and Secretary to the Treasury under the coalition Ministry of the Duke of Portland (1783). For his speeches against the American war, the Congress of the United States wished to present him with £20,000. The gift was gracefully declined. His greatest speeches were against Warren Hast-

ings. In the first (February 7, 1787) he brought before the House of Commons the charges against the Governor-General of India; and in the second (June, 1788) he opened the proceedings at the trial in Westminster Hall. A third speech (May 14, 1794) did not reach the previous high level. Sheridan sided with Fox against English interference in the French Revolution, delivering a remarkable speech in 1794 in reply to the Earl of Mornington (afterwards Marquis Wellesley), but he opposed that revolution when it began to interfere with the peace of England. He also met Pitt in debate against the union of England and Ireland, and strenuously advocated the freedom of the press. Defeat in the election of 1812 brought his Parliamentary career to an end. This was not his only misfortune. The old Drury Lane Theatre, pronounced unsafe, had been replaced in 1794. The destruction by fire of the new building in 1809 put an end to Sheridan's main source of income, which for a while amounted to 10,000 pounds a year. Harassed by creditors, though he was the last man to avoid the payment of a debt, Sheridan could not pay, for debts to him were withheld. A committee formed to rebuild the theatre gave him shares for much other money owed him, but by keeping back 12,000 pounds in cash, they prevented his being returned from Stafford, and caused him to be arrested for debt, August, 1813. He became an inmate of a sponging house in Took's Court, Cursitor street, till Whitbread, head of the committee, handed over the needed sum.

He died after several months' illness, July 7, 1816, and was buried in Westminster Abbey. His portrait was more than once painted by Sir Joshua Reynolds, and a portrait of him by Russell may be seen in the National Gallery.

Sheridan came in a period when satirical comedy could easily find something to make merry over in contemporary society. Moreover, that society was highly picturesque. An arch and dainty eighteenth-century grace permeates both *The Rivals* and *The School for Scandal;* they have an incessant sparkle of wit and elegance of style. By his own avowal Sheridan was not a happy man. Indeed, he often thought life an unendurable burden, but his wit is never sour. He never showed, either in his literary work or in politics, rancor or grudges. Yet he seems to have been slandered from his childhood till his death, though he refrained from replying to calumnies. Sheridan by sheer inborn goodness, if not by sound intelligence, was habitually on what Time's judgment calls the right side.

Consult the biographies by Rae (London, 1896), Sanders (Great Writers Series, ib., 1891), Mrs. Oliphant (English Men of Letters Series, New York, 1883), T. Moore (London, 1825), and *The Lives of the Sheridans*, by Fitzgerald (ib., 1886). Good editions of the comedies are by B. Matthews, *Rivals* and *School for Scandal* (New York, 1884), J. A. Symonds (London, 1884), H. Morley (ib., 1883), and in Macmillan's Library of English Classics (London and New York, 1900). Sheridan's speeches were collected in five volumes (London, 1816), and finally *Sheridan's Plays*, "now printed as he wrote them," edited by W. Fraser Rae (London, 1902).

SHERIDAN, THOMAS (1719-88). A British actor and author, the father of Richard Brinsley Sheridan (q.v.). He was born near Dublin, where he was educated at Trinity College. Having gone upon the stage in 1743, he played for a time at Drury Lane Theatre, in London, and was considered by some, including himself, a rival of Garrick. His management of the Dublin Theatre ended with a riot in 1754. The remainder of his life was spent largely in literary work, especially on the subject of elocution, upon which he was a well-known lecturer at the universities and elsewhere. In 1780 first appeared his *Dictionary of the English Language*, in which particular attention was given to pronunciation. Sheridan also edited the *Works of Swift* (with *Life*, 1784). Consult: Rae, *Richard Brinsley Sheridan, a Biography* (London, 1896); Matthews and Hutton, *Actors and Actresses of Great Britain and the United States* (New York, 1886).

SHERIDAN'S RIDE. A stirring poem by T. B. Read, published, with other war pieces, in 1865, on the famous ride of General Sheridan from Winchester to Cedar Creek after Early's attack during his absence, October 19, 1864.

SHERIF, shâ-rēf' (Ar. *sharīf*, noble, from *sharafa*, to surpass). Among Mohammedans, a name for all descendants of Mohammed. They are very numerous and found in all classes and callings. In the large cities there is a special officer, the *naḳib al-ashrag*, whose duty it is to keep a careful account of their genealogy. The men among the sherifs have the privilege of wearing a green turban, and the women a green veil. The guardian of the Kaaba is a sherif appointed nominally by the Sultan; he acts as governor of Mecca with the title of Sherif of Mecca.

SHERIFF (AS. *scirgerēfa*, shire-reeve, from *scir*, district, county, jurisdiction, business + *gerēfa*, reeve). The chief executive officer of a county, who at times exercises judicial functions also. Notwithstanding his Latin title of *vice comes*, he was never a deputy earl. At the opening of English legal history he appears as "the governor of the shire, the captain of its forces, the president of its court; a distinctly royal officer, appointed by the King, dismissible at a moment's notice, strictly accountable to the Exchequer." The office was not hereditary at common law, although it became so in a few counties. During the thirteenth century it was made elective, but in 1314 Parliament changed it to an appointive office, and the method of appointment prescribed by that statute (9 Ed. III., c. 2) has been continued with few changes to the present time (See Sheriff's Act, 1887, 50 and 51 Vict., c. 55). His term of office is one year, and until his successor qualifies, although he is removable at pleasure. He appoints an under sheriff to act as his deputy, to whom all fees are paid, but for whose acts the sheriff is civilly liable.

Originally, the sheriff in England, as in Scotland, exercised an extensive judicial authority. He presided over the common-law county court. Twice a year he made a circuit of the hundreds or other subdivisions of his shire, to hold a view of frank pledge, to receive presentment of grave criminal offenses, and to collect fines for petty crimes. This was known as the sheriff's tour. At present, however, his judicial functions are comparatively small.

The principal duties of the modern sheriff,

both in England and in the United States, relate to the execution (q.v.) of civil and criminal process. In the more populous counties he has many deputies, for whose misconduct he is civilly responsible, and who give bonds to him for the proper performance of their duties. In such counties the office is a very lucrative one with us. While a few of our States continue the practice of appointing sheriffs, most of them have made the office elective, and many prohibit the immediate reëlection of the same person. It is thought that he might abuse his authority for the purpose of securing a reëlection. The Federal officer corresponding to the sheriff is the United States Marshal. Consult: Pollock and Maitland, *History of English Law* (2d ed., London and Boston, 1899); Mather, *Compendium of Sheriff and Executive Law* (London, 1903); Crocker, *Duties of Sheriffs, Coroners, and Constables* (New York, 1890); Murfee, *Treatise on the Law of Sheriffs and Other Ministerial Officers* (Saint Louis, 1890).

SHERIFFMUIR, shĕr'ĭf-mūr'. A moor of Perthshire, Scotland, 2 miles northeast of Dunblane, famous for the indecisive battle on November 13, 1715, between 9000 Jacobites under the Earl of Mar and 3500 Hanoverian troops under the Duke of Argyll. The action checked the march of the Scottish Jacobites into England.

SHERIFF'S COURT. A Scotch tribunal, corresponding to the county court of England and of the American States. It takes its name from the title of the presiding magistrate—the sheriff (q.v.)—whose judicial functions in Scotland have increased rather than diminished during modern times. Until 1748 the office of sheriff was hereditary in that country, but with the suppression of the Jacobite rising it was made appointive, and its judicial duties are now performed by the sheriff depute and the sheriff substitute. Both officials are appointed by the Crown, and their salaries are a charge upon the civil establishment. The former must be an advocate of three years' standing, the latter an advocate or solicitor of five years' standing, and both hold their office during life or good behavior.

Most civil cases of first instance in this court are heard by the sheriff substitute, who resides permanently in the county for which he is appointed. From his decisions an appeal lies either to the sheriff depute or the Court of Session. Preliminary investigations into crime and summary criminal proceedings are generally brought before the sheriff substitute; while all criminal causes remitted by the counsel for the Crown to the Sheriff's Court for trial by jury are heard by the sheriff depute. From his decision in such cases an appeal lies to the Court of Justiciary. The civil jurisdiction of the Sheriff's Court extends to personal actions upon obligations without limit as to amount; to actions for the recovery of real estate, limited in the case of heritable estates to the value of £1000; to questions of servitude, nuisance, and various other matters. Consult Wilson, *Practice of the Sheriff's Courts of Scotland* (Edinburgh, 1890).

SHERLOCK, Thomas (1678-1761). An English prelate. He was born in London and was educated at Eton and Saint Catharine's Hall, Cambridge, where he took the degree of M.A. in 1701. In 1704 he obtained the mastership of the Temple; in 1714 he became master of his college, taking the degree of D.D. in the same year; and in 1715 Dean of Chichester. He was raised to the see of Bangor, 1728, and transferred to that of Salisbury in 1734, and in 1748 to that of London. Sherlock was a strenuous Tory, and supported the Church and State politics of his day, but displayed a good deal of diplomatic skill in his different official positions. His works, with *Life* by T. S. Hughes, were published in five volumes in London, 1830. The most famous is the *Tryal of the Witnesses of the Resurrection of Jesus* (1729; 15th ed. 1794; American reprint by Presbyterian Board, Philadelphia).

SHERMAN, shĕr'man. The county-seat of Grayson County, Texas, 64 miles north of Dallas, on the Texas and Pacific, the Houston and Texas Central, the Saint Louis and San Francisco, the Missouri, Kansas and Texas, and the Saint Louis Southwestern railroads (Map: Texas, F 3). It is the seat of the Mary Nash Female College, opened in 1877, the Carr-Burdette Christian College for women, the North Texas Female College (Methodist), opened in 1877, and Austin College (Presbyterian), opened in 1850. Sherman is the centre of a cotton-growing, stock-raising, and farming region, and has cottonseed-oil mills, a cotton compress, a cotton gin, flouring mills, iron foundries and machine shops, brick yards, planing mills, and a carriage manufactory. The government is vested in a mayor chosen biennially, and a unicameral council. The water-works and electric light plant are owned and operated by the municipality. Sherman was settled in 1848, and received its present city charter in 1895. Population, in 1890, 7335; in 1900, 10,243.

SHERMAN, Frank Dempster (1860—). An American educator and well-known writer of light verse, born at Peekskill, N. Y. He took a course in the Columbia School of Architecture in New York, graduating in 1884, and pursued advanced studies at Harvard University. In 1887 he was made fellow of Columbia College, then instructor in the department of architecture until his appointment as adjunct professor. He was author of *Madrigals and Catches* (1887), *New Waggings of Old Tales* (1888), with Mr. J. K. Bangs (q.v.), *Lyrics for a Lute* (1890), and *Little-Folk Lyrics* (1892).

SHERMAN, John (1823-1900). An American statesman, born at Lancaster, Ohio. He was admitted to the bar in 1844, and settled at Mansfield, Ohio. He was a member of Congress from 1855 until 1877, first in the House, and after 1861 in the Senate. His ability as a speaker and his familiarity with public affairs made him an influential member from the first. In 1859 he was the Republican candidate for Speaker of the House and came within three votes of election. After his defeat for the Speakership he was made chairman of the Ways and Means Committee of the House and was instrumental in improving the financial condition of the Government. In the Senate he served as chairman of the Finance Committee, and took a conspicuous part in the advocacy of the issue of legal-tender currency during the Civil War and of the bill to establish a national banking system. He was the author of the Refunding Act of 1870, and carried through the resolution announcing the purpose of the

Government to resume the payment of its obligations in specie at as early a date as possible. In 1877 he retired from the Senate to become Secretary of the Treasury under President Hayes. He succeeded in accumulating a redemption fund in the Treasury and made it possible for the Government to keep its promise to resume specie payments on January 1, 1879. In 1881 Sherman returned to the Senate, where he served without interruption until 1897. In 1880, 1884, and 1888 he was a prominent candidate for the Republican Presidential nomination. Besides measures already mentioned Senator Sherman was the author of the important statute of 1890 known as the Sherman Silver Law, providing for the monthly purchase of silver bullion by the Government, and of the notable act of the same year known as the Sherman Anti-Trust Law, forbidding combinations in restraint of trade or commerce among the States. In 1897 he resigned from the Senate to become Secretary of State in the Cabinet of President McKinley. On account of advanced age and growing infirmities, he resigned this office shortly after the outbreak of the war with Spain in 1898, and retired to private life. He died on October 22, 1900. Consult: Senator Sherman's *Reminiscences* (New York, 1895); and Bronson, *Life and Public Services of John Sherman* (Columbus, 1880). Some of his correspondence with General W. T. Sherman was edited by R. S. Thorndike in a volume published in New York in 1896.

SHERMAN, Roger (1721-93). An American patriot, one of the signers of the Declaration of Independence, born in Newton, Mass. He was a shoemaker for a number of years; removed to New Milford, Conn., in 1743; became county surveyor of lands in 1745; after 1750 engaged in mercantile pursuits; studied law, and in 1754 was admitted to the bar. He then served successively as member of the Connecticut Legislature, justice of the peace, judge of the Common Pleas, and treasurer of Yale College. In 1766 he was appointed judge of the Connecticut Superior Court, and in the same year was elected to the Connecticut Senate, continuing in the former office for 23 years, and in the latter for 19. He was an active member of the Continental and Confederation Congresses from 1774 to 1787, served on a number of important committees, and, in particular, was a member of the Committee of Five appointed to prepare a draft of the Declaration of Independence, to which document, as finally adopted, he affixed his signature. While a member of Congress he served (1777-79 and 1782) on the Connecticut Committee of Safety, and in 1783, together with Richard Law, he revised and codified the laws of the State. From 1784 until his death he was Mayor of New Haven. to which place he had removed in 1761. While holding this office he was an active and influential member of the Constitutional Convention at Philadelphia in 1787. He took a conspicuous part in the debates before that body and presented the famous compromise relative to the systems of representation in the two Houses of Congress. He was a member of the Connecticut convention called to take action on the Federal Constitution, and was influential in securing its ratification. He was one of the first Representatives in the Federal Congress from Connecticut, and in 1791 was transferred by appointment to the Senate, in which body he served until his death. Consult Boutelle, *Life of Roger Sherman* (Chicago, 1896).

SHERMAN, Thomas West (1813-79). An American soldier, born at Newport, R. I. He graduated at West Point in 1836, and as second lieutenant took part in the Seminole War. He was promoted to be captain in 1846, served under General Taylor in the Mexican War, and was brevetted major for gallant conduct at the battle of Buena Vista. At the outbreak of the Civil War he was promoted to be lieutenant-colonel of the Fifth Artillery, and soon afterwards was commissioned brigadier-general of volunteers. He commanded the land forces in the operations against Port Royal and the Sea Islands in the winter of 1861-62; commanded a division under General Banks at Port Hudson in 1863, where he lost a leg, and from that time until the close of the war commanded a reserve brigade of artillery and Forts Jackson and Saint Philip at New Orleans. On June 1, 1863, he was promoted to be colonel of the Third Artillery; on March 13, 1865, was brevetted brigadier-general in the Regular Army for gallantry at Port Hudson, and major-general in both the volunteer and the regular armies for his services throughout the war, and on being mustered out of the volunteer service on April 30, 1866, took command of his regiment at Fort Adams, R. I. In 1870 he was placed on the retired list with the full rank of major-general in the United States Army.

SHERMAN, William Tecumseh (1820-91). A distinguished American soldier, born at Lancaster, Ohio, on Feb. 8, 1820. He graduated at West Point in 1840, and afterwards was stationed at several places in the South, during which time he devoted his spare moments to the study of law. Upon the outbreak of the war with Mexico he was sent around the Horn to California, where he served as acting assistant adjutant-general. Returning to the East in 1850, he was appointed captain in the Commissary Department, with headquarters first at Saint Louis and later at New Orleans. In September, 1853, he resigned from the army and engaged in the banking business in San Francisco, where he remained until 1857. He then engaged in business for a brief period in New York; in 1859 he began the practice of law in Kansas; in 1860 became superintendent of a military academy in Louisiana, and at the beginning of the Civil War was president of a street railway company in Saint Louis. In May, 1861, he reëntered the army as colonel of the Thirteenth Infantry, and a few weeks later was appointed brigadier-general. His first active service was in the first battle of Bull Run, where his brigade lost heavily. In August, 1861, he was detached from the Army of the Potomac and sent to take command in Kentucky under General Robert Anderson. Sherman succeeded him in full command on October 17th. It was at this time that he became the target for ridicule on account of his declaration that 200,000 men would be required to end the war in the West. The opinion was regarded as that of a crazy man and he was relieved of his command by General Buell in November and was ordered to report to General Halleck, then commanding the Department of Missouri. After

brief service at Saint Louis he was in February, 1862, assigned to the Army of the Tennessee, and in April took a conspicuous part in the battle of Shiloh, having three horses shot under him and being himself severely wounded. He displayed such judgment and skill in this battle as to cause General Grant to say of him officially: "To his individual efforts I am indebted for the success of that battle." He was commissioned major-general of volunteers and rendered distinguished service in the operations against Corinth. In July he was sent by General Grant to take command at Memphis, which had just fallen into the hands of the Federal forces, and shortly thereafter he began his campaign against Vicksburg. In trying to reach Vicksburg from the rear by the Yazoo River he was defeated and driven back at Chickasaw Bayou, but later rendered important service which contributed eventually to the capture of the city. In July, 1863, he was made a brigadier-general in the Regular Army. His command was now transferred to Tennessee, where he took an active part in the operations under General Grant which ended in the battles around Chattanooga (November), immediately after which he forced Longstreet to raise the siege of Knoxville. In January, 1864, he returned to Mississippi and soon thereafter made his famous raid across the State from Jackson to Meridian and back again, destroying the railroads, Confederate stores, and other property, and desolating the country along the line of march. When Grant was appointed Commander-in-Chief of the armies of the United States he assigned Sherman to the command of the Military Division of the Mississippi, embracing the Departments of the Ohio, the Tennessee, the Cumberland, and the Arkansas, with temporary headquarters at Nashville, and with instructions to undertake the capture of Atlanta.

In May, 1864, his army, about 100,000 strong, set out from Chattanooga for the invasion of Georgia. The Confederates under Johnston were engaged with Sherman's army at Dalton, Resaca, Cassville, Dallas, and Kenesaw Mountain, but were compelled to retreat before his advance. Finally Atlanta was attacked, and after a siege of forty days, marked by several sharp battles, the city was evacuated on September 1st. Gen. John B. Hood, who had superseded General Johnston in command, now moved back to Tennessee, leaving the way open for Sherman's advance through Georgia to the sea. In November Sherman set out for Savannah with his army stretched out at times for a length of 60 miles. The country along the line of march was almost devastated. By December 13th he had reached Savannah, which surrendered on December 21st. Already on August 12 he had been appointed major-general in the Regular Army and now received the thanks of Congress for his 'triumphal march.' In February he resumed his march, turning northward through South Carolina. On February 17, 1865, his army entered Columbia, and on the same day the Confederates evacuated Charleston, which was occupied on the following day by the Federal forces. He then pushed northward into North Carolina, General Joseph E. Johnston attempting ineffectually to check his progress. Johnston's spirited attack at Bentonville on March 19th was repulsed, and a few days later Sherman and Schofield effected a junction at Goldsboro. On April 18th Sherman received the surrender of General Johnston at Durham's Station, but the terms of surrender were regarded by the Government as too lenient and as including matters other than military. A week later the same terms were made as those granted Lee. From the close of the war until March, 1869, Sherman commanded the Military Division of the Mississippi, with headquarters at Saint Louis. Upon the appointment of Grant as full general in July, 1866, Sherman was promoted to be lieutenant-general, and when Grant became President of the United States, March 4, 1869, Sherman succeeded him as general. He retired from the army on full pay in February, 1884, and died in New York on February 14, 1891. His *Memoirs* were published in 1875 (New York, 2 vols.). His correspondence with his brother, Senator Sherman, appeared in 1894 (New York). A short biography has been written by General Manning F. Force (New York, 1899). In 1903 a magnificent monument to the great commander, the work of Saint-Gaudens, was unveiled at the main entrance to Central Park, New York City, and a fine equestrian statue was set up in Washington, D. C.

SHERWOOD, shĕr'wụd, MARY MARTHA (1775-1851). An English author, eldest daughter of George Butt, chaplain to George III., born at Stanford, Worcestershire. In her girlhood she learned Latin and wrote stories, publishing her first book in 1794. In 1803 she married her cousin, Captain Henry Sherwood, with whom she went out to India. On their return to England they settled at Wick, near Worcester, and afterwards moved to Twickenham. Captain Sherwood died in 1849. Throughout her life Mrs. Sherwood devoted much time to charity. Her books, numbering nearly one hundred, comprise mostly tracts and short stories with a strong religious bent. It is said that the children of middle class life in England were brought up on *The History of the Fairchild Family, a collection of stories calculated to show the Importance and Effect of a religious Education* (part i., 1818; part ii., 1842; part iii., 1847). Extremely popular were *Susan Gray* and *Little Henry and His Bearer*. Her stories were translated into many languages. Consult *Works* (New York, 1855); *Life*, by Mrs. S. Kelly (London, 1854).

SHERWOOD, ROSINA (EMMET) (1857—). An American artist, born in New York City. She studied under William Chase and afterwards in Paris under Julien. She first became known as an illustrator, and then as a painter, both in oil and water colors. She was awarded a medal at the Paris Exposition of 1889, in Chicago in 1893, and exhibited in Paris in 1900.

SHERWOOD, WILLIAM HALL (1854—). An American pianist and teacher, born in Lyons, N. Y. His education was under the leading masters, both of the United States and Europe. For several years he was teacher of the piano at the New England Conservatory, after which he went to New York and in 1889 made Chicago his home. He became head of the piano faculty of the Chicago Conservatory, resigning that position in 1897 to establish the Sherwood Piano School. His compositions are principally for the pianoforte.

SHERWOOD FOREST. A stretch of hilly country in the west of Nottinghamshire, England,

between Nottingham and Worksop, about 25 miles from north to south and 6 to 8 miles from east to west. It was formerly a royal hunting forest, and the traditional scene of many of the exploits of Robin Hood and his followers. It is now almost wholly denuded and is occupied by gentlemen's seats, parks, and farms. The town of Mansfield and a number of villages are situated within the ancient bounds. Consult White, *Nottinghamshire and Sherwood Forest* (Worksop, 1875).

SHE'SHONK. King of Egypt. See SHISHAK.

SHE STOOPS TO CONQUER. A comedy by Oliver Goldsmith, among the three or four plays of the period which still hold the stage. It was first performed at Covent Garden in 1773, with immediate success.

SHET'LAND (or **ZETLAND**) **ISLANDS** (anciently *Hialtland*, the Latin *Ultima Thule*). A group of about 100 Scottish islands, 23 of which are inhabited, lying between the Atlantic and the North Sea, 50 miles northeast of the Orkneys, and 210 miles west of Norway (Map: Scotland, F 1). The largest is Mainland, which embraces about half the entire area and population; others are Unst, Yell, Fetlar, Bressay, Whalsay, Papa Stour, Barra, and Foula. The total area of the group is about 550 square miles. Population, in 1891, 28,711; in 1901, 28,195. Lerwick (q.v.), on Mainland, is the chief town. The surface is rugged and wild; the coasts are abrupt and indented with deep bays or voes. The rocks are mainly gneiss, clay-slate, sandstone, and granite. The highest hill is Ronas, 1500 feet. The climate is moist and variable and snow and frost are of short duration. Fishing for cod, ling, and herring is the chief industry; seals and bottle-nosed whales are often caught. Much attention is given to the rearing of cattle, sheep, and ponies, the little Shetland ponies being famous. Almost all the small tenants practice spade cultivation. Oats and barley are the only grain crops; potatoes and turnips are grown. The manufactures are chiefly hosiery and shawls, and the exports, besides these, are cattle, fish, and eggs; the chief imports are oatmeal, flour, tea, tobacco, spirits, sugar, cottons, woolens, timber (chiefly from Norway), tar, salt, etc.

Though little is known of the original inhabitants of Shetland, the physiognomy, character, and language point to a Norse or Scandinavian origin. In Unst cairns have been found over long and short stone coffins, with skeletons, clay urns, weapons, and stone vessels. Tumuli are frequent and contain remains of rude buildings and stone implements. Circular strongholds of unhewn stone, called burghs or 'broughs,' are very numerous, generally on a cliff or headland, but also on artificial islands in fresh-water lochs. Mouse Isle has the most perfect 'brough' known. Consult Hibbert, *The Shetland Islands* (new ed., Edinburgh, 1892).

SHETLAND PONY, or SHELTIE. See PONY.

SHEWBREAD. An expression used in the English Bible for the 12 loaves which, according to the Pentateuchal codes, were placed on a table of acacia wood in the Holy Place. They were made of fine flour, unleavened, and sprinkled with frankincense; they were arranged in two rows of six loaves each, and the bread was changed every Sabbath; when the change was made, frankincense was burned and the old bread was given to the priests to be eaten in the holy place (Ex. xxv. 23-30; Lev. xxiv. 5-9; Josephus, *Ant.* iii. 10, 7). The term 'shewbread' was used by Tyndale in his translation of the New Testament (Heb. ix. 5). The Hebrew name means 'bread of the presence.' Other expressions are used as 'holy bread' (I. Sam. xxi. 6), 'pile bread' (I. Chron. ix. 32). The reference in I. Samuel, where the shewbread of the sanctuary at Nob in the days of David is referred to, indicates the antiquity of the rite. Similar rites are found among various nations of antiquity. There is a Babylonian phrase which is identical with the Hebrew (cf. Zimmern, *Beiträge zur Kenntnis der babylonischen Religion*, Leipzig, 1896-1900), and references are found in Babylonian literature to the piling up of loaves on a table set before a divinity, the number of such loaves being 12, 24, or 36. The inclusion of the rite in the post-exilic regulations of the Jewish cult is an instance of survival, though naturally an interpretation was given in accordance with more advanced ideas. Great care was bestowed upon the preparation of the shewbread. According to the Talmud the flour must be sifted 11 times and the kneading and baking were intrusted to a special priestly family in whose hands the privileges generally remained for several generations. Consult the Hebrew archæologies of Benzinger and Nowack.

SHIAHS, shē'ăz. See SHIITES.

SHIB'BOLETH (Heb., ear of corn, stream). The test-word used by the Gileadites under Jephthah after their victory over the Ephraimites, recorded in Judges xii. 6. It appears that the latter could not pronounce the *sh*, and, by saying sibboleth, betrayed themselves, and were slaughtered mercilessly. It may be noticed that all those Hebrew names in the Old Testament which begin with the *sh* have now, through the inability of the Septuagint to render this sound in Greek, become familiar to us, through the versions that flowed from it, as beginning with the simple *s*, e.g., Simon, Samaria, Solomon, Saul, etc. The word shibboleth is used in modern languages in the sense indicated, viz. a test of speech and manners of a certain party or class of society.

SHICHI-TO, shē'chē'tō' (Jap., Seven Islands). A group of small islands southeast of the peninsula of Idzu, Central Hondo, Japan (Map: Japan, F 6). The most important member of the group is called Vries Island by foreigners and Oshima (large island) by the Japanese. Its centre is an active volcano. The other islands are Rishima, Nishima, Shikineshima, Kautsushima, Miyakeshima, and Mikurashima. The islands were used as convict settlements until the end of the eighteenth century.

SHIDZUOKA, shēz'wō'kâ. The capital of the prefecture of the same name in Japan, near the southern coast of Hondo, 120 miles by rail southwest of Tokio (Map: Japan, F 6). It is a well-built industrial town with manufactures of lacquer ware and basketwork. In the vicinity is produced one of the best kinds of tea found in Japan. The Buddhist temple of Rinzaiji, a short distance from the city, is noted principally on account of its association with the Shogun Iveyasu (1542-1616), the first shogun of the Togugawa dynasty, who resided at Shidzuoka un-

til 1590. The temple of Sengen is surrounded by beautiful grounds, which now serve as a public park, and is especially known for its fine specimens of wood-carving. The town is also associated with the last Shogun of Japan, who retired to Shidzuoka after the overthrow of the shogunate in 1868 and resided there until 1897. Population, in 1898, 42,172.

SHIELD (AS. *scild, scyld*, Goth. *skildus*, OHG. *scilt*, Ger. *Schild*, shield; possibly connected with Lith. *skilù*, I split). A piece of defensive armor borne on the left arm or in the hand, to ward off the strokes of the sword and of missiles. It is common to all nations and all ages in the Old World. The large shield worn by the Greek hoplites was circular or oval, and often ornamented with devices. The shield (Lat. *scutum*) used by the Roman heavy-armed infantry was quadrangular and bent to encircle the body in part. The shields were built so strongly as to afford protection against heavy missiles from the walls of a besieged city. (See TESTUDO.) The Romans also had a lighter form of shield known as the *clipeus*. Among the Germanic peoples the shield was the warrior's chief insignia of honor, and to be lifted on the shield by the warriors of the tribe was to be made leader in war or king. In the early Middle Ages the shield was most important for both horsemen and foot soldiers. Its form was usually round and bent, with a boss of metal in the form of a hollow button or spike in the centre of the convex surface. Across the hollow of the boss was placed a handle of wood covered with iron. If the shield was held at arm's length it was called a buckler; if it was swung over the arm it was known as a target. The body of the shield was made of limewood, though leather was sometimes used. The shields of the northern peoples were fancifully decorated, and as Christianity spread the cross became a common decoration. The heraldic device appears after the age of the Bayeux Tapestry. With the form and visage of men totally concealed under suits of armor, the device on the shield was in fact the only means of distinguishing in the heat of battle between friend and foe. (See HERALDRY.) In the eleventh century the kite-shaped shield was much used, and many shields of this form are found on the Bayeux Tapestry. By the middle of the twelfth century the triangular shield was much in vogue. It was customary at this period and later to make the shield the dead knight's bier. In the thirteenth century the custom was introduced of hanging shields in churches. Pear-shaped, heart-shaped, and quadrangular shields were used in this period, and the shield was much smaller. In the fourteenth century we have mention of large shields carried by the foot soldiers. In the fifteenth century the small buckler was used by the foot soldiers, although large wicker shields were still in use. Even as late as the seventeenth century the target was used effectively by the soldiers of Maurice of Nassau. Consult: Hewitt, *Ancient Armour* (London, 1860); Gourdon de Genouillac, *Grammaire héraldique* (Paris, 1860). See ARMOR.

SHIELD, WILLIAM (1748-1829). An English violinist, born at Swalwell, Durham County. He appeared as concert and theatre conductor, in Scarborough, Durham, and Newcastle, and in 1772 became a member of the London Italian Opera orchestra and musical director at the Haymarket Theatre. From 1782 to 1791 he wrote a series of operas for Covent Garden Theatre. In 1791 he resigned his post and traveled through France and Italy, becoming on his return musical director at Covent Garden. In 1817 he succeeded Parsons as master of the Royal Music. His first comic opera, *A Flitch of Bacon*, was produced at the Haymarket in 1778. He wrote about 40 works for the stage, consisting of operas, pantomimes, and musical farces; besides violin trios, duets, songs, and two theatrical works: *An Introduction to Harmony* (1794) and *Rudiments of Thorough Bass*. He is noted especially as a song composer of great originality. He died in London and was buried in Westminster Abbey.

SHIELD OF HERACLES (Gk. *Ἀσπὶς Ἡρακλέους, Aspis Hērakleous*). A Hesiodic poem of uncertain date and authorship, though almost certainly not the work of Hesiod. It describes, in 480 lines, a struggle at Pagasæ between Heracles and Cycnus, the son of Aves, and contains a long description of the hero's shield, in imitation of the similar picture of the shield of Achilles in the *Iliad*.

SHIELDS, SOUTH and NORTH. Two seaport towns in Durham and Northumberland, England, at the mouth of the Tyne, on opposite banks of the river, 8 miles east-northeast of Newcastle (q.v.) (Map: England, E 1 and E 2). Steam ferries connect the towns, which are the chief English ports for the building of iron ships of every kind and for all supplemental shipping industries. The towns possess large alkali, bottle, and glass works. Coal and coke are exported, and timber, grain, and esparto grass largely imported. NORTH SHIELDS is included in the borough of Tynemouth (q.v.). It has two docks covering 79 acres. Population, about 7000. SOUTH SHIELDS is a municipal, county, and Parliamentary borough with a progressive administration. It has fifteen docks, including the Tyne dock of 50 acres, and a breakwater, the south pier, a mile in length. There are a large public library, a marine school, and a park of 45 acres. Founded in the thirteenth century by the Convent of Durham, the progress of the town was checked by Henry III., who, on the complaints of Newcastle, ordered that no 'shoars' or quays be built, or ships loaded or unloaded. It was incorporated in 1850. Population, in 1801, 8100; in 1851, 29,000; in 1901, 97,300.

SHIELDS, CHARLES WOODRUFF (1825-1904). A Presbyterian clergyman and educator. He was born at New Albany, Ind., graduated at the College of New Jersey, in Princeton, in 1844, and at the Princeton Theological Seminary in 1847. He preached first at Hempstead, L. I., then at the Second Church, Philadelphia, and in 1866 went to Princeton to become the first incumbent of a chair of harmony of science and revealed religion in America. *Philosophia Ultima* (1861; 4th ed. 1898) led to the establishment of his professorship. He published also *The Book of Common Prayer as Amended by the Presbyterian Divines of 1661* (1864; 2d ed. 1883), supplying a form for the use of ministers or congregations who desire a liturgical service. In his advocacy of the unification of thought and of religious observance he wrote: *The Final*

Philosophy, or System of Perfectible Knowledge Issuing from the Harmony of Science and Religion (1877; 3d ed., entitled *Philosophia Ultima; or The Science of the Sciences*, 1888); *The Order of the Sciences* (1882); *The Historic Episcopate* (1894); and *The United Church of the United States* (1895). He also published *The Reformer of Geneva, An Historical Drama* (1898), and *The Scientific Evidences of Revealed Religion* (1900, being the Paddock lectures for that year).

SHIELDS, JAMES (1810-79). An American soldier and political leader, born at Dungannon, County Tyrone, Ireland. He emigrated to the United States in 1826, and in 1832 began the practice of the law at Kaskaskia, Ill. He served in the Mexican War as a brigadier-general, and was brevetted major-general for gallantry at Cerro Gordo. On his return to the United States he was appointed Governor of Oregon Territory (1848), but resigned the next year to accept an election from the Democrats as United States Senator from Illinois. In 1855, however, he removed to Minnesota, and three years later was elected Senator from that State, but in 1859 he went to California. At the outbreak of the Civil War he was commissioned a brigadier-general of volunteers, and in March, 1862, succeeded to the command of General Lander's division. He was in command at the successful engagement at Winchester (March 23d), where he was severely wounded, and at Port Republic (June 9th), where he was defeated by 'Stonewall' Jackson. In March, 1863, he resigned from the army and soon afterwards settled at Carrollton, Mo. He was appointed United States Senator from Missouri in 1879 to fill an unexpired term.

SHIELDTAIL. One of an Oriental family (Uropeltidæ) of small burrowing snakes, sometimes called 'earth-snakes,' in which the tail is obliquely truncated and covered by an oval horny plate.

SHIFTING USE. A use which arises by virtue of an express limitation in a deed, or which may be created by a person named therein upon certain conditions, and which is in derogation of some other estate. For example, if land is conveyed in fee to the use of A and his heirs until B marries C, then to the use of B and his heirs, a shifting use is thereby created, as it is in derogation of A's estate. The doctrine of shifting uses affords a means of limiting a 'fee upon a fee,' which was not possible under the early common law. Shifting uses are not recognized as such to-day, but the principles governing them have been adopted into the modern law of trusts. In a few States the doctrine of uses has been expressly abolished by statute. Consult Gilbert, *Law of Uses and Trusts* (3d ed., London, 1811).

SHIITES, shē'ĭts (from Ar. *shī'ah*, party, sect, from *shā'a*, to accompany, follow, spread abroad). The sect in Islam which insists upon the sole legitimacy of Ali and his descendants as the successors of Mohammed, and so are opposed to the Sunnites (q.v.). The division has its root in the different opinions and struggles concerning the successor of the Prophet. (See MOHAMMEDAN SECTS.) Ali seems to have been capable of invoking an extraordinary enthusiasm in his followers, such as even the Prophet never gained, and the personal element has since remained one of the sources of Shiite strength. Further, the tragedies of his house have given a sentimental *motif* to his party, which is richer and more attractive than anything found in the prosaic orthodoxy of Islam. The memory of the tragedy is still celebrated from year to year by the Shiite world in a kind of passion play on the tenth day of Muharram, the anniversary of Kerbela. (See HASAN AND HOSEIN.) The conservatives acknowledged Ali's caliphate and revered him as a saint and martyr, but they possessed no such legitimist principles as his adherents. A bitter struggle followed his selection as Caliph. (See OMMIADS; MOAWIYAH.) The resulting history is a remarkably complicated one, partly by reason of the interfusion of the Shiites throughout orthodox Islam, and partly because the party itself soon split upon all kinds of political purposes, personal ambitions, and theological tenets. We find them in part founding new States, in part establishing mystical fraternities and schools of liberal thought, in part cherishing, more or less patiently, millennial hopes.

As has been said, the root of the sect lay in the personality of Ali. Politically, this involved the sole right of succession as inherent in his descendants. Here, however, various views developed according to the claims of various lines; some held that descent must pass through Fatima, the daughter of Mohammed and wife of Ali, others that any of Ali's descendants were legitimate. Further, about Ali's person arose a theology which was incongruous to original Islam, and which gave room for all forms of theosophic speculation. He came to be named in the creed along with God and Mohammed as 'the representative of God.' Some, even in his lifetime, held him to be an incarnation of God. Others, starting from his violent death, taught that he was reserved for a future reappearance, as the Hidden Imam, or Mahdi (q.v.), who should establish the millennium; this notion was contributed to by the large numbers of Jewish and Christian converts that came into Islam. Yet another development of thought held that Ali was reincarnated in the Imams, his legitimate descendants; this was the product of Oriental theosophy coming in through Persia and India. In general, the doctrine was that God never left Himself without an authoritative representative or Imam in the world, and that it was the business of the faithful to find him. The strength, therefore, of the Shiites lay in the doctrine of legitimism, and in the opportunity it gave to those temperaments and races which desired a richer theology than that of simple Moslem unitarianism. With the passing of Islam out of Arabian hands, the development of history made the whole doctrine of a legitimacy of blood or race as a *sine qua non* of the ruler a pure fiction, and in its opportunism lay the strength of Sunnite orthodoxy, which was thus able to assimilate the barbarian races which conquered original Islam. As for the peculiar Shiite theologies, they antagonized in general the spirit and letter of the Koran, to which as a religion of a book Islam is necessarily bound. Thus we find Shiism perpetuating itself secretly and coming to the surface sporadically or on the periphery of Islam, but never able to gain any but a temporary control over the great Moslem body. Its history, therefore, is a story

of opposition to the principles of Islam, existing in underground organizations, taking advantage of political and theological opportunities and of free-thinking rulers, now and again creating independent States through the personal ability of some Alide scion. An early instance was the establishment of the Idriside dynasty in North Africa (about 800), through a great-grandson of Ali. From this connection the present Sherifs of Morocco, whose dynasty has existed since the end of the eighteenth century, claim to possess the legitimate caliphate. Another branch of the family, that of the Zaydites, arose in Northern Persia and in Yemen, in Southern Arabia; in the latter land the sect still maintains itself.

The doctrine of the Hidden Imam or the Mahdi soon produced innumerable divisions in the sect. Any Alide might come to be regarded as the Promised One, and so gain a following. The most notable split of this kind occurred in 765, when a dispute arose as between the two sons of the sixth Imam, Jafar al-Sadik. Through one of these, the line was traced down to the twelfth in descent, Mohammed ibn al-Hasan, who was supposed to have been mysteriously translated to abide his return. His followers are called the Ithnaashariya, i.e. Twelvers, and have come to be the prevailing Shiite sect, and the only one now possessing an important political domain, namely, Persia, which came into their hands by conquest in 1502. But Jafar's other son, Ismail, who was the seventh in succession, was accepted by another faction, the Ismaelites or Sabaïyites, i.e. Seveners. His cause was taken up by a remarkable machinator, one Abdallah ibn Maimun (about 850), who founded the secret society which developed into the Karmathians.

A more abiding political result was produced in Africa. Said, great-grandson of al-Maimun, gave himself out in the western regions of Northern Africa as the Mahdi, and gained a political following which enabled him and his line, the Fatimite dynasty, to conquer Egypt and Syria, which they ruled for over two centuries. During the same period (932-1055) the Shiite Buweyhides were political masters of the Sunnite caliphate at Bagdad, so that Shiism appeared triumphant in the heart of Islam. But the mass of the people remained orthodox, and the Saracens finally turned the scale in their favor. From the Shiite Fatimite movement in Egypt sprang two developments, which were for many centuries disturbing factors in Southwestern Asia, namely, the Druses and the Assassins (qq.v.). Also the Syrian Nosairies (see ANSARIES) adopted the Shiite doctrines, and are still a considerable sect.

Modern history finds the Shiites, outside of scattered sects, in political importance in the following lands: There is the Moorish Alide dynasty, although the land is practically Sunnite. In Southern Arabia Yemen is Shiite, and there are other traces of the sect through the peninsula. A large number of the Indian Moslems are of the same persuasion. But Persia is now the only Shiite nation of importance. Here, however, Shiism has not been able to achieve its political ideals. The Safawide dynasty, to which the Shahs belong, and which conquered Persia in 1502, claims descent from Ali, but the Church disowns them, and there has been continuous strife between the political and ecclesiastical authorities. In any case the Shiite theology could recognize their power as but temporary until the appearance of the Hidden Imam. The ecclesiastical head is the Imam-Jumaa, at Ispahan, who is regarded as the representative of the Mahdi. An interesting attempt at reform was made by Ali Mohammed, 'al-Bab' (1843), but, becoming a political agitation, it was cruelly repressed by the Government. See BABISM.

The following points of contrast and agreement between the two great sects of Islam may be noted. The mysticism and extravagant theology of Shiism and the volatile Persian character have sadly corrupted the morality of the Shiite Moslems, and a divorce between religion and ethics exists among them that does not prevail in orthodox Islam. The dervish type of holiness prevails to excess, while superstition, especially in the matter of worship of the saints, runs riot. The people have lost all respect for the ministers of religion. In law the two bodies agree except in details. There exists, however, one important difference in principle between Shiite and Sunnite law. The latter has developed its four schools of law, and the lawyers in each school must keep strictly to the decisions of their accepted masters; they have no power of creating new law. The Shiites have the theory of a living authority in law, and their Mujtahids have the right to make new decisions without appeal to traditional precedent. The traditional mutual hatred of Shiites and Sunnites is still maintained, but the intensity of this sentiment is said to lie now with the Sunnites. On the other hand, the two parties acknowledge one another as Moslems, and stand together as against the Unbelievers.

For literature, besides the works mentioned in the articles MAHDI, MOHAMMEDANISM, MOHAMMEDAN SECTS, consult: Goldziher, *Beiträge zur Litteraturgeschichte der Shi'a* (Vienna, 1874); Baillie, *Imameea Code*, vol ii. (London, 1869).

SHIKARPUR, shĭk'ăr-pōōr'. A town in Sindh, British India, 23 miles northwest of Sukkur (Map India, A 3). It has a fine covered bazaar, and has long been noted for its commercial interests, its situation giving it sole control of the trade carried on through the Bolan Pass. The section is chiefly engaged in farming and fruit-growing, and there are manufactures of carpets, leather, pottery, and coarse cotton cloth. Population, in 1901, 49,491.

SHIKOKU, shē'kō'kōō' (Jap., Four Provinces). The third in importance of the principal islands of the Japanese Empire (Map: Japan, C 7). It is separated from Hondo and Kiushiu by the Inland Sea. Area, 7030 square miles. Its coast line is very irregular, with many long points jutting out into the Pacific and the Inland Sea. It has no really good harbor, but a number of small ones afford safe refuge for junks and small steamers. Its surface is mountainous, so that the greater part is not cultivated. There are no long rivers, and communication for the most part is by sea. The valleys are fertile, bearing the usual grains. On the slopes of the hills the paper mulberry and the

vegetable wax tree are cultivated. Camphor and tea are exported. The climate is warm in the south, so that bananas, grapefruit, and exceptionally fine oranges are grown, also a small amount of sugar cane. The island is divided administratively into four prefectures: Tokushima, Kagawa, Ehime, and Kochi. Population, in 1898, 3,013,817.

SHIL'DON AND EAST THICK'LEY. A coal-mining town in Durham, England, 3 miles southeast of Bishop Auckland. Population, in 1901, 11,760.

SHILKA, shĕl'kȧ. A branch of the Amur River (q.v.).

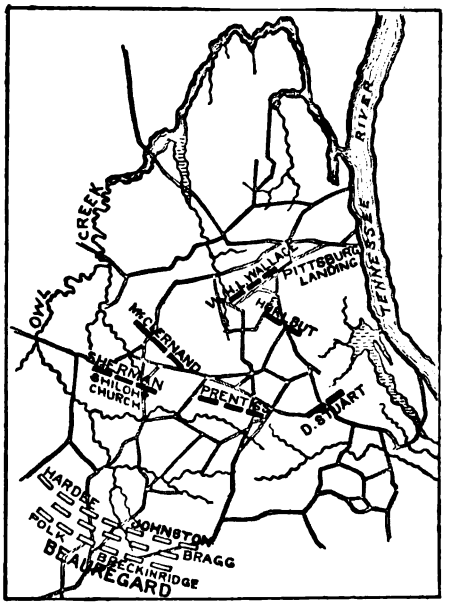
SHIL'LABER, BENJAMIN PENHALLOW (1814-90). An American humorist, born at Portsmouth, N. H. He became a printer at Dover, N. H., in 1830. From 1840 to 1847 he was in the printing office of the Boston *Post*, and after that time was connected with the same paper editorially. At this period he wrote amusing sketches and squibs under the pen name of 'Mrs. Partington,' and gained a wide reputation as a humorist. During 1850-52 he printed and edited the *Pathfinder*, and was associated with Charles G. Halpine (Private Miles O'Reilly) on the *Carpet-Bag*, but was with the *Post* again in 1853-56. From 1856 he was for ten years one of the editors of the Boston *Saturday Evening Gazette;* he then retired to Chelsea and devoted himself to private literary work. Among his successful books may be named: *Rhymes with Reason and Without* (1853); *Poems* (1854); *Life and Sayings of Mrs. Partington* (1854); *Knitting-Work* (1859); *Partingtonian Patchwork* (1873); and *Ike and His Friend* (1879).

SHIL'LETO, RICHARD (1809-76). An English Hellenist. He was born at Ulleshelf, Yorkshire. He studied at Repton and Shrewsbury Schools, and at Trinity College, Cambridge, where almost all of his life was spent as a coach. In 1867 he was elected fellow of Peterhouse. Shilleto's editions of Demosthenes, *De Falsa Legatione* (1844; 4th ed. 1874), and of the first book of Thucydides (1872), as well as his polemic *Thucydides or Grote* (1851), showed him a critic of rare ability.

SHIL'LUK. A negro people on the White Nile, 9° to 12° N., numbering about a million, believed to be of the same stock as the Fur people of Sennar. They are tall, well formed, and nearly jet black. Once a powerful nation, they have been reduced by war and slavery to an abject condition.

SHI'LOH (Heb. *Shīlōh*). A city of Ephraim, 12 miles south of Shechem, where Joshua divided that part of the land of Canaan west of the Jordan (Josh. xviii. 10). Its historical importance is due chiefly to its having been a sacred place where a festival was held annually in honor of Yahweh (Judg. xxi. 19-21) and to which annual pilgrimages were made by the Hebrews till the days of Samuel (cf. I. Sam. i. 3). The sanctuary at the place was a permanent structure the destruction of which, probably by the Philistines, made so deep an impression that it is referred to in the later literature (Psa. lxxviii. 60; Jer. vii. 12). Jeremiah distinctly speaks of it as having been once the dwelling place of Yahweh, and this historical significance of the place is illustrated in the narrative which makes Shiloh the depository of the ark of the Covenant, and the abode of the tabernacle from the time of the conquest until the capture of the ark by the Philistines (I. Sam. i.-iv. 11). The ancient name is preserved in the modern village of Seilun, which shows traces of various ancient buildings. Consult Guérin, *Samarie* (Paris, 1869).

SHILOH, BATTLE OF, frequently called the BATTLE OF PITTSBURG LANDING. A battle of the Civil War fought at Pittsburg Landing, in Tennessee, on the west bank of the Tennessee River, about 20 miles north of Corinth, Miss., on April 6 and 7, 1862, between the Federal Army of the Tennessee, reinforced by the Federal Army of the Ohio, numbering together about 62,500 men, under General Grant, and the Confederate Army of Mississippi, numbering about 40,500 men, under Generals A. S. Johnston and Beauregard. It takes its name from Shiloh Church, near Pittsburg Landing. On March 17, 1862, General Grant took command of the Federal forces stationed at Pittsburg Landing, and by April 1st he had under his command an army of about 45,000 men. On March 15th General Buell, commanding the Army of the Ohio, began his march from Nashville for the purpose of effecting a junction with Grant, a combined offensive movement being planned for the two armies. General Johnston, commanding a large Confederate force at Corinth, determined to strike Grant before Buell could ar-



SHILOH.

rive, and on April 3d issued orders for a general advance. Owing, however, to rain storms and the wretched condition of the roads, the Confederate army was not ready for action at Pittsburg Landing until the afternoon of April 5th, and the attack was not delivered until early on the following morning. Meanwhile the Federal officers seem not to have anticipated an attack in force, and consequently to have made no provision for meeting such an attack, and do not seem even

to have maintained cavalry scouts between Pittsburg Landing and Corinth. On the night of April 5th General Grant went as usual to his headquarters at Savannah, about nine miles down the river, on the east side, where he expected to meet General Buell on the following morning. The positions of the two armies on the morning of April 6th are shown on the accompanying map. Of the Army of the Tennessee the only division at that time not on the field was General Lewis Wallace's division, which was stationed at Crump's Landing, five miles below Pittsburg Landing and on the same side of the river.

At about 7 A.M. on Sunday, April 6th, the engagement began with an attack on the Federal right under Sherman. Gradually the whole Federal line was forced back, taking successive positions, withstanding the Confederates for a time and then withdrawing—the various parts of the army acting more or less independently of one another—until the Confederates had secured possession of the field and the Federals had formed a new line extending diagonally from Pittsburg Landing to Snake River. Perhaps the most stubborn fighting of the day occurred at what the Confederates called the 'Hornet's Nest'—a position assumed by W. H. L. Wallace, Hurlbut, and Prentiss about 10 A.M. and held by them against repeated assaults for five or six hours. It was here that about 2:30 P.M. General Johnston on the Confederate side was killed, General Beauregard then assuming command. About 4 o'clock Hurlbut, attacked in front and flank, was forced to withdraw, and an hour later the divisions of Wallace and Prentiss were attacked in front and on both flanks. General Prentiss with about 2200 men was finally forced to surrender, and though Gen. W. H. L. Wallace's division managed to withdraw without being surrounded, General Wallace himself was killed. General Grant arrived on the battlefield from Savannah at about 8 A.M., but apparently exercised little control over the movements of the Federal troops during the engagement of the 6th. Late in the afternoon the Federal army was reinforced on its left by a division of General Buell's army under General Nelson, which took part in the last fighting of the day. Before the battle was renewed on the 7th the Federal right had been reinforced by General Lewis Wallace, with his division from Crump's Landing, and its left by a large part of General Buell's army. The Federals attacked with great vigor early on the 7th, and by 4 P.M. had driven the Confederates back beyond Shiloh Church, in the neighborhood of which Sherman had been originally stationed. No pursuit of the Confederates was made, and Beauregard withdrew to Corinth (q.v.), whither soon afterwards he was followed by Halleck, who had assumed command in person of the Federal army. In the battle of Shiloh the Federal loss in killed, wounded, and prisoners was about 13,000; that of the Confederates about 10,700. Consult: *Official Records* (vol. x., parts i and ii.); Johnson and Buel (ed.), *Battles and Leaders of the Civil War*, vol. i. (New York, 1887); Ropes, *Story of the Civil War*, vol. ii. (ib., 1898); Nicolay and Hay, *Abraham Lincoln: A History* (ib., 1890); Force, *From Fort Henry to Corinth* (ib., 1881); Grant, *Personal Memoirs* (last ed., 1895); and Swinton, *Twelve Decisive Battles of the War* (ib., 1867).

SHIMABARA, shē'mȧ-bä'rȧ. A city of Japan, situated on a small peninsula in the west of Kiushiu, opposite Kumamoto (Map: Japan, B 7). It is famous on account of the rebellion of the peasants in 1637-38. Excited by misgovernment, they revolted, defeating the troops of their lords and seizing the ruined castle at Shimabara, which they fortified. The Shogun sent an army to put down the revolt. Meanwhile companies of Christians, who had been persecuted for 20 years by the Government of the Shogun, joined the rebels. The siege lasted for 102 days, the castle yielding on April 12, 1638. All within it were massacred. The assailants, however, suffered at least an equal loss. The Dutch in Nagasaki sent their guns and ships to be used against the insurgents. Population, about 20,000.

SHIMODA, shē-mō'dȧ. A seaport of Japan, situated at the extremity of the Idzu Peninsula, in Central Hondo, over 60 miles south of Yokohama (Map: Japan, F 6); the first Japanese port opened to American trade. It was visited by Commodore Perry in 1854 and became in 1857 the residence of the first American Minister to Japan. The present population is over 9000.

SHIMONOSEKI, shē-mō'nō-sĕk'ĭ, or more correctly, **AKAMAGASEKI** ä'kä'mä'gä-sĕk'ĭ, or in Sinico-Japanese **BAKAN**. A fortified maritime town of Japan, in the old Province of Choshiu, and Prefecture of Yamaguchi; situated at the southwestern extremity of the main island, about four miles from the western entrance to the strait leading into the Inland Sea, and separating Hondo from Kiushiu; latitude 33° 56′ N., longitude 130° 56′ E. (Map: Japan, B 6). It lies at the foot of a range of wooded hills and stretches for about two miles along the shore; is the southern terminus of the railway system of Hondo, and stands directly opposite the town of Moji, which has sprung up in connection with the development of the railway system of Kiushiu. The two form a single consular district. Population, in 1898, 42,786.

Here occurred what is known as the 'Shimonoseki affair,' in which in 1864 by a combined naval force of 17 warships—United States, British, Dutch, and French—the Choshiu clan was chastised for having fired in 1863 without provocation on foreign vessels flying the United States, French, and Dutch flags, and an indemnity of $3,000,000 was exacted. The last installment of this sum was paid in 1874. At a later date, however, the United States Government refunded its share, and the money was used by the Japanese for educational purposes. Here in April, 1895, was concluded by Li Hung-Chang, acting for China, and Marquis Ito, for Japan, the treaty of peace which ended the Japanese-Chinese-Korean War.

SHINAR. See BABYLONIA.

SHINER. A name applied to many small fishes of a silvery lustre belonging mainly to the minnows. They are found in the streams of North America. A few species have received popular names, as a dace, the redfin (*Notropis cornutus*), and the golden shiner or 'bream' (*Abramis chrysoleucas*). For the blunt-nosed shiner see MOONFISH. See Plate of DACE AND MINNOWS.

SHING-KING', or more properly, **SHÊNG-KING** (Map: China, F 3). The wealthiest and

the most important, though the smallest, of the three provinces which compose Manchuria (q.v.). Area, about 60,000 square miles. It is roughly triangular in shape, the apex pointing southward and ending in the peninsula of Lao-t'ieh Shan and Port Arthur (q.v.). The northeastern part of the province is occupied by the Shan-a-lin mountain system, whose extensions form the Ts'ien Shan ranges, a long spur of which extends southwest through the peninsula. West of these mountains the country is level; south of them are alluvial tracts of greater or less extent interspersed with hilly ranges of moderate height. The western portion is drained by the Liao, and the eastern by the Ta-yang, which enters the Yellow Sea at Ta-ku-shan (latitude 39° 55′ N., longitude 123° 52′ E.), and partly by the Ya-lu-kiang.

The soil is fertile, producing abundant crops of wheat, barley, millet, maize, pulse, potatoes, cotton, hemp, indigo, tobacco, opium, sesamum and other oil-producing plants, etc. Cattle-raising is an extensive industry, and much wild silk is produced. Gold is found, coal and iron occur in many places and are worked, and there are large areas of valuable peat. Two railways—the Chinese from Peking via Shan-hai-kwan and the Russian from Port Arthur northward to Harbin—traverse the province, but communication is chiefly by roads. The chief ports are Ying-tse (commonly spoken of in connection with Niu-chwang), Port Arthur (q.v.), Ta-lien-wan (q.v.), Pi-tse-we, and Ta-ku-shan, all dominated by Russia, according to the treaty agreement with China, dated March 27, 1898.

The population is estimated at 12,000,000, almost exclusively Chinese.

For centuries Shing-king was held by the Chinese, who made Shin-yang (Mukden) the capital. In 1894-95 the southern part from the Ya-lu to the Liao was captured by the Japanese, but was later relinquished under pressure from Russia, Germany, and France. Since 1898, when Russia leased the southern portion of the peninsula and secured a neutral zone reaching to the middle of the Ta-Yang River and including the village of Ta-ku-shan, Russian influence has prevailed to the practical exclusion of all other nations. See Hosie, *Manchuria, Its People, Resources, and Recent History* (London, 1901).

SHIN'-GON' (Jap., True Word). A Japanese sect of Buddhists. It was founded in the beginning of the ninth century A.D. by Kobo Daishi. Dissatisfied with Buddhism as taught in Japan, he visited China in 802-804, and returning formed his sect. Its doctrine bears little resemblance to the teachings of the historic Gautama, and he is held in relatively light esteem. The worship centres in Vairocana, a quasi-divine being, who is a greater Buddha: he is truth and his emblem is the sun. He is represented as surrounded by four planets, Gautama being one of them, and these again by smaller satellites, and these again by others forming a complete system. This represents the unchanging universe of pure ideas, the 'diamond world,' the true world, only intellectually conceived. Around Vairocana is arranged, like the petals of a lotus, also the phenomenal world, so that all things centre in him. There are two ways of approach, by the intellect and by morality. He who attains salvation perceives the complete unity of both systems and becomes himself identical with Vairocana. The sect was eclipsed in popularity by the rise of the Shin-shu (q.v.) and the Nichiren sects, and at present has comparatively little influence. Consult: Nanjio, *Short History of the Twelve Japanese Buddhist Sects* (Tokio, 1887); Griffis, *The Religions of Japan* (New York, 1895).

SHIN'NECOCK. A remnant tribe of Algonquian stock (q.v.) residing about the bay of the same name near the southeast end of Long Island, N. Y. At the beginning of this century they numbered only about 150 persons, all more or less of negro admixture, and had entirely lost their language and all other primitive characteristics. They are daring seamen and furnish efficient recruits to the United States Life Saving Service, in which several of their most promising young men lost their lives by a storm in 1877. They have no relations with the general Government, but the State of New York supports a school at East Moriches for the benefit of them and the two other Long Island remnants, the *Poospatuck* or *Unquachog* and the *Montauk*, numbering only a few families each.

SHINNECOCK BAY. A bay in Suffolk County, Long Island, N. Y., near the town of Shinnecock Hills (q.v.). Its length is 10 miles, its width from 3 to 4 miles.

SHINNECOCK HILLS. A town in Suffolk County, Long Island, N. Y., 85½ miles by rail east of Brooklyn. It is named after the Shinnecock (q.v.) Indians, a few of whom occupy a reservation in the vicinity.

SHIN-NUNG, shēn'nōōng' (Chin., Divine Husbandman), or SHÊN-NUNG. The second of the legendary rulers of China known as the *Wu Ti* or 'Five Emperors.' He succeeded Fuh-hi (q.v.) in B.C. 2737, and is said to have been the offspring of a certain princess who conceived under the influence of a dragon. He is credited with having introduced plows, discovered the 'Five Grains,' and the medicinal properties of plants, and to have instituted markets for the exchange of commodities. The Temple of Agriculture at Peking (q.v.) is dedicated to him. He was succeeded by Hwang-ti (q.v.) B.C. 2697.

SHIN'RAN SHO'NIN (1173-1262). A Japanese Buddhist theologian and the founder of the Shin-Shu (q.v.), which he established when expelled from his monastery. He was of noble birth, of the great Fujiwara clan, and was educated in the monastery of the Jodo sect of Buddhists on Hiyei San, near Kioto.

SHIN'-SHU' (Jap., True Sect, full name *Jodo Shin-Shu*, True Sect of the Pure Land). A Japanese Buddhist sect. As its title indicates, it is a branch of the Jodo (Pure Land) sect. Like the other Buddhist bodies in Japan, the Jodo derived its teaching from China. It believes in Amida (Skt., Amitabha) only, the Buddha of boundless light, life, and mercy, one of the many beings worshiped in the Great Vehicle. Raising himself to Buddhahood, he vowed to create a 'Pure Land,' to be glorified forever as Buddha of Boundless Light, to save all who should put their faith in his vows. Hence the object of faith is not the historic Buddha, but the 'vow' of Amitabha. Salvation being solely by faith in the 'vow,' the believer needs neither knowledge nor works. Rites and cere-





1. SHINTOIST PRIEST CARRYING GOHEI

2. A SHINTOIST SHRINE AT YAMADA

monies are without efficacy, though the believer as an expression of gratitude lives an upright life and constantly repeats "Glory to Amida the Buddha." The priest is simply the official of the sect and its teacher, all essential distinction from the layman being done away. The priests marry, eat meat, and practice no austerity. The sect is first in popularity with the masses. Its temples are the most magnificent and the most frequented. At present it is the most progressive sect in the Empire, adopting the methods of Christian missions and sending some of its priests as students to Europe and America. In the fifteenth and sixteenth centuries it took part in the feudal wars, armed its priests, and turned its monasteries into fortresses. For more than a century it ruled the great Province of Kaga. Shin-Shu is Buddhist only in name, retaining nothing of the teaching of Gautama and according him no honor. Consult: Nanjio, *Short History of the Twelve Japanese Buddhist Sects* (London, 1887); Griffis, *The Religions of Japan* (New York, 1895).

SHINTŌ, or **SHINTOISM** (Sinico-Jap. *shintō*, Jap. *Kami-no-michi*, the way of the *Kami* (in Chinese *shin*) or gods). The ancient religion and mythology of the Japanese. The history of the religion falls into three periods: the first terminating in the sixth century A.D., the second in the eighteenth century A.D., and the third continuing until the present time. In the first period the religion had no name and was perhaps undifferentiated from other rites. It had neither dogmas, moral precepts, nor sacred writings. The objects worshiped were called *kami*, 'superior.' A late authority declares that the superior representatives of every class are *kami*, as trees, stones, mountains, birds, animals, men and spirits, and denies that the *kami* are spirits within the natural objects. In the ancient traditions mention is made of gods of the earth, and of heaven, which was simply a plane a little above the earth. Some gods were good and some were bad, some were mortal, and some were wedded to women. From one of the latter class of gods is descended the emperor. There were deities also of the cauldron, and kettle, and saucepan, gods of the kitchen, and of the gate, as well as gods of pestilence, storms and heavenly bodies. In fact, there was no distinctive class of gods, but everything was worshiped which excited fear or admiration. Nothing was related of heaven or hell as places of awards, but there were confused and contradictory accounts of hades as the place of departed beings. The rites were purifications by water from crimes and defilement: the offerings were anything of value, swords, armor, spears, and especially cloth, which has become the peculiarly cut strips of paper called *go-hei* which hang before the shrines. The prayers were thanksgivings and lists of offerings. The shrines were simply huts and the shrine-keepers sometimes called 'priests,' had neither sacerdotal nor teaching functions. There were no images in the shrines nor ornamentation of any kind, but in a few of them, a mirror and a 'pillow' for the god.

The second period begins with the sixth century, when Buddhism and Chinese civilization were introduced. Shin-to soon yielded to its rival, the native gods being regarded as incarnations of Buddha. (See KŌBŌ DAISHI.) Buddhist priests became the custodians of the shrines, and introduced their own ornaments, images and ritual. The two religions were united under the name *Riobu-Shintō*, the "Shinto of two kinds," a mongrel system in which Buddhism was the active partner. The mythology was written down with the ancient prayers. Only in the palace of the emperors, who were themselves Buddhists, and at a few of the great shrines were attempts made to preserve something of the ancient usage. The distinctively Shin-to 'priests' became fortune tellers and magicians.

In the eighteenth century a succession of great scholars (Mabuchi, 1697-1769, Motoori, 1730-1801, and Hirata, 1776-1843), animated by a love for antiquity and a hatred of all things foreign, attacked Buddhism and Confucianism and sought the reëstablishment of 'Pure Shinto.' They taught that its essence was obedience to nature and to the emperor. They produced marked effects in literature and in politics, but Shinto was too shadowy and ill-defined to gain religious hold of the people. The sentiment aroused was utilized by the revolutionists of 1865-1868, when the western clans overthrew the government of the Shogun and restored the emperor to the head of the government. At the restoration Buddhism was disestablished and Shinto put in its place. But Shinto could not maintain itself, and became a code of ceremonies for court and officials. At present it represents the intense patriotism of the people, and furnishes the rites for religious ceremonial at the court, all officials being obliged to observe its forms.

The origin of Shinto is unknown. Its legends are evidently from diverse sources, and Chinese influence in the formation of some of them can be detected. It is a confused mixture of nature and ancestor-worship. Its mythology also confuses history with the stories of the gods, putting both into a continuous narrative. It contributed nothing to the civilization of the Japanese, though the scholars mentioned above established in modern times the standard of pure Japanese literature, as distinguished from the Sinico-Japanese. Its legends form the best source for the reconstruction of the primitive life of the people. It expresses the Japanese nature, in its patriotic reverence for the Imperial house, and in its admiration for all things extraordinary.

Consult: Rosny, *La religion des Japonais* (Paris, 1881); Chamberlain, *Translation of the Kojiki* (Yokohama, 1883); id., *Things Japanese* (4th ed., New York, 1902); Cobbold, *Religion in Japan: Buddhism, Shintoism, Christianity* (London, 1894); Griffis, *The Religions of Japan from the Dawn of History to the Era of Meiji* (New York, 1895); Florenz, *Japanesische Mythologie* (Tokio, 1901). See also the section on RELIGION under JAPAN.

SHIP (AS. *scip, scyp*, Goth. *skip*, OHG. *scif, scef*, Ger. *Schiff*, ship; of unknown etymology). In strictly nautical nomenclature the term *ship* is applied to a large vessel with three or more masts, of which at least three are square-rigged. The term is very generally applied to vessels of all kinds which are larger than boats.

Before the application of steam to marine propulsion the largest sailing ships rarely exceeded 200 feet in length and the proportion of length to beam was usually not far from 4 to 1. The bows were bluff and the stern hardly less so,

particularly in line-of-battle ships. Frigates and many merchant vessels were somewhat sharper. The full bows and relatively great width of beam, while they reduced the speed, gave great handiness or manœuvring power—a most necessary requisite in battle and in narrow channels or crowded harbors. The advent of steam changed the conditions materially. Sailing vessels were no longer used as fighting ships, while in the merchant service they had to compete with steamers. Furthermore, in entering or leaving a port and usually in passing through narrow channels, the services of tugs were available. These conditions led to changes in design which culminated in the celebrated clipper ships a little after the middle of the last century. These vessels were intended for long voyages and frequently made such fast passages as to rival the best steamer speeds. The famous *Dreadnaught* made the passage from Liverpool to New York in 13 days 8 hours and the *Red Jacket* in 13 days 11 hours and 25 minutes. The ordinary fast mail steamer passage was then about ten days.

The modern sailing ships are built on lines very similar to those of the old clippers and their average speed under sail is not greatly inferior, but they are designed for greater proportional carrying capacity, and the numerous small and light sails, which added slightly to the speed and a good deal to the cost of maintenance, are rarely fitted. Even in sailing ships steam is now very commonly provided to facilitate handling cargo, hoisting the sails, operating the steering engine, etc.

In the coasting trade of the United States large schooners (q.v.) have almost wholly displaced square-rigged vessels. The large schooners are greater in size than most ships of a half century ago, while the largest ones have seven masts and exceed in length (and probably in carrying capacity) any of the old square-riggers.

The primary advantage of the schooner over its square-rigged rival is the ease with which its sails are handled, whereby the necessary number of men in the crew is greatly reduced. Furthermore, the schooner lies somewhat closer to the wind than the square-rigged ship. The schooner spreads less canvas than the ship of the same size, and is therefore, as a rule, not so speedy a sailer.

The sailing ship was a development of the galley (q.v.), and it was not until the eighteenth century that it attained a form and character suitable to ocean navigation under all conditions of weather. The earlier types were often profusely ornamented and carefully made, but clumsy, slow, and unseaworthy. The sterns, and in some cases the bows, were built high in the air. These awkward excrescences were gradually reduced in height until they took final shape in the poop and topgallant forecastle so common in steamers of the present day. Sailing ships are not now usually built with raised poop or forecastle, as the difference in level of the parts of the deck interferes with ease of handling the sails. In their place deck houses are often fitted. These do not extend the full width of the upper deck, in order to permit of hauling ropes in the gangways abreast them.

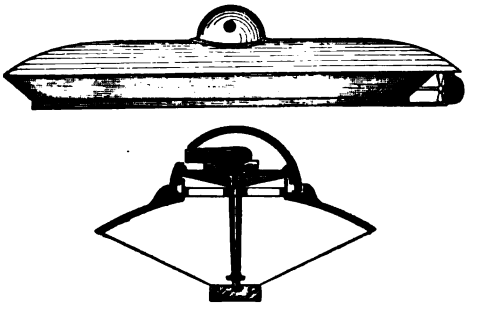
The reform in design of the rigging and sails was simultaneous with the improvement in the hull, the poorly set and absurdly placed sails of the fourteenth, fifteenth, and sixteenth centuries giving way to the precisely planned sails and rigging of the eighteenth and nineteenth. The general adoption of three masts for large square-rigged vessels was due to the relation of length to beam. So long as this ratio does not exceed 6 to 1, three masts are found to be adequate, though as the latter figure is approached the addition of a fourth mast is not unsuitable. Probably no sailing ship of the eighteenth century had a length greater than five times her beam, and in many the proportion was not much beyond three to one.

A very large majority of the sailing ships of the world are built of wood, and doubtless for many years this will be so. But iron ships are more durable, require less expensive repairs, and carry more cargo on the same exterior dimensions; they are therefore beginning to supplant the wood-built ship. The lower masts, and in some cases the upper masts and yards, are of iron, while wire has almost entirely displaced hemp for standing rigging (q.v.).

The sails, masts, and spars of vessels are arranged in many different ways—in nautical language, the vessels have different *rigs*—and each particular style of arrangement has its own distinguishing name. The more common forms are ship-rig, bark-rig, barkentine-rig, sloop-rig, yawl-rig, cutter-rig, and cat-rig. A sailing ship is ship-rigged, of course, but a steamer may be ship-rigged, bark-rigged, brig-rigged, etc. Each principal style of rig has some variations; thus we have four-masted schooners, topsail schooners, etc. The accompanying plate shows in detail the rigging of a modern ship.

For further information, see BARK; BRIG; GALLEY; MAST; SAIL; SCHOONER; FRIGATE; DECK; LOAD-LINE MARKS OF VESSELS; MEASUREMENT OF SHIPS; NAVIGATION; NAVIES; RAM, MARINE; SHIP, ARMORED; and particularly SHIPBUILDING and STEAM NAVIGATION.

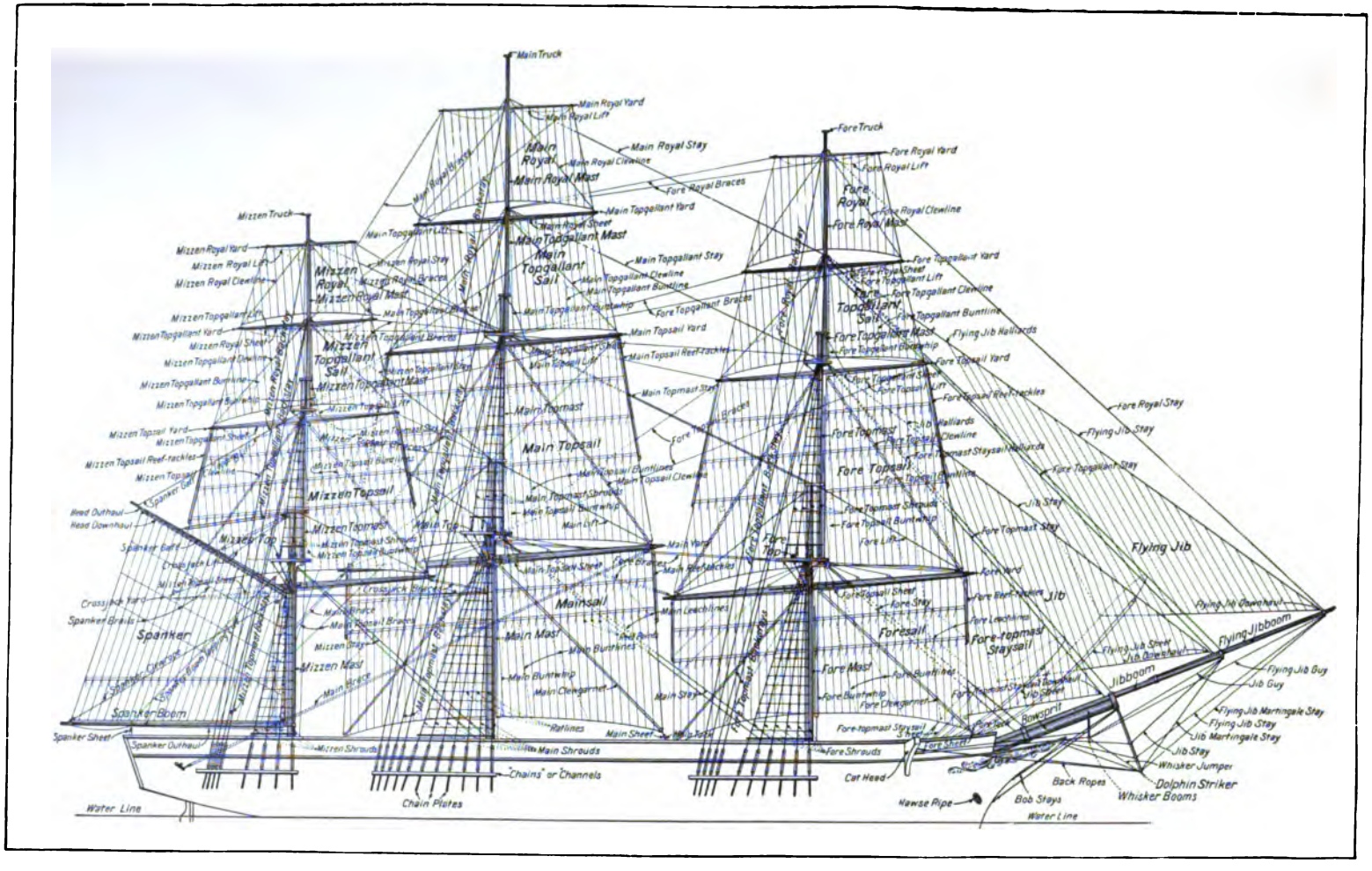
SHIP, ARMORED. The first real armored vessels were floating batteries used at the siege of Gibraltar in 1782. The first proposal to build an armored steam vessel seems to have been made by Colonel John Stevens of New Jersey, who, in 1812, prepared plans for such a craft. In 1841 his son, R. L. Stevens, made proposals to



ERICSSON'S IRON-CLAD CUPOLA VESSEL.

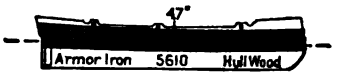
the United States Navy Department to build an ironclad steamer of high speed in which all of the machinery, including the propellers, should be below water. This vessel was not built on the original designs, as it was considered desirable to increase the thickness of armor to be car-

SHIP



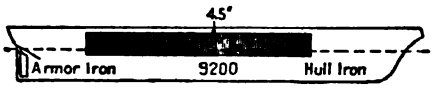
A FULL-RIGGED SHIP

ried from 4.5 to 6.75 inches. The keel was not laid until 1854, only two months before the com-



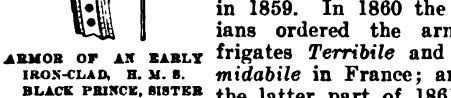
GLOIRE, FRANCE, 1858.

mencement of the 'Kinburn batteries' in France, but it is to be noted that the French vessels were

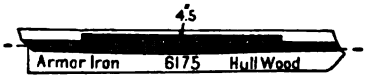


WARRIOR, ENGLAND, 1859.

floating batteries and not high-speed sea-going ships, as was Stevens's. The latter, whose construction, after the death of R. L. Stevens (1856), was continued by his brother, E. A. Stevens, was never completed, and the French were the first to produce a sea-going armorclad, the *Gloire* (for description see ARMOR PLATE), which was a screw line-of-battle ship rebuilt in 1858-59 and armored; they also commenced the first iron-hulled armorclad (the *Couronne*). The *Gloire* and *Couronne* were quickly followed by the *Warrior*, which was laid down in England in 1859. In 1860 the Italians ordered the armored frigates *Terribile* and *Formidabile* in France; and in the latter part of 1861 the Russians changed the plans of the wooden frigate *Petropavlovsk*, then building, and gave her a complete water-line



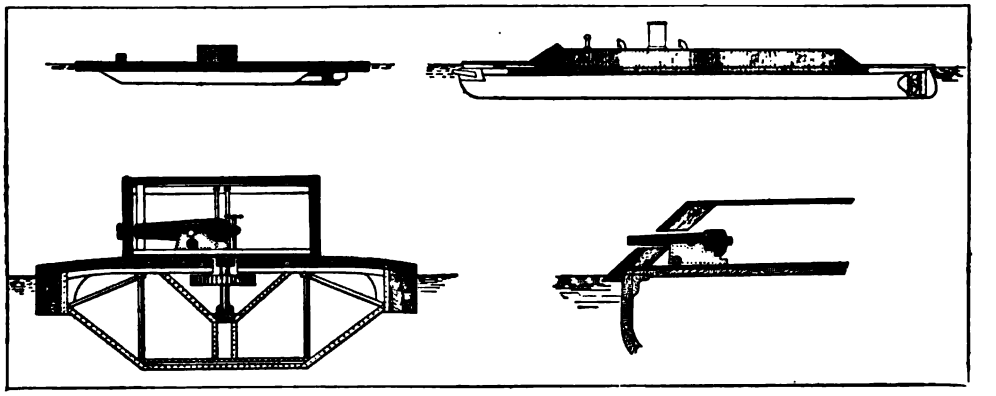
ARMOR OF AN EARLY IRON-CLAD, H. M. S. BLACK PRINCE, SISTER SHIP TO WARRIOR.



PETROPAVLOVSK, RUSSIA, 1861.

belt and casement of iron. So far the application of armor to vessels had brought about no change in the type except to reduce the number of decks on which guns were carried. But in 1861 the *Monitor* and *Merrimac* (*Virginia*) were designed. They differed from all previous men-of-war in being mastless; each was completely armored; one mounted its guns in a revolving turret and one in a central armored battery. If you place a monitor's turret at each end of the *Merrimac's* citadel, make the sides more nearly vertical, and raise the upper deck sufficiently to give seaworthiness, you have the general features of the battleship of 1903.

In 1861, under an act of Congress providing for armored vessels, the *Galena*, the *New Ironsides*, and the *Monitor* were constructed. The *Galena* was an armored gunboat of the ordinary type, except that her sides amidships inclined inward ('tumbled home') at an angle of about 45 degrees and were covered with 2.5 inches of armor. Her plating was found to be too thin to be of much use and she was regarded as a failure. She was completed early in 1862 and took part in the attack on Drewry's Bluff forts, when her armor was repeatedly perforated. In this case, since the forts were elevated, the inclination of her sides was a disadvantage. The *New Ironsides* was finished late in 1862 and attached to the blockading fleet off Charleston, where she remained for two years. She was built of wood and her general plans were similar to those of an ordinary steam frigate of her day, except that she had a ram bow and a retreating stern like that of many recent battleships. Her sides 'tumbled home' at an angle of about 30 degrees from the vertical for about two-thirds her length, and over this portion she was covered by 4.5-inch iron plates of large size from some distance below the water line to the upper deck. The broadside armor was joined at the ends by thwartship plating of equal thickness, the whole forming a citadel protecting the battery, boilers, and engines. She was 232 feet long, 58 feet broad, and had a displacement of 4120 tons at her designed load draught. Her battery consisted of sixteen 11-inch Dahlgren smooth-bores, two 220-pounder Parrot rifles, and four 24-pounder howitzers. She was the most successful armored ship of her day, was in action more times than any other vessel ever built (so far as existing records show), and was struck by more projectiles than any other vessel, yet her armor was never pierced, she was never put out of action, and she was never forced to go to a home port or depend upon outside assistance,



MONITOR AND MERRIMAC.

while in some of the actions in which she was engaged other ironclads were sunk and several monitors were disabled and forced out of action. After the war, in 1866, she was accidentally destroyed by fire at the Philadelphia navy yard.

The third vessel was the far-famed *Monitor*. The contract for her construction was signed October 4, 1861, and she was launched January 30, 1862. Her dimensions were: extreme length, 172 feet; length of hull proper, 124 feet; extreme beam, 41.5 feet; width of hull where it joined the overhang, 34 feet; width of hull at bottom, 18 feet; depth of hold, 11.33 feet; mean draught, 10.5 feet; inside diameter of turret, 20 feet; height of turret, 9 feet; displacement, 987 tons.

The *Monitor* was a most remarkable vessel in many ways, but she was not a ship of war, but a floating battery, and useful only in smooth water. She was fortunate in meeting a craft equally unseaworthy. She was not even the first turret vessel to be commenced, nor was she the best when finished. Before the contract was drawn for the *Monitor*, Denmark had contracted with Captain Cowper Coles for the building of the double-turreted, *sea-going* ironclad *Rolf Krake*, and her keel was laid before the construction of the *Monitor* was authorized. The *Rolf Krake* was a very successful vessel, and, although she was never in close action with another ship, she several times silenced Prussian batteries and held the whole Prussian fleet in check in 1864.

Ericsson, however, was probably the first to produce plans of a practical revolving turret mounted on board a vessel, as there seems to be no design of one antedating those he sent to Napoleon III. in 1854. Ericsson's *Monitor*, also, was the first completed vessel carrying a revolving turret, and while many of her details were faulty, others were original and ingenious in the highest degree.

Whether the fight between the *Monitor* and the *Merrimac* was a drawn battle, as some assert, or a complete victory, the results are the same. The *Monitor*, as in some sense a savior of the country, was accorded an importance its intrinsic merits did not warrant. Other monitors were built, improved in some respects, but embodying many of the defects of the original and some of their own. Almost every nation in Europe also built vessels of the monitor type, but having no patriotic reasons to revere them, the evolution of the turret ship proceeded rapidly, though the value of broadside fire from numerous guns was never quite forgotten, and in many designs, in a modified form, it displaced the turret. This modified form was of two types, called the bow battery and central battery, the latter exemplifying the fullest development of the idea, which was to secure heavy end-on fire without much sacrifice of weight in the broadside.

In 1863 the British converted several vessels into turret ships with four turrets (*Royal Sovereign* class); the North German Confederation



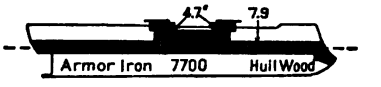
AFFONDATORE, ITALY, 1863.

ordered the *Arminius*, a turret ship of 1600 tons, similar to the *Rolf Krake;* France laid down a number of turret vessels of about 3000 tons (*Taureau* class); Italy laid down the turret ship *Affondatore* of 4400 tons, and Russia, the Netherlands, Norway, and Sweden began the construction of numerous monitors of the American low



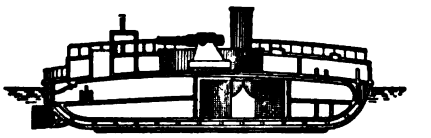
ADMIRAL LAZAREFF, RUSSIA, 1864.

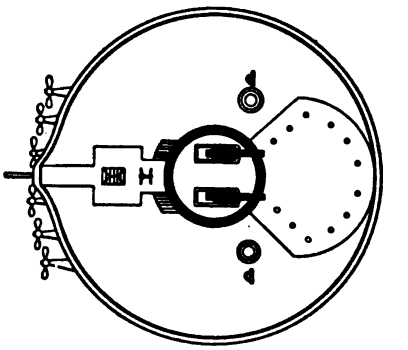
freeboard type. The reaction against the turret ship is noticed in the vessels produced in the next two or three years, which are mostly central battery ships. The long row of guns on the broadside is given up, for it was seen to be im-



OCEAN, FRANCE, 1865–66.

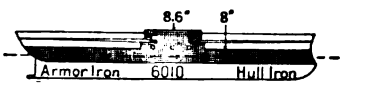
possible adequately to protect so great an area with armor. The guns were decreased in number, but increased in size, and gathered in a group amidships. To secure fire ahead and astern, some guns were mounted in the angles





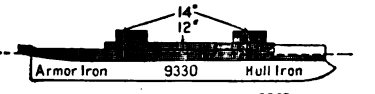
POPOFF STEAM BATTERY NOVGOROD, RUSSIA, 1873.

of polygonal citadels or in circular barbette towers over the corners of the battery. Of the great Powers, Russia alone adhered chiefly to



AUDACIOUS, ENGLAND, 1867.

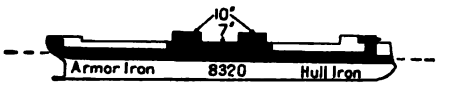
the turret, although she built one or two central battery ships. In 1866 Great Britain re-



DEVASTATION, ENGLAND, 1869.

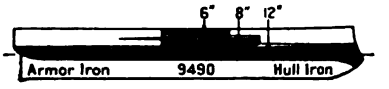
verted to turret ships in the high freeboard *Monarch* and the rather low freeboard *Captain*. The uselessness of sail power in heavy fighting ships

was not yet appreciated; and the *Captain*, with her very moderate height of side, attempting to carry sail in heavy weather in the Bay of Biscay, capsized and went to the bottom with nearly every soul on board. The danger of masting low freeboard ships was then fully appreciated. France continued to develop the barbette ship



MONARCH, ENGLAND, 1866.

in the *Ocean* and *Friedland* types. Italy constructed only central battery or bow battery ships until 1872. Russia built nothing but turret ships, except some armored cruisers (begun in 1870). Great Britain followed the *Monarch* and *Captain* with several low freeboard turret ships, reverting again in 1873 to the central battery in the



ALEXANDRA, ENGLAND, 1873.

Alexandra, one of the last and best of this type. France built a few central battery ships with barbette towers in addition, but continued the development of the barbette, with or without an unprotected auxiliary battery. Germany built chiefly central battery ships in the period 1865-73. Italy built no ships at this time. Russia built three or four central battery craft (but they properly belonged to the cruiser class) and one heavy turret ship, the *Pietr Velikii*.

In 1873-74 a radical change was introduced in the British and Italian navies. Up to this time, with few exceptions, the armor belt of battle-



DUILIO, ITALY, 1873.

ships had extended from bow to stern. In 1873 Italy began the construction of the turret ships *Duilio* and *Dandolo*, and Great Britain laid down the *Inflexible*. These ships were remarkable in



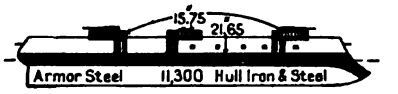
INFLEXIBLE, ENGLAND, 1874.

many ways. They were of unprecedented size (almost 12,000 tons); almost their whole battery was concentrated in four enormous guns behind very thick armor; the complete belt was given up and a central citadel, extending only a



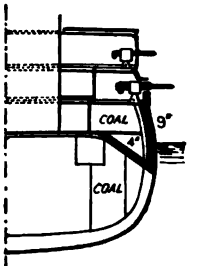
FURIEUX, FRANCE, 1875.

small portion of the length (in the case of the *Inflexible*, less than one-third), but of enormously thick armor, protected the vitals, but did not absolutely insure stability if the unarmored ends were destroyed; to assist in reducing danger in case of injury to the ends, a submerged armored deck extended from the citadel to the bow and to the stern a few feet below water; and lastly, their turrets, instead of being on the middle line of the ship, were placed in 'echelon,' the forward one close out to one side of the ship,



AMIRAL BAUDIN, FRANCE, 1878.

and the after one close out to the other. This method of mounting theoretically doubled the fire ahead and astern; practically the principal result was to reduce the weight of fire on one bow and one quarter and almost destroy fire directly ahead or astern because of interference of the upper works. From this time on the development in each of the principal navies was along different lines. The British next built two reduced copies of the *Inflexible;* then some small single-turret ships shaped like a shoe—high aft, low forward; then two more modified copies of the *Inflexible*. In the *Admiral* class (*Collingwood*, *Benbow*, etc.), which followed, the short belt of the *Inflexible* was retained and made narrower by the height of a deck, the main battery was mounted in barbettes on the middle line, one forward, one aft, and an auxiliary battery of 6-inch guns provided, though they were not protected by armor. Following these came two more shoe-shaped single-turreted vessels of large size (10,500 tons). These were the *Sanspareil* and her sister, the ill-fated *Victoria;* they carried two 110-ton guns in the turret forward, a 10-inch gun on the poop, and a battery of twelve 6-inch guns, which was protected by thin armor. In one of the *Admiral* class and in the *Victoria* and *Sanspareil* the very heavy gun reached its maximum in weight. In the next ships laid down the weight was reduced from 110 tons to 67, and the calibre from 16.25 inches to 13.5. These ships, the *Nile* and *Trafalgar*, were great improvements on their predecessors, and, although their auxiliary batteries were weak, they were well protected, as was the hull. The next design was that of the *Royal Sovereign* class of 14,150 tons, the first of which was laid down in 1889; in these vessels the modern battleship is foreshadowed, but it was not until the *Magnificent* class (1893) that the principal details were well settled. These carried 12-inch guns in turrets and 6-inch guns in armored sponsons. The later ships resembled these quite closely, but in the *Bulwark* class



SECTION OF MAJESTIC (*Magnificent class*).

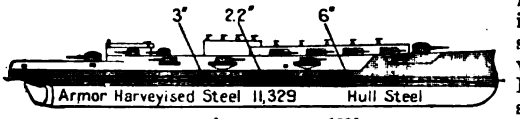


COMMONWEALTH, ENGLAND, 1901.

(1899) the water-line belt was carried to the bow instead of merely covering the vitals amidships, and in the *Albion* (1898) and *Commonwealth* (1901) classes it was carried to both bow and stern. In the last named four guns of

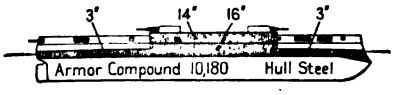
9.2-inch calibre were added to the auxiliary battery of 6-inch pieces, and the displacement was brought up to 16,350 tons.

In French ships the complete water-line belt, extending from stem to stern, was invariably retained. For many years the heavy guns of all French battleships were mounted high above the water in barbettes, one in each (never in pairs—in order to prevent the disabling of two guns by one shot). The arrangement of the heavy guns differed from the practice in other navies; one was placed on the forecastle, one each side amidships. The importance of an



JEANNE D'ARC, FRANCE, 1899.

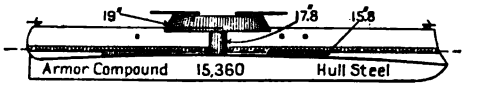
auxiliary battery of guns of medium size was never lost sight of in French designs, though for many years they were unprotected by armor, the *Brennus*, commenced in 1888, being the first in which armor protection was afforded them. In 1893 the *Charlemagne* class was commenced; in these vessels the heavy guns were mounted, as



TCHESME, RUSSIA, 1883.

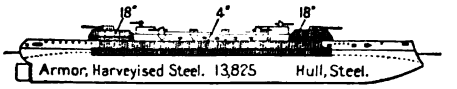
in American and British battleships, in pairs in turrets forward and aft, and this plan has been followed in all subsequent designs.

The Italian navy has shown greatest originality of design, though many of the ships have never been approved by other naval authorities. The Italians early grasped the fact that powerful vessels must be large and did not hesitate to accept great dimensions. Following the *Dan-*



ITALIA, ITALY, 1876.

dolo and *Duilio* of nearly 12,000 tons, which have already been mentioned, they built the enormous nondescripts *Italia* and *Lepanto* of over 15,000 tons. These great vessels have no side armor whatever, but in a large diagonally placed barbette, 19 inches thick, are mounted four 17-inch guns weighing 100 tons each. These were followed by three vessels of about 11,200 tons, also carrying four 100-ton guns, but having the water line protected by armor for about half the length amidships. The *Sicilia*, *Sardegna*, and *Re Umberto*, of 13,300 to 13,900 tons, begun in

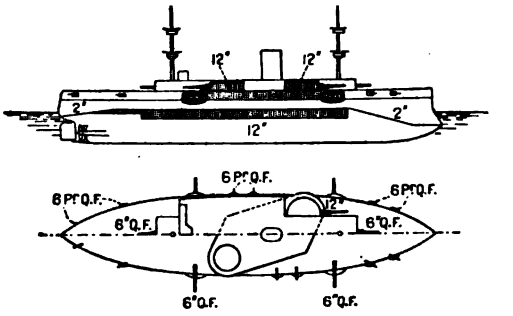


RE UMBERTO, ITALY, 1884.

1884, were originally planned as improved *Italias* without side armor, but when completed more than half the whole side from water line to upper deck was covered with 4-inch plating as a defense against small-calibre rapid-firing guns, and they were the first vessels to be so protected. In the next designs the Italians adopted the 8-inch gun as an intermediate calibre, mounting it much as it is placed in American battleships. In their newest vessels the whole auxiliary battery is made up of 8-inch guns and the speed is put at 21.5 knots, at least 2.5 knots greater than that of any other battleships built or building.

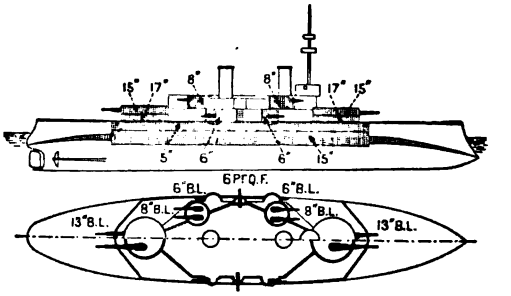
For many years after the formation of the Empire Germany was content to remain in the second rank of naval powers, but in 1889 she began the construction of four battleships of 10,000 tons, which were remarkable from the fact that they carried six 11-inch guns in pairs in three turrets on the midship line. These vessels in 1903 were undergoing alterations with a view to removing the middle turret and its guns. From 1889 the building of battleships proceeded steadily. The ten succeeding ships are remarkable for the smallness of their principal guns (9.4-inch, a calibre adopted to secure rapid loading) and the ingenuity of distributing and mounting the guns to secure wide arcs of fire. The battleships commenced in 1901-02 are of similar design, but they carry 11-inch guns.

In the United States no armored vessels except monitors were built until the small battleships *Maine* and *Texas* were begun in 1889.



U. S. S. TEXAS, 1889.

About two years later the larger battleships *Indiana*, *Massachusetts*, and *Oregon* of 10,280 tons were commenced. A prejudice still existed against 'high-sided' armorclads, and these were designated as 'coast-line battleships' and given very moderate freeboard. They were very remarkable ships for their day. Their speed was rather low than high—but the battery was pow-



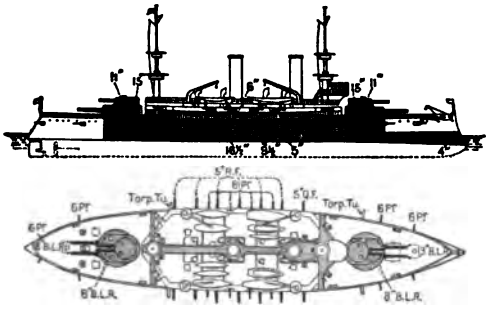
U. S. S. OREGON, 1891.

erful and included, in addition to four 13-inch guns, a powerful auxiliary battery of eight 8-inch and four 6-inch guns. The possession of 8-inch guns makes them still formidable foes for the most recent European battleships, for shells from these



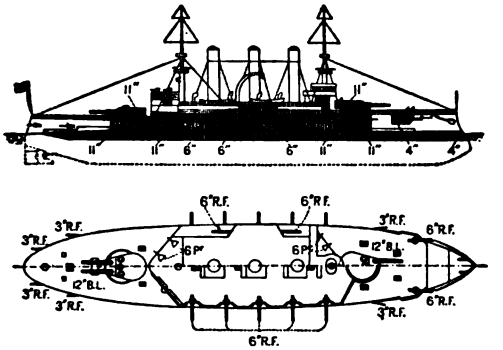
UNITED STATES FIRST-CLASS BATTLESHIP "KEARSARGE."

guns will at battle range pierce the armor protecting any auxiliary battery afloat. Two years later juster ideas of the true uses of a naval force permitted the building of the *Iowa* (11,340 tons), which was frankly called a 'sea-going battleship.' She was followed by the *Kentucky* and *Kearsarge* of 11,525 tons. These vessels embodied many new ideas, the most talked of being



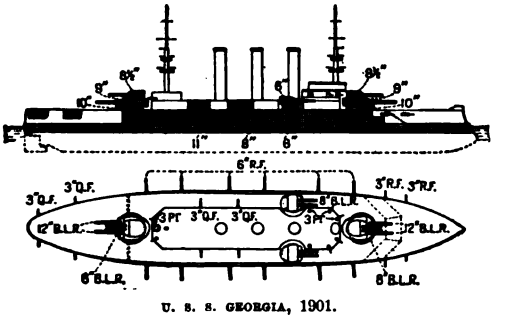
U. S. S. KEARSARGE, 1895.

the superposed turrets of the 8-inch guns, which were placed on top of the turrets of the 13-inch. The second peculiarity is the arrangement of the guns in a long central battery (but separated by 1.5-inch steel screens) behind continuous armor;



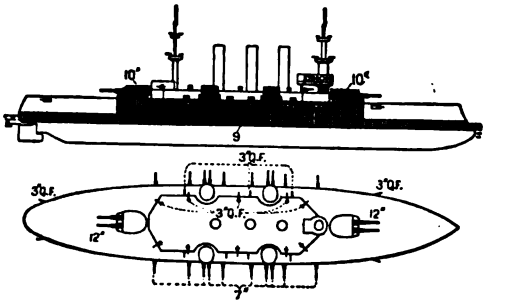
U. S. S. MAINE, 1898.

the side amidships is thus completely armored. The third point of interest is the wide application of electricity—every piece of auxiliary machinery outside the engine and fire rooms being driven by electric motors. In the next ships, the *Alabama, Illinois,* and *Wisconsin* (11,525



U. S. S. GEORGIA, 1901.

tons—completed 1901), and the *Maine, Missouri,* and *Ohio* (12,500 tons, completed in 1902-03), the 8-inch guns were omitted, following the European practice. This mistake was corrected in the next five ships, the *Georgia, New Jersey, Nebraska, Virginia,* and *Rhode Island* (15,000 tons, commenced in 1901), which have superposed 8-inch turrets over the 12-inch guns and another pair of 8-inch guns in a turret on each side amidships; in addition, a battery of twelve 6-inch guns is provided. In the next two ships, com-



U. S. S. CONNECTICUT, 1902.

menced about the end of 1902, the *Connecticut* and *Louisiana* (16,000 tons), the 8-inch guns were retained, but arranged over the central superstructure, nearly as in the *Oregon;* the four 12-inch guns are mounted as in all recent American battleships; and in addition to the 8-inch, there is an auxiliary battery of twelve 7-inch guns. These ships are much the most strongly armed ships so far designed for any navy.

As regards belt armor, the vessels of the *Oregon* class have water-line belts extending for little over half the length amidships; the *Iowa's* belt is proportionately much longer; in the *Kearsarge* and *Alabama* classes the belt is extended to the bow; while in the *Maine, Georgia,* and *Connecticut* types it extends to the stern as well. Reference to the cut in the article SHIPBUILDING, showing a midship section of a modern battleship, will illustrate the arrangement of the armor.

We have so far considered battleships only. Many ships are more lightly armed and armored, but are given high speed and a large coal supply. These are called armored cruisers. At first, armored cruisers were rather small, and the armor confined chiefly to a belt at the water line. While older vessels, designed as battleships, partake of the character of cruisers, the first armored cruisers designed as such were the *Imperieuse* and *Warspite,* of the British navy. They were completed in 1886-88, but were designed about 1881. The armor consists of a short water-line belt and shallow barbettes for the four principal guns. The first innovation was the French *Dupuy de Lôme,* commenced in 1888 and finished about 1892. With the exception of a small area at the bow her sides are completely covered with 4-inch armor from the water line to the upper deck, and, in addition, she has armored barbettes for her principal guns. She was followed by other French ships almost equally covered—the armor a little thinner—but later types in all navies have much less area of side covered. In order to provide adequate sustained speed in heavy seas and to carry large supplies of coal, armor, and armament, the size of armored cruisers has grown until now many of them exceed 14,000 tons in displacement and approach the most powerful battleship in armament and protection. Such, for instance, are the

Tennessee and *Washington* of the United States Navy, which were commenced about the end of 1902. They are 502 feet long, and have a displacement of 14,500 tons, while their battery consists of four 10-inch guns, sixteen 6-inch, twenty-two 3-inch, twelve 3-pounders, four 1-pounders, and eight automatic and machine guns.

The third type of armorclad is the coast-defense ship. The ordinary type of armored coast-defense ship is the improved monitor, of somewhat similar design, a vessel carrying heavy ordnance, and fairly thick armor, with light draught and good manœuvring qualities. Coal capacity, habitability, seaworthiness, and (usually) speed are sacrificed to keep the dimensions within moderate limits. Many small countries have built coast-defense ships on these lines, realizing their inability to maintain an adequate naval force to assume offensive operations against a first-class power. In the greater navies the coast-defense ships are largely vessels of obsolete types, many of them designed originally as sea-going ships, but now unfit for modern offensive operations. For the defense of certain harbors and channels the United States has recently built several improved monitors and a few powerful coast defenders have recently been completed by France, Germany, the Netherlands, and Russia. Many of them are thoroughly seaworthy ships, however, and only regarded as in the coast defense class because of their size and moderate coal supply.

BIBLIOGRAPHY. For further information, consult: *Annual of the Office of Naval Intelligence* (United States Navy), particularly for the year 1889 and subsequent volumes; Brassey, *Naval Annual* (Portsmouth, England); Laughton (ed.), *The Naval Pocket Book* (London, annual); *Aide-mémoire de l'officier de marine* (Paris, annual); *Taschenbuch der deutschen und der fremden Kriegsflotten* (Munich, annual); *Almanach für die kaiserliche und königliche Kriegs-Marine* (Pola, annual); Brassey, *British Navy*, vol. i., "Shipbuilding for Purposes of War" (Portsmouth, 1885); *Proceedings of the United States Naval Institute* (published quarterly at Annapolis, Maryland), particularly vol. ix., No. 3; *Army and Navy Year Book* for 1895 and 1896 (Philadelphia); *Journal of the Society of Naval Engineers* (published quarterly at Washington); the *Proceedings of the Society of Naval Architects and Marine Engineers* (published annually, New York); *Nauticus* (annual, Berlin); *Transactions of the Institution of Naval Architects* (published annually, London); Wilmot, *The Development of Navies* (London, 1892); Very, *The Navies of the World* (ib., 1880); King, *The Warships of Europe* (Portsmouth, 1878); Bennitt, *The Monitor and the Navy Under Steam* (Boston, 1900); Buchard, *Marines étrangères* (Paris, 1891); annual reports of the Secretary of the Navy. See articles on ARMOR PLATE; GUNS, NAVAL, etc.

SHIPBUILDING. The simplest form of floating craft designed to support and transport men or objects is the log; the next step is the raft; then the dugout, or log hollowed out; the 'hollowed out' principle being established, the canoe of bark or skins stretched upon light frames naturally followed when lightness was a matter of importance. To secure increased size the dugouts were split and additional planks inserted between the sides to form a broader bottom, the next step naturally being the construction of a vessel of planks sewed together with ropes, or held together with wooden pins and braced by light interior frames. The next form was that of a vessel in which the planking was attached to strong frames by wooden pins or metal fastenings; when this point was reached the larger craft had whole or partial decks. Lastly we have the iron or steel ship of the present day.

The earliest Egyptian drawings show boats constructed of sawn planks and having sails as well as oars. Notwithstanding the fact that Egyptian ships are the earliest of which we have positive knowledge, there are the strongest reasons for believing that the Egyptians were but tardy imitators of real seafaring peoples —for seafaring themselves they were not. The Chaldeans seem to have been navigators and shipbuilders, but it is certainly to the Phœnicians that belongs the principal credit for the development of the ship. As early as B.C. 900 the Phœnician war galley had reached the trireme stage, and had decks, masts, yards, stays, sails, a ram, etc. The war galleys differed from those used for carrying merchandise in being longer, faster under oars, generally larger, and probably less seaworthy.

Among the ships of the ancients there were many of great size, but it is doubtful if they were strong enough to have 'gone to sea' in the modern sense of the expression. They were chiefly used for harbor service or as house-boats, and, though some were fitted as men-of-war, it does not appear that they were ever in action. One great ship, of which the dimensions are not precisely known, was built for Hiero II., King of Syracuse, under the direction of Archimedes. Though the descriptions are not very clear, she seems to have been copper-fastened and sheathed with lead laid over cloths soaked in pitch. She was presented by Hiero to Ptolemy Philopater soon after completion; her further history is unknown. The ordinary trireme galley was probably 110 to 140 feet in length (including the beak), and had a breadth of 14 to 18 feet. This size seems to have been the general favorite throughout the galley period. As ramming was one of the principal methods of attack, speed, weight, and handiness were of prime importance, and these were better combined in the trireme than in vessels of greater or less size. With merchant vessels the conditions were somewhat different. Merchant galleys used their sails much more and had less imperative need of speed. They were therefore broader in proportion to the length.

As the use of sails became more common and they were better fitted, ships began to increase in average size, the advantage of speed and power being with the larger ships. As soon as the sea power of Venice began to wane the great centres of shipbuilding changed from the Mediterranean to the Atlantic, the North Sea, and the Baltic. William the Conqueror invaded England in very small vessels, but one hundred years later English ships of considerable size were in use. King John established a royal dockyard at Portsmouth. Early in the fourteenth century the use of large sailing ships and of the mariner's compass had become

general. In the reign of Henry VII. ship construction was much improved and ships began to take on much of the form which they have preserved to the present day. During the next four centuries improvements of design and construction were continuously made until the wooden sailing ship reached its culminating point in the clipper ship of the nineteenth century.

So long as ships depended upon sails for propulsion shipbuilding remained a mechanical art bound by rules, traditions, and dogmas which were the result of centuries of experience. But with the advent of steam came the general scientific awakening and shipbuilding received its due share of attention. Its theoretical side has been given the name of *naval architecture*.

For convenience we may divide the subject into three principal parts, viz.: (1) Design as it affects the buoyancy, stability, steadiness, seaworthiness, etc. (2) Design as it affects the efficient propulsion and manœuvring powers. (3) Design as regards the strength, habitability, and general structural arrangement. The various qualities of a ship here mentioned are more or less interdependent, but it is possible to consider each separately and examine the effects of variation of form or structure which different requirements entail.

A vessel floating freely in still water displaces a volume of water equal in weight to its own, and the weight is called the vessel's *displacement*. This weight is supported by the pressure of water which acts at all points perpendicular to the surface of the ship's bottom; but the sum of the vertical components of the water-pressure at all points must balance the weight of the ship, and this sum is termed the *buoyancy*. The total weight of a fully loaded ship may be divided into the *weight of hull* and *weight of lading*. The latter represents her carrying power or useful displacement, and it is of course desirable to make this as large as possible (compared to the weight of the hull), being consistent with other necessary requirements. The reduction in hull weight is the principal cause of the substitution of iron for wood in shipbuilding, and, in turn, the displacing of iron by steel.

In considering ships of different forms it is useful to know something definite concerning their shapes without exhaustive examination, and this is arrived at by comparing them with the parallelepipedon, which has dimensions equal to the length (L), breadth (B), and mean draught (M) of the ship. If v = the volume of the ship, and V the volume of the parallelepipedon, we have $\frac{v}{V} = C$ = coefficient of fineness of the ship. If d and D are the corresponding displacements (i.e. weights) in tons since 35 cubic feet of sea-water weigh a ton,

$$C = \frac{d}{D} = \frac{d \times 35}{L \times B \times M}.$$

This formula takes no account of the shape of the midship section of the ship, in which there is considerable difference in vessels of the various types. A bluff vessel might have a high rise of floor, and a fine-ended ship a nearly rectangular midship section, and yet the coefficient of fineness be the same. To obviate this uncertainty the prismatic coefficient is used. In this case the volume of the ship is compared to the volume of a prism, whose length is the length of the ship, but whose base is the midship section of the ship. If the area of the midship section is A, we have prismatic coefficient, or coefficient of water-lines as it is commonly called $= C' = \frac{d \times 35}{A \times L}$.

In modern steamships the midship section closely approaches a rectangle, and the ordinary coefficient of fineness suffices. For steamers of exceptionally fine form (particularly those with no parallel midship body), the coefficient is from 40 to 50 per cent.; in large fast steamers, 45 to 55 per cent.; in recent battleships, 55 to 65 per cent.; in low-speed cargo steamers, 65 to 78 per cent. The coefficient of water-lines is greater and varies from about 55 to 83 per cent. in value.

In referring to the displacement of a ship it is necessary to specify some particular condition, as, of course, the displacement varies with the loading. With men-of-war the condition commonly used is that of normal, or mean load draught. That is supposed to be the average cruising condition, but is usually somewhat less. The deep load condition for a man-of-war is when her full supply of stores are on board and her coal bunkers are full. For merchant ships, displacement is only beginning to be used, and it is generally given for a light load condition—when the ship is practically empty—or when she is immersed to her Plimsoll mark (see LOAD-LINE); it may also be given for a specific mean draught of water. The tonnage of ships is a measure of capacity for cargo, and is fully treated in the article on the MEASUREMENT OF SHIPS.

After considering the volume of displacement of ships, the next point to be examined is the shape of the volume as regards stability and steadiness. These two expressions are linked together in the minds of many people as if they were convertible terms. Instead of being so they are in a measure antithetical, as we shall presently see. When a vessel is at rest in still water it is evident that her centre of gravity and the centre of gravity of the volume of water she displaces (which is called the centre of buoyancy) must lie in the same vertical line, for only in that condition will the forces of

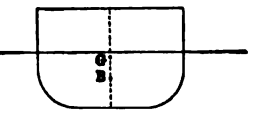


FIG. 1.

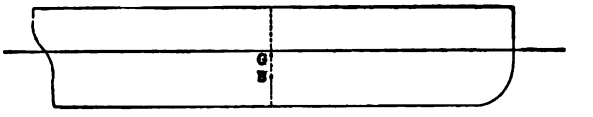


FIG. 2.

weight and buoyancy act in exactly opposite directions and produce equilibrium. The relative positions of these points are shown in the accompanying diagrams, in each of which G is the centre of gravity of the ship and B the centre of buoyancy.

If the ship is made to roll, the position of the centre of buoyancy will be displaced, as shown in Fig. 3. We have then a force acting vertically upward at B′, and a force working vertically downward at G′, producing a couple

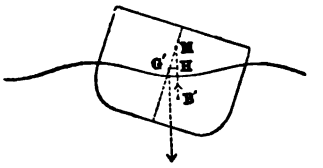


FIG. 3.

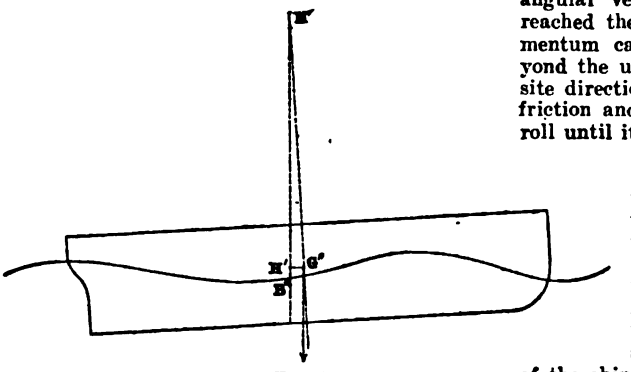


FIG. 4.

tending to turn the ship back to her upright position. Similarly, if the ship pitches, the centre of buoyancy is displaced longitudinally and the couple acts as before. In either case, if W is the weight of the ship in tons the moment of this couple is equal to W × G′H, or W × G″H′. If a vessel rolls and pitches at the same time the centre of buoyancy will be displaced both laterally and longitudinally, and the couple will then tend to act in a plane, making an angle with the keel which is greater than 0 and less than 90 degrees. If a ship is pressed over by a constant force, such as the wind or the action of the rudder, and the surface of the water is smooth, the righting moment is simply that of the couple. But if the surface of the water is broken by waves the shape of the submerged body is constantly changing, thereby moving the centre of buoyancy and adding to or subtracting from the righting force due to the couple.

When a ship is forcibly inclined in still water the point M (Fig. 3), called the *transverse metacentre*, is the point in which the vertical line through B′ cuts the line G′M, which is vertical when the ship is upright; and the distance G′M is called the *transverse metacentric height*. Similarly in Fig. 4, M′ is the *longitudinal metacentre*, and G″M′ is the *longitudinal metacentric height*. In vessels of ordinary type G″M′ is so large that there is practically no danger of their turning end over end unless they are very small. G′M, however, is often very small, and its value must be very carefully considered. Being so much used, it is commonly referred to as *the metacentric height*. The determination of it is effected by inclining the ship in still water. It changes for every change in the position of the centre of buoyancy, but for angles not exceeding 15 degrees the change is slight. The value of the metacentric height usually given in tables is, therefore, that obtained by inclining the ship through a very small angle.

The rolling of a ship when forcibly inclined in still water and then allowed to right herself is like that of a pendulum which has been drawn to one side and then permitted to vibrate until it comes to rest. Acted upon by the couple (the moment of which in this case is called the *moment of statical stability*), she rapidly reaches the upright position at a constantly varying angular velocity. As soon as this position is reached the couple ceases to act, while her momentum causes the roll to continue; but beyond the upright position a couple in the opposite direction is formed and this (together with friction and wave-making) gradually checks her roll until it ends, whereupon the new couple sets up a roll in the opposite direction just as a pendulum returns in its vibration. The rolling continues, though the arcs are smaller and smaller each time, until the vessel comes to rest in stable equilibrium in the upright position. The oscillations of a pendulum in vibrating are performed in equal periods of time, irrespective of their amplitude; and this is practically true of the ship, though the wave-making due to the high angular velocity of deep rolls and the increased friction due to greater area of immersed surface cause some variation. The mean length of time required for a ship to make a complete double roll through a moderate angle in smooth water is called the *still-water period*. In rough water this period is modified by the action of the waves, which gives a constantly varying value to the total righting moment. If the waves pass under a ship in such a way as to add to this moment when the ship is rolling toward the vertical and reduce it when she is rolling away from the vertical, a dangerous condition of affairs is produced which may result in her capsizing. This condition can only exist when the wave period (time between waves) is practically the same as the ship's still-water period; when it does exist the course of the ship with reference to the waves should be materially changed.

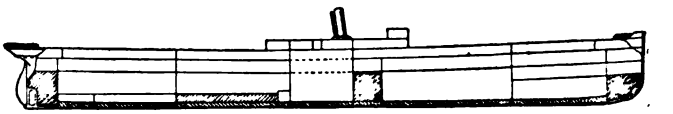


FIG. 5. DIAGRAM SHOWING USE OF WATER-BALLAST TANKS IN A MERCHANT STEAMER.
The shaded portion indicates ballast tanks.

Since the righting moment is the force which makes a ship roll, it is evident that if this force is powerful the ship will roll quickly and perhaps deeply, neither of which is desirable. To reduce the time of rolling (i.e. the still-water period) the metacentric height may be reduced as much as is consistent with safety, or the weights in the ship may be moved away from the midship plane if practicable, at the same time preserving the same height of centre of gravity. To reduce the amplitude of the roll,

and therefore its angular velocity, the best means so far devised is the bilge keel (q.v.), or 'rolling chock.' Horizontal, thwartship water chambers with a central dam, or several dams, and partly filled with water, are useful to reduce small angles of roll, but the noise and shock of the moving water is so objectionable that they have not been adopted. Vessels are designed to have a certain metacentric height under various conditions of loading; and the stowage of cargo should, as far as possible, be so arranged as to give proper value to the righting moment. Vessels with double bottoms may, within small limits, vary their righting moments by filling or emptying double-bottom compartments.

To secure seaworthiness, vessels must not only be sufficiently stable at all moderate angles of roll, but they must be stable at all possible angles. The range of stability is independent of the force of the righting moment and varies in different classes of ships. In battleships and large vessels it usually reaches 70 degrees of inclination on each side of the vertical; for small vessels, such as torpedo boats, the range is usually greater. Seaworthiness further requires a reserve of buoyancy—that is, only part of the hull below the upper deck must be submerged, and the openings in the hull must be capable of being closed in rough seas. Comfort and health require that the sides of the ship, and particularly the bow, should be high above the water; without high sides a vessel can be kept at sea for a short period only.

The second part of the subject relates to efficient propulsion and manœuvring power. In this we must consider the shape and smoothness of the hull as regards resistance to its movement through the water. The total resistance is made up of three parts: (a) Frictional resistance; (b) eddy-making resistance; and (c) wave-making resistance.

Frictional resistance is due to friction between the water and the hull of the ship. It does not depend upon the shape of the hull to any appreciable extent, but upon its smoothness, the area of the wetted surface, the length of the ship, and the speed. It forms the greater part of the total resistance of a ship moving at low speeds and an important part of it at all speeds, particularly if the bottom is rough or foul. For any given ship it varies about as the square of the speed. The difference in resistance between a smooth and a rough bottom is very great. A smoothly painted bottom has only half that of one of the roughness of fine sandpaper, and only about a third of that of coarse sandpaper. The difference in the power required to drive a ship when her bottom is foul and when her bottom is clean is then very easily appreciated.

Eddy-making resistance is not usually important in well-designed ships, and ought not to exceed about 8 per cent. of the frictional resistance. Eddies are chiefly to be found at the stern, where the water rushes in behind the ship. If the run is long and fine, the speed moderate, and the propeller struts, rudder, etc., well designed, they are scarcely noticeable; but a ship with too short a run, badly designed rudder, propeller struts, etc., leaves at full speed a boiling, troubled, eddying wake behind her.

Wave-making is in many respects the most important part of the resistance of ships, for it is the one over which we have the most control, and which is the greatest impediment to high speed. The laws which govern it are not yet fully understood, but the character of the waves and the losses entailed by them have been very carefully examined. A ship moving through undisturbed water puts certain particles of it in motion, carrying some along with her by friction and giving motion to others in such a way as to cause them to rise in waves. All the energy taken up by the water must come from the propelling machinery, and if it is not returned to the ship in pushing her ahead it is wasted.

The 'entrance' of a ship is the tapered forebody which extends from the stem to the point where her hull has obtained the full dimensions of the midship (or maximum) section; and the *run* is the corresponding tapered portion of the after body. These two parts of a vessel are termed the wave-making features, because the movements of the particles of water forming waves depend upon their lengths and shapes. A vessel passing through undisturbed water forms a double series of waves at the bow and at the stern. The former are most readily seen, largely because the action of the screw tends to degrade and confuse those at the stern. One set of waves are called *divergent* because their crests make an angle of 40 to 50 degrees with the keel; the other waves are called *transverse* because their crests are perpendicular to the keel line of the ship. Both sets increase in height with the speed, and this height is a measure of the energy absorbed by them, and indicates the speed with which they are traveling. The divergent waves are thrown off, and, leaving the ship, no longer influence it; but the transverse waves move at the same speed as the ship and keep their crests and hollows at about the same points on her sides so long as the speed is constant. Furthermore, the length between crests is the same as between the crests of ocean waves moving at the same rate of speed. It is found that if a wave crest is maintained at about the middle of the run the wave-making is decreased, but if a wave hollow exists there the wave-making resistance is increased. Some of the variations in power required to drive vessels at different speeds may be due to this cause.

A study of the behavior of models and of full-sized ships of different designs and under different conditions has shown that for every design there is a certain critical speed below which wave-making resistance increases quite regularly and moderately, but beyond which it increases with great rapidity. It is further shown that the greater the length of the entrance and the run the higher is this critical limiting speed. It was at one time supposed that of two designs of equal length and displacement that with the least midship section would give the least resistance, but experiment has shown that this is not necessarily the case. If two designs of equal length and displacement are tested, one having fair lengths of entrance and run and considerable length of parallel middle body, and the other having no parallel middle body and a much greater beam, but tapering from the midship section to the bow and stern, the latter will have the higher limiting speed. Ships, however,

are built to carry cargo. The depth is kept as moderate as possible on account of the shallowness of many harbors; and with a given depth only a certain breadth is practicable or the righting moment will be unduly great. Therefore it is desirable to increase the displacement only by increasing the length; this means that, after allowing a suitable entrance and run, the remainder of the length is applied to extending the parallel middle body.

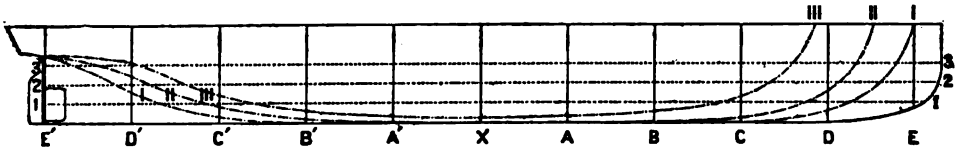


FIG. 6. SHEER PLAN.

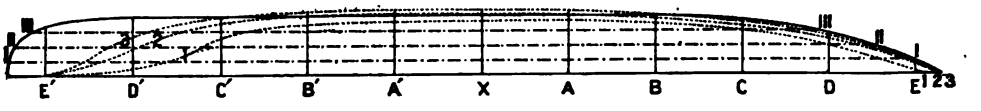


FIG. 7. HALF-BREADTH PLAN.

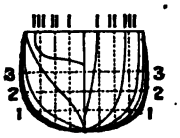


FIG. 8. BODY PLAN.

The designs of the naval architect are prepared on paper, and are occasionally supplemented by a wooden model. The three principal plans are the sheer plan (showing sections of the ship made by vertical longitudinal planes), the half-breadth plan (showing sections made by horizontal longitudinal planes), and the body plan (showing sections made by vertical transverse planes). In the figures the dotted lines 1, 2, 3, are water lines and are the intersections of horizontal longitudinal planes, and the inner surface of the planking or plating of the hull; lines I, II, and III are bow (forward) and buttock (aft) lines, made by vertical longitudinal planes; the full lines in the body plan are sections A, B, C, etc., and A′, B′, C′, etc., made by vertical transverse planes, which are passed at equal distances from each other, X being at the point of greatest breadth and called the midship section. In the body plan the right half shows half-sections forward of the midship section and the left half the half-sections abaft it.

In actual plans many more water lines, bow and buttock lines, etc., are shown, for the full plans are of large size. The planking or plating, positions of frames, decks, and much other detail are also shown. The three principal plans are only a small part of the drawings furnished by the architect to the builder. There must be plans for decks, holds, bulkheads, etc.; of ventilating, drainage, lighting, and flushing systems; of engines, boilers, etc.; and a vast number of plans showing details of construction of parts and fittings.

The drawings being completed, the work is taken up by the constructive force. The plans are laid off on the mold loft floor in full size. Wooden molds are then prepared for the frames or else the shapes of the frames are cut (or scrived) into a great piece of flooring called the scrive board. The frames are heated and bent on the bending slab. This is a large floor of thick metal with a great number of holes in which pins may be placed. The mold of the frame is laid on the bending slab, and pins inserted along its edge. The hot iron angle bar (or channel or Z bar), which is to form the frame (or the outer part of the frame, if it is built up of plates and angles), is then pressed up against these pins and so given its proper curvature. A sufficient number of frames having been prepared, the work of erection begins.

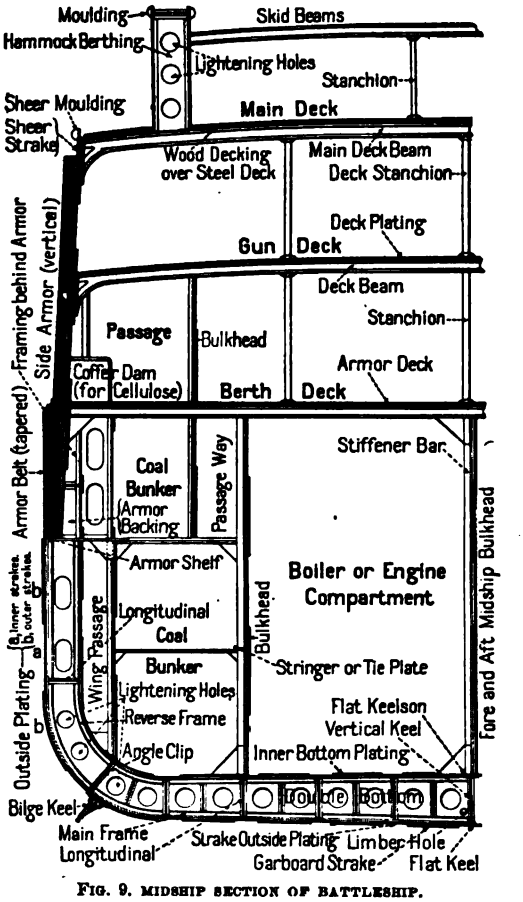
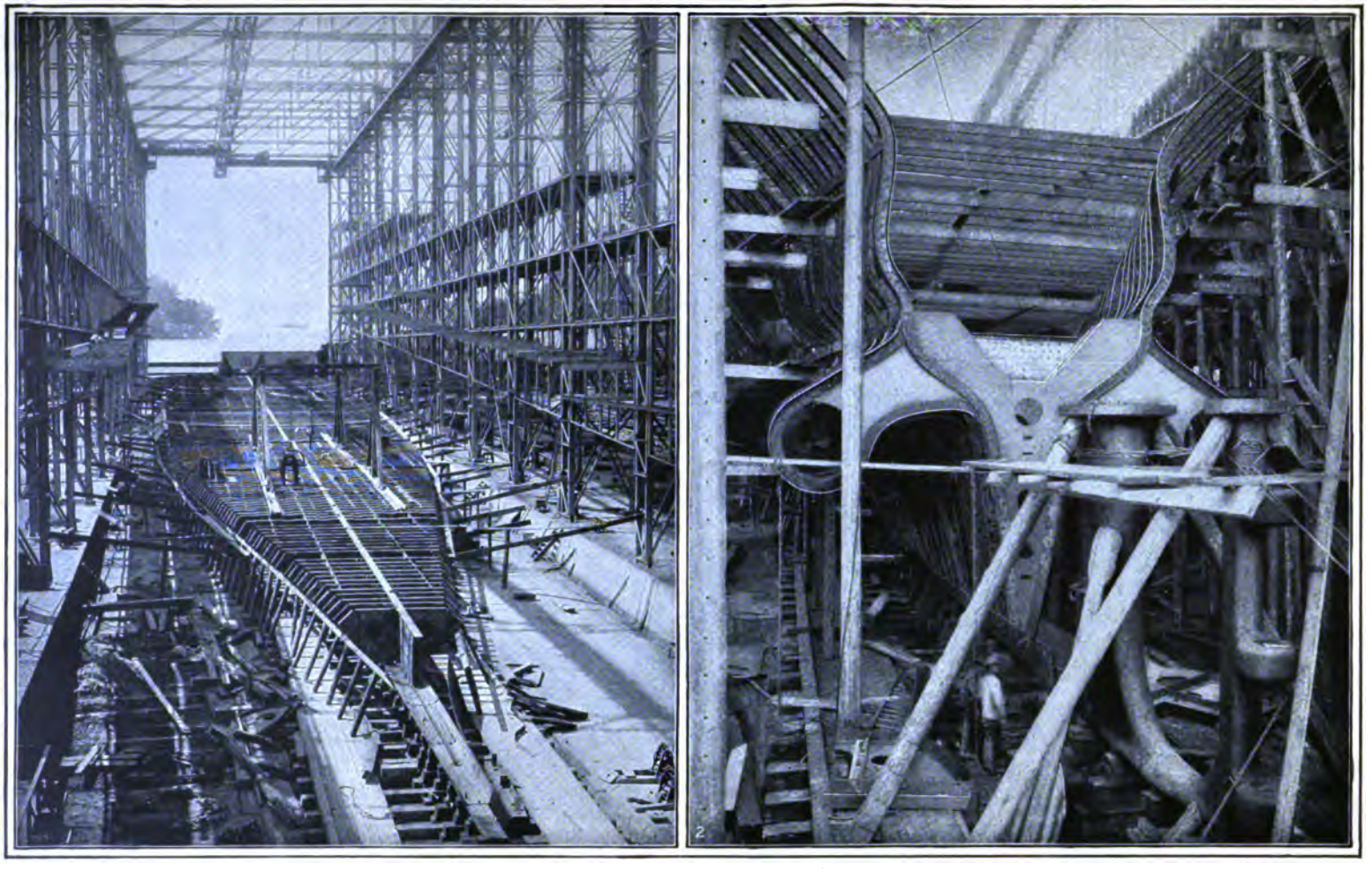


FIG. 9. MIDSHIP SECTION OF BATTLESHIP.

The building way is prepared by setting up the keel blocks. These are short heavy timbers a foot or more square built up in piles two or three feet apart and having the upper surface shaped to the keel line of the vessel. On these the keel is laid. In nearly all modern steamers



THE CONSTRUCTION OF AN OCEAN LINER (THE "KAISER WILHELM II.").

1. Keel and bottom framing, showing double bottom.

2. View of the Stern, showing framing and rudder post.

the keel or keel plate is a broad flat plate of extra thickness. It is in sections, riveted together, and joined to the stem and stern posts. After the keel is laid the midship frames are erected and held in place by shores and ribands until secured by the internal vertical keel, the longitudinals, stringers, side and bottom plating, etc. The large castings or forgings forming the stem and stern posts are then erected, the remainder of the plating put on, and the interior of the ship partly completed. The next step is the launching, and this may take place at any time after the outside plating is on and the interior completed so far as necessary to assure sufficient strength and stiffness. The weight of the vessel has so far been supported on the keel blocks and bilge shores. It must now be transferred to the launching ways. These consist of heavy timber ways inclined at about the same angle as the keel blocks (about five-eighths of an inch to the foot), and are built up on each side of them. Resting on the launchings ways are the sliding bilge ways, also of heavy timber, and on top of the bilge ways is built a framework that fits closely to the bottom of the ship. This is called the cradle. To remove the weight of the ship to the launching ways wedges are driven under the cradle, lifting the ship off the keel blocks. The under surface of the bilge ways and the upper surface of the launching ways having been well lubricated, the ship is ready to slide into the water as soon as released by sawing the tie-piece, or knocking out the dog-shore, which holds her. She starts down the ways slowly, but her velocity on reaching the water is frequently considerable and must be checked by hawsers if there is not much room for her to range astern. As soon as she is water-borne she floats clear of the cradle. Small vessels are usually nearly completed before launching, but large ones are commonly launched when not much over half their weights are on board. As soon as the ship is in the water the boilers and engines are installed, and the interior and upper works finished. In England many armored vessels are built in dry docks. This saves the labor of lifting heavy weights, it being only necessary to lower them; and the cost of the launching and building ways is avoided. As an offset to these advantages the use of a dry dock is lost for a year or two.

Comparatively few wooden steamers are now built, but wooden sailing vessels are still produced in considerable numbers. The general features of wooden shipbuilding resemble those of shipbuilding in iron and steel, but there are of course differences. The keel blocks are laid in the same way. On them are laid the heavy timbers forming the keel, which are sometimes nearly two feet square. The different lengths of timbers are scarfed and bolted together; over and across the keel are laid the floor timbers of the ribs or frames and the frames are thence built up, being held in place by shores, braces, cross-spalls, beams, and ribands. Between the floor timbers and extending up usually to the principal deck (sometimes to the rail) the space is closely packed with filling timbers forming a structure which is nearly tight without planking. The beams in wooden ships are of wood and they may be attached to the frames by wooden or iron knees. The former are considered to give the best fastening, but the iron knees save much room.

The advantage of having a copper bottom has caused a few composite vessels to be built. These are mostly yachts, gunboats, and small sailing vessels. Composite vessels are framed much like those of iron or steel. Over the frames, wood-planking is used instead of metal plating, though a good many plates of metal are placed under the wood to give the proper strength to the structure in different parts. The wood planking is attached to the frames with bolts setting up with nuts on the inside and is covered with copper to a short distance above water. The topsides of many composite vessels are plated with steel or iron above the level where coppering is necessary, as the metal is stronger and more durable than the wood.

The safety of a ship depends upon its stability, strength, water-tightness, and reserve stability and floatability, if injured. The stability of ships has already been considered. The strength is due to the framing and plating or planking. Water-tightness is effected by calking the seams between plates or planks. The seams of iron plates are calked by hammering the edge of the uppermost plate against the one underneath it. The seams between planks are partly filled with

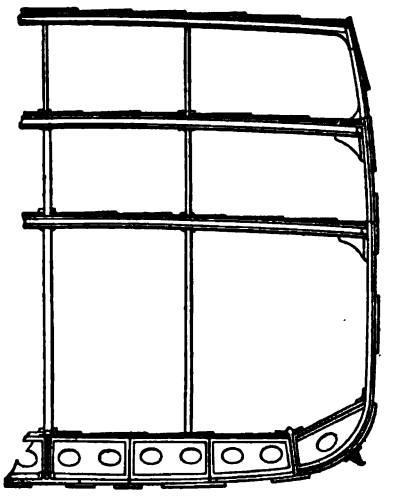


FIG. 10. CELLULAR DOUBLE BOTTOM OF A MERCHANT STEAMER.

oakum, which is forced in, and the remainder of the seam filled with pitch, marine glue, or putty. The reserve stability and floatability when injured depend upon the position and volume of the interior space which is flooded. To reduce this volume to a safe point, vessels are divided into compartments by water-tight bulkheads which extend across the ship at intervals. In merchant vessels the bulkheads usually have no passages through them, but in men-of-war many of the bulkheads have openings closed by water-tight doors. In addition to transverse water-tight bulkheads many ships have longitudinal ones—such, for instance, as the one separating the engine rooms in a twin-screw vessel. As a further protection against flooding due to striking ground, large vessels usually have a double bottom extending the whole or part of the length and rising at the sides to about the turn of the bilge or higher. The inner bottom thus fitted is laid over the inside of the frames and secured

in the same manner as the outside plating. The frames in the double bottoms are deep enough to give considerable space between the inner and outer plating, which is necessary to give access for cleaning and painting. Most frames are lightened by holes cut through them, but about every fourth or fifth frame is water-tight and has no holes. The space between the imperforate frames forms a double-bottom compartment, access to which is had by a manhole closed by a removable water-tight cover. Most ships are fitted with a water-tight bulkhead close to the bow, called the collision bulkhead.

SHIPBUILDING IN THE UNITED STATES FOR THE YEAR ENDING JUNE 30, 1902

CLASS	Number	Tons
Sailing vessels	581	97,698
Steamers	579	308,180
Canal boats	44	4,539
Barges	287	58,416
Total	1,491	468,833

IRON AND STEEL TONNAGE BUILT IN THE UNITED STATES, 1870–1902

YEAR	Steamers, tons	Other vessels, tons	Total, tons
1870	7,602	679	8,281
1880	25,538	44	25,582
1890	75,402	4,975	80,377
1900	167,948	28,903	196,851
1902	270,932	9,430	280,362

IRON AND STEEL STEAM TONNAGE BUILT IN 1902

Country	Tons
Great Britain	1,581,406
United States	270,932
Germany	252,719
France	55,345
Norway and Sweden	27,572
Denmark	12,542
Austria-Hungary	9,679

BIBLIOGRAPHY. Consult: White, *Manual of Naval Architecture* (London, 1894); Thearle, *Naval Architecture, Practical and Theoretical* (London and New York, 1874); Rankine, *Shipbuilding, Theoretical and Practical* (1866); Reed, *Shipbuilding in Iron and Steel* (London, 1869); Ledieu and Cadiat, *Nouveau matériel naval* (Paris, 1890); Reed, *Treatise on the Stability of Ships* (London, 1885); Croneau, *Constructions pratiques des navires de guerre* (Paris, 1894); *Transactions of the Institution of Naval Architects* (London, annual); *Proceedings of the Society of Naval Architects and Marine Engineers* (New York, annual).

For further information, see articles on BILGE; BULKHEAD; CALKING; CHRISTENING A SHIP; COFFERDAM; DECK; GALLEY; GANGWAY; LAUNCH, LAUNCHING; LOAD-LINE MARKS OF VESSELS; MEASUREMENT OF SHIPS; NAVIGATION; NAVIES; SHIP; SHIP, ARMORED; STEAM NAVIGATION, etc.

SHIP CANAL. See CANAL.

SHIP FEVER. See TYPHUS.

SHIPIBO, shē-pē'bō. An important wild tribe of Panoan stock (q.v.) in the forest region of the Upper Ucayali, Northeastern Peru. Very little is known concerning them. They were first visited by Franciscan missionaries in 1651. In 1736 they almost destroyed the neighboring and cognate Setebo in a bloody battle. In 1764, by the efforts of the missionaries, a reconciliation was effected between the two tribes, and the Shipibo were collected into a mission settlement, but three years later they massacred all the missionaries and reverted to their former wild life.

SHIPKA PASS. A pass in the Balkan Mountains, 47 miles northeast of Philippopolis (Map: Balkan Peninsula, E 3). Elevation, 4370 feet. It was made famous during the Russo-Turkish War of 1877-78 (q.v.).

SHIPLEY. A market town in the West Riding of Yorkshire, England, on the Aire, 3 miles northwest of Bradford (Map: England, E 3). The manufacture of worsted and woolens is largely carried on. Population, in 1901, 25,570.

SHIPMASTER. The commander of a merchant vessel. In most countries a license is required of the master of a steam vessel. A master of a ship has complete control of the navigation of the vessel, and over all persons on board, whether passengers or crew. He may resort to extreme measures in case of a mutiny, even to killing a seaman to enforce order and obedience, and may compel passengers to obey reasonable commands. He is the representative of the owners on a voyage and in foreign ports, and may bind the ship by contracts for necessary supplies, repairs, and so on. For this purpose he may even pledge the cargo in extreme cases. The term captain, sometimes applied to a master of a ship, is not technically correct, as that name denotes the commander of a war vessel. Consult Kay, *Shipmasters and Seamen* (2d ed., London, 1894).

SHIP-MONEY. A tax levied in England at various times. In 1008, when the country was threatened by the Danes, a law was made obliging all proprietors of three hundred hides of land to equip a vessel for the protection of the coast. Elizabeth, at the time of the threatened Spanish invasion, required the various ports to fit out a certain number of ships at their own charge. It was in 1626 that Charles I. levied such an impost. This was in time of actual war. The first writ for the levy of ship-money in time of peace was issued in 1634, when a contribution was demanded from the coast shires. In the following year a second writ extended the tax over the entire kingdom. A general spirit of resistance was immediately aroused, chiefly because it was imposed by the arbitrary authority of the King alone. In 1637 the celebrated John Hampden refused payment of the impost, an example in which he was followed by nearly the entire country. He was prosecuted before the twelve judges of the Exchequer and seven of them pronounced in favor of the Crown; but the trial had the effect of thoroughly arousing the public, and the Long Parliament, in 1640, voted ship-money illegal and canceled the sentence against Hampden. Consult: Gardiner, *History of England* (London, 1893-95); id., *Constitutional Documents* (2d ed., Oxford, 1899). See ENGLAND.

SHIP OF FOOLS, THE. A satirical poem by Alexander Barclay (1509), paraphrased from Sebastian Brant's *Narrenschiff*, ridiculing the follies of the day, under the allegory of a ship loaded with fools.

SHIPPING, Law of. See Admiralty Law; Maritime Law.

SHIPPING ARTICLES. Articles of agreement between the master of a ship and a seaman serving on board her in regard to wages, length of service, character of service, etc.

SHIPPING SUBSIDIES. Pecuniary aid to shipping by public grant. The terms bounty and subvention may be employed in the same sense. The first direct bounty in aid of shipping of any kind was granted in 1730 by the 3d George II. (c. 20, § 9), which provided for a bounty of 20 shillings per ton on all vessels of 20 tons or over engaging in the white herring fisheries. The object of these fishing bounties was 'to encourage the fisheries, which served as a training school for mariners for the British war fleet. The bounty laws were modified from time to time until they were finally repealed in 1867. It was not, however, until 1839 that the English Government began the policy of paying subsidies for 'mail service.' In that year Samuel Cunard made a contract with the British Board of Admiralty, by which he agreed to establish a fortnightly mail service between Liverpool and Halifax for a yearly payment of £60,000. The New World terminal was afterwards changed to Boston and then to New York. In 1841 the amount of the subsidy was increased to £80,000 and the number of vessels increased from 3 to 7. The subsidy was again increased in 1848 to £145,000, but was reduced to £80,000 in 1868, after the failure of its chief competitor, the Collins Line. Since that time the amount of the annual subsidy has varied greatly in different years. In 1870 the amount of the subsidy for the transatlantic ocean mail service was made to depend upon the weight of the mail matter transported, the contracts being given to the Cunard and the White Star lines.

The subsidies were given with the two-fold purpose of establishing quicker and better mail communications with America, and of encouraging a rival to the American clipper lines, which were rapidly driving the British ships out of business. When the United States Congress passed the bill giving a subsidy to the Collins Line in 1848, the British Government raised the subsidy to the Cunard Company by £65,000, without requiring any additional services, showing that the British Government was not solely bent on obtaining a quicker mail service. The subsidy undoubtedly gave the Cunard Company a great advantage over its competitors. Whether, as is often alleged, the subsidy really helped to establish steam navigation is more than doubtful. The Great Western Company was in the field before the subsidized Cunard Line. It is highly probable that the subsidy rather retarded than hastened improvements, since it enabled the Cunard Company to earn profits without maintaining the highest standard of efficiency.

In 1868 the Cunard Line received £80,000 as a fixed subsidy, while the Inman Line received £22,161, the North German Lloyd £9,504, and the Hamburg-American £3,343, paid according to the weight of mail carried. The next year the Cunard received £80,000 for its service twice a week, and the Inman £35,000 for a weekly service. The contracts were drawn for seven years. A Parliamentary commission investigated them and recommended that they be disapproved, but the Government did not act upon the recommendation. In 1870 the Postmaster-General introduced the system of payment by weight throughout, by which the English lines were paid 4 shillings per pound for letters and 4d. for papers, and the North German Lloyd 2s. 4d. for letters and 2d. for papers. In 1887 the rates were reduced to 3s. for letters and 3d. for other mail, the Cunard and White Star lines to carry all mail except specially directed letters. These rates are about 1½ times the international postal rates, so there is still a subsidy of about £75,000 to the Cunard and White Star lines, not counting the admiralty subventions, amounting to £42,000, which are paid for the privilege of hiring or buying certain of the faster steamers in case of war.

The Peninsular Company, in 1837, began the carriage of mails to and from Spain and Portugal for an annual payment of £29,600, which was soon after reduced to £20,500. The next year the company took the contract of carrying the mails between England and Alexandria for £34,200 per annum. In 1842 it became the Peninsular and Oriental Company and took over the service from Suez to Calcutta with a yearly subsidy of £115,000, or about 20s. per mile. The service was soon after extended to China, with an addition of £45,000 to the yearly subsidy at the rate of about 12s. per mile. The East India Company continued to carry the mails between Bombay and Suez for a yearly subsidy of £105,200, or 30s. per mile. In 1858 the Peninsular and Oriental took over the service for £24,700 and rendered a much quicker and more regular service. In 1852 the Government advertised for bids for a mail service to Australia. The Peninsular and Oriental offered to perform the Australian service, together with all other contracts, for £199,600 per annum, to be reduced by £20.000 on the completion of the railroad across the peninsula of Suez. This gave a more extended service for £76,000 less than was offered by the only competitor; yet there was much complaint of favoritism shown by the Government to the Peninsular and Oriental.

During the Crimean War the British Government chartered eleven of the Peninsular and Oriental vessels for transport service. This so crippled the company's fleet that they were compelled to give up the service between Australia and Singapore. After the war the contract for a monthly service between Australia and Suez was let (1857) to the European and Australian Steam Navigation Company for £185,000 per year, but the severity of the terms and the inefficiency of the management made the enterprise an utter failure, involving the loss, in one year, of the entire capital of £400,000 and a further debt of £270,000. The Peninsular and Oriental, for a yearly compensation of £180,000, then took the service, including a service to Mauritius and Aden. The latter line was soon given up and the subsidy was reduced to £134,672. In 1866 the service was made semi-monthly and the subsidy increased to £170,000, and four years later a new contract on all the Peninsular and Oriental lines was made, with an annual subsidy of £450,000. Since that time the amount has been steadily decreased until, in 1898, it was £330,000. It is a disputed question whether the mails could have been carried for a less expenditure

of money. Certain it is that the service rendered by the Peninsular and Oriental Company was much less expensive and infinitely more efficient than that of either the East India Company or the Government post-office packets. No doubt the company made substantial profits on the Government service, but that there was no secret connivance with Government officials to secure a monopoly is shown by the attitude of the Government toward the company throughout. Every contract was thrown open to public competition, which in this case seems to have been more than a mere form. If at times the subsidies appear to have been exorbitant, we must consider the urgent necessity to Great Britain of keeping up communications with her colonies, especially India, the tremendous difficulties to be overcome, and the severe governmental requirements. The subsidies gave England the communication she needed earlier than the growth of America. No British ports were touched by the service, and the amount of British mail carried was almost nothing. The bounty kept the company solvent for some years, but the trade was insufficient to justify such a service and eventually the company failed. The Galway Line presents another case of the tendency of subsidies to carry the creation of facilities for trade further than circumstances really warrant. This company contracted, in 1860, to carry English mails from Galway to Portland, Boston, or New York via Newfoundland, agreeing to deliver dispatches in six days. They built four new vessels, but none of them came up to the requirements of strength and speed. One was lost and two others disabled. The company failed and involved all the investors in ruin.

The following table gives the subsidized lines and the amount of mail subsidies paid by the British Government in 1901:

SERVICE	Company	Yearly payment
Dover and Calais (daily)	London, Chatham, and Dover R. R. Co.	£25,000
Brindisi to Bombay (weekly) Brindisi to Shanghai (fortnightly) Brindisi to Adelaide (fortnightly)	Peninsular and Oriental Co.	330,000
Naples to Adelaide (fortnightly)	Orient Steam Navigation Co.	85,000
Halifax to Yokohama, Shanghai, and Hong Kong (monthly)	Canadian Pacific R. R. Co.	60,000
Southampton to West Indies (fortnightly)	Royal Mail	80,000
Aden to Zanzibar (monthly)	British India Co.	9,000
Liverpool to S. America and Falkland Is. (fortnightly)	Pacific Steam Navigation Co.	32,500
Southampton to Table Bay (weekly)	Union Steamship Co.	135,000
Southampton to New York (one way only, semi-weekly)	Cunard and White Star Cos. *	117,655
	Total	£874,155

* A new contract (1902) with the Cunard Co. grants a fixed subsidy of £150,000 a year in place of the payment according to weight of mails as hitherto.

commerce would warrant—a policy naturally involving expense—but by a proper watchfulness, the Post Office authorities kept the subsidies within reasonable limits. The mail business probably paid no higher profits than other traffic, and at times it must have paid less, for the company did not wish to renew the contracts, and at one time tried to abrogate them.

The Royal West India Mail Steam Packet Company is another line which has drawn heavy subsidies from the British Government. It was founded in 1841 and was granted a subsidy of £240,000 for traversing a distance of 684,816 miles every year. There was no advertisement for bids, and no revision of the extravagant terms of the contract until 1874. There was little freight and less mail to be carried, and, in spite of the large subsidy, the company lost about £80,000 the first year through inefficient or dishonest management. The second year the Government reduced the mileage to 392,973 miles, leaving the subsidy as before, and granting new favors. It appears to be clear that the advantages secured by this particular subsidy were not commensurate with the expenditure involved. Without doubt a better service could have been secured at much less expenditure. The service was slow, irregular, and unsatisfactory, and in some years the amount paid in subsidies exceeded the postal receipts of the line by £183,938. The most palpable case of the use of mail subsidy to aid in the extension of British commerce was the Pacific Steam Navigation Company, which was given a subsidy in 1840 for carrying the mails between the ports of Central and South

Besides the above mail payments, a subsidy of £40,000 per annum is paid for the service to Jamaica, as the outcome of the recommendations of the West India Royal Commission of 1896-97, to encourage the fruit trade of the West Indies. This is the only example of a subsidy granted by Great Britain expressly to encourage trade.

Opinions differ as to whether the British postal and Admiralty subsidies have resulted in direct advantages which justify the outlay made by the Government. Mr. Buxton Forman of the British Post Office gave it as his opinion that this is not always the case; Sir Spencer Walpole, former Secretary of the Post Office, thought full value is received. No careful statistical inquiry with regard to this question has ever been made, nor is it possible to make one. The open bidding on mail contracts does not at all secure service at cost, because there is nothing like free competition among steamship companies. Careful observers, however, agree that the British postal and Admiralty subsidies do contain an element of genuine subsidy for the encouragement of British shipping. This belief is strengthened by the refusal of the British Government to let the mail contract to the White Star Line after its purchase by the Mercantile Marine Company in 1902 until full assurance was given that the White Star Company would remain a thoroughly English concern.

The policy of other European countries is quite different from that of Great Britain. Germany pays an annual subsidy of 4,000,000 marks ($952,000) to the North German Lloyd for its East Asian service, and 2,800,000 marks ($666,-

400) for its Australian service. The German East Africa company receives 1,650,000 marks ($392,700) for its services to Africa, and the German Government pays 1,600,000 marks to the North German Lloyd and the Hamburg-American lines for carrying the mails to America. The total mail subsidies to all lines amount to about 10,175,000 marks ($2,421,650). This is perhaps not an excessive amount for the services rendered, but in addition the Government gives indirect bounties in the shape of exemption from import duties on materials of construction, and preferential railway rates on iron, steel, and fuel used in shipbuilding and on many articles exported in German ships. These reductions in railway tariffs amount to from 36 to 66 per cent. of the ordinary rates. The Germans generally feel that these direct and indirect bounties have been a good investment, and point to the fact that German shipping has developed very rapidly since the beginning of this policy of protection in 1886. The development of shipping is not, however, conclusive proof of the advantages of the subsidies, since numerous other factors have contributed to the growth of the German mercantile marine.

The annual postal subsidies voted by France in 1901 amounted to nearly 27,000,000 francs ($5,211,000). In addition to this the Government paid 5,850,000 francs ($1,129,050) in bounties for construction and 12,300,000 francs ($2,373,900) in navigation bounties, making a grand total of 45,150,000 francs ($8,713,950). Furthermore, a bounty of 15 francs ($2.89) per 100 kilos (220 pounds) is given for machinery and boilers built or repaired. There is no pretense that any of these subsidies are given for services rendered. It is the avowed purpose of all this bounty legislation to build up the French merchant marine, but there is no evidence that French trade has benefited by this policy.

In 1901 Austria paid in subsidies $1,590,000, and Hungary $403,000. Russia pays considerable subsidies, but they are mostly for internal commerce and for transport of troops, etc., by the volunteer fleet. Italy began a policy of bounties on construction and navigation in 1885. The Government in 1897 paid out 2,044,339 lire ($394,557) in navigation bounties and 124,973 lire ($20,260) in construction bounties. In 1897 Japan adopted the subsidy policy. In addition to heavy bounties on construction and navigation, the Government of Japan has since 1900 paid special subsidies of $1,331,600 to the Nippon Yusen Kaisha for its European service, and $325,707 for its Seattle line, and $504,912 for the Toyo Kisen Kaisha's line to San Francisco. Holland, Sweden, Denmark, and Norway pay mail subsidies which are no more than fair compensation for services. Norway pays in addition $84,928 for facilitating steamer communications, and it is claimed that this enables Norwegian steamers to drive British vessels out of the trade between Norway and England.

Except for the bounties granted in 1792 to certain fishing vessels, the history of Government encouragement to shipping in the United States begins with the act of March 3, 1845, which provided for the transmission of the mails in American ships. An act of March 3, 1847, authorized the Secretary of the Navy to accept the offers made by E. K. Collins & Company to carry the mails from New York to Liverpool and by Mr. Sloo for a mail service between New York and Chagres. In 1848 two lines were started under subsidies—one from New York to Bremen, the other from New York to Havre. The most important subsidized line was the Collins Line, which began operations June 1, 1850. The original subsidy was $385,000 per annum for 20 voyages, or at the rate of $19,250 per voyage. At this time the Cunard Line was receiving about $30,000 per voyage. In 1852 the subsidy to the Collins Line was increased to $33,000 per voyage for 26 trips, or $858,000 per annum. The competition between the Collins Line and the Cunard Line was severe from the first. Previous to 1850 the Cunard had a virtual monopoly of the fast freight business. In a few months after the Collins Line started freights fell from £7 10s. a ton to £4 a ton. For a time the Collins Line had the advantage in the fight. But the loss of the *Arctic* in 1854 and the *Pacific* a little more than a year later seriously crippled the Collins Line. The *Pacific* was succeeded by the *Adriatic*, the finest and fastest steamship of that day, but it was impossible to retrieve such disastrous losses. In 1856 Congress reduced the subsidy to $385,000 per annum for 20 trips. Two years later all contracts for carrying the mails were abrogated and the Collins Line failed. The cost of this experiment was about $4,500,000. From 1848 to 1858 the United States Government expended a total of about $15,000,000 in subsidies without any manifest benefit to the American merchant marine. The United States Government gave no further mail subsidies until 1866, when a line from New York to Rio de Janeiro was subsidized to the amount of $250,000 per annum. One year later the Pacific Mail Steamship Company was granted a subsidy of $500,000 a year for a monthly service to Japan and China via Hawaii. In 1872 the company offered to double the service for an additional $500,000 a year. With some difficulty a bill authorizing such a contract was passed by Congress in 1873. It was afterwards discovered that the company had spent more than a million dollars to influence Congressmen to vote the subsidy. As a result of this disclosure and of the subsequent failure of the company to comply with the conditions imposed, a new contract was abrogated by the Government. The Pacific Mail Company, during its ten years of contract service, received $4,583,000 in subsidies. In that period there was no increase in the trade of the United States with the Orient that could not be traced to other causes than subsidized mail service, and the general merchant marine declined steadily.

Under the act of 1891 the United States pays for carrying the mails on a mileage basis as follows: For first-class steamers, $4 per mile; second-class steamers, $2 per mile; third-class steamers, $1 per mile; fourth-class steamers, 66 2-3 cents per mile. Besides these contract prices the Post Office Department pays American vessels carrying mail $1.60 a pound for first-class matter and 8 cents a pound for other matter. Foreign vessels carrying United States mails are paid the international postal rates (44 cents and 4½ cents per pound respectively). It will be seen that these payments constitute a very liberal subsidy to the mail steamers. In 1898 Senator Hanna introduced the first general subsidy measure designed to introduce a system of direct navigation bounties. After numerous

amendments the measure passed the United States Senate, March 17, 1902. The bill as passed consisted of four titles: (1) *Ocean Mail Steamers*, which provided for mail payments on the basis of speed and tonnage of vessels, and not for service. Ocean mail steamers were divided into seven classes, according to speed and tonnage. Compensation for 100 miles sailed was: for the first class, 2.7 cents per gross ton; second class, 2.5 cents; third class, 2.3 cents; fourth class, 2.1 cents; fifth class, 1.9 cents; sixth class, 1.7 cents; and seventh class, 1.5 cents. (2) *General Subsidy*. This section was intended to give a bounty of 1 cent per gross ton for every 100 nautical miles sailed to all vessels not receiving mail subsidy. This was intended as an offset to the alleged greater cost of construction and navigation of American ships. (3) *Deep-Sea Fisheries*. Under this title it was proposed to grant $2 per gross ton annually as a bounty on American vessels engaged at least three months in the deep-sea fisheries, and $1 per month to every American sailor employed on such vessel. The purpose of this part of the bill was to encourage an industry which would, it was alleged, serve as a training school for the United States Navy. The fourth title contained only general provisions of no special importance. The measure came before the House in the last session of the Fifty-seventh Congress, but was reported adversely by the committee having it in charge.

SHIP RAILWAY. A railway on which ships are transported either in a cradle running on wheels, or in the water in a tank carried on a wheeled truck or car. Such railways are designed to connect two navigable bodies of water separated by an isthmus, and thus save a long detour around the intervening land. They are of very ancient origin. A railway capable of transporting vessels 149 feet long, 16 feet wide, and drawing 8½ feet of water is said to have been in operation across the Isthmus of Corinth as early as B.C. 427. The Greeks in A.D. 831, the Venetians in 1483 at Lake Garda, and the Turks at Constantinople, used tramways for the conveyance of vessels across intervening land. Coming nearer to modern times, there are various canal inclines and portage railways built in England and in the United States in the early part of the last century. The railway for large vessels was an extension of the canal inclines, and several very ambitious attempts have been made to construct such thoroughfares at various times. None, however, has ever been carried to completion. One of the earliest propositions for a ship railway to carry ocean vessels was the plan submitted to De Lesseps in 1860 for crossing the Isthmus of Suez. This plan was rejected by the famous Frenchman, who afterwards built the Suez Canal. The plan for the Suez ship railway called for a level track with 10 lines of rails. The ships were to be carried in cradles running on this track at a speed of 20 miles an hour. The promoters estimated the cost of this line to be about one-seventh the cost of a canal. In 1872 a similar railway across Honduras was proposed to connect the Atlantic and Pacific Oceans, but the project failed for lack of money. In 1879 Captain James B. Eads proposed a ship railway across the Isthmus of Tehuantepec. Various plans were proposed by Captain Eads for this structure, the earliest being for ships 350 feet long, of 6000 tons, carried in cradles running on 1380 wheels. The length of the road across the isthmus was about 150 miles, and it was planned to run it at a speed of from six to ten miles an hour. An attempt was made to get Congress to grant financial support to this project, but it failed, and, after a year or two of precarious existence, the project died a natural death. The most important project ever developed for a ship railway was that known as the Chignecto Ship Railway in Nova Scotia. A neck of land only 15 miles wide separates Chignecto Bay, an inlet from the Bay of Fundy, from Baie Verte, leading through Northumberland Strait into the Gulf of Saint Lawrence. It was proposed to construct a ship railway across this neck to enable coasting vessels of 1000 tons register and 2000 tons displacement to avoid a stormy detour of 500 miles around the coast of Nova Scotia. The line proposed was 17 miles long and nearly straight throughout. It was level for half its length, and on the remainder the grades did not exceed 1 in 350. The vessels, 235 feet long, 56 feet beam, and 15 feet draught, after being raised out of water by hydraulic runs, were to be conveyed on steel cradles in sections 75 feet long, running on 64 solid three-foot wheels on two lines of track of standard gauge spaced 11 feet apart, and laid with 110-pound rails, at a speed not exceeding 10 miles an hour. The construction of this road was begun in 1888, and was about three-quarters completed in 1891, when work was abandoned for lack of funds. Since the Chignecto railway, no ship railway has been seriously considered, though many individual plans for such roads have been proposed. The literature on ship railways is scattered through the proceedings of the engineering societies and the volumes of the various engineering periodicals.

SHIP'S COMPANY. The ship's company is the crew of the ship. It is organized in accordance with the requirements of the rig. In large, full-rigged ships the crew is divided into forecastlemen, foretopmen, maintopmen, mizzentopmen, and afterguard. Owing to the increase in mechanical means of handling sails these divisions are now less common than formerly. In modern men-of-war the organization of the ship's company is based on the battery and engines, little or no sail being carried. The men are stationed at the guns, ammunition rooms, boilers, and engines, according to the various needs.

SHIP'S MAGNETISM. See COMPASS.

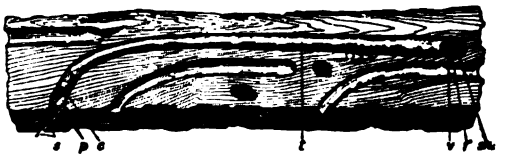
SHIPS OF WAR. See FRIGATE; RAM; SHIP, ARMORED; etc.

SHIP'S PAPERS. A merchant vessel is required to carry certain documents which are termed the "ship's papers." These consist of: (1) *Register*, sometimes replaced or accompanied by (a) *Certificate of enrollment* (if employed in United States coasting trade), (b) *Passport* issued by the sovereign authority, (c) *Sea letter* issued by the local authorities of the port of departure. (2) *Charter party* (q.v.) if chartered. (3) *Log-book* (q.v.). (4) *Bills of lading* (q.v.), or duplicate receipts of cargo from the master to shippers. (5) *Invoices*, or detailed statements of separate lots of goods. (6) *Manifest* (q.v.), or general statement of cargo. (7) *Clearance*

(q.v.), or permission from the authorities to sail. (8) *Muster roll*, or list of crew. (9) *Shipping articles* (q.v.). (10) *Bill of health* (q.v.). (11) *Bill of sale* (if ship has been sold by citizens of one country to citizens of another) together with consular certificate. (12) *Certificate of inspection*. (13) *Officers' licenses*. (14) *Passenger list* (if passengers are carried). (15) *License* to carry on a particular trade (fishing, carrying oil, explosives, etc.). The evidence of nationality of United States vessels is contained in (a) *register* for foreign trade; (b) *certificate of enrollment* for coasting vessels; (c) *license* for enrolled vessels; (d) *license* for vessels under 20 tons; (e) *license* for fishing vessels; (f) *sea letter* or *passport* issued by a collector of a port to certify to national character and ownership of vessel; (g) *consul's certificate* for foreign vessel purchased abroad by American citizens. In foreign countries the evidence is found as follows: Austria, in *royal license* and *certificate of registry;* Great Britain, *certificate of registry;* Brazil, Portugal, and Sweden, *passport;* Denmark, *certificate of nationality and registry;* Germany and Norway, *certificate of nationality;* Russia and Spain, *patent* authorizing the use of flag. The register, certificate of registry, or equivalent document should contain the following information: Name and character of vessel, name of country to which it belongs, dimensions of vessel (including tonnage, masts, number of decks, etc.), rig, date of building, name of master, name of owner or owners, date of registry, number (international signal code), and signatures and seals of the officials issuing the document.

SHIPTON, Mother. A reputed English prophetess of the time of Henry VIII. The statements concerning her personal history are conflicting and of slight value. Very probably she is a purely fictitious person whose name was made the vehicle of many supposed prophecies. She is first heard of in 1641, when *The Prophecie of Mother Shipton*, an anonymous tract, was published in London. Her reputation extended over the kingdom, and chap-books and pamphlets purporting to be collections of her prophecies appeared frequently. The larger number of these were undoubtedly inventions. In 1862 one Charles Hindley reprinted an earlier so-called life of Mother Shipton, inserting some doggerel verses of his own, in which he described certain things that had happened and wound up with the declaration that the world would come to an end in 1881. Hindley in 1873 acknowledged that the verses were a hoax. Consult Harrison, *Mother Shipton Investigated* (London, 1881).

SHIP-WORM, or Teredo. An aberrant or much modified lamellibranch mollusk of the family Teredinidæ, so called from being worm-like in general shape, and from boring into the hulls below the water line of vessels. The animal is several inches to three feet in length. The shell itself is much reduced, equivalve, widely gaping, and only covers a part of the animal. The mantle of the animal secretes a calcareous lining to the burrow. *Teredo navalis* is said to be cosmopolitan, and is the most abundant species on our coast. Several species habit the eastern coast of the United States. The ship-worm besides honeycombing the logs of wharves, piles, and injuring fish-pounds and traps, as well as lobster-pots, has been a serious pest of wooden ships; for this reason ships have had to be sheathed with copper. Its mode of boring has not been satisfactorily explained; it usually tunnels in the direction of the grain of the wood.



A shipworm (*Teredo navalis*).

Timber bored by the mollusk; *t*, tube; *sh*, shell; *v*, valves of shell; *f*, foot; *c*, collar; *p*, pallets; *s*, siphons.

Ship-worms are found in a fossil state first in Jurassic rocks, where their shells are found in burrows made by the animals in wood that is now petrified. They are found in similar situations in the Cretaceous and Tertiary of North America, Europe, and Asia, but show little difference from modern forms. Consult Gould, *Invertebrates of Massachusetts* (Boston, 1870); Verrill, *Invertebrate Animals of Vineyard Sound* (Washington, 1874).

SHIPWRECK. See Wreck.

SHI'RAS, George, Jr. (1832—). An American jurist. He was born in Pittsburg, graduated at Yale in 1853, and was admitted to the Pennsylvania bar in 1856. In 1892 he was appointed associate justice of the United States Supreme Court by President Harrison, and although the nomination was opposed by the Pennsylvania Senators, it was confirmed. He retired in 1903. He was one of the Supreme Court justices who in 1894 decided against the constitutionality of the income tax. See Income Tax.

SHIRAZ, shē'rāz. The capital of the Province of Farsistan, Persia, 112 miles from the Persian Gulf, and 35 miles southwest of ancient Persepolis (q.v.) (Map: Persia, E 6). It is built on a limestone ridge of the great West-Persian mountain system, 4750 feet above the sea, and is inclosed by walls nearly 4 miles in circumference. It has several fine mosques, a citadel, bazaars, colleges, caravanserais, and other public buildings. The houses, which are chiefly built of stone, are superior in appearance to those of most other Persian towns. The adjoining plain is well watered, and is laid out in vineyards and in rose-gardens. The principal manufactures are silk, cotton, and woolen goods, rose-water, glass, and inlaid goods. The wine of Shiraz, which is very strong and resembles Tokay, is famous throughout the East. Shiraz carries on trade with Yezd, Ispahan, and Bushire, receiving from the last town Indian and European goods. It contains a branch of the Imperial Bank of Persia. The city was founded in A.D. 697, and from its beautiful situation and fine climate became a favorite resort of the Persian princes and under Kerim Khan in 1760 the capital of Persia. Destructive earthquakes accompanied by great loss of life in 1812, in 1824 and in 1853, laid almost the whole town in ruins. The city has been partially rebuilt in a somewhat inferior style, and its population is now estimated at from 30,000 to 50,000. Shiraz is celebrated for the number and eminence of the scholars and poets to whom it has given birth, and by whom its praises have been sung.

SHIRE (AS. *scire, scyre*, district, county, jurisdiction, business, from *scirian, scerian*, secondary form of *sciran, sceran, sceoran*, to cut off, shear, OHG. *sceran*, Ger. *scheren*, to cut, shear; connected with Gk. *κείρειν, keirein*, Lith. *skirti*, to cut). A term which seems to have originated before the time of King Alfred, and is applied to the districts, often called counties, into which Great Britain is divided. A considerable number of the counties of England, as Kent, Essex, Surrey, Norfolk, and Suffolk, were formed out of the petty Anglo-Saxon kingdoms, which gradually became consolidated into one kingdom. The substitution of ealdormen (or earls) for kings marks the gradual organization of the shires. It was usually found convenient to split up a large kingdom into several shires. The national and military head of the shire was the ealdorman, whose office was not necessarily hereditary, though it had a tendency to become so. Shire is applied to all the Welsh counties except Anglesea. In Scotland the English tendencies of the sovereigns from the time of Malcolm Canmore and the tide of immigration from the south brought in, among other innovations, the division into shires. Its introduction seems to have begun early in the twelfth century. Twenty-five shires or counties are enumerated in a public ordinance of the date 1305.

In England, south of the Tees, there was a subdivision of the shires into *hundreds* (q.v.), which in some localities were called *wapentakes;* these hundreds or *wapentakes* were further subdivided into *tythings*, and it became incumbent on every one to be enrolled in a tything and hundred for the purposes of government. In some of the larger counties there was an intermediate division between the shire and the hundred. Yorkshire had and still has its *ridings* (q.v.), Kent had its *lathes*, and Sussex its *rapes*. The division into hundreds and tythings never penetrated into the four northern counties of England, or into Scotland, where the *ward* and *quarter* were the immediate subdivisions of the county. Consult Stubbs, *Constitutional History of England*, vol. i. (6th ed., Oxford, 1896). See COUNTY; ANGLO-SAXONS.

SHIRE, shē'rā. A river of Southeastern Africa. It is the outlet of Lake Nyassa, from which it issues in latitude 14° 28′ South, and after a southerly course of 250 miles joins the Zambezi 90 miles from its mouth. The navigation of the upper course is obstructed by cataracts for a space of 35 miles in the course of which the river falls 1200 feet. Below the rapids it expands into a broad, navigable stream, though somewhat obstructed by the abundance of aquatic vegetation.

SHIRE HORSE. An English cart horse. The Shire horse has been described as the final result of the improvement of agricultural horses commenced early in the nineteenth century. Its breed seems to be a cross between native Lincolnshire and Dutch stallions. A well-bred Shire horse is from 16.2 to 17 hands in height with a girth of from 7 feet 6 inches to 8 feet. His chest is wide, shoulders well thrown back, head big, but in perfect proportion, back short, with strong muscular development of the loin, long quarters, and a tail set on well and high. The black Shire horse is gradually becoming extinct, modern breeders preferring browns or bays.

SHIRLAW, shēr'lą, WALTER (1838—). An American decorative, landscape, and genre painter and illustrator. He was born at Paisley, Scotland, but was taken to America in 1840. After being employed for many years as bank-note engraver in Chicago, he took up painting. While in Chicago he was one of the prime movers in the organization of the Academy of Design. In 1870-77 he studied at Munich, and while there painted his "Tuning of the Bell" (1874); "Sheep Shearing," exhibited at the National Academy of Design in 1877; and "Good Morning," now in the Buffalo Academy of Fine Arts. Upon his return to the United States he became professor of the Art Students' League, New York, and was elected National Academician in 1879. He was one of the founders of the Society of American Artists, and its first president. His easel paintings are usually genre subjects, showing fine decorative feeling for line and color, with a tendency toward rich and warm low tones. Among them are: "Eager for the Fray;" the "Goose Girl;" "Jealousy;" the "Kiss;" the "Barnyard;" and "In Mischief." His most important decorative work is the frieze for the dining-room in the house of D. O. Mills, New York City, the subject of which is "Peace and Plenty."

SHIRLEY, shēr'lĭ. A novel by Charlotte Brontë (1849), the scene of which is a Yorkshire mill-town. The action centres in the career of Robert Moore, the mill-owner, frequently involved in riots among his workpeople. His brother marries the heroine, Shirley Keeldar, who was drawn from Emily Brontë.

SHIRLEY (**SHERLEY**), Sir ANTHONY (1565-c.1635). An English navigator. He was educated at Hart Hall, Oxford. In 1591 he accompanied the Earl of Essex on his expedition to Normandy, and was knighted by Henry IV. Queen Elizabeth, angered at his acceptance of this honor without her consent, had him imprisoned until he gave up the order of St. Michael that had been conferred upon him. In 1596 he led a buccaneering expedition to the West Indies and South America. An account of this cruise was published by Hakluyt in *Voyages and Discoveries* (1598). In 1599 he sailed to Persia, where he was hospitably received by Shah Abbas the Great, who made him ambassador to the Christian courts of Europe. Thoroughly discredited at home, he passed his last years in Madrid, a pensioner of the King of Spain. He died in poverty some time after 1635. In 1613 he published *Travels Into Persia*, a dull and tedious book. Sir Anthony had two brothers, SIR ROBERT and SIR THOMAS, who were also adventurers. The three brothers were made the subject of *Travailes of Three English Brothers* (1607), a play written by John Day in collaboration. Consult *The Sherley Brothers* (Roxburghe Club, 1848).

SHIRLEY, JAMES (1596-1666). An English dramatist, born in London. He attended the Merchant Taylors' School, London (1608-12), whence he passed to Saint John's College, Oxford. He afterwards entered Catharine Hall, Cambridge, where he received the degree of B. A. (c.1618). Subsequently he took orders, and became a minister at Saint Albans. He gave up his living owing to his conversion to the Church of Rome and held the mastership of the grammar school from 1623 to 1625. At the end of

this period he moved to London and began his career as playwright. Before the theatres were closed by act of Parliament in 1642, he produced about forty plays, most of which have survived. He was befriended by the Court, for which he composed many masques. He shared in the misfortunes of the Royalists during the Civil War. Surviving until after the Restoration, he became an important literary figure. He died during the great fire of 1666, and was buried in Saint Giles's churchyard. Shirley carried on the traditions of the Elizabethan drama and served as a link to the new drama after the Restoration. He essayed both tragedy and comedy. Of his plays may be cited: *The Witty Fair One* (1628), a good comedy; *The Wedding* (1626), a still better comedy; *The Traitor* (1631), a powerful tragedy; *Hyde Park* (1632), a comedy; *The Gamester* (1633), a comedy revived by Garrick; *The Lady of Pleasure* (1635), perhaps his most brilliant comedy; and *The Cardinal* (1641), a strong tragedy. Of his masques, *The Triumph of Peace*, performed before the King and Queen (1634), is regarded as the best. Consult: *Dramatic Works and Poems*, with notes by Gifford and Dyce (London, 1833); *Shirley*, selected plays, ed. by Gosse (Mermaid Series, ib., 1888); and Ward, *English Dramatic Literature* (revised ed., ib., 1899).

SHIRLEY, SELINA HASTINGS. The Countess of Huntingdon. See HUNTINGDON.

SHIRLEY, WALTER (1725-1786). An English revivalist and hymn-writer. In 1746 he graduated B. A. from New College, Oxford, and became rector of Loughrea, in Galway. Through his cousin the Countess of Huntingdon (q.v.) he became acquainted with Whitefield (q.v.) and the Wesleys (qq.v.), whose opinions he strenuously advocated within the Established Church. Though retaining his living, he made frequent preaching tours through England and Ireland. The revivalist phase of his labors is represented by *Gospel Repentance* (1760) and *Twelve Sermons* (1761). He is now best known for several hymns in common use, as "Source of light and power divine," and "Go, destined vessel, heavenly freighted, go!" (composed on the departure of missionaries to America, 1772).

SHIRLEY, WILLIAM (1693-1771). An American colonial governor, born at Preston, in Sussex, England. After being called to the bar, he emigrated to Massachusetts, where he was appointed a commissioner in the boundary dispute between Massachusetts and Rhode Island, and while discharging his duties as such in 1741 was appointed Governor of the colony. He used his influence against the disastrous financial policy of the Legislature and tried to induce that body to grant him a regular salary, but was unsuccessful in both efforts. On the outbreak of King George's War, he organized the expedition which captured Louisburg in 1745. Soon afterwards he persuaded the colonists to apply the money they had received from the British treasury in reimbursement of their expenses on this occasion to the redemption of their paper currency. In 1749 he went to London to urge the settlement of the boundary disputes between the New England and the Canadian colonists, and in 1753 was appointed one of the British commissioners in the fruitless negotiations at Paris. In the latter year he was reinstalled as Governor of Massachusetts. On the death of Braddock, in 1755, he was appointed commander-in-chief of the British forces in North America, but was soon called to England. Shirley was promoted to the rank of lieutenant-general in 1759, and was for a time Governor of the Bahamas. In 1770 he returned to Massachusetts, where he died. He published a *Journal of the Siege of Louisburg* (1745); *The Conduct of Gen. William Shirley Briefly Stated* (1758); and two or three pieces of fiction.

SHIRWA, shēr'wä. A lake in Southeast Central Africa, on the boundary between Portuguese East Africa and the British Central African Protectorate, 60 miles southeast of Lake Nyassa (Map: Africa, H 6). It is about 40 miles long and 18 miles wide, is surrounded by high mountains, and has no outlet, its water being brackish. It is gradually drying up; it formerly overflowed its barriers and discharged into the Lujenda River.

SHI'SHAK (Heb. *Shishaq*). A king of Egypt in the days of Solomon and Rehoboam, mentioned in the First Book of Kings, and identical with Sheshonk, the first King of the 22d or Bubastite dynasty. His name is found in the portico built by this dynasty at the great temple of Karnak, and on several statues of the goddess Pasht, which probably came from Luxor. Jeroboam fled to Shishak from Solomon (I. Kings xi. 26-40); when the latter died he left Egypt, and headed the rebellion against Rehoboam which resulted in the division of the kingdom of David into the two States of Israel and Judah (I. Kings xii.). In the fifth year of Rehoboam, Shishak, according to the biblical account, marched to Jerusalem with a large army. He took the city, the treasures of the temple, and all the gold bucklers which Solomon had made (I. Kings xiv. 25-26). The conquest of Palestine is recorded on the monuments of Karnak, where Sheshonk is represented dragging before the god Ammon three files of prisoners; various names of places are mentioned, among them Rabbath, Hapharian, Mahaniam, and other Israelitish towns. In all, no less than 156 Palestinian cities are enumerated by Sheshonk. His expedition, however, is insignificant when compared with Asiatic campaigns of the eighteenth and nineteenth dynasties. Consult: W. Max Müller, *Asien und Europa*, pp. 166 et seq. (Leipzig, 1893); Shishak's monument is pictured in Lepsius, *Denkmäler* (Berlin, 1849-59).

SHITTIM WOOD (Heb. *shiṭṭim*, for *shiṭṭah*, Ar. *sanṭ*, Egypt. *shant*, acacia tree). The wood of which the ark of the covenant was made (Ex. xxv. 10; Deut. x. 3). It is generally identified with the wood of the Acacia Nilotica, and the name (*shiṭṭāh*, for *shiṭṭāh*, *sanṭ*) is identical with the old Egyptian word for acacia. This is the characteristic tree of the desert brooks in the wilderness of Sinai and around the Dead Sea; it grows to the height of fifteen to twenty feet and has stiff, thorny branches. The wood is exceedingly hard and well suited for furniture. It is not attacked by insects.

SHOA, shō'ä. A division of Abyssinia, southeast of Amhara. Estimated area, 20,000 square miles; estimated population, 1,000,000 (Map: Africa H 4). It is an elevated country watered by the Hawash and the Blue Nile. It contains

Addis Abeba, the capital of Abyssinia, and the town of Ankobar. Before the unification of Abyssinia under Menelek in 1889, Shoa was a separate kingdom. See ABYSSINIA.

SHOALS, shōlz, ISLES OF. See ISLES OF SHOALS.

SHOCK (MDutch *schock*, Dutch *schok*, OHG. *scoc*, shock, jolt; connected with AS. *scacan*, *sceacan*, Eng. *shake*). A sudden depression of the vital powers due to injury or profound mental emotions. Through this depression of the nerve centres a circulatory paresis is induced, which results in the accumulation of the blood in the large abdominal vessels, with a corresponding loss to the cerebral and peripheral circulation. This is shown by the lowering of the surface temperature, and disturbance of voluntary cerebration. Shock may be slight and transient or severe and prolonged, or it may be almost instantly fatal. *Surgical shock* results from accidental injuries such as extensive burns, gunshot wounds, crushing of the limbs, blows or penetrating wound of the abdomen, injuries to the base of the skull, with concussion of the brain. It is apt to follow extensive operations, especially those upon the abdominal viscera. Sudden and profuse hemorrhage, and occasionally anæsthetics, cause shock. *Mental shock* is induced by sudden grief, fright, or other powerful mental impressions. The condition of shock is denoted by a subnormal temperature, a rapid and feeble pulse, pinched features, a skin cold, pallid, and clammy, or covered with profuse perspiration, shallow and irregular respiration, diminution or loss of sensibility to pain, and a tendency to urinary suppression. The patient is usually conscious, replying to questions, but has no volition either of movement or speech. Delirium is sometimes present, and, in children, convulsions. Shock is increased by cold, loss of blood, and age. Recovery is followed by a period of *reaction*, which often lasts for several hours. This may be preceded by vomiting. Beginning reaction is indicated by returning color, increased temperature, and improvement in the pulse, respiration, and inclination to voluntary movement. *Deferred shock* is a curious condition in which the symptoms do not develop until some time after the occurrence of a violent mental impression. This variety may be more severe than that produced by bodily injury.

The treatment of collapse is as follows: The patient is placed in a horizontal position with the head slightly lower than the rest of the body, and the feet raised. Surface temperature is maintained by hot-water bottles and blankets. Hypodermic injections of brandy, ether, strychnine, atropine, or digitalis are given according to indications. Hot coffee or brandy may be given by the mouth, the stomach retaining these better than anything else. Mustard plasters may be placed over the heart, pit of the stomach, or spine, or a stimulating enema containing turpentine may be given. One of the most useful and frequently employed measures in shock is the injection either through the veins, rectum, or connective tissues of hot, normal saline solution. Enormous quantities of fluid may thus be taken into the circulation, with remarkably quick and certain results. In severe cases bandaging the limbs in order to increase the blood supply of the brain and vital centres is a resort. Operation should never be done during shock except when imperatively necessary to save life.

SHODDY (probably a variant of dialectic *shode*, shedding, separation, from AS. *scēad*, separation, from *scēadan*, Goth, *skaidan*, OHG. *sceidan*, Ger. *scheiden*, to separate; connected with Lith. *skédzn*, I separate, Lat. *scindere*, Gk. *σχίζειν*, *schizein*, Skt. *chid*, to split). A term formerly meaning only the waste arising from the manufacture of wool; it now has a wider and much more important signification, and is almost wholly understood to mean the wool of woven fabrics reduced to the state in which it was before being spun and woven, and thus rendered available for remanufacture. Woolen rags, no matter how old and worn, are now a valuable commodity to the manufacturer; they are sorted into two special kinds, the rags of worsted goods and the rags of woolen goods, the former being made of *combing* or long-staple wools, and the latter of *carding* or short-staple wools. The former are those properly known as *shoddy-rags*, and the latter are called *mungo*. Both are treated in the same way; they are put into a machine called a *willy*, in which a cylinder covered with sharp hooks is revolving, and the rags are so torn by the hooks that in a short time all traces of spinning and weaving are removed, and the material is again reduced to wool capable of being reworked. It is used as a means of adulteration and cheapening woolen cloths, and in making a class of light cloths adapted to mild climates and other purposes.

SHOEBILL, or WHALEHEAD. A large remarkable, heron-like, grayish bird (*Balæniceps rex*) from the White Nile in Eastern Africa. It is made the type of a special family, the Balænicepitidæ, but is closely allied to the umbrette (q.v.). The most peculiar external feature is the huge blotched yellow bill, longer than the head and shaped like a great shoe. These birds feed on fish and snakes, but also eat the viscera of dead mammals, ripping open the carcass with the stout hook on the end of the upper mandible. Consult Newton, *Dictionary of Birds* (London, 1893-96), and authorities there cited.

SHOE BLACKING. See BLACKING.

SHOES (AS. *scēo*, Goth. *skōhs*, OHG. *scuoh*, Ger. *Schuh*, shoe) AND **SHOE MANUFACTURE.** The shoe in its simplest form was undoubtedly a *sandal* or sole with straps attached to it by means of which it might be fastened on to the foot. Such a shoe was designed simply to protect the bottom of the foot from the rough surface of the ground and from the extremes of temperature.

Another primitive form of shoe is the Indian *moccasin*. It differs from the sandal in that it extends over the top of the foot, but, unlike the shoe, the sole and main part of the upper are in one piece. The moccasin is made of buckskin, is soft, flexible, and durable; in fact, one of the best coverings that could be made for the foot. The peasants of several European nations wear a wooden shoe called a *sabot*, which is shaped out of a single piece of wood. The primitive footgear of Great Britain and Ireland resembled the *brogue* still worn by the Irish peasants. The brogue is made of a heavy leather, very simply put together, and much larger than the foot, the space between foot and shoe being filled with hay.

The *clog* or *patten* is a shoe with a wooden sole and leather upper, which is fastened to the sole with nails.

In the United States the art of shoemaking was one of the first to be established, for we are told that Thomas Beard, with hides, both upper and bottom, came in the Mayflower, on its third voyage. Massachusetts has continued to lead in the industry thus early established within her borders. For two centuries the shoemaker was often an itinerant workman, who, journeying from one farmer's family to another, tarried in each of the households long enough to convert the farmer's supply of home-tanned leather into a stock of shoes sufficient to meet the needs of the family till his next annual visit. His last was roughly whittled out of a piece of wood to suit the largest boot in the family, and then pared down for successive sizes.

The American shoemaker sat on a low bench, one end of which was divided up into compartments where his knives, awls, hammers, and rasps were kept and there was also room for his pots of paste and of blacking, his 'shoulder-sticks' for 'setting the edges' of heel and sole, and 'rub sticks' for finishing the bottom; his tacks, pegs, nails, thread, and wax, buttons, and linings. Close by he kept a dish called a 'higgin' in which was placed the water to wet the soles; a pair of clamps to hold the uppers supported between his knees,, while he seamed or bound them, and also the strap which, passing under his foot, held the sole upon the last and both on his knee while he stitched on the welt or sewed the upper to it.

Until the beginning of the nineteenth century all shoes were made by sewing them together by hand, but they were cut and put together in much the same manner as now, except that the operations have been shortened and also multiplied by the introduction of machinery. In order, therefore, that the uses of the various machines may better be understood, the general process of making a shoe will be explained. A shoe consists of two parts: the *sole*, which is made of very heavy leather, and the *upper*, which is made of lighter leather, or of cloth. The upper, in turn, consists of various parts, according to the pattern by which it is cut, but in general the upper front part is the *vamp*, while the back is called the *quarters*. The upper may be sewed on to the sole on the wrong side and turned, or on the right side, usually by means of a welt. The first method was formerly employed for all the lighter, finer grades of shoes, but is now chiefly confined to slippers. Shoes made in this way are called *turns*. A *welt* is a narrow strip of leather, sewed on to the lower edge of the upper, with the seam inside, and then turned and sewed flat on to the outer edge of the sole. It is now the almost universal method for sewing shoes together. The *last* is a wooden form, modeled after the general shape of the human foot, on which the parts are placed in putting together the upper and sole, and finishing the shoe. Last-making was at one time a part of the shoemaker's trade, but is now a separate industry.

In making a shoe, whether by hand or machine, the leather must be solidified by hammering or rolling; it must be *skived*, that is trimmed down to a uniform thickness, and all imperfections cut away; the parts must be cut out and the different portions composing the upper sewed together. The sole consists of two portions: the insole of soft and the outer sole of heavier leather. The insole, rendered pliant by soaking in water, is first tacked to the last. Next its outer edge a channel, called a *feather*, is dug about ⅛ inch deep, along which holes for the stitches are pierced obliquely through the leather into the channel. The top is next lasted, an operation requiring great skill. The welt is then placed around the sole as far as the heel, and then the upper welt and insole are sewed together in one seam. The bottom is then leveled up by filling in the depressed portion formed by the welt with tarred paper or other material. The outer sole, which has first been soaked and then thoroughly hammered on the lapstone, is now temporarily tacked to the insole. A narrow channel is then cut around the edge, through which the sole is securely stitched to the welt. The heel, built of several layers, or lifts, is now nailed to the sole, and the shoe is ready for the final processes of trimming, polishing, etc. Three other methods are employed for fastening the soles to the uppers: pegging, nailing or riveting, and screwing.

Probably the first piece of machinery that was applied to shoemaking was a combined lasting and sole-nailing machine, invented in England by M. J. Brunel, in 1810. In America the first invention which materially changed the methods of the shoemaker was the use of wooden pegs for fastening the soles and uppers together. With their adoption the development of the modern shoe factory began. At first only a small portion of the work was done in the general factory, the rest being performed in private homes, or in shops, as before, but with this great difference, that the shoes were to be sold at wholesale, 'ready-made,' and not according to the orders of individual customers. Shoemaking was divided into three parts: 'cutting,' 'binding,' and 'bottoming.' The cutting was done at the central factory; then the uppers were sent out to one set of workmen, often women and children, to be sewed in their homes; last of all the bottoms and uppers were sent out to local shoemakers, who, in their little 8×10 shops, formed what was known as a 'team' of workmen, who put the parts together, one man doing the lasting, another the pegging, and a third the trimming,

About 1850 the rolling machine was introduced, by which the sole leather is thoroughly compressed in a minute, a process which had required an hour's time of laborious pounding with hammer and lap-stone. A little later the Howe sewing machine was adapted to the sewing of the leather uppers. About the same time horse-power, and soon after steam-power, was applied to the running of shoe-making machinery, and with the adoption of the latter the various branches of shoe-making were gathered together under one roof. In 1860 the McKay sewing machine, for sewing the uppers and soles together, was introduced, and at once revolutionized the business. See SEWING MACHINE.

An improvement upon this was the Goodyear welt machine, introduced about 1877, by means of which the uppers and soles are secured by means of a welt, as previously described. In 1881 the invention of the Reese button-hole machine still

further narrowed the sphere of hand-sewing in the manufacture of shoes.

Of the other earlier inventions the more important are: The cable screw-wire machine for fastening uppers and soles together (1869); Bigelow's and McKay's heeling machines (1870); and the edge-trimming machines (1876). During the last two decades of the nineteenth century many other important machines were invented, including polishers and trimmers. From a hundred to two hundred different pieces of machinery are now commonly employed in a single factory.

The transformation of the raw material into a finished shoe involves over a hundred different manipulations. Boots and shoes are made in twenty-six different lengths, numbered in two series from 1 to 13. Between most of the numbers half-sizes are made and often five different widths for each half size.

The modern factory usually consists of five departments or rooms. In the first room the sole leather is first run through a skiving machine, which pares off the leather to a uniform thickness, rejecting thin and ragged portions. It is then solidified in a rolling machine, after which the soles may be cut out. This is accomplished either by means of dies operated by a steam-hammer or by machine-driven knives, which follow rapidly around a pattern laid on the leather. The heels are also cut by means of dies and various forms of machinery in use for building them up. The cutting of the uppers, as well as of the soles and linings, is often done by dies or other cutting machinery. But the best work is still done with a knife, by hand, in order to make sure that the parts are cut the right way of the grain and out of a portion of the skin of uniform texture. The tips are cut by punching machines with many different dies, according to shape and patterning. In the stitching room the sewing machines are driven by power and often there is a separate girl and machine for each seam. In the bottoming room the uppers are lasted and soled and then heeled.

Different methods of heeling are in practice. By one the lifts are nailed together by a nailing machine, which both cuts the wire off the reel and drives it through the heel. By another, the heel, instead of being built up separately and then secured to the boot, is built up on the boot, and when the top piece is on, the heel is pared and the front curve or breast formed. The final shaping of the heel usually involves several manipulations. In the fifth room the final operations of trimming and polishing are conducted. The trimming is effected by specially adjusted, rapidly revolving wheels. The final polishing is done by machine-driven burnishers, sandpaperers, and other polishing devices. Last of all, if a shiny surface is desired, the shoe is given a coat of liquid polish and rubbed with a hot iron. If a dull finish is desired, as in calfskin, the shoe is rubbed with grease and then with an ebony stick. When the shoes are screwed or riveted, the process is, of course, somewhat changed. In riveted work no welt is used. In screwing, a reel of stout wire is provided with a screw thread, which is driven by the machine through the outer sole, inner sole, and upper and then cut off evenly. This makes a strong, durable shoe. A great variety of different leathers are used in making shoes, including alligator, lizard, snake, and monkey skins, as well as the more common kinds.

RUBBER SHOES. An important branch of shoe manufacture is the making of rubber overshoes and boots, as a protection to the feet from the wet. The best quality of raw rubber is used, which, received at the factory in crude lumps, is ground and washed, and rolled into sheets. The sulphur necessary for vulcanization, lampblack for coloring, and sometimes other ingredients, are added; after which the sheets are passed through heated rollers, which reduce them to a thickness of less than one-third of an inch. A cloth backing is then applied by simply laying the rubber on the cloth and then subjecting it to great pressure under a cloth-calendering machine. Out of this cloth the rubbers are cut, a different thickness of fabric for sole, heel, and upper, and the parts are skillfully joined over wooden lasts. This is not done by sewing, but by using some solvent, as turpentine, which causes the edges to adhere. The shoes are now covered with a coat of rubber varnish and vulcanized (see RUBBER), after which they are ready for the market.

STATISTICS. According to the section on Boot and Shoe Manufacture of the United States Census for 1900, the capital invested in this industry amounted to $101,795,233, and the annual product was $261,028,580. This was distributed among 1,600 establishments, employing 142,922 laborers, of whom about one-third were women. The number of factories or shops was about 350 less than it was in 1880, but that this is simply the result of consolidation is shown by the fact that in 1880 the capital invested was only $42,994,028, and the value of the product, $166,050,354.

In the manufacture of rubber boots and shoes 22 establishments were engaged in 1900, an increase of 13 since 1880. The capital invested was $33,667,533, as against $2,425,000 in 1880. The value of the annual product was $41,089,819, as against $9,705,724 in 1880. The centre of the industry, like that of the manufacture of leather boots and shoes, is in New England.

BIBLIOGRAPHY. There is very little recent literature on shoe manufacture. In 1889 John Bedford Leno published in London a book on the *Art of Boot and Shoe Making*, containing a description of most of the modern shoemaking machinery. A history of the development of the industry in America is given in Depew, *One Hundred Years of American Commerce* (New York, 1895), and also in Shaler, *United States of America* (ib., 1894). The United States Census for 1900, vol. ix., part 3, "Manufactures," gives the history of the development of the industry in the United States, together with much descriptive and statistical information. There is also a section on rubber boots and shoes.

SHOGUN, shō'gŏŏn (Sinico-Jap., generalissimo). The title adopted in Japan for the general commanding each of the four divisions of the Empire in early times. In 1192 Yoritomo Minamoto (q.v.) was given the title Sei-I-Tai-Shogun (Barbarian-quelling great General). By degrees the Shogun became independent of the Emperor, so that in the hands of the Tokugawa family (1603-1868) the shogunate became the *de facto* ruling power in the country. After having been held successively by four great military clans for

nearly 700 years, the office was abolished in 1868. For some years after 1853 the Shogun was known to foreigners as the Tycoon.

SHOLAPUR, shō'lä-pōōr'. The capital of the District of Sholapur, in the Province of Bombay, India, 60 miles north by east of Bijapur (Map: India, C 5). The ruins of the old fort, dating from 1345, a high school, two parks, and a large bazaar are noteworthy. The Ekrukh reservoir and irrigation plant is three miles to the north of the city. The city is an important distributing point for the agricultural products of the region, and manufactures cotton goods, blankets, silks, etc. Population, in 1901, 75,288. In 1818 Sholapur was the scene of the decisive victory of the British forces under Munro over the forces of Baji Rao.

SHOOTING (from *shoot*, AS. *scēotan*, OHG. *sciozan*, Ger. *schiessen*, to shoot; ultimately connected with Skt. *skand*, to leap, Lat. *scandere*, to climb). Proficiency and accuracy in shooting is the object of many associations and competitions with the military rifle, the shotgun, revolvers, and pistols.

MILITARY RIFLE CONTESTS. In 1868 Captain Wingate, of the Twenty-second Regiment, New York National Guard, issued a manual, based on the English 'Hythe' system. It was adopted in many States, and led to the formation of 'The National Rifle Association of America.' The Legislature of the State of New York authorized the purchase of a site for a rifle range at Creedmoor, and in June, 1873, the first annual competition was held. In the following year the Irish team which had won the 'Echo Shield' in the great English rifle contests at Wimbledon challenged all America to a competition. This was accepted by the 'Amateur Rifle Club.' The Irish team was beaten on the last shot by a bull's-eye. The distances were 800, 900, and 1,000 yards. The following year the American team went to Ireland, but were beaten by 967 to 929. In 1876 an American team successfully defended the 'Palma trophy' against teams from Ireland, Scotland, Australia, and Canada. In 1877 another British team was beaten at Creedmoor by 3334 to 3242. In 1880 an American team went to Ireland and won by 1292 to 1280. After that there were no further international contests until the year 1901, when a Canadian team won by 1522 to 1491. In 1902 a British team won it at Ottawa, by 1447 to 1373, and took it to England. In the competition of 1903 held at Bisley, England, the American team was the victor, defeating the English team by 15 points, the score being: America, 1570; Great Britain, 1555.

Competitions of skill in pistol and revolver shooting are more common in America than elsewhere. There is a United States National Revolver Association and an annual championship tournament at Sea Girt. It comprises the military revolver, twenty-five shots at 25, 50, and 75 yards; ordinary pistol, fifty shots at 50 yards; revolver team shooting, five men to a team, each to shoot ten shots at 25, 50, and 75 yards.

SHOOTING STARS. See AËROLITE; METEORS.

SHORE (probably connected with AS. *sceran*, *sciran*, *sceoran*, to cut off, Eng. *shear*, *shire*). The margin between the land area of the earth and the water area. The outline and general character of continental shores are modified chiefly in two ways: (1) By the erosive and transporting action of the sea, whose waves, currents, and tides are constantly at work removing the rock materials in one place and depositing them in another. In this way the seaward edges of strata are cut back to form cliffs, sometimes producing an irregular shore line, with headlands and deep reëntrants; the land waste brought down by rivers is distributed over the ocean floor, and beaches and sand reefs are built up. (2) By secular movements of the earth's crust through which the level of the land, with respect to the sea, is changed. Coastal lands, which have thus been upraised from the sea floor, are generally formed of soft strata, but, owing to their low position, they resist erosion to a marked degree. Moreover, as the waters deepen very gradually off-shore, the waves beat up the sands from the bottom, forming long reefs and the sediments transported by rivers accumulate as deltas, so that such shores have additional protection from the wasting action of the sea. The coastal plain of Texas affords an example of a shore line of this character. Throughout most of its length it is low, monotonously level, and fringed by sand reefs, which are so little interrupted that to give access to deep-sea vessels Galveston has been built on an outer reef. The peculiar shore line of North Carolina, which is indented by shallow sounds and bordered by reefs, has been formed by the gradual depression of an uplifted and dissected sea bottom. Coastal lands that have been subjected to marked depression are usually characterized by an irregular shore line with rocky headlands, numerous harbors, and outlying islands, thus contrasting strongly with the shores of uplifted regions. This follows from the fact that the surface of such lands is diversified through the constantly active process of erosion, while the ocean floor is comparatively smooth and unbroken. The western coast of Norway owes its irregular outline to the depression of a mountainous land surface by which the valleys have been submerged by the sea forming long, deep reëntrants, called fiords (q.v.). The coasts of Great Britain, Maine, and Southern Chile also exhibit these characteristics. See DELTA; BEACHES, etc.

SHORE, JANE (1445-1527). Mistress of Edward IV. of England. She was born in London and was married to a goldsmith named William Shore. She met King Edward about 1470. After Edward's death she was accused of witchcraft by the Duke of Gloucester, afterwards King Richard III., and, suspected of favoring the cause of the young princes, was committed to the Tower. Her property was confiscated, and she was sentenced by the Bishop of London to do penance for her crimes. She lived until the accession of Henry VIII., and died in penury and obscurity. Her life was the subject of many contemporary and subsequent poems and a tragedy by Rowe.

SHORE, LOUISA CATHERINE (1824-95). An English poetess. An elder sister, Margaret Emily (1819-39), early cut off by consumption, showed much literary talent. With a second sister, Arabella, Louisa published several volumes of poems: *War Lyrics* (1855); *Gemma of the Isles, a Lyrical Poem* (1859); *Fra Dolcino and Other*

Poems (1871); and *Elegies and Memorials* (1890). The last collection contains from Louisa beautiful elegies on Margaret Emily and on a brother lost at sea. Louisa published independently *Hannibal*, a poem in two parts (1861). She warmly championed the cause of women. Consult *Posthumous Poems*, with an introduction by Frederic Harrison (London, 1896), and the delightful *Journal of Emily Shore* (ib., 1891).

SHORE-BIRDS, or BEACH-BIRDS. A sportsmen's term for those birds which run along the beaches of the sea or inland bodies of water, and pick up their food from the edge of the waves. All are of the order Limicolæ (q.v.), and (so far as they interest sportsmen) consist mainly of sandpipers, curlews, stilts, plovers, and their nearer allies. They are shot mainly by hiding in 'blinds' at favorable places, and setting out decoys to attract the migrating flocks. Consult, in addition to general ornithologies, any of many special works by both ornithologists and sportsmen, as Elliot, *North American Shore-Birds* (New York, 1898); and Seebohm, *Geographical Distribution of the Family Charadriidæ* (London, 1887), in which are described and largely figured all the shore-birds of the world.

SHORE'DITCH. A borough of London, England, immediately north of the city nucleus. Within its limits is the immense freight depot of the Great Eastern Railway. The two theatres in London during Shakespeare's time were in Shoreditch. The name is probably derived from Sir John Soersditch, who had his residence here in the reign of Edward III.; the tradition is baseless that the name is derived from Jane Shore, mistress of Edward IV., who is said to have died here in a ditch.

SHORE-LARK, or HORNED LARK. The only true lark (*Otocoris alpestris*), that is, a lark of the family Alaudidæ, indigenous to North America. It ranges in its migrations over the entire continent, breeding in Canada, Alaska, and the elevated plateau regions of the West, and appearing along the coasts, about the Great Lakes, and southward in open districts in winter. It is a small, handsome, and highly variable bird, the characteristic feature of which is an erectile, narrow, horn-like tuft of lengthened black feathers on each side of the crown. The plumage of the adult consists of mingled brown and vinaceous tints above, with the lower parts mainly white, and bold black markings on the head and chest. (See Plate of LARKS AND STARLINGS.) Those living on the Western plains, where they are numerous and sociable, are far paler than the Northern and Eastern residents. All make their nests on the ground, and lay brown-speckled eggs. These larks have a brilliant song, which is often heard while they flutter high in the air like skylarks. Consult American ornithologies, especially: Coues, *Birds of the Northwest* (Washington, 1874); Keyser, *Birds of the Rockies* (Chicago, 1902).

SHO'REY, PAUL (1857—). An American classicist, born at Davenport, Iowa. He was educated at Harvard and at the University of Munich. From 1885 to 1892 he was professor at Bryn Mawr College, and in the latter year became the head of the department of Greek in the University of Chicago. In 1901-02 he was professor in the American School of Classical Studies at Athens. Professor Shorey's studies are chiefly in the field of ancient philosophy, particularly Platonism. His published works include: *De Platonis Idearum Doctrina* (1884); *The Idea of God in Plato's Republic* (1895); and an edition of the *Odes of Horace* (1898).

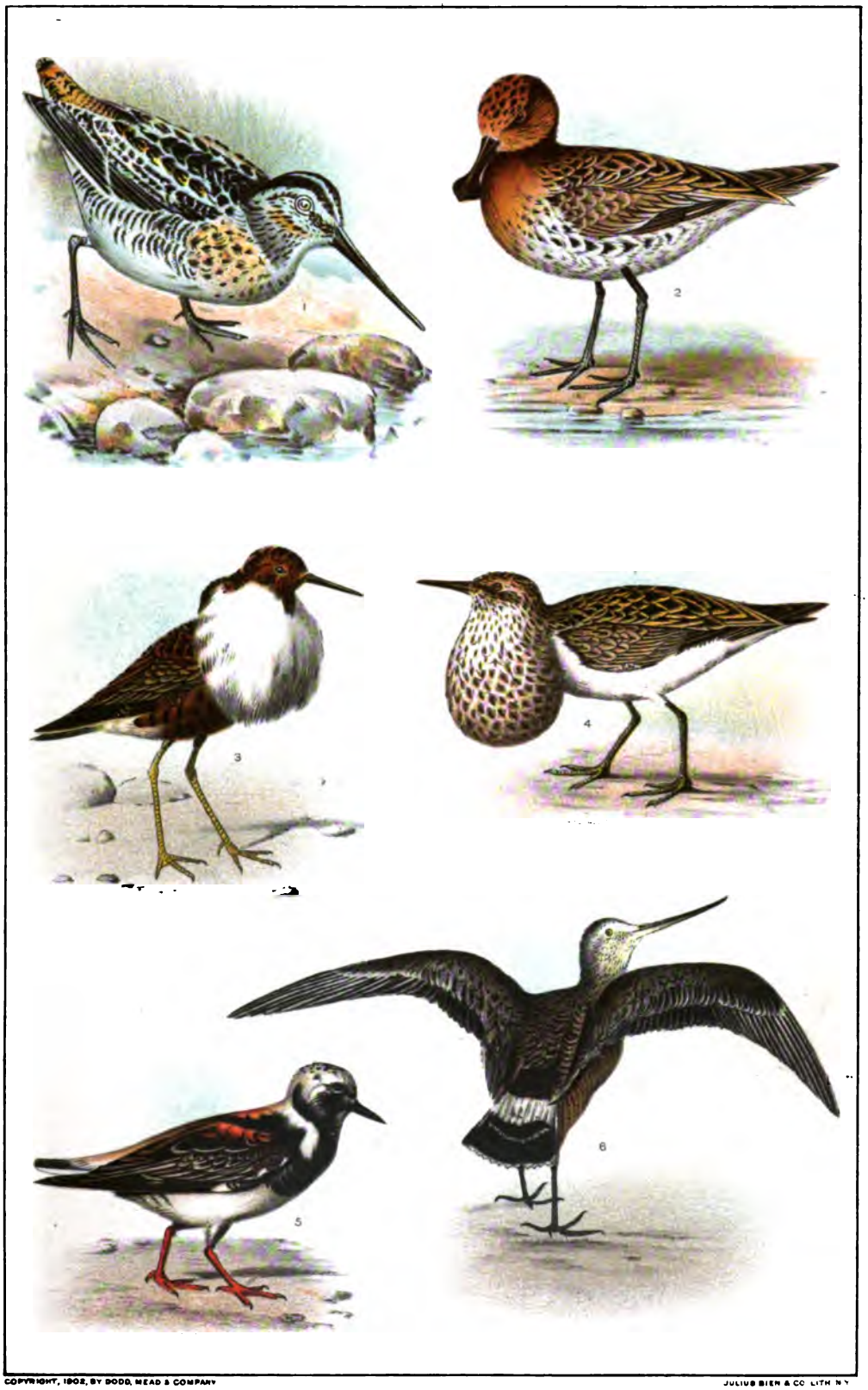
SHORT. A term used to denote brokers, dealers, and speculators in stocks, certificates of indebtedness, or any commodity, who agree to sell or contract to deliver shares, etc., which at the time they do not own, and who to do so are forced to borrow the same for a consideration, and eventually to 'cover' by actual purchase or by an equitable settlement with the buyer. If the market value of the stock or commodity falls the short profits by purchasing the same at a lower price, thus making the difference, whereas on a rising market he will lose, as he is forced to pay more for the stock or commodity than he received in the original sale. See STOCK EXCHANGE; CORNER; MARGIN; DEALS.

SHORT, WILLIAM (1759-1849). An American diplomatist, born at Spring Garden, Surry County, Va. In 1784 he went to France as Secretary of Legation under Jefferson. In 1790 he was appointed a commissioner to negotiate European loans for refunding the national debt. He was commissioned Minister Resident at The Hague in 1792, and later in the same year he and William Carmichael were appointed commissioners plenipotentiary to treat with Spain concerning the navigation of the Mississippi, boundaries, and commerce. Short's commission was changed in 1794 to Minister Resident at Madrid, where he remained until 1796. He did not return to America until 1802. His long residence abroad and his intimate relations with the French nobility combined to make him extremely unpopular at home. In 1808 Jefferson nominated him as the first United States Minister at Saint Petersburg, but the Senate refused to confirm the nomination, and in August, 1810, he returned to the United States. Thereafter he lived at Philadelphia.

SHORT'ER, CLEMENT KING (1858—). A London journalist and critic, editor of the *Illustrated London News* (1891-99), the *Sketch* (1893-99), and the *English Illustrated Magazine* (1894-99). In 1900 he started the *Sphere*, an illustrated literary weekly. Beyond his profession he is best known for his Brontë studies, comprising *Charlotte Brontë and Her Circle* (1896) and a new edition of Mrs. Elizabeth Gaskell's *Charlotte Brontë* (1900). Other books are: *Sixty Years of Victorian Literature* (1897); *The Sanity of Cowper and Other Essays* (1900); and selections from Wordsworth (1894) and the entire Waverley Novels (1898).

SHORTHAND. A common English word used for all kinds of abbreviated writing other than abbreviated longhand. It is not generally applied to the ancient hieroglyphics, though these are a kind of short writing, in which a single character is often made to represent a whole idea. The name 'stenography' is also given to shorthand, and this is commonly used as synonymous with it. It was so used by John Willis in his treatise entitled *The Art of Stenography*, published in 1602. The word 'phonography' should be applied only to those systems of shorthand that are based strictly upon the phonetic principle, such as the Pitmanic system. Various other

SHORE BIRDS



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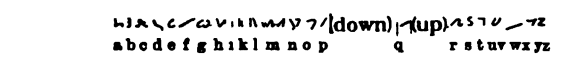
1 WILSON'S SNIPE - (GALLINAGO DELICATA)
2 SPOON-BILLED SANDPIPER - (EURYNORHYNCHUS PYGMÆUS)
3 RUFF - (MACHETES PUGNAX)
4 PECTORAL SANDPIPER - (TRINGA MACULATA); MALE
5 TURNSTONE - (ARENARIA INTERPRES)
6 HUDSONIAN GODWIT - (LIMOSA HÆMASTICA)

titles such as 'tachygraphy.' 'cryptography,' 'radiography,' etc., have been used. The name 'Eclectic' has been used for two systems: first by Elias Longley, because his system was a selection from various modifications of the Pitman system; and later by J. G. Cross, whose system is original rather than selected. The name 'Light-line,' which is appropriated by Mr. Gregg, has also been used before by Eames and by Thornton, and is equally descriptive of nearly all systems in use before the birth of phonography in 1837, as well as of the Pernin and others since.

The origin of shorthand writing is mostly a matter of supposition.

History traces the use of the art with definiteness back to the time of Cicero, about 70 B.C. The invention is sometimes credited to Cicero himself, and sometimes to his secretary, Tullius Tiro; but had it not been the latter, his name would never have been mentioned in connection with it, and the property of the slave at that time was always reckoned as belonging to the master. This system of Tiro was largely employed when letters flourished at Rome, and the philosopher Seneca is said to have added much to its efficiency. Centuries later it was used by the Christian Fathers, and Cyprian adapted it specially to the theological terms in use in his day. We have traces of its being employed in the tenth century after Christ, and even at a later date in a very limited way.

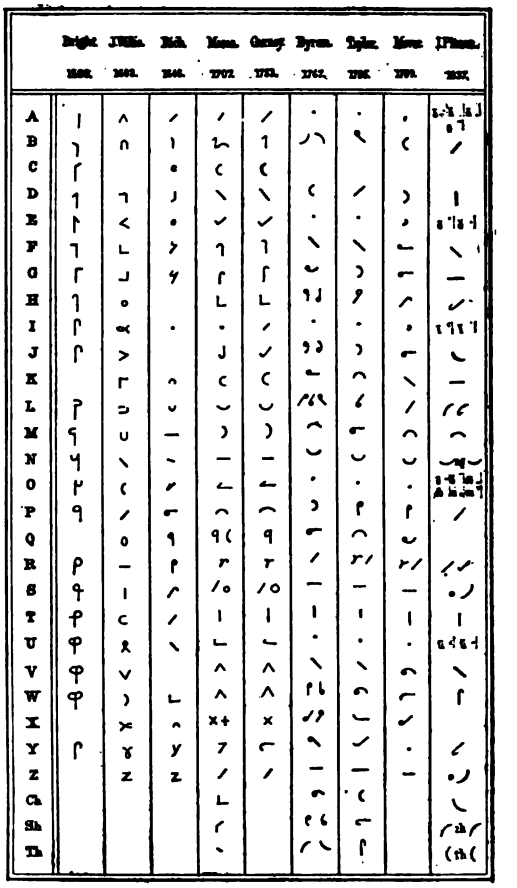
Judging from the few specimens of the system of Tiro that have been preserved, it seems impossible that the pen could be made by it to keep pace with the tongue of even a very slow speaker. The alphabetic signs were much longer than those of modern systems, most of them being only a trifle shorter than the usual Roman character, which it often imitated. Thus:



Besides the clumsy form of these letters, the difficulty was increased both to learner and writer by a very long list of arbitrary forms that must be committed to memory; and to have all these at the finger ends just when wanted, without having to lose time in the effort to call them up, would be no easy task. Success with such materials would be due more to the writers than to the system. Yet we find Gregory of Nazianzus expressing his gratitude in his last days that so many of his public utterances had been preserved by this shorthand. Pliny also kept a stenographer at his side to record his observations. Awkward as Tiro's system may appear in comparison with those of more modern times, we recognize in it some of the basic principles on which these are founded, such as the shortening of alphabetic signs, the use of single letters to represent short and common words, the omission of letters that are lightly sounded or not sounded at all, the adopting of a cursive or running hand, etc.

Nothing seems to be known of the existence of any other system of shorthand during the Greek or Roman ascendency, nor for fifteen centuries afterwards. But at the end of the Dark Ages the invention of printing startled the world from its long slumber; and, soon after, what may be called the second era of shorthand history came into being, and continued without very much improvement until phonography proper gave it an entirely new impetus. During this second period of some three centuries, about 215 systems were submitted to the public, of which only about eight or nine show any real improvement. It is instructive to compare the alphabets of these leading inventors, and note the gradual improvement in the alphabetic signs. The following table is arranged for comparison of the prominent systems of this era, and such as manifest the growth of the shorthand idea:

TABLE I.



The two qualities essential to good shorthand are (1) brevity, in order to secure rapidity in writing, and (2) fullness sufficient to make the writing legible. By examining the above systems a gain in the direction of brevity, so far as the alphabets are concerned, is evident; and at the same time, the characters being quite as varied and significant as are the Roman characters, the writing retains its legibility. When other gains are also taken into account, such as better joinings of letters, omitting silent or semi-silent letters, the gradual adoption of a phonetic principle, pairing of letters according to sound, using distinct signs for combinations of consonants and for syllables, substituting written words for arbitrary signs—taking all these into account, the improvement is very marked.

Timothy Bright, who led this era, and whose treatise was dedicated to Queen Elizabeth, was very sanguine about the excellence of his system. Modern writers, however, are prone to depreci-

ate the advantages that he claimed. Each letter of his alphabet could be written in four directions, as follows: ı\/_ . The first letter alone of a word was written out; by adding to this different terminations, different words would be expressed, and each of these words was to be committed to memory. Thus: ⌋ *abound*, and ⌊ *about*; ⌋ *accept*, and ⌋ *accuse*; ⌋ *advance*, and ⌊ *air*; ⌟ *again*, and ⌝ *age*; ⌟ *all*, and ⌞ *almost*; ⌟ *also*, and ⌞ *although*. Three dozen other words were made by giving the letter the other slopes indicated; thus: ¬ *alter*, and ⌐ *am*; ⌐ *amend*, and ⌐ *anger*, etc. In this way, 864 words could be constructed out of the letters of the alphabet, and each must be committed to memory. This set makes up the author's 'Characterie Table,' as he calls it. Then we have 28 pages of 'appellatine' or synonymous words, with a certain short mark on one side of each letter; placing this on the opposite side reverses the meaning, giving us the antonyms; as ⌝ *abandon*, but ⌞ *retain* or *keep*. One sign also is made to stand for all synonymous words, such as *veracity, truthfulness, sincerity*, etc. Following this list again comes a "Table of English Words," filling 180 pages more, all to be 'learned by heart.' In 1600 Peter Bales brought out a system similar in some respects to Bright's, but which was no easier for the memory. Bales called his system 'brachygraphy.'

The next system that indicated progress appeared twelve years later, by John Willis, and was called "The Art of Stenography, or short writing by Spelling Characterie." That is, spelling out the words and joining the letters, instead of making every word an arbitrary sign to be committed to memory. This was the first real stenographic alphabet for shorthand, and a decided advance beyond Bright. The advance, indeed, was such that the author sincerely believed he had reached the goal, in spite of the many drawbacks in the cumbrous letters, and in the large omissions necessary to secure any degree of brevity, and the still larger number of indispensable arbitraries. The art nevertheless did not stand still, and even during his lifetime Edmond Willis had announced the device of separating the vowels from the consonants, and placing them around the strokes in different positions, so that they might be written or not according to need and opportunity.

During the following twenty-five years, about ten publications appeared, each with new characteristics, but the only one that gained any lasting reputation was that of Jeremiah Rich in 1654, entitled *Semigraphy, or Art's Rarity*. It is better known by a later title, *The Pen's Dexterity*. Rich's shorthand continued to be published with slight changes for at least 150 years.

There is no very striking advance in Rich's system beyond some of the previous systems; such awkward forms as h *h*, ϒ *y*, z *z* still appear in the alphabet, and it included over 300 pure arbitraries. The Book of Psalms and the whole of the New Testament were engraved at great expense in Rich's system. Contemporaneous with it, some dozen systems appeared, many of them quite different in the structure of the alphabet, but no new principle of worth was evolved. The best of these, and the one that obtained most celebrity, was that of William Mason, first published in 1672. The alphabet of Mason's first edition follows Rich's alphabet closely; but that of the third edition departs widely from it. He divides his shorthand principles into four parts: "(1) Spelling Characterie, or the writing of words completely according to sound; by vowels according to their places (three beside the strokes); by consonants single, double, or treble; or by prepositions or terminations. (2) Symbolical shorthand, which uses natural marks for words and sentences—a kind of image visible to represent the words. (3) Deficient writing, when some part of a word stands for the whole, as *ab* for *abbreviate* or *abbreviation*, etc. (4) Arbitrary characters—small marks or dots made at pleasure for some words in frequent use which cannot be made so short by the letters of the alphabet. There are no less than 423 of these symbolical and arbitrary characters to learn. But Mason's great discovery was the use of the circle as a duplicate form for the letter *s*, which has been continued in the structure of some of the most successful systems to the present day.

The last edition of Mason's system is the foundation of the famous Gurney system, which was first published by Thomas Gurney in 1751, and which obtained its fame, not so much from any special merit that it possessed as from the circumstance that Mr. Gurney obtained an appointment from the Government as its shorthand writer—an appointment that has descended with the Gurney family to this day, giving them a monopoly of publishing the debates of the Commons, though much the larger proportion of their staff now use the Isaac Pitman system.

During the latter part of the eighteenth century, and while these last-named systems were in use, some fifty others were issued, none of which made any important place for itself in shorthand history except Byrom's, Taylor's, and Mavor's. Byrom (1767) seems to have had more regard for the ease and gracefulness with which his letters were formed and united than for brevity of style; and in order to attain this object, he employed duplicate forms for a number of his letters, and even a triplicate in the case of *l*, as will be seen by a reference to his alphabet in Table I. Still using the old unphonetic vowel scale, he represented the five vowels by dots placed in order beside the strokes, but arranged in the case of curved horizontals in a manner that appears strange to a modern writer; thus: ⌣ *an, en, in, on, un*. Taylor (1786), apparently making brevity his first and sole aim, discarded all medial vowels, but used a dot occasionally to indicate the presence of any open or sounded vowel at the beginning or end of a word. He says: "Some have characters to represent all the vowels, which they use in common, as in other writing, namely, at the beginning, in the middle, and at the end of words. But this kind of writing ought not to come under the denomination of shorthand." etc. Taylor also abandoned the use of all arbitrary characters. At later dates, Harding and Odell, having an eye to legibility as well as to brevity, modified Taylor's vowel principle; the former using a dot and a dash according to position with regard to the letter, as ⌉ *at*, ⌈ *et*, ⌋ *it*, ⌉ *ot*, ⌉ *ut;* and the latter employing a different sign for each vowel without regard to position, as ⌋ *at*, ⌟ *et*, ⌞ *it*, ⌟ *ot*, ⌟ *ut*, ⌟ *aut*, ⌟ *out*. In neither case, however, were these vowel signs generally in-

serted. Both Harding and Odell also used a few arbitrary characters, but very few.

The peculiarity of Mavor (1789) was that, with a consonantal alphabet of his own, he employed comma marks for *a*, *e*, and *i*, in three different positions alongside the consonants, and dots for *o*, *u*, and *y*; but the commas were found to be clumsy and slower than the dashes. Mavor's system, however, became quite popular, and survived most of the systems in vogue at the time.

Between the time of Mavor and the rising of 'phonography,' in 1837, some 130 different authors published shorthand treatises of greater or less value, a few being original, others being only modifications of preceding systems. But it is needless to particularize any that would not throw light on present-day expedients either as helps or as beacons of warning. Two of this number gained considerable repute at the time for methods that were at least novel, if not useful. In 1800 Samuel Richardson produced an ingenious contrivance, namely, the use of dots for *all* letters, which were distinguished merely by their relative position between the bars of a music staff; this plan was modified and extended some years later by Hinton, Moat, and Tear. Again, in 1802 Richard Roe brought out what he called 'radiography,' or *easy writing*, which was noted, as he says, "especially by the singular property of the characters sloping all one way, according to the habitual motion of the hand in common writing." Over thirty years after, the same principle was taught by Cadman in his *School Stenography*, in which we are told that "lineality is the distinguishing feature of this system," and that "it is impossible for the student to get away from the line—he cannot go wrong." Some modern systems cling also to this feature of shorthand. It was during this period that James Henry Lewis made a name for himself, especially by his *Historical Account of Shorthand*, which is a work of considerable merit; but his reputation was not a little marred by his style of advertising the *Ready Writer*, which he is vain enough to speak of as "the *ne plus ultra* of shorthand; the most easy, exact, lineal, speedy, and legible method ever yet discovered, whereby more may be written in forty minutes than in one hour by any other system hitherto published." And he adds: "The unparalleled success which has attended the dissemination of the above system precludes the necessity of descanting on its peculiar advantages; it is amply sufficient to observe that it has completely superseded all others, in the courts of law, and in both Houses of Parliament; that it is universally adopted in every respectable seminary of education throughout the United Kingdom; and has passed the approbation of both our universities in a manner which can only be equaled by the liberality of those celebrated judges of literature who have pronounced it 'the best they have ever seen.'" This turgid style is continued at some length in rhyme, and, as in advertising other cheap wares, may be regarded as a species of poetic license, others having evidently failed to discover these wonderful virtues and testimonials; for the system never became popular.

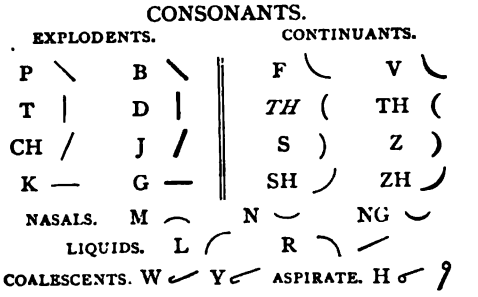
Throughout the past two eras of shorthand history, as we have considered them, the art can hardly be regarded as anything more than a plaything, being confined almost entirely in its use to people of leisure. Mavor himself speaks thus of it: "I was in the constant practice of writing in my system and of corresponding in it, with such ladies and gentlemen as did me the honor of submitting their proficiency to my inspection." It is noticeable that a few inventors of systems at this time professed to follow the *sound* of words rather than the *spelling;* still the practice was never established, particularly in regard to the vowels, on a scientific basis of phonetics until the publication of *Stenographic Sound-Hand* in 1837—renamed by the author *Phonography* about three years later. Whatever might be the cause or causes, the practice of the art took a sudden and mighty leap at the same time, giving reason to suppose that phonetics had more or less to do with this progress. Though it has ever continued to be a recreation, it now became much more. It came to be the handmaid of literature and industry—an indispensable wheel in the vast machinery of the business world. Isaac Pitman's earlier publications were very small and imperfect, but they contained the rudiments of the more fully developed system as now presented in the *Twentieth Century Instructor*. The first treatise was but a four-penny tractate of 12 pages, and the second was but a penny folio sheet, 8 inches by 6½. The author took every advantage of the experience of those who had preceded him. He arranged his alphabet on approved scientific and phonetic principles, employing the shortest signs, consistent with distinctness, for the various sounds of the language,

TABLE II.

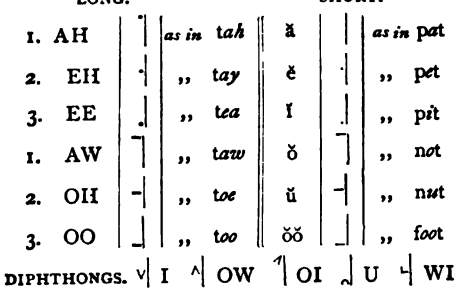
THE PHONOGRAPHIC ALPHABET.

(BY ISAAC PITMAN.)

CONSONANTS.



VOWELS.

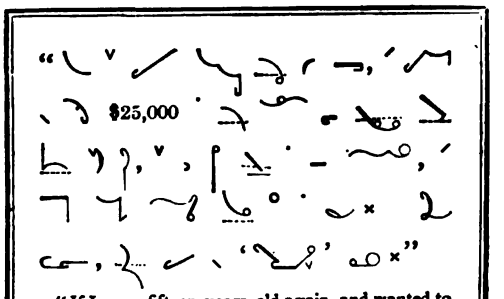


devoting the most convenient ones to the most frequently recurring sounds; he paired those that were cognate in sound, shading the stronger ones; he made simple dots and dashes, with very small curves, both light and shaded, detached and in three positions, do the whole service for

the twelve vowel sounds and the thirty diphthongs, all being distinct; and he gave the shorter and more common words three positions with respect to the line of writing, so that, without impairing legibility, these vowel forms might be dispensed with in ordinary cases. Tables II. and III. illustrate most of these points.

The public were so captivated with the new system that nine editions of the book, each with improvements, were demanded within fifteen years; and although some one hundred systems have been put on the market in Great Britain since the first appearance of the Isaac Pitman system, it has continued to gain ground very rapidly among them all. An 'official' report made by Mr. Storr of the *Times* (London) gives the relative standing of the systems used in the British Parliament in 1895 as: Isaac Pitman, 96; Gurney, 10; Taylor, 11; Janes, 1; Duployan, 1; Lewis, 2. The popularity of the system is also shown by the large amount of shorthand literature published: Two weekly periodicals with a circulation stated to be 35,000 each, from the Bath press; six monthlies of a general character published independently, and one medical journal—all of these in shorthand alone, except *The Phonetic Journal*, which is partly letterpress.

TABLE III.

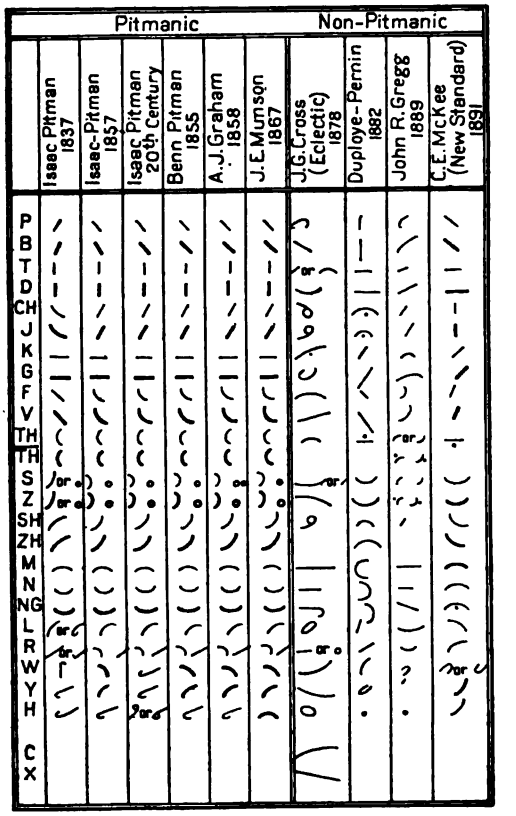


"If I were fifteen years old again, and wanted to earn $25,000 a year in some great business by the time I was thirty, I would study to become a good amanuensis, and get into the Manager's office as a stenographer. There is no quicker, easier way to 'burglarize' success."—*Frederic Irland, Congressional Reporter, Washington, D.C.*

The catalogue of publications now issued through the four publishing houses at Bath, London, New York, and Toronto contains, among other books, 136 of such standard character as the Bible, *The Vicar of Wakefield*, *Tom Brown's School Days*, Dickens's *Pickwick Papers*, etc. Government returns show that, in the year 1895, 91,006 youth were receiving instruction in the Pitman shorthand in the United Kingdom, and the text-books of the system have now been adopted exclusively for the schools of Greater New York. Isaac Pitman's services were recognized by having a knighthood conferred on him in 1893, three or four years before his death.

In America there are no distinct traces of the public use of shorthand until Stephen Pearl Andrews brought the Isaac Pitman system from England in 1844, and planted it on this side of the Atlantic. In Dr. J. Westby-Gibson's *Bibliography of Shorthand*, he enumerates 16 editions of Andrews's and Boyle's *Complete Phonographic Classbook* (Pitman phonography) as published within eight years. Epinetus Webster also published an edition of the system in 1852. A very active propaganda was carried on at this time by these and other publishers, and by Oliver Dyer, who traveled over a large part of the Eastern and Northern States, and into Canada, lecturing on phonography and teaching large classes. In 1853 Benn Pitman, a younger brother of Isaac, came to America, and, with R. B. Prosser, joined the propaganda by publishing *The Reporter's Companion*, and, shortly after, *The Manual*. So far, the system in America had kept pace in alterations with the several English editions; but a year or two later Andrew J. Graham commenced his series of text-books, in which he introduced slight changes of his own. His alphabet, as also that of Benn Pitman, remains the same as the Isaac Pitman of 1856; but the latter undergoing a change in its tenth edition by the transposition of two light and two heavy dot vowels, the Benn Pitman and the Graham did not follow; and that, with the change of the letters *w*, *y*, and *h*, which Isaac Pitman made later, constitutes the principal difference at the present day between these systems and that of Great Britain.

TABLE IV.



In 1866 James E. Munson brought out his *Complete Phonographer*, in which he adopted the Isaac Pitman change of vowels, but retained the old *w* and *y*, and he has a new form of his own for *h*. Elias Longley followed with his *Eclectic*, and says in his Introduction: "As phonography now stands before the public, in this country, it has no generally recognized exponent. It is 'Lo! here,' and 'Lo! there,' and nobody knows who is the true phonographic

prophet." With the benevolent intention of restoring harmony, he simply adds another variation. And so the Pitmanic systems kept on multiplying, until now they number anywhere from 30 to 50, all of which, however, may be understood by a Pitman writer with a few hours' study. The confusion was increased by the introduction of new systems: Lindsley's Tachygraphy; the Gabelsberger and the Duployan (modified and renamed the Pernin), imported from Germany and France respectively; J. G. Cross's Eclectic; C. E. McKee's New Rapid and New Standard; J. R. Gregg's Light-Line; and others less known.

Of the Pitmanic systems, the Benn Pitman has a monthly for its exponent, *The Phonographic Magazine*, which is partly in common print and partly in shorthand; the Graham has *The Students' Journal*, a monthly, also partly in shorthand. Beyond these and the text-books, with a few booklets for reading exercise, the American Pitman systems have no literature. Of the non-Pitmanic, *The Monthly Stenographer* represents the Pernin, and *The Gregg Writer* (monthly) the Gregg system; both of these are partly in the shorthand character of their respective systems, besides which they have published only their text-books. *The Typewriter and Phonographic World* of New York, and *The Stenographer* of Philadelphia, both monthlies, are cosmopolitan in their shorthand character, and are mostly in common print. The English Isaac Pitman had no propaganda in America until the branch publishing houses were opened at New York and Toronto in 1890. The official organ of this system in the United States is *Pitman's Journal*, issued monthly. Shorthand publishing in America is very far behind that of Britain, notwithstanding the vigor with which it started under Andrews, Boyle, Webster, etc.

The systems that are not Pitmanic differ from each other as much as they do from the Pitmanic. The letters of the Cross Eclectic alphabet are constructed upon what the author calls the form of the 'Chirographic Ellipse,' or any ellipse in five different directions lacking the perpendicular. (See Table IV. for the form of the letters.) His vowel scale is but partially phonetic, and he uses five positions with respect to the line of writing, both for vowels and for consonants; the vowels, being strokes, are, of course, joined to the consonants. The Pernin consonants are geometrical and light-line, the paired letters being single and double length instead of being light and heavy, and the vowels are mostly connected and phonetically arranged, but the diphthongs are scantily represented. The special characteristics of the Gregg system are thus presented: "(1) No compulsory thickening. (2) Written on the slope of longhand. (3) Position writing abolished. (4) Vowels and consonants conjoined. (5) Angles are rare." Like the Pernin, and other light-line systems, the heavy sounds of related letters are double length. The vowels are phonetic, and four of them fully connected with the consonants; but the remaining eight, when distinguished from the others, have dots and dashes disconnected. The alphabet shows but four diphthongs; ingenious but somewhat complicated expedients provide, however, for one or two more. The system is new comparatively, originating in England in 1889, whence it was transferred to America about two years later, where it has made considerable headway since, especially in the West. The New Standard, as will be observed by the tables, is shaded like the Pitman; its vowel system is mostly phonetic, and composed of three circles of different sizes and two ellipses, which are also shaded and some of them accompanied by distinguishing dots. The words are all written on the line. This system is also comparatively new in the field.

This is necessarily but a meagre description of what may be called the 'living' systems of America at the present date (1903). New ones are constantly coming and going. In 1890 Julius Ensign Rockwell, with remarkable care and labor, collected shorthand statistics for the Bureau of Education at Washington; and he found 44 different systems taught in 1310 institutions of learning. Some extend the number of systems in actual use in America to 200; but those represented in Table IV. are almost the only ones to be found doing the work at the present time of our press, our courts, and our legislatures.

As to the adaptation of shorthand to different languages, while all admit the truth of Gabelsberger's remark that "the honor of reducing shorthand to a system belongs especially to the English nation," yet we find a French inventor as early as 1651—Jacques Cossard—and others a little later in other parts of Europe; but in modern times the names of Duployé in France and of Gabelsberger in Germany are watchwords in the shorthand circles of these countries. The Isaac Pitman firm has, however, adapted its system to the Spanish, French, German, Italian, Dutch, Welsh, Japanese, Chinese, Hindustanee, and eleven other languages.

The speed with which shorthand can be written is a much discussed subject. It has been made abundantly clear that shorthand can be written so as to keep pace with ordinary public speakers at a rate of from 130 to 180 words per minute. At higher rates, or in lengthened reports, it is customary for reporters to work by relays, thus relieving each other every ten or fifteen minutes; this is not only for the sake of greater accuracy, but that the press may be supplied with copy the sooner. In England, by very strict official tests of ten minutes' dictation, and requiring perfect transcripts of the 'take,' many records of from 200 to 250 words a minute have been made; and it is claimed both in England and in America that these rates have been considerably surpassed, but the tests have not been equally reliable and are generally for only one minute's writing; and experience has shown that statements on this subject need to be taken *cum grano salis*.

The writer of this article acknowledges indebtedness to Dr. J. Westby-Gibson's *Bibliography of Shorthand* (London, 1887), Julius Ensign Rockwell's *Teaching, Practice, and Literature of Shorthand* (Washington, 1893), Isaac Pitman's *History of Shorthand* (London, 1884), and to the several treatises of authors referred to in the article.

SHORTHOUSE, Joseph Henry (1834-1903). An English novelist, born at Birmingham. He was educated at private schools. He passed his life as a chemical manufacturer in his native city. In 1881 he became widely known for his romance, *John Inglesant* (previously issued for private circulation, new ed., New York, 1903), which at once took a high rank among English historical novels for the beauty of its style and

the vivid fidelity of its historical portraiture. It is a sort of Anglo-Catholic tract written in a beautiful style. It was succeeded by *The Little Schoolmaster Mark, a Spiritual Romance* (1883-84); *Sir Percival, a Story of the Past and the Present* (1886); *A Teacher of the Violin and Other Tales* (1888); *The Countess Eve* (1888); and *Blanche, Lady Falaise* (1891).

SHORT-SIGHTEDNESS. See SIGHT, DEFECTS OF.

SHOSHO'NEAN STOCK. An important group of cognate tribes originally holding most of the territory from the central Rocky Mountain region, across the interior basin, to the Sierras and extending on the southeast into the Texas prairies and on the southwest across south California to the Pacific. At one time also they held the south bank of the Columbia, but were driven off by the invasion of Shahaptian tribes within the past hundred years. Their principal tribes are the Banak, Comanche, Hopi, Kawia, Mission Indians (chiefly), Piute, Ute, and Shoshoni proper. Their general line of migration seems to have been southward between the two great mountain chains, the Comanche alone becoming a prairie tribe by separation from the Shoshoni, while other bands of Piute connection penetrated southern California by displacing the weaker natives. Only the Hopi were sedentary or agricultural, the rest being roving savages depending for subsistence upon hunting, fishing, or the gathering of roots and seeds. The Ute and Banak were noted for their fighting temper, but the others as a whole were rather below the warlike standard of the eastern tribes. With the exception of the Hopi, whose culture was that of the Pueblos generally, the Shoshonean tribes were characterized by a democratic looseness of organization and lack of elaborate ceremonial. They number now altogether about 16,000. It is now generally held by competent linguistic authorities that the Shoshonean, Tañoan (including Isleta, Jemez, and other Pueblos), Piman, and Nahuatlan are all but branches of one great linguistic stock, which Brinton designates as the Uto-Aztecan. See Plate of AMERICAN INDIANS, under INDIANS.

SHOSHONE (shō-shō'nē) **FALLS.** A magnificent cataract of the Snake River (q.v.), in southern Idaho, exceeded in grandeur, in the United States, only by the Niagara and the falls in the Yosemite Valley (Map: Idaho, B 4). After flowing through a cañon 800 feet deep the river, here nearly 1000 feet wide, first falls 30 feet through several rocky channels, and then in a single sheet makes a precipitous plunge of 190 feet into a deep and dark-green lake at the bottom of a gorge over 1000 feet deep. The falls are formed by a ridge of hard rock uncovered by the wearing away of the superimposed lava beds. The height exceeds that of Niagara, and during the spring floods the volume does not descend far short of that of the more celebrated fall.

SHOSHONI, shō-shō'nē (probably from *Shishinowits,* snake, the name given them by the Cheyenne). The tribe, calling themselves simply Numa, 'people,' from which the Shoshonean stock (q.v.) takes its name, formerly holding the mountain country of western Wyoming and the adjacent portions of Colorado, Idaho, Utah, and northeastern Nevada. In common with their neighbors, the Banak and Piute, they have frequently been known under the collective term of Snake Indians, a name which seems to have its origin in a misapprehension of the tribal sign in the sign language, viz. a waving outward motion of the index finger. Although commonly interpreted as 'snake,' this sign is said by some good authorities to have been originally intended to indicate a peculiar style of brush-woven lodge formerly used by the Shoshoni. They were divided into several bands with very little cohesion among themselves. The eastern bands had horses and sometimes hunted the buffalo, but usually were kept close to the mountains by their fear of the more warlike Plains tribes. The more western bands depended chiefly upon camas and other roots, seeds, nuts, rabbits, and other small game. None of them were agricultural. Their dwellings varied from the skin tipi in the east to the merest brush windbreak in the west. There was no head chief and very little show of authority of any kind. Physically they are shorter and rather more plump than the people of the Plains tribes. At the beginning of the present century they numbered about 2500, viz. Banak and Shoshoni of Fort Hall Agency, Idaho, 1400; Shoshoni and Sheepeater (a subtribe), Lemhi Agency, Idaho, 400; Western Shoshoni Agency, Nevada, 225, besides others unattached; Shoshoni Agency, Wyoming, 800.

SHOT. See AMMUNITION; PROJECTILES.

SHOTGUN. A term employed to denote a weapon used for sporting purposes in contradistinction to the military rifle, which is discussed under SMALL ARMS (q.v.), where the historic development of firearms will be found treated. The flint-lock gun was used for sporting purposes well into the nineteenth century, and it was not until after many experiments and failures that percussion caps replaced the flints and priming. It is to a Frenchman, M. Lefaucheux, that the world owes the sporting breech-loader, and although it had but slight resemblance to its successor of to-day, it nevertheless was the pioneer of the principle which is now practically universal. The original Lefaucheux breech-loader made its appearance in the year 1836. It consisted of a pair of barrels open at the breech, working on a hinge, with a strong-based cartridge containing its own means of ignition. The gun had a lever lying under and parallel to the barrels when the gun was closed, so that to load the weapon it was necessary to place the hammers at half-cock, move the lever horizontally to the right, and thus liberate the barrels, which would then be raised at the breech end, and lowered at the muzzle; the cartridge was inserted in the breech, and the gun closed by moving the lever back to its original position. The cartridge was exploded by the falling of the hammer on the head of a brass pin inserted through the upper part of the cartridge case, upon which the point of the pin was driven into the percussion cap, and the explosion followed. There were so many faults in the system of pin fire that it was early abandoned in favor of the central-fire system. The first important improvement on the Lefaucheux weapon was the invention of an English gunmaker who strengthened the breech action, and devised a more perfect method of securing the barrels to the breech

action; it was known as the *double-grip breech mechanism*. Next came the *sliding barrel* breech mechanism as first employed in the Bastin Lepagus breech-loader. Instead of being hinged, the barrels were so constructed as to slide backward and forward on the fore part of the stock. The idea was not very successful and soon fell into disuse. The combination of the Bastin and Lefaucheux principles was seen in the *Dougall lock-fast breech mechanism*, in which the barrels turned upon a hinge pin and were moved to and fro on the stock sufficiently far to clear and make contact with the projecting disks attached to the standing breech. To load, the lever was depressed, the eccentric hinge-pin turned, and at the same time the barrels moved forward until the breech ends were clear of the disks, after which the barrels were dropped as in the original Lefaucheux. Of all the different varieties of the *turn-over breech mechanism* which have been tried (at the best with indifferent success), that invented by the Englishman Jeffries in 1862 is about the best known. The great effort of inventors and gunmakers was to dispense with the drop-down or Lefaucheux method for sporting guns, and the breech mechanism of Jeffries is probably the most satisfactory substitute, failure though it was. The barrels turned on a vertical pivot by means of a lever which was pivoted vertically under the breech-action body. In America the *Fox shotgun* followed the same idea, but abandoned the lever. The needle gun adopted by the Prussian Army in 1842 was an improved type of the early central-fire gun, the breech mechanism of which formed a combination of the sliding and drop-down principles. The inventor of the central fire-gun of this type was one Dreyse of Sommerda. A similar weapon was Needham's of 1850, in which the cap of the cartridge was at the base. The Lancaster central-fire system made its appearance about 1852. The barrels followed the principles of the Dreyse gun, but the cartridge case, instead of being consumed, was withdrawn by an extractor after firing. An improved central-fire system, and one which in its many essentials has been carried to the present day, is said to be the invention of M. Pottet, a Frenchman. Improvements in locks and minor mechanisms came next, the rebounding lock, in which a main spring reacts upon the tumbler, automatically raising it to half-cock, having been introduced about 1866. The *Wesley Richards breech-loader* dates from 1862 and was one of the first to introduce a top breech-bolt mechanism. Hammerless guns date from the era of a consumable cartridge case, although no particular claim was put forth in their favor. The development of the principle was interfered with by the success of the pin-fire gun, in which external hammers were a necessity. There were many varieties of hammerless guns, notably those of Daw (1862), Greener (1800), and Murcott (1871). The Murcott weapon was the first of the hammerless variety to achieve success. The *Anson and Deeley gun* (1875) was a very popular mechanism. The leverage of the barrel-cocking mechanism was obtained by the falling of the barrel. When the hammerless weapon was first introduced in its modern form it was very strongly opposed by both sportsmen and gun manufacturers. Other important improvements were in connection with the ejecting mechanism; notably *Needham's hammerless ejector gun*, in which the extractor is in two halves, and the *Perkes mechanism*, by which the cartridge cases were ejected by a separate mechanism situated in the fore part of the gun. Eight years later the *Deeley ejector mechanism* made its appearance, in which locks and barrels are fitted with an ejecting lock mechanism in the fore end. For a long time England held the supremacy in the manufacture of shotguns and sporting firearms, but it is generally conceded that American weapons have now the preëminence. The leading American manufacturers of shotguns are the Colt's Arms Company, Remington Arms Company, Smith and Wesson Company, and the Winchester Arms Company.

SHOULDER-JOINT (AS. *sculdor*, OHG. *scultirra*, Ger. *Schulter;* of unknown etymology). A ball-and-socket joint formed at the junction of the humerus and scapula. The large globular head of the humerus is received into the shallow glenoid cavity of the scapula, by which arrangement extreme freedom of motion is obtained, while the apparent insecurity of the joint is prevented by the strong ligaments and tendons which surround it, and also by the arched vault above formed by the under surface of the acromion and coracoid processes. (See SCAPULA.) As in movable joints generally, the articular surfaces are covered with cartilage, and there is a synovial membrane which lines the interior of the joint. The most important connecting medium between the two bones is the capsular ligament, which is a fibrinous expansion embracing the margin of the glenoid cavity above, while it is prolonged upon the tuberosities of the humerus below.

The morbid affections of the shoulder-joint may be divided into (1) those arising from disease and (2) those dependent on an accident. The shoulder-joint is not as liable to disease as the other articulations; it may, however, become the seat of a synovial inflammation, active, subacute, or chronic, and less often of tubercular syphilitic or rheumatic disease. There may be fracture (1) of the acromion process, or (2) of the coracoid process, or (3) of the neck of the scapula, or (4) of the superior extremity of the humerus; or two or more of these accidents may be associated. Again, the head of the humerus may be dislocated from the glenoid cavity in a direction above, below, in front, or behind this cavity. The anterior variety is most frequent. The following are the most prominent symptoms: The arm is lengthened; a hollow may be felt under the acromion, where the head of the bone ought to be; the shoulder seems flattened; the elbow sticks out from the side, and cannot be made to touch the ribs; and the head of the bone can be felt if the limb be raised, although such an attempt causes great pain and weakness from the pressure exerted on the axillary plexus of nerves. For a description of the symptoms and mode of treatment of fractures and dislocations, consult Park, *Surgery by American Authors* (New York, 1901).

SHOVELER (so called from the shape of its bill). A cosmopolitan fresh-water duck of the genus Spatula, remarkable for the expansion of the end of the mandibles, the lamellæ of which are long and very delicate. The legs are placed near the centre of the body, so that these birds walk much more easily than many of the ducks. The common shoveler (*Spatula clypeata*) is smaller

than the mallard, but rather larger than the widgeon. The male has the head and neck fuscous, glossed with green, the back fuscous, upper and under tail coverts dark green, lower neck and breast white, and the belly chestnut. The female is much duller. In America it is more common in the interior than on the coast and breeds locally from Texas northward. Its flesh is very highly esteemed. Several other species of shoveler are known in Oriental regions.

SHOV'ELL, Sir CLOWDISLEY (1650-1707). A distinguished English admiral, born in Cockthorpe, in Norfolk. He entered the navy in 1664, and served against the Dutch and the Barbary pirates. In 1689 he commanded the *Edgar* in the battle of Bantry Bay, was soon after knighted, and was put in command of a squadron in the Irish Sea. In the following year he was promoted to be rear-admiral of the blue. Two years afterwards he commanded the red squadron in the battle of Barfleur, and by breaking the French line greatly contributed to the English victory. In 1704 he participated with the fleet under Sir George Brooke in the capture of Gibraltar and in the action off Malaga. In the same year he was made rear-admiral of England. In the following year he was appointed admiral, and was made joint commander with the Earl of Peterborough of the expedition which captured Barcelona. In 1707 he coöperated with the Duke of Savoy in the attack on Toulon, and, although the town was not taken, Shovell destroyed a great number of French vessels. On the way back to England his flagship was wrecked on one of the Scilly Islands. He was cast ashore in a helpless condition and was murdered by a woman who coveted an emerald ring on one of his fingers. His body was taken to England and buried in Westminster Abbey. Consult Clowes, *The Royal Navy: A History* (6 vols., London and Boston, 1896-1901).

SHOWBREAD. See SHEWBREAD.

SHRAPNEL. A form of projectile used in field and naval guns and invented by Col. Henry Shrapnel of the British Army. It consists of a shell containing a number of balls, a bursting charge, usually of black powder, and a combination time and percussion fuze. (See FUZE.) The bursting charge may be located either in the front or in the rear of the shell, whose walls are thinner than in the case of ordinary shell. The bursting charge may also be contained in a central tube, as is the case of navy shrapnel, which may be larger than that used in field pieces. Shrapnel is designed for use against troops in open country or for clearing covered spaces, destructive effect over a considerable area rather than penetrative power being desired. With this in view the fuze is so adjusted that the projectile bursts in close vicinity to the target and scatters its fragments and the balls, which may be placed either in metal or wooden frames or plates or in a matrix of resin. In naval warfare shrapnel is used against attack by torpedo boats or small boats. See PROJECTILES, where United States Army 3.2-inch shrapnel is illustrated; also CANISTER; FIELD ARTILLERY.

SHRAPNEL, HENRY (1761-1842). An English inventor, born at Bradford-on-Avon. In 1784 he began to study hollow projectiles. He spent three years in Gibraltar and in 1803 his shot case or shell was recommended for adoption into the service. He improved the construction of howitzers and mortars and invented the brass tangent slide. In 1837 he was promoted to be lieutenant-general. See PROJECTILES; SHRAPNEL.

SHREVE, HENRY MILLER (1785-1854). An American inventor and steamboat builder, born in Burlington County, N. J. He was reared in western Pennsylvania, adopted the career of a river boatman, and early became interested in the problem of steam navigation on the Ohio and Mississippi. In 1814 he was at New Orleans, and with boats protected by cotton bales ran the gantlet of the British batteries to carry supplies to Fort Saint Philip, and later had charge of a gun in the battle of New Orleans. In 1815, in the *Enterprise*, he made the first trip ever accomplished by a steamboat from New Orleans to Louisville. Subsequently he constructed a river steamboat known as the *Washington*, which had many points of improvement over the boats of the Fulton model. The success of the *Washington* was followed by lawsuits brought by Fulton and his associates, who claimed the exclusive right to steam river navigation, but the cases were eventually decided in Shreve's favor. From 1826 to 1841 he was employed by the Government as superintendent of improvements on the Western rivers, and successfully opened the Red River to navigation. He invented many improvements in steamboat machinery and construction, as well as the steam 'snag-boat' and a ram for harbor defense.

SHREVE, SAMUEL HENRY (1829-84). An American civil engineer, born at Trenton, N. J. He graduated in 1848 at Princeton, and afterwards studied law and civil engineering. He directed the construction of numerous railways, and in 1875 was engineer of the New York Rapid Transit Commission. Subsequently he was consulting engineer of the Metropolitan Elevated Railroad, and chief engineer of the Brooklyn Elevated Railroad. He published a treatise on *The Strength of Bridges and Roofs* (1873).

SHREVEPORT. The parish seat of Caddo Parish, La., 170 miles east of Dallas, Texas; on the Red River, and on the Texas and Pacific, the Saint Louis Southwestern, the Kansas City Southern, the Houston and Shreveport, and other railroads. (Map: Louisiana, B 1). Among the noteworthy features of the city are the Charity Hospital, a sanatorium, Cooper Building. First National Bank Building, the United States postoffice, the court-house, and the high school building. Shreveport is in a rich cotton and stock raising region, and is of considerable commercial importance. It carries on a large wholesale trade, especially in groceries, dry goods, and hardware. In addition to several establishments connected with cotton—cotton factory, large compressors, and warehouses—there are molasses works, foundries and machine shops, lumber mills, etc. The government, under the charter of 1898, is vested in a mayor, chosen every two years, and a unicameral council. Shreveport was settled in 1833, and was first incorporated in 1839. Population, in 1890, 11,979; in 1900, 16,013.

SHREW (AS. *scrēawa*, shrew; connected with OHG. *scrōtan*, Ger. *schroten*, to cut, gnaw, bruise, AS. *scrēadian*, Eng. *shred*). A small **nocturnal**

quadruped of the family Soricidæ, and especially of the genus Sorex, which includes the smallest of all mammals. The shrews are often confounded with mice, but belong to an entirely different order, the Insectivora (q.v.). The head is very long; the snout elongated, attenuated, and capable of being moved about. The eyes are minute, the ears small, the tail long, and both body and tail are covered with fine, short hair of a dark color without distinctive variegations. They abound in dry fields, woods, and gardens, and some species are semi-aquatic. They feed chiefly upon insects and worms, especially earthworms; and, as they are able to obtain food at all seasons of the year, they do not hibernate. The northern species are among the hardiest of animals, ranging far toward the Arctic regions, and abroad during all winter. Most species make no burrows, but grub about among the roots of the herbage, make long runways beneath the fallen leaves, and hide in old stumps and beneath rotting logs. They are common and useful in gardens. The males are excessively pugnacious, and fight fiercely in spring, often killing one another. They form the prey of weasels, foxes, hawks, owls, shrikes, and many other animals, and are frequently caught by household cats, but seldom eaten by them, probably on account of their strong musky odor. Although harmless, this animal has long been regarded with dread and hatred by the peasantry of Europe, who believe it to be poisonous, and attribute to it other evils. The numerous American species of shrews fall into three genera, Sorex, Neosorex, and Blarina. The largest of these is the swamp-haunting water-shrew, which is six inches in length, including the tail; it is found from Massachusetts to the Rocky Mountains, and northward. Of the other American shrews, the one most common in the Eastern United States is the 'short-tailed' or 'mole' shrew (*Blarina brevicauda*). This is a blackish, stout-bodied, ravenous little animal, which feeds largely upon flesh of every kind, and often kills the young of small birds. It takes its name of mole-shrew on account of its unusual habit of frequently forcing its way through the loose top-soil like a mole. Perhaps the best known American form, however, is the long-tailed 'shrew mouse' (*Sorex personatus*), which is smaller, lighter in color, and most numerous about marshes and streams. An Italian shrew is the smallest of all known mammals, having a body only an inch and a half in length. It is a member of the genus Crocidura, which also includes the largest known shrew, one Oriental species of which is that known in India as the 'muskrat' (q.v.). Consult standard zoölogies, especially Beddard, *Mammalia* (London, 1902); Stone and Cram, *American Animals* (New York, 1902).

SHREW-MOLE. Any of the American moles of the genera Scapanus and Scalops. See MOLE.

SHREWSBURY. The capital of Shropshire, England, on the Severn, by which it is nearly surrounded, 42 miles west by north of Birmingham, and 163 miles north-northwest of London (Map: England, D 4). The town, irregular in plan, contains many ancient timber-built houses of picturesque appearance. Saint Mary's Church was founded in the tenth century. There are a market-house (1595), the shire hall (rebuilt 1883), and the new market hall (1868). The town has interesting remains of ancient walls, a castle, two monasteries, and a Benedictine abbey. It has manufactures of agricultural implements and linen thread, iron foundries, glass-staining works, and malting establishments, and a large trade in cattle.

Shrewsbury, called by the Welsh Pengwern, was named by the Anglo-Saxons *Scrobbes-Byrig*, of which the modern name is a corruption. The town was taken by Llewellyn the Great, Prince of North Wales, in 1215, during the troubles between King John and the barons; and in July, 1403, Henry IV. here defeated the insurgent Percy with great slaughter, Henry Hotspur being among the slain. The battle is described in Shakespeare's *Henry IV.* The town was taken by the Parliamentarians in 1645. Population, in 1891, 26,967; in 1901, 28,400. Consult: Pidgeon, *Historical Handbook of Shrewsbury* (Shrewsbury, 1857); Phillips, *Shrewsbury During the Civil War* (Shrewsbury, 1898).

SHREWSBURY, EARLS and DUKE OF. See TALBOT.

SHREWSBURY SCHOOL. A public school at Shrewsbury, England, founded by King Edward VI. in 1551 and opened in 1562. Its scope was largely increased by Queen Elizabeth. Under the vigorous administration of Dr. Samuel Butler (1774-1839) it attained a great reputation as a classical school. It has an endowment which is now producing more than £3000 a year. In 1882 it was removed to the new buildings erected on a site covering 58 acres. The attendance since its removal to the new buildings has increased from 170 to more than 300.

SHRIKE (AS. *scric*, Icel. *skrīkja*, shrike, from *skrīkja*, to shriek, titter; connected with Gk. κρίζειν, *krizein*, to creak). A predatory, insectivorous bird of the family Laniidæ, having a short, thick, and compressed bill, the upper mandible curved, hooked at the tip, and furnished with a prominent tooth, the base of the bill beset with hairs, which point forward. About 200 species are known, most of them natives of warm climates.

The typical shrikes or 'butcher-birds' are those of the subfamily Laniinæ, which are mainly inhabitants of northern countries, and closely resemble one another in size (9 to 11 inches in total length), colors (pearl-gray and white, set off with black markings on the face, wings, and tail), and in boldness and rapacity. Two species inhabit North America. These birds prey mainly on large insects, especially grasshoppers, in summer, but also on small mammals, birds, young snakes, frogs, and crayfish. Those they do not eat at once they impale on thorns, splinters of fences, and the like; and in confinement they make use of a nail for this purpose, or stick portions of their food between the wires of the cage. The German peasants believe that nine such victims are regularly accumulated by each bird, and call a shrike 'nine-killer.' The practice originated, probably, in an effort on the part of the birds to fix their food firmly while tearing it to pieces; and it is not properly speaking a storage of food, since in many cases the bodies are not again touched. Large numbers of mice and English sparrows are killed in winter, so that the bird is a public benefactor. The typical European species is the great gray or sentinel shrike (*Lanius excubitor*). The common

or 'great northern' shrike of North America (*Lanius borealis*), familiar in the Northern United States in winter, and breeding northward in a rude nest placed in a tree, is closely similar; while the 'loggerhead' shrike of the Southern States (*Lanius Ludovicianus*) has much the same colors, but is smaller.

The large, bald, and strikingly colored 'piping crows' (q.v.) represent an Australian group called Gymnorhinæ. Those of the subfamily Malaconotinæ are small, brilliantly dressed, forest-dwelling birds of Africa and India, some of which are notable singers. A third group (Pachycephalinæ) includes a series of small tree-dwelling, usually yellow, birds of the Malayan Archipelago and Australia, with the habits of flycatchers. Better known are the East Indian 'wood-shrikes' of the subfamily Prionopinæ, of which the graceful and familiar Australian magpie-lark and the queer helmet-bird of Madagascar are also members.

Consult: Newton, *Dictionary of Birds* (New York, 1896); Evans, *Birds* (London, 1900); and the authorities therein cited.

SHRIMP (assibilated form of *scrimp*, small; connected with MHG. *schrimpfen*, Ger. *schrumpfen*, AS. *scrimman*, to shrink, shrivel, *scrincan*, OHG. *screnchan*, Ger. *schränken*, Eng. *shrink*). A genus (Crangon) of macrurous decapod crustaceans of the family Carididæ, closely allied to crayfish and prawns. The form is elongated, tapering, and arched as if hunch-backed. The claws are not large, the fixed finger merely a small tooth, the movable finger hook-shaped. The beak is very short, affording a ready distinction from prawns. The whole structure is very delicate, almost translucent; and the colors are such that the creature may readily escape observation, whether resting on a sandy bottom or swimming. Their quick darting movements, however, betray them to any one who looks attentively into a pool left by the retiring tide on a sandy shore. When alarmed, they bury themselves in the sand, by a peculiar movement of the fanlike tail fin. The common shrimp (*Crangon vulgaris*) is very abundant in the North Atlantic Ocean on the shores both of America and of Europe, wherever the bottom is sandy. It is about two inches long, of a greenish-gray color, dotted with brown. It is in great esteem in Europe as an article of food, and is taken by nets. The shrimp industry of the Southern Atlantic Coast of the United States amounts to more than $500,000 annually, while that of San Francisco Bay alone is worth half as much. The latter industry consists wholly in the capture, drying, and export to China of *Crangon franciscorum*.

SHROP'SHIRE, or SALOP. A western border county of England, bounded on the west by North Wales, and on the east by the counties of Stafford and Worcester (Map: England, D 4). Area, 1346 square miles. Population, in 1891, 236,827; in 1901, 239,297. The Severn, the principal river, pursuing a southeast course of 70 miles across the county, is navigable throughout, and is joined by two considerable tributaries, the Tern and Teme. To the north and northeast of the Severn the county is generally level, and is under tillage; to the south and southwest it is hilly and mountainous, in the Clee hills rising to an altitude of 1800 feet, and here cattle-breeding is extensively carried on. A breed of horned sheep is peculiar to this county. Shropshire is remarkable for its mineral wealth. Coal, iron, copper, and lead fields at Coalbrookdale, Snedshill, Ketly, etc., are extensively worked and there are important iron industries. Capital, Shrewsbury.

SHROVETIDE (from AS. *scrifan*, to shrive, prescribed penance, from Lat. *scribere*, to write + *tid*, OHG. *zit*, Ger. *Zeit*, time; connected with Skt. *a-diti*, boundless, and ultimately with Eng. *time*). The name given to the days immediately preceding Ash Wednesday, which were anciently days of preparation for the penitential time of Lent; the chief part of the preparation consisted in receiving the sacrament of penance, i.e. in 'being shriven,' or confessing. In the modern discipline of the Roman Catholic Church a trace of this is still preserved, as, in many countries, the time allowed for the annual confession, which precedes the paschal or Easter communion, commences from Shrovetide. In England the pastimes of football, cock-fighting, bull-baiting, and so on, were, down to a late period, recognized usages of Shrovetide; and the festive banquets of the day are still represented by the pancakes and fritters from which Pancake Tuesday took its name. See CARNIVAL; COLLOP MONDAY.

SHRUBS (variant of *scrub*, from AS. *scrob*, *shrub*). Plants which differ from herbs in possessing much woody tissue, and which differ from trees chiefly in height, but partly also in the development of numerous primary shoots of approximately equal value. The distinction is largely artificial, since many transitions exist between these groups.

SHTCHEDRIN, shtchĕd-rēn', MIKHAIL YEVGRAFOVITCH (pseudonym of Count Saltykoff) (1826-89). A famous Russian satirical writer, born in the Government of Tver. He studied at the lyceum in Tsarskoye Selo, and obtained a Government position. In 1847 appeared his first sketch, *Contradictions*, followed in 1848 by *A Complicated Affair*. For these he was exiled to Vyatka, where he was the chief assistant to successive Governors, until permitted to return to the capital, upon the accession of Alexander II. In 1858-60 he was acting Governor at various places; he resigned from the service in 1862 and later joined the editorial staff of *The Contemporary*. Pecuniary straits compelled him to reenter the service in 1864-68, after which he became co-editor of *The Annals of the Fatherland* with Nekrasoff (q.v.), and on the latter's death in January, 1878, editor-in-chief. Just before his death he wrote the famous *Forgotten Words*—his last message to the dormant conscience of the Russian intelligence. Shtchedrin lashed bureaucratic rottenness as well as the idle talk of would-be reformers. His characteristics were brought into still greater relief by his pathetic and loving treatment of the common people. In his *Trifles of Life* and his *Tales* (1887) he reached a larger conception of life than in his previous writings. His best work is *Messrs. Golovlyoff*, which can be enjoyed as a work of art pure and simple. Consult Pypin, *M. Y. Saltykoff* (Saint Petersburg, 1899).

SHU'BRICK, WILLIAM BRANFORD (1790-1874). An American naval commander, born on Bull's Island, S. C. In the War of 1812 he

served on the *Hornet* and *Constellation*, became a lieutenant in 1813, assisted in defending Norfolk against the British, and was attached to the *Constitution* at the time she captured the *Cyane* and the *Levant* in West Indian waters (1815). He took part in the Mexican War, commanding the naval forces in the Pacific, and capturing several ports on the coast. In 1853 he became chief of the Bureau of Construction, and from 1854 to 1858 served as chairman of the Lighthouse Board. In 1859 he commanded the fleet of nineteen vessels sent to Paraguay to exact reparation for firing on the United States steamer *Waterwitch*, and succeeded in obtaining both an apology and an indemnity. He remained loyal to the Union during the Civil War, although a South Carolinian by birth. He was retired with the rank of rear-admiral in December, 1861.

SHUFFLE-BOARD, or **SHOVEL-BOARD.** An indoor game played by two or four persons with iron weights. These weights are slid along a board sprinkled with fine sand. The board is about thirty feet long; the weights or pieces used in the game are two sets of four each, weighing about a pound each. The players are divided into opposing sides, each side using one of the sets of pieces. The board is sprinkled with fine sand and has lines drawn across it five inches from each end, one for the starting line and one for the finishing line. Each player in turn slides his piece or pieces along the board, which if it projects partly over the edge of the board scores three points for the player, and if it lie on the finish line or between it and the edge of the board it will score two points, and is said to be 'in;' the piece nearest the line scores one. In every round the players change ends. The game is for twenty-one points. When played on the decks of ocean steamers a figure is chalked on the deck and wooden weights are used. Instead of being pushed by the hand, a long staff with a curved end is used, each player taking his turn, but nothing being scored till the end of the round. In both games an enemy's weight may be knocked out of the game altogether or a friend's shoved in by a blow from the succeeding player. In the steamer game the winner must make exactly fifty points, all in excess of that number being subtracted instead of added.

The origin of shuffle-board is probably similar to that of bowling, quoits, and curling. An evidence of its strong popularity is seen in the fact that during the reign of Henry VIII. of England it was forbidden by law because it turned the people from the practice of archery.

SHULCHAN ARUCH. See TALMUD.

SHULLUHS, SHILLUHS, SHILHAS, or **SHLUHS.** The name applied to the Berber tribes on the Adrar Mountains in the Western Sahara and the northern slopes of the Atlas Mountains in Morocco. They are Hamitic, but have an infusion of Semitic and of negro blood. In somatic and cultural respects they differ so little from their kinsfolk, the Haratin, Kabyles, and Tuaregs (see HARATIN; KABYLES; TUAREG), that all four may be classed together as Berber (q.v.) or Imazighen (q.v.).

SHUMLA, shụm'lȧ (Bulg. *Sumen*, shōō'mĕn). A town in the Principality of Bulgaria, situated among the foot-hills of the Balkans about 60 miles west of Varna (Map: Balkan Peninsula, F 3). Its position at the converging of several roads and near some of the principal passes over the Balkans gave it formerly great strategical importance, and it is still an important military centre. The Turkish quarter of the town has a number of interesting mosques and other public buildings, while the Christian part is rather poorly built. The principal products are wine, silk, copper ware, and cloth. Population, in 1900, 22,928, of whom about one-third were Turks. Shumla fell into the hands of Sultan Amurath I. toward the end of the fourteenth century. It was strongly fortified in the eighteenth century and withstood three attacks by the Russians, in 1774, 1810, and 1828. It was occupied by the Russians in 1878.

SHUN-CHIH, shụn'chĕ' (1638-61). The reign-title (1644-61) of Fu-lin, the first Emperor of the present Manchu dynasty. He was the ninth son of T'ien-tsung, under whom the Manchus came into possession of Peking. T'ien-tsung died in September, 1643, and, his successor being still a child, the government was placed in the hands of his uncle as Regent, who immediately set about the consolidation of Manchu power, acting with great wisdom until his death in 1651, when Shun-chih took the reins of government into his own hands. He continued the policy of conciliation, leaving the Chinese officials in control of the civil administration, and falling in with Chinese ideas, customs, ceremonies, etc. Only one sign of servitude was insisted on—that of shaving the head and wearing the queue. Shun-chih treated Roman Catholics with favor, and continued Adam Schall in his position of President of the Tribunal of Mathematics. He died in 1661 and was succeeded by his son, the famous K'ang-hi (q.v.).

SHUNT (probably a variant of *shunden*, from AS. *scyndan*, OHG. *scuntan*, to hasten, urge). A branch or a parallel circuit for the passage of a portion of an electric current flowing between two points on a conductor. As the amount of current flowing through the shunt depends upon its resistance, it is so constructed that this quantity is some definite fraction of the resistance of the principal conductor. Thus with a galvanometer, where a strong current would alter its sensitiveness or do other injury, it is customary to employ a shunt having $\frac{1}{9}$, $\frac{1}{99}$, or $\frac{1}{999}$ the resistance of the galvanometer, allowing but $\frac{1}{10}$, $\frac{1}{100}$, or $\frac{1}{1000}$ part of the current to flow through the coils, and making it necessary to multiply the deflection observed on the tangent scale by 10, 100, or 1000, in order to determine the deflection that the entire current would produce. In a shunt-wound dynamo (See DYNAMO-ELECTRIC MACHINERY) there is a branch circuit current through the field coils from the armature, so that only a portion of the current passes through these coils, though there is the same difference of potential as at the commutator of the armature. Consult: Thompson, *Elementary Lessons in Electricity and Magnetism* (rev. ed., New York, 1901); and Kempe, *Electrical Testing* (6th ed., London, 1900).

SHUR. See MOONJAH.

SHURI, or **SHIURI,** shōō'rē'. The capital of the Kingdom of Loo-choo until the islands were entirely incorporated into the Empire of Japan. (See LOO-CHOO and OKINAWA.) It stands about 3¼ miles inland from Napa (Map:

Japan, G 7). It is a straggling town, with the castle or King's palace perched on a hill about 500 feet high in the centre. Population, in 1898, 24,809.

SHUSAN, shōō'sän. An ancient city of Persia. See SUSA.

SHUSHA, shōō-shä'. A district town in the Government of Yelizavetpol, Transcaucasia, 80 miles south of Yelizavetpol (Map: Russia, G 7). It produces mainly silk and leather. Population, in 1897, 25,656, chiefly Armenians.

SHUSH'WAP (properly *Súq-apmuq*). An interesting tribe of Salishan stock (q.v.) occupying an extensive territory extending from the main divide of the Rocky Mountains to Fraser River and from Quesnelle to Shushwap Lake, Southern British Columbia. They are divided into several local bands or village communities, and their houses were circular dugouts set about four feet below the surface of the ground and roofed with logs and thatch covered with earth. Their dress was of furs or buckskin and tattooing was practiced by both sexes, together with the wearing of nose pendants. They excelled in the making of beautiful basketry from split pine roots and mats woven from rushes. The Shushwap hunted deer with dogs and snowshoes. They used sea-shells and copper bracelets as currency medium, obtaining copper by trade or from a digging within their own territory. Food was boiled in baskets of water heated by means of hot stones, and roots were steamed or baked in pits in the ground. The tribe did not have the clan system. Inheritance was in the male line, and there was an order of hereditary chiefs, who regulated the division of labor, decided the time for the salmon-fishing and parceled out the fish and berry harvest, but did not lead in war, that duty falling upon elective war captains. Their weapons were the bow, lance, stone club, and a sort of bone sword, besides which they had body armor of quilted elk-skin or strips of wood. In times of danger they sometimes took refuge in stockades. Slaves were held by war and purchase and were frequently killed by the grave of their owner, usually being buried alive with the corpse. The mourning period lasted for a year, ending with a feast at the grave, on which occasion the son adopted his dead father's name. There were many peculiar marriage, puberty, and hunting ceremonies and tabus. With the exception of a few families all are now civilized and Christianized by the effort of Catholic missionaries, and are reported by their agent to be generally industrious, law-abiding, progressive, healthy, and increasing in numbers. They numbered, in 1903, from 1200 to 1500.

SHUSTER, shōō'stĕr, or **SSUSHTER** (anciently *Sostra*). A city in the Province of Khuzistan, Persia, on the Karun, 30 miles southeast of Dizful (Map: Persia, C 5). It is poorly built, with narrow unpaved streets and houses of mud and stone. On an abrupt sandstone hill above the city stands the citadel, partly in ruins. Among the mosques is the imposing Masjed i Juma. In the early part of the nineteenth century Shuster was the capital of the province and had a population of 45,000. Population, in 1901, about 18,000.

SHUTTLE. See LOOM; SEWING MACHINE.

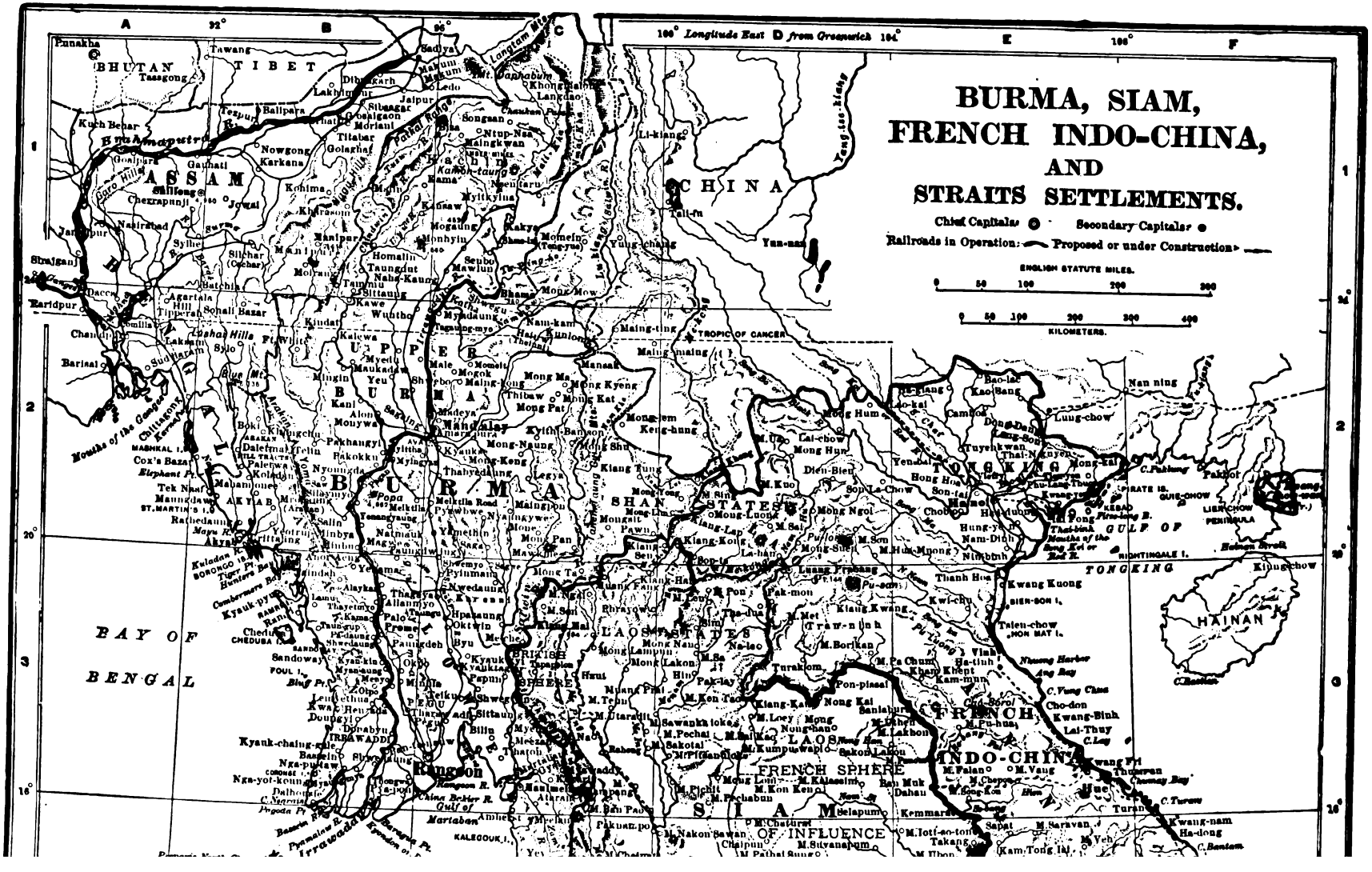
SHUYA, shōō'yà. A district town in the Government of Vladimir, Russia, 186 miles northeast of Moscow (Map: Russia, F 3). It has extensive cotton mills. Population, in 1897, 18,968.

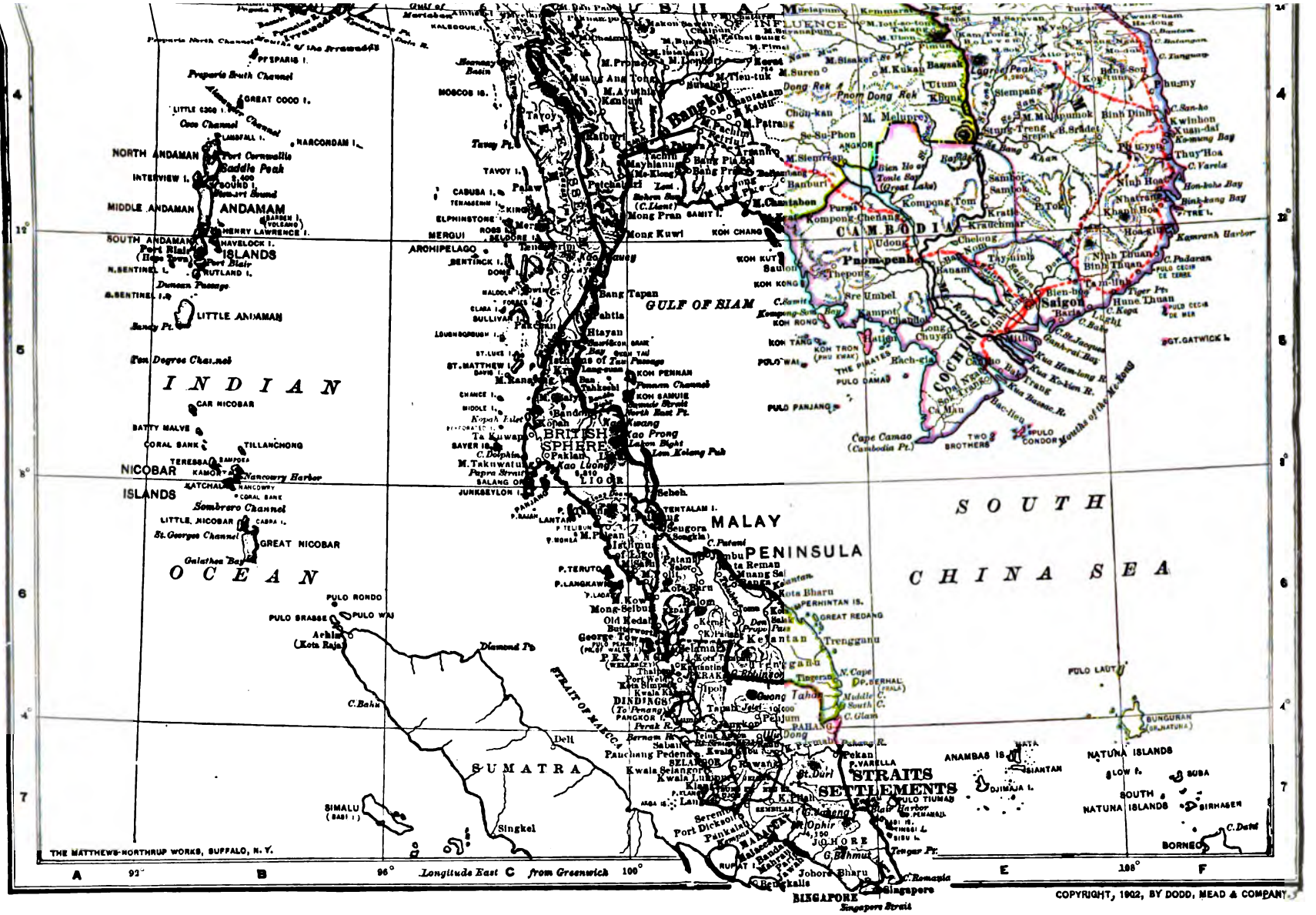
SHY'LOCK. The Jew usurer in Shakespeare's *Merchant of Venice*, the central figure in the play, standing for the vengeful spirit of an oppressed race.

SIALKOT, sē'ăl-kōt', or SEALKOTE. The capital of the District of Sialkot in the Punjab, India, on the Aik River, 72 miles by rail northeast of Lahore (Map: India, B 2). Objects of interest are the ruins of an old fort, and the Christian training school and mission college. The city is the commercial centre of a productive agricultural and cotton-growing section, and manufactures paper, cotton goods, silks, shawl trimming, pottery, cutlery, etc. Population, in 1901, 57,956.

SIAM, sī-ăm'. An independent kingdom of Southeastern Asia, bounded on the north by Burma and French Indo-China (the Shan States), on the east by French Indo-China, on the south by Cambodia, the Gulf of Siam, and the Straits Settlements, and on the west by the Indian Ocean and Burma. Apart from its long, narrow arm, known as Lower Siam, extending southward in the Malay Peninsula to the Straits Settlements, it forms a compact region, known as Upper Siam, lying approximately between latitudes 12° and 20° 40′ N., and longitudes 98° and 106° E. The British have been constantly encroaching on the northwest and southwest and the French on the east. Area, estimated at 236,000 square miles, about one-fourth being in the Malay Peninsula.

Siam slopes south and southeast from the mountainous region in the north to the Gulf and the Mekong, the southern part descending in three large terraces to Bangkok. The average elevation of the country is 600 feet. In the western portion of Upper Siam the large valley of the Menam River (q.v.), with that of its great tributary the Me Ping from the northwest, forms the characteristic feature. The Menam rises in the low mountain district of the Laos country in the extreme north of Siam and flows south, emptying into the Gulf of Siam below Bangkok. This area abounds with swamps, briny wastes and jungles, but the national wealth and commerce are found here, and it constitutes the real Siam, the bulk of the population living along these streams. The western boundary of Siam marks in the main the high granite backbone of the Peninsula. The Salwin River flows on the west, but forms a section of the boundary. The eastern part of Siam is characterized by the valley of the Nam Mun River. This stream flows eastward and enters the great Mekong, which lines the border from the north to the southeast. The central portion of Upper Siam is formed by the Korat plateau—the watershed between the Menam and the Nam Mun. This region—to the northeast of Bangkok—is little known. The Laos inhabitants in the north live usually in small communities on the river banks. Siam is in general a well-watered land. The great Tonle Sap Lake lies in the southeast, and extends into Cambodia. The geology of the country has not been fittingly studied, but the limestones and dolomitic formations, the basaltic districts and


BURMA, SIAM,
FRENCH INDO-CHINA,
AND
STRAITS SETTLEMENTS.
Chief Capitals: ◎ Secondary Capitals: ●
Railroads in Operation: Proposed or under Construction
ENGLISH STATUTE MILES.
KILOMETERS.
Longitude East from Greenwich
TROPIC OF CANCER
BHUTAN
TIBET
CHINA
ASSAM
BURMA
UPPER
LOWER
SHAN STATES
LAOS STATES
BRITISH SPHERE
FRENCH SPHERE
SIAM
OF INFLUENCE
TONGKING
GULF OF TONGKING
HAINAN
FRENCH INDO-CHINA
BAY OF BENGAL
Rangoon
Mandalay
Bhamo
Myitkyina
Mogaung
Katha
Monywa
Sagaing
Shwebo
Maymyo
Lashio
Kengtung
Mong Hsu
Mong Nai
Taunggyi
Thazi
Meiktila
Yenangyaung
Prome
Henzada
Bassein
Akyab
Sittang
Pegu
Martaban
Moulmein
Tavoy
Mergui
Victoria Point
Kyaukse
Myingyan
Pakokku
Minbu
Thayetmyo
Tharrawaddy
Shwegyin
Toungoo
Papun
Kyaukkyan
Kyaukmyaung
Myitkyina
Sadiya
Dibrugarh
Lakhimpur
Jaipur
Ledo
Kohima
Manipur
Cachar
Sylhet
Chittagong
Cox's Bazar
Barisal
Faridpur
Dacca
Goalpara
Gauhati
Shillong
Cherrapunji
Nowgong
Golaghat
Jorhat
Sibsagar
Mariani
Titabar
Balipara
Tezpur
Kuch Behar
Rungpur
Jalpaiguri
Darjeeling
Punakha
Tassigong
Tawang
Langtam Mts.
Mt. Gamlaburn
Khonglalon
Langdon
Songgan
Ntup-Nsa
Maingkwan
Kamon-taung
Hkama
Kaukkwe
Kaukkwe Pass
Li-kiang
Tali-fu
Yung-chang
Yun-nan
Yang-tse-kiang
Lu-kiang (Salween R.)
Lu-kiang (Mekong R.)
Mekong R.
Red R.
Black R.
Song-koi R.
Pakhoi
Mong Tze
Mong Hum
Mong Kung
Mong Kyeng
Mong Kat
Mong Pat
Mong Ma
Mong Nawng
Mong Kong
Mong Yai
Mong Pawn
Mong Nai
Mong Lem
Keng-hung
Mong Sing
Mong Yong
Mong Luong
Mong Ngol
Mong Lin
Mong Nawng
Mong Lampun
Mong Nang
Mong Lakon
Mong Lon
Mong Kon Keng
Mong Pachai
Mong Pachabun
Mong Sakotai
Mong Kumpuwapio
Mong Sawankalokes
Mong Pichit
Mong Kwan
Mong Sen
Mong Sen Pass
Mong Sen Paung
Mong Nakon Sawan
Mong Sawan-pum
Mong Chaiyun
Mong Pathai Sung
Mong Chaburi


INDIAN OCEAN
SOUTH CHINA SEA
BRITISH SPHERE OF INFLUENCE
GULF OF SIAM
MALAY PENINSULA
STRAITS SETTLEMENTS
SUMATRA
BORNEO
ANDAMAN ISLANDS
NICOBAR ISLANDS
NORTH ANDAMAN
MIDDLE ANDAMAN
SOUTH ANDAMAN
LITTLE ANDAMAN
CAR NICOBAR
TILLANCHONG
GREAT NICOBAR
LITTLE NICOBAR
Port Cornwallis
Saddle Peak
Port Blair
Nancowry Harbor
Sombrero Channel
Galathea Bay
Ten Degree Channel
Preparis South Channel
Preparis North Channel
Coco Channel
Duncan Passage
Diamond Pt.
Singkel
SIMALU
PULO RONDO
PULO WAI
PULO BRASSE
Achin (Kota Raja)
C. Baka
Dell
Bangkok
Chantaboon
Pnompenh
Saigon
Cape Camao (Cambodia Pt.)
Kota Bharu
Trengganu
Kelantan
Pahang
Singapore
Johore Bharu
Malacca
Penang
Perak R.
Kwala Selangor
Port Dickson
Pangkalan
Tioman
Anambas Is.
Natuna Islands
Borneo
Longitude East C from Greenwich
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metamorphic schists, represent here in general a broken and complicated geological area.

The climate is tropical, but not one of such extremes as might be expected. The humidity, however, makes it trying for Europeans, and somewhat unhealthful, especially in the wet season from May to October. The rainfall is in some sections as high as 240 inches; at Bangkok it is about 50 inches. Siam is more or less affected by the monsoons. In general the usual temperature ranges from 65° to 90°, the northern and higher regions being drier and cooler, the thermometer at night there often falling below 50°. The cool season begins in November. In the north the valuable teak tree abounds, and oak and pine grow. Siam furnishes also rosewood, ebony, and most of the tropical woods and fruits. Elephants roam wild and play a famous and varied rôle in the life and industries of the country. The rhinoceros, tiger, leopard, the gaur, water-buffalo, flying-fox, gibbon, and crocodile are also plentiful.

The country is rich in mineral deposits. Considerable tin and some gold and copper are mined. Siam furnishes rubies and about one-half of the world's supply of sapphires. In Northern Siam immense forests cover the land, and the cutting of teak is a conspicuous industry (43,735 tons in 1901). The logs drift down by water to the capital. The forests and the teak industry are under British control. Agriculture is confined almost wholly to the river valleys. The great alluvial Menam plain, with its inundating features and irrigation facilities, is one of the richest of agricultural regions. But the farming methods are primitive and progress slow. Chinese coolies are mostly employed. In the vicinity of Bangkok large tracts are being converted into a fine farming country by the network of canals of a European irrigation company. Rice is the staple food of the Siamese, and is the great agricultural product. Cotton is also grown abundantly, and tea and tobacco are produced for home consumption. Pepper comes from Chantabon, and sugar cane, cocoanuts, etc., are grown in large quantities. Most of the manufactures and traffic are in the hands of the Chinese, who are the real toilers. The imports and exports are mainly from and to China, and are increasing, the former having amounted to about $14,000,000 in 1901, the latter to about $21,000,000. Cotton goods form the leading article of import, and rice represents 80 per cent. of the exports. In 1901 ships with 1,090,000 tons entered and cleared the Siamese ports. A large trade is carried on back and forth across the northern boundary by local dealers. There are no good roads except near the leading towns. The streams are the great commercial highways. A railway extends from the capital to Paknan (15 miles) and a line goes to Korat (165 miles). Bangkok is the commercial capital.

Siam has no national debt. In 1902 the public treasury contained £2,000,000 cash. The annual revenues and expenditures practically balance, having increased to about £2,230,000 in 1902-03. The revenues come mainly from the opium tax, customs, and the lottery and gambling tax, land tax and fisheries, the capitation tax, and the tax on spirits. Forests, mines, railways, and post-offices are also taxed. A British official acts as adviser in the national finances. Bangkok has several branch banks which issue notes independent of the Government.

The political régime has long been enlightened and progressive. The government is an absolute monarchy, the succession now passing from father to son. The executive power is held by the King. He is assisted by a Cabinet, whose members are the heads of the several departments of national administration: Foreign affairs, finance, justice, interior, war, marine, police, public works, public instruction, etc. These officials are for the most part relatives of the King. Since 1895 there has been a Legislative Council. It is formed of the Cabinet and officials, and twelve other persons selected by the King. Its members number fifty-one. The prescribed object of this body is to perfect national legislation, and to see that the new laws are adjusted and enforced. The Siamese dominions proper are divided, under the general control of the Minister of Interior, into forty-one administrative circles (muntons), each with a commissioner at its head, having authority from the Crown. The authority of the various local princes is gradually being absorbed by that of the strong central Government. The Malay States of Siam are governed by rajahs who are usually directed by commissioners with full powers, sent by the King. These States retain a certain degree of independence. The Laos States in the north are likewise governed as tributary provinces, and there are still others. All slaves born after December 16, 1897, are free. The number of slaves is large, and the feudal system still hangs heavy on the land. The corvée has been superseded by the poll tax.

There is now an international court in which suits of foreigners against Siamese are brought. The legal code is being modernized, and the police force is being remodeled, extended, and made effective under English guidance. The authorized unit of money is the tical, worth at the rate of 17.46 ticals to the £1. The chang represents 2⅔ pounds avoirdupois. The sen equals .568 of a mill. The regular army is in an inferior condition and numbers only 5000 men. There is no equipped militia. Young men are obliged to serve as recruits for three years, and afterwards for three months in every twelve. Priests, slaves, and certain other classes are exempted from service. There are 22 ships in the navy, 10 being over 500 tons. The marine infantry numbers 15,000. Bangkok is protected by forts at the mouth of the Menam River, and a bar here also prevents large vessels from ascending the stream.

The population is estimated at 5,000,000, consisting in part of 1,500,000 Siamese, 600,000 Chinese, and 600,000 Malays. Bangkok, the capital, is the only large city. Chiengmai, the capital of the Laos country, with over 50,000 inhabitants, is the leading town in the north, where the various tribes of the Thai race are found. In the extreme south are the Malays. The natives have largely intermarried with the energetic Chinese, who have entered the country in great numbers. The Siamese themselves are indolent and indifferent. As the Thai in the limited sense, they form the most important civilized section of the Thai stock of Farther India, akin to the Laotians and Shan tribes of the northern and eastern regions of Siam. The primitive Thai type has been very much changed among the Siamese by inter-

mixture with the Khmers, Kuis, Hindus, and Malays. Physically they are above the average in stature, with very brachycephalic skulls, olive complexions, prominent cheek-bones, lozenge-shaped faces, and short, flat noses. Their hair is dark. Although polygyny and concubinage are permitted by custom, the mass of the Siamese are practically monogamous, with few divorces. There is no caste. The Siamese language is the 'monosyllabic, tonic type,' characteristic of the more or less cultured nations of Farther India, The Siamese are generally Buddhists of the orthodox or southern school. The priests have hitherto had complete charge of education. The Malays are Mohammedans. The missionaries are either French Roman Catholics or American Protestants, and their efforts have not met as yet with any very hopeful results. The educational facilities are quite imperfect, but are in process of being radically modernized. In Bangkok the Government maintains and aids in maintaining many schools, among them a normal institution, several vernacular schools, a training school, and a home school with English instructors for the sons and another for the daughters of the titled families.

HISTORY. The fabulous history of Siam goes back to the fifth century B.C. An attempt is made to show the descent of the King from Gautama Buddha, and of the people from his immediate disciples. The traditions abound in tales of Buddhist miracles and of supernatural interventions. Authentic history begins in the middle of the fourteenth century A.D. Long before, there were many immigrations from the north, with shifting dynasties, frequent wars, and uncertain fortunes. It is not known when Buddhism became the religion of the people. In the middle of the fourteenth century the King, who is known posthumously as Phra Rama Thiboda, built Ayuthia on the site of an ancient town and made it the capital. He extended the Siamese power southward into the Malay Peninsula and eastward into Cambodia. For two hundred years peace and prosperity prevailed. Ayuthia became a large and rich city. In the middle of the sixteenth century it was captured by an army from Pegu and thenceforth for more than two hundred years there were wars of varying fortunes with Burma, Pegu, and Cambodia. In the seventeenth century a considerable intercourse with Europe, China, and Japan was carried on. In 1759 the Burmese captured Ayuthia and after a long struggle conquered the whole country (1767). They introduced a king of their own, and upon the withdrawal of their army anarchy ensued. A Chinaman, the leader of a band of freebooters, seized Bangkok, and, to the joy of the people, expelled the Burmese. He proclaimed himself King, as P'ya Tak. He extended his power southward and eastward, but was assassinated in 1782 by one of his generals, Yaut Fa, who established the present dynasty, the ruling monarch being fifth in descent from him. In 1820 intercourse with the West was renewed, and in 1825 a treaty was made with the United States, and soon after similar treaties with other nations. In 1855 Great Britain made the treaty which is the basis of the present relations. It established extraterritoriality, and put trade on a secure footing. The French protectorate over Cochin-China delivered Siam from its ancient enemies to the east of the Mekong, Cambodia having been previously reduced to the position of a dependency. But France desired access to China by means of the river system of the peninsula, and it presently found a pretext for armed aggression. It accused Siam of encroaching on the territory of Anam. A skirmish ensued and France sent its fleet to Bangkok (1893), where it dictated terms of peace. Cambodia and all the territory east of the Mekong were to be independent of Siam and under French protection; a belt extending for a distance of 25 kilometers west of the Mekong was to be neutralized and certain valuable privileges in trade were to belong to the French. Since that time the French 'sphere of influence' has been extended still farther west, and were it not for Great Britain, doubtless France in time would absorb the kingdom. It remains a 'buffer State,' with its future dependent upon powerful and mutually jealous neighbors.

BIBLIOGRAPHY. Bastian, *Die Völker des östlichen Asien*, vol. iii. (Leipzig, 1867); McDonald, *Siam: Its Governments, Manners, Customs, etc.* (Philadelphia, 1871); Vincent, *Land of the White Elephant* (New York, 1874); Reclus, *Nouvelle géographie universelle*, vol. viii., *L'Inde et l'Indo-Chine* (Paris, 1883); Bock, *Temples and Elephants* (London, 1884); Colquhoun, *Among the Shans* (ib., 1885); De Rosny, *Ethnographie du Siam* (Paris, 1885); Coit, *Siam, or the Heart of Farther India* (New York, 1886); Chévillard, *Siam et les Siamois* (Paris, 1889); Fournereau, *Les ruines Khmères* (ib., 1890); id., *Le Siam ancien* (ib., 1895); Anderson, *English Intercourse with Siam in the Seventeenth Century* (London, 1890); Grindrod, *Siam: A Geographical Summary* (ib., 1892); Smyth, *Five Years in Siam* (ib., 1898); Young, *The Kingdom of the Yellow Robe* (ib., 1898); Hesse-Wartegg, *Siam, das Reich des weissen Elefanten* (Leipzig, 1899); McCarthy, *Surveying and Exploring in Siam* (London, 1900); Campbell, *Siam in the Twentieth Century* (ib., 1902); Pavie, *Indo-Chine* (Paris, 1898-1902).

SIAM, GULF OF. An arm of the Pacific Ocean, bounded on the west by the Malay Peninsula, on the north by Siam, and on the northeast by Cambodia and Cochin-China (Map: Siam, D 5). It is 235 miles wide at its entrance, and extends inland in a northwesterly direction a distance of 470 miles. Four rivers, navigable for a considerable distance, the chief of which is the Menam, fall into the gulf.

SIAMANG (Malay *siāmang*). The largest of the gibbons (q.v.), distinguished from the others by the circumstance that the second and third toes of the foot are joined together as far as the last joint in the male, and to the middle joint in the female; hence the technical name, *Hylobates syndactylus*. It stands three feet high, and is glossy black except for a whitish beard. The hair is comparatively long, and, unlike other gibbons, grows upward from the wrist toward the elbow. Its home is Sumatra, where it dwells in troops in the forests, swinging through the tree tops with amazing agility. It is numerous and frequently captured, but does not endure captivity well.

SIAMESE TWINS (1811-74). A name given to two youths, Eng and Chang, born of Chinese parents in Siam, having their bodies united by a band of flesh, stretching from the

end of one breast-bone to the same place in the opposite twin. See MONSTROSITY.

SIANG-TAN, syäng'tän'. A prefectural city of China in Hu-nan, on the Siang River, in latitude 27° 52′ N., longitude 112° 42′ E. (Map: China, D 6). It is a small city, but has extensive suburbs which stretch along the bank of the river for two miles. It is the commercial centre of Hu-nan, and is the resort of merchants from all parts of the country. It lies on one of the great water routes from Peking to Canton, only 30 miles of portage being necessary. The navigation of the river is now open to foreign vessels, and Siang-tan may be reached by craft drawing five feet. Population, 100,000.

SIANG-YANG-FU, syäng'yäng'fōō' (the *Saianfu* of Marco Polo). A departmental city of the Province of Hu-peh, China, pleasantly situated on the right bank of the river Han, about 100 miles north-northeast of I-chang (Map: China, D 5). It is in itself of no commercial importance, its suburb Fan-ching on the opposite bank of the river absorbing all the business, which is very great. Siang-yang and Fan-ching are both noted for the determined resistance they offered to the besieging armies of Kublai Khan in 1268-73, surrendering only when Marco Polo's father and uncle came to the assistance of the Mongols with mangonels. Population, 50,000.

SIBALÓN, sē'bȧ-lōn'. A town of Panay, Philippines, in the Province of Antique, situated 9 miles northeast of Buenavista. Population, estimated, in 1899, 11,675.

SIBAWAIHI, sē'bȧ-vī'hē. The current name of Abū Bishr 'Amu ibn' Uthmān ibn Ḳaubr, an Arabic grammarian of the eighth century. He was a Persian, and studied at Basra. He returned to Persia and died near Shiraz in 793 or 796. His *Kitāb* (i.e. book) is the oldest systematic presentation of Arabic grammar, and remains the classic study of the subject. Derenbourg has published the text of his work in *Le livre de Sîbawaihi* (Paris, 1881-89), and it has been translated, along with Arabic commentaries, by Jahn, in *Sîbawaihi's Buch über die Grammatik* (Berlin, 1894).

SIBBALD'S WHALE, or BLUE WHALE. A rorqual (*Balænoptera Sibbaldi*), the largest known whale, which reaches a length of 85 feet or more, and exceeds in bulk not only all other whales, but all other known animals living or extinct. Like other rorquals, it passes most of the year in the open ocean, wandering into every sea, but early in summer approaches northern coasts for the purpose of reproduction. At this time its sole food is a small schizopod crustacean (Euphausia), similar to the opossum shrimp, which swarms in the North Atlantic. This whale is dark bluish-gray in color, with whitish spots on the breast and black baleen. See WHALE.

SIBE'RIA. An Asiatic possession of Russia, embracing more than one-half of the area of the entire Empire. It is bounded by Russia in Europe, the Arctic Ocean, the Pacific Ocean, the Chinese Empire, and Russian Central Asia. The area is about 4,830,000 square miles, or more than one and one-half times as great as that of the United States (exclusive of Alaska). The region is divided politically into Western Siberia, Eastern Siberia, and the Amur and Maritime Provinces. While Western and Eastern Siberia (Siberia proper) have been in the possession of Russia for some centuries, and about 90 per cent. of their population is of Russian origin, the Amur lands and the southern part of the littoral (Pacific coast) were not detached from China till 1858, and include as yet only a comparatively small number of Russians.

TOPOGRAPHY. Excepting in the Amur basin and the immediate region of the mountains the whole country slopes gently from south to north, carrying the drainage to the Arctic Ocean. Most of the Arctic coast is low and flat, and, unlike most Arctic shores, it is little intersected with bays and fiords. The only region of considerable elevation appears to be the Taimyr Peninsula, with its low mountain ranges roughly paralleling the coast. The flat Arctic plain (tundra) crosses the Arctic Circle south of the mouth of the Ob River, and in the great northeastern peninsula of Asia and everywhere else merges into the swamp lands or the forests south of it. No glacial covering is found in Arctic Siberia, for the reason that the precipitation is too small for large yearly accumulations of snow. A peculiar feature is that the soil is perpetually frozen to great depths, the frost extending beneath the surface, near the pole of cold, east of the Lena River, to a depth of 650 feet. Intervening in this frozen soil are layers of clear blue ice, called ground ice. It is in this frozen mass that the remains of mammoths and other animals have been kept intact probably ever since the time of the great glacial epoch. The surface thaws in summer, covering the northern regions with almost impassable mud. The coast lands of the Pacific frontage, on the contrary, are fringed by high forest-clad mountain ranges approaching so near the sea that little opportunity is given for deep indentations, and there are long stretches of comparatively straight shore line. Siberia has only a few islands of much importance, the new Siberian group of the Arctic and the large Saghalien Island in the Pacific being most noteworthy. The surrounding seas are very shallow, usually for a long distance from the land. South of the Arctic region the Yenisei River divides Siberia into two parts whose characteristics differ greatly. The region to the west, or nearly the whole of Western Siberia, consists of vast level plains, almost completely covered in the northwest with one of the most extensive swamp regions of the world, in which many rivers wind their sluggish and very tortuous courses. The region of swampy lands embraces nearly all of the Government of Tobolsk and the northern part of Tomsk; and scattered through the swamp area and thickly sown over the southern plains are thousands of lakes, most of them very small, relics of the ice age. The eastern part of Tomsk belongs in its topographic aspects to Eastern Siberia, which strikingly contrasts with most of the region west of the Yenisei.

As Western Siberia is a land of low swamps, plains, and lakes, so Eastern Siberia to the Pacific, especially in the south, is a land of low plateaus sloping gradually to the Arctic and surmounted by many ranges of mountains, most of them not high, but giving the country a very rugged character. The ranges have a general northeast and northwest direction, following the trend of the backbone or central feature of the region—the chain known as the Yablonoi and

Stanovoi mountains, which extends unbrokenly from the Chinese border east of Lake Baikal to Bering Strait, about 4300 miles. In the far north the ranges thin out and dwindle so that the great low plain of North Euro-Asia is continued practically without interruption to Bering Sea. The southern part of the western plains is the chief region of agriculture and population. The eastern mountains are the region of mining, with agricultural opportunities in many valleys. The highest mountains are the Altai, Sayan, Yablonoi, and Stanovoi mountains, the culminating point, outside of Kamtchatka, being the Byelukha, in the Katunski-Altai, which, according to a recent measurement, has an elevation of nearly 15,000 feet. The isolated mountain district of Kamtchatka reaches in numerous peaks elevations of from 10,000 to nearly 15,000 feet.

HYDROGRAPHY. The Arctic rivers flowing through the Siberian lowlands and the Amur of the Pacific have great length and very extensive basins. The four great rivers, the Ob, Yenisei, Lena, and Amur (qq.v.), with their numerous tributaries, afford about 30,000 miles of interior navigation. The Ob and its tributary the Irtysh are the most important rivers of Siberia, flowing as they do through the most fertile and populous districts in the southwest of the country. The Ob with its affluents supplies more than 9000 miles of navigation. Its estuary on the Kara Sea is very large, but vessels drawing more than 12 feet cannot enter it. Its long tributary, the Irtysh, is also navigable. The Yenisei is navigable for 1850 miles and ocean steamers might ascend it for 1000 miles. The ice-choked northern sea, however, makes the Yenisei as well as the Ob unimportant in sea trade. Local trade and steam navigation are developing along the river, but its chief importance is as a link in the line of water communication between Lake Baikal in Eastern Siberia and Tiumen, near the western boundary, a very important route more than half way across Siberia. This route is by way of the Angara tributary of the Yenisei from Lake Baikal and Irkutsk by steamer 400 miles to Bratski Ostrog, where rapids obstruct steam navigation, though the improvements required to make steamers available around the worst rapids (1¼ miles) would not be very costly. Thence the route is uninterrupted to the Yenisei, down that river to the Kass, whose source lies near that of the Ket tributary of the Ob. These rivers were canalized and connected by a canal, so that boats pass between the Yenisei and the Ob (586 miles). The route continues on the Irtysh and its Tobol tributary to Tiumen, over 3000 miles by water from Irkutsk. At that point freight is transferred between boat and railroad.

The Lena is navigable by river steamers for 1750 miles from its mouth, and serves considerable local traffic. The Yana and Kolima, other large Arctic rivers, are still little known. The Amur basin supplies 8940 miles of navigation including the Amur, the Shilka and Ingoda, the Seya and its tributaries, the Sungari and its tributaries, and the Ussuri. The great commercial disadvantage of the Siberian rivers is that they are open to navigation only from three to five months in the year. Lake Baikal, the largest fresh-water lake in Asia, is in Eastern Siberia. Considerable agriculture is developing around its shores and the Government has constructed a number of ports to facilitate the lake trade.

CLIMATE. The winters are long and very severe; the summers are short and hot. In the agricultural districts (the south) the mean annual temperature is approximately 32° F. in Eastern and Western Siberia. The mean summer temperatures are 62° in the east and 63.5° in the west; the mean winter temperatures are —0.4° in the east and 1.4° in the west. Summer on the farming lands of Western Siberia is as warm as in Central Russia. The temperatures farther north are much colder. Verkhoyansk, northeast of Yakutsk, the coldest spot known in the world, has a mean annual temperature of 3.2° F., a mean in January of —56° F. and a maximum cold of —90° to —93° F. The rivers are frozen from 160 to 200 days in the year. The settled regions of the south might be said to have a severe North European climate, in contrast with the Arctic climate of the north. Excepting on parts of the Pacific coast, the rainfall is small and sometimes insufficient to mature the wheat crop. The annual rainfall at Aryan (Sea of Okhotsk) is 36 inches; Yakutsk, 10 inches; Kiakhta, 8 inches; Tobolsk, 18 inches.

FLORA. The treeless northern tundras have mosses, lichens, and a little herbage on their surface. South of the tundras is the wide forest zone, one of the largest in the world. The woodlands, from the Urals to Kamtchatka, are interrupted only by the rivers, peat bogs, marshes, or narrow ravines. Forests covering all the mountains are regarded by mining prospectors as an evil because they make gold-hunting difficult. Conifers, the prevailing trees, include all the species common to Europe, besides the *Pinus pichta* peculiar to Eastern Siberia. It is very tall and slender, with little economic value. The Siberian cedar (*Pinus cembra*) is most useful and is largely cut for furniture. The most common and hardy tree is the larch, found in many varieties throughout the forest zone. Many trees common to temperate Europe also occupy large areas. Forest fires have desolated large parts of the woodlands. Berries of every kind supply food for men and animals.

FAUNA. All the waters bordering Siberia, as well as its rivers and lakes, abound with fish, which are a large food resource. The real incentive to the Russian conquest of Siberia was the great abundance of animals whose furs in that climate have great softness, warmth, and lightness. Though, owing to over-hunting, many of these animals have become extremely rare, Siberia is to-day the largest source of furs, surpassing Canada and Russia. Among the fur animals of the northern forests are the polar hare and fox, the sable, otter, red fox, ermine, wolf, bear, and the gray squirrel, of which about 1,000,000 skins are taken every year. Burrowing animals are very numerous in the south. The tiger is still found in considerable numbers in the south and southeast, especially abundant in the Amur region. The Arctic tribes have the reindeer, and the camel is used in the more southerly parts. The mammoth, whose extermination seems to have been effected in a quite modern period, may almost be considered to be a part of the Siberian fauna.

GEOLOGY AND MINERAL RESOURCES. Most of the lowlands are overlaid with recent deposits resting upon Paleozoic or Mesozoic rocks. The extreme northeast is composed chiefly of Paleo-

zoic rocks. The direction of the mountain ranges, chiefly granite, was determined ages ago by the great disturbances that fractured, folded, or upheaved the earth's crust. The high mountains of Kamtchatka are distinguished by young eruptive rocks and active volcanoes. About two-thirds of the gold of the Empire is mined in Siberia (28,276 kilograms in 1899). But the gold resources have scarcely yet been touched; the quartz deposits have been almost entirely neglected, and the placers are worked by antiquated and expensive methods. The silver output in 1899 was 2737 kilograms from the Altai and Nertchinsk (Amur) mines, and 1384 kilograms from Semipalatinsk. The yield of coal in 1901 was 62,532 short tons, anthracite and bituminous, chiefly from mines 12 to 100 miles from Vladivostok. Great hopes are entertained of the future of the coal industry. Little attention has yet been paid to iron, copper, lead, and tin, though deposits of these minerals are found, and mining is considered well worth developing. Siberia is particularly rich in graphite, and the best mines are controlled by the principal lead-pencil manufacturers of Germany.

AGRICULTURE. As to agriculture, Siberia must be divided into western and eastern halves. Western Siberia is more fertile and more thickly populated and is chiefly devoted to agriculture (nine-tenths of the inhabitants are tillers of the soil), while mining and hunting are still more prominent in Eastern Siberia. All the land, with small exceptions, belongs to the Crown, which leases it to the separate communes, by which the land is redistributed among the inhabitants from time to time. All the best farming land has been taken up and many immigrants are now trying to make homes by the difficult operation of clearing timber from the southern edge of the woodlands. Farming, in the American sense, can be carried on only in the south (in the west up to latitude 60° N.; in the east to 55°), where most of the ordinary grains, potatoes, onions, melons, etc., are produced. The agricultural or southern belt of Western Siberia extends from the western border to Lake Baikal, comprises about 178,000 square miles, three-fourths of which is good farming land with an alluvial soil (in the extreme west, the soil is black earth like that of the Russian wheat belt), and is well adapted for the cultivation of wheat, oats, rye, and barley, as well as cattle-raising. Nearly 9,000,000 acres were under cultivation in 1899; at the opening of the twentieth century the average annual harvest of cereals was nearly 3,000,000 tons (approximately 100,000,000 bushels) a year, of which about 60 per cent. was wheat and oats, 20 per cent. rye, and 20 per cent. barley. It is estimated that 300,000,000 acres all told may be turned into farming lands, of which the Amur and maritime provinces will supply 69,000,000 acres. The summers in the east, however, are not very favorable for cereal crops, on account of excessive moisture. Fruit and vines flourish only in a few sheltered localities on the Ussuri River.

Horses, cattle, and sheep are behind agriculture in importance, but stock-raising is growing, particularly in Western Siberia, where there are 12,000,000 head, of which 60 per cent. are sheep. In 1880 no butter was made in Siberia, but in 1902 there were 2500 butter factories, and the production in that year in the governments of Tobolsk and Tomsk and the Province of Akmolinsk was over 80,000,000 pounds. The price of milk sold to the butter factories, which are owned and conducted by butter-exporting companies, advanced from 8 and 9 cents a pood (36 pounds, equivalent to about 18 quarts) in 1894 to 20 and to 25 cents in 1902.

MANUFACTURES. Previous to 1890 the manufacturing industries were almost entirely confined to tanning, tallow-boiling, distilling, brick-making, and ore-smelting (gold and silver ore treated at Barnaul and Nertchinsk). The building of the Trans-Siberian Railroad has given considerable impetus to manufacturing by making it easier and less costly to import machinery for mills. At the same time the railroad has injured the household industries, which formerly supplied most of the clothing, furniture, and utensils, by enlarging the facilities for the importation of Russian manufactures. Tomsk is the largest manufacturing centre and its mills and factories are now supplying porcelain, refined sugar, flour, iron wares, carpets, and other products in considerable variety. Other western towns also are growing in this respect; and in the east, the Amur Province numbered 69 and the maritime provinces 60 factories in 1901. The chief impediments are lack of good workmen and the high cost of fuel.

COMMERCE. No trade statistics of Siberia are published. The enormous distances between different parts of the country have always hampered both the domestic and the exterior trade, but this situation, mitigated by the development of steam navigation, has been still further improved by the Trans-Siberian Railroad, so that a great deal of grain is now sent from Western to Eastern Siberia, and more wheat and live cattle are sent to Russia and other European markets. In 1900 the railroad carried 17,575,023 poods (approximately 10,000,000 bushels) of cereals; nearly two-thirds of it went west to Russia and other European markets, and the remainder was sent east as far as Lake Baikal. Wheat represented more than half of the exports of grain. The cattle exported numbered 9705. The large shipments of butter go to London and Hamburg; also to Copenhagen for reëxport. Five butter trains left Siberia every week in 1900. The railroad also carried out of Siberia 1,594,246 poods of tea that had been brought to Kiakhta from China by caravan. An enormous amount of tea is still transported by sledge in winter and by the river routes in summer. General manufactures, iron and steel, and sugar, practically all from Russia, are the chief imports. The free-trade policy, long maintained in Siberia, ended in 1900, when the heavy duties levied in European Russia were imposed at the Siberian frontiers and ports. A short free list includes cereals (Eastern Siberia not raising all the grain needed) and agricultural and mining machinery. All Chinese products excepting tea and spirituous liquors are on the free list.

TRANSPORTATION AND COMMUNICATION. In 1900 there were 132 steamers of 8555 tons on the rivers of the Ob system and 207 steamers of 19,257 tons on the rivers of the Yenisei, Lena, and Amur systems. On the Amur proper with its tributaries there were 163 steamers of 16,945 tons. The Siberian railroad has not yet greatly affected the business of the river routes, excepting in grain transportation. In 1900 only one-fifth of

the iron and steel, one-tenth of the refined sugar, and one-third of the manufactures imported were carried by the railroad.

The Trans-Siberian Railroad, however, is having a remarkable effect upon the country. The building of the road was begun in 1891 and was completed in its main features in eleven years, including a branch across Manchuria to Port Arthur and Dalny. It starts from Tchelyabinsk, on the eastern slope of the Urals, and its length to Vladivostok, on the Pacific, is about 4500 miles. The continuous railway route from Saint Petersburg to Port Arthur is 5620 miles long. The road cost $172,525,000. It is giving an impetus to agriculture and all other business enterprises of the country. The sea trade is comparatively small. The vessels clearing from Vladivostok and other Pacific ports in 1900 were 339, of 375,000 tons. North of this port is Alexandrovski, which Russia has turned into a coaling station for its warships. A number of merchant vessels have successfully made their way between European ports and the mouths of the Ob and Yenisei rivers through the Kara Sea and Arctic Ocean, but this route is as yet of no practical importance.

In 1898 there were 402 schools, 1074 teachers, and 27,706 pupils. There is a university at Tomsk. The predominant religious faith is Orthodox Greek, as in Russia. The population in 1897 was 5,727,090, of whom 3,367,576 lived in Western Siberia. The Russians constitute about two-thirds of the population. The Russian immigration into Siberia in 1901 was 128,131, and in the seven years ending in 1900 the average immigration was 150,000 Russians a year. About one-third of the immigrants, disheartened by their pioneering experiences, have returned to Russia. The old Siberian exile system was abolished in 1900. Next to the Russians in numerical importance are the Kirghizes, Buriats, and Yakuts.

For government and further details, see RUSSIA.

ETHNOLOGY. The peoples of Siberia are ethnographically and linguistically very diverse. Apart from the Russians, who number 61 per cent. of the total population, several thousand Poles and about 500 Germans, besides the Semites and the Aryan gypsies, about 8000 and 5000 respectively, the Siberians are mainly Ural-Altaic in race. The tribes of Western Siberia are akin to the Samoyeds (q.v.), who themselves number about 17,000, through the western Finns, while the eastern Siberians belong to the Tungusic group (see TUNGUS), and there is a large population of the so-called Pale-Asiatic stock. The Western tribes comprised under the name of Yeniseians include 6000 Woguls, the Ostiaks, of whom there are about 3500, and the Soiots, numbering some 2000. The Tungusic population amounts to 36,500. The Turko-Tatar division of the Ural-Altaic family in Siberia comprises 230,300 Yakute, and 100,000 Tatars proper, while the Mongolic division includes 59,000 Buryats, 30,500 Chinese and Manchus, and 2000 Koreans. The Pale-Asiatic division is represented by 8000 Tchulstchi, 5000 Koriaks and Yukaghirs, 8000 Gilyaks, 3000 Kamtchadales, and an equal nuber of Aino. See URAL-ALTAIC.

HISTORY. The history of Siberia, an episode in that of the Russian Empire, is a history of national expansion—of adventure, exploration, settlement, and development—a process still going on in all its phases. In the reign of Ivan IV., an enterprising family, the Strogonoff, carried on an active trade in Eastern Russia, near the Urals, and, favored by liberal concessions from the Crown, they founded towns and developed the country. In 1579, with the Czar's permission, they equipped and sent over the Urals into Western Siberia an expedition of about eight hundred men, under the command of an outlaw, Vassili, commonly known as Yermak, or the 'millstone,' a Russian who had joined the Don Cossacks. With this force Yermak defeated the Tatars, captured Isker or Sibir, the capital of Kutchum Khan, and won pardon and honor by giving a new empire to Russia. In the spring of 1582 he sent to Moscow the report of his triumph. Yermak was killed in 1584, but Russia held the country he had won. Tobolsk was built on the site of Sibir and many forts, or *ostrogs*, were located at strategic points. The Siberian tribes had neither the power nor the will to offer any organized resistance to Russian absorption. Southward there was more trouble from the warlike tribes of Central Asia, and this determined the direction of Russian expansion eastward along the line of least resistance. In 1636 the explorers and fur traders had reached the mouth of the Yenisei, in 1637 they had moved forward to the Lena, two years later they were on the shores of the Sea of Okhotsk, and before the close of the century the peninsula of Kamtchatka had been brought under Russian authority. As in all this region there was no organized government, its conquest was the peaceful work of the pioneer, interrupted by barbarous attacks from hostile natives. Siberia extended then southward to the Irtysh, the boundary of Mongolia, and to the Amur.

When the Russians under Khabaroff reached the Amur in 1651 they came into contact with the Manchu power, which had just conquered China, and the long struggle began for the control of the Amur and for Manchuria. The advance on the Amur was due to the energy, foresight, and administrative ability of Khabaroff, who successfully withstood the Manchus. In 1689, when Russian interests were in less competent hands, the Treaty of Nertchinsk was made between Russia and China, the first treaty made by the latter Empire with a Western power. By this treaty Russia yielded the middle and lower portions of the river, and the struggle for the Amur was not resumed until the middle of the nineteenth century. During this period the attention of Russia was turned more to the west, whither it had been directed by Peter the Great. In 1847 General Muravieff (q.v.) was appointed Governor-General of Eastern Siberia. He obtained authority for establishing a post of the Russian-American Company at the mouth of the Amur, for the formation of an effective military force from the Cossack settlers, and finally in 1853 for the occupation of De Castries Bay on the Gulf of Tartary and of the island of Saghalien. Still the hostile attitude of the Asiatic Department in Saint Petersburg embarrassed Muravieff until the outbreak of the Crimean War gave him his great opportunity. With a view to the adequate defense of Russian interests on the Pacific, he was empowered to conduct negotiations with the Chinese Government directly, without reference to Saint Petersburg, and to

open communication by the Amur between Nertchinsk and the coast and thence with the fortified port of Petropavlovsk in Kamtchatka. In May, 1854, he led an expedition down the Shilka, and thence down the Amur, which had been so long closed to Russia. On August 29th an English and French squadron of eight vessels with 236 guns arrived off Petropavlovsk and began an attack on September 1st. This attack was devoid of results. It was renewed on the 24th, when the allies, after silencing some of the batteries by their fire, were repulsed in their land assault with heavy loss—about one-third of the 700 men engaged. Knowing that another attack would be made by the allies in greater force, Muravieff ordered the abandonment of Petropavlovsk early in the spring of 1855 and concentrated his strength about the mouth of the Amur. Empowered as a plenipotentiary to arrange a treaty with China, he concluded in May, 1858, the Convention of Aigun, which made the Amur the boundary between the two countries, the left bank to belong to Russia, the right as far as the Ussuri to China, and from the latter river to Korea. Navigation on the frontier rivers was to be open only to Chinese and Russian vessels, and trade on the rivers was to be free.

In 1859 Russia secured the country between the Ussuri and the sea and in 1860 Vladivostok was founded. In 1872 this was made the chief naval station of Russia on the Pacific, in place of Nikolayevsk, at the mouth of the Amur. The earliest means of communication in Siberia were by the rivers. Russian progress across the continent was closely followed by the great Siberian post road, connecting the chain of towns which formed the administrative centres of the provinces. Along this road there was a regular postal service, increasing in frequency with the development of the country. The work of Muravieff, the colonization of the rich country beyond the Ussuri, and the acquisition of an available Pacific seaboard, brought out the idea of a great transcontinental railway. In 1878 the Government took up the matter and by 1884 had built a road from Perm to Tiumen. Other local projects followed and in 1891 the construction of a Trans-Siberian railway was authorized and begun. To keep its hand upon China and hold in check the ambitions of the new Japan, Russia obtained a foothold in the Liao-tung Peninsula through intervention after the war between China and Japan in 1895, and there established the strong naval station of Port Arthur and the free port of Dalny. This is connected by the Manchurian Railway, built under treaty between Russia and China, with the Siberian Railway in Trans-Baikalia and with Vladivostok.

Until 1900 convicts were exiled to Siberia in great numbers and many barbarities and abuses arose from the system, which was largely mitigated by a ukase of the Czar which substituted imprisonment for exile except in the case of political offenders, for whom transportation was retained, though not necessarily to Siberia. Between 1807 and 1899 it was estimated that 865,000 persons had been transported to Siberia.

BIBLIOGRAPHY. Reclus, *Géographie universelle*, vol. v. (Paris, 1880); Seebohm, *Siberia in Asia* (London, 1882); Lansdell, *Through Siberia* (ib., 1882); Iadrintzef, *Sibirien: Geographische, ethnographische und historische Studien*, from the Russian (Jena, 1886); Kennan, *Siberia and the Exile System* (New York, 1891); id., *Tent Life in Siberia* (ib., 1893); De Windt, *Siberia as It Is* (London, 1892); id., *The New Siberia* (ib., 1896); Price, *From the Arctic Ocean to the Yellow Sea* (ib., 1892); Keane, *Northern and Eastern Asia* (ib., 1896); Hedin, *Through Asia* (ib., 1898); Simpson, *Side Lights on Siberia* (Edinburgh, 1898); Legras, *En Sibérie* (Paris, 1899); Krausse, *Russia in Asia* (London, 1899); Colquhoun, *Overland to China* (New York, 1900); Leroy-Beaulieu, *La rénovation de l'Asie-Sibérie-Chine-Japon* (Paris, 1900); Fraser, *The Real Siberia* (New York, 1902); Zabel, *Durch die Mandschurei und Sibirien* (Leipzig, 1902); Norman, *All the Russias* (New York, 1902); Wright, *Asiatic Russia* (ib., 1902); Gerrare, *Greater Russia, the Continental Empire of the Old World* (ib., 1903).

SIBERIAN RAILROAD. See SIBERIA.

SIB'LEY, HENRY HASTINGS (1811-91). An American pioneer, born in Detroit, Mich. He was only eighteen months old when Detroit was captured by the British, and his family was compelled to flee to Ohio. In 1828 he became a fur trader and lived for many years at Mackinac and Fort Snelling in the employ of the American Fur Company. From 1849 to 1853 he was the delegate to Congress from the Territory of Minnesota, the organization of which at that early date was largely due to his efforts. In 1857 he was a member of the Constitutional Convention, and the next year became first Governor of the State. During the Indian outbreak of 1862 he commanded the troops gathered for the defense of the frontier, and at Wood Lake won a decisive victory. For this President Lincoln commissioned him a brigadier-general of volunteers. The next year he defeated the Sioux in three battles. In 1865 he was brevetted major-general, and in 1866 he was appointed one of the commission to negotiate treaties with the hostile tribes. Consult Williams, "Henry Hastings Sibley, a Memoir," in the *Collections of the Minnesota Historical Society*, vol. vi. (Saint Paul, 1804).

SIB'LEY, HENRY HOPKINS (1816-86). An American soldier, born in Nachitoches, La. He graduated in 1838 at the United States Military Academy, and took part in the Seminole War. He fought through the Mexican War and served in the Utah and Navajo expeditions. He was promoted to be major, but resigned in order to enter the Confederate Army, in which he received a commission as brigadier-general. Appointed to command the Department of Mexico, he raised a brigade, and in 1862 defeated the forces under Colonel Canby at Valverde, N. M. In 1869-73 he was in the service of the Khedive of Egypt, and constructed river and coast defenses. He invented a tent, known by his name.

SIBLEY, HIRAM (1807-88). An American financier. He was born in North Adams, Mass., was a millwright and machinist for a time at Lima, N. Y., and in 1838 opened a banking house in Rochester. When telegraphy came into practical use, he, in association with Ezra Cornell, consolidated twenty smaller telegraph corporations into the Western Union Telegraph Company, of which he was president for seventeen years. In 1861 he was the moving spirit in the construction of a transcontinental telegraph line for the promotion of which Congress granted for ten years an annual subsidy of $40,000. He next

projected a telegraph route to Europe, by way of Bering Strait and Siberia, but though wires were strung in Siberia and Alaska, he abandoned the enterprise on the completion of the Atlantic cable. After 1869 he devoted his attention to railroad building and land investments. He gave $100,000 for a library building at Rochester University, and $160,000 in founding the College of Mechanical Engineering at Cornell University.

SIBLEY, JOHN LANGDON (1804-85). An American antiquary, born at Union, Me. He graduated at Harvard in 1825, and entered the ministry of the Congregational church. In 1841 he became assistant librarian, and in 1856 librarian of Harvard. Owing largely to his efforts the number of volumes was quadrupled in the next twenty-one years. In 1837 he became editor, and afterwards proprietor of *The American Magazine of Useful and Entertaining Knowledge.* In 1877 he was retired as librarian emeritus. Among his publications are, *A History of the Town of Union* (Boston, 1851); *Biographical Sketches of Graduates of Harvard University* (3 vols. Cambridge, 1873-85).

SIBONGA, sē-bŏng'ȧ. A town of Cebú, Philippines, situated on the eastern coast, 26 miles southwest of Cebú (Map: Philippine Islands, H 9). Population, estimated, in 1899, 23,455.

SIB'THORP, JOHN (1758-96). An English botanist, born in Oxford, where he graduated at Lincoln College. He also studied at Edinburgh, at Montpellier, at Göttingen, and at Vienna. His great work, *Flora Oxoniensis* (1794), shows him to have been an able botanist. *Flora Græca* was published in ten volumes (1806-40).

SIBYL (Lat. sibylla, from Gk. *σίβυλλα*, sibyl; connected with Lat. *per-sibus*, wise). The name in Greek legend of women inspired by Apollo with prophetic power. The early authorities mention but one, probably the Erythræan Herophile. Later poets or local legends increased the number, and finally we hear of ten, the Erythræan, the Samian, the Trojan or Hellespontine, the Phrygian, the Cimmerian, the Delphian, the Cumæan, the Libyan, the Babylonian, and the Tiburtine, most of whom, however, enjoyed only local fame. Verses of vague import were current which were attributed to them. In Roman religious history these oracles played an important part. According to the story an aged woman (the Cumæan Sibyl) appeared before King Tarquin the Proud, and offered him nine books at a high price. When he refused her demand, she went away, destroyed three books, and offered the remaining six at the original price; again refused, she presently returned with but three, and these were finally purchased by the King at the price demanded for the nine. These were placed in the cellar of the Temple of Jupiter on the Capitol, and there remained until they perished in the burning of the temple, B.C. 83. A new collection was made by a special commission, which consisted of about 1000 verses. Later, Augustus caused the collection to be carefully sifted, as much spurious material was thought to be present, and the whole to be deposited in a room in the Temple of Apollo on the Palatine. Shortly after A.D. 400 they were burned by Stilicho. For the care and consultation of the books were appointed at first the *Duoviri sacris faciundis*, whose number was raised in B.C. 367 to ten, five patricians and five plebeians, and by Sulla to fifteen. The consultation could only occur by express vote of the senate, and the result was reported to that body in a formal document. The consultation seems to have been ordered in general when prodigies showed special need of conciliating the gods, and the established rites seemed inadequate. Naturally these Greek books contributed largely to the Hellenization of the old Roman religion. Consult: E. Maass, *De Sibyllarum Indicibus* (Greifswald, 1879); Diels, *Sibyllinische Blätter* (Berlin, 1890); K. Schulters, *Die Sibyllinischen Bücher in Rom* (Hamburg, 1895); also the authorities under ROMAN RELIGION. For Christian Sibyllists, see SIBYLLINE ORACLES.

SIBYL, GROTTO OF THE. (1) A cavern on the banks of Lake Avernus. It has a brick gateway and consists of an extensive hewn passage ventilated from above by a shaft. (2) A cavern at Cumæ supposed to be the grotto described by Vergil in the sixth book of the *Æneid.* It has many openings and subterranean passages, most of which are blocked up. (3) A cavern at Marsala, the ancient *Lilybæum*, in Sicily. It contains a spring by means of whose waters the Sibyl was supposed to give forth her oracles.

SIBYLLINE ORACLES. A lengthy collection of Greek hexameters, pseudonymously ascribed to the Oriental Sibyl. These writings belong to an extensive literature first produced by the Jews, whom the early Christians soon followed with the intention of proving that the pagan oracles or the ancient poets had borne witness to the superiority of the true religion of Israel or of Christ, or had prophesied the coming of the Kingdom of God. But few fragments of such literature have survived outside of these Sibylline Oracles, but these obtained a prestige in the early Roman Empire and in the Christian Church that has insured their preservation.

These oracles are a wild chaos of barbarous hexameters, made up of disjointed sections, and full of interpolations, revealing the manner of the origin of the collection. Any one might add or insert his own lines, and they would be readily accepted by the credulous public. Through the older portions breathes a spirit of monotheism and scorn for the vices of heathenism. The collection is divided into fourteen books, of which the eighth, ninth, and fifteenth are now lost. The book containing the oldest fragments is the third. Through its abundant though veiled references to contemporary history (set forth as prophecy), the oldest sections clearly belong to the Maccabean period, and may be dated about B.C. 140. Other sections belong to the last pre-Christian century. The fourth book is now generally attributed to a Jewish writer, in the last quarter of the first century A.D. The fifth is mostly Jewish (according to some Jewish-Christian), with Christian interpolations, and contains material as late as Hadrian's reign. One Christian passage refers to Jesus as "the noble man who came from heaven, who stretched forth his hands on the fruitful cross, the best of the Hebrews." Books vi., vii., viii., maintain the polemic against paganism, give a picture of the persecutions, and paint apocalyptic visions. The remaining books are mostly Christian. It has been thought that Vergil in his Fourth Eclogue, where he congratulates Pollio on the birth of a son and refers to the Cumæan Sibyl, had some passage of this Jewish literature in mind. This pseudepigraphic propaganda was carried on *ad*

nauseam, and produced intense ridicule on the part of the heathen critics; Celsus, Origen's opponent, calls the Christians Sibyllists. But the argument was continued, and Lactantius in the fourth century still relies on the Sibyl. For modern editions of the text, consult: Alexandre (Paris, 1841); Friedlieb (Leipzig, 1852); Rzach (Vienna, 1891); Geffcken (Leipzig, 1902). An English translation is given in Terry, *Sibylline Oracles* (New York, 1890); the more important fragments are given in German, in Kautzsch, *Apokryphen und Pseudepigraphen* (Leipzig, 1900). For literature and general treatment, consult: Schürer, *History of the Jewish People in the Time of Jesus Christ* (Eng. trans., Edinburgh, 1886-90); Harnack, *Geschichte der altchristlichen Litteratur* (Leipzig, 1893); Geffcken, *Komposition und Entstehungszeit des Oracula Sibyllina* (ib., 1902).

SIC'ARD, MONTGOMERY (1836-1900). An American naval officer. He was born in New York City, graduated in 1855 at the United States Naval Academy, and served through the Civil War. He participated in the bombardment and passage of Forts Jackson and Saint Philip, and the Chalmette batteries, and in the passage of the batteries at Vicksburg. When subsequently in the South Atlantic squadron, he took part in the various attacks on Fort Fisher (1864-65), and in the bombardment of Fort Anderson (1865). From 1865 to 1869 he was stationed at the Naval Academy, from 1869 to 1871 he was in the Pacific fleet, in 1870 was promoted to be commander, and in 1870-78 was on ordnance duty at New York City and Washington. In 1878 he commanded in the North Atlantic squadron, and in 1879 was assigned to special duty at Washington. In 1880 he took command of the Boston Navy Yard, and in 1881-90 was chief of the Ordnance Bureau at Washington with rank of captain. He was for a time in command of the Brooklyn Navy Yard, afterwards commanded the North Atlantic squadron with rank of rear-admiral, was in 1878 appointed president of the strategy board, and retired in the same year.

SICCARD VON SICCARDSBURG, zĕ'kärt fôn zĕ'kärts-bōōrk, AUGUST VON (1813-68). An Austrian architect, born in Vienna. He became intimately associated with Eduard van der Nüll (q.v.), and through their coöperation the entire tone of modern Viennese architecture was elevated. The magnificent New Opera House (1860-66) was the principal product of their joint activity.

SICILIANA, sē'chē-lyä'nä (It., Sicilian). In music, a name given to a slow dance, in six-eighth or twelve-eighth time, peculiar to the peasants of Sicily. It is danced by one couple at a time. The man first chooses his partner and then, after having danced with her for a while, retires, whereupon the woman selects another partner. She in turn withdraws and so the dance continues, a man and a woman alternately choosing partners. In many of the older sonatas the Siciliana appears as the andante. There is an excellent example of a Siciliana in Mozart's *Nozzi de Figaro*.

SICILIAN VESPERS. The name given to the massacre of the French in Sicily, which began at Palermo on the day after Easter (March 30th), 1282, while the bells were ringing for the vesper service. Charles of Anjou (q.v.) had deprived the Hohenstaufen dynasty of Naples and Sicily, and had parceled out these kingdoms into domains for his French followers; but his cruelty toward the adherents of the dispossessed race, his tyranny and oppressive taxation, and the brutality of his followers, excited among the Sicilians the fiercest resentment. Authorities differ as to whether the uprising was spontaneous or had been prepared beforehand. It would seem that the intrigues of Peter III. of Aragon had something to do with bringing about the insurrection, but the common story goes that on the evening of Easter Monday the inhabitants of Palermo, enraged at a gross outrage perpetrated by a French soldier on a young Sicilian bride, rose upon their oppressors, putting to the sword every man, woman, and child of them, and not sparing even those Italians and Sicilians who had married Frenchmen. This example was followed, after a brief interval, at Messina and the other towns, and the massacre soon became general over the island. Charles of Anjou made a determined attempt to reconquer the island, but the Sicilians summoned to their aid Pedro III. of Aragon, who had himself crowned King of Sicily, and destroyed the fleet dispatched by Charles for the reduction of Messina. The Angevins thus lost control of Sicily. Consult: Amari, *La guerra del Vespro Siciliano* (9th ed., Milan, 1886; English translation, London, 1850); id., *Racconto populare del Vespro Siciliano* (Rome, 1882).

SICILY, sĭs'ĭ-lĭ (It., Lat. *Sicilia*, Gk. Σικελία, *Sikelia*, from Lat. *Siculus*, Gk. Σικελός, *Sikelos*, Sicilian). The largest island in the Mediterranean Sea, forming part of the Kingdom of Italy. It is southwest of the Italian Peninsula, from which it is separated by the narrow Strait of Messina (Map: Italy, G 10). It is of triangular shape and has an area of about 9936 square miles.

PHYSICAL FEATURES. The island, like the mainland of Italy, is traversed throughout its entire length by a chain of mountains which may be looked upon as a continuation of the Apennines (q.v.). The northeastern part of the chain, running southwest from Capo del Faro, is called the Peloric range, which in Monte Tre Fontane attains the height of 4508 feet; the western and much the longer part is called the Madonian range, which, in the Pizzo dell' Antenna, rises to an elevation of 6478 feet. It forms the great watershed of the island. Toward the northwest coast the chain breaks up into irregular and often detached masses. About the centre of the chain a range branches off through the heart of the island to the southeast, at first wild and rugged, but afterwards smoothing down into tablelands, which slope gradually to the sea. The Madonian chain sends off numerous minor spurs to the south. Mount Etna (q.v.), situated near the eastern shore, is the highest point of the island, rising to an elevation of about 10,750 feet. On the north and east the coasts are steep and well indented, affording several good harbors. On the west and south they are generally flat and their outlines are less favorable for navigation. The rivers of Sicily are mostly short and rapid, and some of them dry up during the summer. The principal are the Alcantara, Simeto, Salso, Platani, and Belice. There are few lakes on the island, but there are a large number

of mineral springs. The sulphur springs were famous in ancient times.

CLIMATE. The climate is typically Mediterranean in character. The temperature is moderate and very seldom falls below the freezing point. The island, however, is visited by the sirocco, with its intolerable dry heat. Some of the lower sections are subject to malaria, but the climate is on the whole salubrious. The summers are almost rainless, and the aridity is aggravated by the fact that the interior is almost entirely deforested, so that there is nothing to retain the moisture from the winter and spring rains. Geologically the mountain ranges consist of a core of granite and gneiss, which is exposed in the northeastern range. The western and southern parts of the island are overlaid with later stratified rocks, and the southern plateau is mainly Tertiary. Basaltic and other volcanic intrusions occur over large areas, especially in the southeastern range, and the immense sulphur deposits as well as the active crater of Mount Etna are further evidences of the volcanic nature of the island.

INDUSTRIES. The chief mineral wealth is sulphur, of which Sicily is the principal source of the world's supply. The output has greatly increased since the formation of the Anglo-Italian syndicate in 1896, the export of sulphur for 1899 exceeding 400,000 tons, valued at nearly $8,400,000. Other minerals are rock salt and asphalt. Agriculture is still the main industry, although the island no longer deserves the name of the 'granary of Italy,' as its present output of cereals is barely sufficient to meet the domestic demands. The growing of cereals is confined almost exclusively to the larger estates, which are found mostly in the interior and along the southern coast. In the smaller holdings the land is devoted principally to the cultivation of the vine, almonds, olives, oranges, lemons, beans, sumach, etc. Agricultural methods are of the most primitive kind. The fisheries (tunny, sardine, coral, and sponge) are extensive, the deep-sea fisheries alone giving employment to over 20,000 persons. The making of wine and olive oil, the canning of fruits and vegetables, and the preparation of citric acid are extensively carried on. There are also produced some glassware, metal-ware, matches, etc., in the larger cities. Sicily exports sulphur, fruits, and vegetables, sumach, salt, wine, oil, and fish, and imports mainly grain, coal, and iron. Almost the entire trade is sea-borne, and the nagivation of the three principal ports of Palermo, Messina, and Catania amounted, in 1901, to nearly 5,000,000 tons. The railway lines have a total length of about 1000 miles.

ADMINISTRATION. Sicily forms, together with the Lipari and Ægadian groups and a few other islands, a compartimento of the Kingdom of Italy, and is divided into the seven provinces of Messina, Catania, Syracuse, Caltanissetta, Palermo, Girgenti, and Trapani. The elementary schools of the island are still inadequate. Secondary education is better provided for, and there are universities at Palermo, Messina, and Catania. The population was 2,927,901 in 1881, and 3,529,266 in 1901. Palermo is the capital. Emigration is constantly increasing. The number of emigrants in 1901 was nearly 37,000, of whom over 13,000 were temporary. The condition of large numbers of the laboring class, especially those engaged in the sulphur industry, is deplorable. The secret organization known as the Mafia (q.v.) frequently interferes with the execution of the law.

HISTORY. Sicily was inhabited at the dawn of history by a people who bore the name of *Siculi* or *Sicani*, and who, according to tradition, crossed over into the island from the southern extremity of the mainland. They were members of the great Latino-Italian family. The recorded history of Sicily only begins with the establishment of Greek and Phœnician colonies. The earliest Greek colony, that of Naxos, was founded B.C. 735; the latest, that of Agrigentum, about B.C. 580. During the intervening century and a half, numerous important colonies were established, including Syracuse, Leontini, Catana, Megara Hyblæa, Gela, Zancle (the later Messana), Acræ, Himera, Mylæ, Casmenæ, Selinus, and Camarina. We read that these cities attained great commercial prosperity, and that their governments were at first oligarchies, and latterly democracies or 'tyrannies;' but it is not till the period of the 'despots' that we have detailed accounts. Agrigentum and Gela early acquired prominence—the former, under the rule of Phalaris (q.v.), becoming, for a short time, probably the most powerful State in Sicily, and the latter, under a succession of able tyrants, Cleander, Hippocrates, and Gelon (q.v.), forcing into subjection most of the other Greek cities. Gelon, however, transferred his government to Syracuse (one of his conquests), which now became the principal Greek city of Sicily—a dignity it ever after retained throughout ancient times. Meanwhile, the Carthaginians had obtained possession of the Phœnician settlements in Sicily. The first appearance of the Carthaginians in the island dates from B.C. 536; but the steady growth of the Greek cities in wealth and power long confined their rivals to the northwestern part, where their principal colonies were Panormus, Motya, and Solois. The first open trial of strength took place in the great battle of Himera in B.C. 480, where the Carthaginian army was utterly routed by Gelon, and its leader, Hamilcar, slain. The Gelonian dynasty at Syracuse fell in B.C. 466, after experiencing various fortunes. During the next fifty years Sicily had peace. In B.C. 410, however, the war between the Carthaginians and Greeks for the possession of the island was renewed. The successes of the former were great and permanent. Selinus, Himera, Agrigentum, Gela, and Camarina, fell into their hands in less than five years; and it was not till Syracuse had a new 'tyrant,' the famous Dionysius the Elder (q.v.), that fortune began to change. Even he, however, could not wrest from the Carthaginians what they had already won; and after the war of B.C. 383 a peace was concluded which left Dionysius in possession of the eastern and the Carthaginians of the western half of the island. Timoleon won a splendid victory over the Carthaginian generals, Hasdrubal and Hamilcar, at the river Crimisus, about B.C. 340. Once more Greek influence was in the ascendent, but the rule of the bold and ambitious tyrant Agathocles (B.C. 317-289) proved in the main disastrous to Greek supremacy. After his death Syracuse lost her hold over many of the Greek cities, which established a weak and perilous independence, that only rendered the preponderance of the Carthaginians more certain.

Finally, Pyrrhus (q.v.), King of Epirus, was invited over to help his countrymen, and in B.C. 278 he landed in the island. The brilliant adventurer for a time swept everything before him. Panormus, Ercte, and Eryx were captured; and though he failed to make himself master of Lilybæum, he might probably have forced the Carthaginians to surrender it, had he not been thwarted in his designs by the miserable discords and jealousies of the people whom he came to save. As it was, Pyrrhus left Sicily in about two years; and in all likelihood the island would have sunk into a Carthaginian possession, had not a new power, Rome, appeared to engage the Carthaginians. In B.C. 241, at the close of the First Punic War, Carthaginian Sicily was given up to the Romans, and in B.C. 210, in the course of the Second Punic War, the whole island became a Roman province—the first Rome ever held. In B.C. 135-132, and again in B.C. 103-100, it was the scene of formidable slave insurrections. Its fertility and the wealth of its citizens and landholders were powerful temptations to greedy and unscrupulous Governors.

In A.D. 440 Sicily was conquered by the Vandals under Genseric. The Vandals, in their turn, were dispossessed half a century later by the Ostrogoths, in whose hands it remained till A.D. 535, when Belisarius conquered it and annexed it to the Byzantine Empire. In 827-878 the Saracens made themselves masters of the island, which flourished under their rule. In 1061 the Normans, under Robert Guiscard and his brother Roger, engaged in the conquest of Sicily, which was completed in 1090, a few years after the death of Robert. In 1127 Roger II., Count of Sicily, was recognized as Duke of Apulia and Calabria and in 1130 he assumed the title of King of Sicily.

In 1194 the Norman rule was succeeded by that of the House of Hohenstaufen (q.v.), whose dynasty was overthrown by Charles of Anjou in 1266. In 1282, after the Sicilian Vespers (q.v.), Sicily became independent and chose for its King Pedro III. of Aragon, who was connected by marriage with the House of Hohenstaufen. In 1296 it was separated from Aragon and for more than a century was ruled by a branch of the Aragonese dynasty, when it was reunited with that kingdom. Ferdinand the Catholic made himself master of the Kingdom of Naples in 1503, and the Spanish Crown retained both countries until the War of the Spanish Succession. By the Treaty of Utrecht (1713), Sicily was separated from Naples, and handed over to Victor Amadeus, Duke of Savoy, who ceded it to Austria seven years later, receiving in exchange the island of Sardinia. In 1734-35 Don Carlos established the Spanish Bourbon dynasty in Naples and Sicily (the Two Sicilies), and down to 1860 Sicily was ruled by Bourbon kings. (See TWO SICILIES, KINGDOM OF THE.) In 1860 Garibaldi's invasion (see ITALY; GARIBALDI) resulted in the annexation of Sicily to the dominions of Victor Emmanuel, which in 1861 became the Kingdom of Italy.

BIBLIOGRAPHY. Hare, *Cities of Southern Italy and Sicily* (London, 1883); Colajanni, *Gli avvenimenti di Sicilia e le loro cause* (2d ed., Palermo, 1896); San Giuliano, *Le condizioni presenti della Sicilia* (Milan, 1896); Paton, *Picturesque Sicily* (New York, 1898); Capuana, *L'isola del sole* (Catania, 1898); Sladen, *In Sicily, 1896-1900* (London, 1901); Rumpelt, *Sicilien und die Sicilianer* (Berlin, 1902); Holm, *Geschichte Siciliens im Altertum* (Leipzig, 1870-98); Freeman, *History of Sicily* (Oxford, 1891-94); Hodgkin, *Italy and Her Invaders* (ib., 1880-85); Bracci, *Memorie storiche intorno al governo di Sicilia del 1815 alla dittatura di Garibaldi* (Salerno, 1870); Di Marzo, *Un periodo di Sicilia dal 1774 al 1860;* Paterno, *Saggio storico politico della Sicilia dal cominciare del secolo XIX. fino al 1830* (Catania, 1848); La Farina, *Storia documentata della rivoluzione di Sicilia nel 1848-49* (Capolago, 1851).

SICKEL, sĭk'el, THEODOR RITTER VON (1826—). A German historian, born at Aken, and educated at Halle and Berlin. He investigated the archives of Milan and Vienna for the French Government, and became professor of history in Vienna in 1857. He was also director of the Institute for Austrian History at Vienna, counselor in 1876, and director of the Austrian Institute at Rome. Among his works are: *Monumenta Graphica Medii Aevi ex Archivis et Bibliothecis Imperii Austriachi Coelesta* (1859); *Beiträge zur Diplomatik* (1861); *Zur Geschichte des Konzils von Trient* (1872); *Kaiserurkunden in Abbildungen* (1881); and *Das Privilegium Ottos I. für die römische Kirche* (1883).

SICKINGEN, FRANZ von (1481-1523). A celebrated German knight, born near Kreuznach. Very early in life he began his military career, and speedily became recognized as a champion of the oppressed. In defense of an injured citizen he began a long feud with the city of Worms in 1513, and besieged the town, though in vain. For similar reasons he fought the Duke of Lorraine and the city of Metz. He also participated in the war of the Swabian League against Ulrich of Württemberg, and when Stuttgart was taken in 1519 he protected the great scholar Reuchlin. Through the influence of Ulrich von Hutten, whose protector he was, Sickingen became an ardent adherent of Luther, and sought to found a league of the lesser nobility and the cities to reorganize religious and political affairs in Germany. In 1522 he began war against the Archbishop of Treves, but failed in his attack on the city. He was besieged in his own castle and mortally wounded in May, 1523, dying five days later. Sickingen has become a favorite figure in German legend and literature and is one of the chief characters in Goethe's *Götz von Berlichingen*, and in Hauff's *Lichtenstein*. Consult Ulmann, *Franz von Sickingen* (Leipzig, 1872).

SICKLES, sĭk"lz, DANIEL EDGAR (1825—). An American soldier and politician, born in New York City. He was educated at the New York University, studied law, and was admitted to practice in 1846. In the following years he sat as a Tammany Democrat in the State Assembly. In 1853 he was appointed corporation counsel of New York City, and was Secretary of Legation at London under United States Minister Buchanan from 1853 to 1855, when he returned to the United States and was elected to the New York State Senate. From 1857 to 1861 he was a Democratic member of Congress. During this period he shot and killed Philip Barton Key, United States District At-

torney for the District of Columbia, for adultery with his wife, but was acquitted after a sensational trial lasting twenty days. At the outbreak of the Civil War he raised the Excelsior (New York) Brigade, becoming colonel of one of its regiments, the Seventieth New York Volunteers. He was appointed brigadier-general of volunteers in September, 1861, and major-general in November, 1862. He commanded a brigade in McClellan's Peninsular campaign and at Antietam, commanded a division at Fredericksburg, and was in command of the Third Army Corps at Chancellorsville and Gettysburg. On the second day of the battle of Gettysburg his corps sustained the brunt of the Confederate attack upon the Peach Orchard, on the Federal left, and Sickles himself lost a leg. (See GETTYSBURG, BATTLE OF.) He continued in the service, however; was commander of the Department of the Carolinas in 1866-67, was brevetted brigadier-general and major-general in the Regular Army for services at Fredericksburg and Gettysburg respectively, served for a time as colonel of the Forty-second Infantry, and on April 14, 1869, was retired with the full rank of major-general. In 1867 he was sent on a secret diplomatic mission to South America. He was Minister to Spain from 1869 until 1873, and presented the demands of the United States for reparation for the execution of the captain and crew of the *Virginius* (see VIRGINIUS MASSACRE). He was sheriff of New York County in 1890, was again elected to Congress as a Democrat in 1892, and for several years was president of the New York State Board of Civil Service Commissioners.

SICYON, sĭs'ĭ-ŏn (Lat., from Gk. Σικυών, *Sikyōn*, Σεκυών, *Sekyōn*). The principal city of a small but fertile State of ancient Greece, Sicyonia, situated in the north of the Peloponnesus, having the Corinthian Gulf for its northern boundary, with Achaia on the west, Phlius on the south, and Corinth on the east. Between the rivers Asopus and Helisson, on a triangular plateau, was situated Sicyon, about two miles south of the Corinthian Gulf, and ten northwest of Corinth. Its position was one of great strength. The earlier city seems to have been situated at the foot of the plateau, to which it was removed by Demetrius Poliorcetes in B.C. 303. The early history of Sicyon is involved in myths, but even in the legends a connection with Argos appears, particularly in the story of Adrastus. At the time of the Dorian invasion it was occupied, but tradition said in a peaceable fashion, and the original population formed a fourth tribe along with the three Dorian tribes. The rule of the Dorian nobles was overthrown by Andreas, or Orthagoras, a member of a non-Dorian family, who about B.C. 665 made himself tyrant—a position held by his house for about one hundred years. Under Clisthenes, early in the sixth century, the State seems to have reached a high degree of prosperity and warlike fame, especially through its part in the Sacred War and establishment of the Pythian games. In later history Sicyon regularly appears as a dependency of Sparta, until the rise of Thebes. After its rebuilding by Demetrius it again fell under the rule of tyrants, but was finally freed and brought into the Achæan League (B.C. 251) by Aratus. After the destruction of Corinth by the Romans, the Sicyonians for a time had charge of the Isthmian games. In later times it seems to have been an insignificant place. On its site is the modern village Vasilikó. There are still considerable remains of the Roman period, and also a Greek theatre, which has been excavated by the American School at Athens. The ancient city was famous from early times for its bronze-casting, and especially for its painting.

SIDA (Neo-Lat., from Gk, σίδη, *sidē*, pomegranate, water-lily). A large widely distributed genus of annual and perennial herbs and shrubs of the natural order Malvaceæ, mostly natives of warm climates, and generally rich in mucilage. Some of the species have strong pliable fibres, which are employed for cordage and for textile purposes. One of the most valuable of these is *Sida rhombifolia*, a perennial tropical shrub also found in Australia and the United States. It is also said to be cultivated as a forage plant. *Sida tiliæfolia*—better known as *Abutilon avicennæ*—is an annual long cultivated in China, for its fibre, which is used like that of hemp. In parts of the United States it is a common weed known as velvetleaf.

SIDDHĀRTHA, sĭd-härt'hâ (Skt., he who has attained his aim). An epithet frequently applied to Gautama Buddha (q.v.).

SID'DONS, Mrs. SARAH (1755-1831). A celebrated English actress. She was the daughter of Roger Kemble (q.v.) and was born at Brecon, in Wales. As a mere child she showed the family genius for the stage, and during her youth she played as a member of her father's company in the provincial towns. She married William Siddons, an actor, in 1773. Shortly afterwards she attracted such great attention that Garrick heard her praises in London and offered her an engagement at the Drury Lane Theatre, where, December 29, 1775, she made her first appearance, acting Portia in *The Merchant of Venice*. Her beauty and fine person pleased the audience, but as an actress she made no great impression. At the end of the season she was not reëngaged. She returned to London in 1782 to enjoy a career of triumph as indisputably the greatest actress of her time, having spent the intervening years on the stages of provincial cities. As Isabella in *The Fatal Marriage*, she reappeared at Drury Lane on October 10, 1782. In 1784 her popularity was temporarily obscured by a calumny which charged her with pecuniary meanness toward certain of her fellow performers; but with this trivial exception her efforts were one long series of successes till on June 29, 1812, in her great character of Lady Macbeth, she took her leave of the public. Belvidera, Queen Katharine, Volumnia in *Coriolanus*, which she played with her brother, John Philip Kemble (q.v.), were but a few of the many parts in which she captivated her audiences. Mrs. Siddons is said to have been strictly a stage genius; elsewhere she seems to have been a woman of no extraordinary intelligence. She carried her tragedy manners with her to the drawing-room or the dinner-table. Scott has recorded the amusement with which at Abbotsford he heard her stately blank verse to the servant: "I asked for water, boy! you've brought me beer;" and Sydney Smith used to say it was never without a certain awe that he saw her "stab the potatoes." In the practice of her art, however, it was this concentrated power of personal presence

which made her irresistible. As a tragic actress she has probably never been equaled in Great Britain. Her picture as the "Tragic Muse" by Sir Joshua Reynolds is famous.

Consult: Boaden, *Memoirs of Mrs. Siddons* (London, 1827; 2d ed. 1831); Campbell, *Life of Mrs. Siddons* (ib., 1834); Fitzgerald, *The Kembles* (ib., 1871); Kennard, *Mrs. Siddons* (ib., 1887); Baker, *Our Old Actors* (ib., 1881); Matthews and Hutton, *Actors and Actresses of Great Britain and the United States* (New York, 1886); Doran, *Annals of the Stage* (ed. Lowe, London, 1888).

SIDEREAL CLOCK (from Lat. *sidereus*, relating to a star, from *sidus*, constellation, star). A clock regulated to indicate sidereal time. (See DAY.) The sidereal clock is a most important aid to the practical astronomer, and is one of the indispensable instruments of an observatory. See CLOCK.

SIDERITE (Lat. *sideritis*, loadstone, from Gk. σιδηρίτης, *sidēritēs*, relating to iron, from σίδηρος, *sidēros*, iron). A mineral iron carbonate crystallized in the hexagonal system. It has a vitreous lustre, and is of a gray, brown to red, and sometimes green color. It occurs in gneiss, mica, and clay slates, and in other rock strata, and also frequently with metallic ores. It is found in Freiberg, Austria, in the Harz, and in Greenland; in the United States it occurs in various places in Vermont, Massachusetts, New York, and Ohio, and other localities where iron ores are common. Its iron is often partly replaced by calcium, magnesium, and manganese. It also occurs in crystallized, concretionary, massive, and earthy forms.

The name siderite is also applied to a translucent blue variety of vitreous quartz, which is also more commonly called *sapphirine*.

SID'EROX'YLON (Neo-Lat., from Gk. σίδηρος, *sidēros*, iron + ξύλον, *xylon*, wood). A genus of trees of the natural order Sapotaceæ, with evergreen leaves and axillary clusters of flowers, natives of and widely distributed in warm climates. They are remarkable for the hardness of their wood, which is sometimes called ironwood, and is, at least in some species, so heavy as to sink in water. A single species, *Sideroxylon Mastichodendron*, occurs along the east coast of Florida, where it is known as mastic and wild olive.

SIDEWALK, TRAVELING. See TRAVELING SIDEWALK.

SIDEWINDER. The local name in Arizona for the horned rattlesnake (*Crotalus cerastes*), which inhabits open plains, and when disturbed moves away sideways. Consult Merriam, *The Death Valley Expedition* (Agricultural Department, Washington, 1893). See RATTLESNAKE and Plate of RATTLESNAKES.

SIDG'WICK, HENRY (1838-1901). An English moralist and economist, born at Skipton, Yorkshire, in 1838. He was educated at Rugby and Trinity College, Cambridge, was fellow of Trinity College from 1859 to 1869, and lecturer from 1859 to 1875, when he was appointed prælector of moral and political philosophy; and in 1883 he was appointed Knightbridge professor of moral philosophy. His principal works are: *The Methods of Ethics* (1874; 5th ed. 1893); *The Principles of Political Economy* (1883); *Outlines of the History of Ethics* (1886; 4th ed. 1896); and *The Elements of Politics* (1891). He took a prominent part in the promotion of the higher education of women at Cambridge, and was one of the founders of Newnham College. He was a public-spirited man, and was liberal with his money. He helped largely to support *Mind*, the English philosophical quarterly, of which he was co-editor. He resigned his chair, May 1, 1900, on account of ill health. His *Methods of Ethics* is a very noteworthy work, in which he criticises in a remarkably fair spirit the ethics of intuitionism (q.v.) and common sense, of egoistic hedonism (q.v.), and of utilitarianism (q.v.), finally giving his adherence to a utilitarianism with an intuitive basis in the abstract moral principles of justice, prudence, and rational benevolence. He was a notable member of the Society for Psychical Research, in regard to the work of which he maintained a cautious and conservative position. See Stephen, "Henry Sidgwick," in *Mind* (January, 1901); James Seth, "The Ethical System of Henry Sidgwick," in *Mind* (April, 1901); Sorley, "Henry Sidgwick," in *International Journal of Ethics* (January, 1901); Haywood, "The True Significance of Sidgwick's Ethics," ib.

SIDI-BEL-ABBÈS, sē'dē bĕl ȧb'bȧs'. The capital of an arrondissement in the Department of Oran, Algeria, on the Mekerra, 48 miles by rail south of Oran (Map: Africa, D 1). It is comparatively a modern town and is surrounded by walls. It has a considerable agricultural trade in grain, alfalfa, and cattle. Population, in 1901 (of commune), 25,739.

SIDI MOHAM'MED (1803-73). Emperor of Morocco from 1859 to 1873. He succeeded his father, Muley Abderrahman. He was soon involved in a war with Spain, caused by the marauding expeditions of the Riff pirates, was defeated by the Spanish under Prim and O'Donnell (1860), and obliged to pay an indemnity of 200,000,000 piasters. His introduction of reforms and the commercial concessions which he granted to foreigners caused several insurrections, in quelling one of which he lost his life. See MOROCCO.

SIDMOUTH, sĭd'mŭth. A watering place on the southern coast of Devonshire, England, at the mouth of the little river Sid, remarkable for its healthful climate and picturesque situation (Map: England, C 6). The esplanade, protected by a sea wall 1700 feet in length, forms an excellent promenade. The interesting parish church dates from 1259. Sidmouth was the residence of Queen Victoria when a child, and her father, the Duke of Kent, died here in 1820. Population, in 1901, 4200.

SIDMOUTH, HENRY ADDINGTON, first Viscount (1757-1844). An English statesman. See ADDINGTON, HENRY.

SID'NEY. The county seat of Shelby County, Ohio, 40 miles north of Dayton; on the Miami River, and on the Cincinnati, Hamilton and Dayton, and the Cleveland, Cincinnati, Chicago and Saint Louis railroads (Map: Ohio, B 5). The public library, Monumental Building, courthouse, and Wagner's Park are noteworthy features. Sidney has considerable industrial importance. The manufactures include road scrapers, whips, hollow ware, corn shellers, horse collars, fly nets, poles and shafts, churns, wheels, car-

riages, aluminum ware, brooms, bicycle rims, newspaper folders, and flour. There is also a large chicken hatchery. The government is vested in a mayor, elected biennially, and a unicameral council. The water-works are owned and operated by the municipality. Sidney was settled between 1800 and 1810, incorporated about 1819, and received its present charter in 1897. Population, in 1890, 4850; in 1900, 5688.

SIDNEY, ALGERNON (c.1622-83). An English Revolutionary statesman. After receiving a careful education he accompanied his father, the second Earl of Leicester, on embassies to Denmark and France. His first military service was against the rebels of Ireland in 1641 while his father was Lord Lieutenant there. In the Civil War he fought for Parliament. The year 1647 saw him lieutenant-general of the Horse in Ireland, and the next year he became Governor of Dover, a position which he held for more than two years. In 1645 Cardiff had returned him to the Long Parliament, and three years afterwards he was appointed a commissioner for the trial of Charles I. He absented himself from the sessions of the court, however, because, as he explains, he wished to keep himself "clean from having any hand in this business." His objection to the trial of the King was that the House of Lords had not assented to it. But it is said that he afterwards spoke of the execution as "the justest and bravest action that was ever done in England or anywhere else." In principle a severe republican, he resented the concentration of power in Cromwell. When the restored Parliament met in 1659 Sidney was again nominated to the Council of State, and dispatched to Denmark on a political mission. After the Restoration he lived precariously on the Continent, flitting about from place to place. Received with great honor into the highest society of Rome, he desired to pass the remainder of his life there; but as political enemies sought his life, he dared not remain long in one place. All came to regard him as the ablest of the English exiles, and the King's friends feared his great influence; but in 1677 Charles II. pardoned him, and he returned to his native country.

Holding persistently to his old principles, however, he favored the Duke of Monmouth as successor to Charles II. in place of the Duke of York. To accomplish his object he solicited the aid of the French monarch, who is known to have supplied him with money through Barillon, the French Ambassador to England. His designs were suspected, and when the Rye House Plot was discovered in June, 1683, the opportunity was seized to be rid of a man felt to be dangerous. With his friend, Lord Russell, and others he was arrested and committed to the Tower. His trial for high treason began November 21st before the brutal Jeffreys, who on the merest mockery of evidence found him guilty and condemned him to death. The execution took place December 7th on Tower Hill. His heroic firmness in death awakened the sympathy and the indignation of the public, which, in recognition of his devotion to principle, has ever since revered him as a patriot hero and martyr. In the history and theory of government Sidney was more deeply learned than any other man of his time. His *Discourses Concerning Government* were published in London in 1698, and his entire works appeared in 1772.

Consult: *Arraignment, Trial and Condemnation of Algernon Sidney*, etc. (London, 1684); Ewald, *Life and Times of Algernon Sidney* (London, 1873).

SIDNEY, Sir PHILIP (1554-86). A celebrated English writer and soldier. He was born at Penshurst in Kent, and when ten years old was sent to the school at Shrewsbury, whence, in 1568, he went to Christ Church, Oxford. He left the university without a degree, but with a high reputation for scholarship and general ability. In 1572 he went abroad to travel. He was in Paris when the massacre of Saint Bartholomew took place, but ran no personal risk, as he was under the protection of the English embassy. Thereafter he visited Belgium, Germany, Hungary, and Italy; wherever he went he occupied most of his time in studying languages, literature, current history, and politics, but he also cultivated the acquaintance of eminent men; and in 1575 he returned home, perfected in all manly accomplishments. His uncle Dudley, Earl of Leicester, was at this time in the zenith of his fortunes, and for Sidney a career at Court lay temptingly open. As a courtier his success was great; with Queen Elizabeth he was throughout life an especial favorite. In 1577 she intrusted him with a mission to Heidelberg and Prague, and, though he failed in his negotiations, he was warmly commended on his return. Three years afterwards he had the boldness to address to the Queen a 'remonstrance' against her proposed marriage with Henry, Duke of Anjou, a union to which she seemed herself not indisposed. It is significant of the high favor in which he was held by her that Elizabeth, imperious as she was in temper, and little inclined to brook such interference, was satisfied with his retirement from Court for a few months. This interval he passed in literary work at Wilton with his sister, the accomplished Countess of Pembroke. For her entertainment he wrote his celebrated pastoral romance, *Arcadia*, which was published posthumously by his sister in 1590. In 1583 he consoled himself for the marriage of Lady Penelope Devereux, to whom he had been ardently attached, and who figures as the Stella of his poems, by marrying Frances, the daughter of Sir Francis Walsingham. In the spring of 1585 he is said to have meditated sailing with Sir Francis Drake in an expedition against the Spaniards in the West Indies, but to have been forbidden by Elizabeth through fear "lest she lose the jewel of her dominions." Later in the year, however, she appointed him Governor of Flushing, whither he went to take part in the war then being waged between her allies, the Dutch and the Spanish. At the battle of Zutphen, in Gelderland, he recklessly exposed himself. A horse was killed under him, and he received a musket-shot in the thigh from which, after great suffering, he died at Arnheim on October 7, 1586. A beautiful trait of humanity was noticed in him while he was borne from the field. As he complained of thirst, a bottle of water was brought him; but when he was about to drink, he was touched by the wistful look of a mortally wounded soldier, who lay close by; and taking the water untasted from his lips, Sidney handed it to his fellow in need, with the words, "Thy necessity is greater than mine."

The esteem in which Sidney was held by his countrymen was shown in the passion of grief with which the news of his death was received. His body was brought to England, and after lying for some time in state, was buried with great solemnity in the old Cathedral of Saint Paul's. The entire nobility went into mourning. The universities of Cambridge and Oxford issued three volumes of elegies on his death, and Spenser, in his *Astrophel*, mourned the loss of his friend.

The love and admiration which Sidney won from his contemporaries were a tribute to the singular beauty of his character. His short life was marked by no brilliant achievement, and his literary genius would scarcely of itself have sufficed to account for the regard he inspired. But the purity and nobility of his nature, and the winning courtesies in which it expressed itself, took captive all hearts while he lived, and have since kept sweet his memory. "Sublimely mild, a spirit without spot," in Shelley's words, he lives in the history of his country, a rare and finished type of English character, in which the antique honor of chivalry is seen shading into the graces of the modern gentleman. His *Arcadia*, overrun as it is with affectations, may still be recognized as a work of great merit. His other well-known work, *Apologie for Poetrie* (1579), republished in 1598 as *Defense of Poesie* (q.v.), will repay the attention of the reader. Many of his shorter poems, more especially some of his sonnets, are also of rare merit. Consult his *Complete Poems*, ed. by Grosart (London, 1877); *Apology for Poetry*, ed. by Shuckburgh (Cambridge, 1891); *Miscellaneous Works* (Boston, 1860; London, 1893); Davis, *Life and Times of Sir Philip Sidney* (Boston, 1859); Ely, *Chaucer, Spenser, and Sidney* (New York, 1894); Symonds, *Sir Philip Sidney* (London, 1886).

SIDNEY SUSSEX COLLEGE. A college at Cambridge, Eng. It was founded in 1596 by the will of Lady Frances Sidney, Countess Dowager of Sussex. The college was founded on the site of the Franciscan or Grey Friars' House, established in 1240, and was called the College of Lady Frances Sidney Sussex. The house of the Franciscans had been suppressed in 1538, and the site given to Trinity College. Trinity transferred it to the new foundation. Sidney Sussex College was almost from the first a 'nursery of Puritanism,' and was the first college in Cambridge to admit Scotch and Irish to membership. It consists of a master and ten fellows, thirty-six scholars, and about seventy-five undergraduates. It presents to eight livings. Oliver Cromwell was a member of Sidney Sussex College, though he did not take a degree. His portrait here is one of the best in existence. Among the other worthies of the college may be mentioned Thomas Fuller and Archbishop Bramhall.

SI'DON (Heb. *Ṣidōn*, from *ṣūd*, to hunt, to fish, or from *Sid*, name of a tribal god). A city of ancient Phœnicia, on the coast of the Mediterranean, about 25 miles south of Beirut (Map: Turkey in Asia, F 6). It was situated on a promontory with an island in front, and possessed a double harbor. It was specially famed for its purple dyes and its inhabitants are said to have discovered the manufacture of glass. (For the ancient history of the city, see the article PHŒNICIA.) Sidon surrendered to the Moslems in 637 or 638. During the period of the Crusades it suffered greatly and passed back and forth from Mohammedans to Christians, ultimately remaining with the former. In the seventeenth century its importance revived; it became the seaport of Damascus, and for nearly 200 years had an important trade. The present town of Saida occupies the western portion of the site of the ancient city. It has about 12,000 inhabitants, and is relatively unimportant as compared with Beirut, which has become the seaport of the district. Missionary establishments are maintained by both Protestants and Roman Catholics. The many tombs of the ancient city have yielded a large number of interesting sarcophagi, including that of Eshmunazar, now in the Louvre, and the so-called sarcophagus of Alexander, now in Constantinople. See PHŒNICIAN ART.

SIDO'NIA, ORDER OF. A royal Saxon order of merit for women, conferred for voluntary services in war and peace. It was established in 1870. The decoration is an eight-pointed cross of white enamel, edged with gold, suspended from a crowned wreath inclosing the initial S.

SID'RA, GULF OF (Lat. *Syrtis Maior*). A large, open arm of the Mediterranean Sea on the coast of Tripoli (Map: Africa, F 1). It is nearly 300 miles wide at the mouth, and extends inward from 75 to 125 miles. Its shores are low and bordered by shallow and dangerous waters, affording scarcely any harbors. The Gulf of Sidra forms the eastern angle of the larger rectangular gulf of the two Syrtes, the western angle being now called the Gulf of Cabes (q.v.).

SIEBENGEBIRGE, *zē'ben-ge-bēr'ge*. A group of seven conical heights in the Rhine Province, Prussia, on the right bank of the Rhine, 22 miles above Cologne (Map: Prussia, B 3). The chief peaks are the Oelberg (1522 feet), the Löwenburg, and the Drachenfels (q.v.). The scenery is strikingly picturesque, and the region is intimately connected with the history and legend of the surrounding country.

SIEBOLD, *zē'bōlt*, KARL THEODOR ERNST VON (1804-85). A German physiologist and zoölogist, born in Würzburg. In 1840 he was appointed to the chair of physiology at Erlangen, in 1845 at Freiburg, in 1850 at Breslau, and in 1853 at the University of Munich. Siebold was the originator, after Cuvier, of the first important reforms in systematic zoölogy, and established the unicellular nature of the Protozoa, which he first combined into a phylum. He produced in 1856 an epoch-making work, translated into English under the title "On a True Parthenogenesis in Moths and Bees" (1857). This was followed, in 1871, by a work in the same line (*Beiträge zur Parthenogenesis der Arthropoden*) in which he established the fact of parthenogenesis in two wasps, in a saw-fly, in several moths, and in certain phyllopod crustacea. Besides many papers giving the results of special investigations among the lower animals, he was the author in 1848, with Stannius, of a manual of the anatomy of animals, in which he established the branch of animals called Arthropoda. His last general work was a volume on the freshwater fishes of Central Europe, in which he pointed out certain of the hybrid forms. With Kölliker he founded the *Zeitschrift für wissen-*

schaftliche Zoologie, still the leading morphological and anatomical journal of Europe.

SIEBOLD, PHILIPP FRANZ VON (1796-1866). A Bavarian physician, naturalist, and traveler, born at Würzburg. After studying medicine and science he entered the service of the Dutch East India Company in 1822, and proceeded to Batavia. From Java he went in 1823 to Nagasaki, as the leader of a scientific mission to Japan. He quickly mastered the Japanese language, and in 1826 reached Yedo with the Dutch Embassy, remaining in that city, but getting into trouble through the purchase of a map, such transfer of knowledge to an alien being then forbidden. He was imprisoned, and banished from Japan in 1830. After his return to Europe he spent nearly thirty years in writing his great work, entitled *Nippon, Archiv zur Beschreibung von Japan* (1832-51); in arranging his collections at the museums of Leyden, Munich, and Würzburg; and in the composition of works on the fauna, flora, and bibliography of Japan. In 1859 he revisited Japan, and was invited to Court by the Emperor, and in 1861 entered the Japanese service as a negotiator with the Powers, but difficulties arose which compelled him to retire. He returned to Europe in 1862, where he published various papers relating to Japan. He died at Munich. A monument of him has been erected in Japan by the Japanese. Consult Siebold, *Leben und Wirken von P. F. von Siebold* (Würzburg, 1896).

SIEDLCE, syĕd'l-tse. A government in the east of Russian Poland, between the Bug on the east and the Vistula on the west (Map: Russia, B 4). Area, about 5540 square miles. It is mostly flat, and marshy in the southeast. Agriculture is the principal industry and is carried on by modern methods. Stock-raising is also important. The chief manufactures are spirits, sugar, and glass. Population, in 1897, 797,725.

SIEDLCE. The capital of the Government of Siedlce in Russian Poland, about 50 miles east-southeast of Warsaw (Map: Russia, B 4). It is little more than an administration centre of the government, and its economic importance is slight. It was for a long time in the possession of the Czartoryskis. Population, in 1897, 17,300.

SIEGBURG, zēg'bo͝orK. A town of the Rhine Province, Prussia, at the meeting of the Agger and Sieg, 16 miles by rail southeast of Cologne (Map: Germany, B 3). The Benedictine abbey (1060) is now used as a prison. Siegburg is a manufacturing and mining town. It has a royal projectile factory, pottery works, lignite mines, and stone quarries. Population, in 1900, 14,162. Siegburg was a wealthy and prosperous city in the Renaissance period, and famous for the curious and artistic 'Siegburg pitchers.'

SIEGE AND SIEGE WORKS (OF. *sege, siege*, Fr. *siege, from* Lat. *sedere*, to sit; connected with Gk. ἕζεσθαι, *hezesthai*, Skt. *sad*, OChurch Slav. *sĕsti*, Lith. *sedeti*, OHG. *sizzan*, Ger. *sitzen*, Goth. *sitan*, AS. *sittan*, Eng. *sit*). In conducting a siege, the enemy, where possible, is surrounded and cut off from supplies or reinforcements, in which case his position is said to be invested. The attacking army in doing this usually intrenches itself completely around and outside the works of the defender. With plenty of time and when there is no prospect of the arrival of relieving forces, an effective investment will cause the defender eventually to starve or surrender. In many cases, as in the siege of Mafeking and Ladysmith, the prospective arrival of a relieving force must always be borne in mind, compelling the attacker to use every means at his command to force the issue. But assuming that a simple investment is impossible, that assault by open force has failed, or, in the opinion of the attacking commander, would surely fail, bombardment would be resorted to and a continuous fire maintained. If the defenders are in a position to construct bomb-proofs sufficient to enable them to hold out against bombardment, it then becomes necessary to resort to a regular siege. The method of procedure is then as follows: The artillery having taken up a position best adapted to enable it to fire upon the artillery of the defense,

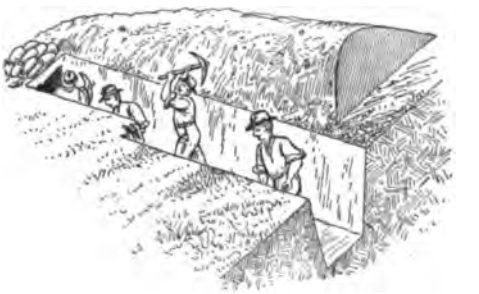


FIG. 1. SAPPING.

the infantry is established in front of this in intrenchments, and continuous attempts are made to hold down the fire of the defenders and to push the infantry intrenchments as close as possible to the work. This is done where possible in large sections of intrenchments parallel to the main line of the defender. Probably the method best adapted to modern conditions is the construction of intrenchments by the method known as *flying sap*. In this process, as soon as darkness falls a large force of men moves into position, carrying gabions or boxes, picks, and shovels. When the line has been moved as far forward as is deemed advisable, the gabions are placed in position, and the men start to dig the earth from behind them, filling first the gabions and then throwing the earth in front of them. When this is not practicable the advance is made by pushing trenches forward obliquely by end work. These 'approaches' are so inclined that they cannot be enfiladed by the enemy. This process is known as sapping. A position having been once gained is fortified as strongly as

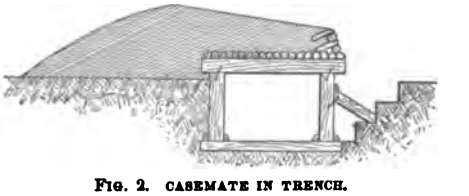


FIG. 2. CASEMATE IN TRENCH.

necessary to enable it to be held. By these methods the attack is pushed as rapidly as possible to a position close to that held by the defenders. If the latter are provided with sufficient provisions and material to enable them to hold out without surrender on account of starva-

tion, an assault is delivered by the attacking force on one of the weakest points of the work. The assaulting party is provided with explosives to be used in demolishing the palisades and similar obstructions, and with ladders, planks, wire-cutters, and other implements to enable it to surmount and cope with the obstacles it may find. From the nature of the case, if the defender is prevented from receiving supplies, and the attacker can receive such reinforcements

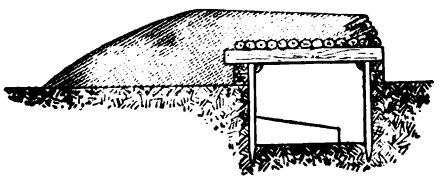


FIG. 3. CASEMATE IN TRENCH (entrance from end).

and supplies as he requires, the victory should normally be with the attacker. It may, however, be only necessary for the defender to hold out until a relieving force more formidable than the attackers can reach the place. It is therefore incumbent upon him to resort to other means to protract the defense. Having noted, for example, that an attack will probably be successful upon certain portions of his line, an additional line would be constructed in rear of this portion, and so fortified that it can be held even if the first falls. His fire is so directed as to delay the attacker's trench work. His force, while not large enough to defeat the attacker in open combat, may be large enough to threaten him so frequently as greatly to diminish his endurance. Sorties are frequently made at night,



FIG. 4. BATTERY ON GROUND SLOPING FROM THE FORTRESS. (Cross section.)

surprising the operations of the attacking force, destroying its material, its work, and generally lowering its morale.

The construction of the emplacements for the siege batteries is a work of the greatest importance. An illustration of the ingenuity used in adapting them to the accidents of the ground is afforded by the accompanying sections.

Sieges are comparatively few in a war as compared with the number of battles and other engagements. The siege of Vicksburg is an in-



FIG. 5. BATTERY ON GROUND SLOPING TOWARD THE FORTRESS. (Cross section.)

stance of an investment carried to a logical conclusion. The Confederate army penned up in the city was gradually surrounded and cut off from its source of supplies. The Union army, under General Grant, while closing in on the city, constructed a line of intrenchments strong enough to resist any possible attack by other Confederate troops for the relief of the city. Although General Grant was gradually pressing his lines forward, the place eventually capitulated as the result of starvation. During the Franco-Prussian War the sieges of Strassburg, Metz, Paris, and Belfort were carried on under different con-



FIG. 6. BATTERY ON GROUND SLOPING TO EITHER SIDE. (Longitudinal section.)

ditions and with different results. In the Russo-Turkish War (q.v.) Plevna is notable. Geök Tepe is an instance where the large but poorly disciplined and poorly equipped Turcoman army was besieged and overcome by the smaller but aggressive and well-handled Russian army under Skobeleff. Allusion has already been made to Mafeking and Ladysmith in the South African War. The siege of Fort Wagner, one of the defenses of Charleston, S. C., by the Union troops was unique in certain respects. Assaults having been made and having failed, recourse was had to advances by parallels and approaches. The time arrived when it seemed impossible to make further headway by this method. Mining could not be resorted to, since the bottoms of the trenches were already near the level of the ground-water. The proximity of the forts to deep water enabled the Union gunboats to add their fire to that of the besieging batteries and so keep down the fire of the fort that the besiegers were able to advance their trenches with great rapidity. In this way the works were carried right up to the fort. The night before the Union troops were to make the second assault the Confederates abandoned the fort, leaving the place by water. The conduct of the siege received the following high encomium from Major Clarke of the English Royal Engineers in his work on fortifications: "The difficulties of the siege, which were considerable, were overcome with a skill and readiness of resource which the most highly trained force in Europe could not have excelled."

Consult: Mercur, *Attack of Fortified Places* (New York, 1894); *Chatham Manual of Military Engineering*, part 2, *Attack of Fortresses* (London, 1896). See also articles on SIEGE GUN; HOWITZER; TACTICS, MILITARY; FORTIFICATION; and FORTIFICATIONS, ATTACK AND DEFENSE OF.

SIEGE GUN. A piece of artillery used for reducing permanent or semi-permanent works. Siege guns may be light or heavy, but are more powerful weapons, though traveling more slowly, than the field guns. They accompany armies in their field operations, being mounted upon carriages, which serve for the transportation as well as a support for the pieces while they are being fired.

The modern siege cannon adopted for the military service of the United States are the 5-inch rifle, the 7-inch howitzer, and the 7-inch mortar, all breech-loading. The 5-inch siege rifle weighs 3660 pounds, is 12.15 feet long, fires a 45-pound projectile with 12½ pounds of powder, and gives a penetration in steel of 2½ inches at 3500 yards. The 7-inch breech-loading rifled siege howitzer weighs 3750 pounds, and fires a projectile of 105 pounds with 10 pounds of powder, giving a penetration in steel at 3500 yards of 2.4 inches. The 7-inch rifled siege mortar weighs 1715 pounds, and fires a 125-pound projectile with 5.5 pounds of powder. See ORDNANCE and ARTILLERY.

SIEGEN. *zē'gen.* A town in the Province of Westphalia, Prussia, situated on the river Sieg, 47 miles east by south of Cologne. It has two castles of the Princes of Nassau-Siegen. Siegen is an important iron centre, the vicinity abounding in iron, copper, lead, and zinc mines. In and about the town are numerous puddling and rolling mills, machine works, and paper, cloth, and leather manufactories. Siegen, formerly a possession of the Dutch branch of the House of Nassau, passed to Prussia in 1815. Population (commune), in 1890, 18,242; in 1900, 22,111.

SIEGEN, LUDWIG VON (c.1609-c.80). A German engraver, born in Utrecht. In 1642 he produced his first known mezzo-tint engraving, a portrait of the Landgravine Amalia Elisabeth, Regent of Hesse, inscribed to her son, the artist's patron. Siegen did not fully realize the possibilities of his discovery. He kept the process secret, however, divulging it only to Prince Rupert of the Palatinate, through whom it became known in England. The engraver passed into the service of the Elector of Mainz in 1654, and died at Wolfenbüttel.

SIEGE PERILOUS. One of the three seats left unoccupied at the Arthurian Round Table, so called because it was reserved for him who was to find the Holy Grail, and any other bold enough to sit in it forfeited his life. See GALAHAD.

SIEGFRIED, *zēg'frēt.* A music drama in three acts by Richard Wagner. It is the third in the tetralogy of the *Ring des Nibelungen* and was first produced at Bayreuth, August 16, 1876. The first American production was at the Metropolitan Opera House, New York, November 9, 1887. See RING OF THE NIBELUNGEN.

SIEGFRIED, KARL (1830-1903). A German Protestant theologian, born at Magdeburg. He was called to the University of Jena in 1875 as professor of Old Testament literature. In 1885 he was appointed to the Lutheran Consistory, and in 1892 was made privy councilor of that body (*Geheimer Kirchenrat*). The following publications bear his name: *Spinoza als Kritiker und Ausleger des Alten Testaments* (1867); *Eusebii Canonum Epitome* (with H. Gelzer, 1884); *Lehrbuch der neuhebräischen Sprache und Litteratur* (with Strack, 1884); and *Hebräisches Wörterbuch zum Alten Testament* (with Stade, 1893).

SIEGLIND, *zēg'lint.* In the Nibelungen legend, the wife of Siegmund and mother of Siegfried.

SIEMENS, *zē'mĕns,* ERNST WERNER VON (1816-92). A German electrical engineer. He was born at Lenthe, near Hanover, and was educated in the Gymnasium of Lübeck and in the school of artillery and engineering at Berlin, becoming an artillery officer in 1838. He studied chemistry and electro-magnetism, and invented a process for electro-plating in 1841. In 1848 he became commandant of the artillery arsenal in Berlin. He was the first to explode a submarine mine by electricity (1848). Devoting himself to electrical engineering, he was engaged after 1849 in the establishment of telegraph lines, particularly through Russia, Brazil, Spain, and Northern Germany. In 1856 he devised the improved shuttle armature which increased the efficiency of the magneto-machine, and in 1876 demonstrated that its electro-magnets could be used without separate exciters, the current being passed through the field coils. He proposed as the unit of resistance a column of mercury one meter long and one square millimeter in cross-section at 0° Centigrade. This was known as the Siemens unit. Siemens was also active in promoting electric traction in Germany, and the first electric railway was erected at the Berlin Industrial Exhibition of 1879 by Siemens & Halske. His researches in electricity resulted in discoveries and improvements of great value, one of which was the determining of the locations of injuries in submerged cables, and also of charging them in order to reduce the disturbing influence of induced currents. In 1884, by the gift of about $125,000, he made possible the foundation of the Imperial Physico-Technical Institute (Reichsanstalt), which has been an important factor in German scientific research and manufacturing. (See LABORATORY.) He wrote numerous scientific works and also a volume of *Personal Reminiscences* which has been translated into English.

SIEMENS, Sir WILLIAM (KARL WILHELM) (1823-83). An English engineer and metallurgist. He was born at Lenthe, Hanover, and was a brother of Werner Siemens (see above), with whom he was associated in many scientific investigations and commercial enterprises. He was educated at Magdeburg and Göttingen and then entered a manufacturing establishment in the former town. He visited England in 1843 to introduce his brother's process of electro-plating, and again in 1844, when he endeavored to dispose of the English rights of a chronometric governor for steam engines and the anastatic process of printing. Settling in England, but maintaining close connection with his brother, he devoted himself to perfecting a regenerative steam engine, but was not altogether successful, and turned his attention to a water meter, which soon came into extensive use. His next and most important invention was the regenerative furnace, which he applied to iron and steel working, and to which from time to time he added important improvements. (See IRON AND STEEL.) He was interested with his brother in various electrical enterprises and conducted the British branch of the business, which in 1874 laid the direct Atlantic cable from the ship *Faraday*, a vessel specially designed by him for that purpose. Sir William played an important part in the application of electricity to lighting and traction in England. Besides his many useful inventions, among which were a pyrometer and the bathometer (q.v.), apparatus for producing low temperatures (see REFRIGERATION), he also carried on important investigations in pure science. In 1859 he became a British subject, and in 1883 he was knighted. He received many honors, including the Bessemer medal of the Iron and Steel Institute of Great Britain, the French Legion of Honor, and honorary degrees from the universities of Oxford, Dublin, and Glasgow. He was president of the Society of Telegraph Engineers, the Institution of Mechanical Engineers, the Iron and Steel Institute, and the British Association for the Advancement of Science, in addition to being a member of many other British and foreign societies. A laboratory of electrical engineering was constructed by his widow at King's College, London, as a memorial. His

collected works were published in 1889. Consult Pole, *Life of William Siemens* (London, 1889).

SIEMERING, zē'me-ring, RUDOLF (1835-1905). A German sculptor, born at Königsberg. Having frequented the academy there, he studied afterwards under Bläser in Berlin, where his first important work was the marble statue of King William, for the Exchange, and where, in 1882, he completed the handsome monument to Dr. Gräfe, the famous oculist. This was preceded by the monument of Frederick the Great (1877) at Marienburg and followed by the statue of Luther (1883) at Eisleben and the "War Monument" (1888) on the Market Square at Leipzig, his principal work. Besides the "Washington Memorial" at Fairmount Park, Philadelphia (1883, unveiled 1897), there are to be noticed the equestrian statue of William I. (1897) at Magdeburg, and in Berlin the heroic statue of William I. (1892) in the Hall of the Rulers, at the Arsenal, the group in bronze of "Saint Gertrude" (1896) on the Gertraudt Bridge, and the marble group of "Frederick William I." (1900) in the Sieges-Allée.

SIEMIRADZKI, syĕ'mē-rädz'kē, HENRYK (1843-1902). A Polish historical painter, born near Kharkov, Little Russia. After frequenting the Academy of Saint Petersburg he traveled in Germany, France, and Italy, and spent some time in Munich. In 1872 he settled in Rome, whence he sent home his "Christ and the Adulteress" (1873, Alexander Museum, Saint Petersburg). The subjects of most of his brilliantly colored pictures are scenes from the life of ancient Greece and Rome, witness his first large composition, "The Living Torches of Nero" (1876, National Museum, Cracow), which was exhibited all over Europe and brought him the decoration of the Legion of Honor in 1878. He also painted "Orgy in the Time of Tiberius," "Vase or Woman?" (1878, Kestner Museum, Hanover), "Sword Dance" (1880), "Phryne at Eleusis" (1889, Alexander Museum, Saint Petersburg), also themes from the New Testament, to wit, "Christ with Mary and Martha" (1886, ib.), "The Last Supper" (Church of the Saviour, Moscow), and "Christ Pouring Oil on the Troubled Waters" (Evangelical Church, Cracow).

SIENA, sē-ā'nȧ. The capital of the Province of Siena, in Tuscany, Italy, picturesquely situated on the crests of three hills, over 1000 feet above the sea, near the Elsa, 60 miles by rail south of Florence and only 30 miles in a straight line (Map: Italy, F 4). It is a delightful mediæval city. The climate is salubrious, the weather, owing to the elevation, not being hot in summer. The town is irregularly built, with crooked, steep, and narrow streets, and retains its ancient walls. The centre of life in Siena is the fine Piazza del Campo, bordered by rich palaces. Of these structures the Palazzo Pubblico and the Palazzo del Governo are the most striking. The former is of brick, was begun in 1289, and combines Gothic with Renaissance features. The interior is covered with mural decorations. The Palazzo del Governo, dating from 1469, has an interesting façade and holds the important archives of Siena. The fine brick Gothic Buonsignori Palace is also worthy of mention.

Siena is famous for its cathedral. This edifice, which is situated on the crowning point of the city, dates from the thirteenth century. It has a dome, a campanile, and is irregular in shape. Its façade, begun in 1284 and planned by Giovanni Pisano, is a far-famed rival of that of the Orvieto Cathedral, and is composed of black, white, and red marble, varied with profuse decorations. The interior is also remarkable, its pavement ornamented with graffito scenes from biblical history being of exceptional interest. There are also in the cathedral a noteworthy portal, Donatello's bronze statue of John the Baptist, and a rare pulpit by Niccola Pisano and others. The splendid structure containing the cathedral library was built in 1495 and was decorated by Pinturicchio. The Church of San Giovanni is noteworthy. It was begun in the early fourteenth century and has an uncompleted façade. The Oratorio di San Bernardino is important for its pictures by Sodoma. In San Domenico is the Chapel of Saint Catharine of Siena, where the head of the saint is supposed to lie in a reliquary. In the Fontegiusta Church is a splendid high altar.

Siena is a lively trading and manufacturing town, weaving being the conspicuous industry. Cloth, silk, velvet, and furniture are exported. The university was famous in the Middle Ages, but now has only two faculties—one of law, and one of medicine and surgery. The Reale Collegio Tolomei (lyceum) deserves to be mentioned. The institute of fine arts is notable for its early Sienese specimens. The Opera del Duomo also possesses an art collection. The school of arts and trades was founded in 1876. The public library, dating from 1663, contains 75,000 volumes and 500 manuscripts. The population in 1901 was 28,355.

HISTORY. Siena (Lat. *Sena Julia* and *Colonia Seniensis*) was made a Roman colony in the time of Augustus. The city rose to great importance in the Middle Ages. The people wrested the governing power from the nobles in the twelfth century. The city became a Ghibelline stronghold, and in 1260 its citizens defeated the Guelphs of Florence at Monte Aperto. A few years later, however, it was forced by Charles of Anjou to join the league of the Guelph cities of Tuscany. It was at the height of its prosperity at the time of the Renaissance. In 1557 it was annexed to the Florentine dominions. In the history of art from 1200 to 1500 Siena stands in the front rank among Italian cities. Consult: Andreucci, *Siena e la sua provincia* (Siena, 1886); Richter, *Siena* (Leipzig, 1901); Douglas, *History of Siena* (London, 1902).

SIENA, COUNCIL OF. A council originally summoned to meet at Pavia by Pope Martin V., in pursuance of the undertaking entered into by him at the Council of Constance, but transferred two months later on sanitary grounds to Siena, where it sat from July 21, 1423, to March 7, 1424. Owing to the uncertainty of the times so soon after the close of the great schism, it was unable to effect much. It condemned the Wiclifite and Hussite doctrines, and took measures for a general suppression of heresy. Before its adjournment Basel was chosen as the place of assembly for the next general council. See BASEL, COUNCIL OF.

SIENESE SCHOOL OF PAINTING. The principal Italian school of painting, next to the

Florentine, in the later thirteenth and fourteenth centuries; during the fifteenth it declined. As compared with the Florentine school (q.v.) it was more detailed in finish, brighter in color, and more refined in sentiment, but inferior in line and dramatic action, and less naturalistic. It appealed to sentiment rather than understanding; its subjects were the ideals and feelings of the Middle Age, and it retained more of the Byzantine elements than did the Florentine. Its founder was Duccio (active 1282-1339), whose pupil Simone Martini ranked with Giotto in the estimation of contemporaries. Among his followers the influence of the school of Giotto makes itself felt, but while gaining in religious earnestness, they retained the essentially Sienese qualities. This combination appears in the brothers Pietro and Ambrogio Lorenzetti, the principal followers of Simone. Others, like the Bartoli brothers and Sano di Pietro, carried the antiquated style far into the fifteenth century. The true successor of the Sienese was the Umbrian school (q.v.), which expressed the same sentiment in the forms of the Renaissance.

During the sixteenth century a new school arose in Siena, by Sodoma (q.v.) (1477-1599), a pupil of Leonardo. Its art, however, was a transplanting of the Lombard manner rather than anything specifically Sienese. The chief representatives of the school are Girolamo della Pacchia, the architect Peruzzi, and Domenico Beccafumi. Consult: Crowe and Cavalcaselle, *History of Painting in Italy* (London, 1866); Berenson, *Central Italian Painters of the Renaissance* (New York, 1897); and the general histories referred to under PAINTING.

SIENKIEWICZ, syĕn-kyĕ'vĕch, HENRYK (1846—). A famous Polish novelist, born in Wola Okrzejska, Government of Siedlce. On graduating from the Realgymnasium at Warsaw he studied philosophy at the university of that city and made his literary début in 1872 with a humorous story, *Nobody is a Prophet in His Own Country*. In 1876 he visited California and described his experiences in a series of letters to the *Polish Gazette* (of Warsaw) under the pseudonym "Litwos." They attracted much attention by their keen observation, quaint humor, and generally attractive style. His drama, *On a Card*, dealing with the party struggles in Galicia (1879), as well as his stories, *From the Note-Book of a Posen Teacher*, *Hanja*, and *Yanko the Musician*, increased his popularity. In 1880 he produced the novel *The Tatar Bondage*. Its success induced him to continue work in the same line, and the great novel *With Fire and Sword* (1884), with its sequels, *The Deluge* (1886) and *Pan Michael* (1887-88), followed. Beyond any doubt they are the greatest novels dealing with the struggle of the Poles and Cossacks. The characters are often untrue to history, but the Dumas-like power of evoking an historical personage and surrounding it with a halo of romanticism places Sienkiewicz's works among the most enjoyable of historical novels. His *Without Dogma* (1890) is a study in pathological psychology. *The Children of the Soil* (1894) is a novel of contemporary Polish manners. *Quo Vadis* (1895) brought its author greater fame than all his previous efforts. He sagaciously saw and fully exploited the dramatic possibilities of the remarkable epoch of Nero's reign for an historical novel. Its success as a novel was enormous, and it has several times been dramatized. His *Knights of the Cross* takes the reader back to the time of the struggles between the Poles and the Teutonic Order. Sienkiewicz was editor-in-chief of the periodical *Slowo* (*The Word*) for many years. His works have been translated into several European languages. There are at least three different translations in English, the one by Jeremiah Curtin being sanctioned by the author.

SIERO, sē-ā'rō. A town of Northern Spain, in the Province of Oviedo, situated 10 miles east of Oviedo. There are coal mines in the neighborhood, and the town has considerable manufactures of leather, as well as soap and cloth. Population, in 1887, 22,218; in 1900, 22,657.

SIERRA LEONE, sē-ĕr'rȧ lē-ō'nē. A colonial possession of Great Britain on the west coast of Africa. The colony proper comprises a narrow strip along the coast from the Great Scarcies River (the boundary line of French Guinea) to the Mano River (the boundary line of Liberia), including also the islands of Sherbro, Banana, Turtle, the Los group farther north, and a number of other islets, having an estimated area of about 4000 square miles (Map: Africa, C 4). The protectorate extends inland for about 180 miles. Total area, about 30,000 square miles. The coast is low and marshy and lined with sand banks and lagoons. The peninsula is traversed by a range of hills reaching in the Sugar Loaf an altitude of about 3000 feet. The interior is usually described as hilly and rising toward the north. The region is well watered by the Great and the Little Scarcies, the Rokelle, the Jongor Bampanna, and the Great Bum, all flowing into the Atlantic, and some of them navigable in the lower course. Sierra Leone has long been known as the 'white man's grave' on account of its deadly climate. This characterization, however, is true only of the low coast region, the climate of the interior being less unhealthful. The dry season in the coast region lasts from the beginning of January to the end of March, and the real wet season sets in at the end of May and continues to the end of October. The dry season is characterized by a persistent dry northeast wind. The rainfall is very heavy, ranging at Freetown on the coast from about 140 to over 200 inches per annum. The mean annual temperature at Freetown is about 80° F. The principal products are kola nuts, palm kernels and oil, and gum copal. The output of groundnuts and hides is gradually declining. The imports of the colony are constantly increasing, while the exports show a slight falling off. The total trade in 1901 amounted to over $4,150,000, of which the imports represented about $2,700,000. There are a number of good roads in the coast region and over 70 miles of railway lines leading from Freetown into the interior. The Colonial Governor is assisted by nominated executive and legislative councils. The capital is Freetown. The protectorate is divided into five districts, each in charge of a European commissioner. There are about 80 primary schools, with an enrollment of about 8000, maintained by various missionary organizations, and also a number of Mohammedan schools maintained by the Government. The revenue and expenditure of the colony amounted in 1901 to $910,242 and $844,735 respectively. The

debt had reached by 1902 the sum of $2,228,828. The population of the colony proper, in 1901, was 76,655, of whom 444 were white, and 33,518 liberated Africans and their descendants. The Christians numbered 43,045, the pagans 24,099, the Mohammedans 9504. The population of the protectorate is estimated at 1,000,000.

The coast of Sierra Leone was discovered by the Portuguese in the fifteenth century and settled by the English in the seventeenth century, but soon abandoned. In 1787 a colony of fugitive slaves was sent there by English philanthropists, who had purchased some territory from the natives. The first attempt having proved unsuccessful, a second settlement was established in 1791, and in 1792 the colony was augmented by 1200 fugitive slaves from Canada and the Bahamas. In 1807 the company transferred its territory to the Crown and in 1896 a British protectorate was declared over the hinterland.

Consult: Jackson, *The Settlement of Sierra Leone* (London, 1884); Banbury, *Sierra Leone* (ib., 1888); Ingham, *Sierra Leone After a Hundred Years* (ib., 1894); Pierson, *Seven Years in Sierra Leone* (ib., 1897); Crooks, *A Short History of Sierra Leone* (Dublin, 1901).

SIERRA MADRE, mä'drā. A name borne in common by the two chief mountain ranges of Mexico, which are nearly parallel to either coast and inclose the great central plateau of Anahuac (q.v.). The western range is often distinguished as the Sierra Madre Occidental or Sierra Madre del Pacífico, while the eastern range is called the Sierra Madre Oriental. They are widely separated in the north, but gradually converge toward the south. A little to the south of Mexico City the intervening plateau is bridged over by the range of lofty volcanoes known as the Cordillera de Anahuac, and farther south the two ranges merge in the mountains of Oaxaca. The western or Pacific range is more continuous than the eastern, and also considerably higher and more rugged in its scenery. Its average height is over 8000 feet, with some peaks rising above 10,000 feet, and its sides are cut by deep and narrow cañons with numerous precipitous crags. The lower slopes are covered with grass; higher up are forests of oak, while pine forests cover the high ridges. Both ranges consist of Archæan crystalline rocks, largely granite, with intrusions of basaltic and other volcanic rocks. The system does not seem to be connected with the South American Andes, and its structural connection with the Rocky Mountains of the north has not been clearly shown.

SIERRA MADRE. A mountain range extending along the eastern coast of Luzon (q.v.).

SIERRA MORENA, mō-rā'nä. A mountain range of Spain running along the southern edge of the great central plateau, and forming the boundary between the provinces of Ciudad Real on the north and Jaén and Cordova on the south (Map: Spain, D 3). It rises but slightly above the plateau, its average elevation being about 3500 feet, but on the south it falls in a steep and imposing escarpment toward the low valley of the Guadalquivir. The railroad from Madrid to Cordova crosses it through several tunnels in the romantic pass called the Puerto de Despeñaperros.

SIERRA NEVADA, nā-vä'dä (Snowy Range). A mountain range of Southern Spain, extending from the centre of the Province of Granada about 60 miles eastward into the Province of Almería, its crest being about 28 miles from the Mediterranean coast (Map: Spain, D 4). It forms a part of the mountain system separating the valley of the Guadalquivir from the southern coast, and is the highest elevation of the Iberian Peninsula. Its greatest height is near the western end, where the peak of Mulahacén has an altitude of 11,420 feet, and that of Veleta 11,385 feet. Eastward it merges gradually into a lower plateau region. It sends out numerous spurs inclosing deep valleys, and on the north falls in wild and rocky precipices toward the Jenil River, on whose banks lies the city of Granada. The range consists mainly of mica slate, and though the low valleys are covered with a rich vegetation, the bulk of the mountain consists of naked rocks. It is covered with snow a great part of the year, and on the Veleta there are permanent glaciers, the southernmost of Europe.

SIERRA NEVADA, nā-vä'dä. A mountain range in eastern California, forming the divide between the Great American Basin and the valley of the Sacramento and San Joaquin rivers (Map: California, D 3). It is a tilted plateau 80 miles wide and extending in a north-northwest direction, 400 or 500 miles according as the range is considered to end at Lassen Peak or at the northern State boundary. In the south it turns westward and merges with the Coast Range, and in the north it is continued into Oregon as the Cascade Mountains. It consists of a granitic core exposed in the higher portions, flanked by metamorphic slates, and in the lower western slopes by later marine deposits ranging from Carboniferous to Cretaceous. North of Lassen Peak, in the northern part of the State, these formations disappear under the great Oregon lava flow, so that here the Cascade Mountains may be said to begin, although the name Sierra Nevada is often extended up to the State boundary so as to include Mount Shasta. The average elevation of the crest is 10,000 feet in the southern half and somewhat less in the north. The range falls abruptly on the east to the valley floor of the Great Basin, 5000 feet below, while on the west it has a wider and more gradual slope. The Sierra Nevada, whose greatest elevation but slightly exceeds that of the Rocky Mountains, appears much more massive and impressive than the latter range, as it rises from a much lower level. The number of peaks, however, is not as great as in Colorado, though there are at least 14 peaks over 12,000 feet high. The highest peaks are clustered near the southern end, and here Mount Whitney, the highest point in the United States proper, attains an altitude of 14,898 feet. Other high points are Fisherman Peak, 14,448 feet; Mount Corcoran, 14,093 feet; Mount Kaweah, 14,000 feet; Mount Brewer, 13,886 feet; Mount Lyell, in the Yosemite Park, 13,042 feet; and in the extreme north Mount Shasta, with an altitude of 14,380 feet. The higher portions of the range are covered with perpetual snow, and the northern slopes of some of the peaks are occupied by glaciers. The snowfall is heavy on the western slope, and feeds a large number of streams flowing to the Sacramento and San Joaquin Rivers. These streams have cut up the slope into deep valleys, some of which, notably

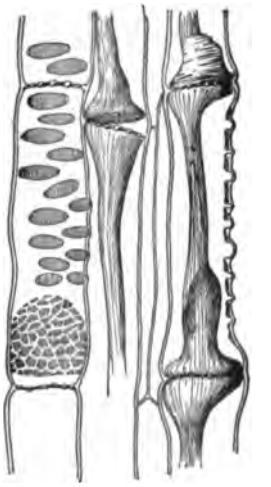
the Yosemite Valley, are remarkable for their scenery. The Sierra Nevada is covered to a height of 8000 feet with dense forests of coniferous trees, which yield to deciduous on the lower western slope. The western slope, above the deciduous zone, is the exclusive habitat of the 'big trees' (*Sequoia gigantea*). Though it is a practically unbroken divide, there are several passes leading across the range at altitudes of 4000 to 7000 feet. Of these the Truckee Pass in the north and the Tehachapi Pass in the south are traversed by railroads.

SIEVERS, *zē'vĕrs,* EDUARD (1850—). A German philologist, born at Lippoldsberg, Prussia. He was educated at Leipzig and Berlin, and became professor extraordinarius of Germanic and Romance philology at Jena in 1871, receiving a full professorship there five years later. In 1883 he went to Tübingen, and in 1887 to Halle, whence he was called in 1892 to Leipzig. Among the numerous contributions of Sievers to Germanic philology may be mentioned his editions of *Tatian* (2d ed. 1892), the *Heliand* (1878), and, in collaboration with Steinmeyer, *Die althochdeutschen Glossen* (4 vols., 1879-98), besides the *Oxforder Benediktinerregel* (1887). His original works on Germanics include *Der Heliand und die angelsächsische Genesis* (1875), *Angelsächsische Grammatik* (3d ed. 1898), and *Zum angelsächsischen Vokalismus* (1900). He also made important contributions to metrics in his *Altgermanische Metrik* (1892) and his *Metrische Studien* (1901-02), dealing with Hebrew metres, while his *Grundzüge der Phonetik* (5th ed. 1901) is one of the standard works on phonetics. In 1891 he became an editor of Paul and Branne's *Beiträge zur Geschichte der deutschen Sprache und Litteratur*, and contributed to Paul's *Grundriss der germanischen Philologie* (Strassburg, 1891 et seq.) the sections on runes, Gothic language and literature, and Germanic metre.

SIEVERS, JAKOB JOHANN, or YAKOFF YEFIMOVITCH, Count (1731-1808). A Russian statesman, born at Wesenberg, Esthonia. He served in the Foreign Office, was secretary to the Copenhagen and London embassies, and was in active service in the Seven Years' War. Made Governor of Novgorod (1764) and Governor-General of Novgorod, Tver, and Pskov (1776-81), he introduced many important reforms. After eight years of retirement he was appointed (1789) Ambassador to Poland, and was chiefly instrumental in bringing about the second and third partitions of Poland. Recalled in 1794, he lived in retirement until Czar Paul made him Senator (1796), and in 1797 he was intrusted with the direction of water communications. The canal he built (1798-1803) between the Volkhoff and Msta Rivers bears his name. Consult Blum, *Ein russischer Staatsmann. Des Grafen Jacob Johann Sievers Denkwürdigkeiten zur Geschichte Russlands* (Leipzig, 1857-58).

SIEVERS, WILHELM (1860—). A German geographer, born at Hamburg. He was educated at Jena, Göttingen, and Leipzig, and was made privat-docent at Würzburg in 1887 after extensive travels in Venezuela and Colombia. In 1892 he undertook for the Geographical Society of Hamburg further explorations in South America. The following publications bear his name: *Reise in der Sierra Nevada de Santa Marta* (1888); *Die Kordillere von Merida* (1888) and *Venezuela* (1888); *Allgemeine Länderkunde* (5 vols., 1891-95); and *Zweite Reise in Venezuela* (1896).

SIEVE VESSELS. Tube-like elongated cells, characteristic of the phloem (q.v.), placed end



SIEVE VESSELS OF PUMPKIN.

to end and communicating with one another by means of perforated areas (sieve plates) in the walls. See HISTOLOGY; WOOD.

SIEYÈS, *sē'ä'yâs',* EMMANUEL JOSEPH, Count (1748-1836). A French revolutionary leader and publicist, generally known as the Abbé Sieyès. He was born at Fréjus, and was educated at Paris with a view to entering the Church. He was made a canon in Brittany (1775) and was later transferred to the Cathedral of Chartres. He soon became diocesan chancellor and vicar-general. He had liberal opinions on all social and political matters, and in 1789 he issued his famous pamphlet entitled: *Qu'est-ce que le tiers-état?* This work, which claimed political recognition for the people, obtained an immense popularity and procured his election as Deputy to the States-General from Paris. Mainly through his urgency and influence, the representatives of the people took the decisive step of constituting themselves into an independent body, on June 16, 1789, and became the National Assembly. In this body Sieyès figured as one of the most prominent leaders. In 1790 he was elected President of the National Assembly. By this time, however, bolder and fiercer spirits had passed him in the race for power and popularity, and in the Convention of 1792 he refrained from any active participation in the debates, and on the occasion of the King's trial he recorded a silent vote for death without appeal to the people. While Robespierre and his party were in power, he retired from Paris. On the fall of Robespierre he returned to the Convention and resumed his active interest in affairs, becoming a member of the Council of Five Hundred. He was engaged chiefly in the Department of Foreign Affairs, and he went in 1798 as Ambassador to Berlin to secure the neutrality of Prussia. He became a member of the Directory in 1799, and among other

measures he succeeded in closing the celebrated Jacobin Club. Perceiving that a dictator was needed in France, he became anxious to secure the coöperation of some powerful military leader, and on the return of Bonaparte from Egypt he entered into a league with him, the result of which was the Revolution of the 18th Brumaire (November 9, 1799) and the institution of the provisional Consulate, Sieyès, Napoleon, and Roger Ducos being the first three consuls. Sieyès and Napoleon differed irreconcilably as to the distribution of power, but the former had to give way, and finally retired from the Government. As a reward for his services he received on his retirement a sum of 600,000 francs, the estate of Crosne, and a seat in the Senate. The title of Count of the Empire was conferred upon him. Banished at the second Restoration as a regicide, he went to Brussels, and did not return to France till after the Revolution of 1830, when he was elected a member of the Academy. He died in Paris. His *Reconnaissance et exposition des droits de l'homme et du citoyen* (Paris, 1789) undoubtedly led up to the famous Declaration of the Rights of Man. His famous constitution is found explained in Boulay, "Théorie constitutionelle de Sieyès," from the *mémoires inédits* of Sieyès (Paris, 1836). Consult also Mignet, *Etude sur Sieyès* (Paris, 1836).

SIGEBERT (sig'e-bĕrt) **OF GEMBLOURS,** zhäN'blōōr' (c.1030-1112). A Flemish chronicler, born in Brabant. He worked under Abbot Obert in the cloister of Gemblours, from which he went to study under Saint Vincent at Metz, and then returned to Gemblours. His principal work is *Chronicon*, a chronicle of the world to 1111. Consult Hirsch, *De Vita et Scriptis Sigeberti* (Berlin, 1841).

SIGEL, sē'gel, FRANZ (1824-1902). A German-American soldier, born at Sinsheim, in Baden. In 1848 he took a prominent part in the revolutionary movement in Baden, and on the renewed outbreak of the insurrection, in the spring of 1849, commanded the troops on the Neckar. In May he was made a member of the provisional government and Minister of War; later he became Mieroslawski's adjutant-general, and after that general's retirement, in July, Sigel led the remainder of the revolutionary army, which retreated into Switzerland. In 1852 he emigrated to the United States; and in 1858 he went to Saint Louis, where he taught in a German military institute, and edited a military periodical. On the outbreak of the Civil War he espoused the side of the North, and organized a regiment of infantry and a battery of artillery, which rendered good service in the occupation of Camp Jackson. On July 5, 1861, he was defeated in the battle of Carthage; later he took part in the battle of Dug Springs; and after the death of General Lyon at Wilson's Creek, conducted the retreat of the army. He was made a brigadier-general of volunteers, and at the battle of Pea Ridge, March 8, 1862, he ordered a well-timed charge which decided the day. Soon afterwards he was made a major-general of volunteers, and was placed in command of Harper's Ferry. He commanded the First Corps in the campaign which terminated with the second battle of Bull Run, August, 1862, and in February, 1864, was given command of the Department of West Virginia. He soon afterwards led an expedition into the Shenandoah Valley, but on May 15th was defeated at New Market by a force under General Breckenridge. In consequence he was relieved of his command by General Hunter, and was put in charge of the division guarding Harper's Ferry. In the following July, he successfully defended Maryland Heights against General Early, but the Administration had lost confidence in him, and he was relieved of command. He resigned from the army in May, 1865, and was for a short time editor of the Baltimore *Wecker*. From 1871 until 1874 he was register of New York City, and from 1886 until 1889 was United States pension agent at the same place. He also lectured, engaged in the advertising business, and for several years published the *New York Monthly*, a German-American periodical.

SIGHT (AS. *ge-sihþ*, OHG. *ge-siht*, Ger. *Gesicht*, from AS. *sēon*, OHG. *sehan*, Ger. *sehen*, to see; connected with Lat. *sequi*, Gk. ἕπεσθαι, *hepesthai*, Lith. *sekti*, Skt. *sac*, to follow), DEFECTS OF. Under this head we shall consider certain affections of the eyesight due to some known or unknown peculiarity of the optical apparatus (including the optic nerve)—viz. near-sightedness, far-sightedness, double vision, color-blindness, night-blindness, and day-blindness. Defects due to errors of refraction include the first two of these.

Near-sightedness, short-sightedness, or *myopia* is often popularly confounded with dim or weak sight; but in reality short sight applies exclusively to the *range* and not to the *power* of sight, and a short-sighted person may possess the acutest power of vision for near objects. In this affection, the rays which ought to come to a focus upon the retina converge to a point more or less in front of it. The cause of this defect probably differs in different persons. It nearly always arises from elongation of the globe in its antero-posterior diameter, more rarely from increased curvature of the cornea, increase in refractive power of the lens in the early stage of senile cataract, or from an imperfect power of the eye to adjust itself to objects at various distances. The distance at which objects are perceived most distinctly by the perfectly normal eye ranges from 16 to 20 inches; an eye which cannot perceive objects distinctly beyond 10 inches may fairly be regarded as short-sighted; and in extreme cases the point of distinct vision may be 3, 2, or even only 1 inch from the eye. There is frequently an hereditary tendency to near-sightedness, but it is rarely congenital. It is often acquired by excessive use of the eyes at an early age for reading or other near work. Overstudy under unfavorable circumstances and poor health favor its development. As a general rule the inhabitants of towns are much more liable to it than persons living in the country, and students and literary men are the most liable of all. The frequency of this affection in the cultivated ranks points directly to its principal cause—tension of the eyes for near objects. Prolongation of the visual axis is attributed to (1) pressure of the muscles on the eyeball in strong convergence of the visual axis; (2) increased pressure of the fluids resulting from accumulation of blood in

the eyes in the stooping position; (3) congestive processes in the base of the eye, which, leading to softening, give rise to extension of the membranes; (4) the shape of the orbit in broad faces, causing excessive convergence, the trouble occurring especially in such persons. That in increased pressure the extension occurs principally at the posterior pole is explained by the want of support from the muscles of the eye at that part. Now, in connection with the causes mentioned, the injurious effect of fine work is, by imperfect illumination, still more increased; for thus it is rendered necessary that the work be brought closer to the eyes, and that the stooping position of the head, particularly in reading and writing, is also increased. Hence it is that in schools where, by bad light, the pupils read bad print in the evening, or write with pale ink, the foundation of myopia is mainly laid. On the contrary, in watchmakers, although they sit the whole day with a magnifying-glass in one eye, we observe no development of myopia, undoubtedly because they fix their work only with one eye, and, therefore, converge but little, and because they usually avoid a very stooping position.

So far from short-sightedness improving in advanced life, as is popularly believed, it is too frequently a progressive affection; and every progressive myopia is threatening with respect to the future. Those cases in which the myopia develops slightly in young persons and practically becomes arrested are called *simple* or *stationary myopia*. *Progressive myopia* is the form which increases steadily with degenerative changes in the choroid and other deep structures. Persons with uncorrected myopia of any severity have a characteristic vacant expression from constant inability to see any other than near objects.

In the treatment of myopia the principal objects are: (1) to prevent its further development and the occurrence of secondary disturbances; and (2), by means of suitable glasses, to render the use of the myopic eye easier and safer.

(1) To effect, if possible, the first object, the patient must look much at a distance, but as we cannot absolutely forbid his looking at near objects, spectacles must be provided which render vision distinct at from 16 to 18 inches. Moreover, it is desirable that at intervals of a half hour work should be discontinued for a couple of minutes, and no working in a stooping position should be permitted. The patient should read with the book in the hand, and in writing should use a high and sloping desk, with good but not too strong light from behind. If the myopia increases, all near work should be given up for life out of doors.

(2) The optical remedy for short sight obviously consists in concave glasses of a focus suited to the individual case. At first sight it might be supposed that glasses with a concavity exactly sufficient to neutralize the defect in the eye would always suffice; and when the glasses are used exclusively for distant vision, or when the affection is slight, and the eye is otherwise healthy, perfect neutralization is admissible; but many require different glasses for distance and reading. An oculist of reputation should always, if possible, be consulted as to the choice of spectacles. Glasses, if injudiciously selected, usually aggravate the evil they are intended to remedy; and in connection with this subject may be mentioned the prevalent habit in foreign countries of employing a single eyeglass; it is most prejudicial to the eye which is left unemployed, and often leads to its permanent injury.

Far-sightedness, hyperopia, or *hypermetropia* is an error of refraction in which parallel rays are brought to a focus behind the retina, usually on account of shortening of the eyeball, sometimes from diminished convexity of cornea or lens, absence of the lens, or changes in the media. It is more common than myopia, is congenital and often hereditary. As the hyperopic eye is obliged to accommodate for parallel rays, it is constantly strained unless corrected by proper convex glasses. If uncorrected it leads to symptoms of asthenopia or eye-strain, frontal and occipital headaches, pain in the eyes, congestion and burning sensations in the lids and eyeballs.

Presbyopia (derived from the Greek words πρέσβυς, an aged person, and ὤψ, *ops*, the eye), or old sight, is a change which naturally occurs in every eye between the 40th and 45th year. On account of loss of elasticity of the lens, the power of accommodation is diminished. The stated time for the occurrence of presbyopia has been arbitrarily fixed, as that is the period at which the near point, the nearest point to the eye at which ordinary print can be easily read, has receded to nine inches and some discomfort is experienced. The near point really begins to recede at ten years of age, and continues to do so through life. If uncorrected there is difficulty in reading, blurring of print, and symptoms of eye-strain as in hyperopia. Correction is secured by convex spherical glasses, which bring the near print to a comfortable distance with respect to the person's occupation. Allowance must be made for coexisting myopia, hyperopia, or astigmatism, and the strength increased at intervals.

Double vision, or *diplopia*, is of two kinds. It may arise from a want of harmony in the movements of the two eyes, the vision of each eye being perfect; or there may be double vision with one eye only. The first form may occur in cases of weakness or paralysis of one or more of the muscles of the orbit, which results in squinting. In squinting (see STRABISMUS), the vision of the most distorted eye is almost always imperfect; and it is well known that impressions on the two retinæ are similar in kind but dissimilar in form. The mind takes cognizance only of the former; so that a person with a bad squint sees objects with the sound eye only. But if the sight of both eyes is nearly equal, as often is the case when the squint is not very well marked, double vision results whenever both eyes are employed together, in consequence of images of nearly equal intensity falling on non-corresponding parts of the two retinæ. This variety of double vision can be corrected by suitable glasses. The second form of double vision—viz. double vision with a single eye—is a much more rare affection than the preceding one, and depends upon some irregular refraction of the cornea or lens.

Color-blindness is noticed under its own name.

Night-blindness, or *hemeralopia* (from the Greek, signifying 'day-sight'), is a peculiar form of intermittent blindness, the subjects of which see perfectly with an ordinary light, but become entirely and almost instantaneously blind as soon as twilight commences. It is seldom encountered in this country except among sailors just re-

turned from tropical regions. It is frequent among the natives of some parts of India, who attribute it, as sailors do, to sleeping exposed to the moonlight. The most probable cause of the affection is, however, exhaustion of the power of the retina from the over-excitement of excessive light, so that this organ is rendered incapable of appreciating the weaker stimulating action of twilight or moonlight.

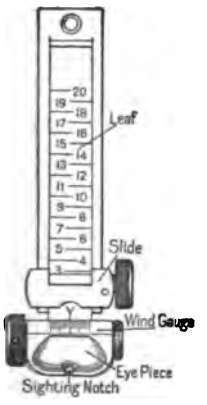
Snow-blindness must be regarded as an allied affection to the preceding.

Day-blindness, or *nyctalopia*, refers to the condition in which the sight is better in a feeble light, as at dusk, than in bright light. This occurs in amblyopia (q.v.) from the abuse of tobacco, and in cases in which there is defective vision of the central portion of the visual field. For example: if there is an opacity of the central portion of the lens or cornea, the dilatation of the pupil which takes place in a feeble light allows the person to see through the unobstructed portion of the cornea or lens surrounding the opacity.

Colored vision sometimes occurs either with or without retinal changes. Red vision, erythropsia, occurs after extraction of a cataract. Xanthopsia, or yellow vision, may follow the ingestion of santonin, gelsemium, digitalis, chromic and picric acids, and amyl nitrate. Cannabis Indica sometimes causes violet vision. Red or blue vision may result from the use of iodoform, and cocaine has caused colored vision. Phosphorus is said to cause sparks and flashes of light, and the same is said to be caused at times by belladonna and santonin.

Other defects of sight are described under the headings AMAUROSIS; AMBLYOPIA; ASTIGMATISM; HEMIOPIA; HETEROPHORIA. See VISION.

SIGHTS. The means by which cannon or small arms are pointed or aimed. There are almost as many varieties as there are varieties of weapons. With modern high-power guns, telescopic sights are necessary on account of the difficulty of seeing the target at the extreme long range of which these guns are capable. The Scott telescopic sight, the invention of an English navy officer, with its various modifications, is probably the most generally used. In small arms two points are installed, one near each end of the barrel, so that when the rifle or pistol is brought to the position of firing the sights come readily into coincidence for the eye and enable the aim to be directed at the object. The sights must represent the direct line in which the bullet is projected. It is evident, therefore, that some form of adjustment is necessary if the sights are to be used at more than one distance. In military rifles sufficient adjustment must be given to enable the aim to be accurately taken at any range up to 2500 yards. Military sights are all variations of one general type and usually consist of a leaf either lying flat or hinged upon a bed or block fixed to the barrel. The leaf must be raised to secure additional elevation, the distance being regulated by a sliding bar, in the centre of which a notch has been cut, through which the sight is taken over the tip of the foresight.



SIGHT OF U. S. SPRINGFIELD RIFLE (1902), seen from above.

The wind gauge is a device which enables the marksman to direct his sight on the object aimed at, although the rifle is actually pointing to the right or left of the mark. As yet this device has only been used for long distance rifle-range matches and fine shooting. Lateral adjustment is rarely necessary at the distances at which sporting rifles are used, and it is not universally advocated as a feature of the military small arm, owing to the difficulty there would be in securing a transverse slide which shall not be so small and so stiff as to be worthless in the excitement of action, or when the soldier's fingers are cold. Sportsmen sometimes employ a foresight of the covered bead variety, or the ivory or copper sight used by African hunters. The Boers, who rank high as practical marksmen, employ the ivory foresight, but European and American sportsmen who have engaged in African or big game shooting generally use the copper sight. Various forms of rear sight are in use, perhaps the best of which is the platina bar on a more or less open V. Another favorite type is the platina pyramid, which is set below a very open V. Telescopic sights are affixed to sporting rifles, and have been found very successful in deer-stalking or any form of hill and mountain hunting where game is difficult to locate. See GUNNERY; GUNS, NAVAL; SMALL ARMS; TARGET PRACTICE; RANGE-FINDER, etc.



GLOBE FORESIGHT.



PEEP SIGHT.

SIG'ILLA'RIA (Neo-Lat. nom. pl., from Lat. *sigillum*, seal). An extinct genus of lycopods that flourished during the Carboniferous period, forming a conspicuous element of the swamp flora of that time. They were trees that often grew to great heights and had few branches. Both branches and trunk were crowded with sword-shaped leaves which were arranged in spiral series. See LEPIDODENDRON; STIGMARIA.

SIGISMUND, sĭj'ĭs-mŭnd, *Ger. pron.* zē'gĕs-mŭnt (c.1368-1437). Holy Roman Emperor from 1411 to 1437. He was the second son of the Emperor Charles IV., whom he succeeded in 1378 in the Margraviate of Brandenburg. In 1379 he

became affianced to Mary, heiress of Louis the Great, King of Hungary and Poland, and in 1387 succeeded to the Hungarian crown. In 1396 he undertook a crusade against the Turks supported by a large force of French and German knights, but at Nicopolis, September 28th, he suffered an overwhelming defeat at the hands of Bajazet I. In 1401 a formidable uprising drove him from the throne, but he was restored with the aid of hired troops and seems henceforth to have ruled with wisdom and moderation in internal affairs. He waged a long succession of wars in order to extend the power of Hungary over Bosnia, Dalmatia, and Servia, but, although success at first attended his efforts, the Hungarian arms were kept in check by the Venetians and Turks. He was elected Holy Roman Emperor in 1411 and was crowned at Aix-la-Chapelle in 1414. He now appears in his most celebrated rôle as the author and protector of the Council of Constance and the guiding spirit in its deliberations. He brought about the deposition of Pope John XXIII., and showed himself zealous in the course of thorough ecclesiastical reform. Much obloquy, however, has attached to him for his desertion of John Huss (q.v.), whom he granted a safe conduct for the purpose of attending the council and then allowed to be burnt at the stake. In 1419, on the death of his brother Wenceslas, the succession to the crown of Bohemia fell to Sigismund. But the Hussites (q.v.) were already in arms, and the country became the theatre of a long and bloody conflict, in which the forces of Sigismund and the crusading armies of Germany met with terrible defeats. It was not until 1436 that Sigismund was recognized as King of Bohemia. He visited Italy in 1431 and 1433, receiving the Lombard crown at Milan and the Imperial crown at Rome. He died at Znaim, December 9, 1437, the last of the House of Luxemburg. Gifted in mind and body, kindly in action, and sincerely concerned for the welfare of the Empire, Sigismund encountered repeated failure on account of the very defects of an amiable and pleasure-loving disposition. Consult: Aschbach, *Geschichte Kaiser Siegmunds* (Hamburg, 1838-45); Creighton, *History of the Papacy* (London, 1894).

SIGISMUND I. (1467-1548). King of Poland from 1506 to 1548, called the Great. He was the youngest son of Casimir IV. and succeeded his brother Alexander as King of Poland and Grand Duke of Lithuania. In 1508 Sigismund gained a brilliant victory over the Russians at Orsha, on the Dnieper. Bogdan, voivode of Moldavia, was reduced to submission and the Tatars were severely punished. The Russians were decisively defeated a second time by Ostrogski in 1514. Subsequent invasions of the Muscovites were repelled as before, and a rebellion of the Wallachs was punished by numerous defeats. A war with the Teutonic Knights was terminated in 1525 by the Treaty of Cracow, in which the Grand Master Albert, Sigismund's nephew, was recognized as Duke of Prussia, which was to be held as a fief of Poland. In 1526 Sigismund aided Hungary against Solyman the Magnificent, and a numerous force of Polish cavaliers fought bravely on the fatal field of Mohács. An important event of Sigismund's reign was the introduction and extension of Lutheranism in Poland. Sigismund died at Cracow, April 1, 1548, and was succeeded by his son SIGISMUND II. AUGUSTUS (1548-72), who continued the tolerant policy of his father and effected the formal permanent union of Lithuania and Poland at the Diet of Lublin (1569). He was the last of the male line of the Jagellons. See POLAND.

SIGISMUNDA, sē'jès-mụn'dȧ. The heroine of one of the most widely known tales in Boccaccio's *Decamerone,* whose father, Tancred of Salerno, punishes her secret love for the page Guiscardo by sending the latter's heart to the Princess in a golden cup. The story was paraphrased by Dryden.

SIGMARINGEN. A line of the elder or Swabian branch of the House of Hohenzollern (q.v.).

SIGMOID FLEXURE. See INTESTINE; RECTUM.

SIGNAL CORPS, U. S. ARMY. That branch of the army to which is assigned the duty of maintaining communication between headquarters and all branches of the military service. In the United States Army this duty is assigned to a special corps, who are expert in the use of flag, heliograph, pyrotechnic, telephone, and telegraph signals, the building of telegraph lines and ocean cables, the management of carrier pigeons, the deciphering of secret ciphers, and the devising of new systems of cipher, the use of balloons, and in fact every method of communication that can be or has been devised. See SIGNALING AND TELEGRAPHING, MILITARY.

The Signal Corps of the United States Army dates officially from the appointment of Major Albert J. Myer in 1860 as chief signal officer. His system of military signals by means of flags was an improvement upon the semaphore telegraph, which had been used since 1790 in Europe and to a slight extent in America. The Signal Corps received a separate and systematic organization by act of March 3, 1863, and its members served with great efficiency on all fields of battle and even on naval vessels. At the close of the war it was again reorganized by the act of July 28, 1866, but in a very unsatisfactory manner, and a school of instruction was established at Fort Whipple, now Fort Myer, near Washington, D. C. By act of Congress, February 9, 1870, the Secretary of War was authorized to provide for the taking of meteorological observations throughout the country and for the prediction of storms; he assigned this duty to the chief signal officer of the army. Eventually it became apparent that the meteorological work was more important than the military work and that it could be quite as well done by civilian organization. Therefore, on July 1, 1891, an act of Congress took effect by virtue of which a Weather Bureau (q.v.) proper was organized in the Department of Agriculture and all the men and the duties relating thereto were transferred to it from the War Department. On the other hand, the Signal Corps of the United States Army was at the same time reorganized so as to contain ten commissioned officers and 50 enlisted men as sergeants.

ORGANIZATION. The Signal Corps, United States Army, consists of a chief signal officer with the rank of brigadier-general, 1 colonel, 1 lieutenant-colonel, 4 majors, 14 captains, 14 first lieutenants, 80 first-class sergeants, 120 ser-

geants, 150 corporals, 250 first-class privates, 150 second-class privates, and 10 cooks.

DUTIES. The chief signal officer is charged, under the Secretary of War, with the direction of the Signal Bureau; with the control of the officers, enlisted men, and employees attached thereto; with the construction, repair, and operation of military telegraph lines and cables, field telegraph lines, balloon trains, and electrical communication for fire-control purposes; with the preparation, distribution, and revision of the War Department telegraphic code; with the supervision of such instruction in military signaling and telegraphy as may be prescribed in orders from the War Department; with the procurement, preservation, and distribution of the necessary supplies for the Signal Corps and for the lake and seacoast defenses. He has charge of all military signal duties, and of books, papers, and devices connected therewith, including telegraph and telephone apparatus and the necessary meteorological instruments for target ranges and other military uses; of collecting and transmitting information for the army by telegram or otherwise, and all other duties pertaining to military signaling.

The Signal Department furnishes all military posts and seacoast defense stations with such instruments and materials as may be necessary for the electrical installation of range-finders and the fire-control system for the purpose of intercommunication. This includes telephonic and telegraphic instruments, electrical clocks, megaphones, field glasses, telescopes, and necessary meteorological instruments, i.e. barometers, thermometers, anemometers, etc. Also, all such cable and land lines as may be required to connect contiguous military posts, or for connecting the posts with the commercial telegraph system.

UNIFORM. Dress coat, dark blue, facings orange piped with white, pipings white. *Chevrons, first-class sergeant:* Three bars and an arc of one bar of orange piped with white inclosing a device of flags, red and white, and a burning torch in yellow. Trousers: Light blue, orange stripe piped with white 1¼ inches wide. *Cap insignia, non-commissioned officers:* Two crossed signal flags and a burning torch of white metal inclosed in a wreath of gilt metal. The wreath is omitted on the private's cap. See UNIFORMS, MILITARY; SIGNALING AND TELEGRAPHING, MILITARY.

SIGNALING AND TELEGRAPHING, MILITARY. The term military signaling usually refers to the art of transmitting intelligence by visual signals, while telegraphing applies to the communication of messages by the electric current, and in its application to military operations is considered here.

From the beginning of human existence signals such as signs, sounds, gestures, and other indications were used by the individuals of tribes or communities to communicate with each other. Sounds came first. These were followed by pictures of natural objects, the hieroglyphics of the ancients, and the other picture writings of savage peoples. The accompanying illustration is a picture dispatch sent by North American Indians to the French during the war with England in Canada. Translated it means that "they (the warriors) departed from Montreal" (represented by a bird just taking wing from the top of a mountain). The moon and the buck show the time to have been on the first quarter of the buck-moon, answering to July.

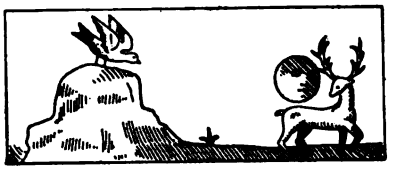


FIG. 1. PICTURE WRITING OF INDIANS.

While oral language was being developed, a means of communication beyond the limits of the voice was also undertaken by pantomimic signs; with the hands and body for short distances, by signal fires, smoke, a prearranged display of shields, spears, flags, clothing, and the like for longer distances. At an early date the necessity for a systematic code of military signals became apparent, and it is surprising to note the perfection attained by the ancients in the development of the theory and use of signals in time of war. The first record of a signal corps is given in the writings of Polybius about B.C. 260. The invention of the system then used is ascribed to Cleoxenes or Democritus, but the development of their ideas into a system was due to Polybius. As the principles of his plan underlie the modern systems of visual and telegraphic signals, the apparatus and method of using are given in some detail below. In the words of Polybius his system is described as follows:

"Take the alphabet and divide it into five parts with five letters in each. In the last part, indeed, a letter will be wanting, but this is of no importance. Then let those who are to give and receive the signals write upon five tablets the five portions of the letters in their proper order and concert together the following plan: That he, on one side, who is to make the signal, shall first raise two lighted torches and hold them erect until they are answered by torches from the other side. This only serves to show that they are on both sides ready and prepared. That afterwards he again who gives the signal shall raise first some torches upon the left hand, in order to make known to those upon the other side which of the tablets is to be inspected—if the first, for example, a single torch; if the second, two; and so of the rest. That then he shall raise other torches also upon the right, to mark in the same manner to those who receive the signal, which of the letters upon the tablet is to be observed and written. When they have

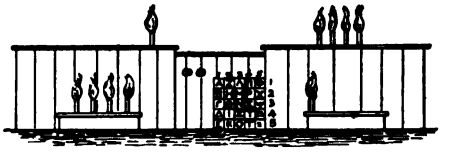


FIG. 2. SIGNAL SYSTEM OF POLYBIUS.

thus regulated their plan and taken their respective posts it will be necessary, first, to have a dioptical instrument formed with two holes or tubes—one for discovering the right, and the other the left hand of the person who is to raise the torches on the opposite side. The tablets must be placed erect and in their proper order

near the instrument; and upon the right and left there should be also a solid fence of about 10 feet in length and of the height of a man, that the torches, being raised along the top of those ramparts, may give a more certain light, and when they are dropped again that they may also be concealed behind them."

Signals are either *transient* or *permanent: transient* when each element disappears upon completion; *permanent* when the signal is the combination of certain arbitrary elementary indications, e.g. sounds, colors, forms, etc., in accordance with fixed rules, known both to the sender and receiver. The elementary indications are called *primary signals*. The signs formed by uniting the primary elements are called *combination signals*. A *combination* may consist entirely of a single primary signal several times repeated the number of repetitions conveying the meaning, e.g. 111; or the combination may be formed by uniting several different primary signals, each used one or more times, e.g. 123, or 113, etc.

A class of signals is the term used to designate the number of elements used to make the signals, e.g. 131, 333, are signals of the third class; 12, 21 are signals of the second class, etc.; a *code of signals* is any number of prearranged signals, each of which has a definite meaning to sender and receiver. If each letter is *homographic* the class term is indicated by a certain and always the same number of symbols; *chronosemic* or *time signals* depend for their meanings upon the interval of time between successive signals. For instance, a second of time between two signals might represent '1,' and an interval of two seconds between the same signals '2,' etc.

The definition and examples cited above are illustrated by the "United States Army and Navy Code Card" below. It is called the Myer system, after Brevet Brigadier-General Albert J. Myer, a former chief signal officer of the United States army. It is a *code of signals* of two primary elements (1 and 2), the combination being of the first, second, third, or fourth class.

SIGNAL CORPS, UNITED STATES ARMY

ARMY CODE CARD—THE MYER SYSTEM FOR UNITED STATES ARMY AND UNITED STATES NAVY SIGNALING (PRESCRIBED BY G. O. NO. 32, A. G. O., 1896).

A	22	O	21
B	2112	P	1212
C	121	Q	1211
D	222	R	211
E	12	S	212
F	2221	T	2
G	2211	U	112
H	122	V	1222
I	1	W	1121
J	1122	X	2122
K	2121	Y	111
L	221	Z	2222
M	1221	tion	1112
N	11		

NUMERALS

1	1111	2	2222
3	1112	4	2221
5	1122	6	2211
7	1222	8	2111
9	1221	0	2112

ABBREVIATIONS

a	after	t	the
b	before	u	you
c	can	ur	your
h	have	w	word
n	not	wi	with
r	are	y	yes

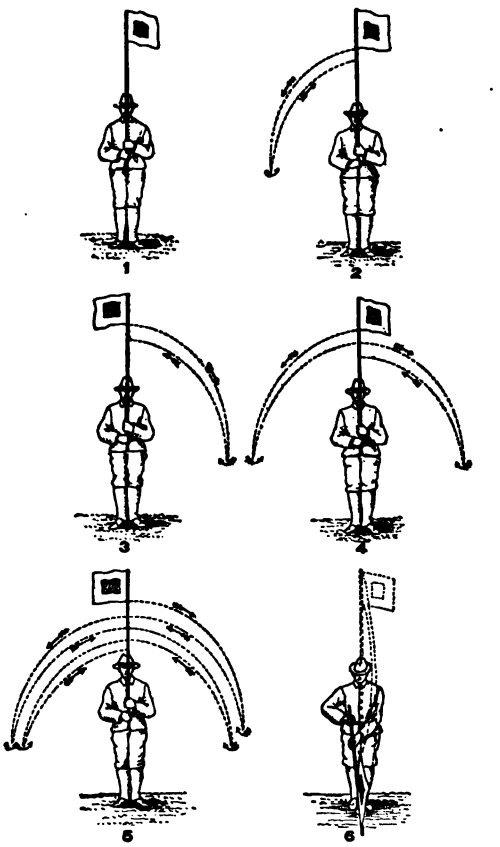
CONVENTIONAL SIGNALS

End of a word	3
End of a sentence	33
End of a message	333
xx3	numerals follow (or) numerals end
sig 3	signature follows
Error	12 12 3
Acknowledgment, or "I understand"	22 22 3
Cease signaling	22 22 22 333
Wait a moment	1111 3
Repeat after (word)	121 121 3 22 3 (word)
Repeat last word	121 121 33
Repeat last message	121 121 121 333
Move a little to right	211 211 3
Move a little to left	221 221 3
Signal faster	2212 3

The Myer system above is used by all the United States Army signal instruments except the electric telegraph, which employs the Morse code given below:

a	b	c	d	e	f	g	h	i
—,	—···,	—·—·,	—··,	·,	··—·,	——·,	····,	··,
j	k	l	m	n	o	p		
·———,	—·—,	·—··,	——,	—·,	———,	·——·,		
q	r	s	t	u	v	w	x	
——·—,	·—·,	···,	—,	··—,	···—,	·——,	—·——,	
y	z	&c.						
—·——,	——··,	·····,						

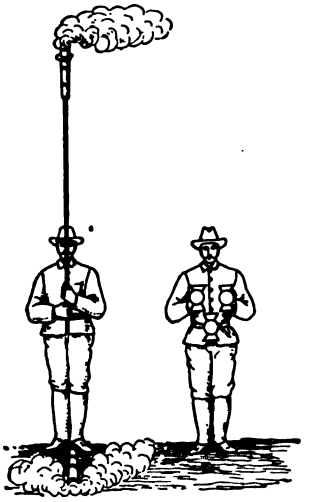
VISUAL SIGNAL APPARATUS. The Signal Corps of the United States Army employs two standard signal flags, 4 and 2 feet square respectively, with white ground and red centre, or the reverse. They are attached to light jointed rods



and swung to the right, left, and centre when signaling. Any other flag, a piece of cloth, handkerchief, or other object attached to a stick may be used in the same way.

The accompanying diagram shows the method of signaling with the flag, which is virtually the same with torch, hand-lantern, or beam of the search light with such modifications as are necessary with these particular instruments. There is one position and three motions. The signal man stands in the first position holding his flag as shown in Fig. 1, facing squarely toward the station with which he desires to communicate. The first motion, corresponding to signal 'one' or 1, is to the right of the centre, the flag describing the motion as shown in Fig. 2. The second motion, corresponding to 'two' or 2, is to the left and is shown in Fig. 3. The third motion is downward directly in front of the signalman and then returned upward to the first position, and is 'three' or 3. A combination of movements is shown in Fig. 4 and Fig. 5, Fig. 4 showing the signals corresponding to 12, while Fig. 5 shows the signals corresponding to 2121. If 12 is sent repeatedly it means that it is desired to stop the signals from the sending station.

For night signaling *the signal torch* is employed. It consists of a cylinder of copper closed at one end, filled with a combustible material and lighted. Cotton strands saturated with turpentine or kerosene are generally used. The *flying torch* is attached to a staff and used like the flag. The *foot torch* is placed on the ground in front of the operator and used as a point of reference. In their place may be used ordinary hand lanterns, the usual arrangement being one strapped on the waist and one in each hand for homographic signals.

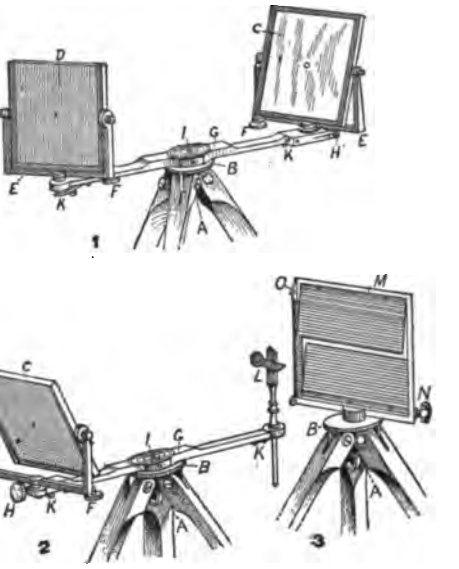


A B

NIGHT SIGNALING.
A, with torch; B, with lantern.

Signal flash lanterns using oil are also employed, and are attached to a tripod, the occulting shutters being placed on another as with the heliograph (see illustration below), while an *acetylene flash lamp* which occults by shutting off the gas with a key similar to the ordinary telegraph key is another device for this purpose.

THE HELIOGRAPH (*sun-writer*) is an instrument designed for signaling by reflected sun flashes. The United States Army 'field kit' contains two 4-inch mirrors, two tripods, a shutter or screen, and a mirror bar. The 'station kit' for permanent or semi-permanent stations uses 8-inch mirrors with provision for attachment to a post, stump, or other firm base instead of tripods. In setting up and adjusting the position of the sun is the guide for determining whether one or two mirrors should be used. When the sun is in front of the operator, that is, in front of a plane through his position, at right angles to the line joining the stations, the sun mirror only is required; with the sun in rear of this plane both mirrors should be used, although a single mirror may be used to advantage with the sun well back of the operator. In the former case the rays of the sun are reflected from the sun mirror direct to the distant station; in the latter they are reflected from the sun mirror to the station mirror, thence to the distant observer. Under favorable atmospheric conditions the range of the heliograph is great. The greatest ranges (100 to 125 miles) ever attained with this instrument are credited to the United States Army during the course of experiments in April and May, 1890, in Arizona and New Mexico, during which, by using intermediate stations, communication was maintained connectedly for about two weeks between points 2000 miles apart.



HELIOGRAPH OF THE UNITED STATES ARMY SIGNAL CORPS.

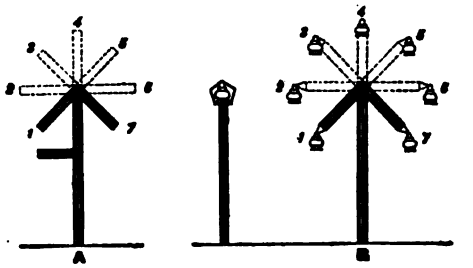
1. Heliograph with two mirrors, sun in rear. 2. Heliograph with one mirror and sighting rod, sun in front. 3. Screen mounted on tripod. *A*, tripod; *B*, tripod head; *C*, sun mirror; *D*, station mirror; *E*, mirror supports; *F*, tangent screw for revolving mirror about horizontal axis: *G*, mirror bar; *H*, tangent screw with ball-bearings for revolving mirror about vertical axis; *I*, clamp screw for attaching mirror bar to tripod; *K*, spring for clamping mirrors and sighting rod; *L*, sighting rod with movable disk; *M*, screen; *N*, key for screen; *O*, screen spring.



SIGNAL DISK.

Other signaling devices are used in addition to the standard apparatus above described as occasion justifies, among which are *disks* (*single*

or *double*) made of white canvas stretched on rings or hoops of wire and attached to a light staff, and *semaphores* consisting of a post with



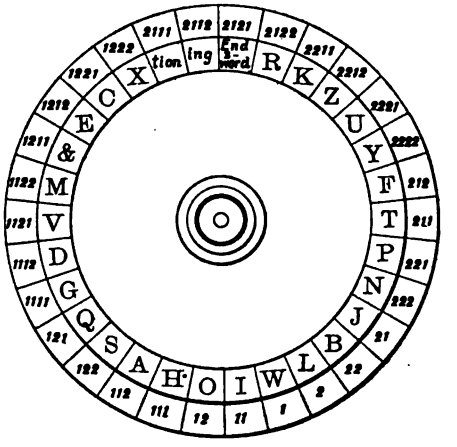
SEMAPHORES.
a, for day; *b*, for night.

arms movable by ropes, each position representing a letter or number. These may be used at night by attaching lanterns to the arms.

Signal flags on halliards, stationary or by motions, are also frequently used, as is discussed under SIGNALS, MARINE.

At night signals may be made by *candle bombs*, which are pasteboard shells charged with brilliant stars, fired from bomb guns or mortars or *signal rockets*, which under favorable circumstances can be used up to ranges of about eight miles. Rockets are most efficiently employed as *chronosemic* or time interval signals. *Signal composition fires* are pyrotechnic compositions which burn with great intensity of light and color, generally red, white, and green. To observe all these visual signals it is necessary to employ powerful and portable telescopes. The *signal telescopes* for use at long ranges magnify about 30 times and have a focal length of 26 inches. The glass is strong. *Binocular glasses* are also useful, as they combine a low magnifying power with a large field. The new 'porro prism' glasses are now issued to the United States Signal Corps.

CIPHERS. A *signal cipher* is a method of or key to secret signaling understood only by those concerned. In the presence of the enemy the necessity for its use is apparent, and in order to secure secrecy it must frequently be changed.



SIGNAL DISK.

Naturally there are countless forms and systems of ciphers. Among these is the *signal disk*, which is a device for readily enciphering and deciphering a message. It consists of a small disk of cardboard or other material, on which are written or printed the letters of the alphabet in irregular sequence and arranged around the circumference of the disk. These letters are so placed that when the disk is properly held all the letters are upright. On this small disk are also printed those combinations of letters which frequently occur in words, as 'tion,' 'ing,' 'ous,' etc., and a sign to mark 'the end of the word.' On a larger disk are written or printed, arranged around its circumference in the same manner, either the letters of the alphabet or the symbolic numbers of signals which are to be used. The disks are fastened concentrically together in such manner that one may revolve upon the other and that they may be clamped in any position. They are of such size that when so fastened the letters, etc., upon the inner disk will each appear close to and directly opposite one of the signal combinations upon the outer disk.

The figures '1' and '8' are sometimes used instead of the figures '1' and '2' to symbolize the elements 'one' and 'two,' because the figure '8' is upright in most positions of the disk. Having a disk so arranged and clamped, it will be clearly understood by any signalist that, so provided, he has before him an alphabetic code with every letter opposite its signal symbols. And he will comprehend that, by referring to the disk, he can transmit a message without the study of any particular code and can transmit it in secret signals or cipher by moving the disks upon each other.

MILITARY TELEGRAPH. The electric telegraph for the transmission of signals came into practical use about 1835. Its history and development will be found discussed in the article TELEGRAPH. Beyond saying that the Morse system makes use of a code of three elements, dot, dash, and space, as shown above, it is necessary here to concern ourselves merely with strictly military lines. With the invention and general use of the telephone came its application to warfare, and this instrument, too, has been specially adapted for this purpose. Military lines for telegraph or telephone field service are generally called 'flying lines.' They are strung on light poles called 'lances,' 2½ inches in diameter and 17 feet long, placed 2 feet in the ground, and about 40 per mile are necessary. Instruments and material are transported by wagons designed for the purpose to accompany the army in the field. These constitute the field telegraph train. For quick work at the front the wire is on reels, carried either on a man's back or on a light cart. The wire is light, strong, and pliable, generally a steel core with copper sheathing, and for the lighter lines is not even insulated. By the use of high frequency currents this bare wire, rapidly reeled off on the ground, constitutes the conductor for the special 'vibrator' forms of telegraph and telephone instruments now used by the United States Signal Corps.

The special apparatus used by the Signal Corps exhibits many modifications from the accepted commercial practice. One of the most important of the instruments used is the 'buzzer,' which is constructed in forms suitable for regular service or for the field. It consists of a telephone receiver and transmitter, a vibrator and induction coil, condenser, telegraph key and switches, and four cells of dry battery. This instrument is used for connecting with rapidly constructed field

lines or for working a regular wire under adverse conditions. The Signal Corps has also a special pattern of service telephone, which is constructed so as to withstand rough usage in transit. The telephone is also supplied in a portable form for field use, while for special use on telegraph lines there is an instrument known as the Russell cut-in telephone, which is very portable and can be used in the field with great facility.

With the telephone is used a special form of cart constructed of bicycle tubing and 30-inch bicycle wheels with heavy cushion rubber tires. The cart is filled with an automatic spooling device for reeling up the outpost cable and carries five reels of cable and one reel knapsack for use in places where the cart cannot penetrate owing to underbrush, etc. As the extreme width of the cart, measured at the wheels, is only 26 inches, it can follow any ordinary path through the underbrush. The weight of the cart complete with spooling device, but without reels, is only 53 pounds; when loaded with reels and reel knapsack the total weight is 157 pounds. The cart is well balanced upon its axle by a device which permits the point of support to be changed to balance the cart as the distribution of weight is changed by the cable being run out. In connection with the reel cart a telephone kit is used, and by attaching the double connector of the kit to one on the frame of the cart the telephone is kept in circuit and conversation can be kept up with the home station. The cart with its load can be easily drawn by one man, and by its use it is possible to connect outposts with the main guard or brigade with regimental headquarters, or brigade with division headquarters, in a few minutes of time.

Signal balloons now form a part of the equipment of all armies. In the United States service they are operated by the Signal Corps. Several successful ascents were made during the Santiago campaign of the Spanish-American War of 1898. For reconnoitring purposes balloons are recognized as a military necessity. Information is transmitted from the captive balloon by telegraph or telephone, the wire being reeled off during the ascent. From balloons photographs of the enemy's country, defenses, and communications may also be taken by the use of telephotolenses. Balloons for military reconnaissance should be of at least 18,000 cubic feet capacity. Gas for inflation is generally carried compressed in steel cylinders. See AERONAUTICS.

Wireless telegraphy is now an important subject of experiment for purposes of military signaling. The Signal Corps of the United States Army has perfected its own system and has in successful operation stations in San Francisco Harbor and elsewhere. See WIRELESS TELEGRAPHY. Consult: Myer, *A Manual of Signals* (Washington, Government Printing Office, 1879); *Instructions for Using the Heliograph of the Signal Corps, U. S. Army* (ib., 1894); *Instruction for Signaling*, United States Navy, 1898 (ib., 1898). See SIGNALS, MARINE; ARMY ORGANIZATION.

SIGNALS, INTERNATIONAL. See SIGNALS, MARINE, and accompanying Colored Plate.

SIGNALS, MARINE. Marine signals now in current use may be divided into three classes: (a) Day signals, (b) night signals, and (c) day and night signals. Day signals consist of set combinations of flags or shapes, moving combinations of arms or shapes, or the waving of shapes or flags. The use of flags of various shapes is wide-spread, and is of ancient origin; the Venetians used such signals, and there is good reason to believe that simple signals of this sort were used in very ancient times. In 1856 the British Government devised a system of signaling by flags which has been adopted by all maritime nations. It formerly consisted of thirteen square flags, five triangular pennants, and a swallow-tail flag. One of the pennants was the code pennant; the other pennants and flags were assigned to the consonants of the alphabet from b to w. On January, 1901, by international agreement, a new code went into effect. It consists of nineteen square flags, two swallow-tail flags, and five pennants besides the code or answering pennant. These are assigned (except the code pennant) to the different letters of the alphabet. The flags and pennants of the old code are retained with few changes, the new ones being additional to cover the vowels and x and z. The flags and pennants are hoisted singly or in combinations of one, two, three, or four. One-flag signals are important in character and much used; two-flag signals are urgent and important; three-flag signals include all ordinary messages; four-flag signals signify geographical positions (seaports, islands, bays, etc.), alphabetical spelling tables, and vessels' distinguishing numbers. The signification of each combination of flags is the same in all languages, each combination standing for a complete message, a sentence, a phrase, or a single word. A vessel using a signal book printed in English can communicate with a vessel using a book printed in Italian as easily as with one using an English book.

The spelling table may be used between vessels having books printed in languages using Roman characters. The American edition of the international signal code is published by the Hydrographic Office of the Navy Department, and is divided into three parts. The first contains urgent and important signals, signals for tables of money, weights, etc., for geographic positions (arranged geographically), and a table of phrases formed with auxiliary verbs. The second part, which includes more than half the book, is an index. It consists of a general vocabulary and a geographical index, each alphabetically arranged. The third part gives lists of the United States storm-warning, life-saving, and time-signal stations, and of Lloyd's signal stations throughout the world; it also contains semaphore and distant signal codes and the United States Army and Navy and Morse wig-wag codes.

In the United States Navy the general code consists of ten rectangular flags, corresponding to 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9; also a number of special flags, pennants, etc. In most other navies the flags of the international code are utilized.

The use of shapes is common for distant signals, as the colors and patterns of flags cannot be determined with certainty beyond two or three miles. These shapes are cones, balls, and drums, supplemented with a square flag and a pennant. The placing of movable arms in certain positions is termed semaphore signaling. Devices for semaphore signaling have been in use for some

centuries at least; they were called telegraphs and were placed in sight of each other to form long chains of communication across country. The modern semaphore has two or three arms, and its use is chiefly at signal stations on the coast or on board ship. In most navies a simple semaphore code is arranged for two small flags, one to be held in each hand of the signalmen. In the United States and British navies there are seven positions—in the French navy, eight. These positions of the first named are: Right arm inclined downward at angle of 45°; same, horizontal; same, inclined upward at angle of 45°; three of the remaining positions are for the left hand at 45° downward, 45° upward, and horizontal; the remaining position is either arm held vertically. In the French code, the right arm held vertically is one position and the left arm held vertically is another. In both codes the combination of any two positions is used in addition to the simple positions. In the United States Army and Navy the signal flag wig-wag code is used as described under SIGNALING AND TELEGRAPHING, MILITARY.

NIGHT SIGNALS are made with lights, rockets, torches, etc. By waving a lamp or torch or changing the direction of the beam of a searchlight from side to side the wig-wag code may be used. In Very's night signals, which are visible at a distance of ten miles or more, under favorable circumstances, red and green stars like those in roman candles are fired from pistols in different combinations, four in each, and each combination or group of four corresponding to a figure. Coston's signals, consisting of different colored flaming lights, were formerly used. Rockets and blue-lights (q.v.) are used to attract attention and for special purposes. The night signals most in use in the navies of the world are the Ardois, the invention of a French officer of that name, and brought into general use in 1885-90. They consist of double electric lamps—one-half white and one-half red—arranged on a cable extending up and down one of the masts. In many foreign navies these lamps consist of five pairs, but in the United States Navy there are but four, and the significations of the wig-wag code are used. The lights are read downward from the masthead, red corresponding to 1 and white corresponding to 2 of the wig-wag code; 3 of the wig-wag code is replaced by a special combination for 'interval' or end of a word. These lights are worked by a keyboard, and the signaling is quite rapid. In the British Navy and in some other foreign services the flashing of a white light is used with the Morse telegraphic alphabet, a long flash signifying a dash and a short flash a dot, etc.

The day and night signals are sound signals and wireless telegraph signals. The former are composed of long and short blasts of a whistle or double and single strokes of a bell. With wireless telegraph systems the usual telegraphic code is employed.

Some simple signals are used in "Rules of the Road at Sea." (See RULES OF THE ROAD.) Signals of distress are of various kinds, such as hoisting the colors, i.e. the national flag, upside down, firing guns, rockets, blue-lights, etc. Consult *Instructions for Signaling, United States Navy* (Washington, 1898). See SIGNALING AND TELEGRAPHING, MILITARY.

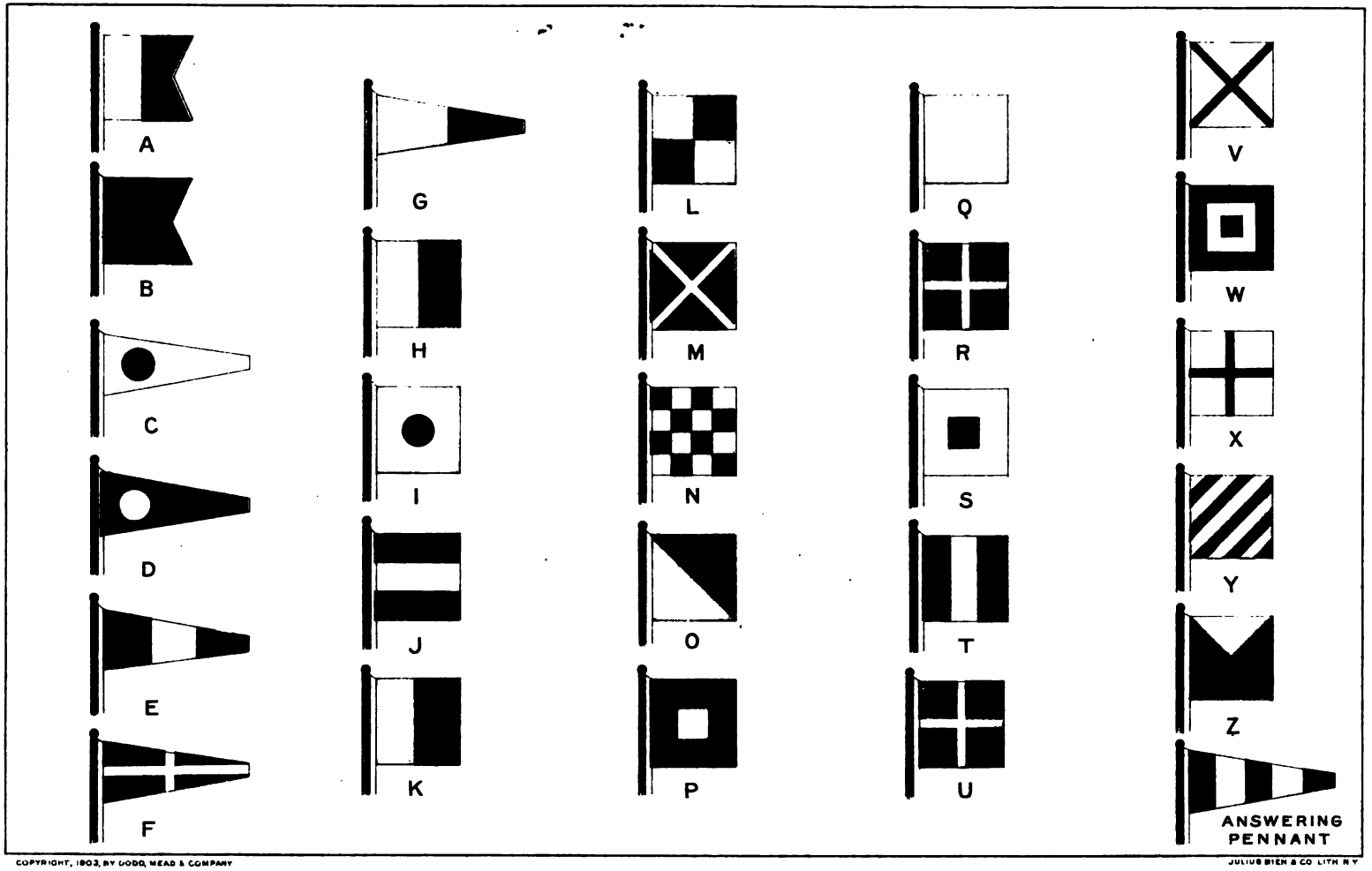
SIGNALS, RAILWAY. See BLOCK SIGNAL SYSTEM; RAILWAYS.

SIGNATURE (ML. *signatura*, from Lat. *signare*, to sign, from *signum*, sign, mark, token). In its broadest legal sense, the name of a person, written or printed, or a sign or mark intended to represent his name, and either executed or affixed by the person himself or adopted by him as his own. It became common to sign legal instruments after the Statute of Frauds, 29 Car. II., c. 3. Previous to that time a person intending to bind himself by a written instrument usually affixed his seal. In most jurisdictions a printed name may be adopted by a person as his signature, and thereon a stamp making an impression of the name on paper, in either written or printed form, may be employed. Where a person wishing to execute a written instrument is unable to write, it is customary to have some one write his name, and to have him make a cross mark between his Christian name and surname. The person who writes the name usually writes above the mark the word 'his,' and below the word 'mark,' and also acts as a witness to identify the mark. Where the illiterate person is very awkward, the person who writes the name may also make the mark, while the former touches the pen, but there are decisions to the effect that this is not necessary. In some jurisdictions a person's name written by another may be adopted by the former as his signature, without going through the form of affixing a mark. A signature is usually affixed at the end of an instrument, but it is generally held in the absence of statute that it may be elsewhere if clearly intended as such. The mere recital of a person's name in the body of an instrument will not constitute a signature. Where a statute requires an instrument to be subscribed, as in case of a will, the signature must be at the end, or the instrument will be a nullity. See SEAL.

SIGNATURE (in music). See KEY; TIME.

SIGN LANGUAGE. A system of intertribal gesture communication among the American Indians used by all the plains tribes in default of a common language, and practically the same from Canada to the Mexican border. In many respects it forms the manual counterpart of the Indian pictograph system as displayed in their buckskin paintings or birch-bark records. The signs are so perfectly based upon natural ideas or the things of every-day Indian life or custom as to be readily interpreted by a member of any of the tribes using the system. Thus, *cold* is indicated by a shivering motion of the hands in front of the body. By an extension of the idea, according to the context of the conversation, the same sign indicates the cold season, i.e. *winter*, and as the Indians count by winters it may mean also *a year*. A slow turning of the hand upon the wrist indicates vacillation, doubt, *maybe*. A modification of this, with quicker movement, is the question sign. *Fatigue* is indicated by a downward sweep of the hands, with index extended, giving the idea of collapse. *Strong, strength*, are indicated by the motion of breaking a stout stick; *bad*, by a motion of contemptuously throwing away; *foolish*, by a circling movement of the fingers in front of the

INTERNATIONAL SIGNAL CODE



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forehead, i.e. 'rattle-brained;' *song, singing,* by the same motion next the side of the head, to indicate the shaking of the rattle which usually accompanies the song. As the song and rattle are almost invariable accompaniments of religious ceremonials and medical conjurations, the same sign may also mean *sacred, religion, doctor, medicine,* according to the context. *White man* is indicated by drawing the fingers across the forehead, typifying the wearing of a hat, and there is a special sign for *Indian* and for each tribe, as well as for particular rivers, mountains, etc. Two fingers extended at the side of the head indicate a *wolf,* as representing the erect ears; the same two extended fingers drawn across in front of the body indicate the *dog,* as the former carrier of the Indian travois; the same fingers brought down crossed over the extended index finger of the other hand indicate the *horse,* as the riding animal.

The signs follow the regular order of the words in the Indian sentence, and in many cases may be made with one hand or both at the will of the user. The general system is so perfectly elaborated that there is a sign or combination for every idea in the Indian category, and so universally understood among the plains tribes that a dozen Sioux from Dakota may, and frequently do, make a long visit to the Cheyenne or Kiowa in Oklahoma, making themselves perfectly at home with their hosts, learning all the news and telling their own, all through the medium of the sign language, without having so many as ten spoken words in common. There is also a system of long-distance signaling by means of smoke, riding in a circle, waving a blanket, etc., in certain ways, for particular occasions. Consult: Mallery, *Collection of Gesture-Signs and Signals of the North American Indians, with Some Comparisons* (Washington, 1880); Clark, *Indian Sign Language* (Philadelphia, 1884). See GESTURE LANGUAGE.

SIGNORELLI, sē'nyô-rĕl'lē, LUCA (1441-1523). An Italian painter of the Renaissance, usually classed with the Umbrian school, but his affinities are rather Florentine. He was born at Cortona, studying first under Piero della Francesca at Arezzo, and at an early period he came under the influence of Pollajuolo at Florence. His life was chiefly spent in peregrinations among the hill towns of Tuscany and Umbria, where most of his work was done. His first recorded activity (1470) is in his native town, but at an early period he worked independently at Florence, executing while there the "Pan," now in the Berlin Museum, for Lorenzo de' Medici—a fine example of his treatment of the nude—and a Madonna, now in the Uffizi. Among other works in Florence belonging to this early period is the fine portrait of a man in the Torregiani Palace. Other well-known altar pieces are a grand Madonna with Saints in the Cathedral of Perugia (1489), and the Bicci altar-piece in San Agostino, and Siena (1498). Many of the small towns of Umbria, like Arezzo, Citta di Castello, and Tuscany, possess fine examples of his work.

But Luca's principal works are his frescoes, which far transcend his panel paintings. He was one of the painters selected to decorate the Sistine Chapel with subjects from the "Life of Moses," and his fresco is esteemed by some the best of the entire series. About the same time he received a commission for the decoration of the sacristy of the Church of Loreto with subjects from the New Testament, which show the influence of Melozzo da Forti. At Siena he also painted in fresco a series of antique subjects in the Petrucci Palace, and in the neighboring Convent of Mont Oliveto (1497) eight large subjects from the "Life of Saint Benedict." His success in these commissions led to his great masterpiece, the frescoes of the Chapel of the Madonna in Orvieto Cathedral (1499-1509). The subject represented is the "End of the World;" in eight panels of the ceiling are Christ and the heavenly hierarchy, while eight frescoes of the wall culminate in the "Last Judgment." Never, perhaps, in the history of art has the human figure been used to express such varied frenzy and emotion.

Under the pontificate of Julius II. and again in 1513 he visited Rome, but was unable to make headway against the rising genius of Michelangelo and Raphael. He retired to Cortona, where he was held in the highest honor, and continued at his craft, his work in no wise deteriorating, until his death, June 14, 1523. His last works are principally in Cortona and the vicinity, like the "Pietà" (1502) and the "Last Supper" (1512) in the Cathedral; an excellent example is the fine "Madonna" with the Trinity, two archangels, and saints in the Uffizi.

Signorelli's great importance in Italian art consists in his having been the first to use the nude body as the chief means of expression. He expresses emotion by means of muscular movement and construction, the faces being only typical of general emotion. He also introduced the use of the human body as a purely decorative motive, foreshadowing Michelangelo, whom he undoubtedly influenced. In his work the drawing, composition, and action are all excellent, and he shows also great strength of conception; but the effect of his painting is often marred by its crude color. Consult: Vischer, *Luca Signorelli und die italienische Renaissance* (Leipzig, 1879); the same author's article in Dohme, *Kunst und Künstler* (Engl. trans., London, 1880); and Antwell, *Luca Signorelli* (London, 1899).

SIGOURNEY, sĭg'ĕr-nĭ, LYDIA [HUNTLEY] (1791-1865). An American poetess and philanthropist, born in Norwich, Conn. She was one of the first women in America to plan for higher female education. She established a select school for young ladies at her birthplace in 1809, and in 1814 at Hartford. This she kept until her marriage, in 1819, with Charles Sigourney, a Hartford merchant. Her first published book was *Moral Pieces in Prose and Verse* (1815). Altogether she published over fifty books. Her autobiographical *Letters of Life* appeared posthumously (1866). In addition to the long list of her separate works, Mrs. Sigourney edited numerous juvenile and religious publications, and contributed widely to periodicals. Some of her poems, such as *Indian Names,* are still readable, but the mass of her poetry is characterized by a "fatal facility."

SIGSBEE, CHARLES DWIGHT (1845—). An American naval officer, born at Albany, N. Y. He graduated at the Naval Academy in 1863,

was assigned to the Gulf Squadron, and took part in the battle of Mobile Bay. In 1865 he was transferred to the North Atlantic Squadron, and participated in the bombardment and the capture of Fort Fisher. From 1874 to 1878 he was employed in exploring the bottom of the Gulf of Mexico, and because of the improvements which he introduced in this work received the order of the Red Eagle of Prussia and a gold medal. He was promoted to the rank of commander in 1882, and to that of captain in 1897. In the latter year he was assigned to the command of the battleship *Maine*, which, while still under his command, was destroyed in the harbor of Havana, Cuba, on February 15, 1898. On this occasion he displayed great courage and coolness and was widely commended for his self-restraint in asking that the American people suspend judgment until a careful investigation should show where the responsibility lay. During the war against Spain he commanded the auxiliary cruiser *Saint Paul*. From September, 1898, to January, 1900, he commanded the battleship *Texas*, and was then appointed chief officer of naval intelligence, a member of the Naval Construction Board and of the Naval General Board. He wrote *Deep Sea Sounding and Dredging, U. S. Coast Survey* (1880), and *Personal Narrative of the Battleship Maine* (1899).

SIGURD, sē'gụrd. The hero of the Norse Eddas, corresponding to the German Siegfried of the *Nibelungenlied* (q.v.).

SIGURDSSON, sē'gụrd-sŏn, JÓN (1811-79). An Icelandic scholar and politician, born at Rafnsevri, Northwest Iceland. For several years he was archivist, and in 1851 was made president of the Icelandic Archæological Society. In 1845, when the Danish Government granted the reëstablishment of the Althing, the Icelandic national assembly, he was made its Speaker, and it was mainly due to his exertions that Iceland obtained practical home rule in 1874. His publications include *Diplomatarium Islandicum, 874-1264*, and *Lovsammling, 1096-1859*, a collection of laws (17 vols., 1853-77).

SIGWART, zĕg'värt, CHRISTOPH VON (1830-1904). A German philosophical writer, born at Tübingen. Educated in theology and philosophy, he was professor in the seminary at Blaubeuren from 1859 to 1863, and in 1865 was made professor of philosophy at Tübingen. His publications include: *Ulrich Zwingli: der Charakter seiner Theologie, mit besonderer Rücksicht auf Picus von Mirandola dargestellt* (1885); *Spinozas neuentdeckter Traktat von Gott, dem Menschen und dessen Glückseligkeit* (1866); the particularly well-known *Logik* (2d ed. 1888-93; Eng. translation 1894); *Kleine Schriften* (1881); *Vorfragen der Ethik* (1886); and *Die Impersonalien* (1888).

SIKA. The small deer (*Cervus sika*) of Japan and Northern China, having a spotted coat in summer which becomes uniformly brown in winter. The antlers usually only have four points, as the bez-tine is lacking. These deer are natives of forested hills, and many specimens have been naturalized in European parks. The 'Manchurian' deer is probably only a larger variety; but two or three other valid species belong to the sika group, of which the best known is that common in the mountains of Formosa (*Cervus taëvanus*). Consult Lydekker, *Deer of All Lands* (London, 1898).

SIKES, BILL. A brutal, hardened burglar in Dickens's *Oliver Twist*, who murders his companion, Nancy, and is strangled in an attempt to escape pursuit.

SIK'HIM. A native State of India. See SIKKIM.

SIKHS, sēks (Hind., from Skt. *śiṣya*, disciple). The term applied to a religious community of which the Punjab, in Northwestern India, is the principal seat.

From the time of the tenth pontificate the sect called itself the *Khālsā*, 'the property' (of God). At first the Sikhs were merely a religious sect affected by Mohammedan influences. Their religon was a deism tinctured with superstition. From the energy which they developed under oppression, and their proselytizing enthusiasm, the Sikhs became, by degrees, a formidable nationality. Their founder, Nanak, was born in 1469, in the vicinity of Lahore, and died in 1539. To him succeeded, in turn, nine pontiffs, each of whom, like himself, is popularly denominated *guru*, or teacher. These were Angad, Amardas, Ramdas, Arjun, Hargovind, Harray, Harkrishna, Teg Bahadar, and finally Govind.

The aim of Nanak was religious and humanitarian, and designed to combine Hindus and Mohammedans into one brotherhood. His three immediate successors held themselves aloof from political complications. Arjun, however, not content with signalizing himself as the compiler of the *Adi Granth* (q.v.), and as the founder of Amritsar, the holy city of the Sikhs, rendered himself conspicuous as a partisan of the rebellious prince Khusru, son of Jahangir. Hargovind, who succeeded Arjun, called the Sikhs to arms, led them in person to battle, and became an active and useful, though sometimes refractory, adherent of the Great Mogul, against whom his predecessor had plotted. Harray subsequently espoused the part of Dara Shukoh, when contending with his brothers for the throne of India. Harkrishna, son of Harray, died a child, and was only nominally a guru. Teg Bahadar was executed as a rebel in 1675. The chief motive that instigated his son Govind, the tenth of the teachers, was, with some probability, a desire to avenge the ignominious death of his father. He resolved to combat both the Mohammedan power and the Mohammedan religion. Hinduism likewise fell under his ban. God, he inculcated, is not to be found save in humility and sincerity. In what measure he was a man of thought is evinced by his legacy to his co-religionists, the second volume of the Sikh scriptures,



SIKA ANTLERS.

which teaches that a Sikh is to worship one God, to eschew superstition, and to practice strict morality, but equally is to live by the sword. Govind was assassinated in 1708. His successor Banda, after three cruel massacres of his Mogul opponents, was himself slain in 1716. After his death the government of the Khalsa passed into the hand of the Akalis, military zealots who in 1764 had become the rulers of the Punjab. In the early part of the nineteenth century Ranjit Singh (q.v.) built up a powerful Sikh monarchy, which in addition to the Punjab embraced Kashmir, and which became a formidable neighbor to the British. Six years after his death (1839) the British engaged in the First Sikh War (1845-46), in which their forces were led to victory by Sir Hugh Gough (q.v.), and which secured to the East India Company the possession of a great portion of the Sikh territory. The Second Sikh War (1848-49), in which Sir Hugh Gough again commanded the British forces, terminated in the submission of the Sikhs, and was followed by the annexation of the Punjab to British India. The Khalsa ceased to exist. The Sikhs are now divided into different religious orders, such as the Udasis, who renounce the Granth, the 'Sons of Nanak,' the Suthres, 'pure,' and the Divine Sadhs, or 'mad saints.'

According to the census of 1901 there were then 2,195,268 Sikhs in India, 1,517,019 being in the Punjab. Consult: Malcolm, *Sketch of the Sikhs* (London, 1812); Cunningham, *History of the Sikhs* (ib., 1849); Trumpp, *The Adi Granth or the Holy Scriptures of the Sikhs, translated from the original Gurmukhi* (ib., 1877); id., *Die Religion der Sikhs* (Leipzig, 1881); Gough and Innes, *The Sikhs and the Sikh Wars* (London, 1897).

SI-KIANG, sē'kyäng', or **WEST RIVER**. The most important river of Southwestern China. It rises in the Province of Yun-nan near Nan-ning Hien (or Kü-ching-fu), flows through a generally mountainous country in a tortuous course through Yun-nan, Kwang-si, and Kwang-tung for 1650 miles to the South Sea (Map: China, D 7). It receives many tributaries, chiefly from the right, the most important being the Yü-kiang or Melancholy River. Near Sam-shui (q.v.) the stream divides, the smaller portion flowing east and, after receiving the waters of the Pe-kiang or North River, being known as the Chu-kiang or Pearl River, on which the city of Canton is situated. The main body of the waters of the Si-kiang continues its course west of the Chu-kiang delta, breaking up into several channels. The estuary is 75 miles wide. The upper courses are obstructed by many rapids. From Sam-shui to Wu-chow it is navigable for vessels drawing not more than eight feet, while lower down the largest vessels may float.

SIKKIM or **SIKHIM**, sĭk'ĭm. A native State in the northeast of India, feudatory to Bengal. It is bounded on the north and northeast by Tibet, on the west by Nepal, and on the southeast by Bhutan (Map: India, E 3). Area, 2818 square miles; population, in 1891, 30,458; in 1901, 59,000. It is on the southern slope of the Himalaya range, Kunchinjinga in the north having an altitude of 28,000 feet. It is drained into the Brahmaputra by the Tista. There are valuable forests of oak, walnut, chestnut, and other trees. Copper is mined, rice, maize, millet, cotton, tea, oranges, and other fruits are cultivated, and there is an increasing trade importing cotton piece goods and tobacco, and exporting grain and general agricultural produce. The natives are of Mongolian origin; their language is a Tibetan dialect and their religion Lamaism; they call themselves Rong, but are known to the Gurkhas as Lepchas. Sikkim was conquered by the Gurkhas in 1789, but after the Nepal war in 1814 the independence of the Raja of Sikkim was guaranteed for his coöperation with the British. He ceded Darjiling to the British in 1836, and opened his territory to their trade in 1861. His successor, opposing the Indian Government, was kept under surveillance in India, but was reinstated in 1895, with a British officer as resident and adviser. In 1889 the Chinese by treaty recognized the British protectorate over Sikkim. Capital, Tumlung.

SILAGE (from *silo*, Sp. *silo*, silo, from Lat. *sirus*, from Gk. *σιρός*, *siros*, *σειρός*, *seiros*, pit for corn), or ENSILAGE. A general name applied to green crops packed and preserved under pressure in specially constructed chambers (silos) or in stacks (stack silos), in each of which they undergo fermentation. The preservation of green crops in silos possibly commenced about the year 1800, and in the United States about 1875, since when the use of silage has greatly extended. The first silos made in the United States were of stone or brick, thick-walled and lined with a smooth coat of cement. Since these were expensive, wooden silos were tried, and were found to give satisfactory results at much less cost. Silos should be deep with smooth walls, with as few corners as possible, preferably round or square, and to be more efficient should be as nearly air-tight as practicable. If made of wood the walls may be covered with gas tar.

A cubic foot of silage under average conditions will weigh 35 to 40 pounds. Ordinarily, this amount with other food is enough for one cow's daily ration, and at this rate one cow will consume about 4 tons in 200 days. Allowing for waste and emergency conditions, 50 tons is considered necessary for a herd of 10 cows for 200 days. For a round silo, 30 feet deep, King gives the following dimensions for herds of different sizes, estimating 5 square feet of surface silage for 1 cow:

					Feet
30 cows,	150	square feet,	inside	diameter	silo 14
40 "	200	"	"	"	16
50 "	250	"	"	"	18
60 "	300	"	"	"	19¾
70 "	350	"	"	"	21¼
80 "	400	"	"	"	22¾
90 "	450	"	"	"	24
100 "	500	"	"	"	25¼

The plants most available for silage in the United States are Indian corn, red clover, rye, oats, wheat, sorghum, the millets, alfalfa, soy beans, and cow-peas. Corn is considered most satisfactory. The entire plant should be ensiled, the best time to cut this and other crops being at maturity before the leaves turn brown or the water content begins to diminish. Corn fodder should be cut into pieces one or two inches long when the silo is filled, otherwise the stalks do not pack closely and are not convenient to handle. Silage should be well distributed and well packed along the sides and in the corners. If cut in a very dry season and not very juicy,

considerable water should be poured on the silage after the silo is filled. After filling, some persons prevent waste from the spoiling of the top layer by feeding at once. Others place 6 inches to 1 foot of chaff or cut straw on the silage to prevent decay, still others place a layer of tarred paper smoothly over the surface before piling on the straw.

When green materials are ensiled various changes take place. A portion of the carbohydrates, and to a less extent the albuminoids, of the plant is broken down and acids and other simple bodies are formed. At the same time, oxygen is absorbed and carbon dioxide is produced. These changes result in a loss of material which ranges from 4 to 40 per cent. of the total amount originally present. The chemical changes are accompanied by the production of heat, the temperature sometimes rising as high as 66° Centigrade.

Generally speaking, 3 tons of silage are equal in feeding value to 1 ton of hay. On this basis a much larger amount of digestible food can be secured from an acre of silage corn than from an acre of hay. The food equivalent to 4 tons of hay can easily be produced on an acre of land planted to corn. Crops may be more compactly and economically stored as silage than as hay. A silo of 180 tons capacity will contain silage equivalent to 54 tons of dry matter in the same space. Less than 23 tons of red clover hay, containing less than 20 tons of dry matter, can be stored in the same space in a barn.

Consult: Plumb, *Silos and Silage*, United States Department Agricultural Farmers' Bulletin 32; Thurber, *Silos and Ensilage* (New York, 1886); Bailey, *Ensilage* (New York, 1881); Collingwood, *Conserved Cattle Food* (New York, 1892); Cook, *Silo and Silage*, Michigan Experiment Station Bulletin 90, ser. 6; Mills, *Silos, Ensilage, and Silage* (New York, 1895); Woods, *Ensilage—Its Origin, History, and Practice* (Norwich, England, 1883); *Hand Book of Experiment Station Work*, United States Department Agriculture, Office of Experiment Station Bulletin, No. 15; King, *Silage and the Construction of Modern Silos*, Wisconsin Experiment Station, Bulletin 83; Conn, *Agricultural Bacteriology* (Philadelphia, 1901).

COMPOSITION OF DIFFERENT KINDS OF SILAGE

KIND OF SILAGE	Water	Protein	Fat	Nitrogen-free extract	Crude fibre	Ash
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Corn	79.1	1.7	0.8	11.0	6.0	1.4
Sorghum	76.1	0.8	0.3	15.3	6.4	1.1
Red clover	72.0	4.2	1.2	11.6	8.4	2.6
Soy bean	74.2	4.1	2.2	6.9	9.7	2.8
Cowpea vine	79.3	2.7	1.5	7.6	6.0	2.9
Field pea vine	50.1	5.9	1.6	26.0	13.0	3.5
Mixture of cowpea and soy bean vines	69.8	3.8	1.3	11.1	9.5	4.5
Rye	80.8	2.4	0.3	9.2	5.8	1.6
Barnyard millet and soy bean	79.0	2.8	1.0	7.2	7.2	2.8
Corn and soy bean	76.0	2.5	0.8	11.1	7.2	2.4
Mature corn, sunflower heads, and horse beans (Robertson's silage mixture)	69.7	4.0	1.9	16.7	6.1	1.6

As shown by analysis, the cured silage does not differ materially in composition from the green crop. It is therefore essentially coarse fodder. Silage from legumes is naturally richer in protein than that from corn or other cereals. In some of the mixtures, notably Robertson's silage mixture, the attempt is made to approximate more nearly a balanced ration than is the case with either material alone. Corn silage has the following average coefficient of digestibility: Dry matter, 70.8; protein, 56.0; fat, 82.4; nitrogen-free extract, 76.1; crude fibre, 70.0; and ash, 30.3. Cow-pea silage: Dry matter, 59.6; protein, 57.5; fat, 62.6; nitrogen-free extract, 72.5; crude fibre, 52.0; and ash, 30.3. As regards digestibility silage compares favorably with the green crop from which it is made or the corresponding dry fodder.

The first general use of silage as a stock food was with dairy cattle. The extensive erection of silos in many parts of the United States, however, has resulted in its adoption by many feeders of horses, sheep, and beef cattle. Animals usually eat sound silage with a relish, and reject it only when decay is present. For milch cattle it seems especially well adapted, and the silo has proved an important and economical addition to the dairy farm. Dairy cattle should be fed relatively small amounts of silage until they become accustomed to it. In changing from grass or dry feed to silage, if a regular ration is given, the silage will perhaps slightly affect the taste of the milk for a few milkings, and if the change is from dry feed it may cause too great activity of the bowels. Its use as a food for swine has not been found successful at the agricultural experiment stations.

SILAO, sē-lä'ō. A town in the State of Guanajuato, Mexico, 14 miles by rail from the city of that name (Map: Mexico, H 7). It manufactures cotton and woolen goods, and is the centre of a rich maize and wheat district. Its population, in 1895, was 15,437.

SI'LAS, or SILVA'NUS. One of the early Christians, mentioned as Silas in the Book of Acts, and as Silvanus in the Epistles. Silas may be a contraction for Silvanus, or Silvanus may be a Latin form for the original Silas. He was known as a 'prophet' and leader of the church in Jerusalem, and was one of those chosen to convey the decision of that church to the brethren in Antioch after the council concerning Gentile converts; he remained in Antioch for some time (Acts xv. 22, 32-33). Later, when Paul was about to begin the second missionary journey and had disagreed with Barnabas regarding Mark, Silas became Paul's companion (Acts xv. 36-41). He went with Paul through Asia Minor, passed with him over to Macedonia, shared his experiences in Philippi, Thessalonica, and Berea (Acts xvi.-xvii. 15). He remained at Berea and joined Paul on his return from Athens at Corinth (Acts xvii. 14; xviii. 5). After the close of the second missionary journey

nothing more is known of Silas, unless, as is quite probable, he is the person referred to in I. Peter v. 12, as the 'faithful brother' of the writer. Consult McGiffert, *The Apostolic Age* (New York, 1897).

SILAS MARNER, The Weaver of Raveloe. A story of humble life by George Eliot (1861), considered by many her finest work. Silas, a linen-weaver, wrongly accused of theft, leads an isolated, miserable existence, his one treasure, the savings of years, being stolen by the Squire's son. In its place, a little child strays into his cottage, and fills his life with joy.

SILAY, sē-lī'. A town of Western Negros, Philippines, situated on the northwestern coast 9 miles north of Bacólod (Map: Philippine Islands, G 9). Population (estimated), in 1899, 14,537.

SILCHER, zĭlk'ĕr, Friedrich (1789-1860). A German song-composer, born at Schnaith, Württemberg. He studied with his father and Auberlen, an organist at Fellbach. He taught music while residing at Stuttgart and in 1817 received the appointment of musical director at the University of Tübingen, which position he held until within a few months of his death. His *Sammlung deutscher Volkslieder* contains many of his songs, which have proved great favorites. Among these are: "Aennchen von Tharau," "Morgen musz ich fort von hier," "Ich weisz nicht was soll es bedeuten," "Zu Strassburg auf der Schanz." Among his other works are three books of hymns, *Tübinger Liedertafel,* and *Harmonie- und Compositionslehre.* He died at Tübingen.

SIL'CHESTER. A village in Northern Hampshire, England, about half-way between Reading and Basingstoke. Near the modern village is the site of the old Roman town *Calleva Atrebatum.* The site is inclosed by the remains of the old wall and broad ditch, but no other ruins of the city are visible above ground, and the place has long been under cultivation. Some slight explorations had been made previously, but the first systematic excavations were attempted in 1864 by Joyce, who renewed his efforts from time to time. In 1890 the Society of Antiquaries took up the work, and now the greater part of the ancient site has been explored. The museum at Reading has been chosen as the depository of such objects as can be transported. The wall forms an irregular heptagon, of about 1½ miles in circuit. Six gates have been found; the main gates are on Roman roads which traversed the town from north to south and east to west. In the centre lay the Forum, an open space surrounded on three sides by colonnades with shops behind them, while on the fourth was the Basilica, a hall 270 feet long by 58 feet wide. Outside the whole block was a colonnade fronting on the street. The streets divided the town into a series of blocks (*insulæ*); the houses were not closely joined, but seem to have stood in their own gardens. They are not of the type of the city house of Italy, but consist of rooms opening from a long corridor, or else of three such corridors about a square court-yard. One house of large size, and with baths attached, is supposed to have been an inn. Three temples have been found, and apparently an early Christian church, a small building with a nave, two aisles, and an apse, as well as side rooms. The place was thoroughly Romanized, as is proved by the inscriptions and the art, in which nothing Celtic is discernible. The earlier excavations are reported in *Archæologia* (London Society of Antiquaries), vols. xl., xlvi., and l. Beginning with vol. lii. (1890) full annual reports have been published, well illustrated by plates and plans. For a brief account of the excavations through 1898, see *The Classical Review,* vol. xiii. (London, 1899).

SILENE, sī-lē'nē (Neo-Lat., from Lat. *Silenus,* Gk. Σειληνός, *Seilēnos,* name of a satyr). A large genus of annual or perennial plants of the natural order Caryophyllaceæ; mostly natives of the northern temperate zone. Bladder campion (*Silene Cucubalus*), a European perennial, grows in grain fields and dry pastures, has a branched stem a foot high, bluish-green leaves, panicles of white flowers, and an inflated calyx. The young shoots are sometimes used like asparagus, and have a peculiar but agreeable flavor, somewhat resembling that of peas. They



BLADDER CAMPION.

are best when blanched. Though recommended for cultivation, the plant has not obtained a place among garden plants. *Silene stellata,* the starry campion of the United States, quite similar to the moss campion (*Silene acaulis*), a little plant, with beautiful purple flowers growing in patches so as to form a kind of turf, is one of the finest ornaments of the higher mountains of Europe. It occurs also in America. Many species are popularly called catchfly from their viscidity.

SILENT WOMAN, The. See Epicœne.

SILE'NUS (Lat., from Gk. Σειληνός, *Seilēnos*). In Greek mythology, one of the Sileni. These are spirits of the springs, streams, and luxuriant marshy meadows, companions of Dionysus, like satyrs. They seem to belong to the Asiatic worship of the wine-god, and it is in Asia Minor that we find a or *the* Silenus in various legends, which, while showing the

drunken, lascivious nature, also exhibit a nobler side, in which he is the possessor of supernatural wisdom. Thus, after his capture through his love for wine, Silenus reveals to King Midas the future and also much other hidden wisdom. So, also, Marsyas (q.v.) appears as a Silenus. Silenus developed in the later legend as a king of Nysa, and as the foster-father of Dionysus, whom he accompanied in his journeys, borne upon his ass, whose bray struck terror to the giants and other foes. Art represented him as an old man, bald-headed, snub-nosed, with a huge paunch, flabby, wrinkled skin, and usually in a state of jovial or helpless intoxication. He usually has beside him a wine-skin, and, if he walks, needs the support of friendly satyrs, or is held by them upon his ass. The Sileni are usually identified with those attendants of Dionysus who have horses' ears, tails, and hoofs, or even legs, and are common on the earlier Attic and Ionic vases.

SILESIA, sī-lē'shĭ-a (Ger. *Schlesien*). The largest of the provinces of Prussia. It occupies the southeastern end of the kingdom, and is bounded by the provinces of Posen and Brandenburg on the north, Russian-Poland and Galicia on the east, Austrian Silesia and Bohemia on the south and southwest, and Saxony on the west (Map: Prussia, G 3). Area, 15,568 square miles. The whole southwestern part is very mountainous. It is traversed by chains of the Sudetic Mountains, the Riesengebirge, and a few other ranges. Its highest summits are the Schneekoppe (5260 feet) and the Grosser Schneeberg (4665 feet). The extensive coal-bearing highlands lie east and west of the Oder, and rise in the Hochwald, west of the river, to nearly 2790 feet. Silesia is drained chiefly by the Oder and its numerous tributaries. The Vistula takes in a small part in the north. The Klodnitz Canal is the chief artificial waterway of the province. There are many mineral springs.

The climate is moderate and healthful in the lower parts, but somewhat raw in the mountainous regions. Silesia is still preëminently an agricultural country. About 55 per cent. of the total area is arable land, of which about two-thirds is divided into small holdings, while the remainder is made up of large estates. The fertile land is found chiefly between the Oder and the southwestern mountain chains; most of the land east of the river is unfit for agriculture. Silesia stands next to Saxony among the grain-producing provinces of Prussia. The chief cereals are rye, oats, wheat, and barley. Potatoes, different kinds of forage plants, beets, and hay are also raised extensively. The forests are very extensive, and cattle-raising is an important branch of agriculture.

Silesia contains the richest coal deposits of Germany, and its coal mines give occupation to over 93,000 persons in 1900. The output of coal for the same year was nearly 30,000,000 tons, or nearly 0.3 of the total output of Prussia. The zinc deposits of Silesia, found in the plateau of Farnowitz, are among the richest in the world, and yielded an output of over 520,000 tons in 1900. Iron and lead are also important mineral products. The District of Oppeln is the centre of the iron industry, which has reached a high degree of development. The other manufacturing industries not connected with mining are also extensive, and the industrial progress is shown by the fact that the population engaged in industrial pursuits outside of agriculture increased from 1,409,698 in 1882 to 1,742,187 in 1895, while the agricultural population for the same period shows a decrease from 1,790,934 to 1,628,105. The textile industry ranks next in importance to mining and allied industries, employing nearly 100,000 people. In weaving and flax-spinning Silesia ranks first among the Prussian provinces. The extensive cloth, woolen, and yarn manufactures are centred in the districts of Breslau and Liegnitz. Other important products are china and other earthen and stone wares, and glassware, beet sugar, spirits, woodenware, apparel, etc. The chief centre of industrial as well as commercial activity is Breslau.

Silesia is divided into the three administrative districts of Breslau, Liegnitz, and Oppeln, with Breslau as the capital. To the Prussian Landtag Silesia sends 65 Deputies to the Lower House and 55 members to the Upper. To the Reichstag the province returns 35 members. Population, in 1900, 4,668,857, including about 1,000,000 people of Slavic extraction, mostly Poles. About 54 per cent. are Roman Catholics.

HISTORY. Silesia was inhabited in ancient times by the Germanic Quadi and Lygii, who were succeeded by Slavic tribes. In the tenth century it came under Polish rule and was soon Christianized. From 1163 the greater part of Silesia was ruled by dukes of the Polish line of Piast. (See POLAND.) These dukes, to repeople the country, which had been devastated by the numerous civil wars, encouraged the settlement of German colonies, especially in Lower Silesia. The practice of division and subdivision of territory prevailed so extensively in Silesia that at the beginning of the fourteenth century it had no fewer than 17 independent dukes. Famous among the Silesian dukes was Henry II. of Lower Silesia, who fell in battle against the Mongols on the field of the Wahlstatt in 1241. In the course of the fourteenth century these petty rulers, who were constantly at war with each other, placed themselves under the overlordship of the King of Bohemia, and Silesia was thenceforth part of the Holy Roman Empire. In 1537 the Duke of Liegnitz, one of the numerous Silesian princes, entered into an agreement of mutual succession (*Erbverbrüderung*) with the Elector of Brandenburg on the extinction of either reigning line. The other ducal lines becoming gradually extinct, their possessions fell to Liegnitz or to Bohemia, or lapsed to the Emperor. In 1675, when the last ducal family, that of Liegnitz, failed, the duchies of Liegnitz, Brieg, and Wohlau would have fallen to Prussia; but the Emperor Leopold I. refused to recognize the validity of the agreement of 1537, and took possession of the Liegnitz dominions, as a lapsed fief of Bohemia. The remainder of Silesia was thus incorporated into the Austrian dominions. In 1740 Frederick II. of Prussia, taking advantage of the helpless condition of Maria Theresa of Austria, laid claim, on the strength of the agreement of 1537, to certain portions of Silesia. Without declaring war, he marched into and took possession of the province, maintaining his hold despite the utmost efforts of Austria in the struggles of 1740-42 and 1744-45, called the

first and second Silesian wars. At the close of the Seven Years' War (q.v.), in 1763, the bulk of Silesia was definitively ceded to Prussia.

BIBLIOGRAPHY. Schroller, *Schlesien* (Glogau, 1885-88); Kosmann, *Oberschlesien, sein Land und seine Industrie* (Gleiwitz, 1888); Adamy, *Schlesien nach seinen physikalischen, topographischen und statistischen Verhältnissen* (7th ed., Breslau, 1893); Partsch, *Schlesien, eine Landeskunde auf wissenschaftlicher Grundlage* (Breslau, 1896); Gruenhagen, *Geschichte Schlesiens* (Gotha, 1884-86).

SILESIA, AUSTRIAN. A duchy and crownland of the Austrian Empire, bounded by Prussian Silesia on the north and west, Galicia on the east, and Moravia on the south (Map: Austria, E 1). Its area is 1987 square miles. The Sudetic chain enters Silesia from the west, and the Carpathians send off several spurs into the interior from the east, giving the surface an extremely mountainous character. The chief rivers are the Oder and the Vistula, both rising in the province. The climate is raw, but, on the whole, healthful. Agriculture is carried on in the valleys, where good crops of cereals and industrial plants are raised. The mountain regions are chiefly utilized for cattle-raising. Silesia is one of the chief coal-mining districts of Austria, with an annual output of from 4,000,000 to 5,000,000 tons. Favored by its abundance of fuel, Silesia has a number of well-developed manufacturing industries. Ironware, textiles, beer, and spirits are the chief products. Silesia has a Diet of 31 members, and is represented in the Lower House of the Austrian Reichsrat by 12 members. Population, in 1900, 680,529, of whom over four-fifths were Roman Catholic. According to nationality the population of 1890 was divided as follows: 44 per cent. German, 22 per cent. Czech and Slovak, and over 30 per cent. Polish. Capital, Troppau (q.v.). For history, see SILESIA.

SILEX (Lat., flint). A generic name formerly used by mineralogists to designate those minerals of which silica is the principal ingredient.

SILICA, or SILICIC ACID. See SILICON; QUARTZ.

SILICIDE OF CARBON, or CARBIDE OF SILICON. See CARBIDES.

SILICEOUS ROCKS. A group of sedimentary rocks characterized by quartz as the principal constituent. Sandstone, quartz conglomerate, arkose, novaculite, and chert are the chief varieties of siliceous rocks.

SILICON (Neo-Lat., from Lat. *silex*, flint), or SILICIUM. A non-metallic element discovered by Berzelius in 1823. Among the ancients minerals rich in silica were used in glass-making, and Becher contended that they contained a peculiar kind of earth, to which he gave the name *terra vitrescibilis*. In the seventeenth century it was found that such minerals did not change when heated by themselves, and only formed a fusible glass when brought in contact with other bodies. In 1660 Tachenius showed that it possessed acid rather than alkaline properties, as it combined with alkalies, but the true nature of silica remained unknown until Davy demonstrated it in the early part of the nineteenth century. Silicon is the most abundant of all elements in the solid earth's crust, with the exception of oxygen. It is never found in the isolated state, but occurs in combination with oxygen as silicon dioxide or silica (quartz, flint, sand, etc.), and in various minerals in the form of metallic silicates. It is also found in mineral springs and in sea water. It was originally prepared by Berzelius by decomposing potassium silicofluoride by means of potassium in an iron tube at a red heat. When allowed to cool, the mass was treated with water, which dissolved the potassium fluoride, leaving silicon in the form of an amorphous brown powder. This method is still used, but with the substitution of sodium for potassium. The element may also be obtained by the electrolysis of a fused mixture of potassium fluoride and silicofluoride. A graphitoidal modification of silicon is recognized by some, and may be produced by heating amorphous silicon in a platinum crucible; while a third modification, known as crystalline or adamantine silicon, is formed by heating in an earthenware crucible a mixture of three parts of potassium fluosilicate, one part of sodium in small pieces, and four parts of granulated zinc.

Silicon (symbol Si; atomic weight, 28.40), when in an amorphous condition, is a lustrous brown powder, which does not conduct electricity and is fusible in a non-oxidizing atmosphere at a temperature between the melting-points of steel and cast iron. The graphitoidal modification consists of shining metallic scales; while crystalline silicon is obtained in the form of grayish-black metal-like leaflets or needles, with a specific gravity of 2.19, and a melting-point between 1100° and 1300° C. Silicon combines directly with a number of the elements, forming *silicides*. With oxygen silicon combines to form only one oxide, the dioxide, or *silica* (SiO_2), which is an important constituent of the solid crust of the earth and may be artificially prepared by burning silicon in air or oxygen. As flint and as sand it has many applications in the arts, as in the manufacture of glass, pottery, etc. Silicon unites with the halogens. Thus, with fluorine, it forms a silicon tetrafluoride, which is a colorless gas that combines with water, forming hydrofluosilicic acid, which in turn unites with bases to form salts known as *silicofluorides*.

SILIPAN, sē'lē-pän'. A Malay tribe in Nueva Vizcaya Province, Luzon; speech, Ifugao. See PHILIPPINE ISLANDS.

SILISTRIA, sĭ-lĭs'trĭ-ȧ. A town of Bulgaria, on the right bank of the Danube, 75 miles below Rustchuk (Map: Balkan Peninsula, F 2). In the vicinity are vineyards and tobacco plantations, and the town produces flour and leather on a considerable scale. Population, in 1900, 12,133. Silistria was called by the Romans *Durostorum* and was an important city of Mœsia Inferior. It was an important fortress under the Turkish rule and repeatedly baffled the attacks of the Russians.

SIL'IUS ITAL'ICUS, TIBERIUS CATIUS (25-101). A Latin poet, whose name appears frequently in Martial and Pliny. He was probably a *delator* under Nero. In 69 he was consul, and soon after proconsul in Asia. He was rich and luxurious, a dilettante in literature, art, and philosophy, being a member of the Roman school of Stoics and a friend of Epictetus. He starved himself rather than linger with an incurable disease. A *Homerus Latinus*, or *Pindarus Thebanus*,

bears his name in acrostic at beginning and end. It is an epitome of the *Iliad*. He is better known by the *Punica*, an artificial heavy epic in seventeen books. The poem is edited by Ruperti (1795-98) and by Bauer (1890-92).

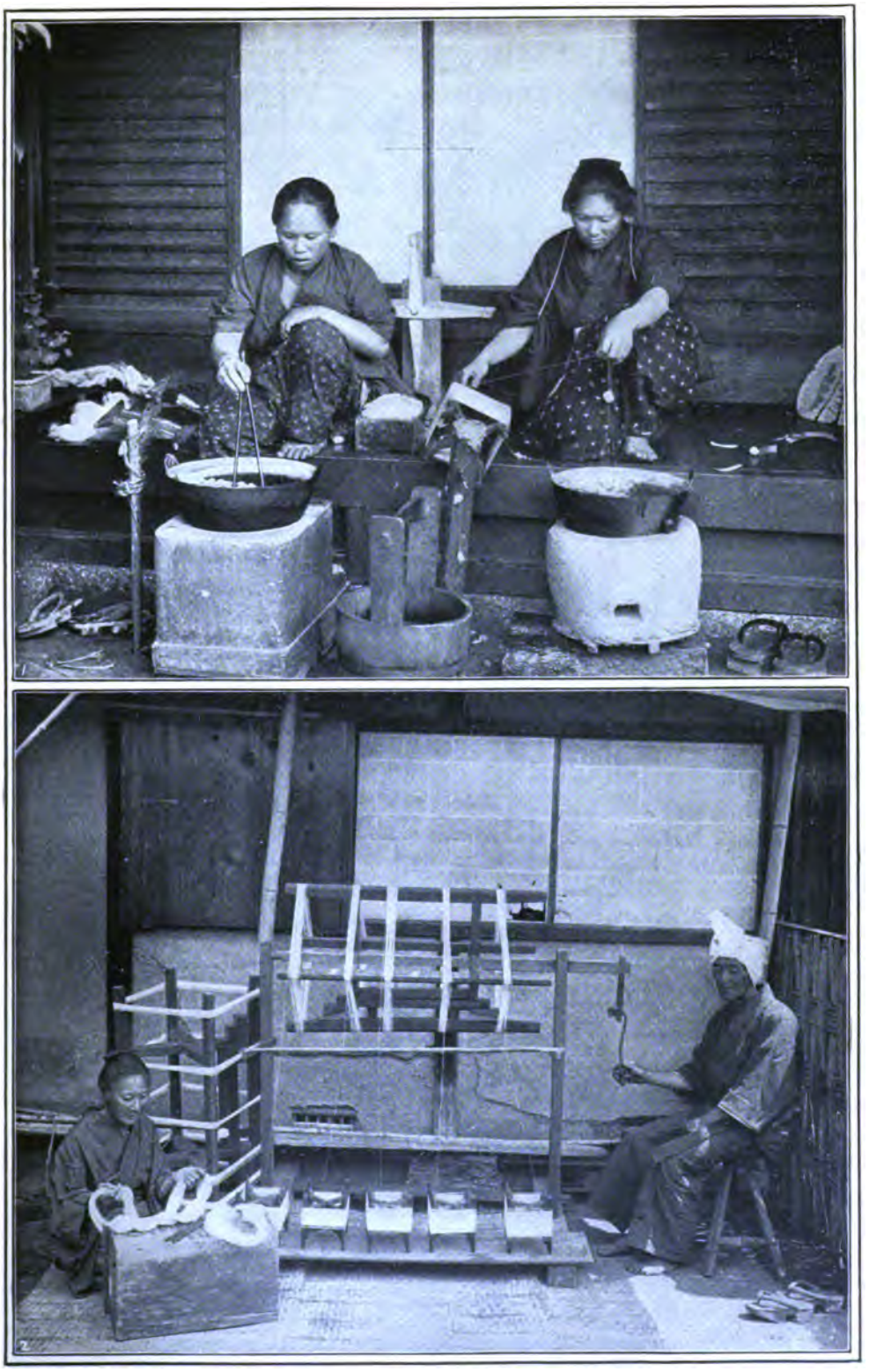
SILK (AS. *seolc, sioloc, sioluc*, OHG. *silecho*, silken robe, probably from OChurch Slav. *šelkŭ*, silk, from Lat. *sericum*, silk, neu. sg. of *Sericus*, Chinese, from *Seres*, Gk. Σῆρες, Chinese; cf. Mongol. *sirek*, silk, Korean *sa, sil, sir*, silk, from Chin. *szĕ, szŭ, sz', sei, si*, silk). The fibre derived from the cocoon of the silkworm (*Bombyx mori*), or from some other form of caterpillar or spider, and woven into many useful and ornamental fabrics.

HISTORICAL SKETCH. Silk appears not to have been well known to the ancients; although several times mentioned in the translations of the Bible, the best authorities deny that it is in the original, or that it was known to the Hebrews. Among the Greeks, Aristotle is the first who mentions it, and he only says that "Pamphile, daughter of Plates, is reported to have first woven it in Cos;" and from all the evidence which has been collected, it would appear that the natives of Cos received it indirectly through the Phœnicians and Persians from China. The silken webs of Cos found their way to Rome, but it was very long before it was obtainable except by the most wealthy. The cultivation in Europe of the worm itself did not take place until A.D. 530, when, according to an account given by Procopius, the eggs were brought from India (China) to the Emperor Justinian by some monks. In China the cultivation of silk is of the highest antiquity, and, according to Chinese authorities, it was first begun by Si-ling, the wife of the Emperor Hoang-ti, B.C. 2600, and the mulberry was cultivated for the purpose of feeding silkworms only forty years later.

Since its introduction into Europe silk culture has always formed a great branch of industry in Italy, Turkey, and Greece, and it has been carried on to some extent in France, Spain, and Portugal. In England, too, from time to time, efforts have been made to cultivate silk, but with limited success.

In the early days the American colonists devoted much time and labor to the growth of the mulberry tree and the culture of silkworms. In 1732 the colonial Government of Georgia allotted a piece of ground for use as a nursery plantation for white mulberry trees. Lands were granted to settlers on condition that they planted 100 of these trees on every 10 acres when cleared, 10 years being allowed for their cultivation. In 1749 the British Parliament passed an act exempting from duty all raw silk which was certified to be the production of Georgia or Carolina. In the same year an Italian expert was sent to Georgia to conduct a filature—for reeling, doubling, cleaning, and twisting, or throwing silk—and in 1759 the receipts of cocoons at the filature exceeded 10,000 pounds, and the quality of the raw silk was so good that it sold in London as high as three shillings a pound more than that from any other part of the world. After 1759, however, the production of silk in Georgia fell off greatly, though a French settlement at New Bordeaux, on the Savannah River, manufactured considerable quantities of sewing-silk during the Revolution. Mansfield, Conn., became, in the latter part of the eighteenth century, an important silk-raising section; and this continued to be a fixed industry in that locality. Pennsylvania engaged in the culture about 1767, and a filature was established in Philadelphia in 1769 or 1770, and in 1771 2300 pounds of cocoons were brought there to reel. This State maintained some prominence in the industry up to the time of the Revolution. From the period of the close of the Revolution up to about 1825 the silk manufacture in the United States was purely domestic, families making small quantities—hardly ever reaching 100 pounds per annum in a single family. The importation of silk goods in the meantime had increased enormously, so that in 1821 it amounted to $4,486,924. It was felt that this costly importation should be stayed, if possible, and several Congressional committees investigated the subject, and voluminous reports were made upon it. This brought about the enthusiastic culture of the *Morus multicaulis*, which grew into a mania, during whose existence hundreds of speculators and thousands of private buyers were ruined.

The result of this speculative incident, the financial depression of 1837, and the fact that in 1844 a blight affected all the mulberry trees in the country were disastrous to silk culture in the United States, and the effort to rear silkworms ceased. In California, in 1860-75, the business was largely prosecuted, but did not succeed financially. In 1884 Congress began making appropriations for the encouragement of silk culture in the United States, and these appropriations, expended under the Department of Agriculture, were continued until 1890, when they lapsed and were renewed in 1901. In the meantime considerable silk was grown in Utah under State bounties, and private individuals have raised cocoons and reeled the silk on hand reels for home weaving in many other States. The climate and soil of many parts of the United States seem admirably adapted to silk culture, but as yet there are no commercial reeling establishments. The first silk mill on the Western continent was set up at Mansfield, Conn., in 1810. The manufacture was introduced into Philadelphia about 1815; and as early as 1824 the Jacquard loom began to be used there. Power-looms were next introduced, and power-loom weaving was begun about 1838. From 1831 to 1839 a large number of factories were started at Windsor Locks, Conn.; Poughkeepsie, N. Y.; in Philadelphia, and elsewhere, most of which failed. Burlington, N. J., became an important silk-producing locality, beginning about 1838. The industry included the culture of the mulberry tree and the raising of silkworms, as well as the manufacture of silk. Hartford, South Manchester (Conn.), Holyoke, Northampton, and Haydenville (Mass.), are among the New England towns in which silk has been manufactured extensively. But the most important centre of this industry in America is Paterson, N. J. (q.v.), where the water power of the Passaic River, facilities for transportation, etc., seem to offer the best possible conditions for its prosecution. The first silk mill in Paterson was set up about 1838, in the fourth floor of Samuel Colt's pistol factory. This was followed by the establishment of other factories, until in the years immediately succeed-



1. UNWINDING THE COCOONS

2. REELING

ing the Civil War Paterson became, and has since remained, the chief seat of silk manufacture in the United States.

PROCESSES OF MANUFACTURE. Although raw silk, unlike other textile fibres, is a continuous thread, and therefore requires no spinning, yet its preparation for the loom includes many distinct operations. After the cocoons that are to be saved for breeding purposes are set aside, those to be used for their silk are submitted to some treatment that will kill the chrysalis without injury to the cocoon, just at the time when the insect has finished spinning and is ready to force its way through its covering. Several methods have been adopted for accomplishing this end. The chrysalis may be destroyed in a hot oven, or by placing it in the hot sun for several days under glass, or by a steam-bath. The last-named method was invented by Professor Castrogivanni, of Turin. The cocoons are placed under an iron receiver, where steam is applied at a uniform temperature of 212° F. One objection to this process is that the pupa sometimes bursts, soiling the silk. It is said that the Chinese reel off the silks from the cocoon while the silkworm is still alive.

REELING. In order to be able to remove the silk from the cocoon, the latter is soaked in warm water, which loosens the gummy substance binding the filaments together. As a single fibre has not sufficient tenacity, from four to eighteen filaments, according to the quality, are taken, and two threads formed by passing them through perforated metal or porcelain guides. The threads are crossed or twisted together at a given point, and again separated and passed through a second pair of guides, the temporary twisting or crossing causing the agglutination of the individual fibres of each thread. The thread is then passed through a pair of distributing guides on to the reel. Great care and skill are required in reeling silk from the cocoons, to keep the thread of uniform thickness. The threads of different cocoons are not of uniform length, and that from the inner part of the cocoon is finer than the outside, so the filament from another cocoon must now and then be added to keep the thread even. The common reeling machine is a simple device consisting of a reel 60 to 90 inches in diameter, adjusted in a frame which contains the guides, the water basin, and means for keeping the water warm. Reeled silk is the raw material of the silk manufacturer, called raw silk. It is shipped by the silk-growers in hanks of various sizes, packed in bundles or bales.

SILK CONDITIONING. One of the most striking physical characteristics of raw silk is its avidity for moisture; it will readily absorb 30 per cent. of its weight in moisture without the fact being perceptible. In order, therefore, to determine the amount of normal silk in a given bulk, the raw silk is tested in an apparatus called a desiccator. This is done by first weighing a sample, then drying it and noting the loss of weight. To the thoroughly dried silk an allowance of 11 per cent. is added and the result taken as normal weight. In the great centres of silk manufacture the testing is required by buyers and is done by special houses called silk-conditioning establishments.

THROWING. The process of preparing the reeled silk for the loom is technically called throwing. The first step is to transfer the silk from the skeins to bobbins. The skeins, inclosed in a light cotton bag, are soaked for several hours in soapy water at 110° F. They are then dried in a hydro-extractor and stretched upon *swifts*, which are skeleton reels so adjusted that they will hold the skeins tightly. Thence they are wound onto bobbins. The silk is next cleaned by passing it from one bobbin to another through the cleaner, which consists of two parallel plates so adjusted that there is just room for the thread to pass through. Adhering dirt or an imperfection in the thread at once holds the thread and at the same time arrests the motion of the spindle until the operator removes the cause. The best Italian silk does not require this process of cleaning, but for Chinese silk it is always necessary.

DOUBLING AND TWISTING is the next process performed, and the manner in which it is done gives the name to the three different silk threads. (1) *Single silk* is not doubled or twisted at all, but is woven direct from the cleaning process. Cloth produced in this way possesses a softness and brilliancy not obtainable in that made from twisted silk. Pongee is a familiar fabric made from singles. (2) *Tram silk* is made by twisting two or more single threads which are then doubled and slightly twisted. It is used for the woof thread in weaving. (3) *Organzine silk* is made by the union of two or more single threads, twisted separately in the same direction, which are doubled and then re-twisted in the opposite direction. It is used chiefly for warp threads.

SCOURING is the process applied to thrown silk to remove more or less of the glue adhering to the silk thread, so it will have a greater lustre and may be able to take a better color in dyeing. According to the amount of gum removed in scouring, silk is known as *boiled*, in which from 24 to 30 per cent. is removed; *souple*, in which only from 5 to 8 per cent. is removed; *écru*, in which not more than 5 per cent. is removed. The scouring is performed in soapsuds. The silk is now ready to be dyed, although for white or pale shades it must first be bleached in sulphur fumes.

SHAKING, GLOSSING, and LUSTRING are supplementary processes for which special machinery has been devised, designed to develop the lustre of the silk.

LOADING or WEIGHTING OF SILK was, in the beginning, an attempt on the part of silk dyers to make up for the loss of weight, often amounting to one-fourth, incurred during the process of scouring, by the use of certain chemicals which, combining with the silk, took up the dye. For a time weavers were satisfied if the dyeing process was so conducted that there was no loss of weight. But the art of imparting factitious weight to silk was soon developed to a ruinous extent. Sugar and glucose were at first the favorite agents of sophistication, but were soon abandoned for more effective materials. In black silks the extreme weighting was first practiced, a pound of silk being treated so as to weigh 100 ounces. The discovery of the use of salts of tin, however, has made it possible to weight the white and colored silks as heavily as black. By this process the durability of the silken fabric, once its most prominent characteristic, is entirely lost.

SPUN SILK. Before winding the cocoons a flossy portion has to be removed. (See FLOSS SILK.) After the filament has been wound off another remains like a compact bag. These, together with the silk from perforated and double cocoons, and the fragments of broken thread which accumulate during the process of throwing, are collected and sold under the name of *waste silk*. This waste is thoroughly cleaned by washing, boiling, and drying, and is then carded and spun like cotton, the yarn produced by this process being known as *spun silk* or *flurt silk*. This greatly economizes the use of silk, as the quantity of silk-waste always greatly exceeds the amount of good silk reeled off. The processes employed in the production of silk-yarn or floss silk, from the waste, differ little from those for spinning other materials. Four million pounds of floss silk are annually consumed in France alone.

WILD SILK. Many silk-producing moths exist besides the *Bombyx mori*, or cultivated moth, from which the ordinary commercial silk is derived. The one at present attracting the most attention is that from which Tussah silk is manufactured, much used in connection with ordinary silk and in the manufacture of plush. Tussah silk is the product of the moth *Antheræa mylitta*, found in India. Other wild silks are the *Eria* silk of India, the *Fagara* silk of China, and the *Yama-mai* silk of Japan. See SILKWORM.

OTHER SILK. A certain amount of silk is spun by many insects. The bombycid and Saturnian moths spin the largest quantity. There is a butterfly (*Eucheira socialis*), however, whose caterpillars live in an enormous silken nest. Insects of other orders, also, have smaller silk glands and secrete some silk. In the Arachnida a number of groups produce silk, the greatest amount being spun by the spiders, and many experiments have been made to place the production of spider-silk upon a commercial basis.

RAW SILK PRODUCTION OF THE WORLD FOR YEAR 1899
[From United States Consular Reports, March, 1901]

COUNTRY	Kilograms	Pounds
Western Europe:		
France	560,000	1,234,576
Italy	3,363,000	6,814,070
Spain	78,000	171,959
Austria-Hungary	276,000	608,470
Total	4,277,000	8,829,075
Levant and Central Asia:		
Anatolia	486,000	1,071,436
Syria	456,000	1,005,298
Salonikí (Adrianople)	210,000	462,966
Balkans (Bulgaria)	42,000	92,593
Greece	34,000	74,956
Caucasus	310,000	683,426
Persia and Turkestan (exportations)	246,000	542,332
Total	1,784,000	3,933,007
Far East:		
Export from Shanghai	5,455,000	12,026,093
" Canton	2,250,000	4,960,350
" Japan, Yokohama	3,542,000	7,808,693
" India, Calcutta	350,000	771,610
Total	11,597,000	25,566,746
Grand total	17,658,000	38,328,828

SILK FABRICS. The process of weaving silk does not differ from that of weaving other fabrics, except that in Europe for the finer grades the hand-loom is still largely employed. (See WEAVING.) In 1889, 17,294 hand-looms were in use in Lyons, France; in 1899 the number had fallen to 8637. The four principal silk woven textures are sarcenet, taffeta, satin, and velvet.

STATISTICS. The accompanying table on the silk production of the world was compiled by Consul Hughes, of Coburg, from statistics issued by the Merchants' Union Silk Syndicate of Lyons. According to the Twelfth United States Census there were in the country at the close of 1900 483 silk factories, with a combined capital of $81,082,201, which used 9,760,770 pounds of raw silk. The rapid growth of the industry during the last half of the nineteenth century is shown by the fact that in 1850 there were only sixty-seven silk factories, having a capital of $678,300 and a product of $1,809,476.

SILK AND MANUFACTURES OF SILK IMPORTED INTO THE UNITED STATES
[From the Statistical Abstract of the United States for Fiscal Year Ending June 30, 1900]

UNMANUFACTURED—			
Cocoons	free	pounds	30,004
		dollars	18,235
Raw, or as reeled from the cocoons	free	pounds	11,259,310
		dollars	44,549,672
Waste	free	pounds	1,784,404
		dollars	761,853
Total manufactured		dollars	45,329,760
MANUFACTURES OF—			
Clothing, ready-made, and other wearing apparel	dut.	dollars	1,657,641
Dress and piece goods	dut.	dollars	15,425,997
Laces and embroideries	dut.	dollars	3,206,857
Ribbons	dut.	dollars	1,811,644
Spun silk, in skeins, cops, warps, or on beams	dut.	pounds	2,420,552
		dollars	3,723,348
Velvets, plushes, and other pile fabrics	dut.	pounds	706,354
		dollars	2,316,115
All other	dut.	dollars	2,752,771
Total manufactures		dollars	30,894,373

In 1900 there was a total of 44,430 silk looms in the United States, of which 20,572 were in New Jersey, 12,949 in Pennsylvania, 5263 in New York, 2975 in Connecticut, and 1040 in Massachusetts. During the year forty-three silk mills were built, and one-third of the silk product of the world was consumed in the United States. Returns for the year 1901 for the State of New Jersey gave the total number of silk establishments in that State as 152; average number of men and women employed therein, 26,046; wages paid, $10,544,948; gross value of product, $41,199,395.

BIBLIOGRAPHY. Most of the recent literature on silk manufacture is in French or German. Sadtler, *Industrial Organic Chemistry* (Philadelphia, 1900), contains a brief but thorough discussion of the physical processes involved, while Posselt, *Structure of Fibres, Yarns, and Fabrics* (Philadelphia, 1890), contains a concise account of the methods and machinery employed in the modern silk factory. Silk-weaving from the historical side is treated in Coles, *Ornament in European Silks* (London, 1899). See, also, bibliography under SILKWORM. See SILKWORM; SPINNING; TEXTILE MANUFACTURING; WEAVING.

SILK, ARTIFICIAL. Artificial silk has been the aim of experimenters for many years. The Comte de Chardonnet, at the Paris Exposition of 1889, exhibited a most ingenious process of producing from cellulose an artificial fibre resembling in all its characteristics and uses the true silk of *Bombyx mori*. The cellulose experimented with was principally of cotton and the pulp of soft

woods. In making artificial silk from cotton the lint is first carded into wadding, which is immersed in a mixture of 15 parts of nitric acid of 1.5 specific gravity and 85 parts of commercial sulphuric acid. This process transforms the cotton into nitro-cellulose and continues until its color, when examined with the microscope and polarized light, is a clear blue. The next stage in the process is to press the nitrated cotton, which is then washed to remove all traces of the acid. It is then dissolved in a mixture of alcohol and ether, forming collodion, which requires aging in order to secure the best results. This collodion is placed in steel cylinders and the liquid is expelled by pressure through capillary tubes into nitric acid diluted one-half with water. The fibres thus produced are wound directly upon reels and are ready for subsequent treatment. This involves the drying of the fibre by warm air and its denitration in a bath of alkaline sulphide. It then goes through additional washing and drying processes, after which it may be spun and dyed like natural silk. The process with wood fibre is quite similar and there has also been an attempt made to produce a similar fibre by drawing gelatin into fine threads. It is said that the elasticity of artificial silk made by the process described is equal to that of the natural silk, while in lustre and brilliancy it is said to surpass the latter. It was claimed at the time that this silk could be produced at from one-third to one-fourth the cost of real silk. Consult Sadtler, *Industrial Organic Chemistry*. (Philadelphia, 1900). See SILK. Compare natural process described under SILKWORM.

SILK, VEGETABLE. A term usually applied to the fibre which surrounds the seeds of the pods of certain plants of the milkweed family. This fibre is soft and silky and has been employed to mix with silk and with wool in the manufacture of certain fabrics. See SILK.

SILK COTTON TREES. See ERIODENDRON.

SILK-OAK. See GREVILLEA.

SILKWORM. The 'silkworm' of commerce is the caterpillar of *Bombyx mori*, a moth of the family Bombycidæ, a group commonly known as the family of silkworm moths. The caterpillars of all of the species of this group have the silk-glands largely developed, and many of them spin large quantities of silk in making their cocoons. The Bombycidæ have a very short and rudimentary proboscis, live for a very short time in their perfect state, and take little or no food; the body is thick and hairy; the wings are large and broad; the antennæ are pectinated. The caterpillars feed on the leaves and other tender parts of trees or other plants; the chrysalids are inclosed in a cocoon of silk. The common silkworm is a native of either the northern provinces of China or of Bengal. The perfect insect is about an inch in length, the female rather larger than the male, the color whitish, with a broad pale brown bar across the upper wings. The females generally die very soon after they have laid their eggs, and the males do not survive much longer. The eggs are numerous, bluish in color, about the size of a pin's head, not attached together, but fastened to the surface on which they are laid by a gummy substance, which, when dry, becomes silky. They are laid about the end of June, and are hatched about the middle of the following April, or at the time when the leaves of the mulberry unfold.

The caterpillar is at first small, not more than a quarter of an inch in length, but rapidly increases in size, till, when full grown, it is nearly three inches long. It is usually of a yellowish gray color, but some varieties are much darker. The skin is changed four times during the growth of the caterpillar. Before each change of skin it becomes lethargic, and ceases to eat, whereas at other times it is very voracious. When the skin is ready to be cast off, it bursts at the fore part, and the caterpillar then, by continually writhing its body, without moving from the spot, thrusts it backward; but silkworms frequently die during the change of skin. A very rapid increase of size takes place while the new skin is still soft. The natural food of the silkworm is the leaf of the white mulberry, but it will also feed on the leaves of some other plants, as black mulberry and lettuce, and in the United States it is frequently fed on the Osage orange. When so fed, however, it produces silk of inferior quality. The silk-producing organs are two large glands (sericteria) containing a viscid substance, which extend along a great part of the body, and terminate in two spinnerets in the mouth. These glands become very large when the change to the chrysalis or pupa state is about to take place.

When about to spin a cocoon, the silkworm ceases to eat, and first produces the rough fibre which forms the outer part of the cocoon, and then the more closely disposed and valuable fibre of its interior. In this process the position of the hinder part of the body is little changed, but the head is moved from one point to another; and the cocoon when finished is much shorter than the body. Each fibre of silk, when examined by a microscope, is seen to be double, being equally derived from the two silk-producing organs of the caterpillar. A single fibre ranges from 800 to 1000 yards in length. The time of the silkworm's life in the caterpillar state is about four weeks. About three days are occupied in the spinning of the cocoon; after which about two or three weeks elapse in the chrysalis stage before the perfect insect comes forth.

DISEASES. The silkworm is liable to various diseases, particularly to muscardine, pébrine, flacherie, gattine, and grasserie. Muscardine, commonly known as silkworm rot, is due to a fungous growth within the caterpillar. A worm so affected becomes of a dull white color, sluggish in action, and soon dies. A few days after death it becomes hard, red, and floury. The cause of the disease was discovered by an Italian, Bassi, and the fungus is called *Botrytis Bassiana*. Pébrine, which unquestionably is a bacterial disease, is hereditary, and probably is contagious and infectious besides. It is the most fatal of silkworm diseases. By 1847 its ravages in France compelled the French to get their silkworm eggs from Italy. The disease spread to Italy and then the eggs were procured from the Danube, then from China, and in 1865 healthy eggs could be obtained only from Japan. Pasteur showed that selection and isolation of healthy moths is the only remedy. With the methods of isolation and care against contamination such as are at present practiced,

France now supplies her own market and exports 300,000 ounces of silkworm eggs annually. In worms affected with flacherie the food ferments in the alimentary tract and sustains vibrios and certain fungi. This disease is probably induced by improper care of the eggs. Gattine is probably only a modification of flacherie. The cause of grasserie (q.v.) is unknown. It is the least fatal of silkworm diseases. To keep silkworms healthy they must be reared in a suitable and constant temperature. Humidity, ventilation, and cleanliness must also be strictly and constantly attended to. Lime is used for whitewashing the walls and buildings in which the worms are reared, and sulphur fumes for sterilizing the trays.

CULTURE OF SILKWORMS. The leaf of the white mulberry (*Morus alba*) is apparently the natural food of the domestic silkworm. There are many horticultural varieties of this plant, some much better adapted than others to commercial silk culture, and some better suited to certain localities. The *Morus moretti*, the *Morus multicaulis*, and the black mulberry (*Morus nigra*) are also used. The red mulberry (*Morus rubra*) does not make good food, and the paper mulberry (*Broussonetia papyrifera*) is also valueless. The best varieties of mulberries are propagated by means of seeds and by cuttings. The trees should be planted well apart and should be pruned so as to form a short trunk and a close low head. Silkworm eggs are kept through the winter at a low temperature, the embryo beginning to take form when the temperature rises above 50° F. The receptacle in which they are stored should be ventilated, the air should not be moist, and great care should be taken to keep them out of the reach of mice and insects. The eggs are hatched in an artificial incubator or by natural heat. When an incubator is used the temperature should be gradually increased until 73° F. is reached. The whitening of the eggs denotes the near approach of the hatching. The eggs should then be covered with sheets of tulle or finely perforated paper, sprinkled over with finely cut white mulberry leaves. The young caterpillars will at once mount to the leaves, and should be fed eight to ten times during twenty-four hours. After each feeding the lower sheet of perforated paper or tulle should be removed with the frass. About the sixth day they will begin to molt and pass into the second stage. As the worms increase in size, paper in which the perforations are larger should be used, and the same general directions followed for each stage until the fifth has been reached.

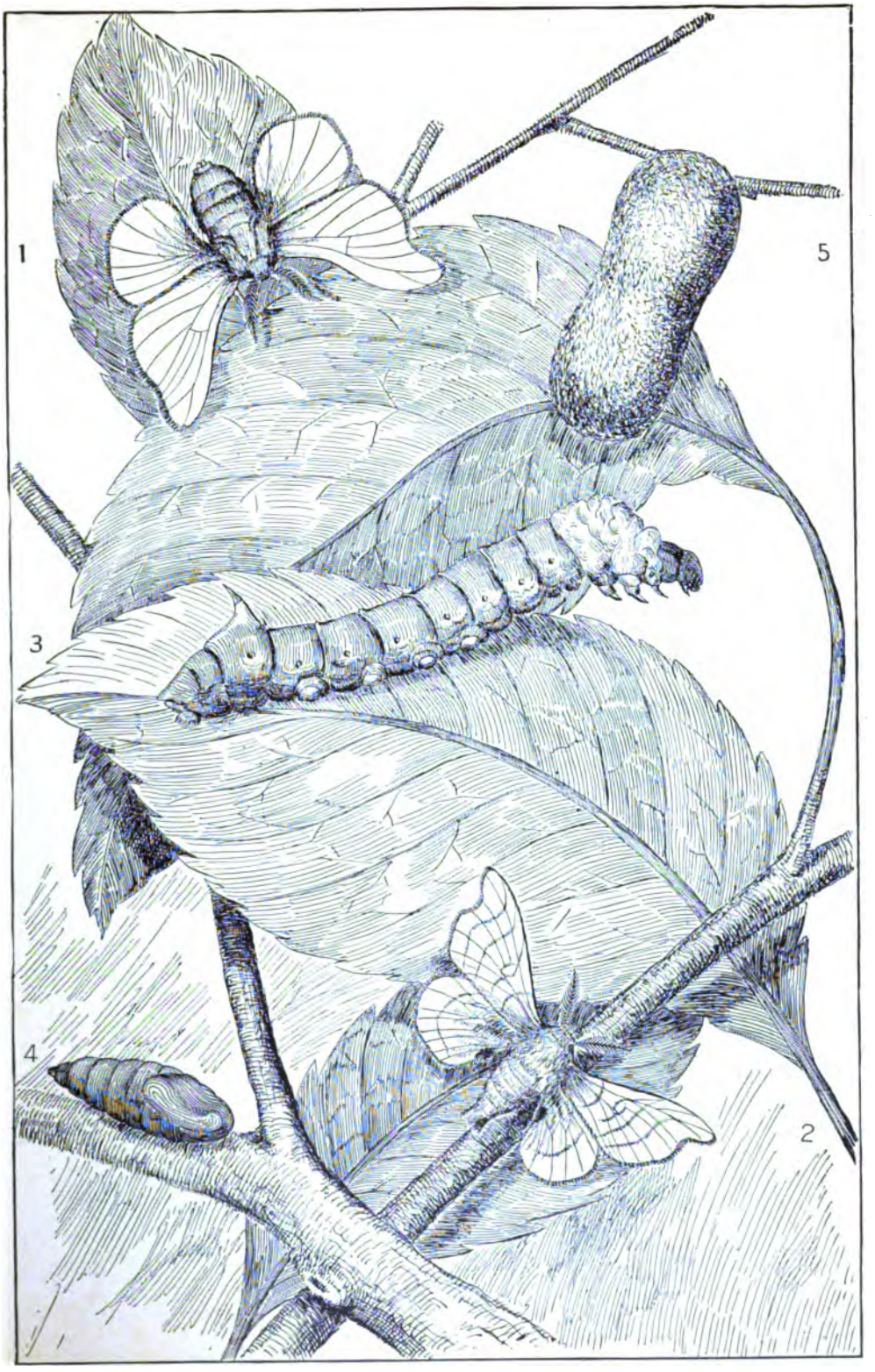
The worms have now grown to nearly full size, and are very voracious, and it is very difficult to satisfy their appetite. After five days in the fifth stage they are ready to spin. In making preparations for spinning, dry brush, bundles of straw or shavings or finely split-up wood may be used. The brush or straw should be placed upright between the feeding shelves, in rows, about 16 inches apart, the tops spread out to form arches and to allow the worms plenty of room to spin. The temperature during spinning should be 75° F., and the humidity throughout the rearing about 65°. The rearing-room should be well ventilated, and before introducing the worms should be disinfected with chloride of lime or sulphur. One ounce of eggs contains approximately 40,000, and the space required may be estimated by allowing one square yard for this amount at birth, on the fourth day two square yards, for the second stage four square yards, three days later eight square yards, for the third stage 16 square yards, for the fourth stage 32 square yards, and for the fifth stage 60 square yards. Plenty of space is desirable, since when crowded the worms will not be so robust. A mean temperature of about 74° F. is the best. There are many commercial varieties of the silkworm graded according to the size, color, and quality of the cocoon. When the cocoons are completed, which is known by the absence of any sound within, they are carefully sorted, and a certain number are kept for laying. The sexes are readily known by the difference of shape as well as of size, the female being plumper and the male, besides being much smaller, having a central depression and sharper extremities. The French growers sort them into nine varieties, those which are less compact, or in which the worm has died—a fact known by external indications—being separated from the good ones. When the sorting is finished, the cocoons are placed in an oven with a gentle heat, which kills the inclosed chrysalis, otherwise they would all become *perforated* by the insect eating through. The cocoons are then ready for the first stage in the manufacturing process, which consists in the removal and winding of the fibrous covering as described under SILK.

OTHER SILKWORMS. It is supposed by some entomologists that the original wild silkworm from which descended the silkworm of commerce is a species known as *Theophila Huttoni*, which occurs in Japan, the Northwest Himalayas, and Assam. The moth is of the same size as that of *Bombyx mori*, is light brown in color, and has the characteristic markings on the wings. The larva almost precisely resembles the domestic silkworm, but has a pair of small black thorns on the back of each segment of the abdomen. It seems very unlikely, however, that this species could have been the ancestor of *Bombyx mori*, since it lacks palpi, which are present in the Bombyx.

Oriental people have utilized the cocoons of a number of species of bombycid moths in the manufacture of silk goods. The so-called tussah, tusseh, or tusser silkworm is *Antheræa mylitta*, a species which occurs in China, India, and Ceylon. In Upper India this silk is extensively produced, and the cocoons are collected in the jungle districts by the Sahars and other half-wild castes who live in such places. Other silkworms which are said to be used in the manufacture of tusseh silk are *Antheræa pernyi*, from China; *Antheræa Assama* (*Saturnia Perottetti* and *Antheræa mezankooria* are synonyms of this species), a native of Assam, and there called 'moonga' or 'moogha;' *Antheræa Roylei*, from India; *Antheræa Helferi* from Sikhim; *Antheræa jana*, from Java; *Antheræa Frithii*, from Sikhim, Bhutan, and Darjeeling; and *Antheræa larissa*, from Java. The very large and beautiful *Attacus atlas*, from India, Ceylon, Burma, and Java, is also said to produce cocoons used in making tusseh silk.

The wild silkworms which have received the

SILKWORM



SILKWORM (Bombyx mori).

1. Female Moth.
2. Male Moth.
3. Caterpillar (Silkworm) on Mulberry Leaf.
4. Chrysalis.
5. Cocoon.

most attention in Europe, however, are *Antheræa yama-mai*, from Japan, commonly known as the 'yama-mai' silkworm; *Antheræa pernyi*, from China; and *Philosamia cynthia*, from Japan, China, the Himalayas, Assam, and Java, which has been introduced into Europe and which has been acclimatized in the Eastern United States. Its larva is commonly known as the ailanthus silkworm, while the yamamai and pernyi silkworms are commonly known as oak silkworms.

The yama-mai silkworm is commonly raised in Japan and its cocoon is large, heavy, and handsome, and of a yellowish-green color. It is readily reeled, and its silk ranks commercially next to that of the domestic silkworm. The silk is strong and valuable. It bleaches well and may then be dyed. Fewer threads are required to make a strand than with *Bombyx mori*, and the cocoons unwind with perfect ease by the ordinary process. The life of the worm lasts from 50 to 80 days, and it feeds on all kinds of oak, but prefers those of the white oak group.

The pernyi silkworm has been cultivated in Europe with better success than the yamamai. It develops more rapidly, is double-brooded, and passes the winter in the chrysalis state. The cocoon is not so valuable, though ranking probably third best among the different silkworm cocoons.

The ailanthus silkworm is utilized extensively in North China. It has been known in Europe since the middle of the last century, and has been cultivated there as well as in the United States with perfect success. The cocoons, however, cannot be reeled successfully, and their silk is utilized principally by carding processes.

In the United States several species of silkworm moths occur, and their caterpillars spin an abundance of silk of a strong and durable quality. The 'American' silkworm (*Telea Polyphemus*) is a large moth of a buff color, whose caterpillar feeds upon the leaves of many trees, including oak, willow, hickory, maple, apple, sycamore, and many others. The cocoon is formed of strong silk, which when unwound has a glossy fibre. It is oval and closed at both ends, dense, and generally fastened to a leaf or leaves with which it sometimes falls to the ground. The fibres are intermixed and cemented with a gummy substance which when dry gives the cocoon a chalky appearance. The principal difficulty in reeling the cocoon is in the hard matter which binds the threads. This, however, may be softened, and no doubt the cocoon could be improved by a process of continued selection. The insect has one generation each year in the Northern States and two in the Southern States, and passes the winter in the chrysalis state.

The large luna moth (*Tropæa luna*) is a beautiful species of a delicate green color, with long tails to the hind wings, whose larva feeds on several forest trees and whose cocoon is less dense than that of the polyphemus moth. The cocoons of these two species have the same general characteristics as those of the yamamai silkworm. Another native North American silkworm (*Callosamia promethia*) resembles in many respects the ailanthus worm. Its cocoon, like that species, is open and is in the same way difficult to reel. It feeds on ash, sassafras, wild cherry, maple, lilac, birch, and other trees. The largest of the American silkworms is the larva of *Samia cecropia*, a beautiful moth of a grayish brown color marked with reddish and yellowish spots and bands. The large green larva, which bears six coral-red tubercles on its thorax and smaller blue tubercles on its abdomen, feeds upon the apple and other rosaceous plants, as well as upon hazel, hickory, maple, willow, and honey-locust. The cocoon is peculiar in being apparently double. There is a thick, wrinkled outer layer which resembles strong brown paper and which covers an inner oval cocoon composed of the same kind of silk, but closely woven like that of the mulberry silkworm. Nearly related to this species are *Samia Gloveri*, of the Rocky Mountain region; *Samia columba*, of the North Atlantic States; and *Samia rubra*, from the Pacific States. In Mexico there are several large silkworm moths of the Saturnian group which produce quantities of silk, but it has not been commercially utilized or experimented with. There is another group of moths belonging to the family Psychidæ, in which the larva makes a large bag of silk which it carries about with it to protect its soft body from the attacks of birds. A common American example is the bagworm (q.v.) or basket-worm. This silk has not been utilized except in China.

BIBLIOGRAPHY. Consult: Riley, *Fourth Annual Report State Entomologist of Missouri* (Jefferson City, 1872); Riley, "The Mulberry Silkworm," in *Bulletin No. 9, Division of Entomology, United States Department of Agriculture* (Washington, 1886); Kelly, "The Culture of the Mulberry Silkworm," in *Bulletin No. 39* (ib., 1903); Villon, *La Soie* (Paris, 1890); Verson and Quajat, *Il filugello e l'arte sericola* (Padova, 1896). See SILK.

SILKWORM GUT. A material used by anglers to form the hook end of a fish-line. Its advantages are its extreme tenacity and its transparency or invisibility in water. It is prepared from the viscid secretion to be found in the silkworm (q.v.) just before it is ready to begin to spin. The grub is immersed in strong vinegar for several hours and the substance which, if it had lived, would have been spun into a cocoon, is forcibly drawn out from the dead worm. This thread is first soaked in cold water and then in a caustic solution. This loosens the outer covering, which is next removed. The silk is then dried in a shady place. If simply dried it will be of a yellowish hue; the pure white thread is produced by bleaching in sulphur fumes. The manufacture of gut strings is carried on in Italy and Greece, and other silk-growing countries, but particularly in Spain, the principal market being Valencia. It takes from 20,000 to 30,000 threads to make a pound, the first price for a pound being from $25 to $30.

SILL, EDWARD ROWLAND (1841-87). An American poet and essayist, born at Windsor, Conn. He graduated at Yale in 1861, resided till 1866 on the Pacific Coast, studied theology at Harvard, and after several years of teaching and literary work in the East was made principal of the Oakland, Cal., High School (1871) and in 1874 professor of English in the University of California. He returned to the East in 1882. He wrote: *Hermione, and Other Poems; The Hermitage, and Other Poems* (1867); *The Venus of Milo, and Other Poems* (1882). A posthumous selection embracing most of his bet-

ter verse appeared in 1888. Two years later was published a posthumous collection of prose, "Being Essays in Literature and Education, and Friendly Letters." The small poetic production of Sill, who was a man of rare temperament and insight, is notable for carefulness of diction, delicacy of feeling, and a dominating strain of spiritual optimism. His thoughtful work has steadily grown in influence and seems likely to maintain a modest place in American literature.

SILL, JOSHUA WOODROW (1831-62). An American soldier, born at Chillicothe, Ohio. He graduated at West Point in 1853, was assigned to the Ordnance Department, and was detailed for duty at the Watervliet Arsenal. From 1854 to 1857 he was assistant professor of geography and history at West Point, and then was again on duty in the Ordnance Department until January, 1861, when he resigned from the army and became professor of mathematics in the Brooklyn Polytechnic Institute. In April, however, he was appointed by the Governor of Ohio assistant adjutant-general of that State. He became colonel of the Thirty-third Ohio Volunteers in August, 1861, and commanded his regiment in the campaigns in Kentucky, Tennessee, and Alabama during the next year. He commanded a brigade in the movement against Nashville in February, 1862, and the subsequent operations in northern Alabama, and at Huntsville. On July 16, 1862, he was commissioned brigadier-general of volunteers, and commanded a division at the battle of Perryville, and in the pursuit of General Bragg's army. He was killed in the battle of Stone River, December 31, 1862.

SIL'LIMAN, BENJAMIN (1779-1864). An American scientist, born at North Stratford (now Trumbull), Conn., the son of Gold Selleck Silliman, a general in the army of the Revolution. After graduating at Yale in 1796 he studied law, became a tutor in Yale, was soon chosen to be a professor of natural science, and went abroad to fit himself for the chair in which he became a teacher of chemistry, mineralogy, geology, and pharmacy. He held his professorship in Yale from 1802 to 1864—from 1853 onward as professor emeritus. He was honored and beloved as a teacher, and acquired even greater distinction as a lecturer, especially on geology. These courses began at New Haven in 1831, and were so much appreciated that Silliman was selected to give twenty-four lectures before the Lowell Institute of Boston, in its first session (1839-40). In 1818 he established the *American Journal of Science* (often quoted as 'Silliman's Journal'), which has been continued under successive members of his family to this day, and is still a leading American repository of scientific papers and intelligence. With Dr. Robert Hare he constructed the compound blowpipe. He published after his return from England a narrative of his journey, and fifty years later, at the end of a second journey, he published a similar memoir. His *Tour to Quebec* (1819) was likewise widely read. His contributions to science were not numerous, one of those most famous at the time being an account (with J. L. Kingsley) of a remarkable meteor which fell at Weston in 1807. His *Life* was written by Professor George P. Fisher and published in two volumes (New York, 1868). Many entertaining reminiscences of his distinguished contemporaries are given in these volumes. During his long career Silliman was an active participant in all the affairs of Yale College—the organization of the Medical School, the formation of a cabinet of minerals, the acquisition of Colonel Trumbull's paintings, and the purchase of the Clark telescope.

His son, BENJAMIN, JR. (1816-85), was also a chemist, and was born in New Haven, Conn. He graduated at Yale College in 1837, becoming an assistant to his father, and in 1842 fitted up, in one of the college buildings, a chemical laboratory, out of which grew the foundation in 1847 of the Yale (now Sheffield) Scientific School. He was professor of medical chemistry and toxicology in the University of Louisville, Ky., from 1849 to 1854. In 1854 he succeeded his father in the chair of chemistry, which he retained until 1870, continuing, however, to lecture in the medical department until his death. He gave popular lectures on scientific topics throughout the country, and was one of the editors of the *American Journal of Science*. He was the author of *First Principles of Chemistry* (1846; 2d ed. 1856); *Principles of Physics* (1858; ed. e. 1868); and *American Contributions to Chemistry* (1875).

SILLIMANITE (named in honor of Benjamin Silliman). A mineral aluminum silicate that has a vitreous lustre, and is brown to green in color. It occurs in gneiss, mica schist, and other crystalline rocks, and is found in many localities in Bohemia, Bavaria, Saxony, and France, and in the United States in Massachusetts, Connecticut, New York, Delaware, and North Carolina. The fibrous varieties are commonly called *fibrolite*, while the name *sillimanite* is given to those varieties that are found in the form of long slender crystals.

SILO. An air-tight storage room either above ground or below, in which green crops usually cut small are tightly packed for future use. See SILAGE.

SILO'AM (Heb. *Shilōah*, *Shelah*). A pool situated at the southern end of the eastern hill of Jerusalem, mentioned in Nehemiah iii. 15 and John ix. 7. Isaiah (viii. 6) speaks of the "waters of Shiloah that go softly." The water in this pool is supplied by the Virgin's Spring and is brought to the pool at the entrance to the Tyropœon valley by a tunnel over 1700 feet in length. The tunnel is rather winding, and about 25 feet from the Siloan end an important inscription was found in the wall in 1880. As translated by Driver, it reads: "(Behold) the piercing through, and this was the manner of the piercing through. Whilst yet (the miners were lifting up) the pick each towards his fellow, and whilst yet there were three cubits to be (cut through, there was heard) the voice of each calling to his fellow, for there was a fissure in the rock on the right hand. . . . And on the day of the piercing through the miners smote each so as to meet his fellow, pick against pick; and there flowed the water from the source to the pool 1200 cubits; and 100 cubits was the height of the rock over the head of the miners." Hence the cutting was evidently done simultaneously from both ends. In default of any date, there has been much controversy as to the age of the inscription. The

form of the letters lends probability to the view that the tunnel was constructed in the days of Hezekiah. The aim in conducting the waters through the tunnel into a pool of the Tyropœon valley was to make it more accessible to the inhabitants of the lower part of Jerusalem. Consult: Tobler, *Die Siloahquelle und der Oelberg* (Saint Gall, 1852); Socin, *Die Siloahinschrift* (Freiburg, 1899); Driver, *Notes to the Hebrew Text of Samuel* (Oxford, 1890).

SILPHIUM (Lat., from Gk. *σίλφιον*, a sort of umbelliferous plant, the juice of which was used in food and medicine). A genus of about a dozen tall, coarse, American perennial plants of the order Compositæ. They have a copious resinous juice, and large corymbose-panicled yellow flowering heads. *Silphium laciniatum*, called rosin-weed, is rough and bristly, grows from 3 to 6 and sometimes 10 feet high, and has pinnately parted leaves. It grows on the prairies of Michigan, Wisconsin, and southward and westward, and blossoms in July. It is called compass-plant (q.v.), from the turning of its lower leaves so that their edges point north and south. Another species, *Silphium terebenthinaceum*, the prairie burdock, grows from 4 to 10 feet high, and has many small heads in a panicle at the top.

SILURIAN SYSTEM (from Lat. *Silures*, a people of ancient Britain). A division of the Paleozoic group of rocks established by Murchison (q.v.) to include the strata between the Archæan and Devonian systems. It was subsequently restricted to the two formations now known as the Ordovician or Lower Silurian and Upper Silurian. These two extend from the upper limits of the Cambrian to the base of the Devonian. Silurian rocks are extensively developed in both the United States and Europe. The rocks of the Silurian system in America are divided as follows:

Silurian system.	3. Lower Helderberg series.	3. Upper Pentamerus stage. 2. Shaly Limestone stage. 1. Lower Pentamerus stage.
	2. Onondaga series.	Salina and water-lime stage.
	1. Niagara series.	3. Niagara stage. 2. Clinton stage. 1. Medina stage.

The rocks are largely limestones, but there are also beds of shales and some sandstones interstratified with them. While there was some disturbance at the end of the Ordovician era, at the same time it was not sufficiently extensive in America to change materially or increase the extent of the land surface which existed in the Ordovician times. Silurian rocks are present in great thickness in the Eastern States, especially along the Appalachian region. The lowest formation, or that known as the Oneida, is a conglomerate which appears in central New York, thinning toward the eastern shore line, but is very thick along the Appalachian ranges as far south as Tennessee. Owing to its great hardness, it forms many prominent ridges, notably the Shawangunk Mountains of New York, also the crests of the Kittatinny Mountains, and the ridges at Delaware Water Gap.

Overlying the conglomerate is a great deposit known as the Medina sandstone, which was formed in shallow water and shows many ripple marks. It extends from Central New York with decreasing thickness toward Ohio, but in eastern Pennsylvania the beds aggregate 1800 feet. Overlying this is the Clinton shale, which is well known from New York down into Georgia, and westward into Wisconsin, in which region it changes into limestone, indicating that the Silurian seas were deeper in that area than they were further east. A subsequent deepening of the water over a still greater area is indicated by the formation of the Niagara limestone, which is well developed in the gorge of Niagara River, and whose resistance to erosion causes the abrupt descent of the Niagara River at the Falls. This formation ranges over a very large territory westward to Wisconsin, and then southward through Illinois into Missouri and West Tennessee. Small areas are also found in Iowa, the Black Hills, and Nevada. Following this great limestone deposit there comes a series of shallow water deposits of salt, gypsum, and shale of the Salina stage, which are well developed in New York and Ohio, but thin out in Pennsylvania. In some localities an argillaceous limestone was deposited during the same period, to which has been given the name of water-lime on account of its value in the manufacture of cement. On top of these beds lie great beds of limestones due to the deepening of the water in which the Silurian sediments were being deposited. To this great limestone series has been given the name of Lower Helderberg. It is probable that the depression made at this time submerged some areas which had been dry land since Ordovician times, as in some cases we find the Lower Helderberg rocks resting directly on Ordovician strata. The Lower Helderberg rocks are abundant in New York, where they form the bold escarpment of the Helderberg Mountains near Albany, but are also known to extend southward through Pennsylvania to Virginia, while additional deposits are known in western Tennessee and Maryland.

Silurian beds are well developed in Europe, China, Northern Africa, South America, and Australia, as well as in North America. At the termination of the Silurian there was a gradual transition into the Devonian, so that it is often difficult to determine the boundary line between the rocks of the two systems.

The plant life of the Silurian, so far as revealed by the fossil remains, was scanty. Seaweeds were abundant, but land plants are rarely found. Among the animals there was a great development of invertebrates. Sponges were present in force, but the graptolites had diminished. Both the hydroid corals and the true corals were very important, the former being especially important as reef builders. Favosites and Halysites are two well-known fossil corals of the Silurian rocks. There was a marked increase of crinoids and also starfishes, while even the sea-urchins were fairly abundant. The trilobites also continued to flourish, although not as numerous as those of the Ordovician; among the common genera were Calymene, Dalmanites, and Lichas. Some insects have also been found, such as scorpions, and prove that there must have been land vegetation. The brachiopods continued in countless numbers, and the genera were quite different on the whole

from those of the Ordovician. The most important were Atrypa, Spirifera, and Pentamerus. The bivalve mollusks were similar to those of the Ordovician, but other orders showed more or less change. Among the pteropods a very abundant form is the Tentaculites, whose remains occur in great numbers in certain strata of the lower Helderberg series. The only vertebrates that are known to have existed were fishes such as ostracoderms and sharks, but their remains are rather fragmentary.

The economic minerals of the Silurian are fairly diversified. In the rocks of the Clinton age we find a very persistent bed of the hematite iron ore known as the Clinton or fossiliferous iron ore. Wherever the Clinton rocks are found this ore is known to occur and forms the basis of the iron industry at Birmingham, Ala., where a deposit four miles long and from 12 to 20 feet thick is worked. In the rocks of the Salina group we find the deposits of gypsum and rock salt, the latter material being of great economic value in the State of New York. Many of the Silurian rocks are also excellently adapted for building purposes, and of these the Medina sandstone, named from its occurrence at Medina, New York, is specially well known.

BIBLIOGRAPHY. Murchison, *Siluria* (London, 1859); Geikie, *Text-Book of Geology* (ib., 1893); Dana, *Manual of Geology* (4th ed., New York, 1896); Scott, *Introduction to the Study of Geology* (ib., 1902); and the following treatises: Darton, "Notes on the Stratigraphy of a Portion of Central Appalachian, Virginia," *American Geologist*, vol. x. (Rochester, 1892); Prosser, "The Thickness of the Devonian and Silurian Rocks of Central New York," *Geological Society of America Bulletin*, vol. iv. (ib., 1893); Weller, "The Silurian Fauna Interpreted on the Epicontinental Basis," in *Journal of Geology*, vol. vi. (Chicago, 1898); Clarke, "Note on the Silura-Devonic Boundary," in *Science, new series*, vol. xii. (New York, 1900); Schuchert, "Lower Devonic Aspect of the Lower Helderberg and Oriskany Formations," *Geological Society of American Bulletin*, vol. xi. (Rochester, 1900). See CLINTON STAGE; SALINA STAGE, etc.

SILURIDÆ. A very large family of soft-rayed fishes. See CATFISH.

SILVA, sēl'vȧ, ANTONIO JOSÉ DA (1705-39). A Portuguese playwright who became a victim of religious fanaticism and was burnt at the stake by the Obscurantists, October 18, 1739. Silva was the son of a converted Jew. His *Operas* are often coarse and rough, but full of wit and humor of a popular kind. Consult "Portugiesische Litteratur," in Gröber, *Grundriss der romanischen Philologie* (Strassburg, 1897).

SILVA'NUS. In Latin mythology, a divinity of the fields and forests, the protector of the boundaries of fields and of cattle. He is by later writers identified with Pan, Faunus, and other divinities, and is represented by the poets and in art as an old man, in love with Pomona. He is especially associated with the cypress and the pine. His sacrifices consisted of grapes, corn, meat, milk, wine, and pigs.

SILVANUS. A leader of the primitive Christian Church in Jerusalem. See SILAS.

SILVELA, sēl-vā'lȧ, FRANCISCO (1843-1905). A Spanish statesman, born at Madrid. He studied law, and in 1869 was elected to the Cortes as a Conservative. In 1879 he became Minister of the Interior (under Campos), and from 1883 to 1884 he was Minister of Justice. After the death of Cánovas, Silvela, as the head of the reorganized Conservative Party, became Prime Minister in February, 1899. He resigned in October, 1900, but after the fall of Sagasta resumed office, in December, 1902.

SILVER (AS. *seolfor, seolubr*, Goth. *silubr*, OHG. *silabar, silbar*, Ger. *Silber*, silver; probably from the Pontic city of Ἀλύβη, *Alybē*, where silver abounded). A metallic element that was known to the ancients, and when first mentioned is referred to as a medium of exchange. It is described in early Hebrew writings under the name *Késeph*, the root of which signifies 'to be pale,' while among the Greeks it was known as ἄργυρος, *argyros*, signifying 'shining.' The alchemists called it *luna* or *Diana*, and referred to it in their writings by the crescent symbol. It occurs native, and specimens weighing several hundred pounds have been found, although it usually occurs in combination, as given below in the table of ores. It also occurs in lead ores, which form one of the main sources of its production. It is found in sea water, and small quantities of it, in the form of chloride, have been detected in volcanic dust. The metal may be readily prepared by heating silver sulphide with litharge or lead sulphate, the lead being separated from the resulting alloy by cupellation. Metallic silver may also be obtained by reducing silver chloride with zinc, or by fusion with carbon and sodium carbonate.

Silver (symbol Ag.; atomic weight, 107.92) is a white lustrous metal that is very ductile and malleable, with a specific gravity of 10.57 and a melting-point of 1040° C. (about 1900° F.). When in the liquid state it possesses the power of absorbing oxygen from the air, which it gives up on solidification. When a mass of the metal is rapidly cooled, the silver solidifies before the oxygen has escaped from the interior, and this gas then bursts through the crusts, driving out part of the fused silver in globular masses and excrescences—a phenomenon known as 'spitting.' Metallic silver finds extensive use in coinage, and, owing to the high polish it takes, for tableware and decorative articles; for silver plating, the silvering of mirrors, and to a slight extent for laboratory purposes. Silver forms alloys (q.v.) with many metals, and that consisting of 9 parts of silver to 1 part of copper is the standard alloy used for the United States coins, while 835 parts silver to 165 parts copper is the standard employed in the Latin Union. An alloy of 100 parts of aluminum with 5 parts of silver is used for making pans of balances, etc., as it is harder and more easily polished than aluminum.

With oxygen silver forms three oxides, an argentous oxide or sub-oxide, a protoxide or normal oxide, and a peroxide or dioxide. Of these the protoxide is the most important. It is obtained as a brown pulverulent precipitate when silver nitrate is treated with potassium or sodium hydroxide. This compound is used to give a yellow color to glass, and finds some employment in medicine as a substitute for silver nitrate. *Silver nitrate*, or 'lunar caustic,' is prepared by dissolving silver in nitric acid and evaporating to crys-

tallization, when large colorless transparent tablets are formed which blacken on exposure to light or in contact with organic matter. They may be fused and cast into sticks or pencils, which form the silver nitrate used as a caustic in medicine. Silver nitrate is the basis of many of the indelible inks, is a constituent of black hair dyes, and is largely used in photography. The haloid salts of silver include the *chloride*, the *iodide*, and the *bromide*, all of which are found native, and may be prepared by the action of a soluble chloride, bromide, or iodide on silver nitrate. These salts, owing to their sensitiveness to light, are extensively used in photography. *Silver sulphide*, which is formed when hydrogen sulphide is added to a solution of a silver salt, is the black tarnish which forms on silver articles, and in order to produce the so-called oxidized surface on art objects of silver they are immersed in a solution of potassium sulphide.

SILVER ORES. The following table gives the composition of the principal silver ores, grouped in the order of their importance:

THE IMPORTANT ORES OF SILVER

NAME	Combining element	Formula
NATIVE SILVER.		Ag. Frequently alloyed with other metals.
ARGENTITE.	Sulphur.	Ag_2S Ag=87.1%
PROUSTITE. (Light ruby silver.)	Arsenic and Sulphur.	$Ag_3 As S_3$ Ag=65.4%
PYRARGYRITE. (Dark ruby silver.)	Antimony and Sulphur.	$Ag_3 Sb S_3$ Ag=59.9%
STEPHANITE. (Brittle silver.)	Antimony and Sulphur.	$Ag_5 Sb S_4$ Ag=68.5%
CERARGYRITE. (Horn silver.)	Chlorine	Ag Cl Ag=75.3%
HESSITE. (Petzite.)	Tellurium.	$Ag_2 Te$ to $(Ag\ Au)_2 Te$
TETRAHEDRITE. (Fahl ore.)	A complex mixture of antimony or arsenic sulphides with sulphides of silver and base metal.	Very complex.

OCCURRENCE. The larger number of the silver minerals given in the above table occur together in many deposits, so that the ores received at the smelting, leaching, or milling works usually consist of a mixture of several silver minerals. Generally native silver and the halogen compounds (chlorides, bromides, or iodides) occur in the upper portions of the deposits, while the sulphides, arsenides, and antimonides are found in the lower portions. Tetrahedrite in most cases occurs by itself. The minerals containing silver as an accidental ingredient are galenite (galena), sphalerite, chalcopyrite, pyrrhotite, pyrite, bournonite, chalcocite, bornite, native arsenic, arsenopyrite, and certain nickel, cobalt, and bismuth ores. Galena often contains silver up to 1 per cent. in quantity (291 ounces to the ton), so that at times the value of the silver in the ore is greater than that of the lead. In Europe the greater portion of the silver output is derived from galena ores, and in the United States at least 85 per cent. of the annual production of lead is obtained from argentiferous lead ores, which necessitate the separation of the silver from the lead bullion formed, not only to extract the value of the silver, but also to render the lead of proper purity for commercial purposes. Copper ores frequently contain a considerable percentage of silver, notably in the Butte district, Montana, where every pound of copper extracted contains on the average an ounce of silver. The famous copper schist of Mansfeld, Germany, also carries silver.

Silver ores occur in the rocks of various geologic ages: in gneiss and allied rocks, in porphyry, trap, sandstone, limestone, and shales. The veins often intersect eruptive rocks, as trachyte or porphyry, or the sedimentary formations in the vicinity of such rocks, and have owed their existence in many cases to the dynamic processes and vapors from below attending the eruptions. As mentioned above, silver ores are often associated with those of lead, zinc, copper, cobalt, and antimony, and the usual gangue is calcite or quartz with, frequently, dolomite or barite.

PRODUCTION. Until recent years the silver mines of Mexico were by far the richest on record, and in spite of imperfect methods of mining and transportation, Mexico has produced more than one-third of the total output of silver in the world, one-half of the production of the Republic having been derived from the central mining districts of Guanajuato, Zacatecas, and San Luis Potosí. According to Humboldt, the Veta Madre lode of Guanajuato alone produced $250,000,000 in silver between 1556 and 1803. The total recorded production of silver in Mexico from 1521 to 1892 amounted to 83,170,307 kilograms, equal in coinage value ($41.57 per kilogram) to $3,457,389,662, although in recent years, owing to the exhaustion of the upper levels in the mines, the production has decreased in value to about $30,000,000 per annum. Until 1860, Bolivia and Peru, followed by Chile, were next to Mexico in the importance of silver production. The total output of silver in Bolivia from 1545 to 1891, was 42,071,231 kg., while that of Peru from 1533 to 1891 inclusive, aggregated 32,199,263 kg., and that of Chile from 1545 to 1891 inclusive, is reported at 4,855,571 kg. In the last few decades the remarkable development of silver-mining in the western part of the United States has increased the output so that it now equals that of Mexico, and at present these two countries supply nearly three-quarters of the world's total annual production of this metal. In Europe Spain has been the most productive country. The richest mines are in the Province of Guadalajara. They were extensively operated as late as 1846, but recently the quantity of silver annually produced has decreased to about 180,000 kg. Austria-Hungary, Saxony, and the Harz Mountain district in Germany have contributed largely to the total output of Europe. The total production of silver in Germany from 1493 to 1875 inclusive is reported at 7,904,910 kg. The silver mines at Kongsberg, Norway, have long been famous, although at the present time the output is comparatively insignificant. The mines of Laurion, in Attica, famous in antiquity for their

yield of silver, are now worked mainly for other metals.

The annual production of silver in the United States has increased steadily from an average of about 600 kilograms in 1834, to nearly 2,000,000 kilograms in 1892—the aggregate reported production during this period being approximately 85,000,000 kg. Of this the famous Comstock lode in Nevada produced approximately 5,000,000 kg. during the period from 1859, the year of its discovery, until 1891; the value of the gold produced with the silver at the Comstock mines amounted to more than $140,000,000 in value. Classified by States, the production of silver in the United States during 1900 was: Colorado, 20,336,712 ounces (derived chiefly from the lead, copper, and gold ores of Lake, Pitkin, Mineral, Ouray, Clear Creek, and San Miguel counties); Montana, 17,300,000 ounces (chiefly from argentiferous copper ores of Butte); Utah, 9,569,183 ounces; Idaho, 6,100,000 ounces (from argentiferous lead ores of the Cœur d'Alêne district); Arizona, 1,750,000 ounces; California, 1,170,902 ounces; other States, 3,335,000, making a total of 59,561,797 troy ounces.

THE PRODUCTION OF SILVER IN THE WORLD IN 1901 *

COUNTRIES	Ounces, troy	Kilograms	Commercial value, 58.95c. per oz.
North America:			
United States	55,215,253	1,717,372.8	$32,549,342
Canada	5,078,318	157,952.1	2,993 668
Mexico	55,152,340	1,715,416.0	32,512,304
Central America	1,072,095	33,345.6	632,000
South America:			
Argentina	383,561	11,930.0	226,109
Bolivia	9,439,294	293,591.4	5,564,464
Chile	5,772,789	179,552.4	3,403,059
Colombia	2,520,000	78,380.1	1,485,540
Ecuador	84,818	2,638.1	50,000
Peru	6,655,257	207,000.0	3,923,274
Europe:			
Austria	1,292,631	40,205.0	762,006
Hungary	727,770	22,636.0	429,020
France	384,076	11,946	226,413
Germany	5,522,802	171,777.0	3,435,540
Greece	1,100,754	34,237.0	648,904
Italy	1,043,750	32,464.0	683,209
Norway	164,935	5,130.0	97,229
Russia	157,057	488.5	92,585
Spain	3,053,606	94,977	2,000,301
Sweden	50,059	1,557	29,510
Turkey	480,400	14,942	283,196
Unit'd Kingdom	174,431	5,426	102,839
Asia:			
Dutch E. Indies	73,690	2,292.0	43,440
Japan	1,895,398	58,953.0	1,117,337
Australasia	10,848,420	337,420.9	6,395,144
Other countries	48,226	1,500.0	28,429
Total	168,391,780	5,237,129.4	$99,714,862

* From *The Mineral Industry*, vol. x., 1902.

It is difficult, if not impossible, to forecast with any reasonable degree of accuracy the future production of silver in the world. A large part of the output is obtained as a by-product in the treatment of certain copper, lead, and gold ores, consequently the total output of silver, to some extent, will go hand in hand with the increased or decreased output of these metals; yet any very marked increase from these sources may cause the price of silver to decline to such an extent as to render unprofitable its direct extraction from ores that do not contain other workable metals. For the production of silver and its use as money, see MONEY; PRECIOUS METALS.

The world's production of silver and the ratio of silver to gold since 1492 are given in the following table, compiled from statistics collected by Adolf Soetbeer and the United States Mint:

WORLD'S PRODUCTION OF SILVER

PERIOD	Mean annual product, kilograms	Ratio of silver to gold, weight	Ratio of gold to silver, value
1493-1520	47,000	8.1	10.75
1521-1544	90,200	12.6	11.25
1545-1560	311,600	36.6	11.30
1561-1580	299,500	43.8	11.50
1581-1600	418,900	56.8	11.80
1601-1620	422,900	49.6	12.25
1621-1640	393,600	47.4	14.00
1641-1660	366,300	41.8	145.0
1661-1680	337,000	36.4	1.975
1681-1700	341,900	31.8	15.00
1701-1720	355,600	27.7	14.21
1721-1740	431,200	22.6	15.08
1741-1760	533,145	21.7	14.75
1761-1780	652,740	31.5	14.73
1781-1800	879,060	49.4	15.09
1801-1810	894,150	50.3	15.61
1811-1820	540,770	47.2	15.51
1821-1830	460,560	32.4	15.80
1831-1840	596,450	29.4	15.75
1841-1850	780,415	14.3	15.83
1851-1855	886,115	4.4	15.41
1856-1860	904,990	4.5	15.29
1861-1865	1,101,150	5.9	15.41
1866-1870	1,339,065	6.9	15.56
1871-1875	1,969,425	11.3	15.98
1876	2,323,779	14.0	17.88
1877	2,388,612	13.3	17.22
1878	2,551,364	13.7	17.94
1879	2,507,507	15.0	18.40
1880	2,479,998	15.2	18.06
1881	2,592,639	16.3	18.25
1882	2,769,065	18.6	18.20
1883	2,746,123	19.0	18.64
1884	2,788,727	18.2	18.61
1885	2,993,805	18.8	19.40
1886	2,902,471	18.2	20.78
1887	2,990,398	18.8	21.10
1888	3,385,606	21.2	22.00
1889	3,820,002	21.0	22.10
1890	4,144,233	23.1	19.75
1891	4,493,100	23.6	20.92
1892	4,730,647	30.2	23.72
1893	5,147,841	21.7	26.49
1894	5,121,017	18.7	32.56
1895	5,210,942	17.4	31.60
1896	5,232,021	17.2	30.59
1897	5,696,110	15.9	34.20
1898	5,259,286	12.2	35.03
1899	5,213,312	11.3	34.36
1900	5,337,008	13.9	33.33

METALLURGY.

The variety of processes for the extraction of silver from its ores is so great that only a general review of the most important is possible here. In all cases the silver is at last obtained in union with lead, zinc, copper, or mercury, or in solution from which it can be precipitated as metal or as sulphide or chloride, or else it is separated by electrolysis from its combinations. The methods of extraction thus fall into three main groups as follows: dry processes, combined dry and wet processes, and electrolytic processes.

DRY PROCESSES. The extraction of silver in the dry way is effected by converting the metal into a silver-lead alloy and then submitting this to an oxidizing melting in the cupellation furnace. The production of the silver-lead alloy depends upon the power which lead possesses of extracting silver from its ores or from various products containing it, the lead readily alloying

with the silver, and the process is carried out either by a simple melting or by a combination of roasting and melting. The silver-lead alloy obtained is called 'work lead.' If the amount of silver in the work lead is not great enough to make direct cupellation profitable, then an intermediate process of concentration is introduced. Therefore, the dry process in its most extended form comprises: (1) the production of work lead; (2) the concentration of the silver in the work lead; and (3) the extraction of the silver from the concentrate or enriched work lead. In the production of work lead we have to distinguish between its production from ores and its production from metallurgical products; further we have to distinguish between its production from rich ores, from medium ores, and from poor ores, for each of which the process differs, and its production from matte, speiss, alloys, and other metallurgical products, each of which likewise requires a different process.

These different processes are all variations of two general processes. One of these consists essentially in introducing the ore, matte, or other product into a bath of molten lead in a reverberatory furnace; the other consists in smelting the ore, matte, or other product with materials rich in lead in a blast furnace. The result in either case is the production of a silver-lead alloy, or work lead, more or less rich in silver. If the silver content is less than about 0.12 per cent. it is generally assumed that it cannot be economically treated by cupellation until the work lead is enriched by concentration. The two processes of concentration employed are the Pattinson process and the zinc process. In the Pattinson process the work lead, by slow cooling from the molten state, is separated into crystals poor in silver and a fluid portion rich in silver. If the richer liquid portion be separated, it again can be divided into a poorer solid portion and a still richer liquid alloy, and this operation can be repeated until the enriched lead contains 2.5 per cent. of silver, when the maximum is reached. The Pattinson process is conducted in large pots of cast iron or cast steel. The crystals are separated from the mother liquor either by leveling them out from the pot or else by tapping off the mother liquor and leaving the crystals behind, and the formation and separation of the crystals is effected either by stirring the cooling mass or by blowing steam through it.

In the zinc process the silver is separated from the work lead in the form of a silver zinc-lead alloy; the lead poor in silver remains behind. The process is based upon the fact that if argentiferous lead be melted, pieces of zinc forming altogether from 1½ to 2 per cent. of the weight of the lead thrown on its surface, the temperature of the bath raised to the melting point of the zinc, and the whole thoroughly stirred and allowed to cool, a crust or scum forms upon the surface as the temperature is lowered. This scum is a solidified mixture of alloys of lead, zinc, and silver, lighter than the molten lead and containing all the silver originally present in the lead, and it can easily be separated from the rest of the metal forming the bath. After separation the excess of lead present is removed by liquation, a process based upon the fact that the alloy has a higher melting point than lead itself. The scum is placed in pots or reverberatory furnaces and heated until the excess of lead melts and separates from the solid alloys. The latter, known as rich scum, is next heated for the separation of the zinc by the processes of distillation, oxidation, or treatment with fluxes, so that only silver and lead remain. The final process of cupelling the argentiferous lead consists of an oxidizing melting of the work lead in a reverberatory furnace. This process may be performed in stages or continuously. The work lead is charged into the furnace with a quantity of litharge and the mass is slowly melted by an increasing heat. As the melting progresses successive scums are formed on the molten surface which contain litharge mixed with the oxides of lead and of the other impurities, and which are drawn off from time to time. The final product remaining is silver with about 10 per cent. of impurities. This is refined by a similar oxidizing process.

WET PROCESSES. Of the various combined wet and dry processes for extracting silver, the amalgamation process is the first which demands consideration. In the amalgamation process, the silver in ores or metallurgical products is converted into a mercury alloy, or amalgam, which is subsequently distilled, the silver being left behind and the mercury condensed and used over again. The various amalgamation processes may be grouped into three classes: (1) Amalgamation with mercury alone; (2) amalgamation with mercury and certain reagents without roasting; and (3) amalgamation with mercury and reagents after a chlorodizing roasting.

(1) Amalgamation with mercury alone, usually called direct amalgamation, is practiced only with ores consisting chiefly of native silver. It was formerly extensively used in Peru, Chile, and Mexico, and is yet used to some extent in those countries where suitable ore is available. The process consists in rubbing the crushed ores with mercury, the crushing either going on at the same time or having been done previously, and is of comparatively limited application.

(2) Amalgamation with reagents and without roasting is employed when the silver exists in sulphur, arsenic, and antimony compounds, and includes what are known as the Gazo, Krönhke, Patio, and Washoe processes. Of these the Patio and Washoe processes are the most important and they only will be described further. The *Patio process* is extensively used in Mexico, and to a less extent in South American countries. In carrying it out the first operation is to crush and grind the ore. The coarse crushing is usually performed in edge-runner mills, stamps, rolls, or rock-crushers (see GRINDING AND CRUSHING MACHINERY), while the fine grinding is done in special mills called arrastras. Described briefly, the arrastra is a circular pit, the sides and bottom of which are paved with hard stone such as quartz or porphyry. In the centre of the pit floor is a pyramidal stone with a hole in its top into which pivots a vertical post supported at its upper end by a horizontal beam. This post carries two or four horizontal arms, to each of which are attached by chains or thongs one or more rectangular blocks of porphyry weighing from 6 to 12 cwt. These blocks are attached in such a way that their front edges are about two inches above the floor while their rear edges drag on the floor. By revolving the vertical shaft these stone blocks are dragged round and round the pit, grind-

ing the crushed ore which is deposited on the floor. Revolution of the shaft is effected by horse power, water power, or steam power. Crude as this mill appears, it has been found that no other form of grinding apparatus serves the purpose so well. The ore is ground with enough water so that when it is removed from the arrastras it is in the form of a thin mud which is termed *lama*. The lama is first placed on the amalgamating floor or *patio* in small heaps to drain and these heaps are then shoveled together into a fewer number of large heaps or *tortas*. The *patio* is simply a spacious area paved with cement or some other material as impervious as possible to mercury. When first formed the *tortas* are of about the consistency of thick mud. They are then covered with a sprinkled layer of salt and turned with a shovel, after which they are trod by mules or horses driven round and round for several hours. Another turning with the shovel follows, and is succeeded by another period of treading. After a sufficient number of repetitions of these alternate processes, sulphate of copper in one form or another is sprinkled over the *tortas* and mixed by a similar method of shoveling and treading. Mercury is then added in a finely subdivided state by placing it in bags of sail cloth, which are carried by men walking over the heaps, the metal falling from the bags in the form of a fine rain of globules. This mercury is in turn mixed by turning and treading. Altogether this treatment of the *tortas* lasts from three to six weeks, and is considered complete when 75 per cent. of the silver contents of the *tortas* have been extracted. The next step is to separate the amalgam from the other materials, and this is accomplished by agitating the *torta* in vats with water. The heavy amalgam settles to the bottoms of the vats and the water and lighter matter are drawn off. The amalgam is collected and pressed into bags, molds, or bottles, and is then ready for distillation in the manner described farther on.

The *Washoe process* of amalgamation is the one most extensively used in the United States. The ore is first crushed in stone-breakers and then stamped fine in stamp mills with water. From the stamps the wet powder passes to the amalgamating pans. These are cylindrical vessels of cast iron, or having cast-iron bottoms and wooden sides. They are from 2 feet to 2½ feet deep and from 4 feet to 5½ feet in diameter. A vertical shaft in the centre of the pan carries a number of arms extending downward and having at their ends shoes which bear against the bottom of the pan. This agitating and grinding apparatus is called a muller. The ore is introduced into the pan with mercury, sulphate of copper, and salt, and the contents are heated by steam. The stirring and heating process continues from two to three hours, when the amalgamation is completed. The contents of the pan are then transferred to another similar vessel where they are agitated with water, this agitation serving to keep the lighter material suspended while the heavier amalgam settles. At suitable intervals the water is decanted off a portion at a time until only the amalgam remains. This is placed in canvas bags and the excess mercury filtered off, when it is ready for distillation. There are several modifications of the Washoe process in use, the two chief ones being the *combination process*, in which the ores are submitted to a preliminary concentration before amalgamation, and the *Boss process*, in which the amalgamation is not conducted in a single pan, but in a series of pans through which the pulp flows continuously.

(3) Amalgamation with reagents and with roasting is carried out by three processes, known as barrel amalgamation, pan amalgamation, and Tina amalgamation. As a preliminary to all of these processes the ores are dried and crushed and then roasted in furnaces generally with salt. The *Barrel amalgamation process* is now nearly obsolete. By it the crushed ore is first roasted with salt to reduce the silver to chloride and is then charged into rotating barrels with scrap-iron and enough water to make a thin paste. After some hours' rotation mercury and sometimes a little copper sulphate are added and the rotation continued for a longer period. The barrels are then filled with water and the mercury holding silver in solution is run off from the bottom. This amalgam is then distilled. In the *pan amalgamation process* the crushed ores, after being roasted with salt, are fed into pans and agitated with water for one or two hours. Mercury is then added, and the agitation continued until amalgamation is complete. Except that the pans are of wood, their construction and operation are the same as in the Washoe process.

In the *Tina process* the pans have copper bottoms, the mullers are of copper, and the salt is added to the roasted ore in the pan. In the barrel and pan processes the brine formed by the salt and water dissolves the silver chloride, and the iron, in the form of scrap in the barrel process and in the muller blades in the pan process, reduces this to metallic silver. In the Tina process the copper of the pan and muller serves the same purpose as the iron in the other two processes.

Distillation is the final operation by which the silver-mercury alloy or amalgam resulting from all the amalgamation processes is separated into silver and mercury. The vessel or retort in which the distillation is performed varies in shape, but the most common forms are the vertical cast-iron cylinder retort used in Mexico and the horizontal cast-iron cylindrical retort used in the United States. In all cases the vessel is closed except for a tube to carry off the mercury gas and convey it to suitable condensers, and the process consists simply in charging it with amalgam and heating it in a furnace until the mercury is vaporized and only the silver remains. Silver absolutely free from mercury cannot be secured in retorts without danger to these vessels from the heat, and consequently the retort silver, containing from 1 per cent. to 1½ per cent. of mercury, is refined in small reverberatory furnaces or in crucibles.

The second class of wet processes to be considered is that in which the silver is received by precipitation from aqueous solutions. In this process the silver contained in ores or metallurgical products is first converted into a compound soluble in water or certain aqueous solutions, and then precipitated as an insoluble compound by suitable reagents and the precipitate worked up for the metal. The soluble silver compound is either the chloride, which is soluble in salt or sodium thiosulphate solution, or else the sulphate, which is soluble in hot water. The principal processes in which silver is ob-

tained in solution in the form of a chloride are: the Augustin process, using brine as a solvent and metallic copper as a precipitant; the Patera process, where sodium thiosulphate, and the Kiss process, where calcium thiosulphate is the solvent. In the Russell process the silver as metal or sulphide is brought into solution by sodium-copper thiosulphate, and in the Ziervogel process the silver is converted into a sulphate and dissolved in hot water. The *Augustin process* is now rarely practiced and need not be mentioned further.

The *Patera process* is used in Mexico and to some extent in the United States. As carried out in the best mills in the United States the process is briefly as follows: The ore is crushed, dried, and roasted with salt in furnaces. The roasted ore is first treated with water in large vats in order to wash out certain salts of the base metals which are soluble in water. After the water is drawn off the vats are filled with sodium thiosulphate solution, which dissolves the silver chloride. The liquor is then run into other tanks for precipitation. If there is lead in the liquor this is first precipitated by adding sodium carbonate, and the remaining liquor drawn into other vats. Here the silver is precipitated by adding sodium sulphide. The precipitate is then drawn off and pressed in filter presses to extract the entrained liquor, when it is dried and cupelled with a lead bath to secure the metallic silver.

In the *Kiss process* a solution of calcium thiosulphate is used for extracting the ores after a chloridizing roasting, the silver being precipitated from the liquors by calcium sulphide. In the *Russell process* the silver present in the ore as metal or sulphides is dissolved by a solution of sodium-copper thiosulphate and precipitated by a solution of sodium sulphide. The *Ziervogel process* is used in treating copper ores containing silver. By careful roasting the silver in such ores is converted into silver sulphate, and this is dissolved out by treating the roasted ore with hot water. From this solution the silver is precipitated by metallic copper.

Electrolytic Process. The electrolytic process is used only to separate the silver from lead-silver and zinc-silver alloys produced by the dry process, and is inferior to the zinc process of desilverization previously described. It has, therefore, not come into extensive use. The silver alloy is remelted and cast into plates which are used as anodes with sheet-brass plates as cathodes. The electrolyte is a solution of lead sulphate in sodium acetate.

Bibliography. Egleston, *The Metallurgy of Silver, Gold, and Mercury in the United States* (New York, 1887-90); Collins, *The Metallurgy of Lead and Silver* (London, 1899-1901); Eissler, *The Metallurgy of Argentiferous Lead* (ib., 1891); Hofman, *The Metallurgy of Lead and the Desilverization of Base Bullion* (New York, 1899); Wilson, *Cyanide Processes for Gold and Silver Ores* (ib., 1896); id., *The Chlorination Process* (ib., 1897).

SILVER, Free Coinage of. See Bimetallism.

SILVER, Medical Uses of. Metallic silver is not used as a therapeutic agent, but is employed in surgery in the form of wire for suturing wounds and uniting bone fragments. The silver salts of the materia medica are the nitrate, the oxide, and the iodide. Nitrate of silver has already been partly considered under the title Lunar Caustic (q.v.). Externally the silver preparations are astringent, stimulating, and hemostatic; in concentrated solution, caustic. Of late years a number of compounds of silver and albumen or nuclein have been made, with the object of eliminating the irritant properties of silver nitrate while preserving its alterative and tonic qualities. Argyrol and protargol are representatives of this class, and are largely replacing the nitrate. These are useful in catarrhal conditions or specific inflammations of the mucous membrane of the eye, nose, throat, middle ear, urethra, and vagina, and are employed as topical applications in conjunctivitis, chronic pharyngitis, or laryngitis, in gleet (chronic urethritis), and inflammation of the vagina or cervix uteri. Internally silver salts, principally the nitrate, are useful in gastric ulcer in combination with hyoscyamus as a pill. In chronic ulceration of the colon from dysentery, keratin-coated pills (which are not dissolved in the stomach) may be given, and high injections of weak silver solution thrown into the bowel. Nitrate of silver is a remedy of value in idiopathic or non-syphilitic spinal sclerosis, but it is often ineffectual. It has been used in various other nervous diseases, such as chorea and epilepsy, but does little good. When the silver salts are given for any length of time they are deposited in the tissues, giving rise to a peculiar pale slate-blue color of the skin. *Argyria*, as this condition is called, is not very amenable to treatment, but potassium iodide may help to eliminate the substance from the tissues.

SILVER-BELL TREE. See Snow-Drop Tree.

SILVERFIN. A minnow (*Notropis Whipplei*), common in clear streams of the northern interior of the United States. It is four inches long, and leaden silvery in color, with a large black spot on the upper posterior part of the dorsal fin. See Plate of Dace and Minnows.

SILVER-FISH, or Fish-Moth. See Bristle-tail.

SILVER GRAYS. A name given in New York to that faction of the Whig Party corresponding to the Cotton Whigs of Massachusetts, which considered the slavery question settled by the compromise of 1850.

SILVERING GLASS. See Mirror.

SILVER LACE. See Gold Lace.

SILVERSIDE, or Sand-Smelt. A slender fish of the family Atherinidæ, which seldom exceed six inches in length. The silversides go in large schools in the tropical and temperate shore-waters. A few are found in fresh waters. All have a silver band along the side, whence their name. When large enough they are highly esteemed as food. See Plate of Mullets and Allies.

SILVER WEDDING. See Wedding Anniversaries.

SILVES, sēl'vĕsh. A town of Portugal, on the Silves River, 115 miles southeast of Lisbon. Cork-cutting is its main industry. In the eleventh century Silves was the capital of the Moorish kingdom of Algarve and was captured by the

Christians two centuries later. Population, in 1900, 9688.

SILVESTRE, sêl'vĕs'tr', PAUL-ARMAND (1837-1901). A French novelist, poet, playwright, and critic, born in Paris. He studied at the Ecole Polytechnique, entered the Government service, and was finally employed in the Bureau of Libraries and Archives. His first verses, *Rimes neuves et vieilles*, appeared in 1866 with a preface by George Sand. Other books of his poetry are: *Renaissances* (1870); *Gloire du souvenir* (1872); *Chanson des heures* (1878); *Ailes d'or* (1880); *Chemin des étoiles* (1885); *Roses d'octobre* (1889); *L'or des couchants* (1899). Silvestre also composed a great many Rabelaisian tales for *Gil Blas*. His prose consists mainly of the short stories which he turned out with journalistic facility, graceful and finished in style, but nearly always sensual in tone and subject. He also wrote *La Russie, impressions, portraits, paysages* (1891), and several dramas, comedies, and libretti. Among the latter are *Dimitri*, music by Joncières (1876); *Henry VIII.*, with Détroyat, music by Saint Saëns (1883); *Pedro de Zalamea*, music by B. Godard; and *Jocelyn* (1888), music by Maillard.

SIMANCAS, sê-măn'kȧs (Lat. *Septimanca*). A town of the Province of Valladolid, in Old Castile, Spain, 20 miles southwest of Valladolid, on the right bank of the Risuerga River (Map: Spain, C 2). The town is situated in the midst of a plain devoted to the culture of cereals, fruits, and the vine. Here an old Roman bridge of sixteen arches spans the river and there are numerous remains of former walls. In Simancas are collected the richest archives of Spain. The Moorish alcazar was selected as the repository by Charles V. and the project received the hearty support of Philip II. These historical treasures are still largely unexplored. The population, in 1900, was 1129. In 934 Simancas was the scene of a bloody battle between the Christians and Moors.

SIMBIRSK, sêm-bêrsk'. A government of Eastern Russia, bounded by Kazan on the north, Samara on the east, Saratov on the south, and Penza and Nizhni-Novgorod on the west (Map: Russia, G 4). Area, about 19,120 square miles. The surface is hilly. It rises to an elevation of over 1000 feet above the sea in the range which covers the eastern part along the Volga. The western part is depressed and intersected by numerous rivers. Simbirsk belongs to the basin of the Volga, and is watered chiefly by that river, which forms its eastern boundary, and by its tributary, the navigable Sura. The climate is continental and severe, and a large part of the surface is still covered with forests. Agriculture, the leading occupation, is favored by a fertile soil and yields extensive crops of rye and oats for export. Linseed and hemp are also grown extensively and stock-raising is important, the government being noted for its breed of horses. The forests furnish the material for the house industry, whose chief products are wagons, sledges, and wooden vessels. Felt hats and boots, bags, and small metal wares are also produced in the villages. The annual output of the manufacturing industries is about $5,000,000, principally military cloth, flour, and spirits. The population in 1897 was 1,549,461, including over 144,400 Mohammedans, chiefly Mordvins, Tatars, and Tchuvashes.

SIMBIRSK. The capital of the Government of Simbirsk, in Russia, on the right bank of the Volga, about 580 miles east-southeast of Moscow (Map: Russia, G 4). It has a pleasant appearance on account of its numerous gardens and elevated position above the river. The principal products are spirits; a considerable trade in horses is carried on. The annual fair is still of some importance. The town was founded in 1648. Population, in 1897, 43,298.

SIMCOE, sĭm'kō, LAKE. A lake of Ontario, Canada, 30 miles long and 18 miles wide, with an area of 160 square miles (Map: Ontario, D 3). It is about 130 feet above Lake Huron, into which it discharges through the Severn, Lake Couchiching, and Georgian Bay. In the winter it is so solidly frozen as to be a serviceable highway. Barrie and Orillia (qq.v.) are the chief towns along its densely wooded banks, on which are also situated numerous pleasant summer resorts and private residences. The waters afford good boating and fishing. The vicinity was the scene of the great war between the Iroquois and Hurons, in which the latter were almost exterminated.

SIMCOE, JOHN GRAVES (1752-1806). An English soldier, the first Governor of Upper Canada. He was born at Cotterstock, Northamptonshire. After education at Merton College, Oxford, he entered the army in 1771, and came to New England during the Revolutionary War, raising and commanding the Queen's Rangers, with the rank of lieutenant-colonel. He was wounded at the battle of the Brandywine and at Monmouth, and surrendered with Cornwallis at Yorktown in 1781. He served as Governor of Upper Canada in 1791-94; Governor of Santo Domingo in 1796-97; became lieutenant-general in 1798, and in 1806 received the appointment of commander-in-chief in India, but was taken ill just after beginning the voyage, and returning, died in England. He founded London (q.v.), Ontario; and Lake Simcoe, a county, and a town in Ontario were named in his honor. He published privately *History of the Operations of a Partisan Corps Called the Queen's Rangers, During the War of the American Revolution* (1787); republished with "Memoir of the Author" (New York, 1844).

SIM'EON (Heb. *Shim'ōn*; of uncertain derivation). A very common Hebrew name (also, Nabatæan), appearing generally in English as Simon (also Symeon); also the name of a Hebrew tribe and of its traditional ancestor, the second son of Jacob. Of the patriarch little is told; he took part with Levi in the raid upon Shechem (Gen. xxxiv.), was hostage for his brothers to Joseph (ch. xliii.), and is cursed along with Levi by the father in 'Jacob's blessing' (ch. xlix.). These traditions doubtless represent tribal conditions in early Hebrew history. Upon the conquest of Canaan Simeon appears as accompanying Judah in the conquest of Southern Canaan (Judges xi.). In the allotment of the territory Simeon acquired districts in the western and southern portions of Judah, including the important towns of Beersheba, Hormah, Ziklag, Sharuhen, yet in Joshua xv. all Simeon's towns are included in Judah. From this time Simeon almost disappears from history, except

for a probably reliable record by the Chronicler (1. Chron. iv. 24 et seq.) of an expansion of the tribe in King Hezekiah's time, even as far as the land of Seir. It does not figure at the division of the kingdom, nor is there any reference to Simeon upon the return. (An old tradition reads Simeon for Shimei in Zechariah xii. 13.) With this disappearance of the tribe goes the testimony of its non-mention in 'Moses's blessing' (Deut. xxxiii.). The legends of patriarchal times therefore stand for the historic fact that Simeon, a border tribe, early lost its identity, partly through war, partly through amalgamation with Judah or with desert tribes, with which history may be compared the fate of Dan. Consult: Graf, *Der Stamm Simeon* (Meissen, 1866); Steuernagel, *Einwanderung der israelitischen Stämme* (Berlin, 1901).

SIMEON, or **SYMEON** (?-c.927). A Bulgarian ruler, son of the Boris who introduced Christianity, which was established firmly by Simeon. He was the first Prince of Bulgaria to take the style of Czar or Emperor of all the Greeks and Bulgarians, upon coming to the throne in 890. His greatest fame was as a warrior. He thrice laid siege to Constantinople, and in 893 concluded a treaty by which the city became tributary to him, as Servia also was during most of his reign.

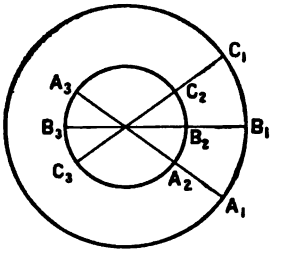
SIMEON, CHARLES (1759-1836). An eminent evangelical preacher of the English Church. He was born at Reading in Berkshire; educated at Eton and King's College, Cambridge, and was ordained a priest in 1783. He was appointed vicar of Trinity Church, Cambridge, in the year of his ordination, and held this office to the close of his life. As a preacher Simeon was distinguished for an impassioned evangelicalism in language, sentiment, and doctrine, that at first roused against him a bitter and protracted opposition. His earnestness, however, met with its due reward. Friends and followers sprang up; and in course of time Simeon became a centre of evangelical influence, that spread itself over the whole Church. His entire works, including a homiletical commentary on the Bible, have been published (21 vols., London, 1840); also selections (2 vols., 1854). Consult his biography by Carus (London, 1847) and by Moule (ib., 1892); also A. W. Brown, *Recollections of Simeon's Conversation Parties* (ib., 1862).

SIMEON STYLITES. See PILLAR SAINT.

SIMFEROPOL, sêm'fê-rō'pôl-y'. The capital of the Government of Taurida, South Russia, situated in the southwestern part of the Crimean peninsula, about 200 miles southeast of Odessa (Map: Russia, D 6). It has a separate quarter for the Tatar inhabitants, and a number of mosques. There are some manufactures of flour and tobacco, and an export trade in fruits and wine. Population, in 1897, 48.821, including many Tatars. Simferopol occupies the site of the Tatar settlement of Ak-metchet.

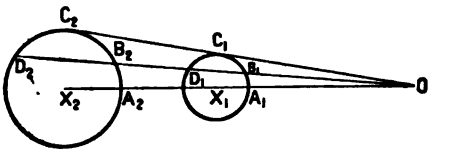
SIMIIDÆ. The family of simian or anthropoid apes. See APE.

SIMILARITY (from *similar*, from Lat. *similis*, similar, like; connected with *simul*, together, Gk. ἅμα, *hama*, together, Skt. *sama*, like, equal, same, and ultimately with Eng. *same*). In geometry, the theory of similar systems and similar figures. Two systems of points $A_1, B_1, C_1, \ldots\ldots$ and $A_2, B_2, C_2, \ldots\ldots$ are said to be similar when



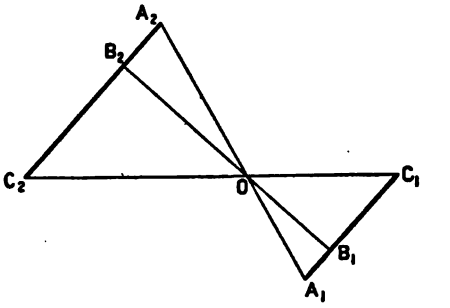
CONCENTRIC CIRCLES.

they can be so placed that all lines, A_1A_2, B_1B_2, $C_1C_2, \ldots\ldots$ joining corresponding points form a



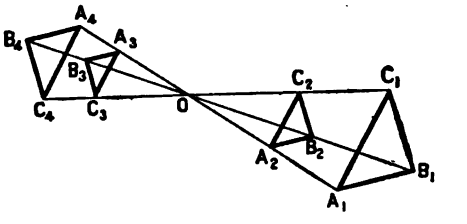
ANY CIRCLES.

pencil whose vertex, O, divides each line into segments having a constant ratio r.



ANY LINE-SEGMENTS.

In the figures $OA_1 : OA_2 = OB_1 : OB_2 = \ldots\ldots = r$. Two figures are said to be similar when their systems of points are similar. The symbol

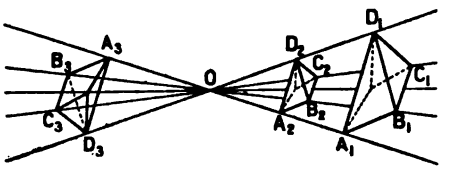


FOUR SIMILAR TRIANGLES.

∞, for similarity, is due to Leibnitz and is derived from the letter S.

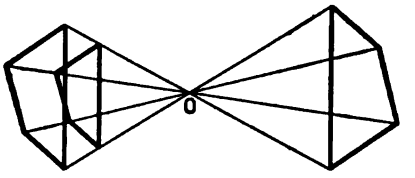
When two similar figures are so placed that lines through their corresponding points form a pencil, they are said to be in perspective, and the vertex of the pencil is called their *centre of similitude*. The above figures are placed in perspective, and in each case O is the centre of similitude. In similar figures, if the ratio, r, known as the *ratio* of similitude, is 1, the figures are evidently symmetric with respect to a centre.

Hence, central symmetry is a special case of similar figures in perspective. The term centre of similitude is due to Euler. (See SYMMETRY.) Some of the principal propositions of Similarity



THREE SIMILAR TETRAHEDRA.

are: Two triangles are similar if they have two angles of one equal to two angles of the other, respectively. Mutually equiangular triangles are similar. If two triangles have the sides of the



THREE SIMILAR QUADRILATERALS.

one respectively parallel or perpendicular to the sides of the other, they are similar. If two triangles have one angle of the one equal to one angle of the other, and the including sides proportional, the triangles are similar. If two triangles have their sides proportional, they are similar. If two polygons are mutually equiangular and have their corresponding sides proportional, they are similar. Areas of similar polygons are proportional to the squares of the corresponding sides. Volumes of similar solids are proportional to the cubes of their like dimensions. Consult Beman and Smith, *New Plane and Solid Geometry* (Boston, 1899), pp. 182, 364.

SIM'LA. The capital of a district of the Punjab, British India, on a ridge of the Himalayas, 7000 feet above the sea, 170 miles north of Delhi (Map: India, C 2). It may be termed the official health resort of India, being the residence of the Viceroy of India and his staff during the hot season. It is situated amid magnificent scenery. There are numerous fine public buildings, and a commodious town hall. In the surrounding district European fruits and vegetables are cultivated, and there is an active export trade in fruit, opium, and wool. Population, in 1891, 13,836.

SIM'MEL, GEORG (1858—). A German sociologist, professor in the University of Berlin. His first book was *Ueber sociale Differenzirung* (1890), a suggestive study of the formation of social classes and groups. In his *Einleitung in die Moralwissenschaft* (1892), he makes an elaborate criticism of popular ethical notions. He also published *Die Philosophie des Geldes* (1900). Consult Bouglé, *Les sciences sociales en Allemagne* (Paris, 1896).

SIM'MONS, ARTHUR THOMAS (1865—). An English physicist. He was born in Devonport, England, and was educated at Hartley College, Southampton, and at the Royal College of Science in London. In 1888 he became lecturer in physics and chemistry at Southport Science and Art Institute, and in 1891 became connected with the scientific staff at Tettenhall College. His publications include many text-books in chemistry, physics, and elementary science.

SIMMONS, DUANE (1834-89). An American physician and scholar, born at Glens Falls, N. Y., who in 1859 went to Japan as a medical missionary, but soon after entered the service of the Japanese Government. In 1862-63 he continued medical study in Berlin. In 1869 he established the Juzen Hospital, instructing voluntary classes of Japanese doctors, and showing how cholera should be treated with the methods of modern sanitary science. In 1881, his health failing, he returned to the United States; but in 1887, drawn again to Japan, he made a systematic study of Japanese feudal institutions. His studies of the Japanese village community are of the highest scientific value, and those on land-tenure and social institutions have been published by Wigmore, in the *Transactions of the Asiatic Society of Japan*, vol. xix. (Yokohama, 1892).

SIMMONS, EDWARD EMERSON (1852—). An American painter, born in Concord, Mass. He graduated at Harvard in 1874 and afterwards studied in Boston, and in Paris under Lefebvre and Boulanger. He executed his first mural decorations for the Liberal Arts Building in Chicago in 1893. This able and dignified work was followed in 1895 by decorative paintings in the Court of Oyer and Terminer in New York City, for which he received a prize from the Municipal Art Society; by nine paintings in the Congressional Library at Washington, D. C.; and by a panel, "The Justice of the Law," in the Appellate Court, New York City.

SIMMONS, FRANKLIN (1839—). An American sculptor, born in Webster, Maine, and educated at Bates College. In 1865 he went to Washington, where he made life-size medallions of Grant, Sherman, Sheridan, Meade, Farragut, and Porter, and Secretaries Seward and Chase. After 1868 he lived chiefly at Rome, and he was knighted by King Humbert in 1898. He executed many portrait busts in marble; the monuments to William King and Roger Williams in the Capitol at Washington; the equestrian statue of General Logan in the Iowa circle at Washington, and the Grand Army of the Republic monument to General Grant in the rotunda of the Capitol at Washington. His ideal statues include "The Young Medusa," "The Seraph Abdiel," "Paris and Helen," and "Grief and History," on the Peace Monument at Washington—one of his early works and one of his best.

SIMMONS COLLEGE. An institution at Boston, Mass., incorporated in 1899 and opened in 1902. It was established in accordance with the provisions of the will of John Simmons, a Boston merchant (died 1870), to afford women a practical education in such branches of art, science, and industry as would best enable them to earn an independent livelihood. In 1903 the number of students in the two classes that had been received was 280, and the number of regular instructors 40, in addition to special lecturers. The first class numbered 146 and the faculty 25. The departments of instruction first organized comprised household economics, secretarial work, library training, and preparatory for teaching, for medicine, or for nursing. Since

then instruction has been planned in nurse training, agriculture, and horticulture. The college offers a complete course of four years, short technical courses for students having adequate preliminary training, and partial courses. Graduation from an approved high school is a prerequisite for admission. College graduates may ordinarily complete the technical work in one year provided they have sufficient training in the sciences. The resources of the college in 1902-03 consisted of an endowment of $2,052,000, and a building fund of $750,000 for the erection of the permanent college buildings on the Parkway in the Back Bay Fens. The gross income was $112,000.

SIMMS, WILLIAM GILMORE (1806-70). An American novelist, born at Charleston, S. C. He was admitted to the bar in 1827, and in the same year published two volumes of poems, *Early Lays* and *Lyrical and Other Poems*. In 1828 he became editor of the *Charleston City Gazette*, the Union proclivities of which lost him money and almost brought him physical ill-treatment during the Nullification excitement. Having left Charleston temporarily in 1832, Simms resided for some months at Hingham, Mass., where he wrote his longest poem, *Atalantis, a Story of the Sea* (1832). The fairly well-known lyric, *The Lost Pleiad*, remains probably his best achievement in verse. But the year after the publication of *Atalantis* saw him enter upon his true vocation. His *Martin Faber*, although in some respects a crude, sensational novel, was full of a genuine narrative power. In 1834 he published *Guy Rivers*, a tale of the gold fever in Georgia, the first of a series of border romances, including *Richard Hurdis* (1838), *Border Beagles* (1840), *Beauchampe* (1842), etc., full of the crime and excitement that filled the Southwest in those years and valuable as pictures of local conditions. *Guy Rivers* was followed, however, by a story which showed Simms more profitable lines along which to walk as a disciple of Cooper. This was his *Yemassee* (1835), a tale of Indian warfare in colonial Carolina. This is by many regarded as his best work, though perhaps equaled in power and interest by some of the series of Revolutionary romances which began, in the same year, with *The Partisan* and was continued with *Mellichampe* (1836); *The Kinsmen* (1841), which was afterwards (1854) published as *The Scout; Katherine Walton* (1851); *Woodcraft* (1854); *The Forayers* (1855); and *Eutaw* (1856). These remarkable romances dealing with the partisan warfare of Marion and other trackers of the Carolina swamps, in a manner almost worthy of Cooper, are in the main relegated to-day to juvenile readers, but display a fund of historical knowledge, of vigorous description, and of narrative interest. Simms was the most representative man of letters save Poe produced by the South before the Civil War. He wrote many short stories, the best of which were collected in two volumes entitled *The Wigwam and the Cabin* (1845-46). He compiled a history of his native State and several historical monographs. He composed biographies of the Chevalier Bayard, Capt. John Smith, General Marion, and Gen. Nathanael Greene. He edited *The Southern Quarterly Review* and compiled the war poetry of the South. He supported the secession movement heartily and lost heavily during the war. At its close he set to work bravely to repair his fortunes by his pen, but with little success. He was a man of strong personality. For his life and many of his letters, as well as for a bibliography, see the biography by W. P. Trent, in the "American Men of Letters Series" (1892). A full bibliography by A. S. Sally, Jr., can be found in the publications of the Southern Historical Association.

SIMOIS, sĭm'ō-ĭs. A stream of the ancient Troad, flowing into the Scamander (q.v.).

SIMON, sē'môN', JULES (JULES FRANÇOIS SIMON SUISSE) (1814-96). A French statesman and philosopher, born at Lorient, and educated at Lorient and Vannes. He occupied positions in the lyceums at Rennes, Caen, and Versailles, and in 1839 through the influence of Victor Cousin became a professor of the history of philosophy at the Sorbonne. The popularity of his lectures, and the publication of two notable works, *Etudes sur la théodicée de Platon et d'Aristote* (1840) and *Histoire de l'école d'Alexandrie* (2 vols., 1844-45), led after the Revolution of 1848 to his election to the Constituent Assembly as a Conservative Republican. Within a year he became a member of the Council of State. He soon resigned his seat in the Assembly, and after the coup d'état of December, 1851, his refusal to take the oath of allegiance to Napoleon's Government resulted in his losing his chair in the Sorbonne also. In the period of retirement which followed, lasting for more than a decade, Simon lived quietly at Nantes, and wrote *Le devoir* (1854); *La religion naturelle* (1856); *La liberté de conscience* (1857); *La liberté politique* (1859); *La liberté civile* (1859); and *L'ouvrière* (1861). Entering the Corps Législatif in 1863, he remained until the fall of Napoleon one of the leaders of the Republican opposition. He strongly opposed the war with Germany, and after the fall of the Empire he became one of the Committee of National Defense. In February, 1871, he became Minister of Public Instruction in Thiers's Cabinet, retaining his office until May, 1873. On leaving the Cabinet he resumed his position as leader of the Republican Left in the National Assembly until in 1875 he was elected a life Senator. In the same year he was elected to the French Academy. In December, 1876, he was called upon by President MacMahon to form a Cabinet, in which he himself was Premier and Minister of the Interior. In May following, however, Simon resigned. In addition to the works already mentioned, he published: *L'école* (1864); *Le travail* (1866); *La poétique radicale* (1868); *La peine de mort* (1869); *La famille* (1869); *Le libre échange* (1870); *Le gouvernement de Thiers* (1871); *Dieu, patrie, liberté* (1883); *Thiers, Guizot, Rémusat* (1885); *Nos hommes d'état* (1887); *Victor Cousin* (1887); *Mémoires des autres* (1889); *La femme du XXème siècle* (1891); *Notices et portraits* (1893); and *Quatre portraits* (1896).

SIMON, RICHARD (1638-1712). A French theologian. He was born at Dieppe, studied at Dieppe, Rouen, and Paris, and entered the Congregation of the Oratory in 1662. His early publications involved him in controversy with the Jansenists and Benedictines of Saint Maur and made the great Arnauld (see ARNAULD, ANTOINE) his enemy, who found occasion for an attack in

1678 when Simon undertook the publication of a book which he had long had in preparation, the *Histoire critique du Vieux Testament*. At the instigation of Bossuet, incited by Arnauld, the greater part of the edition was burned. The book is a critical history of the text, translations, and expounders of the Old Testament and anticipates many of the conclusions as well as the methods of modern scholars. Besides his great work, already mentioned, Simon published: *Histoire critique du texte du Nouveau Testament* (1689); *Histoire critique des versions du Nouveau Testament* (1690); *Histoire critique des principaux commentateurs du Nouveau Testament* (1693), which called forth Bossuet's *Défense de la tradition et des saints pères* (1753); and a French translation of the New Testament (1702). Consult: Bernus, *Richard Simon et son histoire critique du Vieux Testament* (Lausanne, 1869); id., *Notice bibliographique sur R. Simon* (Basel, 1882).

SIMONE DA PESARO, sē-mō'nā dä pā'zä-rō. A name sometimes applied to the Italian painter Simone Cantarini (q.v.).

SIMONIDES, sī-mŏn'ĭ-dēz (Lat., from Gk. Σιμονίδης) (B.C. 556-468). A Greek lyric poet, born on the island of Ceos. He was a finished literary craftsman in many forms of verse rather than a sublime or greatly original poet. His long life almost bridged the century from Pisistratus to Pericles, and in his multifarious and widely dispersed literary activity he represents the transition from the earlier parochial isolation of the Greek cantons to the cosmopolitan culture of the Sophistic enlightenment. His poetic career began with the guidance of Apolline choruses in his native isle. Thence he was called by rich gifts to the Court of Hipparchus at Athens, where he met Anacreon and competed with Lasus of Hermione, the teacher of Pindar. After the assassination of Hipparchus, he attached himself to the great ruling families of Thessaly, the Scopadæ and the Aleuadæ. His dirge in memory of Antiochus of Larissa was greatly admired. A strange poem in which he praises or apologizes for Scopas by 'debasing the moral currency' is analyzed and interpreted in Plato's *Protagoras*. He further displayed his detachment of mind by composing an epigram for the statue of Harmodius in which the assassination of Hipparchus is greeted as 'a great light rising upon Athens.'

Returning to Athens, now a democracy, he bore away the prize from Æschylus with an elegy on the warriors who fell at Marathon. Two epigrams dating from the year B.C. 476 inform us that he won the prize for the dithyramb in that year, and that no man could vie in powers of memory with Simonides at the age of eighty. A year later we meet him in Sicily in the rôle of a mediator between Hiero and Theron. The remainder of his life was probably spent chiefly at the Court of Hiero. He died about the year 468.

Simonides wrote for many clients in a great variety of forms—epigrams, hymns, pæans, skolia, epinikia, dithyrambs, hyporchemes (dance songs), threnoi (dirges). Though an Ionian, he used the modified Doric traditional in these forms of the Dorian chloral lyric. To him, perhaps, after the initiative of Ibycus, may be attributed the full development of the encomian and epinician hymn in praise of living men in which the two other representatives of 'universal melic' won chief fame.

His main opportunity came with the Persian wars. He understood as no other how to crystallize the sentiment of the great national crisis into flawless gems of epigram, fitting memorials for the glorious dead of Thermopylæ, Salamis, and Platæa. Nothing is more truly Greek than these epigrams in their simple adequacy, their chaste reserve, their exquisite finish of form. Ruskin with pardonable exaggeration pronounces the inscription for those who fell at Thermopylæ the most beautiful thing in the world: "Go, stranger, and tell the Lacedæmonians that we lie here in obedience to their laws." The 'tears of Simonides,' the pathos of his dirges, were proverbial. The English reader may form some notion of it from Milman's translation of the beautiful lament of Danaë exposed to the waves in a chest with her infant Perseus.

The vicissitudes of human destiny so amply exemplified in the century of history which he witnessed evoke from Simonides a noble but somewhat conventional strain of melancholy moralizing. For this 'criticism of life' Matthew Arnold ranks him with Æschylus, Pindar, and Sophocles as a prophet of the 'imaginative reason.' His style is chaste, polished, and unobtrusively rhetorical rather than profoundly imaginative. The extant remains of his works may be found in Bergk's *Lyric Poets* or in the *Anthologia Lyrica* of the Teubner texts.

SIMONIDES (or **SEMONIDES**) **OF AMORGOS**. A Greek poet who lived about B.C. 660. He ranked as second, both in time and reputation, of the three principal iambic poets of the early period of Greek literature, namely, Archilochus, Simonides, and Hipponax. He was born in Samos, whence he led a colony to the island of Amorgos. His writings are distinguished from those of his contemporary, Archilochus, by the fact that they attacked entire classes rather than single persons, and contained more general reflections on the constant characteristics of human nature. Of the extant fragments of his writings the most important is Περὶ Γυναικῶν, a satire on women, in which he gives a general description of female characters, deriving their various, though generally bad, qualities from the characteristic qualities of the animals from which he represented them to be descended. Consult Bergk, *Poetæ Lyrici Græci* (Leipzig, 1843; 4th ed. 1882).

SIMONIS, sē'mō'nē', EUGÈNE (1810-82). A Belgian sculptor, born at Liège. Having first frequented the academy there, he continued his studies in Rome (1829-36) under Matthias Kessels (1784-1836) and Carlo Finelli, and on his return won reputation, with some ideal and genre figures. Appointed professor at the academy of Liège, he soon removed to Brussels, where he became director of the academy in 1863. Of six works he exhibited in 1838, especial mention should be made of "Charity," adorning the monument of Canon Triest (Cathedral, Brussels), and "Innocence" (Museum, ib.); but his talent appears fully developed only in his monumental efforts, to wit: the equestrian statue of Godfrey de Bouillon (1848, Place Royale, Brussels), the figures of "Freedom of Public Worship," and of "The Nine Provinces of Belgium," also the "Two Lions" (Colonne du Congrès, ib.), the statue of

Pepin of Heristal (Palais de la Nation, ib.), and that of the geologist André Dumont (1866, Place de l'Université, Liège).

SI'MON MAC'CABÆ'US. One of the five brothers who won independence for the Jews in the war with Syria, B.C. 167-142. (See MACCABEES.) In the capacity of an officer and trusted adviser he worked with his brothers Judas and Jonathan. When the latter was murdered, B.C. 143, Simon, the last of the brothers, at once stepped into the vacant position. Simon soon (B.C. 142) secured the capitulation of the Syrian garrison in Jerusalem and immunity from further tribute to Syria. In the following year (September 18, B.C. 141) a popular assembly of the Jews voted to make Simon high priest and civil and military head, and these offices were made hereditary in his family. The Jews now considered that a new epoch had begun and dated their documents accordingly. The reign of Simon, high priest and ethnarch (he did not call himself king), was very prosperous. The Romans recognized his administration and such opposition as came from Syria was easily repulsed. The aged ruler was treacherously slain at Dak by a son-in-law, Pompey, commander of the Jericho district, at a banquet given by Pompey in his honor. The assassin's scheme for seizing the supreme power for himself miscarried, as Simon was at once succeeded by his son, John Hyrcanus I. (B.C. 135). Consult: I. Maccabees xiii.-xvi.; Schürer, *History of the Jewish People in the Times of Jesus Christ* (Edinburgh, 1886-90); Streane, *Age of the Maccabees* (London, 1898).

SIMON MA'GUS. A character who figures briefly in the New Testament, and at greater length in the writings of the early Christian Fathers. According to the New Testament account (Acts viii. 5-24), he was a sorcerer of much repute in the city of Samaria and was converted by the preaching of Philip. When the gift of the Holy Spirit was conferred upon the converts in Samaria, through the imposition of hands by Peter and John, Simon sought to purchase from Peter, by the offer of money, a like power. Peter rebuked him sternly and charged him to repent; whereupon Simon displayed a penitent temper, and the narrative closes with his petition for the Apostle's prayer in his behalf. With Justin Martyr the legend of Simon Magus takes its first form outside the New Testament. He says that Simon Magus was a Samaritan of Gitta; that he went to Rome, worked miracles there by magic, and became so famous that a statue was erected in his honor, inscribed, "To Simon the Holy God." He was honored as God, above all other power and authority. He was the originator of heresy and the source from which all subsequent error was derived. The details of the later elaboration of the legend are often grotesque and the philosophy at the basis of the heresies is obscure or absurd. The centre of interest is the conflict between Simon Magus and Peter in Rome. The climax is reached when Simon asserts that he will take his flight to God at a certain time before them all. All Rome is gathered to witness the scene. Simon appears flying over the city. Peter then prays and Simon falls to the ground with his leg shattered. The people stone the impostor and follow Peter. The legend of Simon Magus received fresh attention when the German historian Baur asserted that Simon was not an historical character, but a name of reproach invented for Saint Paul, and that the conflict between Simon Peter and Simon Magus represented in the legends was in reality the original conflict between Peter and Paul. The theory has been worked out elaborately by Baur, Lipsius, and Hilgenfeld, but is not maintained widely at present.

For the most valuable early reference to Simon Magus, consult Eusebius, *Church History*, ii. 13, 14. For the later elaborations, consult the *Apostolic Constitutions*, vi. 7-9; the *Clementine Homilies*, where note especially ii. 22-26, the discussions with Peter in the homilies following, and xvii.; and the *Acts of Peter and Paul* (in the *Ante-Nicene Christian Library*, vols. xvi. and xvii., Edinburgh, 1870). The articles "Simon Magus" in the Hastings *Bible Dictionary* (by Headlam) and the *Encyclopædia Biblica* (by Schmiedel) represent the opposing points of view mentioned above.

SIMONOSEKI, sē'mō-nō-sā'kē. A town of Japan. See SHIMONOSEKI.

SIMON PURE. A Pennsylvania Quaker in Mrs. Centlivre's comedy *A Bold Stroke for a Wife*, who has a letter of introduction to the guardian of an heiress. This is taken by Colonel Feignwell, who personates the Quaker and marries the girl. Simon afterwards proves his identity, hence the phrase 'the real Simon Pure.'

SI'MON'S TOWN. The capital of a district of Cape Colony, South Africa, on Simon's Bay, a western inlet of False Bay, 20 miles south by rail of Cape Town. It is a naval station with fortifications of considerable strength, and docks, on which large sums of money are being expended. The town is under the headland which forms the Cape of Good Hope. Population (estimated), 5000.

SIMONY (ML. *simonia*, so called from *Simon* Magus, who attempted to buy the power of conferring the Holy Spirit). In English law, the giving or receiving of holy orders or ecclesiastical preferment for a valuable consideration, or an attempt or agreement to do so. It was severely condemned by the canon law from the earliest ages of the Church, being considered akin to heresy. Canon 40 of 1603 required every person appointed to an ecclesiastical preferment to take an oath that he had not obtained it simoniacally. In addition to the penalties prescribed by the ecclesiastical law, the statute of 31 Eliz., c. 6 (1589), imposed fines upon a person guilty of the offense. The statute also provided that a simoniacal presentation should be void, and that the corrupt presentee should thereafter be disqualified to hold the same benefice, however appointed. However, to-day it is not simony for either a layman or an ecclesiastic to purchase a right to an advowson or to make presentation to a benefice, provided he is not buying for himself, and the church be full. This is true even if there is an immediate prospect of a vacancy, provided it will not be caused as a result of a contract or arrangement between the parties.

As there is no established Church in the United States, simony is not recognized as a civil offense, and probably not as an ecclesiastical wrong. Consult: Phillimore, *Ecclesiastical Law of the Church of England* (2d ed., London, 1895); Cribbs, *Law Relating to the Church and Clergy*

(6th ed., London, 1886); Blackstone, *Commentaries*. See ADVOWSON; BENEFICE.

SIMOOM (Ar. *samūm*, hot pestilent wind, from *samma*, to poison). A hot suffocating wind, carrying clouds of dust. Although these winds occur in their greatest intensity in the deserts of Northern Africa and Western Asia, analogous winds are found in India, North America, and Australia. Simooms may be either local and similar to our hot winds, sand storms, and tornadoes, or they may be more general, like the blizzards of North America or the bora of Northern Europe. Owing to the clear sky over desert regions in the tropics, the soil and adjacent air may become intensely heated, causing local ascending currents and whirlwinds. Temperatures of 120° and 140° F. have been observed in the Sahara and are not infrequent in Arizona, New Mexico, and Australia. The descriptions of the simoom indicate that as it approaches the observer its front extends at least from five to twenty miles, very much like the advancing front of a series of thunder storms on a hot afternoon; the clouds of fine sand and dust that are carried up by the wind extend as a haze overspreading the sky; the heavier sands are also transported in large quantities, and as they fall are collected in mounds around every obstacle like the drifts of snow in winter. In the case of an extended simoom the finer sands are carried so high as to be drawn into the general circulation over Europe. Thus in the great storm of March 10-12, 1901, red and yellow sand and dust from the Sahara fell in nearly every portion of Germany, France, Austria, and Turkey, and southward over the Mediterranean, and was also reported in Southern England for the first time on record. This 'dust' is a mixture of inorganic particles of quartz, mica, and clay with a considerable admixture of fragments of freshwater diatoms entirely similar to the diatoms found in the dust when the northeast Harmattan blows from the same desert southwestward to the Atlantic and the Gulf of Guinea.

The simoom is not to be confounded with the *Khamsin*, which usually blows for about fifty days from the northeast over Egypt. The *Sirocco* is a hot moist southerly wind, in Sicily and Italy; the *Samiel* is the similar hot southerly wind of Turkey; the *Solano* is the hot southeast wind of Spain: these may all exist without any connection with the simoom, but on some occasions dry simoom winds have advanced northward from the desert and merged into the hot moist southerly winds, the Sirocco, of the northern shores of the Mediterranean.

SIMPLE. The servant of Slender in Shakespeare's *Merry Wives of Windsor*.

SIMPLE HARMONIC MOTION. See MECHANICS; WAVES.

SIM'PLICIS'SIMUS. The first modern German novel—*Der abenteuerliche Simplicissimus Teutsch, das ist: Die Beschreibung des Lebens eines seltzamen Vaganten, genant Melchior Sternfels von Fuchshaim* (The Venturesome German Simplicissimus, that is: Description of the Life of a Remarkable Vagabond named Melchior Sternfels, of Fuchshaim) (1669). Its author was Hans Jakob Christoffel von Grimmelshausen (q.v.). The book deals realistically with the Thirty Years' War.

SIMPLICIUS, sĭm-plĭsh'ĭ-ŭs. A Neo-Platonic philosopher of the sixth century, who was a native of Cilicia. He was teaching at Athens when the schools of philosophy were closed by the edict of Justinian, and was one of those philosophers who found a temporary asylum at the Court of the Persian King Khosru I. Subsequently he lived at Alexandria. He was chiefly famous as a commentator on Aristotle. His complete works were edited by Schweighäuser (Leipzig, 1800). His commentaries on Aristotle's *Categories*, *Physics*, *De Cœlo*, and *De Anima* were edited by Karsten (1865), and that on the *Enchiridion* of Epictetus by Enk (Vienna, 1866).

SIM'PLON, *Fr. pron.* săN'plōN'. A famous Alpine mountain pass of Switzerland, 6592 feet above the sea, in the eastern part of the Canton of Valais, near the Piedmontese frontier. The Simplon road, one of the greatest engineering achievements of modern times, leads over a shoulder of the mountain from Brig in Valais to Domo d'Ossola in the north of Piedmont. The road was commenced in 1800 under the direction of Napoleon and was completed in 1806. It is from 25 to 30 feet broad, and 42 miles long. It is carried across 611 bridges, over numerous galleries cut out of the natural rock, or built of solid masonry, and through great tunnels. The construction of a railway tunnel between Brig and Isella was nearing completion at the close of 1903. It will have a length of about 12 miles and will be the longest railway tunnel in the world, surpassing the Saint Gotthard by more than 2 miles. It begins on the Swiss side at an elevation of about 2250 feet and the opening at the Italian end is about 550 feet higher. Consult *La ferrovia del Sempione* (Rome, 1900).

SIMPSON, sĭm'son, EDWARD (1824-88). An American naval officer and author, born in New York City. He was appointed a midshipman in the navy in 1840; in 1845 entered the new Naval Academy at Annapolis; and in the following year graduated in the first class that ever went out from that institution. In the Mexican War he served on board the *Vixen*, and took part in the bombardment of Vera Cruz. In 1855 he was commissioned lieutenant, and in the following year assisted in capturing the Barrier Forts near Canton, China. After some years as instructor at Annapolis, he was in July, 1862, commissioned lieutenant-commander; and in command of the monitor *Passaic*, he participated in attacks on Fort Wagner, Fort Sumter, and Fort Moultrie. Later he was fleet-captain of the blockading squadron before Mobile. He had risen to the rank of rear-admiral when he was retired in 1886. His publications include: *Ordnance and Naval Gunnery* (1862); *The Naval Mission to Europe* (1873); and *Modern Ships of War* (1887).

SIMPSON, Sir GEORGE (1792-1860). A Canadian statesman and explorer, born in Rossshire, Scotland. In 1820 he was sent to British America by the Earl of Selkirk, the leading spirit of the Hudson's Bay Company. In 1821, when the Hudson's Bay Company and its rival, the Northwest Company, coalesced, he was appointed Governor of the Northern Department, and subsequently general superintendent of the company's affairs in America. That position he filled with great success for thirty-five years. In 1828 he crossed the

continent to the Pacific, and did much exploring at other times, and also sent out several notable exploring expeditions. In 1841 Simpson was knighted, and in the same year he started on an 'overland' journey around the world. He published an account of this journey under the title of *A Narrative of a Journey Round the World During the Years 1841 and 1842*. Consult: Hopkins, *Canada* (Toronto, 1898-1900); and Macdonald, *Peace River: A Canoe Voyage from Hudson's Bay to the Pacific by Sir George Simpson* (Ottawa, 1872).

SIMPSON, Sir JAMES YOUNG (1811-70). An eminent Scotch obstetrician, born at Bathgate, Linlithgowshire. He was graduated in medicine in 1832 from the University of Edinburgh. He was elected president of the Royal Medical Society in 1835; lectured on pathology in the university; and later succeeded to the chair of midwifery. He built up a large practice very rapidly, and became one of the physicians to the Queen in 1847. In March, 1847, he introduced to the world the discovery of the anæsthetic properties of chloroform. In 1856 the Monthyon prize of the Académie des Sciences, amounting to 2000 francs, was awarded to him in recognition of his services in the discovery of chloroform anæsthesia and its introduction into midwifery practice. Simpson invented acupressure in hemorrhage, in 1859. In 1866 he was invested by Oxford with the degree of D.C.L., and was created a baronet in the following year. Sir James was noted as an antiquary of eminence as well as a most skillful medical practitioner. It is claimed that Simpson anticipated the discovery of the X-rays. He received a public funeral at Edinburgh, in which city a maternity hospital has been founded to his memory. His bust is in Westminster Abbey. His principal works are: *Obstetric Memoirs* (1856); *Acupressure* (1864); *Selected Obstetrical Works* (1871); *Anæsthesia and Hospitalism* (1871); *Clinical Essays* (1871); *Clinical Lectures on the Diseases of Women* (1871). Consult the *Memoir* by Duns (1873).

SIMPSON, JOHN PALGRAVE (1807-87). An English novelist and playwright, born in Norwich. He was of Norfolk stock. Having graduated from Corpus Christi College, Cambridge (1829), and taken the master's degree three years later, he lived abroad until 1850, when he settled in London. Here he became a well-known figure in literary society. His novels comprise: *Second Love* (1846); *Gisella*, an Hungarian romance (1847); *The Lily of Paris* (1849); *For Ever and Never* (1884); and a few short tales. He was in Paris during the Revolution of 1848, and wrote *Pictures from Revolutionary Paris* (1849). In 1847 he had published the equally brilliant *Letters from the Danube*. Simpson composed or adapted from popular novels and French plays more than sixty pieces which, though successful, have slight literary value.

SIMPSON, MATTHEW (1810-84). An American clergyman, born at Cadiz, Ohio. He graduated at Allegheny College, Meadville, Pa., in 1832; received the medical degree and entered the ministry in the Methodist Episcopal Church in 1833. He was made professor of natural sciences at Allegheny College in 1837, president of Indiana Asbury, now De Pauw University (1839-41); he was editor of the *Western Christian Advocate* in 1848; was elected bishop in 1852; visited the Methodist missions in Syria and the East in 1863, and the Mexican missions in 1874, and was a delegate to the European Missionary Conferences in 1875. He was an intimate personal friend of President Lincoln, and was employed by the Government in several important confidential commissions. He died in Philadelphia. He published: *A Hundred Years of Methodism* (1876); *Cyclopædia of Methodism* (1878); *Yale Lectures on Preaching* (1879); and *Sermons* (1885). See his *Biography* by G. R. Crooks (New York, 1890).

SIMPSON, THOMAS (1710-61). An English mathematician, born at Market Bosworth, Leicestershire. His interest in celestial phenomena seems to have been awakened by the solar eclipse of May 11, 1724. In 1735 he moved to London, devoting his spare time to the teaching of mathematics. In 1740 he was chosen a member of the Royal Academy of Stockholm and in 1745 a fellow of the Royal Society. In 1743 he was appointed professor of mathematics in the Royal Academy at Woolwich. In 1737 he published *A New Treatise on Fluxions*, which, although it contained some obscurities and defects, showed great mathematical ability and enhanced his reputation. Simpson wrote many ingenious works on mathematics.

SIMROCK, sĭm'rŏk, KARL JOSEPH (1802-76). A German poet and scholar. He was born at Bonn, studied there and at Berlin, entered the civil service in 1826, and in 1827 published a translation of the *Nibelungenlied*, which has become classic in more than fifty editions. He followed this with metrical renderings of Hartmann von Aue's *Der arme Heinrich* (1830), was expelled from the Prussian service for a political poem, and gave himself wholly to literature, modernizing the poems of Walther von der Vogelweide (1833); the *Parzival* of Wolfram von Eschenbach (1842); *Reineke Fuchs* (1845); the *Edda* (1851); Gottfried von Strassburg's *Tristan und Isolde* (1855); the Old Saxon *Heljand* (1856); the Anglo-Saxon *Beowulf* (1859); *Der Wartburgkrieg* (1858); Brant's *Narrenschiff* (1872); and other less important works. Simrock wrote many works on German legends, proverbs, etc., and also published a study of the sources of Shakespeare. From 1850 till his death he was professor of the Old German language and literature at Bonn. Consult Hocker, *Karl Simrock* (Leipzig, 1877).

SIMS, sĭmz, GEORGE ROBERT (1847—). An English journalist and playwright. He was born in London, and made his home there, becoming almost as familiar with the darker sides of London life as was Dickens. He was educated at Hanwell College and at Bonn. On the death of Thomas Hood the younger in 1874 he joined the staff of *Fun* and in the same year he began writing for the *Dispatch*, in which first appeared his sketches under the title of *Social Kaleidoscope*, the *Three Brass Balls*, and *The Theatre of Life*. These were exceedingly popular and were translated into French and German. From the feuilleton he drifted into light verse, contributing to the *Referee* the *Dagonet Ballads* (collected in 1882). Among other volumes of verse from his pen are *Ballads and Poems* (1879), *The Land of Gold* (1883), and *Dagonet Ditties* (1893). Turning to the drama, Sims wrote a large number of

plays, beginning with farces like the *Crutch and Toothpick* (1879), which was followed by *Mother-in-Law* and *The Member for Slocum*. His greatest success, however, awaited him in melodrama. *The Lights o' London*, first produced at the Princess's Theatre in 1881, had an extraordinary run in London and afterwards in the colonies and in the United States. Almost equally popular was *In the Ranks*, first performed at the Adelphi Theatre in 1883. Among Sim's other plays are: *The Romany Rye; The Golden Ring; Jack in the Box; The Harbour Lights; Two Little Vagabonds; In Gay Piccadilly;* and *A Scarlet Sin*. In these and other plays Sims has presented striking phases of contemporary London life. His *How the Poor Live* (1883) and his various contributions to the London *Daily News* on the housing of the poor awakened much attention and led to reforms. In 1901 and the following years he edited *Living London, Its Work and Its Play, Its Humour and Its Pathos, Its Sights and Its Scenes*. Consult for Sims's early work, Archer, *English Dramatists of To-Day* (London, 1882).

SIMS, James Marion (1813-83). An American gynæcologist, born in South Carolina. He was graduated in medicine by Jefferson Medical College, Philadelphia, in 1835, and entered upon the practice of his profession at Montgomery, Ala., in 1836. About 1845 he became interested in the hitherto incurable disease vesico-vaginal fistula, and established a private hospital for women, which for several years he supported at his own expense. The success of his experiments at closing these fistulæ was due, he claimed, to the substitution of silver wire for silk and other sutures, and he afterwards extended the use of metallic sutures to general surgery. He published a full account of his operation in the *American Journal of Medical Sciences* in 1852. He settled in New York City in 1853, and was instrumental in establishing the Woman's Hospital, for the treatment of diseases peculiar to women. In 1861 Dr. Sims went to Europe. Here in 1870 he organized the Anglo-American ambulance corps, of which he took charge, and which he accompanied to Sedan. Sims's operation has been of incalculable benefit and his name deserves a place as an inventive genius among the great surgeons of the world. Sims published several monographs and contributed articles to medical journals. He published the following volumes: *Trismus Nascentium* (1846); *Silver Sutures in Surgery* (1858); *On Intra-uterine Fibroid Tumors* (1874); *Clinical Notes on Uterine Surgery* (1866); *Anglo-American Ambulance* (1870); and *The Discovery of Anæsthesia* (1877). See *The Story of My Life*, edited by his son, Harry Marion Sims (New York, 1884); also Austin Flint's *In Memoriam James Marion Sims* (New York, 1886).

SIMS, Thomas M. (c.1829—). A fugitive slave, returned to slavery from Boston, Mass., in 1851. He escaped from slavery at Savannah, Ga., early in 1851 and reached Boston in February on board a trading vessel, but on April 3d was arrested in pursuance of the Fugitive Slave Law (q.v.), and was confined in the Boston court house, which, for protection, was surrounded by chains. His arrest caused great excitement in Boston, and vigorous but unavailing efforts were made by the Abolitionists to secure his release, several large public meetings being held at which such men as Wendell Phillips, Theodore Parker, William Lloyd Garrison, Horace Mann, Henry Wilson, and Thomas W. Higginson delivered addresses. Sims was tried before United States Commissioner George T. Curtis (q.v.), was surrendered to the representative of his master, one James Potter, and was returned to Savannah, where he was subsequently sold to a brick mason of Vicksburg. Unsuccessful attempts were made by people in the North, especially by Charles Devens (q.v.), the marshal who had caused his arrest, to buy and emancipate him. In 1863 he escaped to the besieging army of General Grant, about Vicksburg, and after 1877 was for several years a messenger in the Department of Justice in Washington. His return to slavery did much to accentuate the opposition of people in the North to the Fugitive Slave Law. Consult: Adams, *Richard Henry Dana, A Biography* (Boston, 1891); and an article in the *New England Magazine*, vol. ii. (n. s.). (Boston, 1890).

SIMS, Winfield Scott (1844—). An American inventor, born in New York City. He served in the Civil War in a New Jersey regiment. He experimented with electro-magnets and electromotors, and to him belongs the honor of having been the first to apply electricity to the propulsion and guidance of torpedoes. See Torpedo.

SIMSON, sĭm'sŏn, Martin Eduard von (1810-99). A German jurist and parliamentarian, born at Königsberg. After studying there, in Berlin, Bonn, and Paris, he began to lecture in his native city in 1831, and became professor there in 1833. Elected to the National Assembly at Frankfort in 1848, he was successively its secretary, vice-president, and president, and in 1849 headed the delegation which announced to the King of Prussia his election as German Emperor. In the same year he represented Königsberg in the Prussian Second Chamber with rare oratorical skill, and in 1850 presided over the Erfurt Parliament. Having confined himself to his juridical and academic duties from 1852 to 1858, he was again returned to the House of Representatives in 1859, was its president in 1860-61, and of the North German Reichstag from 1867 on, in which capacity he headed the deputation which petitioned King William I. at Versailles, December, 1870, to accept the Imperial crown, offered him by the German princes. Subsequently also president of the German Reichstag, he declined a reëlection in 1874, owing to impaired health, was appointed president of the Supreme Court at Leipzig in 1879, and retired in 1891, settling in Berlin, where he died.

His son, Bernhard (1840), born at Königsberg, professor of history at Freiburg since 1877, is known as the author of *Jahrbücher des Fränkischen Reichs unter Ludwig dem Frommen* (1874-76); *id. unter Karl dem Grossen* (1883); of the 6th volume of Giesebrecht's *Geschichte der deutschen Kaiserzeit* (1895); and of a biography of his father (Leipzig, 1900).

SIM'SON, Robert (1687-1768). A Scotch mathematician, born at West Kilbride, Ayrshire. He was educated at Glasgow University and in London. At the age of twenty-four he was elected professor of mathematics in Glasgow University. Directed by Halley to the study of Greek mathe-

matics, he devoted much of his life in making the early classics in geometry known in England. In 1761 he retired from his active work in the university and devoted the remaining years of his life to revising his works. Besides numerous memoirs, Simson published the following works: *Sectionum Conicarum Libri V.* (1735, 2d ed. 1750; Eng. trans. 1804); *Apollonii Pergæi Locorum Planorum Libri II.* (1749; Ger. trans. 1822); *Elements of Euclid* (1756, and many subsequent editions). His collected works were published at Glasgow in 1776.

SIMULTANEOUS EQUATIONS. See EQUATION.

SIN (AS. *synn*, OHG. *suntea, sunta*, Ger. *Sünde;* probably connected with Lat. *sons*, guilty, Gk. *ἄτη, atē*, mischief, harm). Voluntary transgression of a moral law believed to possess divine sanction. All theories assume a fact which they presuppose to be well understood from the experiential point of view by all. The various meanings attached to this fact reveal a gradual progression out of the crudest physical conceptions to the highly individualized views of modern ethics. Thus among savages we do not find any consistent perceptions of right and wrong, and it is doubtful if we have any ground for speaking of 'the sense of sin' in their case. The only element of our definition obvious here is the vague apprehension of a power, higher than the human, approving or disapproving, whom it is possible to offend and therefore wise to conciliate. Clearer conceptions appear among the Oriental nations, whose elaborate ceremonial and mechanical piety are calculated to foster the sense of sin in the soul. The Hindus, moreover, extend this idea of evil to the cosmos, which is conceived of as sharing the common evil of all existence. The fatalistic pessimism of the Orient has made little attempt to trace sin to a common root in human nature.

Among the Greeks and Romans the idea of sin takes on the more positive character of their life and temperament. The essential excellence of human nature and the power of the human will, unaided, to attain to a high standard of virtue, was part of the genius of the Græco-Roman civilization. Yet the idea of moral evil is not lacking, especially in the days of the decline of Rome. In the main, however, sin is conceived either as physical disease or as ignorance.

With Christianity there came a change, the chief cause of which was the teaching of the doctrine of a future life, especially the doctrine of penalty for sin. This acted as a strong deterring influence, which showed itself still further in the practice of self-accusation and in the habit of affixing personal responsibility for the smallest departures from the divine law. In their conflict with paganism and Greek philosophy the early fathers were led to define the nature of sin more fully and precisely. We find two broadly divided schools. One regarded sin as an individual affair, as a voluntary act, as an actual reality. The other regarded it as a matter of the race, as a matter of hereditary depravity and corruption. The former school held that moral responsibility was confined to the individual's own acts; the latter, that this responsibility is shared and conditioned by the race as such. Out of these opposing views arose the distinction between actual and original (q.v.) sin. Later speculation made much of the classification into mortal (q.v.) and venial (q.v.) sins.

In modern thought sin is studied for the most part in connection with theodicy, psychological ethics, and sociology. It assumes three forms: (1) the inquiry into the origin of evil; (2) the question of freedom and necessity; and (3) the relation of sin to final causes. As regards the first, we find Descartes and Spinoza practically denying the positive character of sin, being followed in this view by Malebranche, who, however, perceiving the dilemma of absolute determinism, maintained that sin is a phenomenon, through which God occasionally acts, as He might through any other act of a human being. For Leibnitz, the author of the most original system of theodicy, evil is the contrast to the good. The origin of evil, therefore, is not to be found in the divine will, nor entirely in the action of man, but rather in the essential limitations of matter, which is the condition of realizing the good. Thus evil is merely privation and has no true cause. In regard to the second question Spinoza's theory of universal determinism led him to attribute freedom to God alone, and, of course, this caused him to deny the reality of free agency. Descartes's view that God creates the distinction between truth and falsehood, right and wrong, tended in the same direction. Leibnitz, on the other hand, while admitting that God is the only complete and perfect cause, nevertheless contended that He has, in creating man, conferred upon him the prerogative of freedom. Now the possession of freedom by man is not a limitation of God's absoluteness. For, first, freedom in a *finite* agent involves the liability to error and sin; and, second, the sin of man is not predestined or ordained by God, but only permitted, so that the good may be more completely manifested. Sin, therefore, cannot defeat the final purpose of God, which is the completion of the system, the establishment of good in the heart of every man; for God has determined or chosen that, on the whole, the system shall promote the happiness of His creatures, which is the only principle that has positive character.

After Leibnitz we do not find any original systems of theodicy, and the problem of sin tends to be considered in connection with psychological ethics and sociology. Its subjective character and its reflex action on social life are the chief matters of interest to the more modern mind. We notice a disinclination to regard sin as a cosmical or metaphysical reality, and a decided effort to understand its psychological nature. Thus physical conditions are now admittedly agreed to be important predisposing factors of sin. The part played by choice, by feelings of fear, and by the primitive passions in perverting human nature is also fully acknowledged, especially in determining the intention of the act of sin and its relation to the universal disapproval that accompanies wrongdoing (guilt). The tendency to trace all sins to one common root in human nature is illustrated in Julius Müller's idea that the root of all sin is selfishness, i.e. the willful choice of the ego as the supreme object of love. The complex character of sin is, however, from the psychological point of view, nearer the truth than this theory of a single motive. Besides all this, the vast social significance of the fact of sin has been fully recognized, as appears in all modern systems of penology, in which remedial

measures are applied to the correction of the habitual criminal. It is also seen in the importance now attached to the moral education of the young as a means of combating the liability to wrong-doing in the human race.

Consult (besides the ethical works referred to under ETHICS, and the older discussions of Plato, Aristotle, Epictetus, Cicero, Descartes, Spinoza, and Leibnitz): Müller, *Die christliche Lehre der Sünde* (2d ed., Bremen, 1888); Martineau, *Types of Ethical Theory* (London, 1885); Manning, *Sin and Its Consequences* (ib., 1892); Adler, *Moral Education of Children* (New York, 1898); Tennant, *Origin and Propagation of Sin* (London, 1902). See also EVIL; DEVIL.

SINAI, sī'nâ *or* sī'nī (Heb. *Sinai*). The mount on which God is said to have revealed Himself to Moses. It is situated in the southern half of the so-called Sinaitic Peninsula, projecting into the northern extremity of the Red Sea, between the Gulf of Suez on the west and the Gulf of Akabah on the east. This part of the peninsula consists of a mass of granite and porphyry mountains which may be divided into three groups: a northwestern, reaching in Jebel Serbal a height of 6712 feet; a central, including Jebel Musa (7363 feet) and Jebel Katerin (8537 feet); and an eastern and southern, whose highest peak is Jebel Umm Shomer (8449 feet). Whether the biblical Sinai is Jebel Umm Shomer or Jebel Musa is disputed. The former has been advocated by Eusebius, Jerome, Cosmas Indicopleustes, and in modern times by Lepsius and Ebers. Jebel Musa, however, is preferred by most authorities, and is favored by tradition (which, however, dates only from Christian times) indicated by the name 'Mountain of Moses' and the erection of a monastery upon it which goes back to the days of Justinian. The northern peak of Jebel Musa, known as Ras Safsafeh (6540 feet), meets the conditions required, since there is an open space at its foot sufficient to accommodate a large encampment. It should be noted that in the Old Testament Horeb and Sinai are identical, the former being the term used for the holy mountain in the Elohistic source and in Deuteronomy, the latter in the Yahwistic source (see ELOHIST AND YAHWIST) and in the Priestly Code. (See HEXATEUCH.) The Monastery of Saint Catharine is situated on the northeastern slope of Jebel Musa at an elevation of about 5000 feet. It is occupied by monks of the Greek Church, whose number at present does not exceed thirty. It was here that Tischendorf discovered the *Codex Sinaiticus* (see BIBLE) in 1859. The entire region was a favorite abode of Christian anchorites in the early centuries and their cells and caves are very numerous. The so-called Sinaitic inscriptions are graffiti left on the rocks for the most part by heathen Nabateans; a few, however, are the work of Christian travelers. They date from the period extending from the first to the sixth century. See INSCRIPTIONS. Consult: Palmer, *The Desert of the Exodus* (London, 1871); Ebers, *Durch Gosen zum Sinai* (Leipzig, 1872); Hull, *Mount Seir, Sinai*, etc. (London, 1875); also, for a vivid popular description, Stanley, *Sinai and Palestine* (ib., 1856); and the commentaries on Exodus (ch. xix.) of Dillmann (Leipzig, 1880) and Ryssel (ib., 1897), where a full discussion of the controversy as to the site of Mount Sinai may be found.

SINAITIC MANUSCRIPT. See BIBLE.

SINALOA, sē'nâ-lō'â. A maritime State of Mexico, bounded by the States of Sonora and Chihuahua on the north, Durango on the east, the Territory of Tepic on the south, and the Gulf of California on the west (Map: Mexico, E 5). Area, 33,671 square miles. The coast is low, and lined with numerous lagoons. The interior rises gradually from the coast and the eastern part is occupied by the Sierra Madre Mountains. The State is well watered and some of the rivers are partly navigable. The climate is hot and unhealthful on the coast, but more moderate in the highlands. Rains are abundant in the mountains, and the mountain slopes are well wooded. Agriculture is in a backward state and very few agricultural products are exported. The mineral deposits are extensive, including gold, silver, copper, iron, and lead, some of which are worked to some extent. The chief manufactured product is cotton cloth. Population, in 1900, 296,109, including many Indians. Capital, Culiacán (q.v.).

SINCERE BRETHREN (Ar. *Ikhwān al-Safā wa-Khullān al-Wafā*, the Sincere Brethren and True Friends). A transcendental and scientific order of esoteric nature in Islam, existing at Basra, on the Lower Euphrates, about 1000. (See SHIITES.) Little is known of the personality of the members, the leader of whom may have been one Zayd ibn Rifaa. It was a constituent part of their philosophy that perfection could only be reached through the coöperation of souls, each contributing its share to the common treasury of goodness and knowledge; hence logically their association took the form of an esoteric society with a simple organization into which any sincere and helpful-spirited man could enter. The order was divided into four ideal grades: the first for the younger members, and for those of practical ability; the second for those over thirty years, who could fulfill the office of teachers; the third for those over forty, who could rule in the society, their authority being one of mildness and admonition; the fourth for those who were fit to attain the vision of God. The *Epistles of the Sincere Brethren* (*Rasāil Ikhwān al-Ṣafā*) consists of fifty-one treatises and is an encyclopædia of the Arabic philosophy of the age, methodically arranged, and bound together by the philosophy of the order. This is based upon Neo-Platonic and other late Greek philosophies, with evident contributions from Oriental mysticism, the authors being Shiite. The doctrine is that of an All-Soul, which first projects matter from itself, and continuously spiritualizes it by emanations; on the other hand, these soul-parts naturally yearn for return to their origin. But this redemption is hampered by the opposition of spirit and matter. The ethics of the encyclopædia, therefore, inculcates the gradual self-purification of those who recognize their spiritual birthright away from sense to God. But while ethically dualistic, the encyclopædia has a pantheistic metaphysics, and is interested in all created things as being immediately derived from God. Hence the work becomes an encyclopædia of all knowledge. The work has been made known to modern Europe through the labors of Dieterici in a series of translations of

almost all but the last quarter of the book, published between 1861 and 1872 (Berlin and Leipzig), concluding with a general survey in *Die Philosophie der Araber* (Leipzig, 1876-79). He has also published as a translation one of the episodes, *Der Streit zwischen Mensch und Thier* (Berlin, 1858), and its original (ib., 1879); also a selection of the original texts in *Abhandlungen der Ichwān es-Safā* (ib., 1883-86). Consult also: Flügel, in *Zeitschrift der deutschen morgenländischen Gesellschaft*, vol. xiii.; and Lane-Poole, *Studies in a Mosque* (London, 1883).

SINCLAIR', Sir JOHN (1754-1835). A Scotch politician and author. He was born at Thurso Castle, Caithness, studied at Edinburgh, Glasgow, and Oxford, and was admitted to the Scottish (1775) and English bars (1782). With slight interruptions, he sat in Parliament from 1780 to 1811; in 1791 he established the British Wool Society, and in 1793 the Board of Agriculture, of which he was for thirteen years president. In 1784 he published his *History of the Revenue of the British Empire*, but his chief work is the *Statistical Account of Scotland* (21 vols., 1791-99). He published numerous other volumes, and many pamphlets. See his *Correspondence* (1831).

SIND'BAD (or **SINBAD**) **THE SAILOR.** The hero of one of the tales of the *Arabian Nights*. He is a wealthy Bagdad merchant, who relates the story of his marvelous seven voyages to a discontented porter. The history of the third voyage contains the story of Polyphemus. In the fifth he meets the famous Old Man of the Sea (q.v.).

SINDH, SIND, or **SCINDE.** A region in the northwestern part of British India, now forming a division of the Bombay Presidency. It lies around the lower course of the Indus, and is bounded on the north by Baluchistan and the Punjab, on the east by Rajputana, on the south by the Great Rann and the Arabian Sea, and on the west by Baluchistan (Map: India, A 3). The area under British administration covers 47,066 square miles, and the total area, including the native State of Khairpur, is 53,175 square miles. Sindh belongs physically to the Punjab region, and consists in part, like the latter, of very low, flat doabs, or interfluvial regions, here lying between the branches of the great Indus delta. These doabs consist mostly of alluvial clay baked hard in the sun, but toward the east they merge into the sandy wastes of Rajputana. The climate is very hot and dry, the rainfall being entirely insufficient for agriculture. The arable soil consists of the rich alluvium deposited in the periodic inundations of the rivers.

Agriculture is dependent almost wholly upon irrigation, which is secured through a system of canals leading from the Indus River and the annual overflow of that river. The extension of these canals by the Government in recent years has increased the area under cultivation. In 1900-01 the net area cropped amounted to 3,729,433 acres. There are generally two harvests per annum: the first, or rubbī (spring) harvest, consists of wheat, barley, oil-seeds, millet, durra, opium, hemp, and tobacco; the second, or kurīf (autumn) harvest, consists of those crops whose ripening requires much heat, as rice, sugar-cane, cotton, indigo, and maize. The North West Railroad extends from Karachi northward through the region. The navigation of the Indus has, since the construction of this line, been reduced to the traffic of the native boats. Karachi (q.v.) is the principal port for the Punjab and Northwest India region. The population in 1901 was 3,212,808, a gain of 12 per cent. over 1891, consisting of a mixture of Juts (a Hindu race) and Baluchis, with a few Afghans in the northwest; the greater portion of them are Mohammedans, and the remainder profess Hinduism. The capital of Sindh is Karachi.

From the early part of the eleventh century Sindh was generally under Mohammedan domination. Among the mediæval ruling powers were the dynasties of Ghazni (q.v.) and Ghuri (q.v.). Toward the close of the sixteenth century it passed under the sway of the Great Mogul. (See MOGUL, GREAT.) Amid the convulsions resulting from the invasion of India by Nadir, Shah of Persia, Sindh became in 1748 a feudatory dependency of the Durani dynasty of Kandahar. A little more than a generation later the Talpur Baluchis, who had immigrated into Sindh, raised their leader, Mir Fath Ali, to supreme power. This chief made large grants of territory to various relatives, reserving most of Lower Sindh for himself and his three brothers; so that there were four ameers at Hyderabad, three at Khairpur, and one at Mirpur. On the outbreak of the Afghan War in 1838, the British Government intimated its intention to take temporary possession of Shikarpur, and forced the ameers of Hyderabad and Mirpur to agree to a treaty which virtually destroyed their independence. Their expressions of disapproval provoked fresh demands from the Calcutta Government, to which the Hyderabad rulers agreed, despite the clamors and threats of their followers, who attacked the British residency. War with Great Britain broke out in 1843 and an expedition under Sir Charles James Napier, the British envoy, routed the native forces at Miani and soon completed the subjugation of Sindh. The conquered territory was divided into three collectorates, now the districts of Hyderabad, Karachi, and Shikarpur; the Ameer of Khairpur, by continuing faithful to the British, retained his dominions. Consult: Burton, *Sind Revisited* (London, 1896); Hughes, *A Gazetteer of the Province of Scinde* (2d ed., ib., 1876).

SINDHI (sĭn'dē) **LANGUAGE AND LITERATURE.** The modern Indian language and literature of Sindh (q.v.). Sindhi has been derived by some scholars from Śauraseni Prakrit, especially in the Abhiri vernacular, spoken in mediæval times about the mouth of the Indus. Of all the Indian group of languages Sindhi is in many respects the most interesting linguistically. While it is, generally speaking, an analytic language of the same type as English, it retains a number of Prakrit elements, which have been discarded elsewhere. There are, as in Sanskrit (q.v.), eight cases, formed chiefly by postpositions, and the verb has three simple tenses, potential, aorist, and future, from which the various periphrastic tenses are formed (e.g. *āṃūṃ halām*, 'I may go;' *halandō huāṃ*, 'I may be going;' *haliō huām*, 'I may have gone;' *halām thō*, 'I go;' *halandō āṃhiyāṃ*, 'I am going;' *halandō hōse*, 'I was going;' *haliuse*, 'I went;' *haliuse thē*, 'I used to go;' *haliō āṃhiyām*, 'I

have gone,; *haliō hōse*, 'I had gone,; *halanduse*, 'I shall go.; *halandō hunduse*, 'I shall be going'; *haliō hunduse*, 'I shall have gone'). The past tenses of the transitive verb are lacking, and their place is supplied by the passive with the agent in the instrumental case. In its vocabulary Sindhi, as being the first language of India to come under Mohammedan influence, has incorporated many Persian and Arabic loan-words. On the other hand, it has borrowed a smaller number of Sanskrit words than any of the other modern Indian languages. Sindhi is divided into a number of dialects, which shade off imperceptibly one into another. Of them the most important are Lari, in the Indus delta; Thareli, in the Sindh desert; and the one which may be called the standard, Sirai, north of Hyderabad. Among the other dialects are Jathki, Vicholi, Kachi, and Jadgali. The alphabets were formerly numerous, but fell into two classes, the Arabic and those derived from the Sanskrit Devanagari script, and uniformity in this regard has not yet been attained. The distinction in usage was primarily religious, Arabic letters being adopted by the Mohammedans, while the Hindus clung to the Indian characters. Sindhi literature is scanty, but there is a rich store of popular poetry, tales, and the like which deserve to be reduced to writing.

Consult: Cust, *Modern Languages of the East Indies* (London, 1878); Beames, *Comparative Grammar of the Modern Aryan Languages of India* (ib., 1872-79); Stack, *English and Sindhi Dictionary* (Bombay, 1849); id., *Grammar of the Sindhi Language* (ib., 1849); Trumpp, *Grammar of the Sindhi Language* (London, 1872); id., *Sindhi Reading-Book* (ib., 1858); Gajumal, *Handbook of Sindhi Proverbs with English Renderings and Equivalent Sayings* (Karachi, 1895).

SIN'DIA. The name of a powerful Mahratta house, which played an important part in the history of India during the eighteenth and nineteenth centuries. The rulers of the Mahratta Principality of Gwalior, feudatory to the British, still bear the name of Sindia. The Sindia family arose in Gwalior, and was of low caste. Its founder was Ranuji Sindia, who had risen to a high rank in the Peshwa's body-guard, and after 1743 received as an hereditary fief half of the Province of Malwa. His natural son, Madhava Rao (or Madhaji, or Mahadji) Sindia (1750-94), on the death of Mulhar Rao Holkar in 1767, became the chief of the Mahratta princes, and commanded the Peshwa's body-guard. Four years later he coöperated with Tukaji Holkar to aid the Peshwa, Madhu Rao, in assisting the Mogul Emperor of Delhi, Shah Alam, to expel the Sikhs from his territories. As a reward for his services Madhava Rao was made virtual ruler of these lands. He fought against the English in the first Mahratta War (1779-82), which was concluded by the Treaty of Salbai. The terms here agreed upon conferred on Madhava Rao the districts won in Gujarat. He quickly extended his power, and in 1784 he captured Gwalior, after which he seized Delhi, Agra, Alighur, and almost the entire Doab (q.v.), and subjugated the Rajput States of Jodhpur, Udaipur, and Jaipur. Madhava Rao's last years were filled with contests against his rival, Nana Farnavese, until his death in 1794. He was succeeded by his grand-nephew, a boy of fourteen, named Daulat Rao (1794-1827), who allied himself with the Peshwa and with the other Mahratta chiefs, and plundered Poona and Indore. In 1802, while attempting to control Indore through the imbecile son of Tukaji Holkar, he and the Peshwa, despite French training and assistance, were crushed at Poona by Tukaji's illegitimate son, Jaswant Rao Holkar. In 1803 the second Mahratta War broke out, in which Daulat Rao played a leading part. His forces were defeated in the same year at Assaye and Argaum by Sir Arthur Wellesley, afterwards Duke of Wellington, and he agreed to renounce all his claims north of the Jumna and west of the Chambal, all authority over the Mogul, and all *chout* or tribute from any native princes. After this Sindia avoided conflict with the English, even offering to help them in 1804 against Jaswant Rao Holkar, although he later declared for him, but was brought to his senses, and finally was given Gwalior in 1805, which was henceforth his capital. In 1817 he was caught in treasonable negotiations with Nepal, and was compelled to sign a treaty by which the Rajput States, and all other native States that wished it, were taken under British protection. He died in 1827 without leaving a son. His widow, Baiza Bai, adopted Janokji (or Mugat) Rao Sindia (1827-43). After a brief civil war between him and the Queen regent in 1833, Janokji was recognized as the lawful ruler by the English. His rule was weak and uneventful, and in 1843 he died, leaving no heirs. His girl-widow, Tara Bai, adopted a boy of eight years, Jyaji (or Baji) Rao Sindia (1843-86). The dominions of Gwalior were in such a state of anarchy that the British insisted on guarantees for the preservation of tranquillity. These were rejected and a war followed, in which the Mahrattas were routed December 29, 1843, by Sir Hugh Gough at Maharajpur, and on the same day by Major-General Grey at Panniar. The British seized Gwalior six days later, and the Sindia Government submitted to the conditions imposed, being also obliged to maintain a Sepoy contingent at Gwalior. In 1858 Sindia took the field at the head of his army against the Gwalior contingent which had joined the Sepoy mutiny, but he was deserted by most of his troops, and compelled to flee to Agra. He was subsequently reinstated by Sir Hugh Rose, and received from the British Government numerous tokens of its appreciation of his loyalty. In 1886 Jyaji Rao was succeeded by his adopted son, Madhava Rao Sindia. He was active in reform and good government, while his loyalty to the English Government was shown in 1900, when he equipped at his own expense and accompanied a hospital ship for the China War. Consult Keene, *Mádhava Ráo Sindhia* (Oxford, 1892).

SIN'DING, CHRISTIAN (1856—). A Norwegian composer, born at Kongsberg, Norway. In 1874 he became one of Reinecke's pupils at the Leipzig Conservatory, and studied with him for three years. In 1880, with the Royal Scholarship, he studied at Dresden, Munich, and Berlin. He finally settled as organist and teacher, at Christiania. Among his works are three pianoforte quartets, pianoforte quintets, a string quartet, a symphony in D minor, two violin sonatas, Romanze for the violin with the piano; 12 Lieder, "Windrose," op. 28; Gavotte; and 3

Nocturnes. His compositions, the most notable of which are for the piano, are remarkable for their brilliancy and Norwegian characteristics. Many of them have become very popular in the United States.

SINDING, Otto Ludwig (1842—). A Norwegian landscape and genre painter, born at Trondhjem. He studied under Eckersberg in Christiania, under Gude and Riefstahl at Karlsruhe, and under Piloty at Munich. As a marine painter of his own rugged and rock-bound coast he attained distinct success in such pictures as the "Lofoten Laplanders Greeting the Return of the Sun," which was exhibited in 1891 at Munich. His fine picture of "The Surf" (1870) showed him as a marine painter *par excellence*, and as a genre painter he achieved high success in the "Struggle at the Peasant Wedding." His "Ruth and Boaz" was awarded a medal at the Centennial Exhibition in Philadelphia.

SINDING, Stefan (1840—). A Norwegian sculptor, born at Trondhjem. He began his studies under Wolff in Berlin, and there exhibited his first statue, "Volund the Smith." At the Paris Exposition of 1878 he exhibited his "Captive," and afterwards at Rome he produced the "Barbarian Woman Carrying the Body of Her Son Killed in Battle," which established his reputation. By this group he proved his departure from the classic school of Thorwaldsen, which until that time had been supreme in Scandinavia. Other examples of his work are the reliefs of "The Pillars of Christianity;" the symbolic figure of "The Ancestress;" a statuette of "Mercury;" "Iphigenia;" and the fine "Terra Mater" (1900).

SINE. See Trigonometry; Curve of Sines.

SINGAKADEMIE, zĭng'ä-kȧ-dȧ-mē'. A famous Berlin choral society founded in 1790 by Karl Christian Fasch (q.v.). The membership consisted originally of about 16 persons, members of the leading families of Berlin. On May 27, 1791 (when the first record of attendance was made), 27 singers were on the roll. This is the date which is celebrated as that of the foundation of the Singakademie, the name subsequently adopted for the society. They studied choral music not for the sake of amusement and pleasure, but with serious artistic aims. It is to the perpetuation of this spirit that the Singakademie owes its position today as the strongest factor in the promotion of choral culture in Germany. The membership has constantly increased, and is now about 600. Possibly the greatest achievement of the society was the rescue from almost total oblivion of Bach's *Passion According to Saint Matthew*, which Mendelssohn, then a young man of twenty, persuaded the society to perform in 1829.

SI-NGAN-FU, sĕng'ăn'fo͞o', **SI-GAN-FU,** or **SI-AN-FU** (Chin., west tranquil city), also sometimes spelled Hsi-an-fu. A departmental city of China, capital of the Province of Shen-si (q.v.), and noted for its antiquity as well as its importance as a commercial centre (Map: China, C 5). It is finely situated near the Wei River, the principal affluent of the Hoang-ho, in the midst of a great loess plateau sloping southward from the high table-lands of Mongolia to the Tsing-ling range, and eastward from Kan-su to the Hoang-ho. Its walls are not as high as those of Peking, but the four great gates with their lofty towers surpass those of Peking in magnificence. They are well built, and in 1868-71 successfully withstood the attacks of the Mohammedan hosts then in rebellion. They have a circuit of 24 miles. The streets are wide, well paved, and clean, and lined with fine shops and warehouses. An immense trade is carried on here, for here the great trade routes from the northeast, east, and south through Kan-su to Ili (2773 miles), Yarkand (3198), Kashgar (3361), and other Central Asian points converge. Population estimated at 1,000,000, including 50,000 Mohammedans, and many Tibetans, Mongols, etc.

On this spot or in its vicinity several dynasties established their capital, beginning with the Chow in B.C. 1122. It is consequently rich in objects of great antiquarian interest. Among them is the oldest mosque in China, built over 1100 years ago, a very old temple dedicated to Lao-tse; the *Pei-lin* or 'Forest of Tablets' belonging to different dynasties, from B.C. 100, and collected from many quarters, consisting of incised specimens of calligraphy, emblematic animals, historic scenes, etc., and the "Thirteen Classics" cut in stone in the T'ang dynasty (618-960); and in the Manchu City in the northwest quarter of the city is an old palace of the same period. Here in 1625 was discovered a large stone tablet (erected in 781 and still preserved), carved with Chinese and Syriac writing recording the establishment of Christianity in this neighborhood in the seventh century by the Nestorians and eulogizing it as the King-Kiao or 'Luminous Religion.' Si-ngan-fu suffered much during the Mohammedan Rebellion of 1865-78, but has now almost recovered. During the advance of the allied troops for the relief of the beleaguered foreigners in Peking in 1900 the Emperor and Empress Dowager fled hither, and kept their Court here until November, 1901. The Tsung-tuh or Governor-General of the United Provinces of Shen-si and Kan-su (officially known as Shen-Kan) resides here.

SINGAPORE, sĭŋ'gȧ-pōr'. An island belonging to Great Britain and included in the colony of the Straits Settlements. It lies off the southern point of the Malay Peninsula, from which it is separated by a narrow strait from ½ to ¾ of a mile wide, and bordered on the south by the wider Singapore Strait which separates it from the small Dutch islands that lie east of Sumatra (Map: French Indo-China, D 7). It is situated less than 100 miles north of the equator. The island is 27 miles long and 11 wide; area, about 210 square miles. It passed into the possession of the East India Company in 1819, and in 1824 the possession was ratified by the payment to the Sultan of Johore of $60,000 and a life annuity of $24,000. The island is well watered and has a hot, damp, but not unhealthful climate, the range of temperature being less than twenty degrees. The surface of the island is broken by small hills, varying in altitude from 300 to 400 feet, and densely forested. There is no regular rainy season, but showers are scattered throughout the year. The principal products are cocoanut oil, gambier, tapioca, cacao, aloes, nutmegs, and a great variety of fruits and vegetables. The flora and fauna resemble those of the Malay Peninsula,

The population, consisting largely of Chinese, Malays, and Hindus, in 1901, numbered 228,555. The only important city is Singapore (q.v.).

SINGAPORE (from Skt. *Sinhapura*, Lion City). The capital of the British Straits Settlements and the most important commercial emporium of Southeastern Asia, situated on the island of Singapore, in latitude 1° 17′ N., and longitude 103° 50′ 47″ E. (Map: French-Indo China, D 7). The town is well built, not merely in its European residence portion, but also in the native quarters. Its harbor is commodious and easy of access. For six miles along its water front the city is lined with quays, wharves, docks, and shipyards. In the rear of the city still stands Fort Canning, the fort erected on a hill just outside the original settlement, but it is now supplemented by modern batteries, which command the harbor. The Governor's palace is a large impressive structure, situated in the midst of a beautiful park at the top of one of the three hills on the outskirts of the city. The most charming spot of the city is the turfed and shaded esplanade, fronting on the outer harbor. In its midst is erected a monument to Sir Stamford Raffles, the founder of the city. The botanical garden ranks as one of the best in the world. The city hall, the Gothic Cathedral of Saint Andrews, the Roman Catholic Cathedral, and the Raffles Museum and Library are all notable buildings. The greater portion of the trade is in the hands of the Chinese, who constitute about three-fourths of the population.

Its geographical position at the eastern entrance to Malacca Strait, about midway between Hong Kong and Calcutta, the proximity to the islands of the Malay Archipelago, and above all the policy of absolute free trade have made Singapore the centre of a trans-shipping trade that is surpassed in the East only by that of the Chinese ports. The list of imports and exports comprises cotton, copra, rice, tin, textiles, tobacco, spices, petroleum, sugar, coffee, pepper, opium, gambier, coal, fish, rattans, skins, silks, and gutta-percha. The manufactures are not extensive, but comprise the preparation of white pepper, tapioca, sago, and gambier, and the manufacture of vehicles, tools, and furniture, and there are shipbuilding establishments, pineapple canneries, and biscuit factories. The total imports for 1901 amounted to $254,128,315 in Mexican silver, and the exports to $213,108,826. The resident population of the municipality of Singapore, in 1891, was 155,683; in 1900, 193,089. Of the latter number 141,865 were Chinese, 26,230 Malays, 15,646 natives of India, 2748 Europeans and Americans, and 3982 Eurasians.

Singapore has its own municipal organization under supervision of the colonial Government. The founding of the city in 1819 was due to the desire of Sir Stamford Raffles, then an employee of the East India Company, to establish an outpost to counteract the growth of Dutch influence in this quarter of the globe. Despite intense opposition on the part of the Dutch and only half-hearted support from the home Government, he succeeded in gaining the island for England, and the continuously rapid growth of the city of Singapore has fully demonstrated the wisdom of his purpose. After the formal cession of the island to Great Britain in 1824 it was the capital of the consolidated governments of Penang, Singapore, and Malacca, which in 1867 became a Crown colony as the Straits Settlements.

SING'ER, ISAAC MERRITT (1811-75). An American inventor, born at Oswego, N. Y. He became a mechanic, and after a time interested himself in the sewing machine. He constructed an improved machine with a rigid overhanging arm to guide a vertical needle, in combination with a shuttle and what was called a wheel-feed. Singer made a large fortune from the sale of his machines.

SINGER, OTTO (1833-94). A German American pianist and composer, born at Sora, Saxony. He studied at Dresden, at the Leipzig Conservatory, and subsequently with Liszt. In 1867 he came to New York, where he became a teacher at the Mason and Thomas Conservatory. In 1873 he conducted the first May Festival in Cincinnati, and was appointed professor of pianoforte and theory in the Cincinnati College of Music. His compositions include two cantatas, *The Landing of the Pilgrim Fathers* (1876) and the *Festival Ode* (1878), symphonies, concertos, and numerous pianoforte pieces.

SINGER, PAUL (1844—). A German political agitator, born in Berlin. Pursuing a mercantile career since 1858, he founded a cloak factory in Berlin in 1869, joined the Social Democrats in 1870, and was elected to the Reichstag in 1884. Gaining prominence as a debater, he became, next to Bebel, the principal leader of the party.

SINGHALESE (or **SINHALESE**) **LANGUAGE AND LITERATURE.** See CEYLON, section on *Language and Literature.*

SINGHARA (sing-hä'rä) **NUT.** See TRAPA.

SINGING (from *sing*, AS. *singan*, to sing, Goth. *siggwan*, to sing, read, OHG. *singan*, to sing, crow, Ger. *singen*, to sing; possibly connected with Gk. *ὀμφή*, *omphē*, voice, sound). The art of making music with the human voice. The physical apparatus employed in the production of musical tones consists of the larynx, which contains the vocal cords, the lungs, and the muscles of the chest and diaphragm. To these must be added as accessories the cavity of the mouth, the hard palate, and the nasal chambers, all of which aid in modifying the character of the tones produced, and also serve as sounding boards to increase their power. The tones of the human voice, either in speaking or singing, are formed by the vibration of the vocal cords. These are two parallel elastic membranous bands situated in the larynx, which thus resembles a reed instrument, like an oboe. The blast of the air column driven from the lungs sets these bands vibrating. By the act of volition they are set to receive the impact of the column of air in such a way as to produce tone. By closing or opening so as to vibrate at different portions of their length, they give tones of different pitch.

The lungs supply the air and are operated by the muscles before mentioned. The diaphragm, the use of which is often neglected by singers, is generally conceded to be of great service in giving power and control to the breathing, which is of the first importance in singing. Some teachers hold that the secret of good tone production lies entirely in the management of the breath. Clavicular or upper-chest breathing, such as is seen in women tightly laced, is regarded as the

least satisfactory method, and is not employed by any great singer. The abdominal method, advocated by Mandl in 1855 and introduced into the Paris Conservatory and among Italian teachers, consists in keeping the chest as quiet as possible and forcing the diaphragm down and the anterior wall of the abdomen out in inspiration. The leading singers of to-day, such as Jean de Reszke, Sembrich, and Nordica, advocate the use of all the external intercostal muscles and the drawing in of the anterior wall of the abdomen in inspiration. They hold that this method sets the diaphragm firmly, gives greater mastery of the breathing apparatus, and enables the singer better to graduate the power of the air column.

The compass of the human voice extends from the C below the bass clef to the F above the treble. Some exceptional voices have exceeded this range. No one voice has this compass, of course, for the average human voice has an extent of about twelve tones, while trained singers usually have two octaves. Some have had more than three. Five general divisions of singing voices are recognized: two women's, soprano and contralto, and three men's, tenor, barytone, and bass. These are here named in the order of their pitch from the highest to the lowest. Music for sopranos, contraltos, and tenors is written on the treble clef, and that for the other voices on the bass clef. The tenor voice, however, produces tones an octave lower than those written.

The pitch of voices is the result of the length of the vocal cords. These cords are shorter in women than in men, and hence the former have higher voices. The longest vocal cords are those of a deep bass. Pitch, however, is not the only trait which determines the title of a voice, for the quality of the tone must be considered. Tenor and barytone voices of exactly the same range exist, but the character of the tones is different. The quality of the voice, then, is modified to some extent by the conformation of the resonance cavities of the mouth and nose and also by the delicate operation of the muscles of the larynx. The resonating chambers also play an important part in giving power to the sounds made by the vocal cords, which would be feeble if not thus aided.

Each voice is divided into several 'registers,' a term borrowed from the organ. It means a succession of sounds having similar character, or produced by the same mechanism. Authorities differ as to the number of registers which exist in the human voice, but the majority follow Manuel Garcia, the inventor of the laryngoscope and one of the most famous of singing teachers. He holds that there are three registers, which he calls chest, falsetto, and head. Some writers have named as many as five registers, and others find that the voices of men and women differ in their divisions of this kind. The mechanical action of the larynx and certain of the resonating apparatus changes as the singer ascends the scale, and the tendency is toward modifications in the quality of the tones, so that the different registers are dissimilar in character. Between the registers, especially between the highest and the next lower, there are audible breaks, and usually the tones on either side of this are weak and uncertain. One of the most important labors of the teacher is the equalization of the registers, so that the breaks shall become unnoticeable and the quality of tone homogeneous throughout the scale. This is accomplished by cultivated methods of tone formation, in which the air column is voluntarily directed toward certain resonators. These same methods of voluntary treatment of the registers are employed by singers to produce some of their most beautiful effects. Male singers, for example, often employ head tones for the production of soft, aërial effects in the upper middle scale, even where the same notes could be produced in full voice.

The training of the voice for singing is a slow and painstaking process. Most of the training is directed toward securing correct tone formation, or tone placing as it is usually called. Upon the correctness of the placing depend the strength, carrying power, smoothness, and beauty of the tone. The acquirement of a perfect method of tone formation is the only road to the strengthening of comparatively weak vocal organs. No teacher can make a big voice out of a little one. Nevertheless it is undeniable that the lungs can be developed by the practice of deep breathing exercises, and the diaphragm and other expulsive muscles developed by systematic use. So, too, the vocal cords and the muscles and ligaments of the larynx can be made stronger by training, but the limit of development is not large. The principal efforts of wise teachers, therefore, are directed to giving their pupils a firm, round, pure tone, which will carry well without undue tax upon the sound-producing apparatus. The correct placing of tone includes several elements, of which the general management of the breath is the most important. Second only to that is the proper employment of the resonating chambers.

Every tone ought to sound to the hearer as if it were sung a little behind the teeth of the singer. Of course it is not sung there, nor would good results be achieved through trying mentally to locate the sound there. But by keeping the tongue depressed, by allowing a part of the air-blast free passage through the nasal chambers, and by bringing the main body of it to bear upon the roof of the mouth at the proper point, tones may be made to sound as if formed well forward and may be actually projected into the auditorium more sonorously than when improperly made. The requirements of good tone are that it shall be pure, that is, that all the breath must be turned into tone and none allowed to escape in a hissing sound; that it shall be clear, that is, shall never sound as if there were some obstacle in the singer's mouth; and that it shall be free, that is, not muffled or squeezed down in the throat. A correct 'attack' is the most important essential of good tone production. The breath must strike the vocal cords at precisely the instant when they form the tone, neither before nor after. Weak voices are made stronger and good voices better by the mastery of the art of tone formation.

To this must be added the requisites of expression. These are a perfect legato, command of the messa di voce, perfect vocalization of the vowels and perfect articulation of the consonants. *Legato* means 'bound,' and in singing it is the passage of the voice smoothly and connectedly from one note to the next in succession. Without a command of the legato no flowing melody can be sung properly. Variety is sometimes added to a melody by the use of the portamento, which is a sliding or carrying of the voice

through the infinitesimal degrees of pitch lying between two notes. This is opposed to the legato and is often so much abused as to preclude all possibility of singing in tune. The legato is the foundation of all good vocal style, and it was in this that the famous singers of the eighteenth century surpassed all their successors. The messa di voce is the swelling of a tone from a pianissimo to its full power and then diminishing it again to the starting point. This is accomplished entirely by control of the breath, though some mistaken singers try to reach the result by straining the muscles of their throats. The messa di voce is of the greatest importance in expression, as it enables the singer to vitalize his song with minute dynamic gradations of tone, similar to those employed in speech.

The vowels present many difficulties to the singer, as the position of the throat and tongue in sounding some of them, especially at full voice, is inimical to good tone production. Much study is necessary to learn how to give the effect of the vowel sounds to an audience while preserving the essentials of good tone. The articulation of the consonants, which is greatly neglected by English singers, and greatly exaggerated by the Wagnerian school of German declaimers, is absolutely necessary to intelligible delivery of the text. The problem to be solved is how to enunciate clearly consonants which naturally cut off the flow of vowel sounds, on which alone tones can be made, and yet not interrupt the fluency of a pure legato style. The problem is solved by learning how to separate the articulative apparatus from the sound-producing mechanism and to operate the two independently without letting them disturb each other. This, like all the rest of singing, requires long and patient self-study under the guidance of a skilled teacher.

BIBLIOGRAPHY. Mackenzie, *Hygiene of the Vocal Organs* (London, 1888); Bach, *The Principles of Singing* (London, 1897); Botume, *Modern Singing Methods, Their Use and Abuse* (4th ed., Boston, 1896); Garcia, *Ecole de Garcia, Traité complet de l'art du chant en deux parties* (9th ed., Paris, 1893); Jadassohn, *Practical Course of Ear Training* (trans. from the German, Leipzig, 1899); Lavignac, *L'éducation musicale* (Paris, 1902); Marchesi, *Ten Singing Lessons* (New York, 1901); Rockstro, *Jenny Lind, A Record and Analysis of the Method of* (London, 1894); Shakespeare, *The Art of Singing* (ib., 1899); Taylor, *How to Sing at Sight from the Staff* (ib., 1897); Panseron, *The A B C of Music, or Easy Solfeggi with Exercises by Concone* (trans. from the French, New York, 1865); Ferrari, *A Concise Treatise on Italian Singing* (London, 1818). The exercises of Concone, for the various voices, are probably the most practicable for the student.

SINGING BEACHES. See MUSICAL SAND.

SINGING FISH. See SAPO.

SINGLE TAX. A tax designed to meet all or the principal needs of government, levied upon a single object of taxation. The single tax on the rent of land was introduced into general economic discussion about the middle of the eighteenth century by the Physiocrats (q.v.), and was popularized by Henry George (q.v.), particularly in his *Progress and Poverty* (1879) and his speeches in the New York Mayoralty campaigns of 1886 and 1897. George advocated the abolition of all taxes upon industry and the products of industry, and the taking, by taxation upon land values, irrespective of improvements, of the annual rental value of all those various forms of natural opportunities embraced under the general term land.

Three classes of arguments are adduced in support of the appropriation by the State of economic rent: (1) The ethical argument rests upon the theory of natural rights. Man, it is asserted, has an absolute, inalienable right to life, to equality of opportunity, and to private property. By virtue of the right to live he may claim access to those natural opportunities—land—which are necessary for the maintenance of life. This is an individual right. But land differs in fertility and value. By virtue of the right of equality, then, men have a joint claim to the difference between the annual values of the worst and the better lands in cultivation; this differential value is economic rent and it belongs to the community. Finally, man has an absolute and inalienable right to the property created by his own exertions, and this property cannot be rightfully taken from him for any cause whatsoever. As the private appropriation of land was and is wrong, George held that neither the action of the State nor the passage of time could justify it, and that in consequence no compensation could be claimed by existing landholders for the appropriation of land values. Single taxers of course made frequent use of the familiar argument that economic rent is created by the community, not by the labor of the individual owner, and that in consequence it cannot in justice be appropriated by the owner.

(2) The second general argument rests upon the economic theory of distribution. With some modifications George followed the Ricardian theory of economic progress. (See *Ricardo*, under POLITICAL ECONOMY.) With the increase of population, George held, mankind is forced to resort to poorer and poorer lands in order to produce the necessary food supply. But as the margin of cultivation is thus forced down, economic rent—which is the difference between the productivity of the worst and the better lands in cultivation—increases, and wages decrease, because wages in general are fixed by the income which can be earned by the occupiers and tillers of the free land which pays no rent. The share of capital in the product of industry, George also maintained, would follow the same course as wages, capital being in all essential respects simply labor impressed or congealed into matter. Wages and interest, therefore, rise and fall together, varying inversely as rent. Not only does rent increase with the increase in population, but every invention involves a further demand upon the soil for raw produce, and thus increases rent. Everything that lowers interest depresses wages and exalts rent; every new increment of capital, being a demand for land, has the same effect; the accession of every new laborer acts similarly; time that increases the population, science that stimulates invention, frugality that multiplies capital, in short material *Progress* itself, under the régime of the private ownership of land, is synonymous with *Poverty*. Hence the title of George's principal work.

(3) The third class George designated as the arguments from expediency. Some of the most important may be briefly summarized as follows:

First, the appropriation of economic rent would yield sufficient revenue to defray all the legitimate expenditures of government. On the other hand, the abolition of all other taxes would dispose of a large army of tax gatherers, make the government simpler, and hence purer and less expensive. Secondly, it would enormously increase the productivity of wealth by removing the taxes upon capital, production, and consumption which now repress or discourage industry, and by forcing into use and cultivation the lands now held idle for speculative purposes. There could be no speculative holding of land for a rise in value if this value, when it accrued, would be appropriated by the State. Finally, the tax on rent could not be shifted, while it would preserve private property in everything except land and prevent socialism or the public management and operation of land. It is important to note that single taxers in the United States are in general vigorously opposed both to socialism and land nationalization.

Economists have opposed with practical unanimity the extreme theory upon which the single tax reform is based, involving, as is admitted, the confiscation of economic rent without compensation, and the dual proposition that the failure to appropriate all land values, and any taxation of other values, are both species of robbery. Some of the objections most frequently urged against the single tax may be summarized as follows: (1) That land is similar to all other forms of wealth in respect to the fact that it consists of indestructible matter adapted by human exertions to satisfy human wants, and that in consequence George's distinction between property in land and other forms of property is invalid. Moreover, as many economists have pointed out, a very large proportion of rent consists merely of a fair average return to capital and labor which have been expended upon the land. (2) That private property in land is permitted and encouraged because it conduces to the greatest good of the greatest number, and supplies a fund of wealth from which the State can easily derive all necessary revenues by the ordinary methods of taxation; that, acting in this belief, we, as a people, have encouraged innocent parties to invest in lands, or to settle the public domain, clear it, till it, and by their labor and residence invest it with a value; that under such circumstances arbitrarily to confiscate the values so created would be fundamentally inexpedient and intolerably unjust. (3) That the single tax would be inelastic, yielding too much revenue in some districts and too little in others, a dangerous surplus in times of peace, perhaps, and an equally dangerous deficit in times of war and public emergency. (4) That the error of George's theory of distribution is shown by the facts, *inter alia*, that in many communities during the last fifty years rents have fallen, not risen, while in the same period wages have risen with practical universality. (5) That the single tax would prevent the utilization of the taxing power for sumptuary purposes (e.g. taxation of intoxicating liquors), for the protection of home industry, and for the improvement of the present distribution of wealth (e.g. a progressive income tax). (6) That it is difficult, theoretically, to determine the value of land irrespective of the improvements upon it, that in practice the assessment of land is notoriously inexact, and that the single tax would intensify the injustice from this unequal assessment. (7) Finally, it is denied that the single tax would appreciably facilitate the accessibility to the soil, help the farmer, reduce overcrowding in cities, for the reasons among others that the tenant class would be in no better position than at present, merely paying rent to the State instead of the private landlord, while the large number of small landowners would not only be expropriated, but would in the future have to pay large rentals to the State.

While economists have with practical unanimity rejected the proposition to tax all economic rent and abolish all other taxes, a large number have advocated measures looking to the gradual appropriation by the State, either of all the future unearned increment of land, or of a larger share of this future unearned increment than is taken at the present time in taxes. This idea has met with particular favor in regard to urban land. John Stuart Mill advocated the appropriation of the future unearned increment of land. Prof. Adolph Wagner, the distinguished German economist, advocates private ownership of agricultural land, but favors public ownership of urban land, which would, of course, bring into the public treasury all future increment in land values. The exemption of improvements for a period of years, especially buildings, has met with favor, and, indeed, has been adopted in many European countries. This, so far as it goes, is in harmony with the idea of the single tax.

The single tax movement is world-wide and probably is stronger than ever before, although its character has entirely changed since the first Mayoralty campaign of Henry George in 1886. The old popular and political methods of agitation have been abandoned, the nuclei of agitation at present being clubs and single individuals prominent in politics, journalism, and business, such as T. G. Shearman of Brooklyn, Tom L. Johnson, Mayor of Cleveland, and Governor Garvin of Rhode Island. The latter two are the most conspicuous examples of politically successful single taxers.

In the United States the single taxers act almost altogether with the Democratic Party, to which they are particularly drawn, inasmuch as the Democratic Party is the party of tariff reform, and the single taxers, in accordance with their fundamental idea, are in favor of absolute free trade, regarding it as contrary to natural right to levy a tax on imports; on account of this fusion it is difficult to determine just how much progress the movement has made in the United States. In England the single taxers are adherents of the Liberal Party and endeavor to force it to espouse their views. They hold office in many English cities and make the claim that their adherents control the city of Glasgow. The single tax movement is less prominent on the Continent of Europe than in English-speaking countries, and can scarcely be said there to have gained a foothold.

The single taxers are now endeavoring to secure, first, a separation in the assessments of property, of land values, and the value of improvements on land; and, second, what they call home rule in taxation, or the authorization of local political units to place a tax upon land

values and to free personal property from taxation, in case they desire to do so.

BIBLIOGRAPHY. George, *Progress and Poverty* (New York, 1879); id., *Social Problem* (ib., 1896); id., *The Land Question* (London, 1883); Shearman, *Natural Taxation* (New York, 1895); Seligman, *Essays in Taxation* (3d ed., ib., 1900); Walker, *Political Economy* (ib., 1883); Spahr, *Political Science Quarterly*, vol. vi., No. 4; *Proceedings of American Social Science Association* (1890). Periodicals: *The Single Tax Review* (New York City); *Land Values* (Glasgow); *The Public* (Chicago).

SINGPHOS, sĭng'fŏz. A people of Northern Burma of doubtful racial affinities. Certain authorities group them with the Burmese, while others class them as one of the divisions of the Shans.

SING SING. The former name of Ossining (q.v.).

SINGSING (African name). An antelope (*Cobus defassa*) of Western and Central Africa, which differs from the waterbuck (q.v.) in its smaller size, the fineness and softness of its hair, a continuous whitish patch on the buttocks, but none on the throat. See authorities cited under ANTELOPE; and Plate of ANTELOPES.

SINGSPIEL, zĭng'shpēl (Ger., song-play). A term designating a kind of operatic production in great favor during the latter half of the eighteenth century. The singspiel differed from the regular opera of that time in the introduction of modern characters, and in the style of its music, which was a conscious imitation of the style of the German folk-songs. The father of the singspiel was Johann Adam Hiller (q.v.), who wrote simple airs, imitated from the style of folk-songs, for his bourgeois types, and reserved his arias for persons of rank. The principal composers of singspiele were Hiller, Neefe, Reichardt, Schweitzer, Dittersdorf, Kauer, Weigl, Schenk, and Haydn (*Der krumme Teufel*).

SINGULARITIES. See CURVE.

SINIGAGLIA, sē'nē-gäl'yä. A city of Italy. See SENIGALLIA.

SI'NIM. A land mentioned in Isaiah xlix. 12. From the connection it is evident that a country in the Far North or East is intended; consequently the Phœnician Sinim (Genesis x. 17) cannot be considered. The oldest Greek version rendered 'the land of the Persians;' Aquila, Theodotion, and Symmachus transliterated the Hebrew as *Sinein*, the Syriac as *Senyam*. Jerome and the Aramaic Targum translated 'the South Land.' Arias Montanus was the first to suggest China, and has had many followers. But it has been shown, particularly by Terrien de Lacouperie, that this is impossible. As the territories of Tsin and Thien on the Hoang-ho in the north cannot have been intended, the name Tsin for China can only be the designation derived from the Tsin dynasty, which came upon the throne in B.C. 255. This was indeed rendered *Sin* by Ptolemy (vii. 3), but Syrians and Arabs always transcribe it as *Zin*, and that would have been the probable pronunciation among the Hebrews. As this passage may have been written as early as B.C. 540, the Chinese Tsin cannot have been meant. Nor is Shina at the foot of Hindukush, proposed by De Lacouperie, more probable. Saadia thought of Sin (Pelusium in Egypt) and he has been followed by Bochart and Ewald. Dillmann thought of the wilderness of Sin (Ex. xvi. 1) and the mountain of Sinai. J. D. Michaelis and Doederlein first proposed and Klostermann, Cheyne, Duhm, and Marti have adopted the explanation of 'the land of Sinim' as Southern Egypt from Syene (Assuan, q.v.). Cheyne reads *Sewanim*. That there were dispersed Jews in the region in B.C. 540 is, however, difficult to prove. The Greek version suggests that the text originally had a name for Persia or Media. A later copyist may have thought of Genesis x. 17. Consult: Terrien de Lacouperie, *Babylonian and Oriental Record* (London, 1886); and the commentaries on Isaiah by Dillmann (Leipzig, 1890), Duhm (Göttingen, 1892), Marti (Tübingen 1900), and Cheyne (New York, 1898).

SINITIC. A term used by certain ethnologists to designate the group of peoples made up of the Chinese proper, the Tibetans, and the Indo-Chinese, all of whose languages have peculiar features and such affinities that they all point to one ancestral stock.

SINJIRLI, sĭn'jĭr-lē'. The name of a Kurdish village in North Syria under Mount Amanus, 40 miles northeast of Alexandretta. The hill or *tell* on which the village lies is one of several hundreds in that region which scholars have recognized as marking the sites of ancient cities. In 1883 Dr. von Luschan pointed out the eligibility of this site for excavation, and when in 1888 the Germans formed their *Orient-Gesellschaft*, Sinjirli was selected for the first operations. In the same summer an expedition was sent out, followed by a second in 1890 and by a third in 1890-91, all of which were under the direction of Von Luschan except that Dr. Humann acted as director in the beginning of the first campaign. Among other scholars participating were Euting and Koldewey. The excavations uncovered the remains of an ancient city, which was surrounded by two walls, while the inner acropolis was defended by two or three lines of fortification. The massive character of these structures, especially of the gates and of the sculptures, showed that the expedition was making the first excavation of a city originally Hittite, although almost nothing in the way of inscriptions was found here. (See HITTITES.) A more recent part of the city was also discovered which is evidently Aramaic in character. The first important find in the way of inscriptions was a monolith of Esarhaddon, King of Assyria, one of the largest known, remarkable for its rich sculpture and for details of religious value, containing an inscription of fifty-nine lines in which the monarch celebrates the triumph of his second campaign against Egypt, about B.C. 670. Aramaic inscriptions were found which are of great value for the additions they make to our knowledge of Syrian politics and civilization. The earliest of these is the Hadad inscription found in a neighboring village. This is written on a cylinder of dolerite of original height of 4 meters and of 2.5 meters circumference, surmounted by the bust of the Syrian god Hadad. On the lower part is an inscription of thirty-four lines, the characters of which are almost identical with those of the Moabite Stone; in it a certain Panammu, King of *Ja'di*, celebrates his

god. It is the oldest Aramaic inscription we possess, being in a dialect approaching the Canaanitish languages, and may be dated about B.C. 800. Another similar monument, now a torso, contains in a field of 1×1.5 meters an Aramaic inscription of twenty-three lines, in which a king of *Sham'al* records the history of his father, Panammu (different from the one above mentioned, but probably of the same dynasty). This and some smaller inscriptions refer to the suzerainty of Tiglathpileser III. (B.C. 745-727), whose own monuments also speak of *Sham'al*, so that we are able to date the monument—a connection of immense value to epigraphy and philology—and also to locate the ancient State of *Sham'al*, whose political and social conditions are interestingly described on this stone. Consult: *Ausgrabungen in Sendschirli*, in the *Mittheilungen* of the Berlin Museum; Craig, in the *Academy*, 1893, p. 441; D. H. Müller, in the *Contemporary Review*, April, 1894; Lidzbarski, *Nordsemitische Epigraphik* (Weimar, 1898).

SINKING FUND. See under FINANCE, section on *Sinking Fund*.

SIN'NETT, ALFRED PERCY (1840—). An English journalist and theosophist, born in London. He was educated at the London University School. In 1859 he became assistant sub-editor of the *Globe* and subsequently leader-writer on other London newspapers. In 1865 he went out to Hong Kong as editor of the *Daily Press*. Returning to England in 1868, he served on the staff of the *Standard* till 1872, when he became editor of the *Pioneer* of Allahabad in India. In 1879 he joined the Theosophical Society of London, of which he afterwards became president. His occult works have had extensive circulation. They include: *The Occult World* (1881); *Esoteric Buddhism* (1883); *Life of Madame Blavatsky* (1886); *The Growth of the Soul* (1896); and two occult romances, *Karma* (1885) and *United* (1886). He made contributions to the published transactions of the London Lodge of the Theosophical Society.

SINO'PE. An ancient city of Asia Minor. See SINUB.

SINTRAM (zĭn'trȧm) **AND HIS COMPANIONS.** A German romance by Fouqué, published in 1814 as the fourth part of the *Jahreszeiten*, of which *Undine* formed the first.

SINUB, sē-nōōb'. A town in the Vilayet of Kastamuni, Asiatic Turkey, on the southern shore of the Black Sea, 185 miles northeast of Angora (Map: Turkey in Asia, F 1). It is defended by half-ruined fortifications, but its dockyard and naval arsenal have been closed. The Bay of Sinub affords the finest anchorage for ships along the northern coast of Asiatic Turkey. The town exports timber, dried fruits, skins, and silk. Population, in 1901, 9749. The ancient city of Sinope was founded by a colony of Milesian Greeks in the eighth century B.C. For two hundred years after the Peloponnesian War it was almost the mistress of the Euxine. Of its former splendor there remain only the 'Castle of Mithridates' and a few Roman substructures. The Bay of Sinub was the scene of a naval engagement, November 30, 1853, in which a Turkish squadron was destroyed by the Russian fleet.

SINUS (Lat., bend, hollow). The cells or cavities contained in certain bones, as the frontal, ethmoid, sphenoid, and superior maxillary, are called sinuses. The frontal sinuses are two irregular cavities extending upward and outward, from their openings on each side of the nasal spine, between the inner and outer layers of the skull, and separated from one another by a thin bony septum. They give rise to the prominences above the root of the nose called the nasal eminences. They are not developed till after puberty, and vary considerably in size, being usually larger in men than in women and young persons, in consequence of the greater prominence of the superciliary ridges in the former. They communicate on each side with the upper part of the nostril by a funnel-shaped opening, which transmits a prolongation of mucous membrane to line their interior. The sphenoidal sinuses are two large irregular cavities, formed, after the period of childhood, in the body of the sphenoid bone. They communicate with the upper part of the nose, from which they receive a layer of mucous membrane. Like the frontal sinuses, they serve to lessen the weight of the skull and to add to the resonance of the voice. The ethmoid sinuses or cells lie in the lateral masses of the ethmoid bone. They open into the cavities of the nose. The superior maxillary sinus, commonly known as the *antrum of Highmore* (after the anatomist who first accurately described it), is the largest of the facial sinuses. Its uses are the same as those of the others, and, like them, it communicates with the nasal cavities. The *sinuses of the dura mater* are quite distinct from the above described bony sinuses; they are irregular channels for the transmission of venous blood. In surgery the term *sinus* is nearly equivalent to *fistula* (q.v.).

SION, sē'ôN' (Ger. *Sitten*). The capital of the Canton of Valais, Switzerland, situated on the Sionne, which flows through the town in an artificial channel, not far from its junction with the Rhone and 17 miles east of Saint-Maurice (Map: Switzerland, B 2). It is a little town of remarkable picturesqueness, with the ruins of the thirteenth-century Castle of Tourbillon on the north and the Castle of Valeria, the former residence of the canons, on the south. The town proper contains the fifteenth-century cathedral, the thirteenth-century Church of Saint Catharine, and the Gothic town hall. Population, in 1900, 6095.

SIOUAN (sōō'an) **STOCK.** One of the most widely extended and important linguistic groups of North America, occupying within the recent historic period the greater portion of the Plains area, but in earlier times holding also the coast and midland region of Virginia and the Carolinas, with outlying tribes upon the Gulf coast. The universal tradition of the various tribes of the stock, as well as of their Algonquian neighbors, with historical and more particularly linguistic evidence, establishes the fact that their original home was east of the Alleghanies in the South Atlantic region. When or why the first emigrants crossed over the mountains into the central region of the Ohio Valley is not known. It was probably brought about by the pressure of Iroquoian tribes from the north and of Muskhogean tribes from the west. It was not so remote but that the Osage, Quapaw, Omaha, Mandan, and

Sioux have clear traditions of former residence upon the Ohio, followed by a westward movement down that stream and then down the Mississippi or up the Missouri to their later habitations. The Ohio itself was known among the neighboring Algonquian tribes as the river of the Quapaw, although when first known to history the Quapaw were already established upon the Arkansas. The tribal names Quapaw and Omaha, in their original form, denote respectively the people who went down or up stream from the separation point near the entrance of the Missouri. The Winnebago and Sioux apparently moved northwest across Illinois, the former fixing themselves about the lake of their name in southern Wisconsin, while the Sioux continued on toward the head of the Mississippi until compelled to turn westward by the pressure of the Ojibwa advancing from the direction of Mackinac. The expulsion of the Sioux from northern Wisconsin and the head of the Mississippi by the Ojibwa and their consequent emergence upon the plains and occupation of the Upper Missouri and the Black Hills are all within the historic period. Several tribes continued in their ancient seats, where they were known to the early colonists under the names of Monacan, Manaahoac, Saponi, Tutelo, Occaneechi, Catawba, Biloxi, and so on. All of these, excepting a mere handful of Catawba and three or four families of Biloxi, have become extinct within the historic period, chiefly from the relentless hostility of the Iroquois supplemented by dissipation and disease due to contact with civilization.

The Siouan tribes in 1903 numbered a little more than 40,000, including about 1850 Sioux and Assiniboin in the Northwest Territories of Canada. Of the entire number more than 24,000 belong to the Sioux nation.

SIOUX, sōō, or DAKOTA. One of the most important Indian tribes north of Mexico, being the largest in the United States with the possible exception of the Ojibwa. Their popular name is supposed to be an abbreviation from *Nadowesiwug* (corrupted by the French to *Nadaouesioux*), 'little snakes,' i.e. 'enemies,' their ancient name among the Ojibwa, as distinguished from the *Nadowe* or Iroquois, the 'snakes' proper. They are now more usually called *Buanag*, 'enemies,' by the Ojibwa, whence *Asini-buanag*, 'Stone Sioux' of Assiniboin. The Sioux call themselves *Lakota*, *Nakota*, or *Dakota*, according to the respective dialect, the word meaning 'allies.'

According to concurrent linguistic, traditional, and historical evidence the Sioux, with all the cognate tribes of the Siouan stock (q.v.), originally lived east of the Alleghanies. When first known to the French in 1632 they had their principal seats in northwestern Wisconsin and eastern Minnesota, about the west end of Lake Superior and the heads of the Mississippi. The Assiniboin were already a distinct tribe farther to the northwest, by secession from the Yankton division. From this position the Sioux were driven by the Ojibwa advancing from the east, the latter being aided by the French, and gradually moved out into the plains, crossing the Missouri and taking possession of the Black Hills and the Platte region after driving out the previous occupants, the Crows, Cheyenne, and Kiowa. In this migration they lost the agricultural habit, with the exception of the Santee bands remaining behind in Minnesota, and became an equestrian nation of buffalo hunters. In 1815 the eastern bands made their first treaties of friendship with the Government after having sided with the English in the War of 1812. By the general treaty made at Prairie du Chien in 1825 an end was made to the hereditary war between the Sioux and the Ojibwa by the adjustment of tribal boundaries, and the Sioux were confirmed in possession of an immense territory stretching from the east bank of the Mississippi almost to the Rocky Mountains and from about Devil's Lake southward to about the present Sioux City, including nearly half of Minnesota, two-thirds of the Dakotas, and large portions of Wisconsin, Iowa, Missouri, and Wyoming. The headwaters of the Mississippi were left to the Ojibwa by right of former conquest and existing occupancy. In 1835 missions were established among the eastern (Santee) bands by the American Board, which started schools and printed books in the language. In 1837 the Sioux sold all their claims east of the Mississippi. In 1851 they sold the greater part of Minnesota, but dissatisfaction at the delay of the Government in fulfilling the terms of the treaty led to a massacre of settlers at Spirit Lake on the Minnesota-Iowa border in 1857, followed a few years later by a second rising inaugurated by the terrible 'Minnesota Massacre' in 1862, in which nearly 1000 settlers lost their lives. The outbreak was put down by General Sibley, who crushed the Indians and hung 39 of the leaders from the same scaffold. The result was the expulsion of the Sioux from Minnesota. From this time until 1868 the western bands, together with the Cheyenne, Kiowa, and other plains tribes and under the leadership of Red Cloud and other noted chiefs, were almost constantly at war with the whites. A principal event of this was the massacre of Fetterman's entire command of about 100 men near Fort Kearney, Neb., in 1866. In 1868 a treaty of peace was made which remained unbroken until the invasion of the Black Hills by the miners, consequent upon the discovery of gold, led to another war in 1876-77, the principal event of which was the massacre of General Custer's entire command of nearly 300 regular troops, June 25, 1876. (See CUSTER, GEORGE ARMSTRONG.) Sitting Bull (q.v.), the leader of the irreconcilables, escaped to Canada with several thousand followers, but returned in 1881 on promise of amnesty. After being held two years as a prisoner of war, Sitting Bull again took up his residence at Standing Rock Agency, where he remained until his death. In 1889 another treaty was made by which the 'Great Sioux Reservation,' embracing all of South Dakota west of the Missouri, was reduced by about one-half and the remainder cut up into five distinct smaller reservations. The opposition of a powerful minority to this sale, coupled with dissatisfaction at treaty grievances and the excitement aroused by the reported advent of an Indian messiah in the West, led to another outbreak in the winter of 1890-91. Leading events were the killing of Sitting Bull, December 15, 1890, and the Wounded Knee Massacre, December 29, 1890, by which about 300 Indians lost their lives. The outbreak was soon afterwards successfully brought to a close by General Miles.

The Sioux have seven principal divisions, viz.

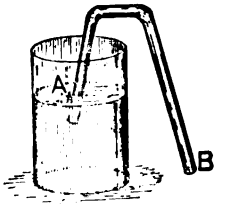
Mde-wakantonwan, 'spirit lake village' (Mdewakanton); *Waqpekuté*, 'leaf shooters;' *Waqpetonwan*, 'leaf village' (Wahpeton); *Sisitonwan*, 'swamp village' (Sisseton); *Ihanktonwan*, 'end village' (Yankton); *Ihanktonwanna*, 'upper end village' (Yanktonais); *Titonwan*, 'prairie village' (Teton). The first four are known collectively as *Isañati* or Santee. The Yankton and Yanktonais resided in that part of Dakota east of the Missouri. The Teton, constituting two-thirds of the whole nation, lived west of the Missouri upon the buffalo plains. The Teton are further subdivided into Ogalala (at Pine Ridge), Brulé (at Rosebud and Lower Brulé agencies), Hunkpapa (at Standing Rock Agency), Two Kettle, Sans Arc, Miniconjou, etc. There are three principal dialects, Teton, Yankton, and Santee, distinguished chiefly by differences in the use of *l*, *n*, and *d*, as exemplified in the various forms of the tribal name. (See above.) The languages have been much cultivated, an alphabet having been adapted to it by the missionaries, so that it now has a considerable literature, including two small newspapers, while nearly all the men can read and write it. It is vocalic, euphonious, but strongly nasal.

The sedentary and agricultural eastern (Santee) Sioux were commonly rated as inferior to their western brethren, who were typical nomad warriors and hunters, the lords of the plains, before whom no other tribe could stand. Their great number and conscious strength bred a brave and haughty manliness which still remains with them. They lived almost exclusively by the buffalo, following with their skin tipis wherever the herds migrated. Beyond what the buffalo gave them of food, clothing, and shelter they had only their horses, dogs, and weapons, nor cared for more. Their greatest ceremony was the annual sun dance (q.v.), held under the direction of the warrior societies, and usually accompanied by voluntary self-torture. The eastern Sioux have been civilized and Christianized for a generation. The western bands are only now beginning to accept the white man's road, but their high character and intelligence bid fair to bring them rapidly to the front. As usual, however, the yearly census shows a decrease, largely from tuberculosis. The whole number of the Sioux is now somewhat over 24,000, distributed as follows: Canada (refugees from United States), 600; Minnesota, 930; Montana (Fort Peck Agency), 1180; Nebraska (Santee Agency), 1310; North Dakota (Devil's Lake and Standing Rock agencies), 4630; South Dakota (Cheyenne River, Crow Creek, Lower Brulé, Rosebud, and Pine Ridge agencies), 15,480. See Colored Plate of AMERICAN INDIANS, under INDIANS.

SIOUX (sōō) **CITY.** The county seat of Woodbury County, Iowa, 156 miles northwest of Des Moines; on the Missouri River, at the junction of the Big Sioux and the Floyd (Map: Iowa, A 2). Among the railroads that enter the city are the Chicago, Milwaukee and Saint Paul, the Chicago and Northwestern, the Chicago, Saint Paul, Minneapolis and Omaha, the Illinois Central, the Great Northern, and the Union Pacific. It is the seat of Morningside College (Methodist Episcopal), opened in 1890, and of the Sioux City College of Medicine. The public library contains nearly 15,000 volumes. The high school building, Saint Joseph's Mercy Hospital, and the German Lutheran and the Samaritan hospitals are other prominent features. The most noteworthy of the city parks is the Floyd Memorial, 20 acres in area, along the river front. Sioux City is situated in an extensive corn-growing and stock-raising region. In the census year 1900 capital to the amount of $5,691,644 was invested in the various industries, which had an output valued at $15,469,702. There are flouring and grist mills, foundries, machine shops, meat-packing establishments, saddlery and harness manufactories, and a brewery. Cudahy, Armour, and Swift have large packing plants here, and the Chicago, Milwaukee and Saint Paul and the Chicago, Saint Paul, Minneapolis and Omaha railways have extensive machine and repair shops. The city spends annually for maintenance and operation about $361,000, the principal items being: schools, $123,000; streets, $42,000; fire department, $30,000; interest on debt, $24,000; water-works, $24,000; municipal lighting, $17,000. The water-works are owned by the municipality. Settled as a trading station in 1849, Sioux City was laid out in 1854 and was chartered as a city in 1857. During its early years it was an important military post, and was the place where the various Black Hills expeditions were fitted out. Population, in 1890, 37,806; in 1900, 33,111.

SIOUX FALLS. The county seat of Minnehaha County, S. D., 90 miles north of Sioux City, Iowa; on the Big Sioux River, here spanned by four bridges, and on the Chicago, Milwaukee and Saint Paul, the Great Northern, the Illinois Central, the Chicago, Saint Paul, Minneapolis and Omaha, and the Chicago, Rock Island and Pacific railroads (Map: South Dakota, J 6). It has the Sioux Falls College (Baptist), a Lutheran Normal School, All Saints School, and the State School for Deaf Mutes. Other prominent features are the State and Federal Penitentiary, Children's Home, the United States Government building, the court-house, and the public library. Sioux Falls is surrounded by a section engaged in farming and cattle-raising, but is chiefly important as the centre of extensive stone-quarrying and manufacturing interests. There are boiler and sheet iron works, a flouring mill, bottling establishments, and carriage and broom manufactories. The government is vested in a mayor, chosen biennially, and a unicameral council. Settled in 1867, Sioux Falls was incorporated as a village in 1877, and was chartered as a city in 1883. Population, in 1890, 10,177; in 1900, 10,266.

SIPHON (Lat. *sipho*, from Gk. *σίφων*, *siphōn*, pipe, tube; perhaps connected with Lat. *tibia*, pipe, shin-bone). A tube in the form of a U and used in an inverted position to remove a liquid from one vessel to another. One arm of the tube, A, is placed in the liquid, while the other, B, which must extend below the level of the liquid, is outside and forms the outlet. If now the air is exhausted from the tube, the liquid will rise from the pressure of the atmosphere, and will



SIPHON.

fill the tube and flow through the lower end. In this way it is possible to draw off the contents of casks, tanks, and other receptacles with great facility, unless the bend of the tube is more than 33 feet above the surface of water or a liquid of equal density, or 30 inches in the case of mercury, in which case the atmospheric pressure is not sufficient to support a column of liquid of such height. The reason can readily be seen, since a column of water 33 feet in height weighs as much as a column of atmosphere of equal cross-section, and consequently the effective pressure would be downward instead of up, that of the liquid being greater than that of the atmosphere. The lower the outside tube below the surface of the liquid the more rapid will be the flow, which will continue until the level of the liquid either sinks below that of the outlet or air finds its way into the tube. Often a pump is connected with the siphon to remove the air, or in the case of a small tube such as would be used with a cask the suction of the mouth may prove sufficient.

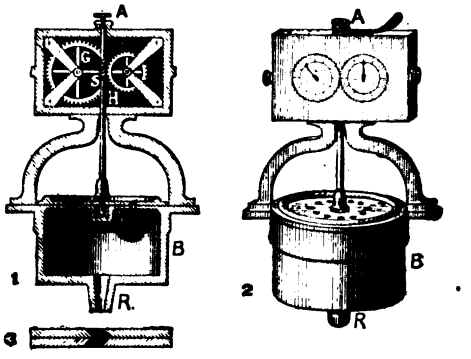
SIPHONOPH'ORA (Neo-Lat. nom. pl., from Gk. *σιφωνοφόρος*, *siphōnophoros*, carrying tubes, from *σίφων*, *siphōn*, pipe, tube + *φέρειν*, *pherein*, to carry). An order of the cœlenterate class Hydrozoa. They are the so-called compound hydroids, living in free-swimming colonies, consisting of polymorphic individuals, or 'zooids'—that is, organs with a strongly marked individuality, but all more or less dependent on one another and originating from a common cœnosarcal tube. In Physalia there are four kinds of zooids—i.e. (1) locomotive, and (2) reproductive, with (3) barren medusa buds (in which the proboscis is wanting), which, by their contractions and dilatations, impel the free-swimming animal through the water; in addition, there are (4) the feeders, a set of digestive tubes which nourish the entire colony. The upper end of the cœnosarcal tube is usually closed by a float, very large in Physalia. This float is filled with air, acts as a hydrostatic apparatus, and enables the colony to maintain a vertical position in the water. See PORTUGUESE MAN-OF-WAR; also Colored Plate of MEDUSÆ AND SIPHONOPHORA.

SIR-DARYA, sêr'dăr'yȧ. A river and territory of Russian Turkestan. See SYR-DARYA.

SIREN (Lat. *siren*, from Gk. *σειρήν*, *seirēn*, siren; probably connected with *σῦριγξ*, *syrinx*, pipe, Skt. *svar*, to sound; hardly akin to Gk. *σειρά*, *seira*, cord). In Greek legend, one of several sea-maidens with voices of such sweetness that all who heard were drawn to them, only to meet death, so that the shores of their lovely island were covered with bones and corpses. In the *Odyssey* Circe gives Ulysses advice by which alone the hero passes in safety. He stopped the ears of his companions with wax, that they might not be turned from their rowing, while he caused himself to be firmly bound to the mast so that he might hear the songs without danger. They also figure in the voyage of the Argonauts, who only escaped because of the superior charms of the song of Orpheus. Later legend represented that, once successfully resisted, they were doomed. Another legend connected them with the rape of Persephone. Here they were said to have grieved excessively at the loss of their friend and sought for her over land and sea. In this aspect they are common on tombstones, apparently as mourners, often with disheveled hair. They are represented in art at first as birds, with female heads, but more and more the human element predominates, until there is little of the bird left but the wings and legs. The type seems connected with the representations of the souls of the dead in the form of birds. Consult Weicker, *Der Seelenvogel in der alten Litteratur und Kunst* (Leipzig, 1903).

SIREN. An instrument for the production of musical sounds in such a manner as to enable us to determine the number of vibrations which produce a given sound, or, in other words, the pitch. In the simplest form of siren there is a revolving disk which is pierced with a series of holes arranged in a circle whose centre is the centre of the disk. If air forced through a tube from a bellows or other source of pressure strikes the disk at a point which is passed by the holes in their revolution, a series of sounds will be produced by the successive puff of air escaping through these openings. While the disk revolves slowly, the ear distinguishes these successive puffs; but when the revolutions are more numerous than about ten per second, the successive puffs cannot be distinguished, and the recurrent sounds are merged into a uniform note, whose pitch rises (i.e. it becomes more and more shrill) the faster the disk revolves. Such an instrument works well when driven by water instead of air. What it shows is that musical sounds consist of the repetition, at equal and very small intervals of time, of some definite noise. By turning the disk by means of a train of wheels, so as to give it a definite rate of rotation, the number of such repetitions per second necessary for the production of a given musical note may be measured.

The siren invented by Cagniard de la Tour in 1819 is better adapted for such a purpose, as it registers the number of revolutions per second. In principle it is identical with the simpler instrument just described; but the details of its construction are different. It consists essentially of two circular disks, the upper of which



CROSS SECTION OF SIREN.

is free to revolve upon the lower, being pivoted at A and *b*. In each a series of holes is cut, arranged at equal distances in a circle about its axis. Through the holes in the lower (fixed) plate, streams of air are admitted from a reservoir, B, connected with a bellows, and pass through the corresponding holes in the upper (movable) plate, when the pair of holes are

superposed; but are checked when the upper plate is turned a little, readmitted when the plate turns a little farther, and so on. The holes are pierced *obliquely* through the upper plate, so that the issuing stream makes it turn about its axis. The sounds given by this instrument are exceedingly pure (see ACOUSTICS), like those of the flute or tuning fork. The axis of the upper plate carries an endless screw, S, which turns a light train of wheels, G and H, with hands and dials resembling those of a gas meter, so that when, by proper adjustment of the pressure of the bellows, the instrument gives steadily some definite note, corresponding with that of an organ pipe or tuning fork whose pitch we desire to ascertain, we may observe the number of turns in any number of seconds by a stop-watch. The number of puffs is obviously to be found from this by multiplying the number of holes in the plate.

A large instrument operated by steam is used as a fog signal, while more complex forms, such as Helmholtz's double siren, have been devised for investigations in the more advanced fields of acoustics. Consult: Tyndall, *Sound;* Muller-Pouillet, *Lehrbuch der Physik* (Brunswick, 1897); Helmholtz, *Tonempfindungen*, English translation by Ellis (London and New York, 1895). See ACOUSTICS; FOG-SIGNALS.

SIREN. An eel-like batrachian of the degraded family Sirenidæ. See MUD-PUPPY.

SIRENIA (Neo-Lat. nom. pl., from Lat. *siren*, siren). An order of large aquatic herbivorous mammals, of doubtful affinity, including the sea-cows, manatees, and dugongs (qq.v.). The early fossil members of this group, found in the Eocene deposits, differ from the modern forms in showing a slightly less marked degeneration from the normal mammalian type. They have more primitive dentition and better developed hind limbs. Their origin is unknown, for they appeared suddenly with their peculiar characters fully evolved in the Eocene. The principal fossil genera are Prorastomus and Halitherium.

SIRIASIS. See HEAT-STROKE.

SIRIUS (Lat., from Gk. Σείριος, *Seirios;* probably connected with Skt. *tviṣ*, to excite, sparkle, flame, Lith. *tvisketi*, to lighten). A star of the first magnitude, the brightest in the heavens, and situated in the constellation *Canis Major* (q.v.), or the 'great dog.' For this reason it is also called the dog-star. It has long been known to possess a 'proper motion' (i.e. an independent progressive motion), which was once believed to be uniform, but has been shown to consist of an undulatory progressive motion. As soon as this became known, astronomers recognized that it could be due to one cause only: Sirius must have a companion star, and the revolution of both about their common centre of gravity would place Sirius alternately in advance of its average position and again behind it. Safford (q.v.) was able to predict the position of such a companion, supposing it to be too minute to be seen; and it was actually discovered in the predicted place, in January, 1862, by Alvan Clark, of Cambridgeport, Mass., while observing Sirius through a new and powerful telescope which he had just made.

The Egyptians called Sirius 'Sothis,' and at one time its heliacal rising (q.v.) was a sure forerunner of the rising of the Nile; while among the Romans it was considered as a star of evil omen. The term 'dog-star' was also applied to Procyon, a bright double star in *Canis Minor*, the small companion of which was found by Schaeberle at the Lick Observatory in 1896. See STAR for discussion of parallax and distance from the earth.

SIR JOHN OLDCASTLE. A play by Drayton, Munday, Wilson, and Hathaway, printed in 1600 with Shakespeare's name on the title-page, afterwards withdrawn. It is founded on the story of Lord Cobham, whose name was first used by Shakespeare for Sir John Falstaff.

SIR LAUNCELOT (lân'se-lŏt) **GREAVES,** THE ADVENTURES OF. A romance by Smollett (1761) in imitation of *Don Quixote*. The scene is the England of George II., and Sancho Panza's place is supplied by an old sea captain.

SIROC'CO (It., from Ar. *sharq*, east, from *sharaqa*, to rise [of the sun]). A hot wind. In the desert of Sahara the sirocco is a hot, dry wind with clouds of dust, not so violent as a simoom (q.v.). Along the northern border of the Mediterranean two classes of warm winds are called the sirocco—the warm, moist, sultry wind followed by rain, and the hot dry wind from the south that frequently brings a dusty haze.

SIR ROGER DE COV'ERLEY. See COVERLEY, Sir ROGER DE.

SIRVENTES, or SIRVENTE. A name applied to a class of poems important in Provençal literature, usually, in contradistinction from the love-songs, dealing with contemporary social or political conditions, and frequently of a satiric nature. See PROVENÇAL LITERATURE.

SISAL. A fibre obtained from an American agave, which is cultivated in tropical America. See HEMP, SISAL.

SISCO. A whitefish. See CISCO.

SISCOWET. A salmon (*Salmo siscowet*) of the deeper waters of Lake Superior, where it is numerous. It differs so little from the land-locked salmon of other northern lakes, called namaycush in Canada, that some ichthyologists regard it as a mere variety of that widespread form.

SISEN'NA, LUCIUS CORNELIUS (c.119-67 B.C.). A Roman annalist, considered by Cicero superior as an historian to any of his predecessors. (Brut. 64, 288.) He was prætor in the year of Sulla's death (B.C. 78), and during the war against the pirates (B.C. 67) was appointed by Pompey commander of the army at Crete. He is mentioned, also, as a friend and defender of Verres (Cicero, *Verr.*, ii. 45, 100). Sisenna's works included his *Historiæ*, in more than 12 books, which embraced the history of his own time, and a Latin translation of the Milesian tales (Μιλησιακά) of Aristides. The commentaries on Plautus which were formerly ascribed to Sisenna were probably written by another person of the same name. The few extant fragments of the *Historiæ* are published in Peter's *Historicorum Romanorum Fragmenta* (Leipzig, 1883). Consult Schneider, *De Sisennæ Historiæ Reliquiis* (Jena, 1882).

SISKIN (from Slovenian *chizhek*, Russ. *chizhŭ*, siskin; connected with OPers. *czilix*, siskin). A small finch of the Old World (*Spinus spinus*),

allied to the goldfinch, 4½ inches long and greenish-gray, yellow, and black. It is found in the temperate parts of Europe and Asia, and is often kept and bred in cages, and called by dealers 'aberdevine.' The 'siskin' of America is the pine-finch (q.v.).

SISLEY, sē'slā', ALFRED (1830-99). A French painter, born of English parentage, in Paris. He was a pupil of Gleyre, but was little known until after the first Impressionist exhibition of 1874. His early work was influenced by Corot, but this influence was afterwards modified by the color theories of the Impressionists, particularly as practiced by Monet. His subjects are confined entirely to landscape, and generally to calm country scenes. He was one of the most remarkable landscape painters of his day, and one whose bold, honest, and withal poetic view was combined with high qualities as a colorist, and uncommon facility in rendering the luminous quality of atmosphere. His numerous works include: "L'Inondation, Marly" (1876); "L'Inondation, Bercy" (1876); "Le Pont de Moret-sur-Loing;" and "La Seine à Saint Mammès." There are several studies by him in the Luxembourg.

SISMON'DI, *Fr. pron.* sēs'môn'dē', JEAN CHARLES LÉONARD SIMONDE DE (1773-1842). A French historian and economist. He was born at Geneva. The French Revolution forced the Sismondi family to leave Geneva and take refuge in England. In 1795, however, they went to Italy and bought a small farm near Pescia, in Tuscany, where their narrow circumstances rendered it necessary for Sismondi to engage in farm work for several years. In 1798 he began to collect materials for a history of the Italian republics. In 1803 appeared a work on political economy, *De la richesse commerciale*, in which he appears as a follower of Adam Smith, though at a later period, in his *Nouveaux principes d'économie politique* (2 vols., 1819), he abandoned the views advanced in his earlier work and opposed the ideas of the English economists. It was in history, however, that his best work was done. The *Histoire des républiques italiennes* (16 vols., 1807-18) placed him in the first rank among contemporary historians, and brought him praise from the most distinguished men in France and Germany. In 1813 appeared his *Littérature du midi de l'Europe*, which has been translated into English and frequently reprinted. In 1819 he began his best and greatest work, the *Histoire des Français* (31 vols., 1821-44), of which he published an abstract later: *Précis de l'histoire des Français* (2 vols., 1839). Besides the works mentioned above, Sismondi wrote *Histoire de la renaissance de la liberté en Italie* (2 vols., 1832) and *Histoire de la chute de l'empire romain* (2 vols., 1835).

SISTER DORA. See PATTISON, DOROTHY.

SISTERHOODS. Communities of women in the Roman Catholic and Anglican churches, organized for religious and charitable purposes. The origin and growth of the principle which gave rise to these organizations has been described under MONASTICISM. The earlier communities for women were nearly always outgrowths of an earlier institute for men, after which their organization was closely modeled; these 'second Orders' for women exist, for example, under the rules of the Benedictine, Cistercian, Dominican, and Franciscan Orders. They were, until the seventeenth century, nearly always inclosed or cloistered communities.

With the development of modern society and the increase of security for the weak, their field of activity was much widened, and they began to take energetic part in active charitable work among the poor, the sick, and the ignorant. Taking new foundations, of those established in the sixteenth century 13 were active and 10 contemplative, but in the seventeenth 54 active and only 12 contemplative Orders were organized.

The more important Roman Catholic sisterhoods will be found treated under their own titles. About the middle of the nineteenth century a strong movement developed among non-Catholics, both in England and Germany, for the organization of women's work in the same fields. In the latter country it developed chiefly a class known as deaconesses (q.v.); but in England the movement, coinciding with the Tractarian revival of the older doctrine and customs, had assumed a form practically identical with that already described. After one or two tentative efforts in London (1845) and Oxford (1847), the thing took definite root with the foundation of the community at Devonport in 1848 by Miss Lydia Sellon, under the advice of Dr. Pusey. Its members, known as Sisters of Mercy, were bound by no vows except one of obedience to the superior while they remained connected with it. Three years earlier Dr. Muhlenberg had established the Sisters of the Holy Communion in New York. These had no fixed costume, were required to be between 25 and 40 years old, and it was understood that they might leave the sisterhood at their own pleasure. This community was placed in charge of Saint Luke's Hospital, which Dr. Muhlenberg founded. Since that date numerous organizations of the kind have grown up both in England and America, and have proved useful auxiliaries to the clergy in their work among the poor and degraded. The later ones usually follow the model of the Roman Catholic sisterhoods, have the same ideals of life, and follow the same practices, including the daily recitation of offices at the canonical hours. In 1903, besides some communities of deaconesses, there were 21 organizations of this kind in the United States. At this date there were 118 Roman Catholic sisterhoods laboring in the same country, many of them having numerous houses in different sections. Consult: Littledale, *Papers on Sisterhoods* (London, 1874-78); Goodman, *Sisterhoods in the Church of England* (ib., 1863); Potter, *Sisterhoods and Deaconesses* (New York, 1873); and, for the growth of the Roman Catholic communities, the bibliography under MONASTICISM.

SISTINE CHAPEL. The private chapel of the Pope in the Vatican. It was built for Sixtus IV., in 1473, by the Florentine architect Giovanni de' Dolci. The apartment is 133 feet long and 45 feet wide, and is somewhat higher than its width. It is lighted by six windows on each side and three in the rear. The screen separating the congregation from the rear of the chapel reserved for the Pope and cardinals is one of the best pieces of marble decoration of the early Renaissance, and the tribune of the singers is equally good. The floor is dec-

orated with beautiful mosaics in imitation of early Christian work. The walls and ceiling are without adornment excepting the frescoes, which form the chief attraction of the chapel. The walls are a museum of the works of the best Tuscan and Umbrian painters of the later fifteenth century, and they contain works by Botticelli, Roselli, Ghirlandajo, Signorelli, Perugino, and Pinturicchio. (See these titles.) On the left wall are incidents from the "History of Moses," while on the right are six corresponding scenes from the "Life of Christ." Under these formerly hung, on great occasions, the famous tapestries of Raphael (q.v.). On the ceiling are the wonderful frescoes of Michelangelo, representing the "Creation," the "History of Noah," and other biblical scenes, together with the celebrated "Prophets" and "Sibyls"—one of the greatest creations of modern art. The entire altar wall is covered by his rather mannered "Last Judgment," the largest fresco in the world. (See MICHELANGELO.) All these paintings have been greatly damaged by time and incense. The Sistine Chapel is the scene of most of the great functions at which the Pope personally assists, and here the Papal elections are held. Its choir was founded by Gregory the Great, and is composed of about thirty priests and Papal chaplains. They sing without accompaniment, and their style, the *messa di voce*, is of world-wide celebrity.

SISTINE MADONNA. See MADONNA and Plate with article RAPHAEL SANTI.

SISTOVA, sĭs'tôvȧ. A town of Bulgaria, about 40 miles above Rustchuk (Map: Balkan Peninsula, E 3). It has a considerable trade in grain and wine. Population, in 1893, 13,212. Sistova is noted for the treaty of peace concluded here between Austria and Turkey in 1791.

ŚIŚUPĀLA, shĭsh'o͞o-pä'lȧ. In Hindu legend, the sovereign of Chedi, a country situated in Central India. Although he was the cousin of Krishna (q.v.), he was his enemy, and ultimately was slain by him. The history of this enmity and the death of Śiśupala form the subject of the *Śiśupālabadha* of Magha. This is a highly artificial Sanskrit epic in twenty cantos, and it dates probably from the ninth century. It has been edited several times in India, notably, with Mallinatha's commentary, by Durgaprasad and Sivadatta (3d ed., Bombay, 1902), and was translated by Fauche in the third volume of his *Tétrade* (Paris, 1863).

SIS'YPHUS (Lat., from Gk. Σίσυφος). In Greek legend, the son of Æolus and Enarete. According to the earlier myth he was married to Merope, but later tradition made him the father of Odysseus by Anticlea. From this the patronymic Sisyphides was applied to the hero of the Odyssey. He is said to have been the founder and King of Ephyra, afterwards Corinth, and became notorious as a fraudulent, avaricious, and wicked ruler. For this wickedness during life he was punished in the lower world by being condemned to roll from the bottom to the summit of a hill an immense boulder which, whenever it reached the top, rolled down again, and compelled him to begin his task anew.

SĪTĀ, sē'tȧ (Skt., furrow). In the Sanskrit epic of the *Rāmāyaṇa* (q.v.), the daughter of Janaka, a king of Mithila, and the wife of Rama. She seems to have been originally an earth goddess, as Sita, 'the furrow,' is besought in the Rig and Atharva Vedas (see VEDAS) to yield fertility to the worshiper. In the later Hindu accounts she is said to have arisen from a furrow when her father was plowing the ground.

SITATUNGA, sĭt'ȧ-to͞o'gȧ. A 'harnessed' antelope. See NAKONG.

SIT'KA. The largest tribe of Kolushan (Tlinkit) stock, occupying Chichagof, Baranov, Kupreanof, Kuiu, and a part of the Prince of Wales islands, Southern Alaska, and numbering with subtribes more than 2,000. The town of Sitka derives its name from them. From the enormous wooden labrets worn by their women the Russians called the tribe *Kalush*, from the Russian *kalushka*, 'a wooden trough, or bowl,' hence the name Kolushan now applied to the stock. They were formerly a fierce and independent people, but are now greatly demoralized and wasted by liquor, which they have even learned to distill for themselves from molasses. Their general culture is that common to the Tlinkit (q.v.).

SITKA. The capital of the Territory of Alaska, 160 miles south by west of Juneau, and 1200 miles north of Tacoma, Washington; latitude 57° 3′ N., longitude 135° 20′ W. (Map: Alaska, H 4). It is picturesquely situated on the western coast of Baranov Island, facing Sitka Sound, in close proximity to several snow-clad mountain peaks. The climate of Sitka, in spite of its northern latitude, is comparatively mild, owing to the influence of the warm Japan Current. Among the noteworthy features of the city are the Russo-Greek church, dating from 1816, the Church of Saint Peter's by the Sea, erected in 1899, and the Sheldon Jackson Museum, connected with the Presbyterian Mission. The educational institutions include public schools founded by the United States Government, a Russo-Greek parochial school, and the Presbyterian Industrial Training School for natives. There are also to be mentioned the Marine Hospital, marine barracks, an agricultural experiment station, the Governor's residence, a United States land office, and the chief customs office for Alaska. Salmon fishing and canning, mining, and lumbering are the most important industries. In 1799 the Russian-American Company established a trading post at Sitka, which, under the name of New Archangel, was permanently occupied by the Russians in 1804. It became later the seat of the Russian Territorial Government. After the cession of Alaska to the United States in 1867, Sitka was made the capital of the unorganized Territory. A military post was maintained here until 1877. Population, in 1890, 1190; in 1900, 1396.

SI'TOPHO'BIA (Neo-Lat., from Gk. σῖτος, *sitos*, food + -φοβία, *-phobia*, fear, from φοβεῖσθαι, *phobeisthai*, to fear). A dread or fear of food, experienced by insane people, which leads them to refuse to eat. As it is a serious matter to a melancholiac or a patient suffering from exhausting mania to miss a single meal, such a patient requires to be fed. Others may be coaxed and permitted to skip a few meals. Some sitophobiacs will eat if led to table, seated, and provided with spoon and fork. If this suggestion fails, the patient should be fed through a soft rubber stomach tube, passed through the mouth, or, preferably, through a

nostril. Through this tube by means of a funnel, eggs, beef juice, peptonoids, milk, and strained gruels may be introduced into the stomach. Forced feeding is usually necessary thrice a day, and in summer it is also necessary to give water in this way, between meals. Consult Ferris, "Case of Prolonged Feeding with the Tube," in *American Medico-Surgical Bulletin*, vol. ix. 13, 1896.

SITTEN, zit'ten. A city of Switzerland. See SION.

SITTING BULL (Tatanka Yotanka) (1837-90). A chief of the Sioux tribe of North American Indians. He was born in Willow Creek in the region which later became Dakota Territory, the son of Chief Jumping Bull. He killed and scalped his first enemy when only fourteen years old, and upon reaching manhood became the leader of the most unruly and warlike band of bucks in the tribe, during the Civil War led raids, and engaged in attacks upon white settlements in Iowa and Minnesota, and in 1864 was driven by General Sully into the Yellowstone and Big Horn valleys. He was on the warpath almost continuously from 1869 to 1876, either raiding the frontier posts and settlements or making war on the Crows, Shoshones, and other friendly tribes. His refusal to return to his reservation in 1876 led General Sheridan to begin against him the campaign in which General George A. Custer (q.v.) and his force were surprised and massacred on the Little Big Horn, in June of that year. After the Custer massacre Sitting Bull and his braves escaped over the Canadian border, remaining there until 1881, when he received from General Miles a promise of amnesty and returned. He continued to wield great power among the Northwestern Indians, and in 1888 he influenced the Sioux to refuse to sell their lands. In 1890 during the prevalence of the "Messiah" craze among the Indians of the West he was considered the principal instigator of the threatened uprising. His arrest in his camp on the Grand River in North Dakota on December 15, 1890, was followed by an attempt at rescue during which he was killed. See SIOUX.

SIUT, sē-o͞ot' (Egyptian *Syowet*), or **ASSIUT**. A city of Upper Egypt, situated near the west bank of the Nile, in latitude 27° 10′ N., 248 miles south of Cairo. In very early times it was a place of importance, owing to its favorable situation in the midst of a fertile district at the starting point of the great caravan route leading to the oases of the Libyan desert and the Sudan. It was the seat of worship of the deity Wep-wat, who is represented in the form of a jackal or wolf, and hence in later times the city was called by the Greeks Lycopolis or 'Wolftown.' Under the Twelfth Dynasty the nomarchs of Siut seem to have maintained great state, and their rock-hewn tombs in the vicinity are richly adorned with sculptures and paintings, and contain inscriptions of great historical value. Plotinus, the greatest of the Neo-Platonic philosophers, was born at Siut, and about A.D. 205 the city and the adjacent district were converted to Christianity. Many anchorites took up their abode in the neighboring necropolis, and one of these, John of Lycopolis, is said to have predicted to Theodosius his victory over Eugenius in 394. The modern town of Siut is situated on the Nile Valley Railway. It has several fine mosques, bazaars, good baths, and well-built houses. It is noted for its pottery and extensive manufactures of the best pipe-bowls. It is the residence of the Governor of Upper Eypt. Population, in 1882, 31,575; in 1900, 42,000. Consult: *Description de l'Egypte* (Paris, 1809-1829); Lepsius, *Denkmäler* (Berlin, 1849-58); Mariette, *Monuments of Upper Egypt* (London, 1877); Griffith, *The Inscriptions of Siût and Dêr Rîfeh* (ib., 1889).

SIU-YEN, shy o͞o'yĕn'. A walled city of Shingking, Manchuria, on the right bank of the Ta-yang river, which flows southward to the Yellow Sea at the port of Ta-ku-shan, distant 35 miles (Map: China, F 3). It is famous for the finely grained marble found in the neighborhood, and its stone-cutting and polishing industry.

ŚIVA, shī'vȧ (Skt., kindly, auspicious). The name of the third god of the Hindu Trimurti or triad, in which he represents the principle of destruction. The name Siva, as that of a deity, is unknown in the Vedic hymns, but is established as such in the later Brahmanic literature, the epic poems, the Puranas (q.v.), and the Tantras (q.v.). Thus, in the *Mahābhārata* (q.v.), Siva is already celebrated as the one all-containing god, and even in the Upanishads (q.v.) he is identified with Rudra (q.v.), as the All-god. In origin Siva was probably an indigenous deity, adopted by the Aryans after their entrance into India. His symbol is the linga (q.v.), emblematic of creation, which follows destruction. From each of his numerous attributes or characteristics he derives a name or epithet. He has five heads (hence his name *Pañcānana*, the five-faced); three eyes (hence his name *Trinētra*, the three-eyed). On his head he carries the Ganges, whose course he intercepted by his hair when this river descended from heaven. Round his neck he carries a garland of human skulls, and bears a rosary (afterwards adopted by the Buddhists). In his hands he holds a trident, a club or pole, armed at the upper end with transverse pieces, representing the breastbone and ribs adjoining, and surmounted by a skull and one or two human heads. His weapons are a bow, a thunderbolt, and an axe. As the destroyer of the world he is also called *Kala* (time or death), and represented as of black color. One of his representations is also half male and half female, emblematic of the indissoluble unity of the creative principle (hence his name *Ardhanārīśa*, half-female lord). He is clothed in a deer-skin, or holds a deer in one of his hands, or he may be represented as sitting on or clothed in a tiger-skin. His sacred animal is the bull Nandi; his home is on Mt. Kailasa in the Himalayas, and his principal wife is Durga, or Uma (q.v.); his sons are Ganeśa (q.v.) and Kartikeya (q.v.).

Siva is the god of asceticism, but also of all arts, especially of dancing. Later tradition tells innumerable tales about him. In the earlier accounts he is represented as killing or maltreating the Vedic gods, and especially as destroying Daksha, symbolic of the older Vedic rites, an intimation of the overthrow of the orthodox religion by the more popular cult of Siva. As a symbol of asceticism he is represented as destroying Kama, the god of love. Though Siva has no incarnations, except in Southern India, where some are said to be known, he is identified with various local gods, especially Bhairava and Vitthoba. He has 1,000 names, but is generally

called Lord, or Great Lord, Maheśvara, or Śankara, Beneficent, or Paśupati, Kine-lord, Shepherd, or simply Mahadeva, great god. The cult of Siva has much in common with Buddhism, and in the art of c.800 A.D. the two are confused. To-day the Siva cult in its various forms (see ŚAIVAS) is the most universal in India. See SIVA in Plate of HINDU DEITIES, under INDIA.

SIVAS, sē'väs'. The capital of the Vilayet of Sivas, Asiatic Turkey, situated on the Kizil Irmak at an altitude of 4420 feet (Map: Turkey in Asia, G 3). It covers a large extent of ground, is well built, and has numerous old mosques, khans, gardens, and excellent bazaars. It contains several interesting ruined medresses, or colleges, beautifully decorated. Besides the Greek churches, there are a Roman Catholic and a Protestant church. The manufactures include coarse woolens and jerked beef. Sivas is built on the site of the ancient *Sebastia*. It was formerly one of the most important cities of Asia Minor, and in the fourteenth century had 100,000 inhabitants. Population, about 44,000.

SIVASH, sē'väsh', or PUTRID SEA (Russian *Gniloye More*). A lagoon on the east coast of the Crimea, separated from the Sea of Azov by a narrow sand-bar, the Tongue of Arabat. It is 68 miles long, from 2 to 14 miles wide, and extremely shallow, consisting largely of salt marshes. The water is stagnant and excessively salt.

SIVATHERIUM (Neo-Lat., from Skt. *Siva*, name of a Hindu god + Gk. θηρίον, *thērion*, diminutive of θήρ, *thēr*, wild beast). An extinct giraffe, of much larger size than the living species, found fossil in the Siwalik beds of Pliocene age in India. The skull was heavily built and provided with two pairs of horns, of which the anterior pair were small and pointed, while the posterior pair were large and slightly palmate with a few short prongs. Another genus, Samotherium, from the Pliocene of the Isle of Samos, had shorter neck and limbs than those of the modern giraffe, and the skull of the male alone was provided with a single pair of frontal horns.

SIVORI, sē-vō'rē, ERNESTO CAMILLO (1815-94). An Italian violin virtuoso, born in Genoa. At the age of five years he commenced his studies with Restano, after which he became a pupil of Costa and finally of Paganini, whom he adopted as his model. In 1827 he went to Paris, where he won remarkable success by his marvelous technique. In 1829 he toured Italy, Germany, and Russia, and in 1846 America. He composed several concertos and many other works for the violin. He died in Genoa.

SIWAH, sē'wä (anc. *Ammonium*). An oasis in the Libyan Desert in the northwestern part of Egypt, 280 miles southwest of Alexandria (Map: Africa G 2). It is nearly 20 miles long and over one mile broad, and has about 25 square miles of agricultural land. It lies nearly 100 feet below sea-level, is watered by numerous streamlets, small lakes, and marshes, and is covered with palm groves and orchards. Population, about 7000, mostly engaged in the cultivation of dates, which form a very important item of export, amounting to 3,000,000 pounds annually. There is a theological seminary. The Temple of Ammon was famous for its oracle in ancient times. In the vicinity is situated the celebrated Fountain of the Sun, mentioned by Herodotus. The miniature town of Siwah is compactly built with lofty dwellings. There is also another settlement, called Agermi, with remains of ancient temples.

SIX ACTS, THE. The name given to a number of measures enacted by the British Parliament in 1819-20 aiming at the repression of the growing democratic movement. The freedom of speech and of the press and the right of association were greatly restricted. See GREAT BRITAIN.

SIX ARTICLES, THE STATUTE OF. An English act to preserve uniformity in religious customs. The appearance of the Bible in the English version of the Reformers gave rise to the eager discussion of religious and theological questions among all classes of Protestants. The mass and other offices of the ancient Church were ridiculed or travestied. All this was thoroughly hateful to Henry VIII., who had no sympathy with the Dissenters. Accordingly the reactionary Parliament of 1539 passed a statute for the enforcement of the uniform profession of six cardinal doctrines: (1) Transubstantiation, or the real presence of Christ in the Eucharist; (2) celibacy of the clergy; (3) communion in one kind only; (4) monastic vows; (5) private masses; and (6) auricular confession. So severe were the penalties for disobedience that the act has been called the 'Bloody Statute.' Burning was the punishment prescribed for denying the real presence; and the same penalty was enforced for a second offense in the case of the other five articles. Refusal to confess or to attend mass was made a felony. Five hundred Protestants in London alone were indicted; and at least twenty-eight persons were executed. But, owing to the influence of Cromwell, the enforcement of the statute was soon relaxed. Consult: Green, *History of the English People* (London, 1879-81); Hallam, *Constitutional History* (new ed., ib., 1876).

SIX COMPANIES, THE CHINESE. Six mutual aid associations representing six different parts of the Province of Kwang-tung, China. They are partly benevolent and partly commercial, taking care of emigrants from China, giving advice and aid when needed, acting as their bankers, looking after the sick, and forwarding the bodies of the dead to their friends in China, for burial in their native place. Membership is entirely voluntary, and they are in no sense secret societies. They are an outgrowth of the conditions prevailing in the middle of the nineteenth century when coolie labor was needed, and was supplied to contractors in the United States by contractors in Hong Kong, Canton, Macao, and elsewhere, whose agents were settled in San Francisco. In course of time groups of these agents found it necessary to combine for self-protection, and on the passing away of the coolie traffic and all forms of contract labor, and the restriction of immigration, these developed into benefit and protection societies, lending money, and engaging in such commercial operations as may convenience or enrich their members. The Six Companies are: Ning Yeung, the largest and most powerful; Hop Wo, Kong Chow, Yung Yo, Sam Yup, and Yang Ying.

SIX NATIONS. See IROQUOIS.

SIX-PRINCIPLE BAPTISTS. See BAPTISTS.

SIXTH. See INTERVAL.

SIX'TUS. The name of five popes. SIXTUS or XYSTUS I., Saint, Pope c.116-25, under the reign of Hadrian.—SIXTUS or XYSTUS II., Saint, Pope 257-258. Under him the communion between Rome and the North African churches, broken off by the controversy over heretic baptism (q.v.) under his predecessor Stephen I., was restored. He died a martyr under Valerian, three days before his devoted deacon, Saint Lawrence (q.v.).—SIXTUS III., Saint, Pope 432-440. To him is due the restoration of the Liberian basilica (Santa Maria Maggiore), in which his work is extant to-day, as also in the nave of another basilica built by him, the present Church of San Lorenzo. He is said to have sent Saint Patrick to Ireland.—SIXTUS IV., Pope 1471-84, Francesco della Rovere. He was born near Savona in 1414, and became general of the Franciscan Order in 1464. Paul II. made him a cardinal three years later and was succeeded by him as Pope. His nepotism is the worst blot upon the memory of his pontificate, and led indirectly, through the ambition of his brother Girolamo, to unfortunate connection with the political affairs of Florence. The Pope's eighteen-year-old nephew, Cardinal Sansoni-Riario, having been arrested in connection with the assassination of Giuliano de' Medici in the conspiracy of the Pazzi, Sixtus demanded his release of Lorenzo de' Medici and satisfaction for the execution of the Archbishop of Pisa, who was suspected of complicity. Interdict, excommunication, and war followed; but after Lorenzo had won over the Pope's ally, the King of Naples, peace was made in 1480, and the Papal forces set free to act against the Turks, who had taken Otranto. Complications with Venice were terminated in favor of the Republic by the Peace of Bagnolo. Sixtus, regarding it as a bitter humiliation and already ill, died five days later. Many public works were furthered by him, of which the most famous is the Sistine Chapel; the Ponte Sisto also commemorates his reign. Taxation, both civil and ecclesiastical, was so increased to carry out these projects and to provide for the Pope's family that it contributed not a little to disaffection against the Church. Consult, besides the general histories of the popes, Frantz, *Sixtus IV. und die Republik Florenz* (Regensburg, 1880).—SIXTUS V., Pope 1585-90, Felice Peretti. He was born in 1521 in the March of Ancona, the son of a poor gardener. Like Sixtus IV., he entered the Franciscan Order and rose to high dignities, becoming Bishop of Santa Agata in 1566 and cardinal in 1570. He had lived a quiet and retired life before his election as Pope, and surprised the world by the masterful vigor of his reign. He began by repressing disorder and exterminating bands of outlaws in the Papal States; reformed the administration of the law and the disposal of patronage; and entered on comprehensive projects for the moral and material improvement of Rome. He laid down new regulations for the college of cardinals, restricting its number to seventy, and organized the modern system of congregations (q.v.), reorganizing that of the Inquisition which already existed; at the same time he strongly disapproved the excessive rigor of the Spanish Inquisition as a State tribunal under Philip II. He published a new edition of the Septuagint, and an edition of the Vulgate (1590) as ordered by the Council of Trent, which contained so many errors that it had to be recalled and its place supplied by another under Clement VIII. The troubles of the League in France and the growth of Protestantism in England and Germany caused him great anxiety until his death on August 27, 1590. Many of the popular stories concerning him are derived from the *Life* by Gregorio Leti (1669), a thoroughly untrustworthy work, answered by Tempesti, a Franciscan, in 1755. The best modern *Life* is by Baron von Hübner (Leipzig, 1871); consult also Capranica, *Papa Sisto* (Milan, 1884).

SIZE. See GLUE, and GELATIN.

SJÖBERG, shĕ'bâr-y', ERIK (1794-1828). A Swedish poet, born at Ludgo, and known in literature as Vitalis. He was educated at the University of Upsala, in which town he afterwards lived as a private tutor before finally removing to Stockholm. His poems—erotic, religious, humorous, melancholy, and satiric, by turns—appeared separately between 1819 and 1826, but were collected after his death by Geijer (1828). In 1873 there was a new edition by Forselius, entitled *Samlade skrifter of Vitalis.* A German translation was published at Leipzig in 1843.

SKAGEN, skä'gen, CAPE, or THE SKAW. The most northerly point of Jutland, Denmark (Map: Denmark, D 1). It is a narrow, sandy spit on which stands a stone lighthouse 148 feet high. Near the extreme point of the cape is the busy little port of Skagen.

SKAGERRAK, skä'gĕr-rāk'. An arm of the North Sea lying between the south coast of Norway and the peninsula of Jutland, Denmark, and washing also the coast of Sweden (Map: Denmark, C 1). It is the connecting link between the North Sea and the Cattegat, and is about 130 miles long by 80 miles wide. It is shallow near Jutland, where the coast is lined with dangerous sand banks, but deepens northward, being 600 feet deep in the middle and over 2000 feet deep near the Norwegian coast. The latter, as well as the Swedish coast, is indented with numerous bays affording good harbors. The Skagerrak is subject to violent northwest storms.

SKAG'WAY. The subport of entry in the southern district of Alaska, 202 miles north of Sitka, at the mouth of the Skagway River, on Lynn Canal (Map: Alaska, H 4). It is the terminus of the White Pass and Yukon Railroad, and of the Seattle and Skagway steamship lines. Skagway lies amid attractive scenery. It has a public library, a United States Government building, and three hospitals. An army post also is here. There are breweries, bottling works, and a lumber mill; but the city is chiefly important as the distributing point of supplies for the interior and the Yukon mining district. The government is administered by a unicameral council, elected annually, which chooses one of its number as mayor. Skagway was settled in 1897, and received its present charter in 1900. Population, in 1900, 3117.

SKALD (Icel., poet), or **SCALD.** The name given in Old Norse specially to that class of poets who exercised their art as a vocation requiring a learned education; that is, a knowledge of the construction of verse, and of the enigmati-

cal imagery, roughly shaped out of obscure tradition, to which Scandinavian poets were prone. The great, if not the only aim of the Skaldic poets was to celebrate the deeds of living warriors or of their ancestors. For this reason princes attached skalds to their courts, and competed with each other, by magnificent presents, for the possession of the most skillful minstrels. See ICELANDIC LITERATURE.

SKAT. A game of cards, the most intricate and perhaps the most scientific of them all. Its origin was in Germany, and dates from about the beginning of the nineteenth century. The derivation of the name is obscure.

Thirty-two cards are used, but, unlike whist cards, they are not double-ended. Not only the face cards, but the spot cards as well, usually show fully executed figures. Three or four persons take part in the game, although but three are active players, one, the *player*, playing against the other two. Each player holds ten cards, two being laid aside in the 'skat.' The use of these two cards determines the two different styles of playing. With the skat, it is a simple game, or it may be *Tourné* (an order to *turn up* one of the cards in the skat), the suit of which becomes trumps. Or it may be without the skat, in which latter case the varieties of the game are designated as *Solo*, *Nullo*, and *Grando*. The four suits of the cards are: *Eicheln* (acorn), the equivalent of *clubs; Grün* (green), the equivalent of *spades; Roth* (red), the equivalent of *hearts; Schellen* (the bells), the equivalent of *diamonds* in other cards.

The four suits have a graded value, clubs counting the best, spades second, hearts third, and diamonds lowest. The trumping value of the jacks, which constitute the best trumps, follows the same order; after which come the ace, ten, king, queen, etc., of the trumps turned. The nine, eight, and seven have no value of their own before the players bid for the privilege of playing the game, the one offering to play in the highest suit securing the privilege. This same player, however, is under the necessity of scoring at least sixty-one points. With sixty, he loses; with thirty points he is cut (Schneider); with no count at all he is black (Schwarz).

Points are as follows: aces, 11; tens, 10; kings, 4; queens, 3; jacks, 2. After the jacks, the ace is next in value, followed by the ten, king, queen, nine, eight, and seven. The four jacks only are trumps in *Grando*, while in *Nullo* there are no trumps at all. Each player must follow suit; but where that is not possible, a trump or any other card may be played. The *dealer* is determined by dealing one card to each player, until a jack is turned up, the player receiving it dealing the first round. The player to the right of the dealer 'cuts,' after which the cards are dealt to the left, five cards to each of the three active hands (the dealer, should there be four players, remaining inactive, then two cards in the skat, and another five cards to each player. *Calling* or *bidding* is according to the following rule: The second hand begins the bidding by offering a game to the first hand; or, if the second hand elects, the third hand makes the offer, and if he passes, the first hand has the play. Where two equally high games are bid, the first hand has preference to the others, and the second to the third. No player may play a game of less value than his declared intention.

SKATE (from Icel. *skata*, skate; perhaps from Lat. *squatus*, *squatina*, sort of shark, angel-fish). The name of certain species of rays (q.v.). The commonest as well as the smallest species along the east coast of the United States is the tobacco-box (*Raja erinacea*); the largest is the barndoor skate (*Raja lævis*), four feet long. The big skate of California is the largest of the American skates, reaching a length of six feet, and its egg-case is nearly a foot long. The flesh, though coarse, is eaten, especially by Europeans. See Plate of RAYS AND SKATES.

SKATING (from *skate*, from Dutch *schaats*, ODutch, *schaetse*, high-heeled shoe). One of the primitive methods of man's progression over the ice when it is free from snow. The earliest form of skate was a shin or rib bone of some animal, tied to the skater's foot. Skates of bone are in the Guildhall collection in London and in other museums. The wooden skate shod with iron appeared in the fourteenth century. With the development of a metal foot piece bearing a cutting edge the art of progressing without the aid of the stick was acquired, the blade being set within a base of wood, which was strapped to the foot. Holland is still the paradise of skaters, and skating there, aside from its practical uses, is a national sport. Other notable skating countries of Europe are Russia, Norway, and Germany. Skating is very popular in Great Britain, and some famous skaters have been produced, especially from the Fens, on the eastern coast of England. The United States and Canada, with their long, cold winters, have produced many fast skaters who vie with the best of those abroad. Few outdoor sports in these countries attract so many devotees from the mass of the people. On the Hudson River have been made some of the fastest skating records, although Minnesota and the Middle West generally now rank with it. Montreal is the centre of Canadian skating. In 1884 a national amateur association was formed, with W. B. Curtis as president, and this has held successful championships ever since. Afterwards Eastern and Western sectional championships were instituted, and in 1899 the distances were measured according to the meter system, in accordance with the custom abroad. Foreign skaters in the United States have, as a rule, had to take second rank to the Americans.

The development of the skate used in the United States embraces three distinct periods. The old-fashioned skate had a straight, thick blade, sometimes with a double edge (gutter), affixed to a piece of wood, the skate being bound on by straps. Then came the club-skate, an improvement in that it was entirely of metal and could be instantly clamped to the foot. The blades were of a 'rocker' shape from end to end, which allowed fancy skating, but which reduced the speed in straightaway skating. Finally the 'Hudson River' or 'Donoghue' skate was introduced, which at once found favor in the West especially. This was practically a return to the old-fashioned form, the skate being straight-bladed and having a wooden top, with straps. The blade is long, projecting behind and before the foot, and very narrow, and the 'club' or foot-piece, when properly made of apple-wood,

is very light. With it has come into popular favor the Norwegian skate, the best skate known, which has a similar blade, fastened permanently to the shoe by three metal pieces screwed to the sole. Its weight is but a few ounces. The hockey skate, a combination of the club and the Norwegian form, namely a short, thick, and straight-bladed skate screwed to the shoe, is another popular form.

The style of skating in America has been not a little influenced by the speed-skate, which by its nature has added considerable grace to the stroke. The principle of this stroke is a gentle falling of the body from side to side, as either skate takes its position for the beginning of a stroke. The foot is pushed almost straight ahead, the blade striking the ice flatly, instead of beginning, as in the club-skate, with the toe, and ending, at the finish of the stroke, with the heel. In pushing off, therefore, with either foot, the whole length of the blade is obtained as a purchase instead of the toe only, as in the case of the club-skate. The result is the greatest imaginable ease in skating, while the length of the stroke is two to three times as long, saving considerable energy.

The competitions in figure-skating in the United States are under the control of the National Association, founded in 1885, which acts in conjunction with the Canadian Amateur Skating Association, founded in 1888, and the competitions for the championships are held annually, alternately in New York and Montreal.

SKAW, skȧ, THE. The most northerly point of Denmark. See SKAGEN, CAPE.

SKEAT, WALTER WILLIAM (1835—). An English philologist. He was born in Park Lane, London, but passed his boyhood in Sydenham, a London suburb, then well in the country. It was here that he became familiar with the Kentish dialect. He attended King's College School, a school at Highgate, and entered Christ's College, Cambridge, where he graduated in 1858, and two years later was elected a fellow. Ordained to the ministry in 1860, he held two curacies, first at East Dereham in Norfolk, and then at Godalming in Surrey; but, owing to an affection of the throat, he was compelled to give up the ministry. He returned to Cambridge, and resumed his studies in English philology and literature. In 1873 he helped to found the English Dialect Society, becoming its first director and afterwards its president. He had already begun editing Middle English texts for the Early English Text Society, established by his friend F. J. Furnivall. In 1878 he was appointed to the Erlington and Bosworth professorship of Anglo-Saxon at Cambridge, and in 1883 he was reëlected fellow of Christ's College. Among his separate publications may be mentioned *The Songs and Ballads of Uhland*, translated from the German (1864); *Lancelot of the Laik* (1865; revised 1870); the three texts of Langland's *Piers the Plowman* (1865-84; reprinted together 1886); *An Etymological Dictionary of the English Language* (1879-84); *A Concise Etymological Dictionary of the English Language* (1882); Barbour's *Bruce* (1870-77; and for the Scottish Text Society, 1893-94); *Complete Works of Geoffrey Chaucer* (1894); *The Student's Chaucer* (1895); *A Student's Pastime*, being a select series of articles reprinted from *Notes and Queries* (1896); *The Chaucer Canon* (1900); *Place Names of Cambridgeshire* (1901); and *Notes on English Etymology* (1901). Skeat is one of the leading scholars in the revival of our older literature, and has done much to popularize his subject. To him more than to all others is due the very general interest in Chaucer.

SKELETON (from *σκελετόν, skeleton*, mummy, dried body, neu. sg. of *σκελετός, skeletos*, dried, from *σκέλλειν, skellein*, to parch, dry up). The framework of hard structure which protects and supports the soft tissues of animals. The skeleton either lies outside the soft tissues (exoskeleton), or is imbedded within them (endoskeleton).

EXOSKELETON. Exoskeletal structures surround and shield the vital organs and muscles and are represented by the shells or chitinous covering of mollusks, insects, and crustaceans, the shields of turtles, and the hair, scales, feathers, nails, and hoofs (qq.v.) of other vertebrates; also by the so-called 'membrane bones' of the skull. Phylogenetically the exoskeleton of vertebrates is older than the endoskeleton, and its structures were derived from the inner layer of the epidermis.

ENDOSKELETON. Endoskeletal structures appear in a few invertebrates (as the cuttlefishes, certain annelids, etc.), but are highly characteristic of vertebrates, in which arises a wholly new tissue —bone. Endoskeletal structures of vertebrates arise from two sources, the endoderm and the mesoderm, and are either membranous, cartilaginous, or bony. In the lower vertebrates the conversion of cartilage into bone takes place on the outside and proceeds inward. In the higher vertebrates ossification also takes place at certain internal centres. In the conversion of cartilage into bone the chondrin or matrix of the cartilage becomes converted into a calcified matrix. The matrix is then dissolved away by certain cells called osteoclasts. Around the walls of the cavities thus produced certain cells, osteoblasts, arrange themselves in a layer and secrete about themselves salts (carbonate and phosphate) of lime. The spaces occupied by these cells and their amœboid processes become much restricted, but persist as the 'lacunæ' and 'canaliculi' of bone. This calcified layer is in turn covered over by another internal layer of osteoblasts, and these in turn by others, until a Haversian system with its concentric layers is produced. Bone is always thus being torn down by the osteoclasts and made over by the osteoblasts. See BONE.

The skeleton of vertebrates may be treated under two heads: (1) the axial and (2) the appendicular skeleton.

VERTEBRAL COLUMN. The axial skeleton includes the vertebral column, ribs, sternum, and head-skeleton. The vertebral column, or 'backbone,' first appears in cyclostomes, where it occurs as fibrous tissue, surrounding the notochord, which thus comes to lie as a rod in the axis of the primitive vertebrate column and is known as the 'skeletogenous layer.' From this point on it becomes a more and more important organ, while the chorda takes less and less part in the composition of the body of the adult. In the lowest vertebrates the skeletogenous layer is replaced at intervals by cartilage, which forms arches around the neural canal. In ganoids and higher forms these consist of five cartilaginous pieces for-

each somite, the fifth or unpaired piece forming the dorsal spinous process. Ventral cartilaginous pieces also occur ventral to the chorda. The bodies (centra) of the vertebræ definitely appear, and the chorda becomes constricted intravertebrally, giving the vertebræ an hour-glass form. The rings of cartilage formed by intravertebral constrictions are biconcave or 'amphicœlous' in all fishes with bony vertebræ and in most Urodela; also in a few fossil and living reptiles (q.v.), and in a few fossil birds. So long as the separate vertebræ of the vertebral column are amphicœlous their connection with one another must depend upon something else than the bony vertebræ themselves. In the lower fishes this union is effected by the chorda and chordal sheath. In the lower Urodela it is effected by the intervertebral, non-ossified cartilage. In the higher Urodela, the Anura and almost all the reptiles, however, the vertebræ are linked together by means of a ball-and-socket joint. The concavity may be on the posterior and the convexity on the anterior end (opisthocœlous) or conversely (procœlous). In crocodiles, birds, and mammals the opposed faces of the vertebræ are approximately plane surfaces. In the development of the vertebræ of man the phylogenetic stages are recapitulated. The typical vertebra of man consists of a centrum from which an arch arises dorsally to protect the spinal cord. These arches together constitute the neural canal. Each half arch is composed of the rounded pedicle and the broad flat lamina. There are three kinds of processes: (1) the dorsal or neuropophysis; (2) the transverse process, serving for the attachment of the muscles which keep the vertebræ together; (3) the forward and backward articulating processes (zygopophyses). The relation of the centra to the somites of the body is an interesting one. They do not arise one in the middle of each somite, but at the plane of separation of adjacent somites, thus insuring flexibility in the column.

The number of vertebræ in mammals is highly variable in different species. With one or two exceptions all mammals have seven cervical (non-rib-bearing) vertebræ. All the artiodactyls possess nineteen thoracico-lumbar vertebræ. The smallest number (fourteen) occurs in armadillos; the largest (thirty) in hyracoids. Since the number of vertebræ corresponds to that of the somites of the body, it seems necessary to conclude that the latter are highly variable in number. If we seek for an interpretation of the differences in the vertebral column we may find it in the different tasks the parts perform, and the differentiation of vertebræ is a late acquisition, gradually acquired with advancing age. The sacral bones begin their fusion only at sixteen years, and this is not completed until the age of thirty. The sacrum is composed of four or five caudal vertebræ fused together.

RIBS. Ribs are also a part of the axial skeleton. Ventrally they end in cartilage and dorsally in two articular surfaces. The main part of the bone is the 'shaft' or 'body,' and its dorsal articular surface the 'head;' on the side near the head is a second articular surface, the 'tuberosity;' between this and the head there is a constriction, the 'neck.' In man the last of the normally twelve ribs is occasionally reduced to an insignificant rudiment, or a thirteenth rib may be present. The transverse process of the seventh cervical vertebra and that of the first thoracic are quite different. The ventral arm of the transverse process of the seventh vertebra represents the rib. Similarly it may be inferred, even from the adult conditions, that all the cervical and trunk vertebræ possess ribs or the rudiments of ribs; and embryology bears out this conclusion.

STERNUM. The sternum or 'breast-bone' of man is a flat bone to which the ventral ends of the ribs are attached. Its anterior part is known as the 'manubrium,' the middle part as the 'gladiolus,' and the posterior cartilaginous tip as the 'xiphoid' or 'ensiform appendix.' The middle part is composed of more than one piece. In nearly all the lower mammals it is made up of as many bones as there are pairs of ribs attached to it, and this composition may be plainly seen in the sternum of a child. Moreover, the sternum of the young of many mammals shows a double origin, and it is plain that the sternum, if a product of the fusion of the ventral ends of the thoracic ribs, was originally laid down as a paired structure. The sternum of lower vertebrates is often closely united to the shoulder-girdle and possesses an accessory bone—the episternum. The sternum of Amphibia is small and the ribs do not meet ventrally. The sternum of most carinate birds is strongly keeled to permit of the attachment of powerful muscles of flight. See BIRD.

SKULL. We may distinguish in the skull the cranium or braincase and the visceral skeleton. In the development of the human skull three stages may be distinguished which correspond with phylogenetic stages: (1) The fibro-connective tissue stage. This is represented in phylogeny by the condition in Amphioxus, where a fibrous cordal sheath surrounds the notochord. (2) The cartilaginous stage. In the anterior region of adult selachians a large cartilaginous capsule, open above, completely surrounds the brain below and laterally, derived from two pairs of cartilage plates. Ventral to the skull the visceral skeleton arises, consisting of the upper and lower jaws and the six branchial arches, the foremost of which early differentiated itself from the other five, entered into connection with the lower jaw, and constitutes the hyoid arch. The lower jaw arises in a manner precisely equivalent

KEY TO SKELETON PLATE.

1. Frontal bone.
2. Parietal bone.
3. Temporal bone.
4. Occipital bone.
5. Malar bone.
6. Superior maxillary.
7. Inferior maxillary.
8. Cervical vertebræ.
9. Nasal bone.
10. Sternum.
11. Humerus.
12. Ulna.
13. Radius.
14. Lumbar vertebræ.
15. Innominate bones.
16. Sacrum.
17. Head of femur.
18. Shaft of femur.
19. Patella.
20. Shaft of tibia.
21. Fibula.
22. Greater trochanter of femur.
23. Condyles of femur.
24. Tuberosity of tibia.
25. Clavicle.
26. Condyles of humerus.
27. Head of radius.
28. Dorsal vertebræ.
29. Scapula.

HAND.

a. Phalanges.
b. Metacarpals.
c. Trapezium.
d. Scaphoid.
e. Unciform.
f. Trapezoid.
g. Pisiform.

FOOT.

h. Astragalus.
i. Calcaneum.
j. Metatarsus.
k. Phalanges.
l. Entocuneiform.
m. Cuboid.
n. Navicular.
o. Ectocuneiform.
p. Mesocuneiform.

to a typical gill-arch, and is composed of two pieces on each side, the quadrate and Meckel's cartilage. Very early a forward outgrowth from the quadrate gives rise to the upper jaw. (3) The bony stage is represented in the bony ganoids, where the frame-case is covered by enamel plates. Dermal bones also cover over the branchial arches and gills, forming the 'operculum.' Even in the Amphibia the bones of the skull preformed in cartilage can be artificially separated from dermal bones, but the higher we go in the vertebrate scale the more intimate is the union, until in mammals the two bones are developed at the same time and are inseparably fused in the adult. With the loss of gills goes that of the opercular apparatus, and the cranium becomes more compact. Of the branchial apparatus there remains the first, the mandibular, the second, the hyoid, and a part of the third, which fuses with the hyoid. Finally the axis of the cranium curves. The curve is first considerable in reptiles and birds and reaches its maximum in man. See SKULL; for the anatomy of the bones of the ear, see EAR; and for that of the dental apparatus, see TEETH.

THE APPENDICULAR SKELETON. Appendages in vertebrates may be divided into two kinds: (1) paired, and (2) unpaired or median. Paired appendages are represented by the lateral fins of fishes, and the legs and wings of higher animals. Unpaired appendages are confined chiefly to fishes, and occur in the sagittal plane dorsally, posteriorly, and ventrally. Certain deep-lying structures which support the appendages must be considered in connection with them. The origin of the appendages is a much disputed question. Two views, however, have gained currency. That of Gegenbaur depends wholly upon anatomical evidences; that of Balfour, Dohrn, and others is based wholly upon embryological evidence. Gegenbaur's theory is that the shoulder and pelvic girdles have each been derived from one gill-arch and that the appendages are modified gill-rays—the bony processes of the gill-arches, supporting the gill-membrane. Now in such a gill-arch one frequently finds one of the middle gill-rays much more highly developed than the others. Sometimes on this larger ray lateral rays arrange themselves. From this latter condition, which occurs in Ceratodus, may be derived and explained the skeleton of the limbs of fishes and of all the higher vertebrates. The girdles have been derived from gill-arches. The theory of Dohrn rests almost wholly upon the evidence afforded by ontogenetic development. The muscles which enter the arm are not derived from one mesodermal somite, but from a number (ten to thirty), and as each gill-arch corresponds to one metamere, the appendages cannot be derived from gill-arches and their rays. Moreover, the muscles of the appendages are derived from the dorsal muscle-plates and those of the branchial arches from the lateral plates of the head, hence the musculature of the two are derived from entirely different sources. Dohrn believes the limbs have arisen from a continuous fin, which is paired anteriorly, but fuses posteriorly to form an unpaired ventral fin that extends up over the tail to the mid-dorsal line. By a failure of the development of a part of this continuous fin two paired ventral fins appear, as well as median or unpaired ventral, caudal, and dorsal fins. The evidence for this Dohrn finds in the fact that masses of muscles are constricted off from the muscle-plate in the interappendicular region just as at the appendages; these muscles later degenerate. Dohrn also finds muscle-masses given off in each somite to the median fin. Hence the median fin is to be regarded as derived from two fused lateral fins.

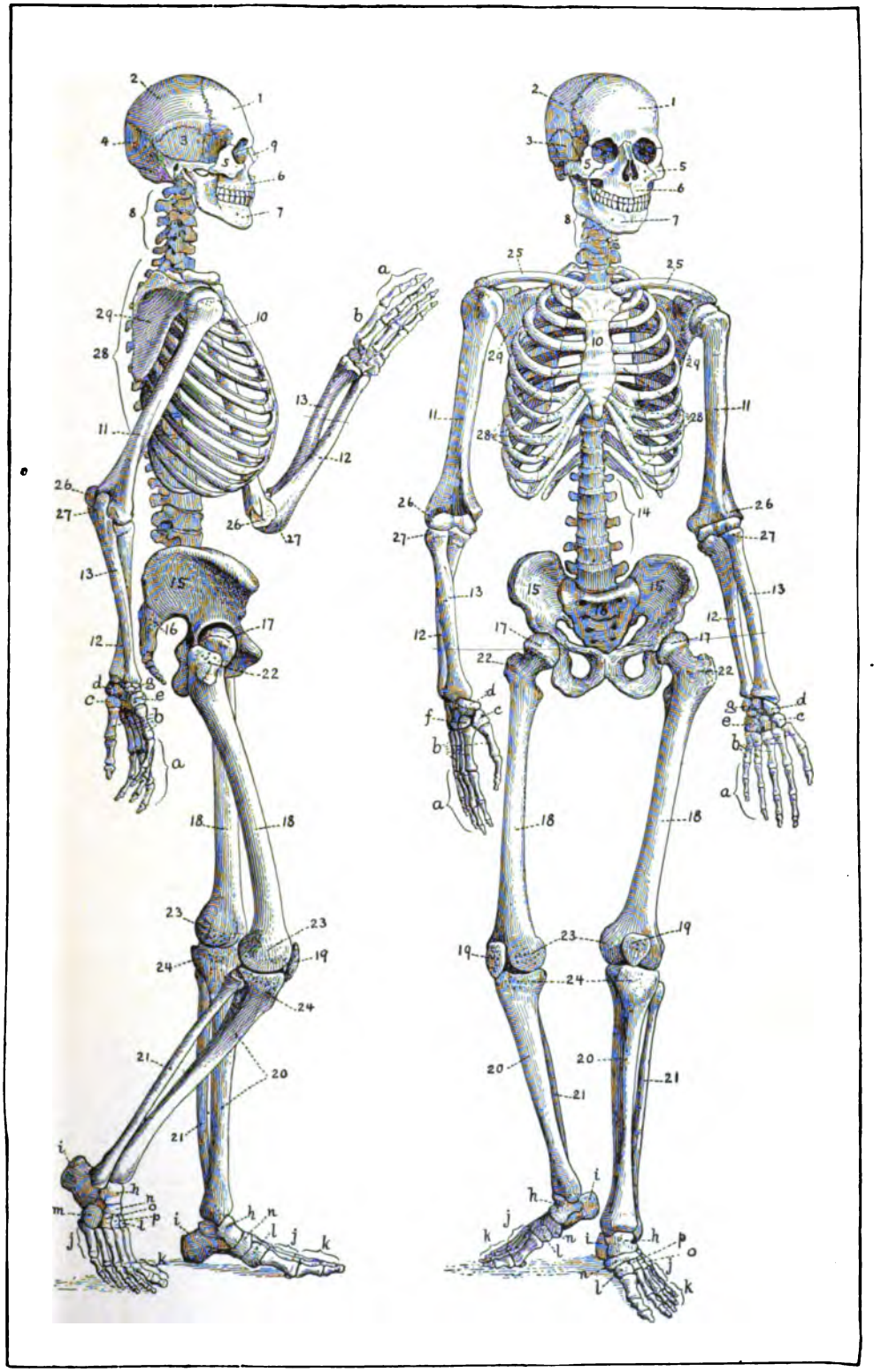
The paired appendages of vertebrates fall into two types: (1) that of fishes, and (2) that of higher vertebrates. We may distinguish in each case two parts: an axial, the girdle, and a peripheral, the free appendage. It seems probable that the free appendage was developed first, and that the girdle arose from the necessity of a firmer axial support for them. The skeleton of the fins of fishes is composed of bone, whereas in selachians it is cartilaginous. The plan of the formation of the anterior and posterior appendages of higher vertebrates is the same, and the remarkable correspondence of their anterior and posterior limbs is to be accounted for by force of similar conditions, for in none of the existing fishes are the fore and hind limbs alike. One of the most striking instances of a loss of parts, as well as of fusion of parts, occurs in the wing of the bird (q.v.), where are present a humerus, a radius and ulna, and two separate carpal bones only. The metacarpals are represented by two bones fused at their extremities and by a small bone on the radial side. Still distal to these are two rows of bones, one composed of two pieces and one of one piece only. The fossil bird Archæopteryx had three or four fingers. The fourth and fifth phalanges have dropped out entirely or are inextricably fused with the other cartilages. In mammals two toes, the third and fourth, remain in artiodactyls (ox, etc.), and in perissodactyls (horses) only one, the third, persists, but in fossil horses (q.v.) all intermediate stages from a five-toed condition have been discovered. In man a number of cases of supernumerary parts (polydactylism) occur. This is a highly inheritable character, regarded by Gegenbaur as a monstrosity, but by Bardeleben considered as a case of atavism. Such a six-fingered condition is found in the adult in some amphibians and reptiles, and also in a rodent (Pedetes). The human carpals are eight in number, arranged in two rows. The tarsal bones are seven in number.

The pectoral girdle arises ontogenetically later than the free appendages. In mammals, however, this part is characterized by a reduction in the ventral pair of pectoral girdle bones, which may result in their entire absence. The coracoid is lost wherever the movement of the arm is restricted to an ambulatory one, since in carnivores and ungulates the clavicle is wanting. In such mammals as use their fore feet for digging, flying, or feeding the clavicle persists. In man the outer surface of the sternum is provided with a prominent ridge, the 'spine of the scapula,' which runs out into a prominent process, the 'acromium.' See PELVIS.

The human skeleton is composed of 200 distinct bones, exclusive of the 32 teeth and the ossicles in each tympanum. It is divided into four regions: (1) the skull, composed of 22 bones; (2) the trunk, composed of 54 bones; (3) the upper extremities, composed of 64 bones; and (4) the lower extremities, composed of 60 bones.

BIBLIOGRAPHY. Besides general works on vertebrates, anatomy, and paleontology, consult:

SKELETON



For Key and Description, see Text.

Reynolds, *The Vertebrate Skeleton* (Cambridge, 1897); Flower, *Osteology of the Mammalia* (London, 1885); Parker and Bettany, *Morphology of the Skull* (ib., 1877); Parker, *A Monograph of the Shoulder Girdle and Sternum* (Ray Society, ib., 1868); Durst, *Entwickelungsgeschichte des Kopfes des Menschen und der höhern Wirbelthiere* (Tübingen, 1869); Gegenbaur, *Vergleichende Anatomie der Wirbelthiere* (Leipzig, 1898).

See ANATOMY; BONE; CARTILAGE.

SKELLIGS, THE. A group of rocky islets off the southwestern coast of Ireland. They belong to the county of Kerry. Great Skellig, in latitude 51° 46′ N., rises 714 feet, and has two lighthouses and the ruins of a monastery.

SKELLY. A fish, the common British chub. See CHUB; and Plate of CARPS AND ALLIES.

SKELTON, JOHN (1460?-1529). An English satirical poet, born probably in Norfolk. He claimed to have studied at both Cambridge and Oxford, from each of which he received the academical honor of laureate. Some time before 1500, Henry VII. appointed him tutor to Prince Henry, afterwards King Henry VIII.; and Erasmus, in allusion to his learning, styled him "a light and honour of British literature." At this time Skelton had produced some translations, and had written elegies on Edward IV. (1483) and the Duke of Northumberland (1489). He entered the Church in 1498, and became rector of Diss in Norfolk. Shortly after this he seems to have struck into that vein of original vernacular poetry for which he stands by himself among our elder poets. It consists in a flow of voluble verse, unrestrained satire and jocularity, and a profusion of grotesque imagery mixed with Latin and colloquial (East-Anglian) phrases. For a jingling and ludicrous effect, he employed short lines, varying from four to six syllables and running on rhymes sometimes repeated seven times over. Caxton said that Skelton improved the English tongue. At times he has gleams of bright fancy and snatches of pleasant description. Of this higher class is his *Phylyp Sparowe*, a nun's lament for the death of a pet sparrow killed by a cat. Very graceful are many passages in a long allegorical poem entitled *The Garlande of Laurell*, such, for example, as the ballad on Margaret Hussey. Noteworthy, too, is *The Bowge of Court*, an early allegory on the right to rations at the King's table. The most humorous of his pictures of low life are contained in *The Tunnynge* [or brewing] *of Elynour Rummyng*, an ale-wife at Leatherhead, in Surrey. This poem was highly popular and was often reprinted in black-letter, garnished with a rude wood-cut of the fat hostess. His best satires are *Colyn Cloute*, and *Why Come Ye not to Courte?* The former is a general satire on the clergy, and the latter a furious attack on Cardinal Wolsey, from whom the poet had not received expected preferment. The angry Cardinal ordered his libeler to be arrested, but Skelton took sanctuary at Westminster, under the protection of Abbot John Islip. In this retreat Skelton remained till his death. Skelton wrote three morality plays, of which only *Magnyfycence* has survived. In the development of the English drama it occupies an important place. Of Skelton's many other lost pieces *A Balade of the Scotyshe Kynge* was discovered in 1878. It was reprinted by J. Ashton in 1882. Skelton was not the author of the jests and merry tales which have circulated under his name. His free verse and allegory had marked influence on Sackville, Spenser, and other Elizabethans. His works were collected in 1568, and reprinted in 1736. The standard edition is by Alexander Dyce (2 vols., London, 1843).

SKELTON AND BROTTON. A manufacturing town in the North Riding of Yorkshire, England, 10 miles southeast of Middlesbrough. It contains an ancient and interesting church of Early English architecture, and Skelton Castle, the family seat of the Barons de Brus (Bruce), the ancestors of the famous line of Scotch Kings Bruce. Population, in 1901, 13,260.

SKENE, skēn, **PHILIP** (1725-1810). An English soldier, born in London of a prominent Scotch family. He entered the English army in 1736, and participated in campaigns on the Continent, and in the battle of Culloden. In 1756 he came to America, and served under Howe and Amherst in their expeditions against Ticonderoga and Crown Point in the French and Indian War. Subsequently he took part in the Havana expedition. In 1759, through grant and purchase, he acquired a piece of land more than 60,000 acres in area along Lake Champlain, where he founded the town of Skenesborough (now Whitehall, N. Y.). During the Revolutionary War he was a Loyalist, and served with Howe at New York and later with Burgoyne, during the course of whose invasion Skenesborough was burned by the British before Skene's eyes, by order of General Haldim, to prevent its being used as a base for the Americans. After the war Skene went to New York with the intention of becoming an American citizen, but his estates were confiscated, and he was compelled to return to England, where he became a pensioner of the Crown.

SKENE, WILLIAM FORBES (1809-92). A Scottish historian, son of James Skene (1775-1864) of Rubislaw, near Aberdeen. He was educated at the Edinburgh High School, and studied in Germany and at Saint Andrews. Apprenticed to an uncle, he became a writer to the signet (1832), and followed his profession in Edinburgh for forty years. He was also for a long period clerk of the bills of the Court of Session. He was admitted to many learned societies, and in 1881 he became historiographer royal for Scotland. Skene was one of the most thoroughly equipped Celtic scholars of the time, and as an historian he ranks among the first that Scotland has produced. His principal works are: *The Highlanders of Scotland, Their Origin, History, and Antiquities* (1837); *The Four Ancient Books of Wales* (1868); and *Celtic Scotland* (1876-80), in three volumes, treating respectively of "History and Ethnology," "Church and Culture," and "Land and People." Besides these works and numerous papers for the Society of Antiquaries of Scotland, Skene also edited *The Chronicles of the Picts and Scots* (1867); *The Chronicles of John Fordun* (1871); and Adamnan's *Life of Saint Columba* (1874). Consult his *Memorials of the Family of Skene* (New Spalding Club of Aberdeen, 1887); and *Proceedings of the Society of Scottish Antiquaries* (Edinburgh, 1892).

SKEPTICISM (from *skeptic*, OF., Fr. *sceptique*, from Gk. *σκεπτικός*, *skeptikos*, inquiring, from *σκέπτεσθαι*, *skeptesthai*, to consider; connected with Lat. *specere*, to look, OHG. *spehōn*, Ger. *spähen*, to spy, Skt. *spaś*, to look). A term applied in philosophy to any system which leaves in doubt either the existence of a world of reality transcending experience (metaphysical skepticism) or the possibility of a valid knowledge (epistemological skepticism). As, however, doubt as to metaphysical reality in the last resort rests on suspicion of man's ability to know anything about such reality, all skepticism is ultimately epistemological; i.e. it rests upon views as to the scope and validity of knowledge. The Sophists (q.v.) of the fifth century B.C. were many of them skeptics. Gorgias (q.v.) declared that all statements are false, and the reason he gave was that a true judgment is an expression of absolute identity; this contention may be illustrated by an insistence that no man is good, for the simple reason that every man is *man*, and only *good* is good. Such a doctrine involving the falsehood of all significant propositions is implicitly at least a denial of the possibility of all real knowledge. Gorgias even went further and argued that there is nothing (nihilism); adding that if there were anything it could not be known (skepticism), and even if it could be known it could not be taught. Protagoras (q.v.) of Abdera taught that all we could know is our perception of things, but not things. Man is the measure of the Knowable Universe. After the constructive work of Socrates, Plato, and Aristotle, it was natural that skepticism should by reaction take a more definite stand, and this it did in Pyrrho and his school. Pyrrho's main thesis was that things are inaccessible to our knowledge, and hence it is becoming in us to suspend judgment. It seems that the school of Pyrrho was the first to win the appellation of 'skeptics,' and so representative was its skepticism that to this day the word Pyrrhonism, derived from the name of the founder of the school, is used as synonymous with skepticism of a thorough-going kind. Timon, Pyrrho's pupil, carried skepticism to its logical conclusion, which of course is contradictory with and yet necessitated by the premise from which it is drawn. This premise is that equally good reasons can be given for any proposition and for its contradiction. This principle applied to the doctrines of skepticism themselves involves the result that as good reasons can be given for an anti-skeptical as for a skeptical view. This result of course takes away all reasonable advantage which the doubter may claim to have over his opponent, and the only course left for him is to give expression to his suspense of judgment by silence on the subject of skepticism. The Middle Academy, of whom Arcesilaus (q.v.) and Carneades (q.v.) were the most prominent leaders, were somewhat less radical in their skepticism; they had the logical grace to have some doubts as to the truth of a skepticism that doubted everything. Ænesidemus (q.v.) elaborated ten reasons for skepticism, and called them tropes (Greek, *tropoi*, methods, i.e. of proving skepticism). Agrippa and Sextus Empiricus (q.v.) were other noted skeptics of antiquity. In the Middle Ages Algazel (q.v.) in Arabia and Duns Scotus (q.v.) in Europe joined a philosophical skepticism with an unswerving religious faith. With the Renaissance, the influence of ancient skepticism began to show itself in the writings of such men as Montaigne (q.v.), Sanchez, and Charron (q.v.), but modern skepticism did not find its adequate expression till Hume (q.v.) wrote his celebrated *Treatise of Human Nature* (1739). In Book I. of this work is to be found the conclusion which Hume draws from his previous speculations, and not even those experiences of life which have a practical import here escape the touch of doubt. "In all the incidents of life we ought still to preserve our skepticism. If we believe that fire warms, or water refreshes, 'tis only because it costs us too much pains to think otherwise." "A true skeptic will be diffident of his philosophical doubts, as well as of his philosophical conviction; and will never refuse any innocent satisfaction, which offers itself, upon account of either of them." Kant (q.v.) and Spencer (q.v.) are dogmatic skeptics with regard to ultimate reality. We know the phenomenal world, but the world of things-in-themselves (Kant) or the absolute (Spencer) is unknowable. This dogmatic skepticism is at the present day called agnosticism (q.v.). For a criticism of skepticism, see KNOWLEDGE, THEORY OF. See also Janet, "Le scepticisme moderne," in *Maîtres de la pensée moderne* (Paris, 1883); Owen, *Evenings with the Sceptics* (London, 1881); Brochard, *Les sceptiques grecs* (Paris, 1887); Maccoll, *The Greek Sceptics from Pyrrho to Sextus* (London, 1869).

SKER'RYVORE. A dangerous rock in the Atlantic Ocean 12 miles southwest of the island of Tiree of the Inner Hebrides. A large lighthouse was with great difficulty constructed here in 1838-44. See LIGHTHOUSE.

SKETCH-BOOK, THE. A collection of tales and sketches of travel, chiefly in England, by Washington Irving (1820) under the name "Geoffrey Crayon." The best known of the tales are "Rip Van Winkle" and "The Legend of Sleepy Hollow."

SKETCH'LEY, ARTHUR. See ROSE, GEORGE.

SKIEN, skēn. A town of Southern Norway, on the Skiens Elv, 62 miles southwest of Christiania (Map: Norway, C 7). It has a handsome town hall, and has been substantially rebuilt since the last great fire in 1886. It has a number of cotton, flour, and saw mills, and manufactures wood pulp, paper, furniture, and chemicals. There is a copper mine in the neighborhood, and the chief exports are ice, timber, wood pulp, and copper. Inland tourist steamers depart from Skien for the lakes of Telemarken. Skien is the birthplace of Ibsen. Population, in 1901, 11,343.

SKIING, skē'ing (from Dan., Norweg. *ski*, from Icel. *skīþ*, snow-shoe, billet of wood, AS. *scīd*, OHG. *scīt*, Ger. *Scheit*, billet of wood; connected with Lith. *skedrà*, Lett. *skaida*, Gk. *σχίζα*. *schiza*, splinter, Skt. *chid*, to split). The method by which the inhabitants of Norway, Sweden, parts of Russia, and parts of North and South America propel themselves over the snow. The ski is, in fact, the Norseman's snow-shoe, differing from the American Indian snow-shoe in having its bearing surface of solid wood and not a webbed frame. The antiquity of the ski is very great. The runners are made of hard pine or ash, generally from six to eight feet long, one-

quarter of an inch thick, and as wide as the sole of the foot. The toe end of it is sloped gradually upward, to avoid obstacles, and narrows to a point at its extreme limit; those used by women are a trifle shorter than the men's. A shallow groove about one-eighth of an inch deep and one inch wide is cut in the under surface or palm, as it is called; this forms a slender ridge in the snow and prevents slipping. Sometimes the palm is left bare, sometimes it is covered with skin, the hair on which acts as a grip in climbing hills; and sometimes with horn, which facilitates its down-hill glide. Midway on the top of the skin is a strap or laced thong called the binding, with which the foot is held in position, and sometimes a heel strap is used. Special shoes are worn made of thick soft leather, pointed and bent upward at the toes so as to fit the loop or binding. The rider carries a *stav*, a strong wooden stick with a small wheel at the trailing end, by which he starts himself and steers. The motion differs from the step of the Indian snow-shoe; it is a glide, zig-zagging up hill, and a slide or shoot down hill. Skiing is the common winter method of locomotion in Northern Europe, and is considerably used in Northwestern America, especially in the States of Minnesota and Wisconsin. The United States soldiers at the Yellowstone National Park find skis very useful in their patrols during the winter months.

Both in Norway and America skiing is the occasion of great gatherings for competitions. In America the first ski club was formed in Minneapolis in 1881 and other clubs soon followed. In 1890 a national association of clubs was organized for the regulation of the annual tourneys, called the Ski Association of the Northwest. The greatest ski contests are those held at Holmenkollen and Frognersæteren, near Christiania, Norway, in February each year. At these there are contests in long and short distance skiing runs and jumping. The long distance run is generally about twenty miles, round trip. The jump is from a take-off erected midway down a sloping hillside, and when the sliding skiman reaches it he stoops, rises in the air, and must, to be successful, land on his feet and keep his equilibrium to the end of the course.

SKIMBACK. A local name in the Mississippi Valley for a fish, one of the most common of the carp-suckers (*Carpiodes cyprinus*), otherwise known as 'sailfish,' 'quillback,' etc.

SKIMMER, or SCISSORSBILL. A sea-bird of the genus Rhynchops, related to the gulls, remarkable for having a bill of a straight, compressed, unequal form. The common skimmer of the North Atlantic (*Rhynchops nigra*), which occurs in late summer as far north as the Bay of Fundy, is about 19 inches long, spreading its wings 44 inches; and is black above and white below, with the legs and webbed feet red, and the bill orange and black. It breeds along coasts after the manner of gulls generally, and is confined to the tropics in winter. When feeding the bird flies to the surface of the ocean, with the blade-like lower mandible under water, and plows through the water, skimming up its food. Two other species are Asiatic.

SKIM MILK. Milk after the cream has been removed by skimming or by the separator (q.v.). It is largely used as a stock food, especially for young animals. During the closing decade of the last century a substance called plasmon was made from it and placed upon the market. This is a flour-like material which contains a high percentage of proteids, and is used for bread and cracker making and for mixing with cocoa.

SKIMPOLE, HAROLD. An amateur artist in Dickens's *Bleak House*, plausible but selfish, who lived on his friends. He was supposed to be a portrait of Leigh Hunt, but Dickens emphatically denied any such intention.

SKIN (Icel. *skinn;* connected with OHG. *scintan, scindan,* Ger. *schinden,* to flay). Considered in its general physiological and histological relation, the skin is merely a part of the great mucous system to which the mucous membrane and secreting glands also belong, and which consists of two essential elements, a *basement tissue*, composed of simple cutaneous membrane, and an *epithelium* of nucleated particles resting on it, while beneath the basement membrane are vessels, nerves, and connective tissue. (See EPITHELIUM and MUCOUS MEMBRANE.) In the skin the hard and thick epithelium is termed *cuticle* or *epidermis*, and the true skin below it is termed the *derma*, or *corium* or *cutis vera*, and is chiefly formed of modified and very dense connective (or areolar or cellular) tissue.

The external surface of the skin formed by the cuticle is marked by furrows of different kinds. Some (termed furrows of motion) occur transversely in the neighborhood of joints, on the side of flexion; others correspond to the insertion of cutaneous muscles; while others, of quite another kind, are seen in aged and emaciated persons, and after the subsidence of any great distention of the integument; and besides these coarse lines, most parts of the skin are grooved with very minute furrows, which assume various courses in relation to one another. These minute furrows are most distinctly seen on the palmar aspect of the hand and fingers, and on the sole of the foot. The outer surface of the skin also presents innumerable pores for the discharge of the contents of the sudoriparous and sebaceous follicles, or the sweat and fat glands; and the modifications of epidermis known as hair and nails occur on the same surface. The epidermis is composed of stratified epithelial cells united to each other by a cement substance. Its entire thickness varies from 0.08 to 0.12 of a micromillimeter. The outermost layer is known as the *stratum corneum*, and is composed of several strata of dry, horny scales, without nuclei. Beneath this lies the *stratum lucidum*, a thin, clear, transparent layer of horny cells with faint nuclei, and next beneath this lies the *stratum granulosum* (or *rete mucosum*, or *rete Malpighii*), which overlies and dips into the spaces between the papillæ of the *corium*. The Malpighian layer is composed of many strata of nucleated cells, which are flattened in the superficial layers, but polyhedral in the deep portion. The pigment of the skin is found in the *rete Malpighii*.

The deep layer of the skin consists of connective tissue, in which both the white and yellow fibrous elements are considerably modified as to the proportions in which they occur, and unstriped muscular fibre is present in no inconsiderable quantity in some parts of the skin. Where

great extensibility, with elasticity, is required, the yellow (elastic) element predominates; and where strength and resistance are specially required, as in the sole of the foot, the corium is chiefly composed of a dense interweaving of the white (inelastic) element. The thickness and strength of this layer differ greatly in different parts, according to the amount of resistance required against pressure. The skin is thicker on the hinder surface of the body than in front, and on the outer than on the inner sides of the limbs. It is unusually thin over the flexures of the joints. It is particularly delicate in the eyelids, and proportionately so in some other situations where great mobility is demanded. In regions which are most subject to external pressure, as the soles of the feet, it is firmly united by very dense laminæ to the subcutaneous fascia; and the intervals between these are provided with pellets of fat, forming a cushion, as an additional means of protection to the delicate organs it incloses and covers. It is on the external surface of the cutis that the *tactile papillæ*, or true organs of touch are developed. The corium is divided into the 'reticular' and 'papillary' portions, the latter being the reddish-gray external superficial layer which contains the upper portion of the hair follicles and cutaneous glands, and whose most important elements are these tactile papillæ. They are most abundant and largest in the palm of the hand and the sole of the foot, while in the back and in the outer sides of the limbs they are almost entirely absent. They occur as small, semi-transparent, flexible elevations, which are usually conical or club-shaped in form; but in certain parts, as the palm of the hand, present numerous points (in which case they are termed compound papillæ). In one square line of the palm of the hand, it has been calculated that there are 81 compound and from 150 to 200 smaller papillæ, arranged in tolerably regular rows.

The glands occurring in the skin are the *sudoriparous* or *sweat glands*, the *sebaceous* or *fat glands*, and the *ceruminous glands*. The *sweat glands* exist in almost every part of the human skin. They lie in small pits in the deepest parts of the true skin, and sometimes entirely below the skin. Their orifices can be seen in the middle of the cross grooves that intersect the ridges of the papillæ on the hands and feet, their arrangement being here necessarily regular, while in other parts they are irregularly scattered. Their size and number in different regions of the skin correspond with the amount of perspiration yielded by each part; thus they are nowhere so much developed as in the axilla or armpit. In that part of the region which in the adult is more or less covered with hair, they form a layer of a reddish color, about an eighth of an inch thick. They are soft, and more or less flattened by their pressure on one another, being imbedded in delicate connective tissue, and covered and permeated with a network of capillaries. On isolating one of these glands, and highly magnifying it, it is found to consist of a solitary tube, intricately raveled, one end of which is closed and hidden within the glandular mass, while the other emerges from the gland. The wall of the tube consists of an outer or *basement membrane*, with which the blood-vessels are in contact, and an *epithelium*, lining the interior, the former disappearing when the tube reaches the surface of the papillæ. The duct, on leaving the gland, follows a meandering and rather spiral direction through the reticular portion of the cutis to the interval between the papillæ, when it becomes straight; and it again assumes a spiral course in perforating the cuticle.

The *sebaceous glands* are small whitish glands, which exist in almost every part of the skin, except the palms and soles, and are especially abundant in the scalp, face (the nose being particularly rich in them), and about the anus. They are usually connected with the hairs, and consist of a duct terminating in a blind pouch-like or pear-shaped extremity. The *basement membrane* of these glands is lined by an epithelium, in the particles of which are included granules of fatty or sebaceous matter, which, having become detached, constitutes the secretion. These glands are the seat of the parasite known as *Acarus folliculorum* (q.v.).

The *ceruminous glands* are brown simple glands, in external appearance like the sudoriparous glands, occurring in the cartilaginous portion of the external meatus of the ear. They yield an adhesive bitter secretion, which protects the membrane of the tympanum from the access of dust, insects, etc.

Regarded as a protective covering, the skin possesses the combined advantages of toughness, resistance, flexibility, and elasticity; the connective framework being the part which mainly confers these properties, although the epidermis cooperates with it. The subcutaneous layer of fat, and the modifications of epidermis in various forms, as hairs, wool, feathers, scales, etc., serve for the preservation of warmth, and occasionally (when they occur as claws, talons, etc.) as means of offense or defense. Besides preserving the warmth of the body, the skin has also the power of reducing body temperature by the evaporation of sweat. The skin is the seat of a twofold excretion, viz. of that formed by the sudoriparous glands and that formed by the sebaceous glands. The fluid secreted by the sudoriparous glands is usually formed so gradually that the watery portions of it escape by evaporation as soon as it reaches the surface; but in certain conditions, as during strong exercise, or when the external heat is excessive, or in certain diseases, or when the evaporation is prevented by the application of a texture impermeable to air, as for example oiled silk, or mackintosh, or india-rubber cloth, the secretion, instead of evaporating, collects on the skin in the form of drops of fluid. When it is stated that the sweat contains urea, lactates, extractive matters, etc., and that the amount of watery vapor exhaled from the skin is on an average two pounds daily, the importance of the sudoriparous glands as organs of excretion will be at once manifest. The secretion of the sebaceous glands is a semi-fluid oily mass, which often solidifies into a white viscid tallow-like matter on the surface or in the glandular ducts, from which it can be removed by pressure, in a form resembling that of a small whitish worm or maggot.

The skin is, moreover, an organ of absorption. Mercurial preparations, when rubbed into the skin, have the same action as when given internally. Potassio-tartrate of antimony, when rubbed into the skin in the form of ointment or solution, may excite vomiting, or an eruption ex-

tending over the whole body, and many other illustrations might be given. The effect of rubbing is probably to force the particles of the matter into the orifices of the glands, where they are more easily absorbed than they would be through the epidermis. It has been proved by experiment that the skin has the power of absorbing water, although to a less extent than occurs in thin-skinned animals, such as frogs and lizards. This fact has a practical application. In severe cases of dysphagia—difficult swallowing—when not even fluids can be taken into the stomach, immersion in a bath of warm water, or of milk and water, may assuage the thirst. Sailors, also, when destitute of fresh water, find their urgent thirst allayed by soaking their clothes in salt water. Further, the skin possesses a respiratory function, giving off a small amount of carbon dioxide and taking up a small quantity of oxygen in twenty-four hours. In thin-skinned animals such as the frog, the excretion of carbon dioxide through this channel is very active. When a frog is immersed in oil death takes place sooner than by ligature of the bronchi, but in the case of man and the higher animals, where varnish and other impervious substances have been applied to the skin, death has taken place from other causes than suffocation.

SKIN DISEASE. A morbid condition of the skin, occurring as a local disorder or as a local symptom of a constitutional disease. Skin diseases are classed according to the anatomical manifestations or the pathological relations involved. *Maculæ* include spots which do not disappear on pressure, such as freckles, moles, and birthmarks. *Exanthemata* include rashes in which there are eruptions of spots variously grouped, red, inflammatory, and fading on pressure, as in measles, roseola, purpura, and urticaria. *Papulæ*, or pimples, are pointed or rounded elevations with or without change of color. *Tubercles* are solid elevations of the cutis of various sizes, and include boils, warts, and lupus. *Vesicles* are small blebs containing fluid, such as in eczema, miliaria, or varicella. *Bullæ* are larger vesicles, as in pemphigus. *Pustules* are vesicles containing purulent fluid. *Furfura* is the term given to bran-like scales, easily separable, as in dandruff. *Squamæ* are scales of larger size than *furfura*. *Scabs*, or crusts, are collections of mottled epidermis, exudation, dust, and blood, or pus, of varying tint and thickness. Skin diseases are largely grouped upon the existence of the characteristics just named in classification. They are separately treated in this work.

SKIN-GRAFTING. In cases of extensive destruction of the skin, leaving large sores that do not heal, and also in treating old ulcers, small particles of skin, cut from the patient or another person, are placed upon the raw surface. Here they soon become attached and grow, forming a number of small islands or patches of skin over the surface of the ulcer; these in time spread till all is covered. Sometimes small pieces of skin, about the size of the head of a pin, are used; but frequently grafts of the superficial skin (one-half to three-quarters of an inch in width and two to three inches in length) are cut with a razor and are transplanted to the denuded area after it has become covered with healthy granulations. In this way some sores are cured which otherwise would never heal. This is termed Thiersch's method. See RHINOPLASTIC OPERATION.

SKINK (from Lat. *scincus*, from Gk. *σκίγκος*, *skinkos*, sort of lizard). A small lizard (*Scincus officinalis*) of the sandy deserts of North Africa and Southwestern Asia. It is from six to eight inches long, reddish-dun in color, with darker transverse bands, a wedge-shaped head, and four strong limbs that give it extraordinary swiftness. It has been in great repute for imaginary medicinal virtues from remote times, and is still in high esteem in the East, dried skinks finding a ready sale. It represents the pleurodont sand-loving family Scincidæ, whose genera and species are scattered all over the world, and exhibit many variations, five, four, three, or two toes distinguishing species even within the same genus. An aberrant and curious form is the Australian Trachysaurus, illustrated on the Plate of LIZARDS (q.v.). A few true skinks of the genus Mabouia dwell in tropical America; but the small swift lizard frequently so called in the Northern United States (see FENCE LIZARD) is not of this family. Consult Gadow, *Amphibia and Reptiles* (London, 1902).

SKINNER, CHARLES MONTGOMERY (1852—). An American editor and author, born at Victor, Ontario County, N. Y. He received a common-school education in Cambridge, Mass., and Hartford, Conn., and in 1884 joined the staff of the Brooklyn *Eagle*. Among his chief publications are three volumes of interesting essays on nature subjects, *Nature in a City Yard* (1897), *Do Nothing Days* (1899), and *Flowers in the Pave* (1900); *Myths and Legends of Our Land* (1896); *Myths and Legends Beyond Our Borders* (1899); *Myths and Legends of Our New Possessions* (1900); and *American Myths and Legends* (1903).

SKINNER, CHARLES RUFUS (1844—). An American educator. He was born in Oswego County, N. Y., and attended the Mexico Academy and the Clinton Liberal Institute. From 1877 to 1881 he was a member of the New York Assembly; from 1881 to 1885 a member of Congress; from 1886 to 1892 Deputy State Superintendent of Public Instruction in New York; and in 1896 was appointed State Superintendent of Public Instruction.

SKINNER, JOHN (1721-1807). A Scotch poet, born at Balfour, in Aberdeenshire, where his father was a schoolmaster. He was educated at Marischal College, Aberdeen, and thereafter passed several years as a teacher in parish schools. Abandoning Presbyterianism, in which he was brought up, he was appointed in 1742 Episcopal minister at Longside, in Aberdeenshire, where he passed his life. Owing to his Jacobite sympathies during the excitement of 1745, his church was destroyed, and in 1753 he was imprisoned six months for preaching. He published several theological and controversial works, including *A Preservative Against Presbytery* (1746), *A Dissertation on Job's Prophecy* (1757), and an *Ecclesiastical History of Scotland* (1788). He is, however, more widely known for his songs, which were generously praised by Burns. Indeed, the younger poet ranked *Tullochgorum* as "the best Scotch song ever Scotland saw." Burns also liked the pathos of *The Ewie wi' the Crookit Horn*. Among Skinner's

other songs are *John o' Badenyon, The Marquis of Huntly's Reel,* and *The Old Man's Song,* all natural and sincere in tone and execution. Skinner was also skillful at Latin verse in the Horatian manner. Consult: Skinner's *Theological Works* (3 vols., Edinburgh, 1809) with a biography by his son, John Skinner; and his *Songs and Poems,* ed. by H. G. Reid (Peterhead, 1859). Individual songs appear in collections like Ward's *English Poets.*

SKIP. In music, a term denoting the progression of a part by an interval greater than a second.

SKIPJACK. (1) An oceanic fish (*Scomberesox saurus*) of the family Scomberesocidæ, called also 'saury' and 'billfish,' and in Great Britain 'skipper' and 'garonook.' The body is elongated, with the snout drawn out into a long bill. The scales are minute and deciduous. It is 18 inches long and is found in the temperate waters of the North Atlantic. The sauries travel in great schools, and when pursued by larger fishes often leap out of the water and skim along the surface for great distances. The flesh is good. See Plate of NEEDLE-FISH, PIKES, ETC. (2) A fish (*Pomolobus chrysochloris*) of the Mississippi Valley, introduced into the Great Lakes through canals, and known there as 'blue herring.' It is closely related to the alewife (q.v.), is about 12 inches long, and is a brilliant blue above, with the sides silvery. It is not good food, because excessively bony. It is also taken in deep water in the Gulf of Mexico. (3) The bluefish (q.v.). (4) The cutlass-fish (q.v.).

SKIPJACK or SNAPPING BEETLE. See CLICK-BEETLE.

SKIPPER. A butterfly of the family Hesperiidæ. (See BUTTERFLIES.) The skippers are usually rather small, but have stout bodies with an especially strongly developed thorax. Their wings are rather short, but very powerful, and the butterflies are very rapid and erratic in their movements. Both sexes have six legs adapted to walking. The family comprises more



SWALLOW-TAILED SKIPPER.

a, Butterfly, or 'bean leaf-roller' (*Eudamus proteus*); *b,* caterpillar; *c,* chrysalis in rolled up leaf.

than 2000 species, of which nearly 200 occur in the United States. The caterpillars are cylindrical and smooth, and generally possess large globular heads. The name 'skipper' is also applied to the cheese maggot or 'cheese-hopper,' larva of *Piophila casei.* See CHEESE INSECTS.

SKIPTON. A market town in the West Riding of Yorkshire, England, on the Aire, 15 miles northeast of Burnley (Map: England, D 3). It is the centre of a large cattle and sheep raising district and has manufactures of cotton and woolen goods. It has an old castle, a church in the late Perpendicular style, and a grammar school of the sixteenth century, restored in 1877. The municipality owns its water and gas works. Population, in 1901, 12,000.

SKIRMISH (OF., Fr. *escarmouche,* It. *scaramuccia,* formerly *schermuzio,* skirmish, from *schermire,* to fence, fight, from OHG. *scirman,* Ger. *schirmen,* to shield, defend, from OHG. *scirm, scerm,* Ger. *Schirm,* shield, shelter; probably connected with Gk. *σκίρον, skiron,* parasol, *σκιά, skia,* shadow, Skt. *chāyā,* shadow). Irregular engagements between small bodies of combatants are usually described as skirmishes; and a company or a battalion of infantry extended so as to cover a wide area of ground is said to be in skirmishing or extended order. The art of skirmishing is one of the most important branches of the infantry soldiers' training, as well as the most difficult to acquire. It enables contact to be made with an enemy with the lowest possible percentage of loss. Skirmishing makes the individual the unit, and consequently much depends on the intelligence and resourcefulness of the individual soldier. In the United States the squad is the basis of extended order, and men are trained to regard the squad as the unit from which they must never be separated; or if their squad is broken up, or separated, to place themselves with the nearest squad and to act under the orders of its leader. See TACTICS, MILITARY.

SKIRRET (probably a corruption of *sugar-root* or *sugar-wort*), *Sium Sisarum.* A perennial plant of the natural order Umbelliferæ, a native of China and Japan, long cultivated for its tuberous, clustered, sweet, succulent, somewhat aromatic roots, which are used like salsify, and also to make a spirituous liquor. The plant, sometimes six inches long, and three-quarters of an inch thick, is propagated either by seed, division, or by small offsets from the roots. It is little used in the United States, but in Europe is more highly esteemed.

SKIRT DANCE. A modern spectacular performance in which the dancer wears a skirt made very full and of a light and often gauzy material, so that, grasped by the fingers, it may be waved in accompaniment to varying steps and rhythmical motions of the body. The dance has come to differ, with the gradual increase in the size of the skirt, from true dancing in that the steps are of less importance than the movements of the body, and especially of the arms, which produce the swirling effect of the many yards of tissue composing the skirt. Often the performer remains practically stationary. To increase the radius of the whirls of tissue, on all sides and above the head, and thus emphasize the characteristic feature of the dance, light sticks of a few feet in length, held in the hands and concealed in the garment, are often used by the dancer. The skirt dance was made popular in England by Miss Kate Vaughan, and was further developed, there and in the United States, by Miss Sylvia Grey, Miss Letty Lind, Miss Topsy Sindon, and others. In 1897 Miss Loie Fuller, famous as a danseuse in both America and Europe, introduced the modification of the skirt dance known as the serpentine dance, in which the skirt is decorated so as to give peculiar serpentine ef-

fects; and later she produced the fire dance, the effect of which, in a darkened theatre, is gained by a brilliant red light thrown on the dancer wearing a light-colored skirt. Various colors, in succession or combination, are also used.

SKITTAGETAN, skĭt'tȧ-gē'tan. A North American Indian linguistic family. See HAIDA.

SKITTLES (variant of *shittle, shuttle,* from AS. *scēotan,* OHG. *sciozan,* Ger. *schiessen,* to shoot; ultimately connected with Skt. *skand,* to leap, Lat. *scandere,* to climb). Excepting in the details and method of playing, skittles does not differ materially from American bowling. The nine pins are set in the same pattern at the end of an alley, but are much heavier, weighing nine pounds each. The ball, which is of a different pattern from that used in American bowling, is in the shape of a flat cheese rounded at the edges, and usually weighs from twelve to fourteen pounds. It is cast at the pins and not rolled. It must hit a pin after leaving the player's hand before touching the ground, no hit counting which is caused by a rebound of the ball from the alley's side. Each skittle fairly downed counts one. It is a game considerably played in Great Britain in the agricultural districts, but in the eastern counties the usual number of pins is four, one at each angle.

SKOBELEFF, skō'be-lyĕf, MIKHAIL DMITRIVITCH (1843-82). A Russian general. He entered a guard regiment in 1861 and fought with renown against the Polish insurgents in 1863. As a member of the general staff he was sent in 1869 to Samarkand, and in 1873, in the Khiva expedition, he commanded the vanguard of one of the Russian columns, and was among the first to enter the Khan's capital. Two years later he commanded the cavalry in the expedition against Khokand, and after the city had surrendered pursued the fleeing Khan and took him prisoner. He was made major-general in 1876 and placed over the newly organized Province of Ferghana. As commander of a division in the Russo-Turkish War he stormed Lovatz (September 3, 1877), and fought bravely around Plevna, which he occupied on December 10th, after the defeat of Osman Pasha. He led the Russian advance over the Balkans, and on January 9, 1878, with Generals Mirski and Radetzky, captured the Turkish forces in the Shipka Pass, proceeding thence to Adrianople. In 1880 he was once more in Turkestan as head of an expedition to suppress the marauding Tekké tribes, and achieved a brilliant feat in the storming of Geök-Tepe (January 24, 1881). In the same year he was made Governor of Minsk and became prominent as an ardent advocate of Panslavism. He died at Moscow, July 8, 1882.

SKO'DA, JOSEPH (1805-81). An Austrian physician, born at Pilsen, Bohemia. After studying in Vienna and a short practice in Bohemia, he was detailed to the Public Hospital in Vienna in 1833, became primary physician in 1841, professor at the clinic in 1846, and was elected a member of the Academy of Sciences in 1848. His *Abhandlung über die Auskultation und Perkussion* (1839; 6th ed. 1864) created an epoch in diagnostics, by demonstrating the principle that the physical symptoms observed in a patient only indicated certain physical conditions in his organism, whereupon it devolved upon the rational physician to draw his conclusions as to the real internal disease from his pathologic-anatomical experience. This was in opposition to the French doctrine, until then prevalent, which interpreted the physical symptoms immediately as the signs of a definite process of disease.

SKOKOMISH, skō-kō'mĭsh. A tribe of Salishan stock (q.v.) formerly occupying both sides of Hood's Canal on Puget Sound, Washington, and now gathered upon a small reservation near Union, within their own limits. In primitive characteristics they resembled the neighboring Nisqualli and Puyallup (qq.v.) in nearly everything excepting language. The women were expert in weaving hair cloth, mats, and baskets. The men usually went naked except for the G-string, while the women wore a sort of skirt of twisted strands. In war the men wore helmets of cedar bark with body armor of quilted elkskin or a sort of corset of strips of wood. Scalping was not practiced. Head-flattening was universal. The dead were usually laid away in the grave, and slaves were sacrificed according to the rank and wealth of the deceased, frequently being starved to death or even tied to the corpse and left thus to perish. The great ceremonial was the potlatch (q.v.) and the clan system was unknown. The Skokomish have now decreased to 165.

SKOPTSY, skŏp'tsĭ (Russ., eunuchs). A Russian religious sect practicing castration. The first to adopt this practice in Russia was a foreign monk, Adrian (1001), and at least six other cases are on record among the higher Russian clergy up to Theodosius, Bishop of Lutsk (1326). Two famous trials occurred in the eighteenth century, and in 1772 Catharine II. severely punished the leading heretics. The Skoptsy emigrated in masses, chiefly into Rumania. The movement reached its height in 1871 under Lisin, "the second Redeemer and Tsar Peter III.;" he was sent to Siberia in 1876, and prosecutions have been continued since then.

SKOWHEGAN, skou-hē'gan. The county-seat of Somerset County, Me., 18 miles north of Waterville, on the Kennebec River, here spanned by two bridges, and at the terminus of the Maine Central Railroad (Map: Maine, D 6). It has a public library of 8000 volumes, a fine court house, and Coburn Park. There are manufactures of oilcloth, woolen and worsted goods, shoes, sash and blinds, wooden ware, foundry and machine shop products, etc. Population, in 1900, 4266. Skowhegan was originally part of Canaan, and was incorporated as the town of Milburn in 1823. It received its present name, the old Indian name for the place, in 1836. Consult Hanson, *History of the Old Towns of Norridgewock and Canaan, comprising Skowhegan* (Boston, 1849).

SKU'A (Norweg. *skŭa,* Icel. *skūmr, skūfr,* skua), or JAEGER GULL. A gull (q.v.) of the subfamily Stercorariinæ, in which the nostrils open beneath the edge of a horny cere and other structural peculiarities exist, sufficient, in the opinion of some ornithologists, to entitle this group to family rank. These birds are fierce and rapacious, habitually attacking and annoying terns and small gulls, and compelling them to drop or disgorge fishes they have already taken. The Antarctic species strike down living birds as hawks would do and feed upon them. They

are moderately large, about 20 inches long and about 4 feet in extent of wings. The plumage is dusky above and usually white below. Consult Selous, *Bird Watching* (London, 1900).

SKULL (Icel. *skāl*, bowl, cup; connected with AS. *scale*, Eng. *scale*, bowl, dish of a balance, and with AS. *scealu, sceale*, OHG. *scala*, Ger. *Schale*, husk, scale, Goth. *skalja*, tile, OChurch Slav. *skolika*, mussel, Lith. *skelti*, to split). The bony framework of the head. It is divided into two parts, the cranium and the face. In human anat-

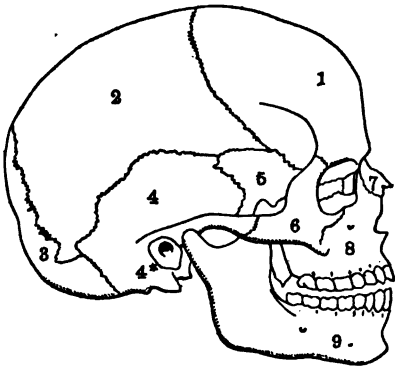


FIG. 1. SIDE VIEW OF HUMAN SKULL.

1, Frontal bone; 2, parietal bone; 3, occipital bone; 4, temporal bone (squamous portion); 4*, Do. (mastoid portion); 5, sphenoid bone; 6, malar bone; 7, nasal bone; 8, superior maxillary or jaw bone; 9, inferior maxillary or jaw bone.

omy it is customary to describe the former as consisting of 8 and the latter of 14 bones; the 8 cranial bones, which constitute the brain-case, being the *occipital, two parietal, frontal, two temporal, sphenoid*, and *ethmoid;* while the 14 facial bones are the *two nasal, two superior maxillary, two lachrymal, two malar, two palate, two inferior turbinated, vomer*, and *inferior maxillary*. The bones of the ear, the teeth, and the Wormian bones are not included in this enumeration. At a very early period of fœtal existence the cerebrum is inclosed in a membranous capsule external to the dura mater and in close contact with it. This is the first rudiment of the skull, the cerebral portion of which is consequently formed before there is any indication of a facial part. Soon, however, four or five processes jut from it on each side of the mesial line, which grow downward, incline toward each other, and unite to form a series of inverted arches, from which the face is ultimately developed. Imperfect development or ossification of these rudimentary parts of the face gives rise to the peculiarities known as harelip (q.v.) and cleft-palate, or in extreme cases to the form of monstrosity termed cyclops, in which, from absence of the frontal processes, the two orbits form a single cavity, and the eyes are more or less blended in the mesial line. See MONSTROSITY.

The following is a brief summary of the succession of events that occur in the ordinary or normal development of the skull. Cartilage is formed at the base of the membranous capsule, which has been already described as thrown round the brain and capable of enlarging with it. This is speedily followed by the deposition of osseous matter at various points of the capsule, which soon becomes converted into flakes of bone, which afford protection for the brain, while the intervening portions, which remain membranous, permit the skull to expand as its contents enlarge. The formation of these bony flakes on the convexity of the cranium is soon followed by the appearance of osseous nuclei in the cartilage at the base, corresponding to the future occipital and sphenoid bones. Lastly, the various bones, some originating in membrane and some in cartilage (see OSSIFICATION), approach one another by gradual enlargement and become united in various ways, so as to form a continuous and ultimately an unyielding bony case admirably adapted for the defense of the brain, for the accommodation of the organs of special sense, and for the attachment of the ligaments and muscles by which the skull is supported and moved on the spine. At the period of birth most of the principal bones have grown into apposition with their neighbors, forming the *sutures*, but one large vacuity remains at the meeting-point of the parietal and frontal bones, which is termed the anterior fontanel, which does not close till the second year after birth, and sometimes remains open much longer. There are two fontanels in the mesial line, as shown in Fig. 2, and two lateral fontanels on each side.

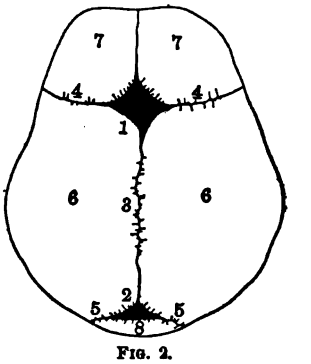


FIG. 2.

1, Anterior fontanel; 2, posterior fontanel; 3, sagittal suture; 4, 4, coronal suture; 5, 5, lambdoid suture; 6, 6, parietal bones; 7, 7, two halves of the frontal bone, still united; 8, occipital bone.

After the sutures have been formed and the skull has acquired a certain thickness a process of resorption commences in the interior of the bones, and reduces the originally dense structure to a more or less cellular or cancellated state. The interior thus altered is called the *diploë*, and by this change the weight of the skull is much diminished, while its strength is scarcely affected.

The growth of the skull after the seventh year proceeds slowly, but a slight increase goes on to about the age of twenty. The skull bones are freely supplied with blood from arteries, which pass from the dura mater internally and the pericranium externally, through numerous foramina, the blood being returned by veins which take various directions.

The base of the skull, whether seen from within or from below, presents many objects of physiological interest in relation to the nervous system. As seen from within the base presents on each side three fossæ, corresponding to the anterior and middle lobes of the cerebrum and to the cerebellum. These fossæ are marked, as is the whole skull-cap, by the cerebral convolutions, and they contain numerous foramina and fissures which give passage to nerves and blood vessels. The external or outer surface of the base of the skull, if we consider it from before backward, is formed by the palate processes of the superior maxillary and palate bones; the vomer; the

pterygoid, and spinous processes of the sphenoid and part of its body; the under surface of the temporal bones; and the occipital bone. The hard palate is formed by the palate processes of the superior maxillary bone.

The anterior region of the skull, which forms the face, is of an irregularly oval form, and the bones are so arranged as to inclose the cavities for the eyes, the nose, and the mouth, and to give strength to the apparatus for masticating the food. The size of the face and the capacity of the cranial cavity stand in an inverse ratio one to another, as may be readily seen by comparing vertical sections (through the mesial line) of human and other mammalian skulls; and if, in place of mammalian skulls, we take skulls of lower vertebrates (the crocodile, for example), this ratio is far more striking. In man the face is at its minimum as compared with the cranial cavity, chiefly in consequence of the facial bones being arranged in a nearly vertical manner beneath the cranium, instead of projecting in front of it. The human face is also remarkable for its relatively great breadth, which allows the orbits for the reception of the eyes to be placed in front instead of on the sides of the head, and renders their inner walls nearly parallel, thus contributing, through the parallelism of the optic axes, to that clear, accurate, and steady vision which results from the ready convergence of the eyes upon every object. Each orbit is of a pyramidal form, with the apex behind, and is composed of seven bones, viz. the frontal, ethmoid, lachrymal, sphenoid, superior maxillary, malar, and palate, the last contributing very slightly to the human orbit, while it is an important constituent in the orbit of many animals. For description of the nasal cavities, see NOSE.

The different varieties of mankind present certain well-marked and characteristic peculiarities in the form of the skull. There are *three typical forms* of the skull which seem to be well established from the examination and comparison of a large number of crania: the *prognathous*, the *pyramidal*, and the *oval* or *elliptical* cranium. When the upper jaw slopes forward the insertion of the teeth, instead of being perpendicular, is oblique. A skull with this peculiarity is *prognathous* or *prognathic*, the opposite condition being termed *orthognathous* or *orthognathic*. The negro of the Guinea coast and the negrito of Australia present the prognathous character in its most marked form. The pyramidal form is characterized by the breadth and flatness of the face, which, with the narrowness of the forehead, gives this shape to the head. The Mongolian and Eskimo skulls belong to this type. The oval or elliptical type is that which is presented by the natives of Western or Southern Europe, and which is not distinguished by any particular feature so much as by the absence of the longitudinal projection of the first type, or the lateral projection of the second, and by a general symmetry of the whole configuration. For the skull as a basis of classification in anthropology, see ANTHROPOMETRY.

THE MORPHOLOGY OF THE SKULL is the highest and most difficult problem of comparative anatomy. Huxley destroyed the archetypal theory, previously held by Owen and others, and established the newer theory on sure grounds of actual observation. Taking first the unsegmented cranium of a skate or dogfish, with its appended jaws and arches, we find that in development, though the notochord extends into the region of the head, the vertebræ stop short of it; but that on each side of the cranium there arise a pair of cartilaginous bars, the *trabeculæ* or rafters of the future skull; three pairs of cartilaginous capsules, nasal, ocular, and auditory, form round the developing sense organs; the nasal capsules unite with the ends of the trabeculæ, which are meanwhile uniting below, and growing up at the sides to form the brain-case. The auditory capsules become united with the trabeculæ by the appearance of two new masses of cartilage, the parachordals. The first pair of a series of seven or more arches develops an ascending process, becoming the palato-pterygoid arch or upper jaw. The second pair of arches, the hyoid, is modified to support the jaws, while the rest are modified to support the gills. In the bony skulls of higher vertebrates the chondro-cranium and subjacent arches develop in the same way. The bones originate in two distinct ways: either by actual ossifications or by the ossification of overlying dermis, known as cartilage bones and membrane bones respectively, the latter corresponding to the dermal bones and teeth of ganoid and elasmobranch fishes. In mammals the ends of the mandibular and hyoid arches lose their suspensory function, are taken into the interior of the ear capsule, and are metamorphosed into the auditory ossicles. See SKELETON.

FRACTURE OF THE SKULL may take place either in the vault or at the base of the skull. In fracture of the vault the fracture is usually direct, the bone giving way at the point at which it was struck, and the result being either a simple fissure or a breaking of the bone into several fragments (a comminuted fracture). Although fractures may be limited to the outer or to the inner table of the skull, they most commonly extend through the whole thickness, and the broken bone is generally driven inward; and the most ordinary form of fracture with depression is that in which several fragments of a somewhat triangular form have their points driven down and wedged into each other, while their bases remain on a level with the surrounding bone. There are no signs by which we can in all cases recognize the existence of fracture of the vault. Fissures involving the whole thickness of the vault of the skull occasionally exist without ever having been suspected during life, and even an extensive and comminuted fracture, with great depression of the fragments, may escape notice when hidden under the temporal muscle or under a large extravasation of blood. When, however, the fracture is accompanied by a wound leading down to the bone, it may, in general, be easily detected. With regard to treatment, it is now an established rule that simple fractures of the skull with depression and without symptoms are to be let alone. The depression may be so marked as to be easily detected; and yet so long as there are no symptoms all operative interference, of whatsoever form, is carefully to be avoided. If, however, there be a wound leading down to the bone in a depressed fracture without symptoms, immediate operative interference is called for. When a depressed fracture is accompanied by primary brain-symptoms an operation for the purpose of raising or removing the depressed fragments is usually necessary. If, however, the

fracture is a simple one and the symptoms are not urgent, an expectant plan of treatment may be employed. Cases occasionally occur in which very urgent symptoms of cerebral pressure, such as unconsciousness or convulsions, persist for a long time and are relieved at once on the pressure being removed.

FRACTURES OF THE BASE may be direct or indirect, but in most cases are indirect, that is to say, the bones give way at a point remote from the seat of the blow. At certain parts, however, the bones of the base are so thin that if direct pressure be brought to bear upon them they readily give way. Thus scissors, slate pencils, knitting needles, and other objects have often been thrust into the skull through the orbits or the nostrils and have given rise to wounds which are very serious because of the readiness with which the brain may be thus injured. The only symptoms that can be depended upon as indicating a fracture of the base of the skull are connected either with an escape of the substance of the brain, or blood, or watery fluid, or with an injury done to the nerves as they emerge at the base. Bleeding from the mouth or nose or from the ear occurs in about half the cases. A copious watery discharge from the ear was, until very recently, regarded as a diagnostic sign of fracture of the base; and there can be no doubt that when such a discharge of cerebro-spinal fluid occurs either from the ear or nostrils it *most probably* is connected with fracture. Operative interference is very seldom required in these fractures.

SKUNK (from Abenaki *seganku*, Cree *seecawk*, skunk). A fur-bearing mammal of the genus Mephitis (or Chincha) of the weasel family (Mustelidæ), approaching the badgers in the lengthened claws of the fore feet, in the plantigrade hind feet, in dentition, and in habits. Skunks are found only in America, where they are distributed in many species from Northern Canada to Patagonia. All are animals of moderate size with long hair, bushy tails, and black and white markings. All have nocturnal habits, and are renowned for the excessive development of the anal glands, common to most of the family (see BADGER, POLECAT, etc.), from which an acrid, fetid discharge may be projected to a considerable distance. The best-known species to which the name ordinarily refers is the common skunk of Eastern North America (*Mephitis mephitica*), which is numerous from New England and Canada, nearly as far northwest as timber grows, to Florida and Texas. Its body is about 18 inches long and the tail about 9 inches, but considerable variation occurs, and females are always smaller.

Skunks are wholly terrestrial and live in dens and burrows, usually of their own excavation. They are sluggish in movement and usually show little fear of human beings. Although chiefly nocturnal, they are often seen moving about in the daytime. They hibernate only during the severest part of the winter. Five to seven young are born in May in the Northern States. Their food consists largely of mice, reptiles, insects, and birds' eggs, and they frequently become excessively fat, especially when grasshoppers are abundant. In many parts of the United States they destroy the 'white grubs,' a great pest in lawns and meadows. They occasionally rob the poultry yard, but these small depredations are more than offset by their destruction of noxious mammals and insects. Skunks have been extensively trapped for furs ever since the settlement of the country by white men, and attempts have been made to breed them in confinement, but, although 'skunk farms' have been started in several States, the industry has not flourished. The fur is sometimes sold under the name 'Alaska sable.' Apparently there is but one molt in a year, and this occurs in late summer or in autumn.

That which particularly distinguishes skunks from other animals is their means of defense, consisting of a characteristic malodorous fluid, which, when ejected, speedily discourages the boldest aggressor. The fluid is secreted by two anal glands similar in character to those possessed by other members of the Mustelidæ, but larger and more muscular. They lie one on each side of the rectum, and are imbedded in a dense, gizzard-like mass of muscle, which serves to compress them so forcibly that the contained fluid may be ejected to the distance of 15 feet. Each sac is furnished with a single duct that leads into a prominent, nipple-like papilla that is capable of being protruded from the anus, and by means of which the direction of the jet is governed. This liquid causes acute distress when in contact with mucous membrane, as, for example, the eyes. Another extraordinary feature of these animals is their tendency to canine rabies. It is popularly believed that they 'go mad' with a form of the disease peculiar to themselves, but an extensive investigation of the matter by Dr. Elliott Coues showed that the disease was doubtless canine rabies.

The skunks west of the plains are divided into several species, that of the coast of Great Basin being *Mephitis occidentalis*. In the Southern and Western United States and throughout Mexico occur also small 'striped' skunks of another genus (Spilogale) marked with four narrow stripes breaking into spots and cross-bars on the rump; these are called 'zorillos' in the Spanish-speaking countries. Still another well-known form is the 'conepate,' 'mapurito,' or white-backed skunk (*Conepatus mapurito*), which is found from Arizona throughout Central and South America.

Consult Coues, *Fur-Bearing Animals* (Washington, 1874), and the many authorities therein referred to; Merriam, "Mammals of the Adirondack Region," in *Transactions of the Linnæan Society of New York*, vol. i. (New York, 1882); Howell, "Revision of the Skunks of the Genus Chincha," in *North American Fauna, No. 20* (Department of Agriculture, Washington, 1901); Merriam, "Revision of the Genus Spilogale," in *North American Fauna, No. 4* (ib., 1890); Stone and Cram, *American Animals* (New York, 1902).
See Plate of MINOR CARNIVORES with CARNIVORA.

SKUNK CABBAGE (so called because of the fetid odor), *Symplocarpus fœtidus*. A plant of the natural order Araceæ, growing in bogs and moist ground from Nova Scotia to North Carolina and west to Iowa and Minnesota. The hooded, shell-shaped, rather fleshy variegated purplish spathe appears in earliest spring before the smooth, radical, ovate, heart-shaped leaves. All parts of the plant, especially when bruised, emit a fetid skunkish odor. The fruit, which ripens in September, is a roughened globular mass 2 or 3

inches in diameter. In the Northwestern United States, extending through Alaska to Japan and Siberia, is a related plant (*Lysichitum Camtshatcense*), which from its resemblance to the above is called skunk cabbage.



SKUNK CABBAGE.
Leaf much reduced as compared with spathe.

SKUNK PORPOISE. The bay porpoise, so called on account of its variegated black and white markings. See PORPOISE, and accompanying illustration.

SKUNK TURTLE. The musk-turtle, or musk-tortoise (q.v.), so called in reference to its vile odor.

SKUPSHTINA, skupsh-tē'nā (Serv., assembly). The name of the Servian national parliament. See SERVIA.

SKY. See ATMOSPHERE; CLOUDS; DUST.

SKYE, skī. The second largest of the Scottish islands and the most northerly of the inner Hebrides (q.v.), forming part of the County of Inverness, from the mainland of which it is separated by a narrow channel (Map: Scotland, B 2). Area, 535 square miles. Skye is mountainous and moory, but contains some arable and pasture land. The principal mountains are the Coolin Hills, which stretch irregularly chiefly from southwest to northeast, culminating in the sharp peaks of Scoor-nan-Gillean (3167 feet) and Scoor Dearg (3233 feet). The most famous scene in this region, immortalized by Sir Walter Scott in the *Lord of the Isles*, is Loch Coiruisg, a small fresh-water lake near the head of the Bay of Scavaig. Glen Sligachan, extending from the head of the loch of that name about nine miles to Caumsunary, is considered the grandest glen in the Highlands. The coasts abound in herring, cod, ling, and saithe, and the fisheries are extensive. Lobster fishing is also carried on to a considerable extent. Sheep-raising engrosses almost exclusively the attention of the farmers. The island produces a well-known breed of pet dog. The principal exports are cattle and sheep, wool, fish, shell fish, and eggs. There are manufactures of tweed at Portree and of whisky at Carabost. The principal port of Skye is Portree, a picturesque village with a population of 2798. Among the famous castles are those of Armadale and Dunvegan. The population, in 1891, was 15,705; in 1901, 14,642, chiefly Celtic, with a mixture of the Norse element. The common language is Gaelic. Consult: Boswell, *Tour in the Hebrides* (London, 1802); Smith, *A Summer in Skye* (Edinburgh, 1885).

SKYE TERRIER. See TERRIER.

SKYLARK. A European lark (*Alauda arvensis*), the 'lark' (q.v.) par excellence of Great Britain, which, notwithstanding the tameness of its brown plumage, is a universal favorite on account of the sweetness of its cheerful song, which it pours forth while soaring and floating in the air. More rarely it sings on the ground. It is in great repute as a cage-bird, and sings well in confinement, fluttering its wings while singing, as if still desirous of soaring in the air. It abounds chiefly in open but cultivated districts. It is common in most parts of Europe, but from the more northern parts it migrates southward on the approach of winter. It is also a native of Asia, and is a winter visitant of the north of Africa. It has been introduced into America, and has become naturalized on Long Island. It makes its nest generally in an open field, and often under shelter of a tuft of herbage, or a clod of earth; lays four or five mottled eggs; and generally produces two broods in a season. It is not truly gregarious in summer, but in winter large flocks assemble together, and at this season multitudes of larks are taken for the table in the south of Europe by various trapping devices. See Plates of LARKS AND STARLINGS.

The crested lark (*Alauda cristata*), very similar in size and plumage to the common lark, but having the feathers of the crown of the head more distinctly developed into a crest, although a very common bird in many parts of Europe, has very seldom been seen in Great Britain. The wood lark (*Alauda arborea*), a smaller species, not unfrequent in some parts of England, but rare in Scotland, is a bird of very delightful song, and usually sings perched on the branch of a tree. It frequents wooded districts and is also a favorite cage-bird. The nearest American representative of these birds is the shore-lark (q.v.). Consult Dresser, *Birds of Europe* (London, 1879).

SLA, slä. A seaport of Morocco. See SALLEE.

SLABY, slä'bē, ADOLF (1849—). A German engineer. He was born in Berlin, and was educated there, becoming in 1873 instructor at the Royal Industrial School in Potsdam, and in 1876 at the Industrial Academy in Berlin. In 1882 he was appointed professor of the theory of machines and electricity at the Technical Institute in Charlottenburg, and in 1884 he became director of the electro-technical laboratory there. In 1902 he was made professor in the University of Berlin. He wrote *Versuche über Kleinmotoren* (1879), *Kalorimetrische Untersuchungen über den Kreisprozess der Gasmaschine* (1894), and *Die neuesten Fortschritte auf dem Gebiete der Funkentelegraphie* (1901).

SLADE, slād, FELIX (1790-1868). An English antiquary, born in Lambeth, then a suburb of London. He lived mostly at Walcot Place, the home of his father, in Lambeth. On the death of his elder brother, he inherited the family es-

tate of his mother in Yorkshire, known as Hallsteads. In 1866 he was elected a member of the Society of Antiquaries. Slade expended a large fortune in collecting books, bindings, engravings, manuscripts, carvings, glass, and pottery, which were bequeathed to the British Museum. He also set apart in his will £35,000 for art professorships at Oxford, Cambridge, and University College, London. John Ruskin received the first appointment to the Slade professorship at Oxford. Consult the *Guide to the Slade Collection of Prints in the British Museum* (1869) and the *Catalogue to the Slade Collection of Glass* (London, 1869).

SLA'DEN, Douglas Brooke Wheelton (1856—). An English verse-writer and man of letters, born in London. Having studied at Cheltenham College and at Trinity College, Oxford, he went out to Australia (1879), where he became the first professor of history in the University of Sydney. His principal volumes of verse (ballads, epics, and dramas) are *Frithjof and Ingebjorg* (1882); *Poetry of Exiles* (1883); *A Summer Christmas* (1884); *In Cornwall and Across the Sea* (1885); *Edward the Black Prince*, an epic drama (1886); *The Spanish Armada* (1888). In fiction he wrote *A Japanese Marriage* (1895) and *Trincolox and Other Stories* (1898); in general literature, *The Japs at Home* (1892); *On the Cars and Off* (1895); *Brittany for Britons* (1896); and *The Admiral*, a defense of Nelson and Lady Hamilton (1898).

SLAGS (Swed. *slagg*, dross, slag; connected with Goth., OHG. *slahan*, Ger. *schlagen*, to strike, AS. *slēan*, Eng. *slay*). Fused compounds of silica in combination with lime, alumina, or other bases, resulting as secondary products from the reduction of metallic ores. More or less of the metal always remains in a slag; in the early days of iron-smelting the proportion of metal thus wasted was so great that some old slags have been profitably smelted in recent times. Slags, being silicates, are of the nature of glass, and externally have a glassy, crystallized, or stone-like character. Beautifully crystallized specimens are occasionally to be met with at smelting works. (See Iron and Steel; Cement.) Broken slag is also used as a covering for roads, but its brittleness and sharpness are objectionable qualities for this purpose. Slags containing large percentages of phosphorus are used to some extent for fertilizers.

SLANDER (OF. *esclandre, esclaundre, escandre, escandle, escandele, scandele*, from Lat. *scandalum*, from Gk. *σκάνδαλον, skandalon, σκανδάληθρον, skandalēthron*, stumbling-block, snare, offense, scandal; connected with Lat. *scandere*, to climb, Skt. *skand*, to leap). Defamation which is committed by way of speech; that is, either by vocal sounds or by the sign language of the deaf and dumb. English law distinguishes sharply between libel (q.v.) and slander. The latter is "actionable only when special damage can be proved to have been its proximate consequence, or when it conveys imputations of certain kinds." An enumeration of these special imputations, as they existed at common law, will be found in the article on Defamation. In England and in many of the United States the oral imputation of unchastity to a female has been declared actionable by statute, without proof of special damage.

Although slander is one of the few torts in which malice (q.v.) is an essential element, that term, in this connection, means only that the defamation must have been uttered without just cause or excuse. Actual ill will on the part of the speaker toward the plaintiff is not necessary, unless the occasion of its utterance was conditionally privileged, as in the case of a statement by a master about the character of a servant made to one whose inquiries he may lawfully answer in good faith.

Inasmuch as slander consists in uttering words to the injury of another's reputation, it follows that they must have been uttered to, or in the hearing of, third persons who understood them. It is not essential, however, that the speaker knew of the presence of the others. Even though they were concealed from him, if they overheard his slanderous words, a case of 'publication' by him is made out. Nor is it any defense to one who reports a slanderous statement that he gave the name of his informant and expressed no opinion as to its truth. Of course, the truth of the defamatory matter may be set up as a defense; for the law will not permit a man to recover damages in respect of an injury to a reputation which he ought not to possess.

It is sometimes difficult to determine whether particular language is slanderous or whether it is only 'fair comment.' This difficulty is generally one of fact, however, to be solved by the jury. The rule of law on this topic seems to be as follows: Where a person has done or published anything which may fairly be said to have invited comment, every one has a right to make fair and proper comment thereon. He may freely criticise such acts or publications; but his criticism must be limited to their character and consequences, and not directed against the personality of the actor. Consult: Odgers, *A Digest of the Law of Libel and Slander* (London, 1896); Newell, *The Law of Libel and Slander* (Chicago, 1898); Pollock, *The Law of Torts* (London and New York, 1901).

SLANDER OF TITLE. The disparagement of the property of another to his damage by false and malicious statements. This species of tort (q.v.) took its name from the fact that for a considerable period its only form was that of disparaging misrepresentations of a person's title to real property. At present it is extended to such statements concerning any property interest. Accordingly a disparaging publication about the quality of a public dinner served by a caterer, or about the age of a race horse, or about the right to use a particular trade-mark, if false and malicious and causing special damage to the plaintiff, is an actionable slander of title. It will be observed, therefore, that the name has ceased to be really descriptive of the tort. The wrong may be committed without slandering any one and without affecting title to any property.

Not only must the malicious statement cause actual damage, but it must be a statement of fact and not one of opinion merely. Not being an action for injury to the person, slander of title is not subject to the common-law rule that a personal action dies with the person.

SLANG (of uncertain origin; probably a cant use of the archaic preterite *slang*, regarded as a participle of *sling*, AS., OHG. *slingan*, Ger. *schlingen*, to fling, sling; connected with Lith.

slinkti, to creep). Colloquial words and phrases originating for the most part in the lower classes of society or in professional jargon. The term may also be applied to words and phrases which are formally in harmony with the standard language, as sanctioned by what is regarded as best usage, but which in their meanings diverge from this norm so far as to be generally considered inelegant and vulgar. The importance of slang in the semasiological development of language (see SEMASIOLOGY) can hardly be overestimated. Not only must a language be enriched with new words, if it is to survive, but it must be augmented by new meanings of the terms which it already contains; and one of the chief factors of this increase of significations and applications of words is slang. The condemnation of slang, therefore, finds no support from a linguistic point of view. On the contrary, the use of slang in itself, in so far as it does not usurp the functions of the standard language to too great a degree, is to be encouraged. Slang is the radical counterpart of conservative purism, and the two must exercise a constant check on each other as a necessary condition to the existence of language. It need hardly be added that slang which is vulgar is to be condemned unsparingly, not because it is slang, but because it is low. Slang is furthermore the vocabularistic side of dialect, and is accordingly governed by the laws which control dialectic growth. (See DIALECT.) If, therefore, a given slang expression, originated by an individual or by a group of individuals, is found for any reason to supply a need, as on account of its shade of meaning, or its superior convenience over the corresponding standard word, it may be adopted into the standard language. Even then it is regarded at first with suspicion and admitted only on sufferance. The life of the average slang word is very short. A slang term may, however, ultimately become a word recognized even by the most conservative adherents to a strictly standard dialect, and thus lose its character as a slang word, as in the case of 'blizzard' and 'skyscraper,' which, originally slang words, are now standard in America.

The principal basis of slang is metaphor (q.v.). Thus in poker players cash their 'chips' at the close of the game. From this comes the use of the phrase 'to pass in his chips,' as a slang equivalent for death. Again a girl as being sweet, plump, of a peach-like complexion, and generally 'good enough to eat,' is called a 'peach;' or as being dignified, and commanding respect, or of exceptional beauty, she is a 'queen;' while a clumsy, inept, stupid person is called a 'lobster.' Although such terms as these which have been drawn intentionally from slang unrecognized in literature, seem at first sight vulgar, equally violent transfers of meaning have been made in course of time in literary usage. For example, the evolution of the French *tête*, 'head,' from the Latin *testa*, 'jar' (found also in the later Latin poets in the sense of 'skull'), is in itself no better and no worse than the 'low' English 'mug' for 'face,' yet *tête* is considered standard and 'mug' is regarded as slang. On the other hand, certain words and phrases which were formerly regarded as strictly literary are now slang, at least in certain collocations. As familiar examples of this may be cited 'awful,' 'fierce,' 'devilish,' 'keen,' 'wise,' in such phrases as 'an awful swell,' 'a fierce hat,' 'devilish good,' 'to be keen on something,' or 'to put a man wise to a thing.' Not only does the inexact use of the word make it slang, but frequently, as in the case of 'mug,' it seems to be the brevity and commonness of the term which renders it objectionable. Akin to this latter class is the slang of clipped words, as 'enthuse' for 'make enthusiastic,' 'beaut' for 'beauty,' 'gent' for 'gentleman,' and the like. The objection to this class of words seems justifiable on linguistic as well as on æsthetic grounds. A prolific source of slang is euphemism, especially that which is based on propriety. Akin to euphemistic slang are clipped oaths, most of which are now little used, although they were common in earlier English. Examples of this class of slang are: 'Zounds,' 'od's life,' 'by cock and pie,' and in modern usage the rustic oaths 'dod rot,' 'gol darn,' 'I swan,' and the low city oath 'hully Gee.' Yet another class of slang is borrowed from foreign languages. This enters as a rule among the higher circles of society, and is therefore wider in its vogue and more lasting in its vitality. There belong such words as *fin de siècle*, 'up to date,' *bon-ton*, 'high society,' as well as translated phrases, as the expression current during the Chinese Boxer troubles in 1900, 'to save one's face,' that is, 'to retain an appearance of dignity despite a real concession to superior circumstances.'

Every grade of society and almost every profession has its peculiar slang. These varieties frequently vary so much as to be almost or even quite mutually unintelligible. The slang of the race course, the prize ring, the barroom, and the variety show are distinct from one another, and stand in marked contrast to the slang of the cultured classes. Here there are separate slangs for the artist, the actor, the stockbroker, the society man, the club man, and the university man. It is in the colloquialisms of the two latter classes, indeed, that slang is found which is consistent with good taste. Intrinsically there is no reason why one slang should be preferred to another, and it is as entirely proper to speak in low slang of 'winning by a neck,' or 'putting to sleep,' or 'rushing the growler,' as to use the high slang of 'a slump in the market,' 'slating a book,' 'doing a turn,' 'skying a picture,' or 'boning up with a crib for an exam.' The only criterion is the exact and intelligible expression of the idea.

Closely connected with professional slang is cant, and the two often overlap so as to be distinguishable only by some arbitrary rule. Cant differs from slang in that it is originally designedly unintelligible to any but members of the profession, although it may of course spread and even become a part of the literary language. Cant, like slang, is of all grades. It ranges from thieves' cant, as 'douse the glim' for 'put out the light,' or 'pinch a cove's wad and ticker,' for 'steal a man's money and watch,' through stage-cant, such as 'see the ghost walk,' for 'get one's salary,' 'angel' for 'patron,' up to financial cant, as 'to take a flyer in futures,' and artists' jargon, as 'to chic' for 'to sketch from memory,' or 'to sky' for 'to hang a picture so high as to escape notice in an exhibition.'

Slang has many minor varieties. Among these may be mentioned back slang, centre slang, and rhyming slang. Back slang is founded by roughly spelling words backward, sometimes with considerable mutilation of the original sound, as 'gyp'

for 'bitch.' Centre slang is more elaborate. The middle vowel of the word to be turned into slang is taken as the initial letter, followed by the latter part of the original word. To this the first part of the word is added, often with extra letters to give it a finished sound, as 'ockler' for 'lock.' In rhyming slang, a phrase which rhymes with the word to be disguised is substituted, as 'apples and pears' for 'stairs.' The linguistic necessity of slang is shown by its universality. Not only is it current in all modern languages, but it reaches its acme in the most highly developed tongues, as English, French, and German, and is used by the most cultured society, despite puristic attempt to suppress it. Furthermore, it is not a characteristic of modern languages alone, but of ancient ones as well. Slang abounds in the more popular literature of Greece and Rome, as in the comedies of Aristophanes and Plautus, or in the *Satyria* of Petronius.

Consult: Hotten, *Slang Dictionary* (2d ed., London, 1885); Barrère, *Argot and Slang* (ib., 1887); Farmer and Henly, *Slang and Its Analogues* (ib., 1890-96); Maitland, *American Slang Dictionary* (Chicago, 1891); Barrère and Leland, *Dictionary of Slang, Jargon, and Cant* (New York, 1893); Kluge, *Deutsche Studentensprache* (Strassburg, 1895); Francisque-Michel, *Etudes de philologie comparée sur l'argot et sur les idiomes analogues parlés en Europe et en Asie* (Paris, 1855); Rigaud, *Dictionnaire de l'argot moderne* (ib., 1885); Delvan, *Dictionnaire de la langue verte* (ib., 1889); Larchey, *Dictionnaire historique de l'argot* (10th ed., ib., 1887-89); Timmermans, *L'argot parisien* (ib., 1893).

SLATE (OF. *esclat*, Fr. *éclat*, splinter, fragment, from OHG. *slizan*, Ger. *schleissen*, AS. *slîtan*, Eng. *slit*). A hard, fissile rock which has been produced from shale or clay by metamorphism. This process by means of heat and pressure consolidates the original rock and obliterates the original stratification, developing new lines of parting or cleavage planes along which slate splits easily and in thin layers. Many fine-grained shales which split readily along the bedding planes are erroneously called slate, but true slate is a very hard and compact rock, little likely to be acted on by the weathering agencies. Owing to its origin, slate is found only in regions of metamorphic rocks, and therefore its geographical distribution is somewhat restricted. Its geological range extends from the Cambrian to the Jurassic. Slate is commonly bluish black or gray black in color, but red, green, purple, and variegated varieties are known. In the United States the most important slate quarries are in Maine, Vermont, New York, Pennsylvania, Maryland, and Georgia. A small production is also made in California and Minnesota. The supply of slate in Europe is derived mostly from Wales and France.

Slate was formerly quarried by blasting, but at present it is generally extracted in large blocks by means of a channeling machine, similar to that used in quarrying marble. The rock splits best when it is green or freshly taken from the quarry. Slate is extensively employed as a roofing material and for sinks, washtubs, billiard-table tops, electrical switchboards, flooring, mantels, blackboards, school slates, pencils, and in acid towers. In roofing it is necessary to lay the slates in two thicknesses, so that the sloping joints may be covered by the overlap of the course above, and the third course must also cover the first by an inch or two, to prevent rain from penetrating. Slate for interior decoration is subjected to a process called marbling, which consists in coating it with materials which give the surface a veined appearance like marble.

The value of the slate produced in the United States in 1901 was $4,787,525. Most of this product was used for roofing purposes. The exports amounted to $898,262, a large part being shipped to Great Britain.

BIBLIOGRAPHY. Merrill, *Stones for Building and Decoration* (New York) and "The Strength and Weathering Qualities of Roofing Slates," *Transactions of American Society of Civil Engineers*, September, 1892, and December, 1894; Dale, "The Slate Belt of Eastern New York and Western Vermont," in *Nineteenth Annual Report of United States Geological Survey*, pt. iii. For statistics, see volumes on Mineral Resources issued annually by United States Geological Survey.

See METAMORPHISM; SHALE; BUILDING STONE.

SLATER, JOHN FOX (1815-84). An American manufacturer and philanthropist, the nephew of Samuel Slater (who introduced in this country the business of cotton-spinning), and grandson of William Slater, of Belper, Derbyshire, England. John F. Slater (son of John Slater) was born at Slatersville, R. I., and after a good academic training took charge of his father's woolen mill, at Hopeville, Conn., and of a cotton mill near by, at Jewett City. In 1842 he removed to Norwich, Conn. (still retaining with his brother William S. the business of a cotton manufacturer), and there he remained till his death. He was a liberal benefactor of local institutions, and as his years advanced he determined to set apart $1,000,000 for the education of "the freedmen." (See SLATER FUND.) Congress voted thanks to Mr. Slater for his beneficence, and caused a gold medal to be struck in commemoration of it. Consult the "Memorial," privately printed in Norwich, Conn. (1885).

SLATER, SAMUEL (1768-1835). An American manufacturer, founder of the cotton-spinning industry in the United States. He was born in Derbyshire, England. He acquired a thorough knowledge of cotton-spinning under Jedediah Strutt, the partner of Richard Arkwright, and in 1789 emigrated to the United States for the purpose of introducing the industry there. He left England secretly for fear attempts would be made to prevent him from carrying his knowledge and skill to a foreign country. In January, 1790, he proceeded to Pawtucket, R. I., where he entered into a contract to build and equip a mill with spinning machinery modeled on the Arkwright system. After great labor and several failures the machinery was completed and the spindles were set to work on December 21, 1790. In 1806, in conjunction with his brother, John, he constructed extensive cotton mills on the site of the present town of Slatersville, R. I., and there accumulated a large fortune. By 1810 there were in the United States 100 mills in operation, all constructed on the Arkwright system after the Slater models. In 1812 Slater constructed mills at Oxford, Mass., and

in 1815-16 erected woolen mills. Consult White, *Memoir of Samuel Slater* (Philadelphia, 1836).

SLATER FUND. An endowment established by John F. Slater (q.v.) in 1882 for the encouragement of industrial education among the negroes in the South. In May, 1882, Mr. Slater transferred $1,000,000 to a board of trustees, incorporated by the State of New York, of which President R. B. Hayes was the original chairman. By good management this fund in 1903 had grown to the amount of $1,500,000, and the annual income—not far from $60,000—is at the disposal of the trustees for the uplifting of the blacks in the Southern States. Bishop Haygood, of Georgia, and Dr. J. L. M. Curry, of Richmond, Va., have been the general agents of this fund. The trustees have given their influence to the promotion of normal and industrial training, and have made large appropriations to the Hampton and Tuskegee institutes, and lesser amounts to several kindred and well-managed institutions.

SLATIN PASHA, slä'tên pä-shä', RUDOLF KARL (1857—). An Egyptian soldier, born near Vienna, Austria. He served for a time in the Austrian army, in 1878 entered the Egyptian service under General Gordon, and in 1881 became Governor-General of Darfur. Not long after his appointment to this post the Mahdi began his famous religious war, and in 1883, after the defeat of Hicks Pasha, Slatin gave himself up as a prisoner. He became the servant of Abdullahi, who afterwards succeeded to power on the death of the Mahdi. After a captivity of eleven years Slatin succeeded in 1895 in escaping to Lower Egypt. Upon reaching Cairo he was made a pasha by the Khedive. Afterwards he took part in the campaigns that resulted in the complete overthrow of Abdullahi. In 1900 he was appointed inspector-general of the Sudan. He published an account of his experiences in captivity under the title of *Feuer und Schwert im Sudan* (1896). A translation, *Fire and Sword in the Sudan*, was brought out in New York in the same year.

SLAUGHTER-HOUSE CASES. The term popularly applied to a group of notable cases decided by the United States Supreme Court at the December term of 1872, and reported in the sixteenth volume of Wallace's Reports. The cases arose out of an attempt of the Legislature of Louisiana to place far-reaching restrictions upon the butchery industry in the interest of the public health in the city of New Orleans. The restrictions practically amounted to a denial of the right of the general public to engage in the business, and suits were brought to overthrow the statute on the ground that it was an infringement upon the Fourteenth Amendment to the Constitution of the United States. The cases were carried to the Supreme Court, where it was held by a majority of 5 to 4 that it was not the purpose of the Fourteenth Amendment to deprive the States of their police power; that this remained with them unimpaired; that there is a citizenship of the United States and a citizenship of a State, which are distinct from each other, and that the privileges and immunities belonging to the latter must rest for their security and protection where they had theretofore rested, namely, upon the States. The doctrine here laid down constitutes an important feature of our Federal jurisprudence, and its announcement by the Supreme Court was regarded as the beginning of a reactionary movement against the tendency upon the part of the Federal Government, which was quite marked during and after the Civil War, to usurp the powers of the States.

SLAUGHTER HOUSES. The first attempt to regulate the conduct of establishments where animals are slaughtered for food probably was made during the reign of Richard II., for in 1388 an act of Parliament forbade the casting of offal and other refuse of slaughtered animals into rivers and other waters. During the nineteenth century a national system of municipal slaughter houses was established in France and Germany and an agitation for a similar system of public ownership was under way in Great Britain and had been established in many towns. This great public improvement originated with Napoleon, who passed a decree in 1807 for the erection of public abattoirs.

In Germany each town council has authority to erect and maintain public slaughter houses and to forbid the slaughtering of meat elsewhere. It may enact that fresh meat brought from outside this area for the use of restaurants and hotels shall not be prepared for food until it has been inspected. The importation of prepared meats may be, at the discretion of the town council, entirely prohibited. The council may also order that meat not slaughtered at the public slaughter houses shall be exposed for sale in a separate place by meat dealers.

In many of the German cities, not only slaughter houses, but also markets for the sale of meat, usually located in the suburbs, are maintained at public expense.

England is far behind Germany in the regulation of the slaughter and sale of meat. Inspection has not been made compulsory by Parliamentary enactment, nor has the maintenance of municipal slaughter houses been authorized. Several towns, however, have secured such authority by special legislation. Abattoirs were opened in Edinburgh in 1851, and in Manchester in 1872. Birmingham has a city market, which includes most of the appliances of the best German markets, but is located in the centre of the city. Its cost, including an expensive site, was $600,000. Throughout Europe the construction of municipal abattoirs has been general, and they are now considered necessary in order that not only the slaughtering of animals, but also the inspection of meat, may be concentrated and regulated. In Berlin two municipal slaughtering establishments, erected at a cost of nearly $5,000,000, were opened in 1883 and took the place of nearly 1000 slaughter houses privately owned.

In the United States, though there are no municipal abattoirs, the consolidation of a very large proportion of the business of slaughtering, dressing, packing, and shipping meat in a few immense establishments has greatly lessened the number of private slaughter houses and correspondingly lessened the need for municipal slaughter houses. The market value which has arisen for what were formerly considered waste products has simplified the problem of disposing of the offal. (See PACKING INDUSTRY.) Such regulations as exist are due largely to municipal rather than State or national control, and therefore vary with the localities. Consult: Parke, on *Municipal Authorities and Slaughter Houses*, read before the Sanitary Institute at

Birmingham, England, in 1898; also Maltbie, *Municipal Functions* (New York, 1898), and Shaw, *Municipal Government in Continental Europe* (ib., 1895).

SLAVE COAST. A geographical name for a division of the coast of Upper Guinea, washed by the Bight of Benin. It owes its name to the active slave trade which was formerly carried on in this region. See DAHOMEY; BENIN.

SLAVERY (from *slave*, from OF. Fr. *esclave*, from MHG. *slave*, *sklave*, Ger. *Sklave*, slave, Slav; originally referring to Slavs taken by the Germans in war). *Legally*, that status of an individual or individuals characterized by the perpetual and almost absolute loss of personal and political liberty; *socially*, an institution defined by law and custom similar to patria potestas, comitatus, clientela in personal dependence and to villeinage, vassalage, serfdom, servitude, and apprenticeship in personal and economic subjection and common incidents, but distinguished from them as the most absolute and involuntary form of human servitude.

The slave is the property, chattel or real, of his master, and cannot participate in the civil right of personal freedom, though, except in strict Roman law, he may enjoy limited personal rights. Slavery represents a stage in social or industrial organization and development. It probably coincides with the beginnings of settled agricultural tribal life, but its ultimate origin is in dependence resulting from inequality of capacity or opportunity between individuals or sets of individuals brought into competitive relations. Whether recognized by common, statutory, or international law, slavery is a developing status varying its character in place and time as defined by local law and custom. Slavery, either by historic contact, slave trade, or independent origin, existed anciently among Babylonians, Assyrians, Egyptians, Hebrews, Persians, Phœnicians, Greeks, and Romans, and in India, China, and Africa. It is interpreted in ancient monuments and literature and locally defined by law. Philosophic justification of slavery, ancient and modern, rests historically upon natural subjection and difference of race or creed, or both. But nationals as well as barbarians, heathen, and heretics have been enslaved by all races. Classical philosophy, Hebrew and other ancient religions, Brahmanism, Buddhism, Christianity, and Mohammedanism sanctioned the institution, but its essential sanction rested in law defining the status and its incidents. Of the chief sources of slavery (capture in war, man-stealing, purchase, birth by a slave parent, and action of law), capture was most prevalent in early society. Hebrew, Greek, and Roman slavery, recruited from all these sources, more often than modern slavery, applied to a subject the equal or superior of his master. An extensive slave trade with the Mediterranean islands, Asia Minor, Africa, or Southern Europe aided to fill Athens, Corinth, Ægina, and Italy with vast numbers of slaves, numbering often thrice the free men. At Sparta conquered *helots*, owned by the State but let to individuals, numbered seven to one Spartan.

The incidents of Greek, Roman, and American slavery are strikingly similar, but Rome's warlike and organizing genius gave the institution greater legal definiteness and harshness. In each country the slave was sold, hired, seized for debt, and treated as his master's property, chattel or real. He was controlled by whipping, branding, fetters, exile, or by the tie of mutual affection in the family of which he was one. He had customary limited rights of marriage, property, maintenance, contract, religion, and personal security and sanctuary (in Greece). Post-Homeric Greece, the later Roman Empire, and some American colonies of the eighteenth century legalized his right to life and limb. Previously Roman slaves were 'things' in the master's *dominica potestas*, subject to life and death, torture, mutilation, crucifixion, gladiatorial combat, and work in mines under drivers; but were, like American slaves, superior to Greek in having greater opportunity to obtain their freedom. Greek and Roman freedmen gradually became free men. Classical and American slave labor was prædial, domestic, industrial, clerical, and public. Rome denied slaves civil or military service. Many Greek and Roman slaves entered learned professions. Italian latifundia worked by slaves destroyed free-hold yeomanry and increased, with harsh treatment, danger of servile insurrection. Serious revolts occurred in Greece and Rome, and later in the West Indies, but North America suffered only minor local insurrections, such, for instance, as Gabriel's Insurrection (q.v.) and Nat Turner's Insurrection. (See TURNER, NAT.) The closing of Roman conquest, *jus naturale*, and Christianity, modified the rigid chattel conception of *jus civile* and *jus gentium*, and law gave the slave personality and protection. Finally Justinian enlarged the *coloni*, men personally free but tied to the soil like serfs. Thereafter slavery, the chief labor system since the Punic Wars, though practiced by Rome's Teuton conquerors, was gradually replaced in mediæval Europe by feudal vassalage, villeinage, or serfdom, particularly where German and Roman life came in close contact. Serfdom persisted to modern times, surviving in Russia until 1861. See SERF.

Slavery and the slave trade, continued by mediæval Venice, the Saracens, Tatars, Turks, and African tribes, were freshly extended by Mohammedans in Africa and Asia, who made subject alike Christians, heathen, whites, and blacks. Negro slavery was a long established African tribal custom with debtors, criminals, vagrants, and captives. The commercial expansion of Portugal incidentally began the African slave trade in modern Europe and America. Through kidnapping and from Moorish slavers Prince Henry of Portugal received negro slaves in 1442, and two years later began the European slave trade from the west coast of Africa. For a half century Portugal monopolized the traffic, which finally embraced the Spanish possessions in America, where Indian slavery established by Spain was exterminating the natives. Spain entered the slave trade in 1517; the English (under John Hawkins) in 1553, and France in 1624; they were followed by Holland, Denmark, and the American colonies. The market was the West-European countries and their colonies in America, particularly the Spanish West Indies. England finally took the lead in the commerce, granting from the time of Elizabeth to 1670 five separate patents for its monopoly to favored merchants and companies. Between 1712 and 1749 the exclusive supply of the Spanish colonies was

granted by Spain to the English South Sea Company. Thereafter all Englishmen could enter this field and continue their former trade to the English colonies. Of the total number of slaves imported previous to the American Revolution, British subjects probably carried half, employing in one year 192 ships, carrying 47,000 slaves. Often a fourth of the slaves perished in the overcrowding of the 'middle passage.' Massacre and the torch marked the track of the kidnapping African slaver and numbers of slaves died during the process of 'seasoning,' or acclimatization in their new homes.

Research has proved that the first negroes landed at Jamestown in 1619 and others brought by early privateers were not reduced to slavery, but to limited *servitude*, a legalized status of Indian, white, and negro servants preceding slavery in most, if not all, of the English mainland colonies. Statutory recognition of slavery occurred in Massachusetts in 1641, in Connecticut in 1650, in Virginia in 1661, and later in the other colonies. Jews, Moors, and Turks were also subjects of colonial slavery. Indian slavery was confined chiefly to the seventeenth century with the English, as their Indian captives were less profitable than those of the Spanish, who were subjected to more rigorous treatment. Slavery in the region now constituting the United States was patriarchal. Statutory law and court decisions added to such incidents of *servitude* as alienation, whipping, disfranchisement, limited marriage, trade, etc., first the incident of perpetual service and then a denial of civil and juridical capacity, as well as of marriage, property, and possession of children, thus creating slavery. The slave, contrary to the famous *obiter dicta* in the Dred Scott decision (see Dred Scott Case), had some legal rights, such as limited personal agency, security (after 1788), support in age or sickness, a right to limited religious instruction, and suit and evidence in special cases. Custom gave numerous rights, such as private property, marriage, free time, contractual ability, and to females domestic or lighter prædial labor, which, however, the master was not bound to respect. Barbarities like mutilation, branding, chaining, and murder were regulated or prohibited by law, but instances of cruelty were not infrequent before the nineteenth century.

It was a mooted point in the courts of the former slave-holding States of the United States whether a slave had any rights under the common law which the master was bound to respect. There was very little precedent in the English law, and under the early Roman law a master had absolute power of life and death over his slaves, who were generally captives taken in war. In 1820 a Mississippi court held that under the common law the wanton killing of a slave was murder. In 1851 the Supreme Court of Georgia repudiated the reasoning advanced for the above conclusion, contending that a master had absolute dominion over a slave under the common law. The first legal provision in America on this subject seems to have been a Virginia statute of 1723, making the willful killing of a slave murder. In 1770 a colonial act prohibited the malicious and unnecessary killing of slaves by white men. However, in most of the Southern States, statutes were enacted prohibiting the wanton killing or mutilation of a slave, thus finally disposing of the question. Slaves were liable under the criminal laws of the States in which they lived. Most of the slave States also passed statutes securing to slaves certain other rights, such as to be treated in a humane manner, to receive medical attention when ill, and to be provided with the necessaries of life when from old age or other causes they were unable to work.

With such humane provisions recognition of a slave as a person ceased, and for all other purposes he was regarded as a chattel, subject to the will of his master, and a thing to be bought and sold. The law of personal property was applied in governing his ownership. The children of a slave mother belonged to her owner, irrespective of who owned the father. In most of the Southern States the marriage of slaves was not recognized in law, though perhaps generally encouraged by slave-owners from religious or moral principles. The legal duties and priviliges of the marriage relation were considered to be incompatible with the duties owed by the contracting parties to their owners. The question of the legal status and effect of a slave marriage has become important since the general emancipation of the slaves in determining the descent and distribution of property of former slaves. Generally, the States in which slavery flourished have enacted statutes providing for legalizing such marriages by certain formalities, and in a few States continued cohabitation merely, after emancipation, was held sufficient. However, it is doubtful if any of these States would recognize as valid a marriage contracted during slavery and followed by separation before emancipation.

A slave could not hold property, and anything acquired by him belonged to his master. The testimony of a slave would not be received in a civil action in which a white person was a party. However, slaves could testify in a criminal suit in which other slaves were defendants, or in actions to secure their freedom. The right of an owner to give a slave his freedom was recognized, and a free negro could hold property.

Sentiment against the increase of the negro population and the slave trade early developed in America. English colonies by numerous statutes from 1695 imposed duties to discourage or prohibit slave traffic, but British merchants and commercial policy defeated these efforts. The enforced slave trade appears in State constitutions, and in the first draft of the Declaration of Independence as a justification of the American Revolution. Virginia by protest in 1772, Connecticut by statute in 1774, and Delaware by her Constitution in 1776 attempted to stop the trade, and Virginia, by an act of 1778, was the first political community to prohibit it with efficient penalties. Similar action in nine other States during 1783-1789; abolition of slavery in Massachusetts and Pennsylvania in 1780; the desire of John Jay to make prohibition a feature of the Treaty of Paris of 1783; the struggle for prohibition in the Federal Convention, resulting in the compromise limiting the duration of the trade to twenty years, at the end of which period the United States passed the act of 1807 abolishing it, show the priority and force of American sentiment against the slave trade. Similar sentiment developed in Europe. Denmark by royal order prohibited the trade after 1802 in her pos-

sessions. France, following the doctrine of her Revolution, abolished her colonial slavery and slave trade in 1793, but Napoleon soon undid the work of the Convention. Napoleon's decree of March 29, 1815, however, confirmed by the Treaty of Paris and a law of 1818, made the trade illegal. In England Dellwyn, Sharpe, Clarkson, and Wilberforce began to organize anti-slave trade opinion in 1787. In 1788 Dolben and Pitt moved bills for its regulation or suppression. But mercantile interests repressed the movement until 1806, when the Grenville-Fox Ministry secured the passage of acts for the partial abolition of the slave trade, which were followed by an act on March 25, 1807, for total abolition.

The Jay-Fox *entente* of 1783 paved the way for the joint pledge of England and the United States, in 1806, to strive for international abolition. This object appears in treaties of England with Denmark, Portugal, and Sweden, during 1810-1814. France then pledged aid to British advocacy of abolition in the Congress of Vienna. The Netherlands, by royal decree in 1814, abolished the traffic. Spain restricted it, and Portugal in 1815 agreed to prohibit it in the Northern Hemisphere. In the Treaty of Ghent the United States and Great Britain again pledged their endeavors for suppression. The United States by supplementary acts in 1818 and 1819 endeavored to enforce her prohibition. From this time to 1840 England's chief efforts were bent on establishing an international right of search in time of peace to stop the illicit slave traffic, which increased from 40,000 a year in 1820 to 200,000 in 1837. In 1827 Portugal and Brazil promised to abolish the trade in 1829. A second time England interested a European congress, that of Verona in 1822, against the trade, now carried on with 352 ships. England urged a declaration in international law making the trade piracy, but secured, as at Vienna, only a general denunciation of the traffic. The United States and other Powers opposed right of search in time of peace as dishonor to the flag and a means of securing England's naval supremacy. (See SEARCH, RIGHT OF.) Though not a party at Verona, the United States promptly favored international declaration of the slave trade as piracy, and prepared a treaty with England to this effect in 1824. But, as England was unwilling to yield her claim to search in American waters, the Senate rejected the treaty and the United States could only urge the international declaration. By 1833 Sweden, France, Denmark, the Hanse Towns, and some Italian States had agreed in part to England's contention for mutual search, but slavery had become such a delicate question in American politics at this time that the United States refused England's proposed concessions. In 1842 the United States and England agreed on joint naval cruising on the African coast to repress the trade. English statutes in 1824 and 1837 made the slave trade piracy punishable by death or life transportation. Conferees of England, France, Austria, and Prussia, in London, in 1838, proposed the Quintuple Treaty of December 29, 1841, declaring the trade piracy and admitting mutual right of search. On account of this admission France refused to ratify, and Lewis Cass (q.v.), the American Minister at Paris, denied its application as international law to the United States. Belgium joined, in 1845, in the Quintuple Treaty, and the United States, though refusing England's invitation to an international conference in 1860, completely changed attitude with the advent of Lincoln and Seward, admitted mutual right of search in 1862, and imposed the death penalty on smugglers of slaves. Suppression was organized, but until 1866 required a United States naval squadron on the African coast. The French, Spanish, Portuguese, and United States flags had protected slavers. Northerners sold to Southerners in Florida, Texas, and Cuba, but the Confederacy in 1861 declared against the trade. The Civil War and the Thirteenth Amendment practically and legally completed the extinction of slavery and the slave trade in the United States. The English, inspired by Livingstone, sought to put an end to the slave trade in the Sudan, but the efforts of Baker and Gordon proved ineffective in the face of the Mahdist convulsions. Tewfik, however, prohibited the Egyptian slave trade in 1884. The Powers in the Berlin Conference in 1884-85 promised their efforts for repression, and in 1890 an act for this purpose resulted from the international conference, including Turkey, Persia, Zanzibar, and the United States, invited by Leopold of Belgium. Enforcement of the General Act of Brussels is encouraging if slow, but if conscientiously done will end a trade now connived at even by officials of the Congo Free State.

The anti-slavery sentiment and the movement aimed against the existence of the institution of slavery followed and in many cases coincided with, or were affected by, those against the slave trade from early colonial duties and taxes to steps for repression and emancipation. Promoted by the same, though a more limited and sometimes excitable public, including distinguished statesmen, authors, humanitarians, and sectarians, the movement originated and first rose to importance in North America and England. Eighteenth-century Christian sentiment, particularly among Friends, encouraged customary and legal manumission and the mitigation of slave codes. Justice Lord Mansfield's decision in 1772 freed slaves, like the negro Sommerset, brought to the soil of Great Britain. English emancipation societies arose in 1783, and French in 1788. Slaveholders like Washington, Jefferson, Henry, Mason, and Madison, and other statesmen, such as Franklin, Hamilton, and Adams, condemned slavery in principle, and emancipation was accomplished or in progress in every Northern State except New Jersey by 1799. Jefferson proposed in 1784 to prohibit slavery in the Northwest Territory, and he also advocated emancipation for Virginia in 1779. Tucker prepared another Virginia emancipation plan in 1796, New Jersey emancipated her slaves in 1804, and Congress limited the slave trade in Louisiana. The movement in its first stage rested chiefly on a moral or an economic basis, but soon became political. American anti-slavery organizations began from Pennsylvania petitioning Congress for Federal interference with slavery. Congress denied its constitutional competency to regulate the domestic institution beyond the slave trade; but petitions continued, and the sentiment of the North and South, united in the Ordinance of 1787 (see NORTHWEST TERRITORY), but divided

in the Constitutional Convention, was increasingly committed, respectively, to an anti-slavery and a pro-slavery programme. A movement toward united sentiment and national organization to solve the slavery and free negro questions by emancipation and colonization took tangible shape in the American Colonization Society, 1816, and its affiliated State societies. (See COLONIZATION SOCIETY.) Though patronized by statesmen and divines, such as Madison, Harper, and Breckenridge, by many slaveholders, and by the Federal Government, this movement, which resulted in the establishment of a negro colony in Liberia, was viewed by extreme anti-slavery men as a pro-slavery reaction.

From 1818 to 1820 political anti-slavery sentiment became more prominent, opposing particularly slavery extension. Dissatisfaction in the North with the Missouri Compromise (q.v.) laid the basis of abolitionism. William Goodell with his *Investigator* in Rhode Island, and Benjamin Lundy (q.v.) with his *Genius of Universal Emancipation*, established in 1821, began an anti-slavery press, while Lundy went on lecture tours, and endeavored to find a slave asylum in Texas and Mexico. John Rankin formed an abolition society in Kentucky, and William Lloyd Garrison (q.v.), supported by Arthur and Lewis Tappan, established the *Liberator* at Boston in 1831. The era of expansion and reformation, mechanical, moral, and political, then beginning, favored the increasing anti-slavery societies and press, such as Griswold and Leavitt's *New York Evangelist* and Goodell's *Genius of Temperance* (1830) and *Emancipator* (1833), the New England Anti-Slavery Society, founded in 1832, and the New York City and the American anti-slavery societies, founded in 1833. The last resulted from a National Anti-Slavery Convention in Philadelphia representing every Northern State. These agencies distributed broadcast tracts, books, pamphlets, and business labels denouncing slavery. The abolitionists denounced slavery and slaveholding as crimes, demanded immediate and unconditional abolition without compensation, encouraged breach of slave laws and unconstitutional measures, and affirmed natural equality of persons. Garrison, Lovejoy, Phillips, Gerrit Smith, John Brown, Hutchinson, Storrs, and Birney became leaders. Channing, Emerson, Bryant, Whittier, Lowell, and Longfellow gave literary and moral support to reasonable anti-slavery methods, but less conservative men in border free States manipulated an 'underground railway' to Canada for fugitive slaves. (See UNDERGROUND RAILWAY.) John Quincy Adams and others fought for the right of petition concerning slavery and constitutional abolition. Southern apologists, such as Dew, Dabney, Smith, and Fitzhugh, answered the polemics culminating in Mrs. Stowe's *Uncle Tom's Cabin*, 1852, a protest against the Fugitive Slave Law; and the paper war raged till Lincoln's election assured the anti-slavery victory and made actual war inevitable. President Lincoln issued his famous emancipation proclamations on September 22, 1862, and January 1, 1863, and the Thirteenth Amendment (1865) practically and legally secured the success of the abolitionists by Federal abolition.

Great Britain, where Clarkson and Wilberforce had been the most prominent leaders in the anti-slavery movement, pursued a less radical method of abolition, providing by law in 1833 for future and progressive emancipation in her West Indian colonies and compensating slaveholders by purchase and an apprenticeship subsequently limited to 1839. In 1843 she abolished slavery in India. Sweden followed with colonial abolition in 1846; France in 1848; Holland in 1859; Brazil with progressive emancipation in 1871, and total emancipation in 1888; Spain in Porto Rico in 1873, and in Cuba in 1880; Great Britain and Germany in their African protectorates in 1897 and 1901; the United States in the Philippines in 1902; and Egypt in the Sudan. The South American republics abolished slavery when they emancipated themselves from the yoke of Spain.

Mohammedan countries have been the last to feel this influence, and slavery exists in Turkey, Persia, Egypt, Zanzibar, Pemba, Tripoli, Morocco, and Central Africa, but in almost all steps favoring liberty or mitigation of status have been taken. Of 100,000 slaves in Zanzibar and Pemba in 1897 half that number were freed by 1903.

Slavery was chiefly a moral and economic question in the American colonies, but it appeared as a political one during the Confederation, particularly in the debates of the constitutional and ratifying conventions, when the question of submitting it and other States' rights to Federal initiative arose. The dictum of natural equality and inalienable rights in the Declaration of Independence, even when reappearing in bills of rights, could not be practically applied except in limited cases, as by George Wythe in Virginia, to the liberation of slaves. But Northern emancipation provisions showed that the economic and social basis in the North was to be increasingly laid in free labor and a farm system contrasting with the slavery and plantation system of the South. Economic and social sectionalism in the colonial period rapidly became political in the federal. From 1787 Mason and Dixon's Line (q.v.) had political significance; slavery as one of the basal elements of the difference of sectional interests and sentiment rose from a local State question into the most important and permanent in national politics. Controlling conditions were: (1) Increasing sectionalism from localization of industrialism in the North; (2) constitutional compromise provisions granting Federal legislation in regard to the slave trade and fugitive slaves, and representation for slaves on the three-fifths basis; (3) a Federal domain increasing by cession, purchase, treaty, and conquest and subject to Federal organization and representation in Congress; (4) the growth of political parties opposed as to constitutional construction; (5) sectionalized anti-slavery sentiment, and (6) development and expansion of Southern staples adapted to slave labor, especially cotton after the invention of the cotton gin in 1793. The Constitution purposely avoided the use of the terms 'slave' and 'slavery,' yet the bargain of South Carolina and Georgia with commercial New England riveted upon it recognition of the institution. Slavery had thus two connected phases: (1) As to its existence in the States, a State right, a local question, involved in national politics in the general States' rights struggle; (2) as to its existence and extension in Federal territory, a national question,

constitutionally subject to Federal legislation. National expansion necessarily brought it into politics. Support of members from the slave States in Congress secured the ordinances of 1784 and 1787, prohibiting slavery in the Northwest Territory and preparing the way for new free States. In 1793 Congress passed almost unanimously a fugitive slave law to secure owners in their property. (See FUGITIVE SLAVE LAW.) The bill abolishing the slave trade renewed sectional debate and showed predominant anti-slavery sentiment in the North. Between 1803 and 1817 four States, two free (Ohio and Indiana) and two slave (Louisiana and Mississippi), were admitted into the Union, and the theory of balance of power between slave and free States was established. But the further organization of the Louisiana territory in 1818-20 drew the issue sharply on slavery extension. Only temporary political adjustment of slavery followed the Missouri Compromise (q.v.) prohibiting slavery north of 36° 30′ N. latitude, except in Missouri. From 1820 to 1830 tariff and public land policy were, together with slavery, the issues conditioning the life and expansion of the Southern and Northern economic systems. Non-extension was interpreted as eventual extinction of slavery. Discussion of tariff bills in 1824 and 1828, dogmas of nullification, State rights, and abolition, and the Hayne-Webster debate of 1830, greatly increased the importance of slavery in sectional politics and made it the leading question after the tariff compromise of 1833. Anti-slavery men who believed in attaining their ends through constitutional methods and abolitionists organized the Liberty Party (q.v.), and twice in 1840 and 1844, nominated J. G. Birney (q.v.) for President. The annexation of Texas in 1845, and the Mexican War in 1846-48, were pro-slavery victories, the latter adding territory from which the unsuccessful Wilmot Proviso (q.v.) failed to exclude slavery. There now arose over the question of slavery a controversy destined to split both Whigs and Democrats, to bring about new party alignments, and eventually to hasten, if not cause, a great civil conflict between the North and the South. By 1848 Oregon (q.v.) was organized without slavery, and the Free Soilers, who strove for the exclusion of slavery from the Territories (see FREE SOIL PARTY; TERRITORIES), had taken the place of the Liberty Party. The anti-slavery cause won in the Compromise of 1850 in free California, and slave trade prohibition in the District of Columbia, but lost in a fugitive slave law federally executed. (See COMPROMISE MEASURE OF 1850.) Douglas's mistake in the repeal of the Missouri Compromise and his substitution for the arrangement then effected of 'squatter sovereignty' by the Kansas-Nebraska Bill (q.v.) in 1854, precipitated a sectional struggle for possession of Territories by colonization and border warfare. (See KANSAS.) The free-State settlers practically won in 1857, and the Republican Party, absorbing Anti-Nebraskans, Free Soilers, Abolitionists, and Anti-slavery Whigs and Democrats, completed the victory, though the Dred Scott decision opened the Territories to slavery. Cuban annexation, which had been a pro-slavery policy since 1841, was defeated in 1859, and Lincoln's election following the John Brown raid of 1859 was the signal for the secession, 1860-61, of a South jealous of her State rights, and resentful of interference in slavery. Congressional acts in 1862 and Lincoln's emancipation proclamation in 1863 (a war measure), and the Thirteenth Amendment in 1865, legally destroyed the institution of slavery, while the Fourteenth and Fifteenth Amendments gave freedmen full civil rights. Consult: Goodell, *Slavery and Anti-Slavery* (New York, 1853); Hurd, *Law of Freedom and Bondage in the United States* (Boston, 1858-1862); Wilson, *Rise and Fall of the Slave Power* (ib., 1872-79); Wallon, *Histoire de l'ésclavage* (1879); Richter, *Die Sklaverei im griechischen Altertume* (1886); Ingram, *History of Slavery* (London, 1895); Du Bois, *Suppression of the African Slave Trade to the United States* (New York, 1896); *Documents relatifs à la répression de la traité des esclaves* (Bruxelles, 1901); *Johns Hopkins University Studies in Historical and Political Science,* 11th, 13th, 14th, 17th series, and extra volumes (Baltimore, 1889-1902); Tillinghast, *The Negro in America and Africa* (New York, 1902); Ballagh, *A History of Slavery in Virginia* (Baltimore, 1902); Von Holst, *Constitutional and Political History of the United States* (8 vols., new ed., Chicago, 1889), which gives an excellent account of the history of the slavery question in American politics; W. H. Smith, *A Political History of Slavery* (2 vols., New York, 1903); Olmsted, *The Cotton Kingdom* (2 vols., New York, 1861); and id., *Journey in the Seaboard Slave States* (New York, 1856), which give an interesting account of slavery in the Southern States.

SLAVIC LANGUAGES. A branch of the Indo-Germanic languages (q.v.). Among these languages Slavic is most closely connected with the Baltic group, which includes Old Prussian, Lettic, and Lithuanian. The most universally accepted theory places the original home of the Slavs within the borders of present Russia in the region lying between the upper course of the Don on the one hand and the Baltic Sea with the upper course of the Vistula on the other. The heart of this country belongs mainly to the basin of the Dnieper. The principal characteristics of the Slavic languages are as follows: (1) The disappearance of consonants and syllables at the end of words, as OChurch Slavic *dŭmŭ*, 'house'; Russian, Serb, Bulgarian, Slovenian, *dom*; Polish, Czechic, *dum;* Sanskrit, *damas;* Greek, *δόμος*, Latin, *domus.* (2) The monophthongization of primitive diphthongs, as OChurch Slav., *zima*, 'winter'· Russ., Serb, Bulg., Sloven, Pol., and Czech., *zima;* Lithuanian, *žëmà;* Gk., *χεῖμα, χειμών*; Skt., *hōmen;* Albanian, *dimen.* (3) Change of short *i* and *u* into indistinct sounds, *ĭ*, *ŭ*, in Old Slav. and their complete disappearance in Modern Slavic languages, as OChurch Slav., *vĭdova*, 'widow;' Russ., Czech., *vdova;* Serb, *udova;* Bulg., *vdovica;* Skt., *vidhávā;* Gk., *ἦϝλεος*, Lat., *vidua;* Goth., *widuwō.* (4) Development of nasal vowels, as OChurch Slav., *pętĭ*, 'five'; Pol., *pięć;* Skt., *páñca;* Gk. *πέντε*; Lat., *quinque;* Lith., *penki;* Ger., *fünf.* (5) Development of the peculiar sound *y* from the primitive *ū*, as OChurch Slav., *dymŭ*, 'smoke;' Russ., Pol., Czech., *dym;* Skt., *dhūmás;* Gk., *θυμός;* Lat., *fūmus;* OHGer., *toum;* Lith., *dúmai.* (6) Change of primitive intervocalic *s* into *ch* (*kh*) as OChurch Slav., *ucho*, 'ear'; Russ.,

Serb, Bulg., Pol., Czech., *ucho;* Lith., *ausis;* Lat., *auris;* Goth., *ausō.* (7) Change of primitive *k* to (a) *s*, and *ĝ*, *ĝh*, and *ḑ*, *ḑh* into *z*, as OChurch Slav., Russ., Serb, Slav., Bulg., Czech., *slovo*, 'word;' Pol., *słowo;* Gk., *κλυτός;* Lat., *inclutus;* OIrish, *cloth;* Skt., *śrutas;* (b) *ĝ*, OChurch Slav., *znati*, 'to know;' Russ., *znat;* Pol., *znać;* Gk., *γιγνώσκειν;* Lat., *gnoscere;* Skt., *jñā;* Goth., *kann;* OHGer., *knāen;* OIrish, *gnāth;* Lith., *žinóti;* (c) *gh*, OChurch Slav., *azŭ*, 'I;' Skt., *ahám;* Gk., *ἐγώ;* Lat., *ego;* Goth., *ik.* (8) Palatalization of *g*, *k*, *kh*, into (a) *ž*, *č*, *š* before the palatal vowels *e*, *i*, and *ь*, later into *z*, *c*, *s*, before *ě* and *i* resulting from primitive *oi*, *oi*, as (a) *ž*, OChurch Slav., *živŭ*, 'alive'; Lat., *vivos;* Gk., *βίος;* OIrish, *beo;* Goth., *qius;* Skt., *jivás;* Lith., *gývas;* *č*, OChurch Slav., *očese*, gen. sing. of *ok-o*, 'eye;' Russ., Serb, Slov., Bulg., Czech., Pol., *oko;* Lith., *akis;* Lat., *oculus;* Ger., *auge;* *š*, OChurch Slav., *ušesa*, nom. pl. of *ucho*, 'ear;' Russ., Serb, Slov., Bulg., Czech., Pol., *uši.* (b) *z*, OChurch Slav., *bozě*, loc. sing., and *bozi*, nom. pl. of *bogŭ*, 'God'; *c*, OChurch Slav., *člověcě*, loc. sing., and *člověci*, nom. pl. of *člověkŭ*, 'man;' *s*, OChurch Slav., *dušě*, loc. sing., and *dusi*, nom. pl. of *duchŭ*, 'soul.' (9) The preservation of the primitive free accentuation, the penultimate accentuation in Polish and the Czechic accent on the first syllable being of a decidedly late origin.

The first attempt at a scientific classification of the Slavic languages was made by Dobrovsky, who in his *Institutiones Linguæ Slavicæ Dialecti Veteris* (Vienna, 1822) divided them into a Western and an Eastern group. A later division was into Eastern, Southern, and Western. The most accurate plan would be to consider the several languages without trying to reduce them to groups. This Miklosich did in his *Vergleichende Grammatik der slavischen Sprachen*, where he arranges them as follows: Palæo-Slovenian, Neo-Slovenian, Bulgarian, Serbo-Horvatian (Serbo-Croatian), Little Russian, Russian, Czechic, Polish, Upper Lusatian, and Lower Lusatian. At present the following representatives are distinguished in the Slavic group: (1) Russian (with its Great Russian, Little Russian, and White Russian branches). (2) Bulgarian (with its Macedonian dialect). (3) Serbo-Horvatian, or Serbo-Croatian (Shtokavian-Servian in the South, and Chakavian-Horvatian in the West), with its (4) Slovenian or Kaykavian dialect in the West; (5) Czecho-Moravian, with its (6) Slovak dialect; (7) Serbo-Lusatian or Sorbian (with the Upper Lusatian and Lower Lusatian dialects); (8) Polish, with (9) Kashubian; (10) Polabian (along the Elbe), now extinct, and (11) Old Church Slavic. Though attempts at a genetic classification must be futile, the labors of scholars have ascertained a number of phonetic peculiarities which may be made the basis of a conventional grouping, as being a common characteristic of several members of the group. The distinguishing features of the groups designated above as Eastern, Southern, and Western are the following: (1) Treatment of the sound combinations *tj*, *dj;* (2) presence or absence of *l* in the treatment of the primitive combinations *pj*, *bj*, *vj*, *mj;* (3) retention or dropping of the dentals *t*, *d*, in the combinations *tl*, *dl*, *tn*, *dn;* (4) treatment of the primitive combinations *ar*, *al*, *er*, *el;* (5) treatment of the original combinations *gv*, *kv.* On the basis of these criteria the groups will be characterized as follows: (1) *tj* becomes *č* in Eastern Slavic, as *svěča*, 'candle,' for **svět-ja;* *št* in Bulgarian, as *svěšta*, *o* in Serb, as *svěca;* Slov., *svéča;* *o* (= *ts*) in Western Slavic, as Czechic, *svíce;* Polish, *swieca;* *dj* becomes *ž* in Russian, *meža*, 'boundary line,' for **medja*, cf. Lat. *medius* (= English *j* in Serb, *meda;* Sloven., *méja*, *žd* in Bulg., *mežda*, in Western; *z* in Czechic, *mieze;* *dz* in Pol., *miedza.* (2) *pj*, *bj*, *vj*, *mj*, become *plj*, *blj*, *vlj*, *mlj* in Russian, *toplju*, 'heat,' infinitive *topit;* *ljublju* 'I love,' infinitive *ljubit;* *lovlju*, 'I seize,' infinitive *lovit;* *zemlja*, 'earth,' for **zemja;* also in Southern Slavic, as Serb, *toplen*, *lublen*, *lovlen*, *zemlja;* Slov. (Eastern), *topljen*, *ljubljen*, *lovljen*, *zemlja* (Western), *topjen*, *ljubjen*, *lovlen*, *zemla;* Bulg., *topjǫ*, *libją*, *lovją*, *zemja;* while in Western the sound *l* is absent, as Polish, *topię*, *lubię*, *łowię*, infinitives *topić*, *lubić*, *łowić*, *ziemia;* Czechic, *topu*, *lovu*, infinitive *topiti*, *loviti*, *země;* (3) *t* and *d* before *l* and *n* fall in Russian, as *plel*, 'I led,' *vel*, 'I wove,' to *pletu*, 'I lead,' *vedu*, 'I weave;' in Southern, as Serb, *pleo*, *veo*, Slov. (Eastern), *plel*, *pléo*, *vel*, (Western) *pletl*, *vedl;* but are retained in Western: as Czech., *pletl*, *vedl;* Pol., *plótł*, *wiodł;* (4) *ar*, *al*, *er*, *el*, become *oro*, *olo*, *ere*, *ele* in Russian, as *boroda*, 'beard;' *golova*, 'head;' *bereg*, 'shore;' *peleva*, 'membrane;' *re*, *la*, *rě*, *lě* in Southern Slavic, as *brada* (Serb, Slov., Bulg.), *glava* (Serb, Slov., Bulg.), *breg* (Serb, Bulg.), *brěg* (Slov.), *pléva* (Serb), *pléva* (Slov.), *pléva* (Bulg.); in Western Slavic *ra*, *la*, *re*, *la* in Czechic, *brada*, *hlava*, *břeh*, *pleva;* *ro*, *lo*, *rze*, *le* in Polish, *broda*, *głowa*, *brzeg*, *plewa;* (5) *gv* and *kv* become *zv*, *sv* in Russian and Southern Slavic, as Russ., Serb, Bulg., *zvězda*, 'star;' Slov., *zvézda;* *cvět*, 'color, flower,' Russ., Serb, Bulg., Slov., but remain in Western Slavic, as Czechic, *hvězda*, *květ;* Polish, *gwiazda*, *kwiat.* The Slavic nations do not all use the same alphabet for writing and printing. In the ninth century two different alphabets were introduced, the *Glagolitsa* (q.v.) and the *Kirillitsa* (q.v.). After a time the nationalities that accepted Roman Catholicism adopted the Roman characters for their alphabet, while those professing Greek Catholicism retained the alphabets mentioned. The Kirillitsa in a modified form is the present alphabet of the Russians, Servians, and Bulgarians.

With regard to the morphology of the Slavic languages the following table of the declension of *o*-stems will show at a glance how well the original Slavic inflection has been preserved in the modern members of the family, remembering that the vocative has been lost in Slovenian entirely and in literary Russian almost completely.

Singular: Nominative: OChurch Slav. *popŭ*, 'priest,' Russ., Pol., Czech., Serb, Slov., *pop;* genitive: *popa* for all; dative: *popu* for all; accusative: *popa* for all, or is like the nominative in inanimate nouns; vocative: OChurch Slav. *pope*, Little Russ. *pope*, Russ. *Boże* (from *Bog*, 'God'), Pol. *popie*, Czech., Serb., *pope;* instrumental: OChurch Slav. *popomĭ*, Russ. *popom*, Pol., Czech. *popem*, Serb, Slov. *popom;* locative: OChurch Slav., Russ. *popě*, Pol. *popie*, Czech. *popě*, *popu*, Serb, Slov. *popu.* Dual: Nominative, accusative, vocative: OChurch Slav., Slov., Serb, Lusatian, Kashubian *popa;* genitive, loca-

tive: OChurch Slav. *popu*, Russ. *vo-očiyu*, 'with one's two eyes,' Serb *očiju, ušiju*, 'with one's two ears' (used as genitive plural); dative, instrumental: OChurch Slav. *popoma*, Little Russ. *očima*, Slov. *popoma*. Plural: Nominative, vocative: OChurch Slav. *popi*, Russ. *popy*, for the rest *popi;* genitive: OChurch Slav. *popŭ*, Russ. *popov*, Pol. *popów*, Czech. *popuv*, Serb *popa*, Slov. *popov;* dative: OChurch Slav. *popomŭ*, Russ. *popam*, Pol. *popom*, Czech. *popům*, Serb *popima*, Slov. *popom;* accusative: OChurch Slav. *pop, popy*, Russ. *popov*, Pol. *popów*, Czech. *popy*, Serb, Slov. *pope;* instrumental: OChurch Slav. *popy*, Russ., Pol. *popami*, Czech. *popy*, Serb *popima*, Slov. *popi;* locative: OChurch Slav. *popěchŭ*, Russ., Pol. *popach*, Czech. *popich, popech*, Serb *popima*, Slov. *popih*.

With the phonetic laws given above it is easy to see the correspondence of the Slavic with the Indo-Germanic inflections.

Singular: Nominative: *vran-u*, 'raven,' Skt. *vṛka-s*, 'wolf,' Lat. *lup-us*, Gk. λύκ-ος; ablative (coinciding with the genitive in Slavic): *vran-a, vṛk-āt, lup-ō(d);* accusative: *vran-ŭ, vṛk-am, lup-um*, λύκ-ον; vocative: *vran-e, vṛk-a, lup-e*, λύκ-ε; locative: *vran-ě, vṛk-ē, Corinth-oi* (-i), 'at Corinth,' οἴκ-οι, 'at home.' Dual: Nominative, accusative, vocative: *vrana-a, vṛk-ā* (-*au*), *du-o*, 'two,' λύκ-ω. Plural: Nominative, vocative: *vran-i, lup-i*, λύκ-οι; genitive: *vran-ŭ, vṛk-ām* (-*ānām*), *div-ōm*, λύκ-ων; locative: *vran-ěchŭ, vṛk-ēṣu*, λύκ-οισι.

In conjugation the Slavic verb is well exemplified in the Old Church Slavic. (See OLD CHURCH SLAVIC LANGUAGE AND LITERATURE.) The following table will make clear the relations of the Slavic languages in this regard, both to each other and to Sanskrit and Greek:

Slav. *ničitože ne bystī*, 'nothing happened;' Russ. *nikto ne znayet*, 'no one knows;' Bulg. *tija pari ne sa ni na tebe*, 'that money is not thine;' Serb *nitko ne smje*, 'no one hears;' Czech. *nycz gemu ne odpowyedye*, 'he answers him not;' Polish *nic nie widzem*, 'I see nothing.' Another feature is the use of the genitive instead of the accusative after transitive verbs with a negative: OChurch Slav. *ne datŭ jesi kozĭlęte*, 'thou didst not give a lamb;' Russ. *ne imeyu knigi*, 'I have no book;' Serb *glasa ne izdvignu*, 'he did not send forth his voice.' This is carried even to the subject of the negative auxiliary verb when equivalent to the English, 'there is' or 'there are:' Serb *u mene vise nema blaga*, 'there is no greater good for me.' Another peculiarity is the complete substitution of the genitive for the accusative in nouns denoting animate beings in the singular and plural masculine, but only in the plural feminine: OChurch Slav. *ostavliša korablĭ i otĭca svojego*, 'leaving the ship and their father;' Russ. *vižu brata i sestru*, 'I see a brother and sister;' but: *vizu bratev i sester*, 'I see brothers and sisters;' Serb *imam majku i brata*, 'I have a mother and brother.' The possessive pronoun of the third person has usurped the functions of the other two when referring to the subject, in Russian invariably, in Old Church Slavic usually: OChurch Slav. *idi vŭ domŭ svoji*, 'go unto thine house;' *pomaži glavą svoją i lice tvoje umyji*, 'anoint thy head and wash thy face;' Russ. *Ya* (*ty*) *vidělŭ svoyego brata*, 'I saw (thou sawest) my (thy) brother.' In other respects the Slavic languages of the ancient period were obviously influenced by the syntax of their Greek originals, while at present the same is true to a certain extent regarding the influence of the modern languages.

VERB

No.	Person	Skt.	Gk.	O. Church, Slav.	Russ.	Pol.	Czech.	Serb	Bulg.	Slov.
Singular	1	*as-mi*	εἰμί	*jesmĭ*	*yesmĭ*	*jeśm* (old) *jestem* (new)	*som*	(*Je*)*sam*	*sŭm*	*sèm*
		bharāmi	φέρω	*bera*	*beru*	*bere*	*berem*	*berem*	*bera*	*bérem*
	2	*asi*	ἐσσί (Syracusan)	*jesi*	*yesi*	*jeś* (old) *jesteś* (new)	*si*	(*Je*)*si*	*si*	*si*
		bharasi	φέρεις	*bereši*	*bereš*	berieśz	*bereš*	*bereš*	*bereš*	*bereš*
	3	asti	ἐστί	jestĭ	yestĭ	jest	jest, je	je(st)	(J)e	je(st)
		bharati	φέρει	beretĭ	beretŭ	berie	bere	bere	beré	bere
Dual	1	svás	.....	jesvě	Lost	jeswa (old)	Lost	Lost	Lost	svà, svè
		bhārāvas	.....	berevě						beréva
	2	sthas	ἐστόν	jesta		jesta (old)				stà, stè
		bharathas	φέρετον	bereta						beréta
	3	stas	ἐστόν	jesta,-e		jesta (old)				stà, stè
		bharatas	φέρετον	bereta,-e						beréta
Plural	1	smas	εἰμές (Doric)	jesmŭ	yesmy	jeśmy (old) jeśteśmy (new)	sme	(je)smo	swe	sulò
		bhārāmas	φέρομες (Doric)	beremŭ	berem	beriemy	bereme	beremo	berém	berémo
	2	stha	ἐστέ	jeste	yeste	jeścię (old) jeśtescie (new)	ste	(je)ste	ste	stè
		bharatha	φέρετε	berete	berete	beriecie	berete	berete	beréte	beréte
	3	santi	ἐντί (Doric)	satĭ	sutĭ	są	sú, sa, jesú	(je)su	są	sô
		bharanti	φέροντι (Doric)	beratĭ	berut	berą	berú	beru	berąt	berô

In the syntax perhaps the most striking feature is the use of double negatives: OChurch

Consult: Miklosich, *Vergleichende Grammatik der slawischen Sprachen* (Vienna, 1852-75; vols.

i., iii., and iv. in 2d ed., ib., 1879, 1876, 1883); id., *Etymologisches Wörterbuch der slawischen Sprachen* (ib., 1886); Berneker, *Slawische Chrestomathie* (Strassburg, 1902), extracts in all Slavic languages, with special vocabularies for each section; Jagic, ed., *Archiv fur slawische Philologie* (Berlin, 1876 et seq.). See also the special articles on the individual languages and literatures.

SLAVONIA. The northeastern part of the autonomous province of Croatia and Slavonia (q.v.) in Austria-Hungary.

SLAVONIC ENOCH. A pseudepigraphical work extant only in a Slavonic version to which this name has been given in order to distinguish it from the Ethiopic Enoch. (See ENOCH.) In the manuscripts it bears the title *The Book of the Secrets of Enoch.* The existence of this work seems to have been unknown in modern times until 1880, when the South Russian recension was published by Popoff. The more complete version of Morfill and Charles was based on five manuscripts, of which two contain the complete text in Russian and Bulgarian recensions of the seventeenth and sixteenth centuries, one is an incomplete but valuable Servian codex of the sixteenth century, and two are fragmentary copies. Other manuscripts are known to exist. The Bulgarian text contains five additional chapters on Melchizedek.

The book was translated into the Old Church Slavic from the Greek, possibly in the ninth century. It is evident that the author was influenced by Hellenistic thought. Charles thinks it probable that he lived in Egypt, since he believed in the preëxistence and immortality of the soul, the seven natures of man, the egg theory of the universe and such monsters as the Phœnixes and Chalkadri, cherished no Messianic hope, and used the Book of Ecclesiasticus. On the other hand, Hellenizing Jews, Essenes, and others in Palestine seem to have cherished views similar to those found in the Slavonic Enoch. The conception of the human soul as preëxistent and immortal, the opposition to oaths, the indifference to the sacrificial cult were characteristic of the Essenes. Many circles were evidently untouched by the political hope of a Messiah (q.v.). The idea of a world-egg had existed in Syria at least since the Persian period, and Egyptian mythological figures found at all times ready entrance there. The Greek Bible was unquestionably used by Hellenizing Jews in Palestine in the first century A.D. If the Greek original of the Slavonic Enoch had been known in Alexandria in the beginning of our era it would be very strange that it was not translated into Ethiopic with the rest of the Enoch literature, while its survival only in the Slavonic churches would be natural if it found its way from Syria, Asia Minor, and Constantinople into Bulgaria. It is possible that this work is quoted in the *Testaments of the Twelve Patriarchs*, but the date of the latter work is far from certain. Nevertheless, there is much that favors a date for the Slavonic Enoch earlier than A.D. 70, especially if a Palestinian origin be assumed. It is a most important document of the Judaism of the first century, apparently untouched by Christianity. In it we have the most complete description of the seven heavens, the doctrine of the millennium (q.v.), the conception that God requires no sacrifices but a pure heart (xlv. 3), the idea that the souls of animals as well as men survive the shock of death (lviii.), and beatitudes, curses, and admonitions reminding in a very striking manner of the ethical precepts and ideals found in the Synoptic Gospels. Consult: Morfill and Charles, *The Book of the Secrets of Enoch* (Oxford, 1896); Bonwetsch, *Das slavische Henochbuch* (Göttingen, 1896).

SLAVONIC MUSIC. The music of the Slav peoples, of whom those of importance are the Russians, Poles, and Bohemians.

RUSSIA. Just as the hymns of the Church of Rome exerted a powerful influence upon the music of Western Europe, so a similar influence was exerted upon the music of Eastern Europe through the hymns of the Greek Church. Although both the Greek and Roman hymns can be traced to a common origin, a differentiation took place in the earliest centuries of the Christian era, and thenceforward the music of the East and the West developed separate characteristics. In the East the folk music became strongly tinged with characteristics of the music of the Greek liturgy, and these characteristics have found their way through the folk music into the art music of the modern Russian composers. All the emotions of the Russian peasant find expression either in songs or primitive dance tunes, and every season of the year has its particular songs. The return of spring, for instance, is greeted by the girls and boys in the Russian villages with a choral dance known as the *Khorovod*, which is somewhat similar to the old May-day festivities in England. The *Dumas* were improvisations upon some epic subject, and were recited in irregular rhythm and in a slow monotonous chant. But the real folk songs of Russia are always metrical, although the poetry does not rhyme. The words are most frequently sung without any instrumental accompaniment. In a general way the national melodies are either lively or slow. The former, which are mostly of gypsum origin, are generally dance tunes in the major keys. They are sung in unison, the rhythm being marked by the feet. The latter—and these are the best and most popular—are in minor keys, and are sung in harmony.

When during the seventeenth and eighteenth centuries Italian opera practically ruled all Europe it also found its way into Russia. The few Russian musicians were completely under Italian influences. The first distinctly Russian music was that of Glinka (1804-57) (q.v.). Like his predecessors, this master had been trained by German and Italian musicians, but during a stay in the South of Russia in 1829 he was attracted by the national element in the music of his country. In 1834 he met the famous theorist S. Dehn in Berlin. Upon his suggestion Glinka began to work with a conscious purpose toward the establishment of a national Russian school. By the end of 1834 he had returned to Saint Petersburg with the almost completed score of the first opera written in Russian upon a Russian subject, *The Life for the Czar.* The success of this work was instantaneous, and to this day it is a standard work in the repertoire of every Russian opera house. In 1842 his second national opera, *Ruslan and Ludmilla*, appeared, and was enthusiastically hailed by Liszt. Two years later Glinka produced a number of his compositions in Paris,

where they called forth the unqualified admiration of Berlioz. The approbation of two such men spread Glinka's fame beyond his native land. Whereas Glinka wrote in a naïve manner, in accordance with a natural bent of his genius, the works of his immediate successors show evidence of careful study. Dargomyzhsky (1813-69) (q.v.) began his career under French influences, but soon became an enthusiastic follower of Wagner's reforms. The result was a national opera *Rusalka* (1856), which was followed by two others. But the most powerful influence Dargomyzhsky exerted not so much through his own compositions as through the interest he inspired in some of the younger composers. Five of these organized themselves into a society called *The Innovators.* They were Cui, Balakireff, Mussorgsky, Borodin, and Rimsky-Korsakoff. While their instrumental works are well known, their national operas have not succeeded in gaining friends outside of Russia. The more recent of the prominent Russian composers are Count Yussupoff, Sokoloff, Arensky, Glazunoff, Taneyeff, and Rebikoff. Among all the Russian composers Rubinstein and Tschaikowsky (qq.v.) stand forth preëminent. Russia has also produced sound theorists who have done much to preserve the old folk music and to establish the qualities that constitute the specific national characteristics upon a theoretic scientific basis. Faminzin published several collections of Russian folk songs, and translated many of the famous theoretical works of German authors into Russian; Arnold showed the influence exerted by the old church modes upon Russian melodies; Melgunoff published many Russian folk songs with characteristic national harmonization; Lisenko collected and edited many folk songs and popular dances, and Shafranoff wrote a valuable book, *The Structure of Russian Folk Melodies.* The principal characteristics of Russian music are archaic harmonies reminiscent of the old church modes; peculiar grace notes; intervals pertaining to the *pure* minor scale (see MINOR), which are expressive of deepest melancholy; frequent use of melismas; augmented and chromatic intervals; strongly accented rhythm; a marked tendency toward the employment of *bassi ostinati.* Although the classic masters favor periodic structures of an even number of measures (two, four, eight, sixteen), the Russians manifest a strong leaning toward periods of three, five, or seven measures.

POLAND. Much that has been said about the development of the national element in Russian music through the folk song and the general state of musical affairs applies to the art music of Poland. But whereas the older Russian songs are mostly melancholy, quiet, of even rhythm, and regular periodic structure, those of the Poles are more fiery and passionate. The melodies, which for the greater part are not remarkable in themselves, are rendered effective by means of skillful ornamentation and piquant rhythms. Difficult and unusual intervals occur with great frequency, imparting to the Polish folk songs something of an instrumental character. Polish music during the nineteenth century is represented by the works of only a single great musician. This remarkable man is Frédéric Chopin (q.v.). In addition to Chopin, Poland has produced a few other composers, some of whom devoted their energies to the establishment of a national Polish opera. When the singspiel (q.v.) became popular in Germany, Kamienski (1734-1821) conceived the idea of writing similar works in Polish. Thus he wrote the first Polish opera, *Nendza Uszesliwiona* (Luck in Misfortune), which was produced in Warsaw in 1775. This was followed by five others. Elsner (1769-1854), although a German by birth, was identified with Poland. He wrote no less than nineteen operas, while his successor in the post of principal conductor of the Warsaw National Opera, Kurpinski (1785-1857), composed twenty-six. Chopin's friend Dobrzynski (1807-67) contributed only one opera, but wrote chamber music of sterling merit. Moniuszko (1820-72), who wrote fifteen operas, ranks next to Chopin, but the gap that separates him from his great compatriot is enormous. His reputation rests chiefly upon his Polish songs, which are full of local color. In 1901 the opera *Manru*, by Paderewski (q.v.), was performed in Europe and America, and elicited favorable comment.

BOHEMIA. The folk music of Bohemia is especially rich in popular dance tunes, some of which, like the polka, have also found great favor in other countries. The influence of church music is pronounced in many of the folk songs, especially in those dating from the fifteenth and sixteenth centuries, where we find entire chorales introduced as middle sections. The later songs are distinguished by a broad melodic outline, showing to some extent Italian influences, and by a spirit of humor. As in the case of Russia and Poland, a distinctive national trait appeared in the music of Bohemia as soon as national composers introduced the folk music into their serious works. The first of these was Tomaczek (1774-1850), who wrote several Bohemian songs and also occasionally introduced national themes into his instrumental works. Just fifty years after the appearance of the first Polish opera, a Bohemian opera by Franz Škroup (1801-62) was performed at Prague. This was a very simple work in the style of the German singspiel. Two other and more serious operas followed, *Udalrich and Bozena* (1828) and *Libussa's Wedding* (1835). But these attempts for many years remained the only evidences of a national school of opera. The erection of a new Bohemian National Theatre in 1862 fired the ambition of national composers. Skuhersky (1830-92) had written his first two operas, *Wladimir* and *Lora*, to German texts. He had both these works translated into Bohemian, and then they were produced at the new theatre. These were followed by an original Bohemian opera, *The General.* Johann Škroup (1811-92), a younger brother of Franz, contributed in 1867 *The Swedes in Prague.* In the same year Blodek (1834-74) added *In the Well* to the national repertoire. Schebor (1843—) between 1865 and 1878 wrote five Bohemian operas; Bendl (1838-97) wrote seven; and Rozkosny (1833—) eight. But all these men attained only local fame. The first Bohemian musician whose works attracted general attention in Europe was Smetana (1824-84). He was not satisfied to obtain a national coloring in his music by the mere introduction of folk songs and dances in their primitive dress. As conductor of the National Theatre in Prague he wrote eight national operas, which not only constitute the stock of the Bohemian national repertoire, but have also met

with great favor outside of Bohemia. Perhaps the best known of these is *The Bartered Bride* (1866). Among more recent Bohemian composers may be mentioned Hfimaly (1842—), whose opera *The Enchanted Prince* (1870) scored a lasting success, and Fibich (1859—), who between 1870 and 1898 wrote five operas and a trilogy, *Hippolamia* (1891). This composer is also prolific in the field of instrumental music. Beyond doubt the greatest of Bohemian composers is Antonin Dvořák (1841—) (q.v.), who has done much for the cause of Bohemian music through his masterly arrangement of national dances for orchestra as well as pianoforte. Consult: Cui, *Historical Sketch of Music in Russia,* in "The Century Library of Music" (New York, 1901); Zielinski, *The Poles in Music* (ib.); Soubies, *Précis de l'histoire de la musique russe* (Paris, 1893); Pougin, "Essai historique sur la musique en Russie," in *Rivista Musicale Italiana,* vols. iii. and iv. (Turin, 1896-97).

SLAVOPHILS. See PANSLAVISM; RUSSIAN LITERATURE.

SLAVS. A branch of the Aryan or Indo-Germanic family, which constitutes the great bulk of the population of Europe east of the meridian of 15° E. as well as of Siberia. They are broad-headed, below the average Aryan in height, with the color of skin pale white, swarthy, or light brown, and eyes brown, hazel, gray, and black.

The Slavs comprise the following groups and nationalities: *Eastern Group*—Great Russians, Little Russians or Malo-Russians (including the Ruthenians), White Russians. *Western Group*—Poles, Wends, Czechs (Bohemians and Moravians), Slovaks. *Southern Group*—Slovenians, Serbo-Croats, Croats, Serbs, Morlaks, Uskoks, Herzegovinians, Bosniaks, Montenegrins, Slavic inhabitants of Macedonia, Bulgarians.

It has long been recognized that in this vast complex resulting from racial mixtures there can be found no 'Slav type.' Investigations among the Slav peoples show an interblending of 'races' exclusive of the Finno-Tatar admixture. The most persistent physical character among the Slavs is the head form, which is brachycephalic, so that this uniformity, conflicting materially with diverse statures in the various groups, has led most anthropologists to class them with the Alpine race, i.e., short-headed people like the Celts.

The country occupied by the Slavs before the time of the great migration of nations appears to have been a region extending several hundred miles on either side of the Upper Dnieper, reaching northward as far as the Valdai Hills and westward into the basin of the Upper Vistula. From this seat in the period from the third or fourth century to the seventh century they spread in all directions, toward the Baltic, beyond the Elbe, into the basin of the Danube, and beyond into the Balkan Peninsula. In the tenth century they occupied the basin of the Lower Dnieper. From the tenth century on the Germans pressed back the Slavs, and in the course of several centuries region after region that had been occupied by Slavic tribes again became German. The Bulgarian invaders of the Balkan Peninsula were a Finnic people, who appear to have been akin to the Huns. After their settlement in Bulgaria they became Slavicized. The Polabians, a Slavic people, who dwelt about the Lower Elbe and the southwestern corner of the Baltic Sea, have become extinct. The total number of Slavs is not far from 125,000,000.

Consult Zograf, *Les peuples de la Russie* (Moscow, 1895). See Colored Plate of WHITE RACES OF EUROPE, under EUROPE, PEOPLES OF.

SLAVYANSK, slâv-yânsk'. A town in the Russian Government of Kharkov, about 100 miles southeast of Kharkov (Map: Russia, E 5). It is noted for its large output and export of salt, obtained from the adjacent lakes. Population, in 1897, 15,644.

SLEDGE DOG. A dog used for hauling sledges, especially in the Arctic regions. Until civilized explorers, fur traders, and miners introduced other breeds, the native dogs of all northern peoples were little more than half-domesticated wolves. The typical Eskimo dog is broad-chested, with powerful shoulders, a short, thick neck, sharp wolf-like muzzle, slanting eyes, short and generally erect ears. He has a coat of the warmest and thickest hair, normally wolf gray, although black, black and white, and pure white occur. The Eskimo dog does not bark or bay, but howls a long-drawn wolfish howl. The Mackenzie River dogs or 'huskies' resemble the Arctic fox. They are slenderer and more graceful than the Eskimo dogs, with sharper noses and pricked ears. The 'native dogs' are able to endure a surprising amount of cold and work, so long as they are fairly fed. Harnessed to a toboggan or a sledge, a team of five will drag a heavy load 60 miles a day, day after day. The demand for beasts of burden following the rush to Alaska in 1898 took there all kinds of large dogs. This incursion and the havoc wrought among the native dogs by overwork is modifying the breed of the sledge dog in Alaska.

There are two other kinds of sledge dogs, the 'Ostiaks' and 'Samoyeds.' The Ostiaks vary very much in appearance, some being stout, heavily boned, and weighing 50 to 70 pounds, others leggy and wolf-like. In color they range from gray to dark brown, are thick-coated, prick-eared, and more or less wolf-like in disposition, especially in their dealings with one another. The Samoyed dogs are entirely white, with the exception of the nose; the tail is bushy and turned over the back, and the ears are pricked. They weigh from 40 to 60 pounds and much resemble large Pomeranians.

SLEEK, AMINADAB. A hypocrite in Morris Barnett's comedy *The Serious Family.*

SLEEP (AS. *slæp,* Goth. *slēps,* OHG. *slāf,* Ger. *Schlaf,* sleep, from AS. *slæpan,* Goth. *slēpan,* OHG. *slāfan,* Ger. *schlafen,* to sleep; connected with OChurch Slav. *slabŭ,* lax, Lat. *lăbi,* to slide, fall). A condition of the body in which the normal activity of the nervous system is so far reduced that self-consciousness and consciousness of surroundings are entirely wanting, or at an extremely low ebb. (On the question of dreamless sleep and the consciousness of conditions between waking and sleeping, see DREAMING and SOMNAMBULISM.) It is, furthermore, a normal and rhythmic process, and as such differentiated from stupor, unconsciousness under drugs, and other cases of abnormal loss of consciousness. Its most conspicuous physiological features are cerebral, or at least cortical, anæmia; relaxation of muscular tone; slower and deeper breathing;

slower and weaker pulse; and lessened arterial pressure.

There are three main types of sleep theory, the *circulatory*, the *chemical*, and the *histological*. The first circulatory theory was that of *congestion*. Sleep was the result of pressure upon the brain due to venous congestion. The evidence for this view came from the analogy between the condition of sleep and that produced by apoplexy, opiates, and the lethargy caused by pressure on the brain in cases of fractured skull. The second theory turns to *anæmia*, the exact opposite of congestion. A large number of well-attested facts prove the existence of a cortical anæmia during sleep. Pressure upon the carotid arteries will produce a dream-like state of consciousness. In several instances of fractured skull direct mechanical measurements have demonstrated the anæmia of sleep.

The *chemical* theories are of two types, according as they are based on (1) combustion or (2) auto-intoxication. The *combustion* theories, all of which are concerned with the use of oxygen or carbonic-acid gas, may be represented by Pflüger's idea that the stored-up intra-molecular oxygen is exhausted by activity (vibration and explosion) of nerve cells, and each cell finally becomes saturated with carbonic acid. The explosions of the cells become less numerous, and the condition of relative cerebral inactivity, sleep, thus results. This theory is not buttressed by sufficient experimental evidence, nor does our recent knowledge of the function of oxygen in the body warrant us in attributing sleep to its lack. In the *auto-intoxication* theories it is asserted that certain products of decomposition of

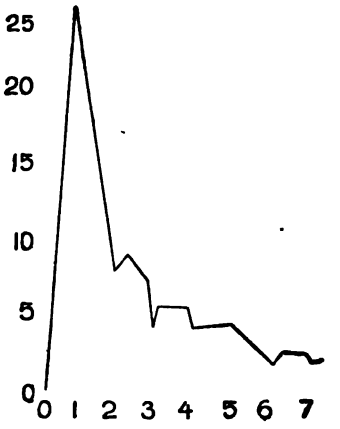


DIAGRAM SHOWING THE DEPTH OF SLEEP AS THE NIGHT ADVANCES.

The abscissæ (0, 1...7) represent the hours elapsed since the oncoming of sleep; the ordinates (0, 5...25) show the relative intensity of stimulus necessary to arouse the sleeper in any given hour.

living substance influence the continuance of cell activity; in the older form of this theory the products mentioned were chiefly lactic acid and creatine; in the recent theories the influence of modern bacteriology has led to the substitution of certain poisons, such as the ptomaines and the leucomaines, which are formed more rapidly than they can be oxidized during active labor of the day. During sleep these poisons are gradually oxidized and removed from the blood. An excessive quantity of these substances produces insomnia, which, as we all know, is often characteristic of extreme fatigue.

The rapid advance in histological technique within the last few years has led to certain discoveries concerning the nature of the nerve cell and its processes, or the neurone, which shed some light upon the conditions of sleep. Of special interest are the results of investigations upon the connection of neurone to neurone. We know that each nerve element is structurally independent, but functionally interdependent. Microscopic examination has shown that the nerve cell possesses different chemical properties when in a waking or a sleeping or fatigued condition, and that the disposition of the 'contact granules' or 'gemmules,' which some authorities deem the structural means for the interconnection of neurones, while functioning, varies according to the condition of activity or rest in the nervous system. Upon these facts various theories have been advanced, which find the cause of sleep in dissociations of the neurones. These theories have taken three principal forms: Dissociation through amœboid movements of cell processes, dissociation through interposition of neuroglia (non-nervous) cells, and profuse connection through torpor of processes.

But no single theory, whether vaso-motor, chemical, or histological, is adequate for a complete explanation of sleep. Recent observations of the daily life of protozoa and other simple forms show that such organisms never sleep, and, of course, never exhibit phenomena of fatigue. Somewhere in the line of evolution the phenomena of fatigue and sleep must make their appearance. It seems likely, therefore, that profitable work upon the problem of sleep is to be expected in the future from the side of comparative physiology and psychology.

BIBLIOGRAPHY. Donaldson, *The Growth of the Brain* (New York, 1897); *American Text Book of Physiology* (Philadelphia, 1896); Errera, *Sur le mécanisme du sommeil* (Brussels, 1895); Manacéïne, *Sleep, Its Physiology, Pathology, Hygiene, and Psychology* (Eng. trans., New York, 1897); Michaelis, *Der Schlaf nach seiner Bedeutung für den gesunden und kranken Menschen* (Leipzig, 1894). For detailed bibliography, consult Foster or Manacéïne. See DREAMING; SOMNAMBULISM.

SLEEPER SHARK, or NURSE SHARK. One of the large Arctic sharks of the family Scymnidæ, closely allied to the dogfishes (Squalidæ), especially *Somniosis microcephalus*, which reaches a length of 25 feet and is renowned as an enemy of whales, biting large pieces out of their bodies.

SLEEPING BEAUTY, THE. The fairy-tale of a princess who falls into an enchanted sleep for a hundred years and is awakened by a prince, who penetrates the dense wood which grew up about her castle. It is told by Charles Perrault in "La Belle au Bois Dormant," in *Contes du temps passé* (1697), translated by Grimm as *Dornröschen*, and versified by Tennyson in "The Day Dream." The legend in varying forms is very old, found even in Egyptian and Hindu tales and paralleled in the magic sleep of Brunhilda.

SLEEPING SICKNESS, or NEGRO LETHARGY. An epidemic disease occurring among the inhabitants of tropical West Africa, characterized by periods of sleep recurring at short intervals. The course of the disease is from four months to

as many years, and it is fatal. The victim appears at first languid, weak, pallid, and stupid. His eyelids become puffy; an eruption appears on his skin. He falls asleep while talking, eating, or working. As the disease progresses he is fed with difficulty and becomes much emaciated. The failure of nutrition and the appearance of bedsores are followed by convulsions and death. Some patients become insane. Manson has suggested *Filaria perstans* as the cause of the disease. (See FILARIA.) In 1898 Cagigal and Lepierre of Coimbra, Africa, isolated a bacillus which they believed was the cause; but this claim is yet to be substantiated. Inoculations into rabbits of a culture of this bacillus caused similar symptoms to those exhibited by a young negro affected with sleeping sickness, from whose blood they removed this bacillus for cultivation. Some cases of the disease have developed in Congo negroes seven years after they have left Africa for a permanent residence in Europe. A few cases of the disease have been found among negroes in our Southern States. Consult Manson, *Tropical Diseases* (London, 1900).

SLEEP OF PLANTS. A popular name for the phenomenon of leaf movement in certain plants, especially of the Oxalideæ and Leguminosæ, whose leaves have a nocturnal position distinct from the diurnal. Usually the petioles rise or fall and sometimes the leaf blades become folded. The phenomenon is due to the sensitiveness of certain parts to variations in the intensity of the light reaching them, and has no likeness whatever to the sleep of animals. See MOTOR ORGANS; MOVEMENT.

SLEEPY HOLLOW. A picturesque valley near Tarrytown, N. Y., traversed by a small stream called the Pocantico River, famous as the scene of Washington Irving's *Legend of Sleepy Hollow*. It contains an old Dutch church, dating from 1699 and built of bricks brought from Holland.

SLEEVE DOG. A Japanese breed of tiny spaniels. See SPANIEL.

SLEIDAN, slī'dăn, or **SLEIDA'NUS,** JOHANN (c.1506-56). An early German historian whose real name was Philippson. He was born at Schleiden, near Cologne, studied law at Liège, Paris, and Orleans, and, entering the service of Francis I. of France in 1537, acted as intermediary between him and the Schmalkaldic League. In 1544 he made his home at Strassburg and thenceforth was active as diplomat, pamphleteer, and apologist in the cause of the Reformation. In 1551 he represented the city of Strassburg at the Council of Trent. His chief work is *De Statu Religionis et Reipublicæ Carolo Quinto Cæsare Commentarii* (Strassburg, 1555; edited by Am Ende, Frankfort, 1785-86), the best contemporary account of the Reformation, for the history of which it is still a valuable source. He also wrote *Summa Doctrinæ Platonis de Republica et de Legibus* (1548). Consult Baumgarten, *Ueber Sleidans Leben und Briefwechsel* (Strassburg, 1876).

SLEMMER, ADAM J. (1828-68). An American soldier, born in Montgomery County, Pa. He graduated at West Point in 1850, served against the Seminole Indians in Florida, and then for several years was stationed in various garrisons on the Pacific Coast. From 1855 to 1859 he taught at West Point. In January, 1861, he was in command of a small body of regular troops in Fort Barrancas, Pensacola Harbor, Fla. On the 10th of the month, after the surrender of the Pensacola navy yard, he transferred his force to the more secure position afforded by Fort Pickens in the same harbor. This fort he successfully held against Confederate attack until he was reënforced. Promoted to be major, he was attached to General Buell's command and took part in the Corinth campaign and the advance on Nashville, became brigadier-general of volunteers (November 29, 1862), and participated in the battle of Stone River (December 31, 1862), receiving a wound that incapacitated him for further active service during the war. In 1865 he was brevetted colonel and brigadier-general in the regular service for meritorious conduct and was commissioned lieutenant-colonel of the Fourth Infantry. He died while in command of Fort Laramie.

SLENDER. An awkward, foolish countryman in Shakespeare's *Merry Wives of Windsor*, cousin to Shallow and a suitor of Anne Page.

SLES'WICK. See SCHLESWIG.

SLICK, SAM. The pseudonym of the British-American humorist Thomas Chandler Haliburton (q.v.).

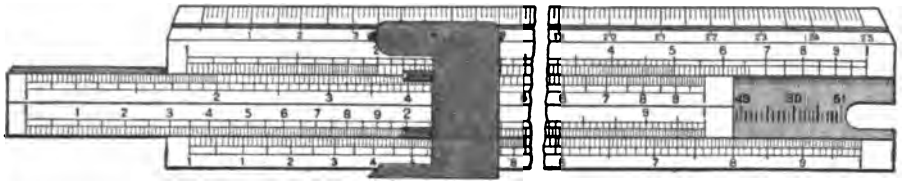
SLICKENSIDES. The name given to the polished surfaces found along the joints and fault planes of rocks. They are caused by the rubbing together of the rocks during faulting or differential movement along the planes of fracture.

SLIDE (from AS. *slīdan*, to slide; connected with Ir., Gael. *slaod*, slide, Lith. *slysti*, to slide, Skt. *sridh*, to go astray). A piece of mechanism applied to instruments of the trumpet and trombone family, for lengthening and shortening the sounding tube. (See TROMBONE.) The term slide signifies a diatonic series of two or more tones, either ascending or descending, one of which is to be accented and the others played as grace-notes.

SLIDELL', JOHN (1793-1871). An American politician, born in New York City. He graduated at Columbia College in 1810. In 1819 he removed to New Orleans and from 1829 to 1833 was United States District Attorney for Louisiana. In December, 1853, he became United States Senator, but resigned upon the secession of Louisiana from the Union. In September, 1861, he was appointed commissioner of the Confederate States to France, and ran the blockade from Charleston, S. C. At Havana, with James M. Mason, commissioner to England, he embarked upon the British mail steamer *Trent*, which was overhauled on November 8th by Captain Charles Wilkes in the United States sloop *San Jacinto*, and the envoys and their secretaries were arrested and confined for a time in Fort Warren, Boston. Upon the demand of England the act of Captain Wilkes was disavowed and the commissioners sailed for England January 1, 1862. (See TRENT AFFAIR.) Mr. Slidell failed in securing the assent of France to the convention giving to that nation control of Southern cotton if the blockade should be broken, but was permitted to begin negotiations for the £15,000,000 Confederate loan. At the close of the war Slidell settled in England.

SLIDE RULE. An instrument composed of sliding scales, and used to perform certain arithmetical calculations. The annexed figure

shows the Nestler rule. In using this scale for multiplication the figure 1 on the slide is made to coincide with one of the two factors on the scale, the product then being found opposite the other factor as read on the slide. In division it is necessary merely to place the divisor read on the slide above the dividend read on the rule, and the quotient will be found on the rule below 1 on the slide. For involution the numbers on the upper scale of the rule are the squares of the numbers on the lower scale, and the cubes can be found by inverting the slide. The inverse of this gives the square and cube roots. On the reverse of the slide is a scale of sines and tangents, and a scale by the use of which logarithms may be found.



SLIDE RULE.

SLI'GO. A maritime county of the Province of Connaught, Ireland, bounded on the north by the Atlantic and the Bay of Donegal (Map: Ireland, C 2). Area, 707 square miles. Population, in 1841, 189,900; in 1851, 128,600; in 1901, 84,083. The coast line is indented with numerous bays dangerous for navigation, except in the Bay of Sligo. The navigable streams are the Moy, the Owenmore, and the Garrogue. The picturesque loughs Arrow and Gill are in this county. The mineral products consist of copper, lead, iron, and manganese. The chief occupation is cattle-rearing. The sea and salmon fisheries are important, and there are manufactures of woolens, linens, and leather. Capital, Sligo. Consult Wood-Martin, *History of Sligo, County and Town* (Dublin, 1890-93).

SLIGO. The capital of County Sligo, Ireland, on the Garrogue, 131 miles northwest of Dublin (Map: Ireland, C 2). It is well built, and contains several handsome public edifices. There are a town hall, including an assembly room, exchange, free library, etc., and the ruins of an old abbey. Steamers ply regularly between Sligo and Glasgow, Liverpool, and Londonderry. Sligo had its origin in the erection of a Dominican abbey and a castle in the thirteenth century by Maurice Fitzgerald, Earl of Kildare. In the reign of James I. it received a charter. Population, in 1901, 10,862.

SLIMEHEAD. One of the beautiful, red, richly ornamented berycoid fishes of the genus Beryx, called by the French 'alfonsines.' They are found in the deep seas of all warm latitudes, and one species (*Beryx splendens*) is taken in the Gulf Stream. See Plate of MULLETS AND ALLIES.

SLIME MOLD. The common name of the Myxomycetes (q.v.).

SLINGELANDT, slĭng'e-länt, PIETER CORNELISZ VAN (1640-91). A Dutch painter, born at Leyden. He studied in his native town with Gerard Dou. Although he never caught the luminosity which his master learned from Rembrandt, he patiently imitated the delicate brushwork and was able to use the outward manner of his teacher. Among his numerous works (some of them dated) are: "Family Group," in the National Gallery; "Male Portrait" (1656) and "Kitchen Utensils," in the Louvre; "Interrupted Music Lesson" (1672) and "Poultry Vender" (1673), in the Dresden Museum; "Tailor's Shop," in the Old Pinakothek, Munich; and "Musical Party in a Kitchen," in the Rijks Museum, Amsterdam.

SLIP. A semi-fluid form of clay with or without other ingredients, used by potters to coat a vessel in order to obtain a glaze or other desired condition of surface, or to secure a decorative effect by applying the same unevenly or in the form of a rough pattern in relief. See POTTERY.

SLIPPED. In heraldry (q.v.), a term applied to a leaf, branch, or flower which is represented with a stalk and torn from the parent stem.

SLIVEN, slē'ven, **SLIVNO,** or **SELIMNIA.** A town in Eastern Rumelia, situated at the important pass in the Balkan Mountains known as the Iron Gate, 65 miles north of Adrianople (Map: Balkan Peninsula, F 3)). Silven is noted for its black wine and has an important Government cloth factory. Population, in 1900, 24,542.

SLIVINSKI, slê-vĭn'skê, JOSEPH (1865—). A Russian pianist, born at Warsaw. He studied there at the conservatory with Strobl and later took a four years' course with Leschetizky at Vienna, completing his studies with Anton Rubinstein at Saint Petersburg. He made his début in 1890, but his reputation was not established until his London appearance three years later. His first American recital took place in 1893. He became well known for his technique and for his mastery of intricate phrasing.

SLOANE, slōn, Sir HANS (1660-1753). An eminent British physician and naturalist. He was born in Ireland of Scotch parents, and was educated in London and in France. He was elected a member of the Royal Society in 1685, and of the Royal College of Physicians in 1687. He was physician to Christ's Hospital (1694-1724), president of the College of Physicians (1719-1735), secretary to the Royal Society (1693), foreign associate of the French Academy of Sciences (1708), and succeeded Sir Isaac Newton as President of the Royal Society in 1727. He had been created a baronet and physician-general to the army in 1716, and in 1727 received the further honor of being appointed royal physician. He gave a strong impulse to the practice of inoculation by performing that operation on several of the royal family. He formed a museum of natural history, antiquities, coins, etc., and a

library of 50,000 volumes and 3560 MSS., which he directed to be offered at his death to the nation for £20,000, and which formed the commencement of the British Museum (q.v.). He contributed numerous memoirs to the *Philosophical Transactions*, whose publication he superintended for a number of years, and published in 1745 a treatise on medicine for the eyes.

SLOANE, Thomas O'Conor (1851—). An American writer on science, born in New York City. He graduated at Saint Francis Xavier College in 1869, and at the School of Mines of Columbia University in 1872. For many years he served as a gas engineer, inventing a self-recording photometer, and was later professor of natural sciences in Seton Hall College. His publications include many books on popular science.

SLOANE, William Milligan (1850—). An American educator and historian, born at Richmond, Jefferson County, Ohio. He graduated at Columbia College, New York City, in 1868, and from then till 1872 was instructor in classics at Newell School, Pittsburg, Pa. Then he became private secretary to George Bancroft, who was United States Minister to Germany, and while in Germany studied history under Mommsen and Droysen. In 1883 he was made professor of history in the College of New Jersey (Princeton), a position which he resigned in 1896 to become professor of history at Columbia University. From 1885 to 1888 he was editor of the *New Princeton Review*. He published the *Life and Work of James Renwick Wilson Sloane* (1888), *The French War and the Revolution* (1896), *Napoleon Bonaparte* (1895-97), and *Life of James McCosh* (1896).

SLOAT, slōt, John Drake (1780-1867). An American naval officer, born in New York City. He entered the navy as a midshipman in 1800, but after a year's service was honorably discharged through operation of the Peace Establishment Act of 1801. In 1812, however, he reëntered the navy as a sailing-master, and throughout the war with England was attached to the frigate *United States*, which in October, 1812, captured the British frigate *Macedonian*. In 1813 he was promoted to be lieutenant. In 1823-25 he commanded the schooner *Grampus*, which was one of the squadron engaged in suppressing piracy in the West Indies. He became a captain in 1837, commanded the Portsmouth Navy Yard in 1840-44, and from 1844 to 1846 was in command of the Pacific Squadron, and took possession of Monterey and San Francisco at the outbreak of the Mexican War. He commanded the Norfolk Navy Yard in 1847-51, and was retired in 1861, but was subsequently promoted to the rank of commodore in 1862 and to that of admiral in 1866.

SLO'CUM, Henry Warner (1827-94). An American soldier, born at Delphi, N. Y. He graduated at West Point in 1852. In 1856 he resigned from the military service and became a counselor-of-law in Syracuse, N. Y. At the outbreak of the Civil War he was appointed colonel of the Twenty-seventh New York Volunteers, which he led at the first battle of Bull Run, where he was severely wounded. He returned to active service in September, 1861, with the rank of brigadier-general of volunteers. He rendered conspicuous service at the battle of Gaines's Mill (q.v.). After the battle of Malvern Hill (July 1, 1862) he was promoted to the rank of major-general of volunteers. He was engaged in the second battle of Bull Run, and in the battles of South Mountain, Antietam, Chancellorsville, and Gettysburg. He later commanded the Twentieth Army Corps, taking part in the capture and occupation of Atlanta. In Sherman's march to the sea Slocum was given the left wing, a command which he held until after Johnston's surrender at Durham Station. In 1865 he resigned from the service and resumed the practice of the law at Brooklyn, N. Y. He was elected to Congress in 1868 and 1870.

SLOE (AS. *slā*, *slāhæ*, OHG. *slēha*, Ger. *Schlehe*, sloe), or Sloe-Thorn (*Prunus spinosa*). A shrub of the natural order Rosaceæ, by some botanists supposed to be the original species of some of the cultivated plums. It is generally a much branched spiny shrub of 4 to 10 feet high, or sometimes a small tree of 15 to 20 feet, with small snow-white flowers, which generally appear after the leaves. The fruit, generally about the size of large peas, is used for making preserves, brandy, and gin. An astringent extract, called German acacia, prepared from it, was once much used as a substitute for gum arabic. The juice is much used in the manufacture of spurious port wine, and to impart roughness to the genuine. The sloe is abundant in European thickets and borders of woods, and in arid places, and is sparingly introduced in the Eastern United States.

SLONIM, slō'nyĕm. The capital of a district in the Government of Grodno, Russia, situated on the Shara, a navigable tributary of the Niemen, 110 miles southeast of Grodno (Map: Russia, C 4). It has manufactures of cloth, tobacco, and spirits. Population, in 1897, 15,893, mostly Jews.

SLOOP (Dutch *sloep*, Ger. *Schlupe*, sloop; probably from OF. *chaloupe*, from Sp. *chalupa*, Eng. *shallop*). A small vessel having a single mast and fixed bowsprit. A sloop's sails are mainsail, gaff topsail, jib, and staysail; spinnaker, club topsail, jib topsail, balloon jib, and flying jib are carried by large racing sloops. Formerly sloops and cutters differed considerably in shape, the cutter usually being much narrower and deeper, but at present the difference in form is very slight. Before the advent of steam a sloop of war was a ship-rigged vessel, but smaller than a frigate; in the early days of steam men-of-war a sloop of war was a war vessel carrying her guns on a single deck; the term is now obsolete. See Yacht and Yachting.

SLOP, Doctor. An irascible, enthusiastic physician in Sterne's *Tristram Shandy*, who broke the hero's nose at his birth.

SLOTH (from AS. *slāw*, OHG. *slēo*, *slēw*, dialectic Ger. *schlēw*, *schlō*, Eng. *slow*). An edentate mammal of the family Bradypodidæ, remarkably adapted to an arboreal life, and represented by many species, all residents of tropical America. They vary in size from that of a small bear to that of a cat. They feed on the leaves, buds, and young shoots of trees, among the branches of which they are born and spend their entire lives, rarely and unwillingly de-

scending to the ground. They do not walk upon the branches, but cling beneath them, with the back downward, and they can progress, if they please, with the agility of monkeys. They are chiefly nocturnal, resting sleepily during the day, from which circumstances, and from a misunderstanding of their habits generally, the misnomer of 'sloth' arose.

The fore legs are much longer than the hind ones, and the feet are furnished with very long sharp claws, curved into hooks by which sloths hang beneath the branches even in sleep. A peculiarity of the group is the extraordinary number of dorsal vertebræ. The head is round, and the muzzle so short that the face is monkey-like. Although members of the order Edentata, sloths are by no means 'toothless.' There are no incisor teeth, but sharp canine teeth, and eight



JAWS AND TEETH OF SLOTHS.

1, Three-toed sloth (*Bradypus tridactylus*); 2, collared sloth (*Bradypus infuscatus*).

molars in the upper, six in the lower jaw. The molars are cylindrical, and are adapted merely for crushing, not for grinding, the food. For this, however, there is compensation in the stomach, which is somewhat imperfectly divided, by transverse ligatures, into four compartments, for the longer retention and more thorough digestion of the food. The hair is coarse and shaggy, affords an excellent protection from insects, and gives sloths such a gray appearance that they are not readily observed except when in motion. This protective effect is enhanced by the growth upon it of a minute grayish-green alga, allying the hair almost precisely in color with the 'gray-beard moss' that drapes tropical trees, and amid which they are fond of hiding.

The sloth produces only one young one at a birth, which clings to its mother till it becomes able to provide for itself. The voice of the animal is a low plaintive cry. Less than a dozen species of sloth are known, grouped in two subfamilies, according to the number of toes on



JAWS AND TEETH OF TWO-TOED SLOTH.

the fore feet. All have three toes on the hind feet, but the Cholœpodinæ have only two toes on the front feet, the Bradypodinæ three. The latter have nine cervical vertebræ and twenty abdominal, and of the latter 15-17 bear ribs; while the former have only six or seven cervical vertebræ, and twenty-seven abdominal, of which 23-24 bear ribs. Of the Cholœpodinæ, or 'unaus,' there are only two species, the two-toed (*Cholœpus didactylus*), which is common in Brazil, and a Central American species (*Cholœpus Hoffmanni*), which is lighter colored. They are about two feet long. Of the Bradypodinæ conspicuous species are the three-toed sloth (*Bradypus tridactylus*) and the collared sloth (*Bradypus infuscatus*). The latter is the largest of the family and has a collar of long black hair around the neck, behind which is a patch of pale orange. Consult: Beddard, *Mammalia* (London and New York, 1902), and the memoirs there cited relating to anatomy and classification; also Lydekker, *Royal Natural History*, vol. iii. (London, 1895); Alston, "Mammals," in *Biologia Centrali-Americana* (London, 1879-82); and Bates, *Naturalist on the Amazons* (2d ed., London, 1892). For fossil forms of the sloth, see GANODONTA; MEGATHERIUM; MYLODON; MAMMALIA, FOSSIL.

SLOUGH, slou. A market town and railway junction in Buckinghamshire, England, 18 miles west of London, and 2 miles north of Windsor Castle. Here the elder Herschel erected his observatory and great telescope, and made many of his important astronomical discoveries. Population, in 1901, 11,461.

SLOUGH OF DESPOND. A bog encountered by Christian, in *Pilgrim's Progress*, at the outset of his journey. It typifies the discouragement and apprehension caused by a sense of sin.

SLOVAKS, slō'väks. A Slavic people of Northwestern Hungary and Southern Moravia. They are closely akin to the Czechs. They number about 2,000,000. Most of them are Roman Catholics.

SLOVE'NIANS. A South Slavic people of Austria-Hungary, inhabiting Carniola (where they constitute the great bulk of the population), Carinthia, Styria, and other districts. About the sixth century they migrated from their original home in the Carpathian Mountains to the region south of the Danube, where they now live. See SLAVS.

SLOWACKI, slō-väts'kē, JULIUSZ (1809-49). A distinguished Polish poet. He was born at Kremenez, in Volhynia, the son of a professor of literature in the University of Vilna, where he received his education. Because of the somewhat morbid and misanthropic nature of his writings he received the name of the 'Satan of Literature.' Among his works are the poems "Jan Bielecki," "Arab," "Lambro," "Beniowski," "Waclaw," and the dramas *Maria Stuart, Mazeppa, Balladyna*, and *Lilla Weneda*. Some of them were translated into several languages. His collected works were published at Leipzig (4 vols., 1860 and later ed.) and at Lemberg (4 vols., 1880). Consult the biography by Malecki (Lemberg, 1866).

SLOW LEMUR. A lemur of the genus Nycticebus or Loris, noted for its slow movements, especially the common Asiatic loris, also called 'sloth monkey' (*Nycticebus tardigradus*). See LORIS; and Plate of LEMURS.

SLOW-MATCH. A rope or cord which has been saturated or steeped in a solution of saltpetre, so that it will burn slowly and regularly.

Slow-match was formerly used by artillerists to ignite the fuming powder of guns and for the explosion of blasts and mines. For the latter purpose various improved fuzes or electric devices (see BLASTING) have taken its place. For igniting fireworks quick-match, which burns more rapidly, is used. See PYROTECHNY.

SLOWWORM (AS. *slāwyrm, slāwerm*, slow-worm, from *slēan*, Goth., OHG. *slahan*, Ger. *schlagen*, to strike + *wyrm, werm*, worm; influenced by popular etymology with Eng. *slow*). A burrowing, elongated lizard of the family Anguidæ. (See BLINDWORM.) One species (*Ophisaurus ventralis*) occurs in the United States south of the Ohio River, and is sometimes called 'joint-snake,' because, on account of a loose articulation of the vertebræ, the tail easily separates from the body. When the tail is cast off a new one soon regenerates. Compare BLINDWORM.

SLUBBER. See SPINNING.

SLUG (from ME. *sluggen*, Norw., Swed. *slōka*, to go draggingly, to droop, Icel. *slōkr*, slouching fellow). A terrestrial pulmonate gastropod, or snail, in which the shell is represented by an internal horny plate overlying the respiratory cavity. The slugs are chiefly of two families, Limacidæ and Arionidæ, and most commonly are of the genus Limax. They are vegetable eaters, and often ascend trees in search of food, and then let themselves down by means of a mucous thread spun from a gland opening on the anterior edge of the foot. In Europe they ravage garden and field crops in moist weather; they do little damage in the United States. Their general economy is that of the snails (q.v.). The great gray slug, sometimes four inches long, is a European species which has been introduced into and become common in Eastern North America. A native American species, very common in the United States, is *Lima campestris*, a small species less than an inch long.

SLUTER, slu'tẽr, CLAUX (?-c.1405). The principal Dutch sculptor of the later Middle Ages. The earliest record of his life is that in 1389 he became statuary in ordinary at Dijon, to Philip the Bold of Bungundy, whose service he had entered a few years before. In charge of the sculptures for the Carthusian monastery, the Chartreuse de Champmol, which Duke Philip had founded in 1383, he surpassed in ability all his predecessors and enjoyed a position similar to that of the Pisani in Tuscany, producing works worthy to be ranked with the noblest and most original creations of plastic art in any epoch. In 1398 Sluter, aged and infirm, called to his aid his nephew and pupil, Claux de Werve, of Hattem, to whom must be attributed a more or less important part in the execution of his uncle's latest productions. The earliest of Sluter's works that still remain on the site of the former Chartreuse, now occupied by a lunatic asylum, are the figures on the portal of the chapel (c.1390-94), to wit: "Duke Philip in Prayer," "Saint John," "Duchess Marguerite," and "Saint Catherine," the first and last of which are especially remarkable for the freshness of their realism. Next comes the famous "Moses Fountain" (1395-1404) in the courtyard, a hexagonal base with the life-size figures of the "Six Prophets," admirable specimens of psychological individualization, polychrome, according to mediæval usage. A reproduction of this work is in the Dijon Museum which also contains Sluter's masterpiece, the Tomb of Philip the Bold (1404-11), in black and white marble, the mighty sarcophagus surrounded with arcading, through which passes a procession of forty small alabaster figures of mourners, endowed with great dramatic power and exquisitely finished. The recumbent figure of the Duke is of striking realism. Claux de Werne undoubtedly completed this monument. Consult: Lübke, *History of Sculpture* (London, 1872); Reber, *History of Mediæval Art* (New York, 1887); Gonse, *L'art gothique* (Paris, 1890); id., *La sculpture française depuis le XIVième siècle* (ib., 1894); Ratcliffe, *Schools and Masters of Sculpture* (New York, 1894).

SLUTSK, slutsk. The capital of a district in the Government of Minsk, Russia, situated 123 miles south of Minsk (Map: Russia, C 4). It has a fifteenth-century church. Population, in 1897, 14,180. Slutsk passed to Lithuania in the thirteenth century and attained great importance as the capital of the Principality of Slutsk. It came into the possession of Russia in 1795.

SLY, CHRISTOPHER. A tinker and bear-keeper who, in the induction to Shakespeare's *Taming of the Shrew*, is found drunk by a lord, taken to his house and made to believe he is master, while the comedy is performed before him.

SMAL'CALD. A town of Prussia. See SCHMALKALDEN.

SMALCALDIC LEAGUE. See SCHMALKALDIC LEAGUE.

SMALL ARMS. A military term denoting the firearms carried by the soldier, in contradistinction to machine guns and artillery. Under this title will be found discussed the history of the development of the modern military rifle, while pistols and revolvers are discussed under their own heads. Firearms used for purposes of sport are treated under SHOTGUN.

The first hand firearms date from about the fourteenth century and were in the form of hand cannon or bombardello, which consisted of a small bombard, fired from the shoulder by means of a match applied to a touch-hole. The bombard was welded on to an iron rod, which was carried suspended from the neck of the soldier. The powder chamber was smaller in its internal diameter than the bore of the gun, but externally larger. These weapons are also known as *bastons-à-feu* (fire-sticks). The hand culverin was a small cannon secured to a stock by iron bands, and had a bore of little more than half an inch, but, nevertheless, it was in general use throughout Europe. The Swiss army at the battle of Morat (1476) included about 6000 culveriners. The hand culverin was fired from a forked rest usually, and required two men to work it, the one aiming and holding the weapon, while the other discharged, loaded, and assisted in carrying it. Further improvements included an enlarged bore, a bent stock, and finally the placing of the touch-hole upon the side. The barrels were octagonal or hexagonal in form. Small culverins were used for horseback fighting, and larger ones for the foot soldiery. The first real approach to the modern small arm was the early match-lock, which was the ordinary gun of the

period with the addition of a serpentine or cock for holding the match. The serpentine was hung upon a pivot which, passing through the stock, formed a lever for the hand. Before the weapon could be discharged it was necessary to bring the serpentine in contact with the burning match on the barrel, until the former was ignited, after which the lever was raised and the serpentine brought into contact with the priming of the touch-hole and the gun discharged. The next improvement was to reverse the position of the serpentine and provide a spring to hold the match away from the touch-hole, after which a certain amount of pressure brought to bear upon the lever caused the serpentine with the lighted match to fall into the flash-pan.

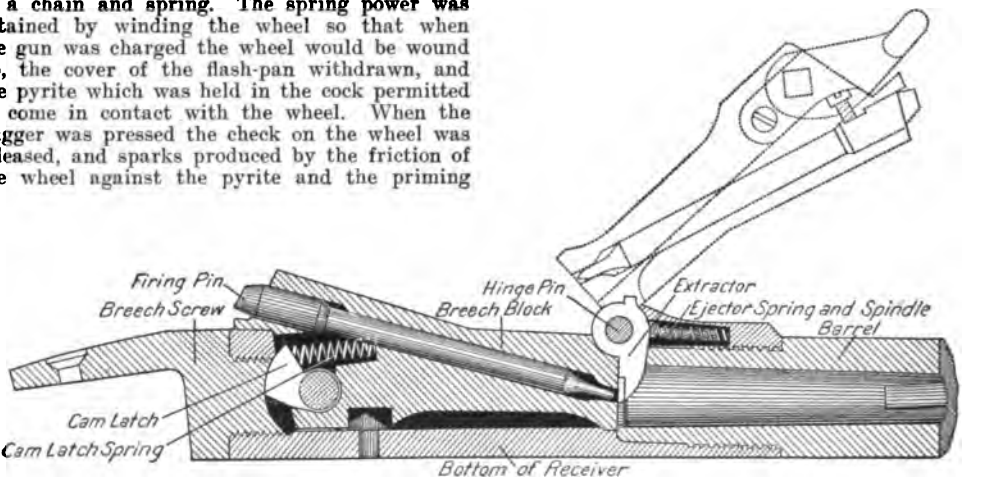
In the nature of things the effect of the firearms of this period was more of a moral than a destructive character. Many strange varieties of firearms gradually came into use, such as combinations of club and pistol, of pistol and battle-axe, and particularly the 'holy water sprinkler,' which latter consisted of a strong mace formed by four or more barrels arranged as is the chamber of the modern revolver. An improved invention in the form of the wheel-lock was made in 1515. It consisted of a grooved steel wheel, having a serrated edge connected to the lock-plate by means of a chain and spring. The spring power was obtained by winding the wheel so that when the gun was charged the wheel would be wound up, the cover of the flash-pan withdrawn, and the pyrite which was held in the cock permitted to come in contact with the wheel. When the trigger was pressed the check on the wheel was released, and sparks produced by the friction of the wheel against the pyrite and the priming ignited the charge. Owing to its expense, the wheel-lock gun was used almost entirely for sporting purposes, and soon after this the use of firearms in the chase became general.

The flint-lock, which followed the wheel-lock, seems to have been of Spanish origin and to date from early in the seventeenth century; in it the process of igniting the charge was considerably simplified. The hammer or cover-plate was forced backward by the bolt so that the flint, which was screwed in the jaw of the cock, and the priming in the flash-pan were exposed to the sparks caused by the contact of the flint and the hammer, and thus the charge was ignited. The flint-lock was a long time coming into favor, owing to the fact that in its original form the sparks frequently escaped without firing the charge. Flint-lock muskets were first introduced into England during the reign of William III., and in one form or another remained in use in the British army up to as late a period as 1840.

Crude forms of repeating, breech-loading, revolving, and magazine weapons sprang up here and there throughout Europe, but they are of interest only as showing that these principles which form so important a part of our modern weapons are not in themselves modern. It is in the improved methods of ignition which Forsyth made possible that the next important step in the evolution of small arms was accomplished. His invention dates from 1807, and is described by him as "a detonating principle for exploding gunpowder in firearms, etc." Many subsequent improvements in the system were made by the manufacturers whom the patentee engaged to make the guns. The percussion principle was applied first to muzzle loading and afterwards to breech-loading guns, and, strangely enough, did not at first appeal to the various governments of Europe as suitable for weapons for military purposes.

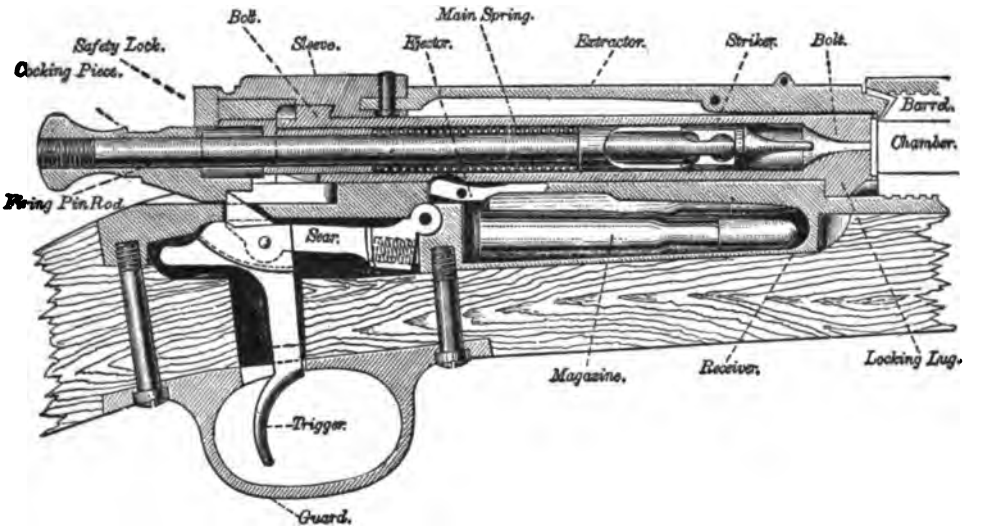
MODERN MILITARY RIFLES. Although the principle of rifling small arms dates from the beginning of the sixteenth century, it was not till toward the close of the seventeenth that the principle was employed for military weapons. Owing to the fact that the rifle could not be loaded after a few rounds had been fired, some method had to be found to obviate the difficulty; none, however, proved satisfactory until an English gunmaker in 1836 devised a bullet of egg-shaped construction which had a cavity at one end to receive a conical plug which under pressure of the gas generated by the discharge expanded the bullet into the grooves. The Minié rifle of the French was the next improvement on this principle; in that an iron cup was utilized to expand the cone when forced home by the gas. In the three-grooved Enfield rifle (English) of 1855 a wooden plug was used instead of the iron cup. Next followed the Whitworth hexagonal rifling, which made possible the use of a bullet of a more elongated design and which lowered the trajectory of the bullet by offering a smaller front to the resistance of the air.

The first breech-loading small arm of conse-



BREECH MECHANISM OF U. S. SPRINGFIELD RIFLE, CALIBRE .45 INCH.

quence was Hall's rifle, invented in 1811, and manufactured in small quantities about 1818 for the United States Army; its chamber rose on a hinge at the rear end for loading. About 1812 Pauly, an officer under Napoleon, evolved a breech-loader which is the progenitor of all later guns with swinging block. Dreyse, working



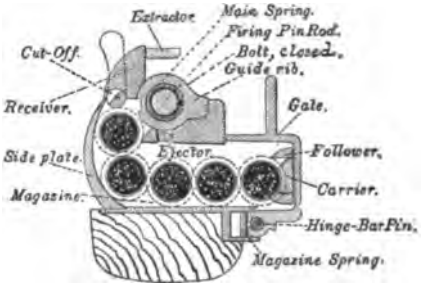
U. S. MAGAZINE (KRAG-JÖRGENSEN) RIFLE, CALIBRE 30 INCH.

under him, developed a discarded model of Pauly's into a successful breech-loading needle gun, which is the forerunner of all bolt-action guns. In 1841 the Prussians adopted their famous needle gun, which earned them many victories from 1848 to 1866.

Although crude in construction, this weapon marked a great advance in military rifles. The bullet was conical in shape, and together with the powder was inclosed in strong paper. In the centre of the outer surface of the wad (immediately behind which was the powder) was a detonator, to explode which the needle fixed in the breech would upon pulling the trigger be released and penetrate the cartridge. The French adopted the Chassepot (q.v.), an improved needle gun. This gun, as well as other weapons employed by European armies, had the action now generally used, a bolt containing firing pin and spiral spring and sliding axially with the bore in a metal receiver behind, and fastened to, the barrel. A handle fastened to one side of the bolt engages in front of a lug when the bolt is run forward and rotated to the right, thus locking the breech.

England converted her Enfield rifles, which were of the three-grooved expanding bullet muzzle-loader type, into Snider breech-loaders by alterations at the breech end of the barrel. A chamber was made by which the cartridge could be inserted in the barrel, after which the block (worked on a hinge) was then closed and the space completely filled. A needle or striker passed through the breech block, struck the cap in the base of the cartridge and thus ignited the charge. In 1869 the Martini-Henry rifle was adopted for the British army. It consisted of a combination of the Martini breech action with the Henry barrel. The Italians and Swiss adopted the Vetterli gun, which was of the repeater or magazine type, having a tube under the barrel in which were contained eleven cartridges, which were in turn forced into the breech by the same action which discharged the empty cartridge. Russia adopted the Gorloff gun with a block hinged in front and rising to open. This is the principle of the Springfield breech-loading rifle (calibre .45) adopted for the United States Army in 1873, and retained until 1892 (see illustration), when it was succeeded by the United States magazine rifle, developed from the Krag-Jörgensen.

The question of magazine arms was considered (1891-92) in the United States by a board which tested 53 different designs, among which they found two general classes—repeaters, which

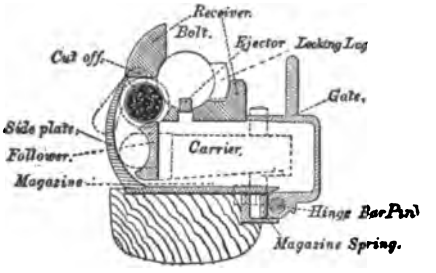


U. S. MAGAZINE RIFLE AND CARBINE, CALIBRE 30 INCH.
Transverse section through magazine.

could not be used as single-loaders while the magazine was charged, and magazine guns proper, in which the magazine could be charged and held in reserve for an emergency while loading is done shot by shot. The gun selected was one of the latter class—a bolt-action gun with magazine under and rising to the left of the chamber. It had a clasp containing 5 cartridges placed under and to the left of the receiver; the calibre of the barrel was .30 inch. It was sighted up to 1900 yards. and had a firing capacity (single loading) of 42 shots to the minute. It

was the weapon used by the regular troops in the war with Spain, and was found to be all that was claimed for it. The Krag-Jörgensen bullet had a weight of 220 grains, and a velocity of 2200 feet per second. It had an inside of tin and lead composition, and an outer jacket of cupro-nickel steel. Its weight without bayonet was 9.187 pounds, and its total length without bayonet 48.9 inches. The cartridges are put in on the right through a gate, lie side by side, and are pushed sideways across and up into the chamber by a follower. Partly entering the magazine, they are caught by the bolt coming forward, forced on an inclined path into the bore, and supported behind by the bolt, which is locked by lugs and the handle engaging in recesses when rotated.

An example of the repeater is the Austrian Mannlicher, a bolt gun, into which is introduced



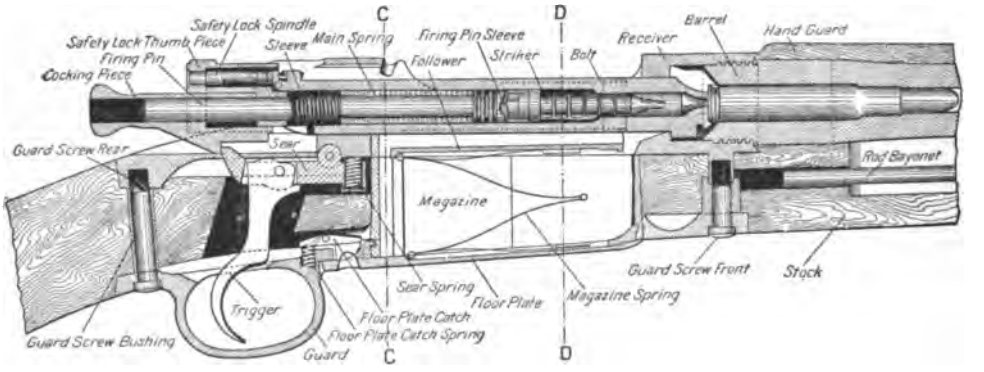
U. S. MAGAZINE RIFLE AND CARBINE, CAL. .30.
The same cross section when all but the last cartridge has been fired; the magazine is 'on' and the bolt opened.

from above, through the receiver, a metal packet holding five cartridges. The packet forms an essential part of the mechanism until all its cartridges have been used, when it falls out. There is no cut-off, as in the Krag-Jörgensen, by which the magazine can be held in reserve; all five cartridges must be fired before any more can be put in.

The Mauser rifle was a modification of the French Chassepôt, constructed for the use of the military gas-check cartridge. It was first adopted by the Prussian Government as the successor of the needle gun, but it has been so frequently improved that in 1903 it still remained one of the most effective of modern military weapons. The Spanish troops were armed with the Mauser magazine rifle during the Spanish-American War, and derived from it a great advantage in effective rifle fire over the American volunteer regiments, who were for the most part armed with the Springfield .45. The bore of the original Mauser as adopted for the Prussian military service was 11 millimeters (.433 inches) diameter, and was rifled with four flat grooves. The length of the barrel was 33.65 inches, and the total length 53.15 inches.

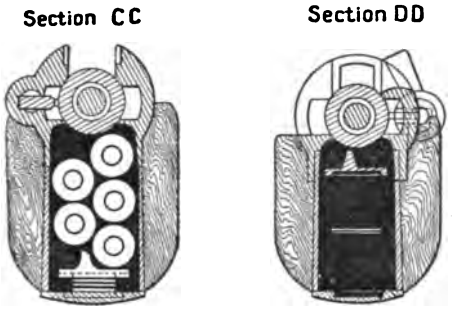
During the last fifty years of the nineteenth century, as we have seen, the muzzle-loader was superseded by a single-shot breech-loader, and this in turn by a magazine rifle, which latter weapon is being replaced in some armies by automatic rifles ejecting and loading by the energy of discharge. During this time there was a constant decrease in the calibre until 1895, when some reaction was felt. The average is now about .30 inch, that of the United States gun. The wisdom of arming the soldier with an automatic magazine rifle is a subject of grave debate among military authorities. It is argued on the one hand that the percentage of hits with repeating fire weapons indicates wasteful and badly directed fire, and such an arm is strongly subversive to good fire discipline, besides adding considerably to the already complex problem of ammunition supply. On behalf of the automatic and magazine systems it is urged that the soldier is in a constant state of readiness, and that, notwithstanding its undoubted tendency to wastefulness, its faults are more than compensated for in critical moments when rapid-fire action is of vital importance. In 1903 the tendency was to reduce the length of the barrel and increase the strength of the charge; to increase the magazine capacity, and, where such was not already employed, to replace the detachable magazine with a clip.

In the United States the Springfield magazine rifle, model 1902, has been adopted as the military weapon. It differs from the weapon that is displaced in that it is centrally fed by clips, and the bolt has two lugs instead of one. The barrel has four grooves, and a calibre of 0.30. The bullet weighs 220 grains, and is fired by a powder charge of a little over 44.5 grains, giving a pressure of 4200 pounds per square inch and an initial velocity of 2300 feet, a velocity at 1000 yards of 958 feet, and a muzzle energy of 2581.6 foot pounds. The rifling in the barrel makes one turn in 8 inches. The magazine is charged from a clip, the cartridges being forced from it directly into the magazine by pressure of the thumb on the top of the cartridge. The clip is



U. S. SPRINGFIELD MAGAZINE RIFLE, MODEL 1902. LONGITUDINAL SECTION.

ejected by the forward motion of the bolt. The gun may be used as a single loader with the magazine empty, and it may be filled by the insertion of a single cartridge. There is a rod bayonet,



U. S. SPRINGFIELD MAGAZINE RIFLE. MODEL 1902. TRANSVERSE SECTIONS.

A, Transverse section at CC; B, transverse section at DD.

which also is used as a cleaning rod. An interesting fact in connection with the preliminary tests of this weapon before the examining board was the fact that it exceeded by 9.3 per cent. in rapidity and 18.6 per cent. in hits, the results obtained by the same marksman with the regular service weapon. Later tests gave still more favorable results.

The weapon with which the British army was equipped in 1903 was a modification of the Lee-Metford weapon. Notwithstanding all that had been promised for the Lee-Metford magazine rifle, with which the troops were armed during the South African War, it was found to be sadly deficient in all the qualities that make a good service weapon. The new weapon is five inches shorter than the old one, thus securing an appreciable reduction in weight. In the old weapon there was a small wooden grip to protect the hand from the heat of the barrel; in the new one the barrel is inclosed in a wooden casing throughout its entire length, to within an inch of the muzzle. This, of course, has necessitated a new method of fixing and securing the bayonet. A separate nose cap is fitted to the barrel, to which the bayonet is attached. A greater velocity of the projectile is secured by slightly enlarging the bore from about ten inches from the muzzle, on the principle that where the bore commences to increase the force of the explosion of the cartridge has already been expended, so that by enlarging the bore a small fraction of an inch an increased velocity is obtained, because if the bore was in the same diameter throughout its entire length the tight barrel would cause friction and a consequent reduction of velocity. The disadvantage of the shortened barrel is that the back and fore sights are brought closer together, thus demanding a greater care in taking aim, since the possible angle of error is greatly increased. To obviate this the backsight has been made so as to be capable of adjustment up to a considerable range without raising the leaf. The magazine is concealed within the stock and carries ten cartridges, as did the former rifle, but instead of loading the magazine by hand a clip similar to that of the Mauser rifle is employed.

The Mannlicher automatic rifle is an improvement on the ordinary Mannlicher model, is 0.7 kilograms (1.54 pounds) less in weight, and has a shorter barrel than the original weapon. It is an automatic firearm with a fixed barrel, the bolt mechanism being operated by powder gases from the barrel, which act on a piston moving in a gas cylinder parallel to the barrel and the bolt. The energy created by the gases is transmitted from the piston to the breech mechanism. The gas piston is driven back a short stroke by the gas, upon which it unlocks the bolt and starts it toward the rear. The gas piston does not accompany it the entire length of its movements in either direction, its functions being confined to giving it the impulse to continue its rearward movement. The advantage of this construction is that it enables the breech mechanism to be operated with a very short and light brass cylinder and piston, at the same time leaving the greater part of the movement to the barrel independent of the gas mechanism, so that should the opening in the barrel for the escaping gas be closed the breech mechanism can still be operated independent of the gas mechanism, as in the ordinary reneating rifle. The vent is bored in the barrel through which the powder gases enter the gas cylinder the moment the projectile has passed beyond the vent, the gas cylinder being fastened underneath the valve by means of a screw. The piston, which is situated in the gas cylinder, is constantly pressed forward by a spiral spring, and is forged in one piece with an arm extending to the rear and to the side. This arm moves in a slit in the sleeve and engages with the bolt by means of a lug. The mechanical process by which the rifle is operated is that of all automatic firearms; the bolt continues its rearward movement under the impulse received (as already described), the hammer is cocked and the empty shell is disengaged from the extractor by a blow against the ejector, after which the bolt-spring drives the bolt forward again. Several important advantages are claimed for this weapon, not the least of which is that the vent in the barrel leading to the gas cylinder can be sealed by the screw, making the weapon to all intents and purposes a non-automatic repeating rifle. Again, should the rifle be operated automatically and the bolt spring become useless or break, the breech mechanism may be locked by hand and the rifle still remain available as a repeater.

The construction of the Mauser automatic repeating rifle is closely similar to the automatic pistol of that name, in that the energy required for its operation is supplied through the recoil. After firing the barrel is moved backward by the breech. The same movement readjusts the spring and cocks the hammer, after which the barrel is disconnected from the breech action. The breech, however, continues its recoil movement by virtue of the velocity acquired, and besides extracting from the barrel and ejecting the shell from the breech causes the compression of a second recuperating spring. The first spring then expands and reloads the chamber; the breech is closed, and the second spring expanding in its turn brings the barrel into a firing position. Thus all that is necessary is to press the trigger and the weapon continues to fire to the full extent of the magazine capacity.

The carbine employed by all the nations of the world is the cavalry firearm which uses the same cartridge as the infantry rifle and with

Country	System or inventor	Date of model	Calibre		Length		Weight				Magazine				Sighting	
							Empty		Filled						† Standing sight. ‡ Leaf sight.	
					Without bayonet	With bayonet	Without bayonet	With bayonet	Without bayonet	With bayonet	Position	No. of rounds	Methods of loading	Weight of clip or loading packet		
			Mm.	*Ins.*	*Ins.*	*Ins.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*				*Grs.*	*Min. yds.*	*Mx. yds*
Canada	Lee-Enfield.		7.7	.303	49.5	61.45	9.25	10.21	.....	.....	Detachable vertical box under receiver	...		.....	.....	.....
United States	Krag-Jörgensen, mod.	1898	7.62	.30	48.9	60.7	9.187	10.174	9.517	10.504	Horizontal under receiver, with side door	5	Charging packet of 5, or one by one	656¼	300	1,900
Mexico	Mauser	1895	7	.276	48.626	58.506	8.818	9.70 (without scabbard)	9.089	9.971	Box vertical under receiver	5	Charged through receiver with clip	154.32	†328.1 ‡437.45	2,187.27
Argentina	Mauser	1891	7.65	.301	48.62	64.368	8.598	9.73	8.895	10.03	Box vertical under receiver	5	Charged through receiver with clip	92.59	273.4	2,187.27
Brazil	Mauser	1894	7	.276	48.626	60.435	8.818	9.766	9.089	10.037	Box vertical under receiver	5	Charged through receiver with clip	154.32	†328.1 ‡437.45	2,187.20
Chile	Mauser	1895	7	.276	48.626	58.506	8.818	9.70 (without scabbard)	9.089	9.971	Box vertical under receiver	5	Charged through receiver with clip	154.32 (clip)	†328.1 ‡437.45	2,187.27
Peru	Mannlicher	1888	8	.315	50.4	60	9.7	10.5	10.08	10.88	Box vertical under receiver	5	Clip of 5; clip part of mechanism	339	219	2,406
Austria-Hungary	Mannlicher	1895	8	.315	49.92	59.55	8.198	9.134	8.518	9.166	Box vertical under receiver	5	Charger of 5; charger part of mechanism	254.638	246	2,460
Belgium	Mauser	1889	7.65	.301	50.277	60.040	8.598	9.590	8.907	9.899	Box vertical under receiver	5	Charged through receiver with clip	83.33	109.36	2,187.27
Denmark	Krag-Jörgensen	1889	8	.315	52.36	62.60	9.50	10.031	9.819	10.35	Horizontal under receiver, with side door.	5	Charging packet of 5, or one by one	.....	273	2,296
England	Lee-Metford, Mark II.	1893	7.7	.303	49.5	61.45	9.25	10.22	9.843	10.813	Detachable vertical box under receiver	*	Loaded one by one through receiver	None	200	2,800
France	Lebel	1886-93	8	.315	51.457	71.85	9.22	10.097	9.73	10.61	Tubular in stock under barrel	8	Charged through receiver one by one	.....	273.4	2,187.27
Germany	Mauser	1898	7.9	.311	49.20	69.49	9.02	.....	.....	....	.....	5	Charged with clip of 5; clip part of mechanism	107.8	218.7	2,187
Greece	Gras	1874	11	.433	51.18	72.05	9.26	10.50	.....	.....	.....	1	Single loader	.....	328	1,968
Holland	Beaumont-Vitali	1871-88	11	.433	51.97	72.129	9.965	10.802	10.387	11.225	Box vertical under receiver	4	Clip of 4	308.647	109	1,968
Holland	Mannlicher	1895	6.5	.256	50.79	64.96	9.423	10.274	9.687	10.538	Box vertical under receiver	5	Clip of 5; clip part of mechanism	155.863	437	2,296
Italy	Mannlicher-Carcano	1891	6.5	.256	50.39	.....	.....	.....	.....	.....	Box vertical under receiver	6	Packet of 6 cartridges	.....	.....	.....
Japan	30 Meiji Murata		8	.315	48.03	59 (about)	9	9.656	9.535	10.191	Tubular under barrel	8	Charged through receiver, one by one	.....	.....	2,187
Norway	Krag-Jörgensen	1893	6.5	.256	.....	.....	8.818	9.347	9.077	9.606	Horizontal under receiver, with side door.	5	Charger of 5, or 1 by 1	.....	.....	2,406
Portugal	Kropatschek	1886	8	.315	51.968	70.472	10.22	11.42	10.837	12.037	Tubular under barrel	8	Charg'd with single cartridges thro'h receiver.	.....	328	2,406
Rumania	Mannlicher	1893	6.5	.256	48.38	58.15	8.84	9.634	9.114	9.907	Vertical fixed under receiver	5	Charged with clip of 5; clip part of mechanism	185.188	.....	2,187
Russia	Mouzin	1891	7.62	.30	51.34	68.11	8.818	9.48	9.10	9.76	Box vertical under receiver, attached to trigger guard	5	Clip of 5 cartridges	132.72	310	2,096
Spain	Mauser	1893	7	.276	48.626	58.585	8.818	9.687	9.089	9.958	Box vertical under receiver	5	Charged through receiver with clip	154.32	†328.1 ‡437.45	2,187.27
Sweden	Remington, new barrel	1867-89	8	.315	48.82	68.11	8.818	9.634	.....	.....	.....	...	.....	.....	218	2,624
Switzerland	Schmidt-Rubin	1889	7.5	.296	51.259	62.99	9.48	10.428	10.207	11.16	Semi-detachable; box vertical under receiver	12	By charger of 6 at a time (charger does not enter mag'ine), or 1 by 1.	308.65	328	2,187
Turkey	Mauser	1890	7.65	.301	48.618	66.73	8.598	10.362	8.895	10.659	Box vertical under receiver	5	Charged thr'gh receiver with clip, or 1 by 1	92.59	.....	2,187.27

* Mark I., 8; Mark II., 10.

most nations is constructed on the same principle as the rifle. It is never, with one exception (Italy), used with a bayonet. The different types of small arms in use in 1902 by the great Powers of the world will be found specified in the accompanying table. The following countries were at that time improving or replacing the weapons therein specified as follows: Japan, the Murata rifle, constructed on the unwieldy fixed magazine tube system, having a range of 2000 meters, was found too heavy and was gradually being replaced by the Arisaka rifle, which has a range of 2500 meters, affords more convenience in loading, and contains 5 shots in the magazine. Portugal was gradually replacing the Kropatschek rifle by the Steyr, which weighs 8.36 pounds, and has a calibre of 6.5 millimeters. The Mauser was rejected on account of its inferior range and more complex mechanism. Switzerland reduced the weight of the Schmidt model of 1889-96 by shortening the breech block. The United States, as already described, has adopted the new Springfield magazine rifle, while the English army had adopted a modified form of the Lee-Metford.

SMALLEY, George Washburn (1833—). An American journalist, born at Franklin, Mass. He was graduated at Yale (1853), studied law at Harvard, practiced in Boston, became war correspondent of the New York *Tribune* (1861), and in 1863 was admitted to the editorial staff of that journal. He reported the Austro-Prussian War (1866), and after 1867 represented the *Tribune* in London, particularly distinguishing himself at the time of the Franco-German War, and at the death of William I. of Germany (1888). In 1895 he returned to America as correspondent of the London *Times*. He published *London Letters and Some Others* (1890), and *Studies of Men* (1895).

SMALLPOX, or Variola. A specific contagious fever having a characteristic eruption followed by permanent scarring. The first accurate description of variola was given by Rhazes, an Arabian physician, who lived in the ninth century. After the Crusades it prevailed in most of the southern countries of Europe, whence it spread into England and the more northern countries by the thirteenth century. The Spaniards introduced the disease into America in the early years of the sixteenth century. It appeared first in Santo Domingo, three years later in Mexico, when it destroyed three and one-half millions of people, and thence spread with frightful severity over the New World. In 1707 it reached Iceland, when more than a quarter of the inhabitants fell victims, and in 1733 it almost depopulated Greenland. In the seventeenth century a careful study was made of the disease by Sydenham, who introduced many improvements in its treatment, but no means of preventing its spread were devised until Jenner discovered vaccination (q.v.) in 1796. An attempt to mitigate the severity of smallpox was made by reviving the practice of inoculation (q.v.), and this was introduced into England by Lady Mary Wortley Montagu in 1718.

Smallpox is one of the most contagious of diseases, and few who are exposed, unless protected by vaccination, escape infection. Even the unborn child may be attacked through the medium of the mother, and may be born with the characteristic rash or pitted. The malady is particularly fatal in young children and among aboriginal races; negroes are especially susceptible. One attack usually, but not invariably, protects against another. No specific micro-organism has been identified with the disease, although eagerly sought. The *contagium* exists in the pustules, in the fluids of the body, and apparently in the exhalations from the lungs and skin. The dried scales thrown off during desquamation are the most important element in disseminating the malady, which travels long distances and with great rapidity, through the medium of clothes, furniture, or other articles which have been in contact with a patient.

The first symptoms of smallpox make their appearance after an incubation period of about 12 days. The onset is abrupt, with a severe chill, pains in the back and limbs, intense headache, and vomiting. The temperature rises rapidly to 103° or 104° F., with loss of appetite, furred tongue and the other accompaniments of high fever. On the third day the typical rash appears. This, however, is in some cases preceded by a preliminary eruption assuming various characters in different cases. These initial rashes commonly appear on the second day, if at all, and fade away before the full development of the typical eruption. The latter begins as a collection of small red papules on the face and forehead, spreading rapidly downward over the whole body. It sometimes occurs upon the mucous membranes. On the third day after their appearance they develop into vesicles filled at first with a clear transparent fluid, which becomes purulent in the course of the three days following, this change being preceded by a process known as umbilication. Each vesicle becomes depressed in the centre, the circumference forming a prominent ring around it. This change is often accompanied by great swelling of the face so that the features are unrecognizable. The suppurative stage lasts two or three days, after which the pustules gradually dry up, leaving in their place depressed white scars, popularly known as 'pits.' After the initial rise of temperature, coincident with the primary rash, the fever falls nearly or quite to the normal, remaining low until the vesicles begin to mature, when the secondary or suppurative fever begins. This lasts for six or eight days, and is accompanied by sleeplessness, headache, and perhaps delirium. The fever subsides with the drying up of the eruption, and convalescence begins.

Several varieties of smallpox are described. To the ordinary or *discrete* the above description applies. In this the pustules remain distinct and scattered. *Confluent smallpox* is a severe form in which the rash is very abundant and the pustules exhibit a tendency to coalesce and form irregular purulent blebs. The mortality in this variety is very high. *Malignant* or *hemorrhagic* variola is characterized by small hemorrhages beneath the skin, and is also very fatal. *Modified* smallpox, often called *varioloid*, occurs in persons who have been vaccinated, but in whom protection is incomplete either on account of the lapse of time or because vaccination was inefficient. This variety is of short duration, and recovery is the rule. In the form of smallpox produced by artificial inoculation, a pimple arises

at the seat of the operation on the second day. This develops into a vesicle or pustule, and is followed by modified symptoms of the disease. About the eleventh day the typical eruption of variola makes its appearance and passes through its various stages. The attack is generally mild, and confers immunity, but it is, on the other hand, occasionally fatal and always contagious. Inoculation is no longer practiced. Variola may be complicated or followed by destruction of the eyes, chronic discharge from the ears, bronchitis, pneumonia, and pleurisy.

The preventive treatment of smallpox at the present time consists almost solely in vaccination and isolation. That vaccination confers complete immunity not only to individuals, but to communities, has been abundantly proved. A patient with the disease should be placed in bed in a well-ventilated room and should have an abundance of milk and other easily digested liquid foods, with cooling drinks to quench the thirst. Fever is kept within the limits of safety by cold sponging. Many attempts have been made to prevent the occurrence of disfiguring scars or pits. Painting the face with iodine or nitrate of silver, or washing it with various antiseptic lotions, or anointing it with carbolized oil, have all been tried with indifferent success. The best plan is to protect the face from the light and keep it covered with a mask of lint saturated with antiseptic solution. But if the inflammatory process goes below the true skin, a pit will result. Particular attention must be paid to the eyes. They must be sponged frequently and kept free of secretion. Beyond these measures the treatment is purely symptomatic, no specific having been discovered for the disease.

SMALLWOOD, William (1732-92). An American soldier, born in Kent County, Md. He was elected colonel of a Maryland regiment in January, 1776, and served with great gallantry at Long Island, White Plains, Fort Washington, Germantown, and particularly at Camden, becoming a brigadier-general in October, 1776, and a major-general in September, 1780. He refused to serve under Baron Steuben in the South, but remained in the army until November, 1783. In 1785 he was elected to Congress, and from 1785 to 1788 was Governor of Maryland.

SMALTITE (from *smalt*, from It. *smalto*, enamel, from OHG. *smalzjan*, *smelzan*, Ger. *schmelzen*, to melt; connected with Gk. *μέλδειν*, *meldein*, to melt, OHG. *malz*, Ger. *Malz*, AS. *mealt*, Eng. *malt*). A mineral cobalt diarsenide crystallized in the isometric system. It has a metallic lustre, and is white to steel-gray in color. It occurs associated with other metallic arsenides and sulphides, and with cobaltite in veins. It is found in Saxony; in Bohemia; in Cornwall, England; in Dauphiné, France; in Chile; and in the United States at Chatham, Conn.; Franklin, N. J.; and in Gunnison County, Colo. It is one of the commercial sources of the cobalt oxide which is used as a blue coloring matter for glass and pottery. It is sometimes called tin, white cobalt, or 'speisskobalt.'

SMART, Christopher (1722-71). An English poet. He was born at Shipbourne, Kent, and was educated at Cambridge (B.A. 1742), where he took the Seatonian prize for poetry five years in succession. In 1753 he went to London and endeavored to make a living by his pen. He translated the Psalms, Horace, and Phædrus into English verse, and made a prose translation of Horace. His original poems show considerable talent. Among them may be mentioned his "Song to David." His works were published in collected form (London, 1791). He became insane through dissipation and deprivations, and died in a debtor's prison in London.

SMART, Henry (1813-79). An English organist and composer, born in London. He held the position of organist at several churches in London, and finally (in 1864) at Saint Pancras. That year he lost his sight, and in 1879 received a Government pension. Among his works are an opera, *Bertha, or the Gnome of Hartzburg* (1855); the cantatas, *The Bride of Dunkerron* (1864), *King René's Daughter* (1871), *The Fisher Maidens* (1871), and *Jacob* (1873). In addition he wrote considerable church music, songs, and part songs. His biography was written by William Spark (1881) and by W. D. Seymour (1881).

SMEATON, smē'ton, John (1724-1792). A British engineer. He was born at Ansthorpe, near Leeds, and was educated for the bar. In 1754 he studied the canals and other great engineering works in Holland, and a few months after his return was called to replace the second Eddystone lighthouse. The new structure erected from his plans (1756-59) was considered a model of engineering. After it had been standing about 120 years it was found necessary to replace it by a new lighthouse. (See Lighthouse.) Afterwards he built bridges at Perth, Banff, and Coldstream, the North Bridge at Edinburgh, and the Hexham Bridge. The Forth and Clyde Canal was the most important of his canal work. He also made harbor improvements at Ramsgate. In 1769, after considerable experimental work, he began the construction of steam engines of greater size and length of stroke than had previously been built, in which numerous improvements were introduced. Smeaton's improvements on Newcomen's engine did much to increase its range of usefulness, and engines designed by him were exported to the Continent of Europe. A small club of engineers, founded by him in 1771, afterwards became the Institution of Civil Engineers. His engineering work is described in three volumes of *Reports*, published in 1812. A biographical memoir will be found in Smiles, *Lives of the Engineers—Smeaton and Rennie* (London, 1861).

SMEDLEY, Francis Edward (1818-64). An English novelist. He belonged to a family of scholars and educators, but, owing to a serious malformation of the feet, he was unable to attend public school and the university. He was accordingly educated by private tutors, and for a long time lived at Chesterton, near Cambridge, with his uncle, Edward Arthur Smedley, chaplain of Trinity College. There he saw much of student life, which he subsequently turned to good use. To *Sharpe's London Magazine* for 1846-48 he contributed the popular *Scenes from the Life of a Private Pupil*, afterwards worked over into *Frank Fairleigh* (1850), which ranks second to Thomas Hughes's *Tom Brown's School Days*. Of less merit are *Lewis Arundel* (1852), and *Harry Coverdale's Courtship* (1855). With

Edmund Yates (q.v.), he wrote a book of nonsense verses entitled *Mirth and Metre* (1855). His last years were spent in retirement near Marlow.

SMEDLEY, William Thomas (1858—). An American painter and illustrator, born in Chester County, Pa. He studied at the Pennsylvania Academy of Fine Arts, and under Laurens in Paris. His sketches, published in the standard magazines, are clever delineations of modern life. His other works include "Challenged" (1900), "In a Gallery" (1900), and "Old People in a Park" (1900), and portraits. He was elected an associate of the National Academy of Design, and received the Evans prize at the American Water Color Society in 1890, and a bronze medal at the Paris Exposition of 1900.

SMELL. Sensations of smell are set up through the stimulation of the end-organs of the olfactory nerve, by odorous particles contained in the current of inspired air. The ultimate number of smell qualities is difficult to determine. Like tastes, odors come to us highly fused with affective qualities, with other sensations, pressure, temperature, tickling, or even pain, and with secondary effects such as drowsiness, sneezing, or weeping. Compare the effects of carbon disulphide, chlorine, acetic acid. In 1896 Aronsohn suggested a method of classification by *exhaustion.* A given substance is smelled until entire fatigue (perhaps better, adaptation) ensues; other substances are then applied with the result that (1) some remain at their normal intensity, (2) others possess a lessened intensity, and (3) others are entirely imperceptible. Thus, after exhaustion by iodine, cajeput is strong, mace very weak, pine imperceptible; after exhaustion by camphor, cajeput is very faint, mace strong, pine very faint. Certain smells are compensatory; if given simultaneously, they cancel one another. *Compensation,* it should be noted, is not the mere swamping of one odor by the sheer intensity of a second, which is often observed in actual life, e.g. in the operating room; it is a complete nullification of olfactory sensation, comparable to the production of neutral gray by the mixture of complementary colors. Finally, there are smell contrasts. Cheese and Bordeaux, high game and Burgundy, are evidently opposed odors. Experimental investigation shows that sensitivity to either one of the scents of a compensation-pair will be increased by previous stimulation with the other.

Bibliography. Aronsohn, *Archiv für Anatomie und Physiologie* (Leipzig, 1886); *Gamble, Am. Journal of Psychology,* x. (1898); Kuelpe, *Outlines of Psychology* (London, 1895); Nagel, *Zeitschrift für Psychologie und Physiologie,* xv. (1897); Titchener, *An Outline of Psychology* (New York, 1899); id., *Experimental Psychology* (ib., 1901); Vintschgau, "Physiologie des Geruchssins," in *Hermann's Handbuch der Physiologie,* iii. (1880); Zwaardemaker, *Die Physiologie des Geruchs* (German trans., Leipzig, 1895). See Intensity; Nose.

SMELLIE, William (1740-95). A Scottish printer and antiquary, born in Edinburgh. From the grammar school he passed to an Edinburgh printing house, where he performed his duties with marked efficiency. Meanwhile he attended lectures at the university. In 1765 he began business as printer, in conjunction with a fellow apprentice. The firm brought out the first edition of the *Encyclopædia Britannica* (1771). Smellie held important positions in several learned societies of Edinburgh. Of his works the most popular was *The Philosophy of Natural History* (completed by his son in 1799).

SMELT (AS. *smelt;* perhaps connected with *smeolt, smylt,* smooth). One of a genus (Osmerus) of fishes of the family Argentinidæ, sometimes included under the Salmonidæ. They are merely reduced salmon, from which they differ principally in the form of the stomach and in their smaller size. They are slender, delicate fishes, inhabiting the coasts of Europe and North America; some enter rivers to spawn. Their flesh is most delicate and they are highly valued as food. There are only a few species. The common European smelt is *Osmerus eperlanus,* called 'spirling' or 'sparling' in Scotland, and 'eperlan' in France. It grows to be about 8 inches long, and is abundant. The American smelt (*Osmerus mordax*) is very closely related to the European species, attains a length of about 12 inches, and is abundant along the Atlantic coast of the United States from Virginia to the Gulf of Saint Lawrence. It ascends streams to spawn and has become landlocked in lakes in New England, where it thrives, and is important not only for the markets, but especially as food for salmon and trout. On the California coast and northward to Alaska occurs an important species (*Osmerus thaleichthys*) and a common species of the Far East is *Osmerus Japonicus.*

See Colored Plate of Philippine Fishes; and Plate of Whitefish, Smelts, etc.

SMELTING. See sections on *Metallurgy* in the articles on Iron and Steel; Copper; Gold; Silver; and other metals.

SMERDIS (Lat., from Gk. *Σμέρδις,* also *Μέρδις, Merdis,* Babylonian *Barziya,* OPers. *Bardiya;* connected with Av. *bərəza,* high). A son of Cyrus. At his father's death the young prince controlled several provinces in Eastern Iran, but he was soon put to death by the order of his elder brother Cambyses II. (q.v.). During the absence of Cambyses in Africa a Magian named Gaumata, who closely resembled Smerdis, impersonated the dead man, since the murder was not generally known. The rebellion begun by this pseudo-Smerdis in 522 became so dangerous that, if the inscription of Darius Hystaspes, the earliest record of these events, may be trusted, the entire Persian Empire was in commotion, a reign of terror followed. According to the classical authors, some Persian nobles soon suspected the impostor, and were convinced when they found through one of his wives that his ears had been cropped. Seven of them then entered the palace and killed the pretender after he had reigned seven months.

SMET, Peter John de (1801-72). A Roman Catholic missionary to the Indians. He was born in Termonde, Belgium, was educated at the episcopal seminary at Mechlin, and in 1821 embarked for the United States. He was received into the Jesuit Order at Whitmarsh, Md., and in 1828 went to Saint Louis, participated in the establishment of the University of Saint Louis, and became one of its professors. In 1838 he entered upon the work that occupied him the remainder of his life, first among the Potawatami Indians and later among the Flatheads of the

Rocky Mountains, in whose behalf he made several visits to Europe, collecting money and enlisting recruits as missionaries and teachers. He wrote *Letters and Sketches and Residence in the Rocky Mountains* (1843); *Oregon Missions and Travels Over the Rocky Mountains in 1845-46* (1847); *Western Missions and Missionaries* (1863); *Reisen zu den Felsengebirgen und ein Jahr unter den wilden Indianerstämmen des Oregon-Gebietes* (1865).

SMETANA, smĕ-tä'nȧ, FRIEDRICH (1824-84). A Bohemian composer and pianist, born in Leitomischl. He studied music under Proksch of Prague, and later with Liszt. He founded a music school in Prague, but in 1856 went to Sweden, where he became conductor of the Philharmonic concerts at Gothenburg. Returning to Prague in 1866, he became kapellmeister at the National Bohemian Theatre. Smetana's works are thoroughly Bohemian, and as a national composer he is of the greatest importance. His works include the following operas: *The Bartered Bride* (1866); *Dalibor* (1868); *Two Widows* (1874); *The Kiss* (1876); *The Secret* (1878); *Libussa* (1881), and *The Devil's Wall* (1882); the symphonic poems, *Richard III.* (1858); *Wallensteins Lager* (1859); *Hakon Jarl* (1861); *My Country*, comprising six independent works (1874-79); and other symphonies, string quartets, and smaller compositions. He died in the Prague lunatic asylum. For his biography, consult Wellek (Prague, 1899).

SMETHWICK, smĕTH'ĭk. A municipal borough in Staffordshire, England, three miles northwest of Birmingham (Map: England, E 4). It is an important manufacturing centre with iron, machine, glass, chemical, and other works. The municipality owns gas and electric lighting plants, and garden allotments, and maintains a free library and reading rooms, park, public baths, and an isolation hospital. Population, in 1891, 36,100; in 1901, 54,560.

SMEW (probably a variant of *smee, smeath*, perhaps from MDutch *smeente*, Dutch *smient*, widgeon). A small merganser (*Merganser albellus*), which abounds from Lapland to Kamtchatka, but not east of Bering Straits, and visits Europe in winter. It is a very handsome bird, the plumage of the male being chiefly white, marked with black and gray, and on the head with green.

SMICHOW, smĭK'ôv. A town of Bohemia, Austria, on the river Moldau, opposite Prague, of which city it is an important suburb, and with which it is connected by the Palaky Bridge. The town contains a new municipal building and a botanical garden. There are a large wagon factory, rattan furniture factories, chocolate and confectionery establishments, and flour mills. Population, in 1900, 47,135, mostly Czechs.

SMIKE. A miserable, half-witted drudge at Squeers's school, in Dickens's *Nicholas Nickleby*, befriended by Nicholas, and at last found to be Ralph Nickleby's son.

SMILACEÆ. A group of monocotyledonous, generally climbing, herbs and sub-shrubs formerly considered a separate order, but now included in the order Liliaceæ. Most of the species belong to the genus smilax (q.v.).

SMILAX (Lat., from σμῖλαξ, yew). A genus of about 200 species, mostly herbs and woody climbing or trailing plants, of the natural order Liliaceæ, most numerous in the temperate and tropical parts of Asia and America. In some species (the greenbriers) the stems are often very prickly. The roots or rootstocks of a number of species, particularly *Smilax medica* and *Smilax papyracea* of Central and South America, yield sarsaparilla. The fleshy, starchy rhizomes of others (*Smilax China* of Eastern Asia and *Smilax pseudo-China* of the Southern United States) have similar properties and are sometimes used, the former as food, the latter as medicine. There are at least a dozen American species, the best known of which are the *Smilax herbacea*, carrion flower, with herbaceous stems, and *Smilax rotundifolia*, the greenbrier or horsebrier. The smilax commonly cultivated in greenhouses for decorative purposes is *Asparagus medeoloides*, a native of South Africa.



GREENBRIER (*Smilax rotundifolia*).

SMILES, SAMUEL (1812-1904). An English writer, born at Haddington, Scotland. He studied medicine at the University of Edinburgh. At twenty he began practice at Haddington and later at Leeds. He subsequently gave up his profession to assume the editorship of the *Leeds Times*. In 1845 he was appointed secretary of the Leeds and Thirsk Railway, and in 1854 of the Southeastern Railway, retiring in 1866. In recognition of his services to letters, the University of Edinburgh honored him with the degree LL.D. (1878). As early as 1838 Smiles published, at his own expense, *Physical Education*, and in 1857 a *Life of George Stephenson*. His *Lives of the Engineers* appeared in 1861. He gained immense success with *Self Help* (1859), practical talks to young men. It has been translated into seventeen languages. Similar books are *Character* (1871), *Thrift* (1875), *Duty* (1880), and *Life and Labor* (1885).

SMILLIE, smil'li, GEORGE HENRY (1840—). An American landscape painter. He was born in New York City and was a pupil of his father, James Smillie, an engraver, and of James Hart. In 1862 he opened a studio in New York City, exhibiting at the National Academy of Design in 1864. His principal works in oil include the "Merrimac River" (1882), Boston Art Club; "Light and Shadow Along Shore," Union League Club, Philadelphia; and a "Gray Day." In water-colors are "Under the Pines of the Yosemite" and "September on the New England Coast."

SMILLIE, JAMES D. (1833—). An American engraver, etcher, and landscape painter, born in New York City. He was the pupil of his father, James Smillie, an engraver. Until 1862 he worked chiefly at bank-note vignettes, but at times devoted himself also to general design and illustration, studying at the schools of the National Academy of Design. From 1862 to 1864 he studied in Europe, and upon his return to his native city exhibited at the National Academy of Design, of which he was made member in 1876. Paintings in oil include "Evening Among the Sierras of California" and "Lifting of the Clouds in the Adirondacks;" in water-colors are the "Scrub Race on Western Prairies" and "Track of the Torrent." As an engraver Smillie produced original plates in illustration of the various styles of engraving, for the department of graphic arts at the Pratt Institute, Brooklyn, and the Smithsonian Institution, Washington, D. C. His work shows artistic skill and deftness in handling color.

SMIRKE, Sir ROBERT (1781-1867). An English architect, born in London. He studied under Sir John Soane and in the schools of the Royal Academy, winning the gold medal for design in 1799. After visiting Greece and Sicily he began to practice his profession as an architect in London in 1805. Among his works in the classic style are the College of Physicians, the Post-Office, the Mint, and the British Museum, the main façade of which is his best known work. In the Gothic style are his extension of the Inner Temple and restoration of York Minster. He published *Specimens of Continental Architecture* (1806). His brother, SIDNEY SMIRKE (1799-1877), also an architect, designed the great circular reading room of the British Museum.

SMITH, ADAM (1723-90). An eminent political economist. He is regarded as the founder of political economy as a separate branch of human knowledge. He was born at Kirkcaldy, in Fifeshire, Scotland. He studied at the University of Glasgow and won there an exhibition on the Snell foundation, which took him to Balliol College, Oxford, where he remained seven years, after which he retired for a time to his old home at Kirkcaldy. In 1748 he was in Edinburgh, where, at the suggestion of Lord Kames, he delivered a course of lectures upon rhetoric and belles-lettres. These seem to have given him a reputation as a scholar and to have introduced him to a circle of learned and accomplished men, of whom the most famous was David Hume. The friendship thus begun was an important one for Smith, who remained on terms of friendly intimacy with Hume during his life. In 1751 Smith was appointed professor of logic at the University of Glasgow, and a year afterwards was transferred to the chair of moral philosophy.

In 1759 he published his first work, *The Theory of Moral Sentiments*, which still holds an honorable place in the history of ethics. In 1763 he became tutor to the young Duke of Buccleuch and accompanied the latter upon his travels in France. He spent a year or more in Paris, and became acquainted with the more important men of letters of France. He was particularly attracted by the group who termed themselves *Economistes* and who are better known as Physiocrats. Quesnay, the leader of the school, and several of his more noted followers, were in the circle of Smith's acquaintance. Through them he became thoroughly familiar with the theories of the Physiocrats, which exercised a great influence upon him. In 1766 he returned to Kirkcaldy. He was now engaged in the preparation of his great work, *An Inquiry Into the Nature and Causes of the Wealth of Nations*, which first appeared in 1776. The work made a great impression. Five editions were printed during the life-time of the author, and before the close of the century it had been translated into the principal European languages. (For its place in economic thought, see POLITICAL ECONOMY.) In 1778 Smith was appointed a Commissioner of Customs for Scotland, and he took up his official residence in Edinburgh. In 1787 he was elected Lord Rector of the University of Glasgow. He died in Edinburgh, July 17, 1790.

Consult MacCulloch, "Sketch of the Life and Writings of Adam Smith," in *Treatises and Essays on Money* (Edinburgh, 1859). A scholarly and exhaustive biography, *The Life of Adam Smith* (London, 1895), was published by John Rae. See also Haldane, *Life of Smith* (London, 1887); Pria, *Economic Science and Practice* (London, 1896).

SMITH, ALEXANDER (1830-67). A Scottish poet, born at Kilmarnock. His father was a lace-pattern designer. After the usual education of a Scotch boy, Smith took up the trade of his father at Paisley and Glasgow, whither the family in turn had gone. His *Life Drama* (1853) created a sensation. It was both defended and ridiculed. The faults of the book were obvious; every page showed immaturity and extravagance; a rather narrow reading had made him passionately fond of a few modern poets, as Keats and Tennyson, and their peculiar turns of expression, reappearing in his verse, gave color to the charge of plagiarism, which was pushed to an absurd length. The richness and originality of imagery in his verse atone for its many sins against taste and knowledge. In 1854 Smith was appointed secretary to the University of Edinburgh; and in the following year, along with Sydney Dobell, he published a volume of *Sonnets on the Crimean War*. He also wrote *City Poems* (1857), *Edwin of Deira* (1861), and several delightful prose works, as *Dreamthorp* (1863), *A Summer in Skye* (1865), and *Alfred Hagart's Household*, a story of Scotch life (1866), and a sequel, *Miss Dona M'Quarrie*. After his death appeared *Last Leaves* (London, 1868), edited with a memoir by P. P. Alexander. Smith's verse and prose, though often admirable, just pass the bounds of sanity. He was classed with Philip James Bailey (q.v.), Sydney Dobell (q.v.), and Gerald Massey (q.v.), as a member of the

'Spasmodic' school. The epithet was first used in *Blackwood's Magazine* for May, 1854. Besides the memoir cited above, consult Brisbane, *Early Years of A. Smith* (London, 1869).

SMITH, ANDREW HEERMANCE (1837—). An eminent American physician, born in Saratoga County, N. Y., and educated at Union College and the College of Physicians and Surgeons, New York City. He served as surgeon of United States Volunteers in 1861-62 and as assistant surgeon in the United States Army in 1862-68, resigning in the latter year to practice medicine in New York City. He served for many years as attending physician to Saint Luke's and the Presbyterian Hospitals, and was for a long period a surgeon in the throat department of the Manhattan Eye and Ear Hospital. He became a member of the Association of American Physicians, the Philadelphia Academy of Natural Sciences, and the Berlin Gesellschaft für Heilkunde, and was president of the New York Academy of Medicine and president of the Medical Association of Greater New York in 1902-03. Dr. Smith's contributions to our knowledge of pneumonia were frequent and notable, and to him is due the credit of suggesting and exploiting the medical uses of oxygen (q.v.). He also published much original work upon the malady termed by him caisson disease (q.v.), which he studied when serving as surgeon to the New York Bridge Company, during the construction of the Brooklyn Bridge. Besides many monographs on other medical themes, his publications include valuable papers on inflammation (q.v.), the existence of which as a separate self-perpetuating process, outlasting its cause, he was the first to deny.

SMITH, ANDREW JACKSON (1815-97). An American soldier, born in Berks County, Pa. He graduated at West Point in 1838, served on the Southwestern frontier and in the Mexican War, and afterwards against the Indians in Oregon and Washington Territory. At the outbreak of the Civil War he was commissioned colonel of the Second California Cavalry. He served as chief of cavalry successively in the departments of the Missouri and the Mississippi up to July, 1862; and on March 17, 1862, was commissioned brigadier-general of United States volunteers. He was engaged at the siege of Corinth, in the Yazoo River expedition (December, 1862), in the attack on Arkansas Post (January, 1863), and in the Vicksburg campaign, in which he commanded a division of the Thirteenth Army Corps. Subsequently he commanded a division in the Sixteenth Army Corps, took part in Banks's Red River expedition, and for services at the battle of Pleasant Hill, La., April 9, 1864, he received the brevet of colonel in the Regular Army. He was commissioned major-general of volunteers, May 12, 1864; later in the year was engaged in Mississippi and Tennessee, and participated in the battle of Nashville, December 15-16, 1864, receiving for gallant and meritorious services in that struggle the brevet rank of major-general in the Regular Army. He was placed in command of the Sixteenth Army Corps in February, 1865, and took part with it in the Mobile campaign, and in the operations against Montgomery. Leaving the volunteer service in January, 1866, he was appointed colonel of the Seventh Cavalry. In May, 1869, he resigned from the army and was appointed postmaster at Saint Louis, Missouri.

SMITH, BENJAMIN BOSWORTH (1794-1884). An American prelate, for sixteen years presiding bishop of the Episcopal Church. He was born at Bristol, R. I., and educated at Brown University, where he graduated in 1816. The following year he was ordained, beginning his ministry in Marblehead, Mass. He held several pastoral charges, and was for a time editor of *The Episcopal Recorder*, an influential paper in Philadelphia. His last rectorship, in Lexington, Ky., he held until 1837, though in 1832 he had become bishop of the diocese. At the death of Bishop Hopkins in 1868, as the senior in consecration he became presiding bishop. The most important event of his tenure of this office was the organization of the separatist movement which became the Reformed Episcopal Church, under the leadership of Bishop Smith's own assistant bishop, George David Cummins. He died in New York City, where he had resided after age and infirmity had made it impossible for him to continue active episcopal work.

SMITH, BUCKINGHAM (1810-71). An American antiquary, born on Cumberland Island, Ga. He graduated at the Harvard College Law School in 1836, practiced for a time in Maine, but removed to Florida and became a member of the Territorial Legislature. From 1850 to 1852 he was secretary to the United States Legation in Mexico, and acted as chargé d'affaires in 1851. Here he studied Indian philology and began to collect material on the Spanish exploration and settlement of America. While secretary of legation at Madrid (1855-58), he collected further material from the Spanish archives. He returned to Florida in 1859, and became a judge and a member of the State Senate. Among his translations and other publications are: *Narrative of Alvar Nuñez Cabeza de Vaca* (1851; new ed. 1871); *Grammatical Sketch of the Heve Language* (1861); *Grammar of Pima or Névome, a Language of Sonora* (1862); and *Narratives of the Career of Hernando de Soto in the Conquest of Florida* (1866).

SMITH, CHARLES EMORY (1842—). An American journalist and politician. He was born at Mansfield, Conn., and graduated at Union College in 1861. In 1865 he became editor of the Albany *Express*, and several years later of the *Evening Post*. For many years he took an active interest in politics as a Republican and stood high in the party's councils. He removed to Philadelphia in 1880, and as editor of *The Press* continued to take part in politics. From 1890 till 1892 he was American Minister to Russia, and was active in distributing supplies to the famine sufferers in that country. From 1898 till 1902 he was Postmaster-General of the United States. An important measure of his administration was the establishment of rural mail routes.

SMITH, CHARLES FERGUSON (1807-62). An American soldier, born in Philadelphia, Pa. He graduated at West Point in 1825, and served with distinction through the Mexican War. During the Civil War he rose to the rank of major-general in the Federal Army, and was for some time commander of the District of Western Kentucky. He led the decisive charge at Fort Donelson and soon afterward he was given command of the

troops sent up the Tennessee. During these movements he was accidentally injured, and died April 25, 1862.

SMITH, CHARLES HENRY (1826-1903). An American humorist, born at Lawrenceville, Ga. He graduated at Franklin College, Athens, Ga.; became a lawyer in Rome, Ga.; and served in the Confederate Army. After the war he was a planter and took some interest in politics. He removed to Cartersville, Ga. He was widely known for his newspaper letters, under the signature "Bill Arp," which began in 1861, and with their homely, genuine humor cheered the hearts of the Southern people. The letters were subsequently collected as *Bill Arp's Letters* (1868); to which were added *Bill Arp's Scrap Book* (1886) and other volumes.

SMITH, CHARLOTTE (1749-1806). An English poet and novelist, eldest daughter of Nicholas Turner of Stoke House in Surrey. With her marriage, at the age of sixteen, to Benjamin Smith, the son of a merchant and a director in the East India Company, misfortunes began which followed her through life. She left her husband eventually and supported herself and seven children by her pen. She gained the attention of the London literary world with *Elegiac Sonnets and Other Essays* (1784), a volume which passed through many editions. Her wider public was won by a series of novels describing contemporary life. Among them are *Emmeline* (1788), *Desmond* (1792), and *The Old Manor House* (1793). Consult the memoir and generous estimate of C. Smith by Sir Walter Scott in his *Miscellaneous Prose Works*, vol. i. (Edinburgh, 1834-36).

SMITH, CLEMENT LAWRENCE (1844—). An American Latinist, born at Upper Darby, Pa., and educated at Haverford College, at Harvard, and in Europe. In 1869-70 he was professor of Greek and German at Swarthmore, Pa., and was then called to Harvard as tutor of Latin. He became assistant professor in 1873, professor in 1883, and was appointed to the Pope professorship in 1901. In 1897-98 he was director of the American School of Classical Studies at Rome. With Professor Tracy Peck of Yale he edited the *College Series of Latin Authors*. In this series he edited *The Odes and Epodes of Horace* (Boston, 1894).

SMITH, DAVID EUGENE (1860—). An American mathematician and educator, born in Cortland, N. Y. He was educated at Syracuse University, and was member of the New York bar (1881-84). He was teacher of mathematics at the Cortland (N. Y.) Normal School (1884-91), professor of mathematics in Michigan State Normal College (1891), principal of New York State Normal School, Brockport (1898), and became professor of mathematics in Columbia University (1901). He also delivered several courses of lectures in the Harvard University summer courses. He wrote: "History of Modern Mathematics," in Merriman and Woodward's *Higher Mathematics* (1896); *The Teaching of Elementary Mathematics* (1900); and a series of text-books (1903). He was also the joint author of a number of text-books on elementary mathematics. Smith was mathematical contributor to the *New International Encyclopædia*. He became editor of *The Bulletin of the American Mathematical Society*, and librarian of the society. With Professor W. W. Beman he translated Klein's *Famous Problems of Geometry* (see KLEIN, F.) and Fink's *History of Mathematics*.

SMITH, EDGAR FAHS (1854—). An American chemist, born in York, Pa. He graduated at Pennsylvania College in 1874, and at the University of Göttingen, Germany, in 1876. After filling various chairs in chemistry, he was called to the University of Pennsylvania and made director of the John Harrison Laboratory, and he afterwards became vice-provost of the university. His contributions to chemistry have been considerable, especially in the domain of mineral chemistry and in electrolytic methods of analysis. He wrote *Chemistry of the Carbon Compounds* (2 vols., 3d ed. 1900), and *Experiments Arranged for Students in General Chemistry* (with H. F. Keller, 4th ed. 1900).

SMITH, EDMUND KIRBY (1824-93). An American soldier, born at Saint Augustine, Fla. He graduated at West Point in 1845. During the Mexican War he was brevetted first lieutenant for gallantry at Cerro Gordo, and captain for bravery at Contreras and Churubusco. From 1849 to 1852 he was assistant professor of mathematics at West Point. He became first lieutenant in March, 1851, captain of the Second Cavalry in March, 1855, and major in January, 1861. He resigned from the army April 6, 1861, was appointed lieutenant-colonel of cavalry in the Confederate Army, and became brigadier-general June 17, 1861. He served as chief of staff under Gen. Joseph E. Johnston in the Shenandoah Valley during June and a part of July, and brought in the fresh troops which decided the first battle of Bull Run, July 21st, but was himself severely wounded. He became major-general in October, 1861, and in March, 1862, was placed in charge of the District of East Tennessee, and afterwards of the Department of East Tennessee, Kentucky, North Georgia, and Western North Carolina. Here he led the advance of General Bragg's army into Kentucky, defeated General Nelson near Richmond (southeast of Lexington), August 30, 1862, gathered men and supplies, and threatened Cincinnati. On October 9, 1862, he became lieutenant-general and in February, 1863, was assigned to the Trans-Mississippi Department. He became general on February 19, 1864, and in April baffled General Banks's unfortunate Red River expedition. He finally surrendered to General Canby in May, 1865. From 1866 to 1868 he was president of the Atlantic and Pacific Telegraph Company, from 1870 to 1875 was chancellor of the University of Nashville, and from 1875 until his death was professor of mathematics in the University of the South, at Sewanee, Tenn.

SMITH, ELI (1801-57). A Protestant missionary and scholar. He was born at Northford, Conn., graduated from Yale College in 1821, and Andover Seminary in 1826. The same year he was put in charge of the printing establishment of the American Board at Malta, and remained there until 1829, barring a period spent at Beirut to study Arabic. In 1829 he traveled through Greece, later through Armenia and Georgia to Persia in company with H. G. O. Dwight, and published the results of their observations in *Missionary Researches in Armenia* (1833). The

Armenian and Nestorian missions were shortly afterwards established by the American Board. In 1833 he settled in Beirut. In 1838 and 1852 he accompanied Edward Robinson (q.v.) on his tours of investigation in the Holy Land. He ceaselessly prosecuted linguistic studies in preparation for what he considered his life work, the translation of the Bible into Arabic; but he died after completing the New Testament, the Pentateuch, and part of the prophetical books. The work was completed by Dr. Cornelius V. Van Dyck of the Syrian Mission, and published in 1866-67.

SMITH, Elizabeth Oakes (Prince) (1806-93). An American author, born at Cumberland, Maine. She was removed in infancy to Portland. There she married Seba Smith (q.v.), and wrote much prose and verse, assisting her husband in his profession of journalism. In 1839, after financial reverses, she adopted literature as a means of subsistence, and settled in New York in 1842, contributing to periodicals and writing stories, plays, and lectures. Some of her volumes are: *The Sinless Child and Other Poems* (1841), *Woman and Her Needs* (1851), and *Kitty Howard's Journal* (1871). She also published two tragedies and was noted for her advocacy of woman's rights.

SMITH, Erminnie Adelle (1836-86). An American ethnologist, born in Marcellus, N. Y., and educated at Mrs. Willard's Seminary in Troy, N. Y. In 1855 she married S. H. Smith, and while educating her sons in Germany studied mineralogy and other sciences. In 1878 she became connected with the Bureau of Ethnology, and was detailed to study the language, customs, myths, and peculiarities of the Iroquois Indians, spending two summers for that purpose among the Tuscaroras of Canada, who adopted her as a member.

SMITH, Francis Henney (1812-90). An American soldier, born at Norfolk, Va. He graduated in 1833 at the United States Military Academy, and in 1837 was appointed professor of mathematics at Hampden-Sidney College. In 1839 he was selected to be superintendent and professor of mathematics in the newly organized Virginia Military Institute. Soon after the outbreak of the Civil War he was appointed colonel, and was stationed at Norfolk and in command of Craney Island Fort. Subsequently he reopened the Institute, whose buildings had been destroyed by fire during the war. He published *The Best Methods of Conducting Common Schools* (1849), *College Reform* (1850), and numerous text-books.

SMITH, Francis Hopkinson (1838—). An American artist, author, and engineer, born in Baltimore, Md. After receiving a good academic education he became a clerk in a Baltimore ironworks, subsequently studied engineering, and became a successful contractor. In this capacity he was engaged in several Government works of importance on the Atlantic seaboard, including the construction of the sea-walls at Block Island, Governor's Island (New York Harbor), and Tompkinsville, the Race Rock Lighthouse, off New London, Conn., and the foundation for the Bartholdi Statue. At the same time he attained distinction as an artist, particularly in water-colors. Some of his best known pictures are: "The Old Man of the Mountains" (1874); "In the Darkling Wood" (1876); "Peggothy on the Harlem" (1881); "Under the Towers, Brooklyn Bridge" (1883); "In the North Woods" (1884); and "A January Thaw" (1887). He also became well known for his work in charcoal and as an illustrator. In recent years, however, his fame as an author has almost eclipsed that of the engineer and artist. Among his published works are: *Well-Worn Roads* (1886); *Old Lines in New Black and White* (1886); *A Book of the Tile Club* (1887); *A White Umbrella in Mexico* (1889); *Colonel Carter of Cartersville* (1891); *A Day at Laguerre's* (1892); *American Illustrators* (1892); *A Gentleman Vagabond and Some Others* (1895); *Tom Grogan* (1896); *Gondola Days* (1897); *Caleb West, Master Diver* (1898); *The Other Fellow* (1899); and *The Fortunes of Oliver Horn* (1902).

SMITH, Sir Francis Pettit (1808-74). An English inventor, born in Hythe. In 1834 he constructed a model of a steam vessel to be propelled by a screw driven by a spring, and three years afterwards built a larger boat on the same principle, which he successfully tested in the English Channel. He constructed for the British Navy the screw steamer *Archimedes* of 237 tons, 90 horse-power, which he completed in 1840, and the success of which led to the rapid introduction of screw vessels into the English Navy and the mercantile marine.

SMITH, George (1808-99). A Scotch-American banker and financier, born in Aberdeenshire, Scotland. He was educated at Aberdeen College, emigrated to America, and in 1834 settled in Chicago, and for the next quarter of a century was closely identified with the industrial and financial history of the Northwest. In 1837 he was granted a charter for the Wisconsin Marine and Fire Insurance Company at Milwaukee, which allowed him to carry on a general banking business, and issue notes to the amount of $1,500,000. This corporation was for many years the most stable financial institution in the West, and its notes, payment upon which was never refused, circulated widely, and were of great benefit to other banks and to business houses in times of panic. In 1839 he also founded the house of George Smith & Co., the first banking house in Chicago. Subsequently he became interested in banking in the South, but after the outbreak of the Civil War gradually withdrew from active business and retired to London, where he died.

SMITH, George (1824-1901). An English publisher, born in London. His father was a Scotchman, who had established a book-shop in London in partnership with Alexander Elder in 1816. In 1843 Smith took charge of most of the firm's publishing, and in 1846, on the death of his father, became head of the firm. Under his supervision the early works of John Ruskin were published, Charlotte Brontë's *Jane Eyre* was brought out in 1848, and Thackeray's *Henry Esmond* in 1851. In 1859 Smith founded *The Cornhill Magazine*, with Thackeray as its first editor; and in 1865 he established the *Pall Mall Gazette*, an independent evening paper, retaining control of it until 1880. He projected and published the great *Dictionary of National Biography* (67 vols. with supplement and index, 1885-1903), edited by Leslie Stephen and Sidney Lee.

SMITH, George (1840-76). An English Assyriologist, born at Chelsea. He was an en-

graver by trade. Becoming interested in Assyriology, he gave much of his leisure time and spare money to the study, and attracted the favorable notice of Rawlinson. In 1866 he discovered a text relating to the tribute paid by Jehu to Shalmaneser II. The remarkable aptitude which he showed for arranging and classifying Assyrian documents led to his being associated with Rawlinson in the preparation of the third and fourth volumes of the *Cuneiform Inscriptions of Western Asia* (published 1870, 1875). In 1867 Smith became officially connected with the British Museum. In 1871 he published the *Annals of Assur-bani-pal*, and prepared valuable papers on the *Early History of Babylonia* and *The Reading of the Cypriote Inscriptions*. In 1872 he made his most famous discovery—the Babylonian account of the deluge, which had been found at Nineveh and brought to England by Layard. As a result he was sent to Nineveh the following year at the expense of the *Daily Telegraph* to search for more fragments of the account, and returned in a short time, having succeeded in his mission. He again conducted excavations at Nineveh for the British Museum in 1874. In October, 1875, he started a third time for the East; after many difficulties he reached Nineveh, only to find that it was impossible to excavate, owing to the disturbed state of the country. His health broke down from care and worry, and he died at Aleppo, August 19, 1876. Besides the works already mentioned, he published: *Assyrian Discoveries* (1875), the account of his explorations; *The Assyrian Eponym Canon* (1875); *Ancient History from the Monuments: Assyria* (1875); *The Chaldean Account of Genesis* (1876; edited by Sayce, 1880); and papers in the *Transactions* of different societies. *Ancient History from the Monuments: Babylonia* (1877) and *The History of Sennacherib* (1878) appeared posthumously.

SMITH, George Adam (1856—). A Scotch theologian and Hebraist, born in Calcutta, India. He was educated in Edinburgh at the university and at New College. In 1880 he became assistant at Brechin. From 1880 to 1882 he was instructor in Hebrew at the Free Church College in Aberdeen; then, until 1892, was pastor of the New Church, Queen's Cross, Edinburgh; and in that year was named professor of Hebrew and of Old Testament exegesis in the Free Church College of Glasgow. Professor Smith traveled in Palestine in 1891 and 1901, and published the valuable *Historical Geography of the Holy Land* (1894; 7th ed. 1901). He frequently visited the United States, and in 1896 he was Percy Turnbull lecturer on Hebrew poetry at Johns Hopkins University, and in 1899 gave the Lyman Beecher lectures at Yale on *Modern Criticism and Preaching of the Old Testament* (published 1901). Professor Smith was Jowett Lecturer in London in 1900, and in the spring of 1903 again visited America, and lectured at Union Theological Seminary and elsewhere. In the *Expositor's Bible* he published a "Commentary on Isaiah" (1888-90) and "The Twelve Prophets" (1896-97). His other writings are *The Preaching of the Old Testament to the Age* (1893), *Historical Atlas of the Holy Land* (1895), and *The Life of Henry Drummond* (1898; 6th ed. 1902).

SMITH, George Williamson (1836—). An American clergyman and educator, born at Catskill, N. Y. He graduated at Hobart College in 1857. After being ordained priest in the Protestant Episcopal Church in 1864 he was an assistant in various churches in Washington. In 1865-68 he was chaplain of the United States Naval Academy, and from 1868 to 1871 was chaplain on the United States Steamship *Franklin*. From 1872 to 1883 he was rector of churches in Jamaica and in Brooklyn, L. I., and in the latter year he was elected president of Trinity College, Hartford, Conn., an office which he resigned in 1903.

SMITH, Gerard Fowke. See Fowke, Gerard.

SMITH, Gerrit (1797-1874). An American philanthropist, son of Peter Smith, of Utica, N. Y., who, associated in the fur trade with John Jacob Astor, accumulated a great fortune which the son greatly increased. Gerrit graduated from Hamilton College in 1818, and, without regularly studying law, he entered upon that profession and practiced with distinction in both the State and Federal courts. He made his home in Peterboro, Madison County, N. Y. Entering Congress in 1853, he found public life distasteful, and abandoned it after the long session of 1854. At this time, one of the largest landowners in the United States, Smith developed radical views in opposition to private land monopoly. Putting theory into practice, he began and during many years continued to distribute holdings to poor families—in his later years showing a preference for negroes—in parcels of fifty acres each. In religious matters also he was a radical, and attempted to build up an independent church both by money gifts and his own preaching. Plunging at length into the anti-slavery movement, he became by his generosity and earnestness one of its most effective agitators. A stanch and lifelong friend of John Brown, he loyally supported him in his Kansas raids and through his subsequent tribulations. The signing of Jefferson Davis's bail bond when the Civil War was over, by Gerrit Smith and Horace Greeley, was one of the most characteristic acts of each of those unusual men. Besides numerous speeches and pamphlets, chiefly on the slavery issue, Smith wrote *The Religion of Reason* (1864), and *Nature the Base of a Free Theology* (1867). There is a biography by Frothingham (New York, 1878) which the family attempted to suppress.

SMITH, Goldwin (1823—). An Anglo-American publicist, born at Reading, in Berkshire, England. He was educated at Eton and Oxford. Elected fellow of University College in 1847, he devoted some time to tutoring, and was called to the bar at Lincoln's Inn in 1850. He never practiced law, however, but gave his first public efforts to university reform, serving as assistant secretary to the first and secretary to the second Oxford commission, through whose efforts important changes were made in the university system. From 1858 to 1866 he was regius professor of modern history at Oxford. During the following two years he lectured on questions of political reform. During the Civil War Smith was one of the stanchest friends of the North, combating in the *Daily News* the pro-Southern views of the *Times*, in an effective manner. In 1868 he came to the newly founded Cornell University at Ithaca, N. Y., as professor of English

and constitutional history. He resigned this chair three years later, but retained a non-resident professorship. At Toronto, which became his home after leaving Ithaca, he increased his reputation as 'scholar, statesman, and philosopher.' As regent of the University of Toronto, as founder and editor of the leading periodicals of his city—the *Canadian Monthly*, the *Nation*, and the *Toronto Week* (1884)—he lent his support to the cause of reform and liberty. As professor of history at Oxford he developed his philosophy of history, combating the view that history is governed by necessary law, claiming on the contrary that all progress comes through the efforts of individuals, thus finding a moral rather than a physical basis for historical evolution. He believes in the ultimate union of Canada with its neighbor to the south, and advocates reciprocity in trade relations between the two countries. As an historian he has thrown much light on the relations of England and Ireland, claiming that the contest is of historical origin, and primarily a struggle on the part of the Irish people to reacquire the ownership of their soil. His writings are so voluminous that only a few of the more important ones can be mentioned. Such are: *Lectures on Modern History*, delivered at Oxford, 1859-61 (1866); *Irish History and Irish Character* (1861); *The Empire* (1863); *Speeches and Letters*, from January, 1863, to January, 1865, dealing with the American Civil War (1865); *A Short History of England, Down to the Reformation* (1869); *The Political Destiny of Canada* (1879); *Lectures and Essays* (1882); *Dismemberment No Remedy* (1886), on Home Rule; *History of the United States* (1893); *Essays on the Questions of the Day* (New York, 1894).

SMITH, Green Clay (1832-95). An American soldier, legislator, and preacher, born at Richmond, Ky. He served through the Mexican War as lieutenant in a Kentucky regiment, graduated at Transylvania University in 1850, and at the Lexington Law School in 1853, and settled in Covington for the practice of his profession in 1858. In 1860 he was elected to the Kentucky Legislature, where, on the approach of the Civil War, he tried to keep the State in the Union. On the outbreak of hostilities he recruited and became colonel of the Fourth Kentucky Cavalry (Federal), took part in the Tennessee campaigns of 1862, and in June of that year was commissioned brigadier-general of volunteers. In the succeeding year, however, having been elected a Unionist member of the Thirty-eighth Congress, he resigned his commission. He was reëlected to Congress in 1864, and in 1866 was appointed by President Johnson Governor of Montana Territory. He retired from politics in 1869, was ordained in the Baptist ministry, and attained considerable prominence as an evangelist. In 1876 he was the candidate of the Prohibition Party for the Presidency.

SMITH, Gustavus Woodson (1822-96). An American soldier, born in Scott County, Ky. He graduated at the United States Military Academy in 1842, fought in the Mexican War, and was brevetted lieutenant for gallantry at Cerro Gordo, and captain for services at Contreras. In 1861 he was commissioned major-general in the Confederate service. After Gen. Joseph E. Johnston was wounded in the battle of Seven Pines, Smith was for a short time in command of the Army of Northern Virginia, but was seized by a temporary attack of paralysis and was superseded by General Lee. Afterwards he was in command of Richmond and then of the Georgia militia. He published *Confederate War Papers* (1883; 2d ed. 1884).

SMITH, Henry Hollingsworth (1815-90). An American surgeon, born at Philadelphia, Pa. He graduated from the medical department of the University of Pennsylvania in 1837, studied two years in the hospitals of London, Paris, and Vienna, and was professor of surgery in the University of Pennsylvania from 1855 till 1871, when he became professor emeritus. When the Civil War began he was appointed surgeon-general of Pennsylvania. He very thoroughly organized the field hospital service, introduced the practice of embalming on the field of battle, and in 1862 resigned to take up his practice and his work in the university. Among his published works are: *Minor Surgery* (1846); *System of Operative Surgery* (2 vols., 1852); *The Treatment of Disunited Fractures by Means of Artificial Limbs* (1855); and *Practice of Surgery* (2 vols., 1857-63).

SMITH, Henry John Stephen (1826-83). An eminent English mathematician, born in Dublin. He was educated at Oxford. In 1848 he gained the Ireland University scholarship, and in 1849 was elected Fellow of Balliol. In 1850 he was appointed lecturer in mathematics at Balliol College, and in 1851 senior scholar in mathematics. In 1860 Smith became Savilian professor of geometry, and in 1861 was elected Fellow of the Royal Society and of the Royal Astronomical Society.

Smith was the leading English writer on the theory of numbers and a disciple of Gauss, whose writings he thoroughly examined. These researches occupied his time from 1854 to 1864, and are contained in his *Report on the Theory of Numbers*, presented to the British Association in six parts, 1859-65. His most important contributions were contained in two papers: "On Systems of Linear Indeterminate Equations and Congruences" and "On the Orders and Genera of Ternary Quadratic Forms" (1861, 1867). Smith gave the formulæ relating to the representation of a number as a sum of five squares, and also of seven squares. Jacobi had proved the cases of two, four, and six squares; Eisenstein had proved the case of three squares, but left that of five squares without demonstration. This was supplied by Smith, but through an unaccountable oversight the French Academy set this as the subject of their 'Grand prix des sciences mathématiques' for 1882. The prize of 3000 francs was awarded him two months after his death. Smith also devoted his attention to elliptic functions, the results of which were published in the *Proceedings* of the London Mathematical Society. Smith's published writings were collected and edited by Glaisher, in two volumes (Oxford, 1894). Consult: *Monthly Notices of the Royal Astronomical Society*, vol. xliv.; and the *Fortnightly Review* (May, 1883).

SMITH, Henry Preserved (1847—). An American theologian and Orientalist, born in Troy, O. He was educated at Amherst College,

at Lane Theological Seminary, and in Berlin. He was appointed professor of Hebrew and of Old Testament exegesis at Lane Seminary, 1877. In 1891, after the Briggs heresy case, Professor Smith in an address on *Biblical Scholarship and Inspiration* urged a distinction between inerrancy and inspiration, and, for his attack on the former doctrine in the particular case of parallel accounts in Chronicles and in Samuel and Kings, was tried by the Presbytery of Cincinnati in 1892, and suspended until these errors should be renounced. The trial is outlined from the side of the defendant in his *Response, Rejoinder, and Argument* (1893) and with all the documents in question in his *Inspiration and Inerrancy* (1893). In 1893 Professor Smith became professor in Andover Theological Seminary and entered the ministry of the Congregational Church, and in 1897 was made professor of Biblical literature in Amherst College. He wrote: *The Bible and Islam* (Ely Lectures, 1897); *A Commentary on Samuel* (in "The International Critical Commentary," 1899); *Old Testament History* (in "International Theological Library," 1903).

SMITH, HORACE. An English humorist. See SMITH, JAMES AND HORACE.

SMITH, JAMES (c.1715-1806). One of the signers of the Declaration of Independence, born in Ireland. He came to America with his father who settled on the Susquehanna in Pennsylvania in 1729. He was educated at the College of Philadelphia, studied law, and settled near Shippensburg, as a lawyer and surveyor, but soon removed to York. He was a delegate to the Provincial Conference to discuss the state of the colonies in July, 1774, raised a volunteer company, and wrote an *Essay on the Constitutional Power of Great Britain Over the Colonies in America.* He was a delegate to the Provincial Convention in January, 1775, to the conference in June, 1776, and to the Constitutional Convention in July. From 1775 to 1778 he served in the Continental Congress, and during this time signed the Declaration of Independence. In 1780 he was a member of the General Assembly and afterwards returned to his profession.

SMITH, JAMES (1737-1812). An American backwoodsman, born in Franklin County, Pa. He was captured by the Indians in 1755 and was adopted into the Caughnewaga nation, but escaped in 1759. He was the leader (1763) of the 'Black Boys,' a company organized to fight the Indians in spite of Quaker opposition, served as lieutenant in Bouquet's expedition of 1764 (see BOUQUET, HENRY), and in 1766-67, with four companions, explored the southern part of Kentucky. In 1769, at the head of eighteen men, he captured Fort Bedford and released several prisoners there, this being the first fort ever taken from British troops by American colonists. He served as captain of rangers in Lord Dunmore's War and sat in the Pennsylvania Assembly in 1776-77, and in the latter year was commissioned colonel and assigned to the frontier service. In 1788 he removed to Bourbon County, Ky. He published *An Account of the Remarkable Occurrences in the Life and Travels of Col. James Smith* (1799), considered by Parkman as "perhaps the best of all the numerous narratives of captives among the Indians," and *A Treatise on the Mode and Manner of Indian War* (1811).

SMITH, JAMES (1775-1839) and HORACE (1779-1849), authors of the *Rejected Addresses*, were sons of a London solicitor. Both were educated at a school at Chigwell. James succeeded his father as solicitor to the Board of Ordnance; Horace adopted the profession of stock-broker, and made a handsome fortune, on which he retired with his family to Brighton. Both were popular and accomplished men—James remarkable for his conversational powers and gayety, and Horace distinguished for true liberality and benevolence. The work by which they are best known is a small volume of verse parodies or imitations, perhaps the most felicitous in the language. On the opening of the new Drury Lane Theatre in October, 1812, the committee of management advertised for an address to be spoken on the occasion, and the brothers adopted a suggestion made to them, that they should write a series of supposed "Rejected Addresses." They accomplished their task in six weeks—James furnishing imitations of Wordsworth, Southey, Coleridge, Crabbe, Cobbett, etc., and Horace those of Scott, Byron (all but the first stanza), Monk Lewis, Moore, and others. Horace Smith wrote several historical novels in imitation of Scott. The best is *Brambletye House* (1826), dealing with the Commonwealth and the Restoration. Consult *Rejected Addresses*, ed. by Percy Fitzgerald (London, 1890).

SMITH, JOHN (1580-1631). A famous adventurer, colonist, and explorer, born at Willoughby, Lincolnshire, England. He was left an orphan at an early age. At the age of fifteen he accompanied the sons of an English nobleman on a tour of the Continent, as a page; but soon left them and enlisted under the Protestant banner in France. He served as a soldier of fortune in different lands, and, according to the memoirs which he published of his life, met with a series of wonderful and romantic adventures. The most remarkable of these incidents is his victory over three Turks, whom he asserts he slew on one occasion in single combat in Transylvania. For this achievement he claimed to have received from the prince of that country a pension and a patent of nobility (which he published in the original Latin), empowering him to emblazon upon his shield the bleeding heads of three Turks. He was taken prisoner, he asserts, at the battle of Rothenthurm, was sold into slavery, was sent to Constantinople, finally killed his master, and escaped after being befriended by a Turkish lady. Upon his return to England in 1605 he was induced to take part in the colonization of Virginia, and sailed with the expedition fitted out for this purpose in 1606. He was named a member of the Council to direct the affairs of the infant community in the secret list prepared before the departure of the ships, but during the voyage he was imprisoned on a charge of sedition. On the arrival of the vessels, when the sealed instructions were opened, he was not allowed to take his seat. He indignantly demanded an immediate trial, which was finally accorded. He established his innocence, but the jealousy of his comrades still excluded him from his seat. But his military reputation, and his fiery spirit, tempered by prudence and sagacity, soon made his influence felt, and his advice was often sought by the authorities.

He was sent on several expeditions for forage

and discovery among the Indians, and distinguished himself by the ability with which he conducted them. After the first trip of discovery he was, in June, 1607, admitted to the Council. It was on one of these occasions, in December, 1607, that he was captured by the Indian chief Powhatan (q.v.). The story which he relates of the young Indian maiden Pocahontas, the daughter of Powhatan, who, when he was condemned to death by the savage chieftain, saved his life by her interposition, is now discredited by perhaps a large majority of careful historians. (See POCAHONTAS.) After a period of turbulence and disaster, Smith's influence became paramount in Jamestown. During another of his journeys, in the summer of 1608, he explored Chesapeake Bay as far as the Patapsco, and made a map of the bay and the adjoining country. He was elected president of the Council in September, 1608, and several times seems to have saved the colony from ruin by his decision, sagacity, and force of character. In his dealings with the Indians he showed himself an astute and unscrupulous politician, and a valiant soldier, who became at once an adept in all the peculiarities of Indian warfare. His services were not sufficiently appreciated, and upon the grant of a new charter and the reorganization of the government, he returned to England at the close of 1609, broken in health and poor in purse. He was sent out on various voyages of discovery, and in 1614 made a fairly complete exploration of the New England coast from the Penobscot to Cape Cod. To the same end he twice sailed in 1615, the first time being driven back by bad weather and the second time being captured by the French. He was given the title of 'Admiral of New England,' and made ineffective efforts to secure means to enable him to plant a colony in New England. After this his attention was directed chiefly to literary pursuits. He died in London, and was buried in the choir of Saint Sepulchre's Church.

His two really historical works are his *True Relation*, published in 1608 (the best edition being that edited by Charles Deane, Boston, 1867), and his *General Historie of Virginia, New England, and The Summer Isles*, published in 1624. Three other works of importance are his Maps of Virginia (1612), his *Description of New England* (1616), and his *New England's Trials* (1620). The only comprehensive edition of Smith's *Works* is that by E. Arber (Birmingham, 1884; Westminster, 1895). Charles Dudley Warner has written a short study of Smith's *Life and Writings* (New York, 1881).

SMITH, JOHN (1618-52). One of the founders of the Cambridge Platonists. See CAMBRIDGE PLATONISTS.

SMITH, JOHN LAWRENCE (1818-83). An American chemist. He was born in Louisville, Ky., and was educated at the University of Virginia, the Medical College of South Carolina (M. D. 1840), in Germany, under Liebig, and in Paris, under Pelouze. In 1844 he began the practice of medicine in Charleston, and established the *Medical and Surgical Journal of South Carolina*. In 1846 he was appointed by the Turkish Government to report on the mineral resources of that country. For four years he continued in that work, discovering coal, chrome ore, and the famous emery deposits of Naxos. He returned to the United States, and in 1852 was made professor of chemistry in the University of Virginia. In 1854 he resigned and settled in Louisville, Ky., where he was professor of chemistry in the medical department of the university. His specialty was mineralogical chemistry; his collection of meteorites was the finest in the United States, and on his death passed to Harvard. His published papers were more than 150 in number, and the more important of them were collected and published as *Mineralogy and Chemistry, Original Researches* (1873, enlarged with biographical sketches, 1884). The sum of $8000 paid by Harvard for his meteorite collection was by Mrs. Smith transferred to the National Academy.

SMITH, JOHN PYE (1774-1851). An English Congregational scholar. He was born in Sheffield, and spent the early years of his life in the shop of his father, a bookseller. In his 22d year he entered an independent academy at Rotherham, became classical tutor in the Homerton Theological School (Congregational) 1800, divinity tutor 1806, and held the position till 1850. His principal works are: *Scripture Testimony to the Messiah* (1818-21; 4th ed. 1847); *The Sacrifice and Priesthood of Christ* (1828; 3d ed. 1847); *On the Principles of Interpretation as Applied to the Prophecies of Holy Scripture* (1829); but especially *Relation Between the Holy Scriptures and Some Parts of Geological Science* (1839). Consult his *Life* by Medway (London, 1883).

SMITH, JOSEPH, Jr. (1805-44). The founder of Mormonism. He was born in Sharon, Vt., December 23, 1805. Of illiterate and neuropathic ancestry and dissatisfied with the 'clash of creeds' in Palmyra, N. Y., whither his parents had removed in 1815, Smith at fourteen claimed to receive a series of visions concerning the founding of a new Church and the writing of a religious history of the aborigines of America. The 'translation' of this *Book of Mormon* began in 1827; the various 'witnesses' to the book formed the nucleus of the Church of Jesus Christ of Latter-Day Saints, which was founded in 1830 and of which Smith was successively first elder, prophet, seer, and revelator. (For a description of the origin of the Book of Mormon, see MORMONS.) In 1831 Smith moved with his followers to Kirtland, Ohio, where he absorbed the Church Joint Stock Company of Sidney Rigdon (q.v.), an ex-Campbellite minister. The prophet succeeded in neither his community store-house nor the Kirtland Safety Society Bank, and fled to Independence, Mo., where he founded the city and temple of Zion. Characteristic alike of Smith's activity and his ambition were his putting himself at the head of the first presidency of the Church in 1834, his choice of his own adherents as the Twelve Apostles in 1835, his proselyting in the East in 1838, his assisting the persecuted saints to escape from Missouri in 1839, and finally his running for President of the United States in 1844. Driven from Missouri on the charge of fostering polygamy, Smith, as Mayor of Nauvoo, Ill., and head of the Nauvoo Legion, was accused of attempting to found a military Church. He was indicted for perjury and adultery and was murdered in Carthage jail on June 27, 1844. In spite of

the opposition of his son, Joseph Smith, third, he was succeeded in the presidency of the Church by Brigham Young (q.v.). See MORMONS.

SMITH, JOSEPH (1832—). A Mormon leader, son of Joseph Smith (q.v.), founder of the Mormon Church. He was born at Kirtland, Ohio, and received a common school education at the Mormon settlement of Nauvoo, Ill., but he did not join his fellow-religionists in their migration to Utah. He opposed the practice of polygamy, became a leader among the Mormons of the Middle West, and in 1860 was chosen president of the Reorganized Church of Jesus Christ of Latter-Day Saints. In 1863 he became editor of the Mormon paper, the *Saints' Herald.*

SMITH, JOSHUA TOULMIN (1816-1869) (known in letters as Toulmin Smith). An English lawyer and author. He was born in Birmingham, England. He studied law, first with a local solicitor, and afterwards at Lincoln's Inn, London. In 1837 he came to the United States, settling eventually in Boston, where he gave lectures on phrenology and other subjects. His studies of the Icelandic sagas resulted in *The Northmen in New England, or America in the Tenth Century* (1839), said to be the earliest account in English of the voyages of the Icelanders to Vineland. He returned to England in 1842. At the time of his death he was at work on a *History of English Gilds,* which was edited in 1870 by his daughter for the Early English Text Society.

SMITH, JUDSON (1837—). An American educator and missionary, born at Middlefield, Mass. He graduated at Amherst in 1859, and at the Oberlin Theological Seminary in 1863, and was ordained a Congregational minister in 1866. He was professor of Latin in Oberlin in 1866-70, of ecclesiastical history in the Oberlin Theological Seminary in 1870-84, and was lecturer on modern history there in 1875-84. In 1884 he became corresponding secretary of the American Board of Commissioners for Foreign Missions. He visited the Board's missions in Turkey in 1888 and those in China in 1898. From 1882 till 1884 he was editor of the *Bibliotheca Sacra,* and was its associate editor after that time. He published *Lectures in Church History and the History of Doctrine from the Beginning of the Christian Era till 1864* (1881) and *Lectures on Modern History* (1881).

SMITH, MELANCTON (1810-93). An American naval officer, born in New York City. He was appointed a midshipman in the navy in 1826, and in 1839 on board the *Poinsett* coöperated with the land forces against the Seminole Indians in Florida. He became a commander in 1855, and in 1861-62 commanded the *Massachusetts* in the Gulf Blockading Squadron. He was promoted to be captain in 1862. He commanded the naval forces in the capture of Biloxi, Miss., and after running by the Confederate forts took part in the capture of New Orleans. He attacked and destroyed the Confederate ram *Manassas,* but in the attack on Vicksburg his vessel, the *Mississippi,* ran aground while attempting to pass the Confederate batteries, and had to be abandoned. In the battle of Mobile Bay he distinguished himself particularly in command of the *Monongahela,* and in both attacks on Fort Fisher commanded the *Wabash.* He became a commodore in 1866, and a rear-admiral in 1870, and retired in 1871.

SMITH, MUNROE (1854—). An American jurist and historian, born in Brooklyn, N. Y. He graduated at Amherst in 1874, and at Columbia Law School in 1877, and in 1880 received the degree of J. U. D. at Göttingen. He was instructor in Columbia from 1880 to 1883, and adjunct professor of history until 1891, when he was appointed professor of Roman law and comparative jurisprudence. He became an editor of the *Political Science Quarterly* in 1886, wrote articles on Roman law and cognate subjects for the *New International Encyclopædia,* and contributed to Johnson's *Universal Encyclopædia,* to Harper's *Classical Dictionary,* to Lalor's *Cyclopædia of Political Science,* and to the *American Historical Review,* and other periodicals. His separate publications include: *Bismarck and German Unity* (1898); "Orations and Essays of Cicero," in *The World's Great Books* (1900); and a chapter on "Germany," in *The Nineteenth Century* (1901).

SMITH, PERSIFOR FRAZER (1798-1858). An American soldier, born in Philadelphia, Pa. He graduated at the College of New Jersey (Princeton) in 1815, studied law under Judge Chauncey, and removed to New Orleans. As colonel of Louisiana Volunteers he served against the Seminole Indians in 1836 and 1838. He was brigadier-general of Louisiana Volunteers at the outbreak of the Mexican War, but entered the regular service of the United States as colonel of mounted rifles, May 27, 1846. He was brevetted brigadier-general for gallantry at Monterey, and major-general for his conduct at Contreras and Churubusco. He was commissioner to arrange an armistice with Mexico in August, 1847, and was placed in charge of the Second Division of the army. In October, 1847, he was military and civil Governor of Mexico, and in May, 1848, held the same position at Vera Cruz. He remained in the army at the close of the war, became brigadier-general December 30, 1856, and was sent to Kansas to quiet the disturbances there.

SMITH, RICHMOND MAYO. An American economist. See MAYO-SMITH, RICHMOND.

SMITH, RICHARD SOMERS (1813-77). An American soldier and educator, born in Philadelphia, Pa. He graduated at West Point in 1834. He resigned his commission in 1836 and for four years was engaged in engineering work. He was reappointed to the army in 1840, and from 1840 to 1855 was stationed at West Point, first as instructor and after 1852 as professor of drawing, but again resigned in 1855, and became professor of mathematics at the Brooklyn Polytechnic Institute from 1855 to 1859, and director of the Cooper Institute in 1859-61. In the latter year he was commissioned major in the Regular Army (Twelfth Infantry), was engaged as a recruiting officer in Maryland and Wisconsin, commanded his regiment in the operations of the Army of the Potomac in 1862, and a brigade in the early months of 1863, until after the battle of Chancellorsville. He resigned from the army on May 30, 1863, to become president of Girard College, where he remained until 1868. From 1868 to 1870 he was professor of engineering at Pennsylvania State College, and from 1870 to 1877 was professor of drawing at the United States

Naval Academy. He published *A Manual of Topographical Drawing* (1853) and *A Manual of Linear Perspective* (1857).

SMITH, ROBERT (1689-1768). An English mathematician and astronomer, born at Lea, near Gainsborough. He was educated at Trinity College, Cambridge. In 1716 he was elected to succeed Cotes as Plumian professor of astronomy at Cambridge, a position which he held till 1760. Besides astronomy he also lectured on optics and hydrostatics, and was a defender of Newton's method of fluxions. He also effected the completion of the observatory over the great gate at Trinity College. In 1742 he became master of Trinity College and also acted as vice-chancellor of the university (1742-43). He was also master of mechanics to George II., and mathematical preceptor to the Duke of Cumberland. Smith was the founder of the prizes at Cambridge which bear his name. He wrote: *A Compleat System of Opticks* (2 vols., 1728; student's edition, 1778); *Harmonics, or the Philosophy of Musical Sounds* (1744; 2d ed. 1759, and postscript 1762). He also edited Cotes's works and left several papers on Cotes and Newton, which were later bequeathed to the college and from which was collected the *Correspondence of Newton and Cotes,* by Edleston (1850).

SMITH, SAMUEL (1752-1839). An American soldier, born at Lancaster, Pa. He removed to Baltimore with his father, John Smith, a well-known merchant, in 1759; received a commercial education, and subsequently spent three years (1772-75) in Europe. He became a captain in Smallwood's Maryland Regiment in January, 1776, and served with great gallantry at the battles of Long Island and White Plains, attaining the rank of lieutenant-colonel in February, 1777. He afterwards participated in the attack on Staten Island and in the battle of Brandywine, and from September 26th to October 23d was in command of Fort Mifflin (q.v.), repelling the repeated attacks of the English, though finally dangerously wounded. He was a member of the Maryland House of Delegates in 1792, commanded the quota of Maryland militia sent to help suppress the Whisky Insurrection in 1794, was a member of Congress from 1793 to 1803 and from 1816 to 1822, was for a time in 1801 Secretary of the Navy, was United States Senator from 1803 to 1815, commanded the State troops as major-general of militia in the defense of Baltimore in 1814, and was Mayor of Baltimore in 1835-38.

SMITH, SAMUEL FRANCIS (1808-95). An American clergyman and hymn writer. He was born in Boston, graduated at Harvard College in 1829, and at Andover. He was pastor of the Baptist Church at Waterville, Me., and professor of modern languages in Waterville College, 1834-42; pastor at Newton, Mass., 1842-54; editor of *The Christian Review* (Boston), 1842-48, and of the publications of the American Baptist Missionary Union, 1854-69. He wrote "My Country, 'Tis of Thee" (first sung in the Park Street Church, Boston, July 4, 1832), "The Morning Light Is Breaking" (1832), and other favorite hymns. His publications include a *Life* of Rev. Joseph Grafton (1848) and of William Hague (1889); *Missionary Sketches* (1879; 2d ed. 1883); *History of Newton, Mass.* (1880); and *Rambles in Mission Fields* (1884). A collected edition of his poems appeared at New York in 1895.

SMITH, SAMUEL STANHOPE (1750-1819). An American clergyman and educator. He was born at Pequea, Pennsylvania; was graduated at the College of New Jersey, Princeton, 1769; was ordained to the Presbyterian ministry and preached in Virginia, 1774; was first president of Hampden-Sidney College, 1775-79; was made professor of moral philosophy in the College of New Jersey, 1779; professor of theology, 1783; vice-president, 1786; and president, 1795-1812. Among his publications are: *Lectures on the Evidences of the Christian Religion* (1809); *Lectures on Moral and Political Philosophy* (1812); *Comprehensive Views of Natural and Revealed Religion* (1815). Consult the memoir prefixed to his *Sermons* (Philadelphia, 1821).

SMITH, SEBA (1792-1868). An American humorist, born at Buckfield, Maine. After graduating at Bowdoin in 1818 he became a journalist in Portland, Maine, editing three papers, the last of which was *The Daily Courier*, to which he contributed, beginning in 1830, the humorous letters on local and national politics which purported to be written by 'Major Jack Downing.' These letters, first collected in 1833, were immensely popular and are still readable in their Yankee dialect. They are not to be confounded with the amusing letters of a second 'Major Downing' published in 1834 by Charles Augustus Davis (1795-1867), an iron merchant of New York City. In 1839 Smith lost his property and three years later began life anew in New York. Here he succeeded at journalism and also published in the magazines many contributions in prose and verse. Among his works may be named: *Dewdrops of the Nineteenth Century* (1846); *Powhatan, a Metrical Romance* (1841); and *Way Down East, or Portraitures of Yankee Life* (1855). In 1859 he parodied the title of Senator Benton's great work by publishing *My Thirty Years Out of the Senate,* in which he collected 'Major Downing's' letters on Maine politics, on his relations with 'Old Hickory,' and with President Polk in connection with the Mexican War. This humorous performance is homely and vigorous, and justifies Smith's long continued popularity as a good-natured political satirist.

SMITH, SOPHIA (1796-1870). An American philanthropist, founder of Smith College (q.v.). She was born in Hatfield, Mass., one of seven children of a Revolutionary soldier. All of them died before her, the last in 1861, leaving her with a large fortune, which she determined to devote to charity and in aid of education. She founded Smith Academy in her native town and gave liberally to Andover Theological Seminary and to foreign missions. The bulk of her estate, however, amounting in all to about $400,000, she left for the establishment of the woman's college at Northampton, Mass., which bears her name.

SMITH, SYDNEY (1771-1845). An English humorist, born at Woodford, in Essex. Sydney was sent to Winchester School, from which he passed to New College, Oxford (1789). In 1794 he was ordained to the curacy of Nether Avon, near Amesbury, in Wiltshire. From 1798 to 1803 he lived in Edinburgh. During this time he occasionally preached at the Charlotte

Chapel and published *Six Sermons* (1800). In 1802 he joined Jeffrey, Horner, and Brougham in founding the *Edinburgh Review*, the first three numbers of which he mainly edited. To this periodical he contributed during the next 25 years about 80 articles of various kinds. In 1803 he gave up tutoring, which he had hitherto combined with preaching, and settled in London. He there gained fame as preacher, lecturer, and humorist. Church preferment, however, came slowly. In 1806 he obtained from Lord Erskine the rectory of Foston-le-Clay in Yorkshire. In 1809 he settled at Hesslington, near his parish, and in 1814 moved to Foston, where he rebuilt the rectory in which he lived for 14 years. He proved an admirable village parson. In 1828, to his great delight, Lord Lyndhurst, the Chancellor, presented him to a prebend in Bristol Cathedral, and the next year enabled him to exchange Foston for Combe-Florey, a more desirable rectory in Somersetshire, where he now moved. In 1831 Earl Grey appointed him one of the canons residentiary of Saint Paul's; and this completed his round of ecclesiastical preferments. In 1839 he inherited from his brother £50,000 and took a house in Grosvenor Square, London.

Smith's writings comprise the famous *Letters on the Subject of the Catholics, to my Brother Abraham, who Lives in the Country, by Peter Plymley* (anonymous, 1807-08), written to promote the cause of Catholic emancipation, and abounding in wit and irony worthy of Swift; *Three Letters to Archdeacon Singleton on the Ecclesiastical Commission* (1837-39); and *Letters on American Debts* (1843). Though the works of Smith relate mostly to temporary controversies, they yet hold a place in our literature as specimens of clear and vigorous reasoning, rich humor, and solid good sense. His jokes, exaggeration, and ridicule are all logical, driving home his arguments; and his wit is sportive, untinctured with malice. The House of Lords, standing in the way of reform, he likened to the excellent Mrs. Partington attempting with her mop and pail to hold back the Atlantic Ocean in storm. This story, related in detail in a speech delivered at Taunton (October 11, 1831), is one of the humorist's best-known inventions.

Consult: *Memoir* by his daughter, Lady Holland (London, 1855); Reid, *Sketch of Life and Times* (4th ed., ib., 1896); Saintsbury, *Essays in English Literature* (1st series, ib., 1890); *Wit and Wisdom of S. Smith*, with memoir, by Duyckinck (New York, 1856, often reprinted); *Works* (London, 1840; Philadelphia, 1844); *Selections*, ed. by Rhys (London, 1892), and in Elia Series (New York, 1897); *Peter Plymley's Letters* (Saintsbury's Pocket Library, ib., 1891); and *Bon Mots of Smith and Sheridan*, ed. by Jerrold (New York, 1893).

SMITH, Sir THOMAS (1513-77). An English statesman and scholar, born at Saffron Walden, in Essex, and educated at Queen's College, Cambridge. He traveled and studied abroad and received honorary degrees from the universities of Padua, Cambridge, and Oxford. As a teacher at Cambridge he tried to change the pronunciation of Greek from the modern method then in use to the Erasmian system; in defense of his reform he wrote (1542) his *De Recta et Emendata Linguæ Græcæ Pronuntiatione* (Paris, 1568). In 1544 he became Regius professor of civil law in Cambridge, and in 1547 received from Edward VI. the post of clerk of the Privy Council, and in 1548 was made Secretary of State. A zealous supporter of the Reformation, he lived in retirement under Mary, but in Elizabeth's reign he became eminent as a statesman and diplomatist. In 1564 he negotiated the peace of Troyes with France. While in Paris he wrote his *De Republica Anglorum; The Maner of Government, or Policy of the Realme of England* (London, 1583). From this date diplomatic missions occupied much of his time. In 1572 he succeeded Burleigh as Secretary of State, but in 1576 ill health compelled him to retire. In addition to the works mentioned above he translated psalms, composed orations and essays, and wrote voluminous letters on official matters. Especially interesting is his *De Recta et Emendata Linguæ Anglicæ Scriptione Dialogus* (Paris, 1568), a proposed reform in spelling. Consult also Strype, *Life of Sir Thomas Smith* (Oxford, 1820).

SMITH, WILLIAM (1769-1839). Called 'the father of English geology,' one of the foremost of the early workers in this field. While practicing the profession of civil engineering he became interested in the study of rocks and soils. As a result of his investigations he formulated the principle that stratified rocks exhibit a definite order of succession and that the different horizons in the stratigraphical series may be identified by their included fossils. In 1794 he made a long tour through England, examining the geological structure of various regions and gathering evidence in support of his theories. Some of the data thus collected were published in *Order of the Strata and Their Embedded Organic Remains, in the Neighbourhood of Bath, Examined and Proved Prior to 1799* (1799). Following this he began the preparation of a geological map of England and Wales on a scale of five miles to one inch, which occupied nearly 15 years of his life, and which was supplemented by separate maps of the counties published in colors on 21 sheets. These were the first geological maps of England to be published and the first attempt to show the distribution and arrangement of the rock formations of a whole country. His services were recognized officially by a Government pension, while the Geological Society of London conferred upon him the Wollaston medal. Besides his geological contributions he published a treatise on *Irrigation* (1806). For an estimate of his scientific work, consult Geikie, *The Founders of Geology* (London, 1897).

SMITH, Sir WILLIAM (1813-93). An English classical and biblical scholar. He was born in London and graduated at London University. He was made professor of Greek, Latin, and German in Highbury and Homerton colleges, then independent; and when they were consolidated as New College he became professor of the Greek and Latin languages and literatures. Furthermore he was classical examiner in London University in 1853 and editor of the *Quarterly Review* in 1867. He was knighted in 1892. He was the editor of many valuable works, especially students' manuals and dictionaries. The more important of these, with their latest editions, are the following: *English-Latin Dictionary* (1899); *Dictionary of Greek and Roman An-*

tiquities (1890-91); *Dictionary of Greek and Roman Biography and Mythology* (1890); *Dictionary of Greek and Roman Geography* (1854-57); *Dictionary of Christian Antiquities* (1875-80); *Dictionary of the Bible* (1863; revised, 1887); *Dictionary of Christian Biography* (1877-87).

SMITH, WILLIAM FARRAR (1824-1903). An American soldier, born at Saint Albans, Vt. He graduated from West Point in 1845, and from 1846 to 1848 and again in 1855-56 he was assistant professor of mathematics there. He was a muster officer in New York at the time of the outbreak of the Civil War, served on the staffs of Generals Butler and McDowell in June, July, and August, 1861; became colonel Third Vermont Volunteers (July 16, 1861), participated in the first battle of Bull Run; became brigadier-general United States volunteers (August 13, 1861), and was in command of a division in the Peninsular campaign from March to August, 1862. He was brevetted lieutenant-colonel United States Army for gallantry in the battle of White Oak Swamp (June 28, 1862). He became major-general United States volunteers (July 4, 1862), took part in the Maryland campaign, and was brevetted colonel United States Army for gallantry at Antietam. He commanded the Sixth Corps of the Army of the Potomac from November 14, 1862, to February 4, 1863, when he was transferred to the Ninth Corps, which he commanded until March 17. He commanded a division of the Army of the Susquehanna from June 17 to August 3, 1863, and engaged in pursuit of the Confederates after the battle of Gettysburg. He was chief engineer, Department of the Cumberland, in the fall of 1863, and by building a bridge at Brown's Ferry (October 26) was able to join Hooker's forces with the Army of the Cumberland, saving the latter from possible capture at Chattanooga. He was again promoted to the rank of major-general United States volunteers (March 9, 1864), and served with the Army of the Potomac, from May 2 to July 9, 1864, in the operations before Richmond. He was brevetted brigadier-general United States Army (March 13, 1865) for services at Chattanooga and major-general the same day for services during the war. He resigned from the volunteer service on November 1, 1865, and from the Regular Army March 7, 1867. From 1864 to 1873 he was president of the International Telegraph Company, became a member of the board of police commissioners of New York (May 1, 1875), and president December 31, 1877. After 1881 he practiced civil engineering.

SMITH, WILLIAM HENRY (1833-96). An American journalist and author, born in Columbia County, N. Y. He was taken by his parents in 1835 to Ohio, and there received an academic education. In 1855 he became editor of the *Type of the Times*, a political weekly at Cincinnati, and in 1858 became an editor on the staff of the *Cincinnati Gazette*. In 1863 he was private secretary to Governor Brough for one year, and was then Secretary of State until 1867, when he resigned to take editorial charge of the *Cincinnati Chronicle*, a new evening newspaper. In 1870 he became manager of the Western Associated Press at Chicago, and in 1882 upon its consolidation with the New York Associated Press as the American Associated Press he became general manager of the new organization, remaining at its head until 1893. In 1877 he was made collector of the port of Chicago. His publications include: *The Saint Clair Papers* (2 vols., 1882), in which he gathered together much hitherto inaccessible material on the early history of the Northwest Territory, and *A Political History of Slavery* (1903), a narrative of the anti-slavery struggle and of the reconstruction period.

SMITH, WILLIAM ROBERTSON (1846-94). A distinguished Semitic scholar, known as Robertson Smith. He was born at New Farm, Keig, Aberdeenshire. He was educated privately by his father, a minister of the Free Church of Scotland, and at Aberdeen University, where he was graduated in 1865. Having chosen the ministry as his profession at an early age, he entered New College, Edinburgh, in 1866 as a student of theology. During his theological course he spent two summers in Germany, at Bonn and Göttingen, where he heard the lectures and made the acquaintance of Bertheau, Lotze, Ritschl, and others of the foremost scholars of the time. He was particularly influenced by Ritschl, who in turn bore testimony to his pupil's ability. While still a student he was appointed assistant professor of natural philosophy in the University of Edinburgh, and in 1870 became professor of Oriental languages and exegesis of the Old Testament in the Free Church College at Aberdeen. During the summer of 1872 he was again in Germany, studied Arabic with Lagarde, and became acquainted with Fleischer, Wellhausen, and other prominent Orientalists. In 1875 he became a member of the Old Testament revision committee. When the ninth edition of the *Encyclopædia Britannica* was undertaken in 1870 Professor Smith was chosen as the contributor of articles upon Old Testament subjects. His articles "Angels" and "Bible" (both published in 1875) aroused suspicion and hostility in the Church. A committee was appointed by the General Assembly in 1876 to investigate, and, after much discussion and protracted proceedings, Professor Smith was dismissed from his chair in June, 1881. The case is a famous one; its practical outcome was to popularize and establish the scholarly methods and most of the views which he represented in both Scotland and England. While his case was pending he spent two winters in the East, visiting Egypt, Palestine, Syria, and Arabia. From his dismissal till 1888 he was associated with Professor Baynes as editor of the *Britannica*; the successful completion of the work was due in no small degree to his efficient management. At the same time he continued his Semitic studies with unflagging zeal and most valuable results. In 1883 he succeeded Edward Henry Palmer as Lord Almoner's professor of Arabic at Cambridge; in 1886 he was elected chief librarian of the university, and in 1889 he succeeded William Wright as Adams professor of Arabic. He died at Cambridge.

Besides numerous papers in scientific periodicals and his articles in the *Britannica* he published: *What History Teaches Us to Look for in the Bible* (1870); *The Old Testament in the Jewish Church* (1881; 2d ed. 1892); *The Prophets of Israel* (1882; 2d ed. 1895); *Kinship and Marriage in Early Arabia* (1885). In 1888-90 he gave three series of lectures at Aberdeen (the Burnett lectures) upon the theme, "The Primi-

tive Religions of the Semitic Peoples Viewed in Relation to Other Ancient Religions and to the Spiritual Religion of the Old Testament and Christianity." The first series only was published under the title, *The Religion of the Semites; Fundamental Institutions* (1889; 2d ed. 1894).

SMITH, Sir WILLIAM SIDNEY (1764-1840). An English admiral, born at Westminster. From 1790 to 1792 he aided the King of Sweden in the war with Russia and was knighted by Gustavus III. for his services. In 1793 he assisted Lord Hood at Toulon, and during 1795-96 was active in freeing the Channel of French privateers. He was taken while attempting a daring capture in the harbor of Havre and was imprisoned for two years, when he escaped. In 1798 he was made plenipotentiary to Constantinople, and in 1799, from March till May, made the famous defense of Saint Jean d'Acre against Bonaparte, which earned for him a permanent place among English naval commanders and drew from Parliament a vote of thanks and an annuity of £1000. His customary vanity was rendered unrestrainable by these tokens of enthusiasm, and, usurping the prerogatives of commander-in-chief, he concluded the untenable Treaty of El-Arish (January 24, 1800), which caused a renewal of the war. In 1805 he was made a rear-admiral and was active during the next few months in guarding Naples and Sicily, capturing the island of Capri and relieving Gaeta. Consult: Barrow, *Life of Sir W. S. Smith* (1848); Mahan, *Influence of Sea Power upon the French Revolution and Empire* (1892).

SMITH, WILLIAM SOOY (1830—). An American engineer. He was educated at the Ohio State University (1849) and West Point (1853). After serving in the artillery he resigned from the United States Army in 1854, and became a civil engineer. In 1857 he made surveys for the first international bridge across the Niagara River. Subsequently he was connected with the Trenton Locomotive Works, but resigned in 1861 to reënter the United States Army. He became brigadier-general of volunteers, serving in the Vicksburg campaign under Grant, and later in the Department of Tennessee under Sherman, but in 1864 was compelled to resign in consequence of illness. He returned to his profession, settling in Chicago, and in 1865 became actively engaged as engineer for various bridge and tunnel constructions, including the bridge across the Missouri River at Glasgow, Mo., and the Hudson River tunnel at New York. General Smith made many notable improvements in pneumatic processes for sinking foundations, and in methods of construction of high buildings.

SMITH COLLEGE. An institution for the higher education of women at Northampton, Mass., chartered in 1871 and opened in 1875. The college was founded by Miss Sophia Smith (q.v.), of Hatfield, who bequeathed for this purpose the bulk of her estate. The undergraduate course is partially elective. All undergraduate courses lead to the degree of bachelor of arts (after 1904). The degree of master of arts is conferred on graduates of at least two years' standing, who have spent a year in advanced study at the college, and on graduates of three years' standing who by printed essays or other proofs of scholarly work give evidence of at least one year spent in advanced study. A number of annual scholarships in the various departments provide incomes of $50 to $250 for needy students. Two tables at the Marine Biological Laboratory at Woods Hole, Mass., are maintained by the college, which also contributes to the support of a table at the zoölogical station at Naples, and to the classical schools at Athens and Rome. The college buildings, centrally located in the town, include College Hall, containing the offices of administration; Seelye Hall, with 20 recitation rooms and a library; Lilly Hall of Science; Chemistry Hall, in part the gift of the class of 1895; a well-equipped observatory; Music Hall; the Hillyer Art Gallery, containing extensive collections, with an endowment of $50,000 for their increase; the Alumnæ Gymnasium, and the Lyman Plant House, which with the botanic gardens furnishes material for laboratory work and opportunity for special investigations. Home life is provided for the students in 13 dwelling houses, presided over by a college officer. In connection with many of the departments clubs are organized under the joint management of teachers and students, for advanced or special work. In 1903 the student enrollment was 1015, and the faculty numbered 90. The endowment was $1,100,000, the grounds and buildings were valued at $1,149,000, and the income was $308,000.

SMITHFIELD, or **SMOOTHFIELD.** An historic cattle market in London, mentioned as early as 1150, and since 1868 the seat of the Central Meat Market, covering 3½ acres. In the twelfth century Smoothfield was an open spot, which served the citizens as a playground and promenade. It was outside the city walls. Here Wat Tyler met his death in 1381, and the place is associated with trials by battle, tournaments, the burning of martyrs, public executions during many centuries, and a variety of incidents connected with the history of the metropolis. The most celebrated fair in England, Bartholomew Fair (q.v.), was always held in Smithfield.

SMITHS FALLS. A town of Lanark, Leeds, and Grenville counties, Ontario, Canada, 39 miles southwest of Ottawa. It has some manufactures (Map: Ontario, G 3). Population, in 1891, 3864; in 1901, 5155.

SMITHSON, JAMES (1765-1829). Founder of the Smithsonian Institution at Washington, known in early life as James Lewis or Louis Macie. He was born in France, the natural son of Hugh Smithson, first Duke of Northumberland, and of Mrs. Elizabeth Keate Macie, a member of the Hungerford family of Studley. Smithson (or Macie as he was called) was a student at Pembroke, where he received the degree of M.A. in May, 1786, and he was admitted as a fellow of the Royal Society on April 26, 1787. His scientific work lay in the main in the fields of chemistry and mineralogy, and he read 28 papers before the Royal Society, while he published 18 in Thomson's *Annals of Philosophy*. He left in addition a considerable number of unpublished manuscripts and a collection of some 8000 or 10,000 minerals, which were destroyed by fire in the Smithsonian Building in 1865. Smithson passed a large part of his life on the Continent, and died in Genoa, Italy, where he was buried in the English cemetery. His remains were removed to the United States

in 1904 and are interred in the grounds of the Smithsonian Institution. His fortune came mainly from a son of his mother by a former marriage, Col. H. L. Dickinson, except £3000 from a half-sister on the paternal side, Dorothy Percy. He bequeathed to his nephew, Henry James Hungerford, his fortune, amounting to $515,169, stipulating furthermore that if the legatee should die without issue, legitimate or illegitimate, the money should pass to the United States "to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men." As Hungerford so died in 1835, the bequest reverted to the United States. (See SMITHSONIAN INSTITUTION.) In the obituary notice of Davies Gilbert, president of the Royal Society, the name of Smithson is associated with those of Wollaston, Young, and Davy, and he corresponded and associated with Arago, Biot, and Klaproth. Smithson was never in America, and it is not known what induced him to give his fortune to the United States, though a clue may be found in the following sentences which indicate his sense of wrong in the illegitimacy of his birth. He wrote: "The best blood of England flows in my veins. On my father's side I am a Northumberland, on my mother's I am related to kings; but this avails me not." "My name," Smithson wrote, "shall live in the memory of man when the titles of the Northumberlands and the Percies are extinct and forgotten." Consult: Rhees, *Smithson and His Bequest* (1880); Langley, "James Smithson," in *The Smithsonian Institution, 1846 to 1896, and the History of its First Half Century*, by George Brown Goode (Washington, 1897).

SMITHSONIAN INSTITUTION, THE. An institution in Washington, District of Columbia, created by an act of Congress on August 10, 1846, in accordance with the will of James Smithson (q.v.), who bequeathed the reversion of an estate amounting to $515,169 to the United States to be devoted to the "increase and diffusion of knowledge among men."

HISTORY. Upon the death of Smithson's nephew, Henry James Hungerford, in 1835, the United States legation in London was notified of the bequest. The disposition of the property was for ten years debated in Congress, but ultimately the trust was accepted and Congress created an establishment consisting of the President and the members of his Cabinet who intrusted the management of the institution to a board of regents, consisting of the Vice-President and Chief Justice of the United States, three regents to be appointed by the president of the Senate, three by the Speaker of the House of Representatives, and six to be selected by Congress, two of whom should be residents of the District of Columbia, and the other four from different States, no two being from the same State. The regents met for the first time on September 7, 1846, and elected Joseph Henry as executive officer, with the title of secretary, under whose guidance the institution took shape. He prepared a programme of organization, which was adopted in 1847 and has since been the plan under which the institution has been conducted. Having in mind the exact statements of Smithson, he recommended to 'increase knowledge' by the following methods: (1) To stimulate men of talent to make original researches by offering suitable rewards for memoirs containing new truths, and (2) to appropriate annually a portion of the income for particular researches, under the direction of suitable persons. To 'diffuse knowledge' he proposed: (1) to publish a series of periodical reports on the progress of the different branches of knowledge; and (2) to publish occasional separate treatises on subjects of general interest.

Under Henry was begun the construction of a building designed by James Renwick in the Norman style of architecture, which has since been the home of the Smithsonian Institution. A library was formed by exchange and purchase, and materials for a museum collected. Original research was fostered. One of the first subjects to be studied under the direction of the Smithsonian Institution was the phenomena of storms, and the investigations of Espy and others led to the establishment of a telegraphic weather service which subsequently developed into the Weather Bureau. The material collected by the various exploring expeditions and the Pacific railway surveys was deposited with the Smithsonian Institution, and that likewise led in time to the formation of the United States National Museum (q.v.). The 'diffusion of knowledge' was inaugurated by the issuing of various publications. These include: (1) *Smithsonian Contributions to Knowledge*, a quarto series of original memoirs embracing the records of extended original investigations and researches, which began in 1848 with a monograph by Squier and Davis, and now comprises 32 volumes; (2) *Smithsonian Miscellaneous Collections*, an octavo series of papers on the present state of knowledge on particular branches of science, which began in 1860, and now consists of 43 volumes; and (3) *Annual Reports of the Board of Regents*, which are also octavo in form and consist of the reports and proceedings of the officers of the institution, together with a general appendix containing a selection of memoirs of interest to collaborators and correspondents of the institution, teachers, and others engaged in the promotion of knowledge. These reports began in 1847 and have been published annually since.

INTERNATIONAL EXCHANGES. The publication of these different series led to an extensive exchange with serial publications and transactions of learned societies resulting in one of the most notable collections of the world, the greater portion of which, since 1866, has been deposited in the Library of Congress. In 1851 a system of international exchanges was established primarily for the circulation of the Smithsonian publications, but in 1867 the duty of exchanging official documents for similar works published by foreign departments was assigned to this service by the Government. The *Annual Report* for 1902 shows the correspondents of this service to consist of 14,942 libraries and 23,258 persons. This bureau is supported by an annual appropriation from Congress.

NATIONAL MUSEUM. See UNITED STATES NATIONAL MUSEUM.

BUREAU OF AMERICAN ETHNOLOGY. Early in its history the Smithsonian Institution showed an interest in American anthropology, chiefly in the branch of ethnology and with special reference to American Indians. Beginning with 1867, various exploring parties, under the direction of John W.

Powell (q.v.), were sent out. Especially to be mentioned is the famous exploration of the Grand Cañon of the Colorado. Subsequently, the United States Geographical and Geological Survey of the Rocky Mountain region was organized under Major Powell, and the collections made were deposited in the National Museum. On the consolidation of the various geological surveys in 1879, the Bureau of American Ethnology was established by act of Congress, and placed under the direction of the Smithsonian Institution, and it has since been continued with annual appropriations from Congress. It has for its principal objects the carrying on of studies in the ethnology, archæology, pictography, and linguistics of North America. It publishes *Annual Reports*, quarto, which were begun in 1879, and a series of octavo bulletins begun in 1877; it also completed the *Contributions to North American Ethnology*, a series of nine quarto volumes that were begun in 1877. The first Director of the Bureau was Powell, who continued in that office until his death in 1902, when he was succeeded by William H. Holmes.

National Zoölogical Park. A desire to preserve the wild animals of this continent that were rapidly becoming extinct led to the establishment of temporary quarters for captive specimens in the immediate vicinity of the National Museum. This collection grew until in 1890 Congress appropriated $200,000 for the purchase of a tract of land of about 170 acres in Rock Creek Valley in the vicinity of Washington, and by act of April 30th of that year established a National Zoölogical Park, which was placed under the direction of the Smithsonian Institution. In 1902 a collection of nearly one thousand animals was being cared for in the park.

Astrophysical Observatory. The early desire on the part of those prominent in the establishment of the Smithsonian Institution that a portion of the bequest should be devoted to researches in physics found a culmination soon after the appointment of Langley to the secretaryship of the Smithsonian Institution in the annual appropriation by Congress, beginning in 1891, of $10,000, which sum has since increased to $12,000, for the maintenance of an astrophysical observatory. A modest building was erected in the rear of the Smithsonian Institution, and apparatus of a value of more than $30,000 has been accumulated. Considerable investigation under the immediate direction of Langley has been carried on, especially on the infra-red portion of the spectrum, and the observatory has issued a single volume of *Annals of the Astrophysical Observatory*.

Research. In 1891 Thomas G. Hodgkins made a donation of $200,000 to the Smithsonian Institution, of which the interest of $100,000 is permanently devoted to the increase and diffusion of more exact knowledge in regard to the nature and properties of atmospheric air. In accordance with this bequest a prize of $10,000 was awarded to Lord Rayleigh and Sir William Ramsay in 1895 for the discovery of the element argon in the atmosphere. A medal bearing the name of Hodgkins, and awarded for important contributions to knowledge concerning the nature and property of atmospheric air, or for practical applications of our existing knowledge to the welfare of mankind, was established, and was awarded to James Dewar in 1899 for his researches on the liquefaction and solidification of atmospheric air, and in 1901 to J. J. Thomson, for his investigation on the conductivity of gases, especially of the gases that compose atmospheric air. Numerous grants from the Hodgkins fund have been made to students, both in this country and abroad, engaged in the study of atmospheric air. For many years a table for original investigation in biological science has been supported by the Institution at the Naples Zoölogical Station, and a number of American students have availed themselves of its use for research.

International Catalogue. Subsequent to a conference held in London in 1898, an international catalogue of scientific literature was undertaken in England and the cataloguing was begun with the beginning of the present century. The collecting of titles of American scientific publications was accepted by the Smithsonian Institution, and has since 1900 been conducted under its supervision.

American History. In 1889 the American Historical Association (q.v.) was incorporated by act of Congress, and authorized to report annually to the secretary of the Smithsonian Institution concerning its proceedings and the condition of historical study in America. In accordance with this provision, annual reports have since been published. The collections, manuscripts, books, pamphlets, and other material for the history of this association are chiefly deposited in the Smithsonian Institution and in the National Museum. Similarly, in 1896, the National Society of the Daughters of the American Revolution was incorporated, and they also submit annual reports to Congress through the secretary of the Smithsonian Institution. Their collection is likewise deposited in the National Museum.

Funds. To the original bequest of Smithson other gifts and bequests, including over $200,000 from Thomas G. Hodgkins, have been added, making a total of $937,000 as the permanent fund of the institution, which is deposited with the Treasurer of the United States, and yields an income of 6 per cent.

Consult: Goode (ed.), *The Smithsonian Institution, 1846-1896* (Washington, 1897); Rhees (ed.), *The Smithsonian Institution, 1835-1899* (ib., 1901).

SMITHSONITE (named in honor of James *Smithson*). A mineral zinc carbonate crystallized in the hexagonal system. It has a vitreous lustre, and is white to gray and light green and brown in color. It occurs with galena and other zinc minerals, also with copper and iron ores in veins and in beds, and is sometimes produced by the action of zinc sulphide on carbonated waters. It is found in Siberia, Hungary, Belgium, Greece, England, and in the United States at the zinc mines in New Jersey, Pennsylvania, Wisconsin, Missouri, and Arkansas. The zinc is often partially replaced by copper, iron, or manganese. Smithsonite occurs crystallized or in botryoidal and stalactitic forms, granular or earthy. The rich colored varieties are occasionally cut for cabinet gems.

SMITH SOUND. The channel separating Ellesmere Land from the Prudhoe Peninsula of Northwestern Greenland, and connecting Baffin

Bay with the expansion to the north known as Kane Basin. The sound was discovered by Bylott and Baffin in 1616. See map of ARCTIC REGIONS. For subsequent explorations, see POLAR RESEARCH.

SMOCK, JOHN CONOVER (1842—). An American geologist, born in Holmdel, N. J., and educated at Rutgers, where he graduated in 1862. He became professor at Rutgers in 1871, after having studied for two years at the Berg Academy and at the University of Berlin. From 1864 to 1885 he assisted on a geological survey in New Jersey, and in 1890 was appointed geologist of that State. He wrote *Report on Clay Deposits; Building Stones in New York* (1888); and volumes iii. and iv. of *Geological Survey of State of New Jersey.*

SMOHALLA (c.1820—) (corrupted from *Shmoquala,* preacher, the name assumed by him in later life). The originator and high priest of the "Dreamer" Indian religion of the Columbia River region. He was chief of the Wanapum, a small tribe living about Priests Rapids on the Upper Columbia, Washington, and closely related to Yakima (q.v.) and Nez Percé (q.v.). When about forty years old, in a fight with a rival chief, he was left upon the ground as dead, but regained consciousness and was brought off by some white men, who took him down the river in a boat without the knowledge of his people. On his recovery, he started upon a journey of exploration down through Oregon and California into Mexico, then back through Arizona, Utah, and Nevada to his old home, where he announced that he had been all this time in the spirit world, from which he had returned to deliver a new revelation, the burden of which was an immediate return to the primitive Indian customs. He also organized a priesthood with an elaborate ritual in many points suggestive of the Catholic ceremonial, with which he had formerly become familiar at the Yakima mission. He fell into frequent prolonged trances, in which he was perfectly insensible to the most painful tests, and from which he always emerged with a fresh revelation from the spirit world. He forbade his disciples to follow the white man's road, to use liquor or tobacco, or to sell their lands. His following soon included nearly all the Indians of eastern Washington and Oregon and western Idaho. About 1870 the matter came to the notice of the Government from the refusal of the "Dreamers" to come under reservation restrictions. In 1884 his doctrines were made the subject of a special military investigation in connection with land troubles on the Yakima reservation. There were then two principal Dreamer churches, at Priests Rapids, where Smohalla resided, and at Union Gap on the reservation. Besides Sunday services at these, according to their own ritual, the Dreamers had a memorial lament for the dead in early spring, a salmon thanksgiving in April, and a berry thanksgiving in the fall, each being accompanied by processions, bell-ringing, trance recitals, and a feast. See Mooney, *The Ghost Dance Religion* (Washington, 1897).

SMOKELESS POWDER. An explosive substance that burns without developing much smoke, and is used chiefly for military purposes. The history of smokeless powders begins with the discovery of mercuric fulminate in 1800, and is continued by various attempts to substitute ammonium nitrate for potassium nitrate as the oxidizing agent in gunpowder mixtures. Powders of this character were manufactured and sold, but were unsatisfactory, owing to the deliquescent nature of the ammonium salt. Subsequent to the discovery of guncotton in 1845, experiments were undertaken for the purpose of producing a smokeless powder with that agent, and such powders were made by experts in France, Germany, Great Britain, the United States, and especially in Austria, where Von Lenck is credited with having obtained excellent results with guncotton preparations that were used with field guns in 1867 and 1868. The present employment of smokeless powder may be said to have begun with the invention of *poudre B.* in France in 1886. Guttmann divides the smokeless powders into three classes, as follows: (1) Powders in which guncotton, either the insoluble or the soluble variety alone, is used, which, by the aid of a solvent, has been converted into a horny substance and then is formed into flakes or cords; (2) powders in which a mixture of nitroglycerin and either dinitro- or trinitro-cellulose is transformed into a similar horn-like substance, either with or without the aid of a solvent; and (3) powders that contain nitro-derivatives of the aromatic hydrocarbons, either by themselves or in connection with nitro-cellulose. In a general way, the process for manufacturing these powders consists in steeping cellulose in a mixture of nitric and sulphuric acids, and the resulting nitro-cellulose or guncotton is then brought into the colloid condition by treatment with some solvent such as a mixture of alcohol and ether, ethyl acetic ester, or acetone. The solvent chosen depends on the character of the cellulose nitrate used and the special qualities sought in the product. In certain of the smokeless powders oxidizing agents, such as the nitrates of metallic bases, are added to increase the velocity of the explosive, and when the action of the explosive is too violent a deterrent or substance rich in carbon is added. The colloid or horn-like substance is then cut into flakes by machines, or as originally in Italy forced through spaghetti machines, and formed into cords, either solid or perforated, of the desired dimensions, which are then cut into grains.

Among the various smokeless powders are: *Ballistite,* invented by Alfred Nobel in 1888, and made in England; *cordite,* invented by Sir Frederick Abel and James Dewar, and made in England; *Du Pont powder,* invented by F. C. & P. S. Du Pont in 1893, and made in Wilmington, Del.; *indurite,* invented by Charles E. Munroe in 1889, and made at Newport, R. I.; *cibalite,* invented by J. K. von Falkenstein, and made in Germany; *poudre J.,* invented by Bruneau, and *poudre pyroxyée,* made by the French Government; *Troisdorf, Von Förster, Walsrode,* and *Wetteren* powders, made in Germany, each of which varies slightly from the others in the preparation of the mixture or proportions of the ingredients. For full information on the subject, see the history of the development of smokeless powders given in Charles E. Munroe's Presidential address before the Washington Section of the American Chemical Society in 1896. Consult also Longridge, *Smokeless Powder and Its Influence on Gun Construction* (London, 1890), and

Guttmann, *The Manufacture of Explosives* (London, 1895).

SMOKE NUISANCE. Smoke is produced by the incomplete combustion of fuel, tiny bits of unconsumed matter being wafted into the air by the gases which are liberated and not decomposed. In order to effect complete combustion, it is necessary that all the constituent gases be raised to a very high temperature and mixed with oxygen before the temperature falls.

The difference betweeen bituminous and anthracite coal is that while anthracite is composed of almost pure carbon, bituminous contains in addition to the fixed carbon a compound of carbon and hydrogen, which makes, under present methods, all the trouble. When bituminous coal is ignited these hydrocarbons are first volatilized by the heat, then the hydrogen unites with the oxygen of the air and the carbon is set free. These free carbon particles are made incandescent by the intense heat, and it is this which produces the bright flame so characteristic of bituminous coal. If there is at this stage a sufficient supply of oxygen and enough, but not too much, heat, the carbon will be transformed into carbonic acid gas and combustion will be complete. If there is not enough oxygen some of the free particles of carbon will escape through the chimney as smoke. Smoke will also be produced by the volatilization of the hydrocarbons at a heat less than that necessary to separate the hydrogen from the carbon; or if, on the other hand, the heat is so suddenly intense that some of the fixed carbon is carried off before it has time for combustion. All the conditions necessary for complete or smokeless combustion may be met by properly constructed furnaces and intelligent firemen.

In recent years a number of American States have authorized some or all cities within their boundaries to prohibit the emission of dense smoke from chimneys and smoke-stacks and to establish special departments to abate the smoke nuisance. In 1903 such departments existed in Chicago, Saint Louis, and Cleveland. In New York the local Board of Health has authority in this matter. The smoke nuisance has also been the subject of general legislation in foreign countries, notably in Great Britain.

Bibliography. Littlejohn, article "Effects of Smoke and Fog on Health," in the *Sanitary Record* (June 18, 1897; also November 4, 1898); *Journal of the Franklin Institute* (Philadelphia, 1897-98, and 1898) containing the reports made to the committee appointed to investigate the subject of smoke prevention by various specialists; "Coal Combustion and Smoke Prevention," in *American Gas-Light Journal*, August 29, 1898.

SMOKE PIPE. A pipe, usually of thin iron or steel, which serves to conduct the smoke and gases of a steam boiler to the open air. In large vessels there are usually several smoke pipes, which in some instances have a diameter of more than 25 feet and a height of 125 feet above the furnaces. The area of the cross-section of the pipe depends upon the amount and speed of the gases which are expected to escape through it. The speed of the moving gases (i.e. the draught) is much accelerated by increasing the height and a due consideration of this fact has added considerably to the length of smoke pipes in recent years. On modern seagoing vessels they are usually surrounded by thin sheet-iron casings, leaving air spaces between these and the smoke pipes proper. This plan prevents surrounding objects from being injured by the heat and the casing remains at a temperature sufficiently low to permit of its being kept neatly painted. The various steamship companies in many cases have adopted different colored bands or painting for the smoke pipes of their ships as distinguishing marks.

SMOKY (or Great Smoky) **MOUNTAINS.** A division of the Appalachians. See Unaka Mountains.

SMOLENSK, smŏ-lyĕnsk′. A government of Russia, bounded by Tver on the north, Moscow and Kaluga on the east, Orel on the southeast, and Mohilev, Vitebsk, and Pskov on the west (Map: Russia, D 3). Area, about 21,640 square miles. The northern part belongs to the central elevation of European Russia and is generally hilly. In the south and the east the surface is mostly level, and marshy in the northwest. The Government of Smolensk is well watered by the Dnieper, Düna, and several tributaries of the Volga and the Oka. The soil is mostly unfertile and about one-third of the government is still covered with forest. The principal agricultural products are rye, oats, and flax. Stock-raising is in a state of decline. The house industry is only slightly developed. Of late there has been a considerable growth in the manufacturing industries. Oil, textiles, trimmed lumber, and spirits are the chief products. The population, in 1897, was 1,551,068, chiefly Great and White Russians. The mediæval Principality of Smolensk is mentioned first as a separate State in 1054. It attained great power in the twelfth century, but declined greatly under the sway of the Tatars and was annexed to Lithuania at the beginning of the fifteenth century. The region was permanently reunited with Russia in 1654.

SMOLENSK. The capital of the Government of Smolensk, Russia, situated on the Dnieper, 260 miles west-southwest of Moscow (Map: Russia, D 4). The main part of the city on the left bank of the river is surrounded by the remnants of the old walls and contains the Uspenski Cathedral, with a venerated picture of the Virgin. There are a seminary for priests, and a historico-philological museum. The philanthropic institutions are numerous. There are few industries and the export trade is unimportant. Population, in 1897, 46,899. Smolensk is one of the oldest cities of Russia and is mentioned by Nestor as the capital of the Krivitches. It was the capital of the Principality of Smolensk and later obtained Magdeburg rights and other privileges from Lithuania. In 1514 it was taken by the Russians and in 1611 it was recovered by the Poles, after a siege of twenty months. With its final annexation to Russia in 1654 Smolensk was deprived of its privileges and gradually lost its importance. It played a prominent part in the wars of Peter I. with the Swedes and is especially noted as the scene of a fierce engagement between the French and the Russians on August 17, 1812, in which the Russians were defeated and retreated to Moscow.

SMOL'LETT, Tobias George (1721-71). A British novelist, descended from an old and re-

spectable Scotch family having a seat called Bonhill in the beautiful valley of the Leven, near Dumbarton, Scotland. His grandfather, Sir James Smollett, often sat in the Scottish Parliament, was a judge of the commissary court in Edinburgh, and helped frame the articles of union (1707). Tobias wished to enter the army, but was thwarted by his grandfather, who appears in *Roderick Random* as the unamiable Old Judge. After attending the Dumbarton grammar school, Tobias was sent to the University of Glasgow to qualify for medicine, and was apprenticed (1736) for five years to Dr. John Gordon, of Glasgow. Much later (1750) he obtained the degree of M.D. from Marischal College, Aberdeen. In 1739 Smollett went to London with a tragedy called *The Regicide*. Embittered by his fruitless attempts to get it performed, he accepted the post of surgeon's mate on board the *Cumberland*, which sailed in 1740 to join Admiral Vernon's fleet, then in the West Indies, on the unfortunate expedition to Cartagena. On the return voyage he met in Jamaica a beautiful Creole, whom he brought to London and afterwards married (1747). He left the navy for good in 1744, and settled in London as surgeon. As his profession did not prove remunerative, he turned to literature. After some parodies, satirical verse, and his vigorous poem, *The Tears of Scotland* (1746), anent the manner of crushing the Highland rebellion, he published his first novel, *Roderick Random* (1748), which met with instant success. For it he drew largely on family history, his journey from Glasgow to London, his troubles over *The Regicide*, and his experiences in the navy. Here first appear in fiction the real English tars. As a result of a visit to Paris (1750) he produced *Peregrine Pickle* (1751), containing the brilliant but brutal satire on Mark Akenside and the notorious "Memoirs of a Lady of Quality" (Frances Hawes, Lady Vane). For the insertion of these memoirs written by Lady Vane herself Smollett is said to have received a handsome fee. After practicing medicine for a short time at Bath, Smollett returned to London, and settled at Chelsea, where he wrote *Ferdinand, Count Fathom* (1753), more ideal in motives than his other novels. For some years he was engaged in hack work, translating *Don Quixote* (1755) and writing, among many other things, a history of England (1757-65). On the founding of the *Critical Review*, a Tory organ (February, 1756), Smollett became editor. He wrote many abusive articles, one of which—an attack on Admiral Knowles—led to a fine of £100 and imprisonment for three months (1759). In the meantime, his farce *Reprisal, or the Tars of Old England* (1757) was performed at Drury Lane, under the direction of Garrick. Resuming the novel, Smollett contributed to the *British Magazine* (1760-61) *The Adventures of Sir Launcelot Greaves*, an adaptation of *Don Quixote*. It is of bibliographical interest as the first English novel to appear in a serial. In 1762 he edited the *Briton*, a weekly paper started to defend the Tory policy of Lord Bute.

Broken in health and sorely grieved by the death of his daughter (1763), Smollett now spent two years on the Continent, where he wrote his *Travels Through France and Italy* (1766). The next few years were passed in a visit to Scotland, at Bath, and in London. The most noteworthy production of this time is the fierce political satire, *The Adventures of an Atom* (1769). Now utterly unnerved, he left England never to return (December, 1769). At a villa near Leghorn in Italy he wrote *Humphrey Clinker* (1771), an amusing novel in letter form, based upon his own vain search for health at Bath and in the North. He died September 17, 1771, and was buried in the English cemetery at Leghorn. For fifty years after his death Smollett was ranked high as a novelist; but during the latter half of the nineteenth century his fame unduly sank. Thackeray was the last of the great novelists to praise him. Smollett's art is indeed crude when compared with recent craftsmanship. His novels, constructed after the type of *Gil Blas* and other picturesque adventurers, possess no organic unity. On the other hand, he wrote vigorous English, and created many admirable characters, as Captain Bowling, Commodore Trunnion, Tabitha Bramble, and Lismahago. Consult: Chambers, *Life and Selections from Writings* (London, 1867); *Life*, by D. Hannay (ib., 1867) and by O. Smeaton (Edinburgh, 1897); the *Memoirs*, by W. Scott, containing a famous comparison between Fielding and Smollett, prefixed to Smollett's novels in the *Novelists' Library* (London, 1821); the *Quarterly Review* (vol. ciii., 1858); *Works*, ed. with excellent memoir by Saintsbury (12 vols., London, 1895); and *Topography of Humphrey Clinker*, in Dobson's *Eighteenth Century Vignettes* (second series, London, 1894).

SMOLT. A British term for a young salmon (q.v.) two or three years old, which has graduated from the 'parr,' or banded, state and become silvery.

SMRITI, smrē'tē (Skt., remembrance). In Sanskrit literature the technical term for those works, especially the Sutras (q.v.) which deal with civil and religious usage, regarded as based on tradition received from ancient sages, and not on divine revelation. Smriti is therefore contrasted with *śruti*, or revelation. See ŚRUTI.

SMUGGLING (from *smuggle*, LGer. *smuggeln*, to smuggle; connected with Icel. *smjūga*, to creep through a hole, AS. *smēogan*, *smūgan*, to creep, Ger. *schmiegen*, to cling to, bend, get into, OChurch Slav. *smykati*, to crawl, Lith. *smùkti*, to glide). The act of importing or exporting goods from a country in violation of law. Such infringement of the laws is defined by the United States statutes substantially as follows: To "knowingly and willfully, with intent to defraud the revenue of the United States, smuggle or introduce into the United States any goods, wares, or merchandise subject to duty, and which should have been invoiced, without paying or accounting for the duty," or to "make out or pass, or attempt to pass, through the customhouse any false, forged, or fraudulent invoice." A person convicted of either of above acts is "guilty of a misdemeanor and . . . shall be fined in any sum not exceeding five thousand dollars, or imprisoned for any length of time not exceeding two years, or both." It is necessary to prove intent and knowledge of the wrongful act in order to convict a person under the statute, and the defense of innocent intention is often successful in preventing prosecution. Concealment of dutiable articles in baggage is punishable by the forfeiture of such articles and the

persons guilty of the fraud are liable to a penalty of treble the value of them. The court may in proceedings other than criminal, arising under the revenue laws, direct the defendant to produce in court all bills of lading, invoices, books, etc., relating to the importation of the goods in question. Smuggled property is condemned and sold and the proceeds, after payment of costs and rewards for information, if any, are paid into the United States Treasury.

SMUTS (probably from AS. *smitta*, OHG. *smiz*, stain, spot, smut; connected with AS. *smītan*, to smite, Goth. *bi-smeitan*, OHG. *smīzan*, Ger. *schmeissen*, to strike, smear). A group of fungi considered parasitic upon cereals and characterized by black dust-like masses (spores) which take the place of the natural seed parts. There are many species, nearly every kind of cereal being subject to the attack of one or more. In general the smut spores which, as a rule, are attached to the grain when sown, germinate at the same time as the seed, the fungus entering the young plantlet in which it develops unseen until about the time the grain is beginning to head, when the flower or grain becomes filled with a mass of delicate threads which soon mature their spores for the infection of the next crop. The smuts are of two classes: the stinking smuts, so called from their disagreeable odor, and the loose smuts. The former destroy only the kernel; the latter, which are dusty and are blown away, leaving a bare stalk, destroy the whole head. The amount of injury done the cereal crops is very great. Hardly a country is not more or less ravaged by these diseases. A conservative estimate places the annual loss due to smut on the oat crop of the United States at $18,000,000.

The smuts of wheat, barley, rye, and oats can be controlled to a great degree by treating the seed prior to sowing with various fungicides. Oat smut (*Ustilago avenæ*) may be controlled by soaking the seed for 24 hours in a solution of one pound of potassium sulphide to twenty gallons of water, or for two hours in one pound of formalin in 45 to 50 gallons of water. Or the seed may be thoroughly wetted with the solution and allowed to stand for the same length of time, after which the grain is sown. For the other smuts the hot water or Jensen treatment is recommended. Two vessels of at least twenty gallons' capacity are filled with water, one at a temperature of 110°-120° F., the other at 132°-135°, and kept constantly at those temperatures. The seed is placed in covered baskets or loose bags and dipped into the first for one to two minutes, and then plunged into the second vessel, raised and lowered several times for ten to fifteen minutes, and then spread to dry. In treating wheat and barley for loose smut (*Ustilago tritici* and *Ustilago nuda* respectively) a preliminary soaking for four hours in cold water is advised. For the stinking smuts of wheat (*Tilletia fœtens* and *Tilletia tritici*) and the covered smut of barley (*Ustilago hordei*), soaking seed for twelve hours in copper sulphate solution (one pound to 24 gallons of water), and dipping a few minutes into lime water, is also recommended. In all these treatments the treated seed must not come in contact with smut in unclean grain bags, bins, or seeding implements.

None of these treatments is of benefit in preventing maize or corn smut (*Ustilago maydis*). The black spores germinate upon the ground, in manure or other suitable locations, and quickly develop thin-walled colorless spores that are carried by wind, germinate upon the rapidly growing tissues of the corn plant, which they may infect locally at any time, and in a few weeks produce boil-like growths. Each smut mass is believed to represent a separate infection. Destruction by burning all smut balls, whenever found, is the only remedy. Throwing them upon the ground, or manure heaps, or feeding to stock will only aid in spreading the disease. Experiments with cows have shown that corn smut is not poisonous, as it is often believed to be, the animals having eaten ten pounds or more daily without any noticeable inconvenience.

SMYBERT, smī'bĕrt, or **SMIBERT**, JOHN (1684-1751). A Scotch-American painter, born in Edinburgh. He studied in London in Sir James Thornhill's academy, and in Italy, and became a portrait painter in London. When Bishop Berkeley received permission from the British Government to found a college in the Bermuda Islands, he took Smybert with him to be professor of fine arts. But the promised funds were not forthcoming, and after remaining in Newport, R. I., three years, Berkeley returned to Europe. Smybert went to live in Boston, and came to have considerable influence on the painters Copley, Trumbull, and Allston. His best work, "Bishop Berkeley and His Family," painted in 1729, and presented to Yale College in 1808, was the first group of the kind produced in America. His other portraits, which are characterized by a dry formal style, but are good likenesses, are those of Jonathan Edwards and Judge Edward Quincy (in the Boston Art Museum); Governor Endicott, Peter Faneuil, and Mrs. Smybert (in the gallery of the Massachusetts Historical Society); and John Lowell (in Harvard Memorial Hall).

SMYRNA, smĕr'nȧ. The capital of the Vilayet of Aidin (or of Smyrna), the chief city of Asia Minor and the second seaport of the Ottoman Empire, situated at the head of the Gulf of Smyrna, in latitude 38° 26′ N. and longitude 27° 9′ E., and somewhat over 200 miles southwest of Constantinople, with which it is now connected by rail (Map: Turkey in Asia, B 3). The city is laid out partly on level land and partly on the slopes of Mount Pagus, and presents an imposing appearance from the sea. It is divided into five quarters: the Moslem Quarter, with its numerous minarets and narrow crooked streets; the Jewish Quarter, poor, overcrowded and dirty; the Armenian and Greek quarters, well built and European in their cleanliness; and, finally, the European Quarter, with its fine quay, shops, and hotels. The centre of archæological interest is Mount Pagus with its ruined castle and portions of the Acropolis walls, in which Greek masonry can be traced. Of considerable interest also is the Caravan Bridge, with its Greek and Roman foundations, although the statement that the stream crossed by it is the celebrated Meles is generally discredited. The mosque called Hissar Jami is of some interest. The finest Christian churches are the Greek Cathedral of Saint Photini and the Armenian Cathedral of Saint Stephen. Smyrna contains numerous schools maintained by the various nationalities which make up the heterogeneous population of the city. A number of interesting collections and

libraries are attached to some of the higher schools, and hospitals and other benevolent institutions are maintained by the foreign colonies. The industries are limited in extent, and the product for which the town is most famous. Smyrna rugs, comes from the small places around the city. The chief manufactures are silk, woolen, and cotton goods, pottery, leather, and some machinery and iron and steel products. The chief exports are figs, raisins, tobacco, rugs, silk, sponges, hides, cereals, etc. The imports are manufactures, coal, iron, dairy products, etc. The annual value of the trade averages over $25,000,000 and the value of the exports in 1901 was over $20,000,000. A considerable proportion of the commerce is with Great Britain.

Smyrna has a curious municipal form of government. The Christian and Jewish communities have separate elected councils presided over by the respective religious heads of the communities. The population is estimated at 250,000, of whom over one-half are Greek, including about 45,000 Greek subjects. The Mohammedans constitute about one-fourth of the population.

HISTORY. Old Smyrna was an Æolian colony, but early in the seventh century B.C. was seized by exiles from Colophon, and thus brought into the Ionian League. Its situation, which commanded the route from Sardis to the coast, enabled it to develop a rich commerce, but excited the jealousy and aggressions of the Lydian kings. Gyges was defeated, but Alyattes about B.C. 575 captured and destroyed the city. Only a village remained at this point until after the Macedonian conquest. Antigonus began to build the new city on the shore a few miles southeast of the old site. His death (B.C. 301) checked its growth, but it was completed by Lysimachus. It was laid out with great magnificence, and adorned with several fine buildings, among which was the *Homereum*, where the poet was worshiped as a hero. The city had an excellent harbor and, from its admirable situation, soon became one of the finest and most flourishing cities in Asia. It seems to have been favored by the Seleucidæ and in B.C. 243 was declared by Seleucus II. sacred and inviolable. This position of neutrality must have aided its growth. It was treated with consideration by the Romans, and when it suffered severely in A.D. 179 from an earthquake, the Emperor Marcus Aurelius helped to restore it. It is mentioned in the Apocalypse as the seat of a Christian church, and it is said to have been the scene of the martyrdom of Polycarp. Throughout the greater part of the Middle Ages Smyrna belonged to the Byzantine Empire. In the fourteenth century it passed into the possession of the Knights of Saint John. The Mongols under Tamerlane destroyed it in 1402. Since the early part of the fifteenth century the town has belonged to the Turks.

Consult: Scherzer, *Smyrne* (Leipzig, 1880); Georgiades, *Smyrne et L'Asie Mineure au point de vue économique* (Paris, 1885); Rougon, *Smyrna* (ib., 1889); Lane, *Smyrnæorum Res Gestæ et Antiquitates* (Göttingen, 1861); and the inscriptions and other monuments published in the *Μουσεῖον καὶ βιβλιοθήκη τῆς εὐαγγελικῆς σχολῆς* (Smyrna, 1874 et seq.).

SMYRNA RUGS. See RUGS.

SMYTH, smith, CHARLES PIAZZI (1819-1900). An English astronomer, born in Naples, Italy. He was employed in the observatory at the Cape of Good Hope under Sir Thomas Maclear, and was astronomer royal of Scotland (1845-1888). He made elaborate studies of the Great Pyramid of Egypt, which he maintained was built by divine inspiration as a standard of weights and measures. He advocated this peculiar theory in several books. Smyth was very eccentric and became the hero of numerous anecdotes current in astronomical circles.

SMYTH, EGBERT COFFIN (1829-1904). An American educator, born at Brunswick, Me. He graduated at Bowdoin College in 1848, studied divinity in the seminary at Bangor, and entered the Congregational ministry. In 1854 he became professor of rhetoric at Bowdoin, and from 1856 to 1863 was professor of natural and revealed religion there. In 1863 he accepted the professorship of ecclesiastical history at the Andover Theological Seminary. In 1878 he was chosen president of the Andover faculty. He contributed frequently to current denominational literature, and was one of the founders and editors of the *Andover Review*. Among his writings are a translation of Uhlhorn's *Conflict of Christianity with Heathenism* (1879), which he made in collaboration with C. J. H. Ropes, and *Influence of Jonathan Edwards on the Spiritual Life of New England* (1901).

SMYTH, HERBERT WEIR (1857—). An American classical scholar, born at Wilmington, Del. He was educated at Swarthmore College, at Harvard University, and at Göttingen. After teaching at Johns Hopkins, he was appointed professor of Greek in Bryn Mawr College in 1888, and in 1901 was appointed to a similar position at Harvard University. In the following year he was elected to the Eliot professorship of Greek language and literature. He was professor in the American School of Classical Studies at Athens in 1899-1900. His most important publications are *The Dialects of Greece* (1894) and *Greek Melic Poetry* (1900).

SMYTH, or **SMITH**, JOHN (?-1612). An English clergyman, known as the 'Se-baptist.' He graduated at Christ's College, Cambridge, in 1575, became a fellow of his college, and took orders. He was publicly rebuked by the university authorities for advocating a Judaic observance of Sunday in 1586. He preached in Lincoln, 1603-1605; then left the established Church and set up an independent congregation at Gainsborough in 1606. About 1608 he went to Amsterdam, where he adopted Arminian principles and publicly baptized himself, whence he gained his name of the 'Se-baptist.' His views changed rapidly and in a short time he and those who agreed with him were excommunicated by the Amsterdam Church. After his death (at Amsterdam, 1612), the remnant of his followers joined the Mennonites. Smyth wrote several theological and controversial treatises. He was the author of some of the first expositions of General Baptist principles, which were printed in England, and hence has been regarded as the 'father' of the English General Baptists. Consult Dexter, *The True Story of John Smyth, the Se-baptist* (Boston, 1881).

SMYTH, SAMUEL PHILLIPS NEWMAN (1843—). An American clergyman and author, born in Brunswick, Me. He graduated at Bowdoin College in 1863, and afterwards served as lieu-

NORTH AMERICAN SNAILS



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For Names and Discription see Article 'Snail'

tenant in the Sixteenth regiment of Maine volunteers, which saw active service in Grant's Virginia campaigns. After the close of the war he studied theology at the Andover Theological Seminary, graduated there in 1867, and filled pastorates in Bangor, Me., and Quincy, Ill., until 1882, when he was called to the pulpit of the First Congregational Church in New Haven, Conn. His publications include: *The Religious Feeling: A Study for Faith* (1877); *Old Faiths in New Lights* (1879); *The Orthodox Theology of To-Day* (1881); *The Reality of Faith* (1884); *Christian Facts and Forces* (1887); *Christian Ethics* (1892); and *The Place of Death in Evolution* (1897).

SMYTH, William Henry (1788-1865). An English naval officer, the son of an American loyalist. He was born in Westminster; entered the English navy from the merchant marine in 1804; saw much active service; and became a lieutenant in 1813 and a commander in 1815. During the next nine years he was engaged in making a survey of the Italian, Sicilian, Greek, and North African coasts, and constructed charts that form the basis of those still in use. He was one of the founders of the Royal Geographical Society, of which he was president in 1849-50, and was president of the Royal Astronomical Society in 1845-46. He attained the rank of admiral in 1863. Among his works are: *Memoir . . . of the Resources, Inhabitants, and Hydrography of Sicily and Its Islands* (1824); *The Cycle of Celestial Objects for the Use of . . . Naval, Military, and Private Astronomers* (2 vols., 1844); and *The Mediterranean: A Memoir, Historical and Nautical* (1854).

SNAIL (AS. *snægel*, Hessian Ger. *Schnegel*, OHG. *snecko*, Ger. *Schnecke*, snail; connected with AS. *snacu*, Icel. *snākr*, *snōkr*, Eng. *snake*, from AS. *snīcan*, to creep, Eng. *sneak*, and ultimately with Skt. *nāga*, snake). The name applied to many gastropod mollusks, but more especially to the terrestrial air-breathing gastropods (Pulmonata) and to the fresh-water gastropods such as the pond-snails (Physa, Limnæa, etc.). The Pulmonata are gastropods with two pairs of tentacles, the nervous ganglia concentrated around the œsophagus, and fitted to breathe air through a pallial cavity formed by the union of the front edge of the mantle with the neck region. The spiral shell is either well developed, or in the slugs either vestigial or absent. The eyes are either at the base of the tentacles or situated at the end of the larger pair. Snails are mostly plant-eaters or live on dead leaves, cutting their food by means of the long slender rasp-like radula or 'lingual ribbon.' The eggs of the common Physa (q.v.) are laid in the early spring and three or four weeks later from fifty to sixty embryos with well-formed shells may be found in the capsule. After passing through the morula, gastrula, and trochosphere stages a definite veliger stage is finally attained. Soon the definite molluscan characters are assumed, the shell, creeping foot, eyes, and tentacles appearing, and the snail hatches in about twenty days after development begins. The range of form and type of coloration is shown on the accompanying Plate.

Use as Food. In Southern Europe and France snails are everywhere eaten, and snail-gardens (escargotières) still exist in France, also at Brunswick, Ulm, in Germany, and at Copenhagen. The markets at Paris, Marseilles, Bordeau, Toulouse, Nantes, and also those of Algiers, are chiefly supplied by snails gathered from the open country, and especially from the vineyards, where the 'edible snail' (*Helix pomatia*) abounds. When snails are eaten directly after being collected they may, from having fed on some poisonous matters, prove harmful. They should be fed in gardens previous to being eaten. Consult: Binney, *Terrestrial Mollusks of the United States* (Boston, 1851); Ingersoll, "In a Snailery," in *Wild Life of Orchard and Field* (New York, 1902).

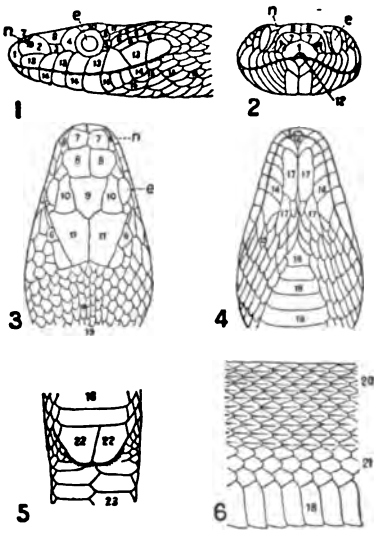
SNAKE (AS. *snacu*, OIcel. *snākr*, *snōkr*, snake, from AS. *snīcan*, to creep, Eng. *sneak;* ultimately connected with Skt. *nāga*, snake), or Serpent. A reptile representing the highly specialized saurian order Ophidia. Snakes differ from their nearest relatives the lizard, primarily in having the two halves of the lower jaw connected by an elastic band. They agree with them in many particulars, and the external resemblance is so close in some cases that the true relationships were long confused. Although snakes as a whole form an ascending series, degeneracy has played an important part in their phylogenetic history. This degeneracy consists mainly in the reduction of the mechanism for rapid movement, the shortening of the tail, and the decrease in the size of the eye and mouth. The most highly developed are those with a poison apparatus, and among these the rattlesnakes seem most advanced. The form is greatly elongated and ordinarily cylindrical, but in the sea-snakes (q.v.) is likely to be laterally compressed in adaptation to an aquatic life. The body is clothed in scales (q.v.), which are folds in the skin, lacking osteoderms and covered with a horny epidermis. Ordinarily they overlap, like tiles on a roof, but sometimes are flat and edge to edge, like tiles in a floor. They are small on the back and sides, lie in a definite number of equilateral longitudinal rows, and frequently are ridged or 'keeled;' but on the ventral surface (except in the burrowers and sea-snakes) are so large as to reach from side to side, forming 'abdominal scutes' (gastroleges in front of cloaca and wrosteges behind), each attached at both ends to a pair of ribs. The scales are often enlarged on the head into plates or shields. (See illustration.) The arrangement and shape of both the headplates and the gastrosteges are of great service in classification. In some the nasal plates are broad-

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KEY TO PLATE OF NORTH AMERICAN SNAILS.

1, Helix Pennsylvanicus; 2, Helix spinosa (side view); 3, Glandina decussata; 4, Helix glaphyra; 5, Helix Nicklliniana; 6, Helix clausa; 7, Helix fuliginosa; 8, Helix Vancouverensis; 9, Helix spinosa (showing aperture; compare Fig. 5); 10, Helix hirsuta; 11, Helix Californiensis; 12, Helix multilineata; 13, Helix appressa; 14, Helix Columbiana; 15, Helix auriculata; 16, Helix palliata; 17, Helix profunda; 18, Helix elevata; 19, Helix thyroideus; 20, Helix subplana; 21, Helix auriculata (varietal form of Fig. 15); 22, Helix alternata (spire); 23, Helix alternata (aperture); 24, Bulimus dealbatus; 25, Glandina truncata (small form); 26, Glandina truncata (typical large form); 27, Bulimus fasciatus; 28, Glandina truncata (Key West variety); 29, Helix Townsendiana; 30, Ampullaria depressa; 31, Helix indentata; 32, Helix tudiculata; 33, Helix plicata; 34, Valvata tricarinata; 35, Helix gularis; 36, Helix aspersa (spire); 37, Helixal bolabris; 38, Helix aspersa (aperture).

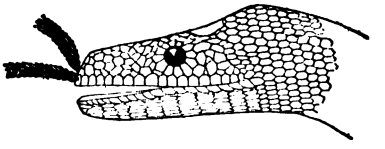
ened, turned up, or bear curious appendages, as in Herpeton and the langaha (qq.v.). Periodically, usually several times a year, the snake sloughs off its corneous epidermis, which splits across



PLATES AND SCALES OF A TYPICAL SNAKE.

1, Side view of head of a colubrine snake; 2, front view; 3, top of head; 4, under side of head and throat; 5, vent and anal plates; 6, side of a part of the body. Numbers and letters: *e*, eye; *n*, nostril; 1, rostral plate; 2, nasal; 3, loreal; 4, preocular or anteorbital; 5, postocular or postorbital; 6, temporal; 7, internasal; 8, prefrontal; 9, frontal; 10, superciliary or supraocular; 11, parietal; 12, notch in rostral for protrusion of tongue; 13, labial; 14, infralabials; 15, gular; 16, mental; 17, submental; 18, abdominal scutes or gastrosteges; 19, dorsal scales; 20, keeled body scales; 21, unkeeled lateral scales; 22, divided anal scute covering anus; 23, wrosteges.

the face, and then is peeled off by the animal scraping through a crevice or a fold of its own body; even the coating of the eye is included.



NASAL APPENDAGES OF HERPETON.

All snakes except the purely aquatic ones move by means of the abdominal scutes. No snake can leap from the ground, though the more active sometimes hurl themselves from bough to bough, or down to the ground. The vertebræ are extremely numerous, sometimes nearly 300, and are concave in front and convex behind, connected by free ball-and-socket joints, and provided with complicated processes, one effect of which is to prevent any considerable vertical motion. Every vertebra except the atlas bears a pair of ribs, articulating by the capitular head only, and united at their ventral extremities (in the absence of any sternum) by cartilages attached to the gastrosteges. The ribs admit of much movement and have an extensive and powerful musculature. The bones of the skull are not soldered together (except those of the brain-case), but are loosely joined by elastic cartilages. The two halves of the lower jaw are connected by a ligament so loose and elastic that they are capable of separation to a great extent. The teeth are simple, sharp, curved backward and solidly fixed in sockets. When broken or lost they are renewed. There are typically two rows on the upper jaw and two on the palate (maxillaries, palatines, and pterygoids), and each mandible of the lower jaw bears a single row; but vipers and rattlesnakes have none in the upper jaw except the poison fangs, which are depressible at will and fold back out of the way of food entering the mouth. The process of swallowing is laborious. With a large victim this process may last for hours, the head and throat be stretched to almost bursting, and the snake become nearly exhausted by its efforts. A great amount of saliva is poured out in this process, but the story that snakes cover their prey with slime before swallowing it is a fable.

Most snakes are carnivorous. Small mammals, frogs, reptiles, and insects form the bulk of the diet of ordinary land species. Some of them eat eggs, and a few species are fond of milk. Many of them are of great assistance to the agriculturist by devouring the grasshoppers, mice, gophers, and other pests of the farm in great numbers. The stomach is long and narrow, as also are the lobes of the liver. Snakes drink much water when in active life; yet they possess no urinary bladder. The intestines are highly absorbent. The heart is placed well forward. The lungs are elongated, and when bilobed, as in boas and rattlesnakes, one lobe is far larger than the other. The trachea is long, is provided with air sacs, and opens far forward in the mouth, all of which arrangements guard against suffocation during the tedious process of swallowing. The forcible expulsion of air from the trachea makes the hissing sound which is the serpent's only vocal utterance; but the bull-snake has special tracheal arrangements (see illustration) by which its hiss may be increased to a sort of bellow.



MOUTH OF A SNAKE.

Open mouth of the bull or pine snake (q.v.) showing the (black) tongue and opening of the windpipe: *a*, sheath of the tongue; *b*, epiglottis; *c*, glottis.

Snakes have a well-developed nervous system, and are intelligent. Many may be tamed and show docility and regard for their friends. Most of them are very timid and harmless, endeavoring to frighten their enemies by menacing attitudes (see HOGNOSE) or otherwise. Even the well-armed poisonous ones, though sullen and resistant, are rarely aggressive. All have good eyes, and some of the many nocturnal forms very large ones; but the eyes have no lids and are not movable. No external ear is present, but a complicated internal apparatus exists, so that snakes hear very well and are affected by musical sounds. The sense of taste is probably deficient, but that of smell is acute, and many serpents, as the

FOREIGN VENOMOUS SERPENTS

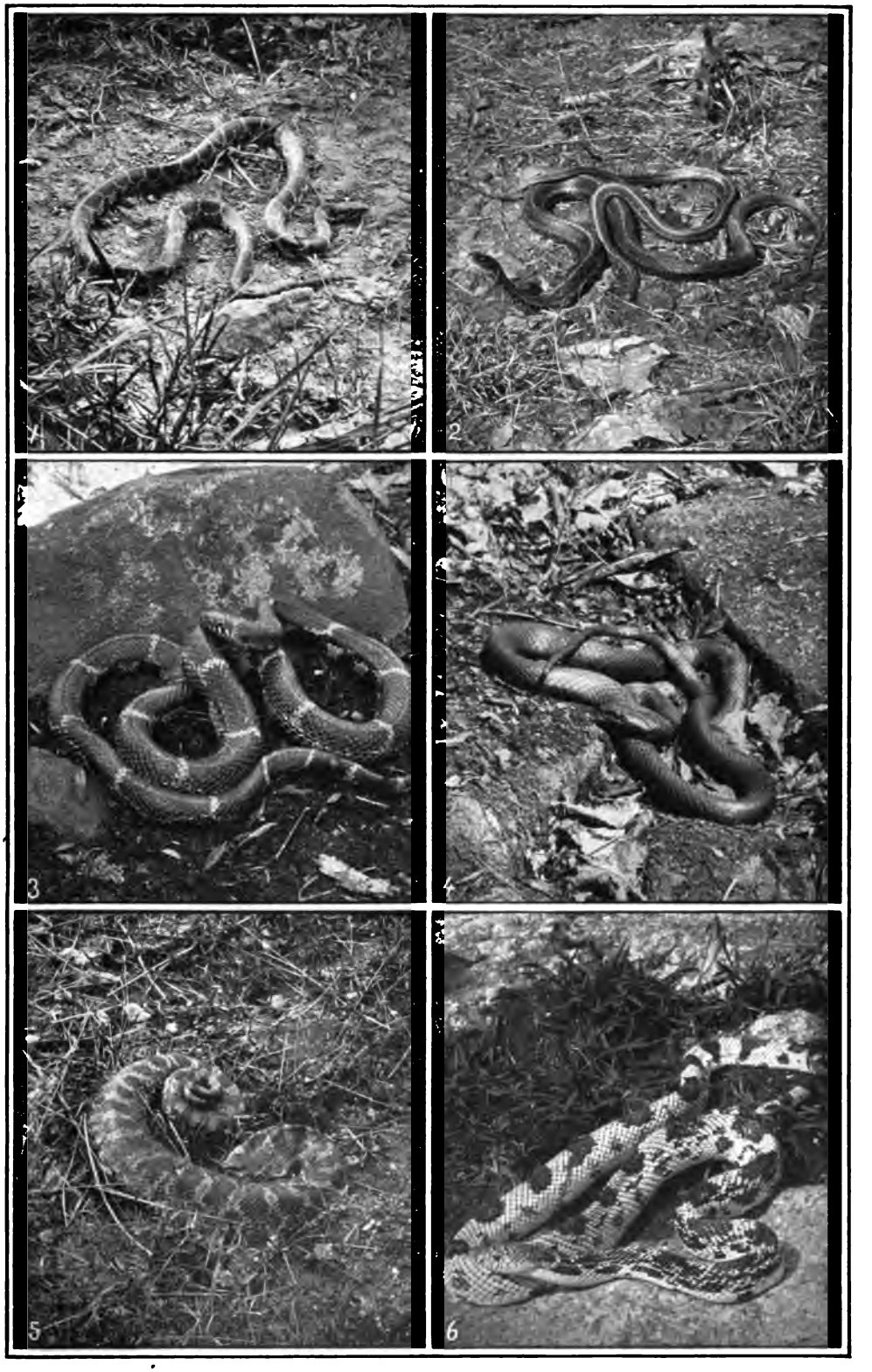


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1 BUSHMASTER - (LACHESIS MUTUS)
2 COBRA - (NAJA TRIPUDIANS)
3 CARAWALA - (HYPNALE NEPA)
4 TIC-POLONGA - (DABOIA RUSSELLI)
5 CORAL SNAKE - (ELAPS CORALLINUS)
6 PUFF-ADDER - (CLOTHO ARIETANS)
7 EAST INDIAN SEA SNAKE - (HYDROPHIS NIGRICINCTA)

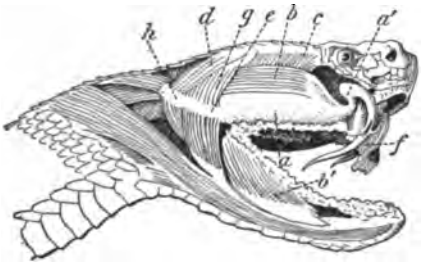
AMERICAN HARMLESS SNAKES



1. MILK SNAKE (Osceola doliata, var. triangula).
2. GARTER SNAKES (Eutænia sirtalis).
3. CHAIN SNAKE (Ophibolus getulus).
4. BLACK SNAKE (Zamenis constrictor).
5. HOGNOSE (Heterodon platyrhinus).
6. PINE SNAKE (Pityophis Sayi).

American blacksnake, hunt largely by scent. Many serpents lay eggs, but most venomous ones, and many of our commonest species, are viviparous. The young are ready to take care of themselves as soon as they escape from the egg, but are usually guarded for a time by the mother.

A very remarkable means of livelihood and of defense among snakes is the poison apparatus with which one large group (Solenoglypha) and some members of the generally harmless Colubri-



POISON APPARATUS OF A RATTLESNAKE.

a, poison gland; *a'*, poison duct leading to the fang (*f*); *b*, anterior temporal muscle *b'*, mandibular portion of same; *c*, posterior temporal muscle; *d*, digastricus muscle; *f*, sheath of fang; *g*, middle temporal muscle; *h*, external pterygoid muscle.

dæ are provided. This consists of a pair of very large labial glands, one beside each upper jaw, modified from parotid salivary glands, and containing saliva imbued with an alkaloid poison, likely to be fatal to all animals into whose circulation it enters. (See illustration.) These fangs are of three kinds. They may be the most forward of the maxillary teeth in the upper jaw, immovable and deeply grooved on the anterior side, as in the cobras and others of the Proteroglypha; or they may be thus fixed and grooved, but posterior in position (Opisthoglypha); or they may be lengthened and the maxillary bone so hinged as to dip down, allowing the fangs when not in use to lie back in a fold of the gum (where there are no other teeth); and the fang-groove may be closed over for most of its length, forming a canal opening near the point of the tooth, as in vipers and rattlesnakes. This contrivance insures the conveyance of the poison into the deepest part of the wound. When the snake is about to bite, the mouth is opened very wide, the fangs are unsheathed, swung forward and held fixed by muscular contraction, and then sunk into the flesh of the victim with a marvelously sudden and swift forward and downward stroke. Secondary and partly involuntary action of other muscles presses the poison out of the gland and through the duct and tooth. The venom will sometimes exude and drip from the fangs of a snake excited and ready to strike, and some of this may be blown forward by the forcible expulsion of the animal's breath; but the stories of 'spitting poison' have no better foundation than this. For the nature, effects, and antidotes of snake poison, see TOXICOLOGY.



A FANG.

Poison tooth of a rattlesnake: *a*, dentine of the tooth; *b*, poison duct, leading into it; *c*, the canal-groove; d, pulp cavity.

The older families of snakes are circumtropical, and none are found where a really cold climate prevails. The great family Colubridæ is cosmopolitan, as also is the Boidæ, being absent only from New Zealand, which, like most oceanic islands, has no serpents at all, and from the colder latitudes. Their near allies, the Amblycephalidæ, are altogether Oriental and Malayan. The Viperidæ (including the crotaline group) are cosmopolitan, but no true vipers occur in America, whereas some crotalines are found in Southern Asia, although all the rattlesnakes proper are American. The number of species of snakes is about 1800.

Snakes perform an important part in preserving the balance of life, for all are carnivorous, and prey principally upon insects and the small animals, mostly rodents, which tend to multiply excessively. They are, therefore, of great service to agriculture in keeping down the hordes of injurious locusts, mice, gophers, and the like, which afflict the farmer. Their flesh is white, chicken-like, and wholesome, and is eaten by savage peoples, and occasionally by persons in civilization who are free from the traditional prejudice.

FOSSIL SNAKES. About thirty-five species of Tertiary fossil snakes are known, and none of them presents any wide differences from its nearest living allies. They occur mostly in the fresh-water Tertiary deposits of Germany, France, England, and North America. No undoubted snake remains are known older than the Tertiary.

BIBLIOGRAPHY. Duméril et Bibron, *Erpétologie générale*, Suites à Buffon, vol. vii. (Paris, 1852); Jan et Sordelli, *Iconographie des ophiaiens*, 3 vols. of plates (Milan, 1866-81); Boulenger, *Catalogue of Snakes in British Museum* (2d ed., London, 1893-96); Cope, *Crocodilians, Lizards, and Snakes of North America* (United States National Museum, Washington, 1900); Gadow, *Amphibia and Reptiles* (London and New York, 1900); Holbrook, *North American Herpetology* (Philadelphia, 1842); Garman, "Ophidia of North America," in *Bulletin of Museum of Comparative Zoölogy*, vol. xiii. (Cambridge, 1888); Stejneger, *Poisonous Snakes of North America* (United States National Museum, Washington, 1893); Kreft, *Snakes of Australia* (Sydney, 1869); Fayrer, *Thanatophidia of India* (London, 1874); Ewart, *Poisonous Snakes of India* (ib., 1878); Hopley, *Snakes* (ib., 1882); and general works. For fossil snakes, consult Rochbourne, "Révision des ophidiens fossiles," in *Nouvelles Archives du Musée d'Histoire Naturelle*, ser. ii., vol. iii. (Paris, 1880); Cope, "Vertebrata of the Tertiary Formations of the West," *Report of United States Geological Survey of the Territories*, vol. iii. (Washington, 1883).

See BOA; RATTLESNAKE; VIPER; and other names of the various groups and species of serpents; also Plates of FOREIGN VENOMOUS SERPENTS; AMERICAN HARMLESS SNAKES; BOAS; RATTLESNAKES.

SNAKEBIRD. A steganopode bird with long bill, often known as the DARTER (q.v.).

SNAKE-CHARMING. A popular form of amusement which has existed in Egypt and throughout the East from remote antiquity. There are several allusions to serpent-charming in the Old Testament, and many classical writers refer to it. Serpent-charmers ascribe their power

over snakes to some constitutional peculiarity, and the profession is handed down in a family from one generation to another. It is generally supposed that the poisonous snakes used for the purpose have had their fangs and even the poison glands removed. The assertion that snake-charmers are immune from the poison of such snakes as the cobra or the rattlesnake is not credited by authorities, and the stories told about the effective use for this purpose by American Indians of certain herbs are not credited by scientific observers. See COBRA; RATTLESNAKE.

Certain feats of the snake-charmer depend upon his knowledge of the nature and peculiarities of the reptile. Many species have a liking for music; to the sound of the flute they will rise from the basket and sway the upper part of the body, while it rests upon the spiral formed by the lower half. The asp has no external ear, and is certainly deaf as to whistling or the sound of the pipe, but the charmer knows that the snake's glance can be attracted to a moving object and will follow the rhythmical movement. Thus the snake, while seeming to be charmed by the music, or to be ruled by the eye, is in reality swaying to the moving hand of the performer. Exceedingly interesting is the ancient trick of spitting down the snake's mouth, shutting it, and then laying the snake on the ground in a cataleptic state, or turning it into a stick. Such a transformation of the asp (*naja-haje*) into a staff is possible through its liability to cramps; when the muscles of the neck back of the head are strongly compressed or water is thrown upon them they become rigid. The Eastern snake-charmer is reputed to have the power of removing serpents from gardens and the vicinity of houses by luring them out of their holes by means of magic words and music.

SNAKE DANCE. A ceremony of the Hopi (Moki, Moqui) Indians of northeastern Arizona in which the handling of live rattlesnakes is a striking feature. The ceremony is held every two years, alternating with the flute dance, and in only five of the seven pueblos, at a date near August 20th. The celebrants are the Snake and Antelope fraternities, whose meeting-places are in separate kivas or underground chambers allotted to these societies. The public 'dance' is the culmination of nine days' secret rites in the kivas, during which an extremely complicated ritual is carried on, the chief features being the gathering of snakes from the world quarters, the snake-washing, and the snake drama. On the morning of the eighth day the Antelope Fraternity foot race occurs, and in the afternoon follows the antelope dance, which is a counterpart of the snake dance, except that the priests of the former society take the leading part and instead of snakes a bundle of green cornstalks and vines is carried. The morning of the ninth day is ushered in with the snake drama and race, the runners coming to the pueblos from a spring some miles distant at sunrise. About five in the evening the costumed and painted dancers file into the plaza, at one side of which a small hut of cottonwood boughs or kisi has been erected. The dancers march around the plaza several times, each man stamping on a small board sunk in the ground, supposed to cover the entrance to the underworld, and throwing sacred meal upon it. This action is for the purpose of notifying the dwellers of the underworld that a ceremony is going on. The Antelope priests line up on either side of the kisi, which contains the snake-passer and the snakes, and the Snake priests form in line facing them. A low, weird chant begins, growing louder and marked by the rattles in the hands of the Antelope chorus. The lines begin to sway with serpentine movements as the chant increases in volume, the dancers leap forward and back, the Snake priests form in groups of three and dance with a curious hopping step around the plaza, while the Antelope priests remain in line and sing. When the trios come near the kisi the snake-carrier drops on his knees and is handed a snake, which he grasps with his mouth about the middle, and, rising, dances with his two attendants around the plaza three times, when he drops the snake to the ground and secures another. One attendant places one hand upon the shoulder of the carrier and in the other holds a wand or 'snake whip' of eagle plumes, which he waves in front of the snake. The other attendant, also armed with a feather wand, gathers up the snakes dropped by the carrier and holds them in his hands.

A third group of actors in this ceremony are women and girls arrayed in ceremonial costume and carrying plaques of sacred meal. Their office is to sprinkle the dancers with meal as they pass. When all the reptiles have been duly carried around the plaza there is a pause while a cloud design in meal is thrown on the ground. Upon this the snakes are thrown and a wild scramble for them ensues, and each priest runs with his prizes down the trails and sets them free at the prescribed places. When the priests return they remove their trappings and drink of a powerful emetic for the purpose of purification. There follows general feasting by the entire pueblo. Several species of snakes are used in the ceremony, though from the nature of the case the rattlesnake preponderates. So far as is known no dancer has died from the bite of a snake in the ceremonies; it is exceedingly rare that they are bitten; the preliminary handling and the careful though seemingly fearless manipulation of the snake is sufficient to prevent accident. The ceremony is in effect a petition to the nature powers to give rain as the fundamental good in the arid region.

Consult: Fewkes, *Tusayan Snake Ceremonials* (Washington, 1897); Hough, *The Moki Snake Dance* (Chicago, 1898).

SNAKE-FLY. A neuropterous insect of the family Raphidiidæ, allied to the hellgramite-flies (Corydalis), and so called on account of the long flexible 'neck.' They occur in Europe, and also on the Pacific Coast of the United States, and spend their life upon trees. They are easily known by the prolonged, neck-like prothorax; and the female has a long curved ovipositor, with which it places its eggs deep in bark crevices. The cruciform larvæ are active and voracious, developing in rotten wood and the dust under loose bark, and preying upon other insects and their young. They are assiduous in hunting for food, and kill great numbers of larval codling-moths and other pests of fruit-trees. The larva makes no cocoon, but enters the pupa state beneath the shelter of bark, and begins to move about before it re-transforms to the imago state. Consult Howard, *The Insect-Book* (New York, 1901).

SNAKE-HEADED FISH, or SERPENT-HEAD. An East Indian fish of the family Ophiocephalidæ, relating to the climbing-fish (q.v.), and so called because of the long eel-like form and the flattened head, which is covered with large scales.

SNAKE INDIANS. See SHOSHONI.

SNAKE RIVER, also called SHOSHONE. A large tributary of the Columbia River, flowing through the Northwestern United States. It rises on the Rocky Mountain Divide in the southern part of the Yellowstone Park, and flows first southeast, turning gradually west and then northwest in a great curve through southern Idaho, then north on the boundary between Idaho and Oregon, and finally westward through the southeastern part of Washington, where it joins the Columbia about 20 miles above the Oregon boundary (Map: Oregon, G 3). Its length is about 900 miles. In the greater part of its course the river flows through a vast lava plateau, the floor of which consists of arid sagebush plains. The river bed, however, has been worn into narrow cañons from 1000 to nearly 4000 feet deep. At the bottom of this gorge the stream flows sometimes in tumultuous rapids extending for 100 miles, and in several places it plunges over rocky ledges in magnificent cataracts, of which the most noted are the Shoshone Falls (q.v.). The chief tributaries are the Salmon River, from the east, and the Owyhee, from the west. The main stream is navigable for steamers 100 miles to the Idaho boundary, and in several isolated stretches in its middle course.

SNAKEROOT. See POLYGALA; SERPENTARIA; and Plate of GOLDENROD, ETC.

SNAKEWEED. Another name of bistort (q.v.).

SNAKEWOOD. Another name of letterwood (q.v.).)

SNAPDRAGON (*Antirrhinum*). A genus of about twenty-five species of annual and perennial herbs of the natural order Scrophulariaceæ, chiefly natives of the temperate parts of the Northern Hemisphere. The English name refers to a peculiarity of the corolla, the lower lip of which, if parted from the upper, so as to open the mouth, shuts with an elastic spring or snap. Common snapdragon (*Antirrhinum majus*), a favorite plant with many fine varieties used for ornamenting beds, borders, and rockeries, is the most frequently cultivated species. It is a native of Europe, and bears racemes of variously colored flowers. The plants are propagated by seeds sown in gentle heat early in spring; the seedlings are transplanted to pans or pots, and after having been hardened to light and air are set out in the open ground during May. Seeds are often sown as soon as they have ripened in the summer, the young plants being protected in cold frames until they are transplanted the following spring. Choice varieties are often increased by cuttings made in the fall from well-formed flowerless shoots.

SNAPPER. A name given to several active, marine, carnivorous fishes of the family Lutianidæ (and to some others) on account of their voracity and quick biting at food. They are related to the sea-bass and drum-fish. The name especially applies to the members of the 'pargo' genus Neomænis, many species of which inhabit warm seas, especially along the American and African shores, and are highly valued as food. The best-known and most valuable is the 'red' snapper (*Neomænis aya*) or 'pargo colorado,' which is known on rocky banks as far north as New York, but is very numerous in the Gulf of Mexico. It reaches a length of two feet or more, and is one of the best of American food-fishes. Consult Goode, *Fishery Industries*, sec. i. (Washington, 1884); and see Colored Plate of FOOD FISHES with article FISH AS FOOD.



COMMON SNAPDRAGON.

SNAPPING TURTLE. A large fresh-water tortoise (*Chelydra serpentina*) of the rivers and marshes of North and Central America, noted for its fierceness. It sometimes exceeds three feet in length, but ordinarily is about half that. Its shell is too small to permit it to retract either the snake-like head and neck or the long tail. The carapace is covered with pyramidally thickened plates, and the plastron is reduced to a cruciform shape. Its jaws are large and so strong that often it may be lifted from the ground by the object it bites. It feeds upon fish and all sorts of small aquatic animals. A second species belongs to the Lower Mississippi Valley—the 'alligator-snapper' (*Macrochelys lacertina*), which is larger and is considered for its size the strongest of reptiles. These turtles, early in June, seek a sandbank, where the females dig holes with their hind feet and bury twenty-five or thirty small spherical eggs, smoothing the sand carefully over them. These two species constitute the family Chelydridæ.

SNARE-DRUM (from *snare*, from AS. *snear*, OHG. *snarahha*, *snara*, sinew, nerve; connected with Lat. *nervus*, Gk *νεῦρον*, *neuron*, Skt. *snāvan*, Av. *snāvarə*, sinew, nerve + *drum*). The ordinary small military drum. It is built of a

hollow body made of brass, over both ends of which a membrane is stretched which can be tightened or loosened. Across the lower membrane are stretched several strings of cat-gut, which vibrate and act upon the lower membrane very much like drum-sticks. Thus a bright, piercing sound is produced. See DRUM.

SNEEK, snāk. A town in the Province of Friesland, the Netherlands, to the west of the Sneekermeer and 24 miles southwest of Leeuwarden (Map: Netherlands, D 1). There are a gymnasium, an industrial institute, and some metal manufactures. It is the chief trading centre of the province for dairy products. Population, in 1900, 12,075.

SNEERWELL, LADY. A beautiful widow in Sheridan's *School for Scandal*, a member of the Scandal Club, and an adept in slander.

SNEEUWBERGEN, snā'bĕr-gen. A range of mountains in South Africa. See CAPE COLONY.

SNEEZEWORT. An herb. See ACHILLEA.

SNEFRU, or SNOFRU. The name of the first king of the Fourth Egyptian Dynasty. He reigned about B.C. 3000, and was the immediate predecessor of Cheops (q.v.). Snefru opened mines for copper and malachite at Wadi Maghara in the Sinaitic Peninsula, and on a rock tablet at this place the King is depicted in the act of slaying an enemy. Later accounts state that he defended Egypt from an invasion of Asiatic tribes. The tomb of Snefru is the so-called step-pyramid of Medum (q.v.). Consult: Wiedemann, *Aegyptische Geschichte* (Gotha, 1884-88); Meyer, *Geschichte des alten Aegyptens* (Berlin, 1887); Petrie, *A History of Egypt* (New York, 1897); Budge, *A History of Egypt* (ib., 1902).

SNEHÆTTEN, snā'hât'en (Norw., snow cap). The highest peak of the Dovrefjeld in Norway, 80 miles southwest of Trondhjem (Map: Norway, C 5). Its altitude is 7566 feet.

SNEL'LIUS, WILLEBRORD (1591-1626). A Dutch mathematician and astronomer. He was born and educated at Leyden and succeeded his father as professor of mathematics there. Snellius discovered the law of refraction of light (1619), and the properties of polar spherical triangles, and gave a scientific method for measuring the arc of a meridian. His chief works are: *Eratosthenes Batavus* (1617); *Cyclometrica* (1621).

SNI'DER, JACOB (?-1866). An American inventor. He conducted a wine business in Philadelphia, Pa., where he devoted much attention to inventions connected with dyeing and brewing, and subsequently with the coach-wheel and the sheathing of ships. In 1859 he went to England, where he endeavored to secure the adoption by the British Government of a system of breech-loading or converting rifles. But although he succeeded in securing its introduction he was unable to obtain adequate remuneration, and died without having received the reward of his labors.

SNIPE (Icel. *snipa*, OHG. *snepho*, *snepfo*, Ger. *Schnepfe*, snipe; probably connected with Eng. *snip*, *snap*). A small limicoline marsh-bird of the family Scolopacidæ and genus Gallinago, having a very long, straight bill, with nasal grooves extending almost to the tip, which expands a little and is soft and very sensitive, smooth, and shining in the living bird, but soon after death becomes pitted like the end of a thimble by drying. The tip of the bill is filled with the terminals of the nerve-fibres (for which consult Yarrell, *British Birds*, 4th ed., London, 1884), enabling the bird to detect by touch, as well as by odor, the hidden worms, and the like, upon which it feeds, and which it obtains by probing mud and soft soil with its bill. The head is compressed; the eyes are large and placed far back in the head. The feet have three toes before, divided to the base or very nearly so, not edged by membrane; the hind toe is short. The tail is short and contains 14 to 16 feathers.

The common snipe of Europe (*Gallinago gallinago*) is about 11 inches in entire length, the bill almost 3 inches. The sexes are alike in plumage, but the female is rather larger than the male. The general color of the upper parts is blackish brown, finely mixed with pale brown and buff; three pale brown streaks along the head are characteristic of the whole genus. The neck and breast are pale rust color mottled with black; the belly is white. It makes a rude nest of a little dry herbage in a depression of the ground, or sometimes in a tuft of grass or rushes. The eggs are four in number, pale yellowish or greenish white, the larger end spotted with brown. The snipe is everywhere in high esteem for the table. North America has but a single species of Gallinago. The common American or Wilson's snipe (*Gallinago delicata*) is about equal in size to the common snipe of Europe, and much resembles it also in plumage. This species is abundant in summer in northern parts of the United States and in Canada, in the more southern States in winter. The peculiar cry of this bird, 'scape-scape,' and its twisting motion in flight are highly characteristic; and in spring it circles about in the air near its nest with a queer zigzag flight, uttering a curious drumming or 'bleating' noise. This noise seems produced by means of the vibration of the peculiarly modified outer tail-quills. Consult general ornithologies and books on shooting, and Selous, *Bird Watching* (London, 1900). See Colored Plate of SHORE BIRDS, and Colored Plate of GAME BIRDS, with article GROUSE.

SNIPE-EEL (so called from the long jaws). One of a group of little-known, extremely slender eels forming the family Nemichthidæ, in which the jaws are excessively prolonged and almost needle-like, the upper the longer and somewhat recurved. Many of them live in the ocean depths, the one illustrated on the Plate of EELS, CONGERS, AND MORAYS (see EEL) belonging to the Gulf Stream. The best-known species is *Nemichthys scolopaceus*, common in rather deep water in the North Atlantic.

SNIPEFISH (so called from the long snout). A fish of the related hemibranch families Fistulariidæ and Macrorhamphosidæ, allied to the pipefish and variously known as 'trumpet-fish,' 'bellows-fish,' 'flutemouth,' etc. Specifically the term usually refers to a small species of the southern European coast, occasionally straying to America (*Macrorhamphus scolopax*), remarkable for the conformation of the head, the skull being elongated into a tube, at the extremity of which are the mouth and jaws. Some related species of tropical waters become from four to six feet in length.

SNIPE-FLY. Any one of the small, slender flies of the family Leptidæ. They have long legs and slender bodies, and are predatory, destroying other insects. Generally they have smoky wings and velvety bodies. They are sluggish in habits. The larvæ are found in water, decaying wood, earth, moss, dry sand, and in the burrows of wood-boring beetles. More than 50 species occur in the United States.

SNOILSKY, snoil'skē, KARL JOHAN GUSTAF, Count (1841-1903). A Swedish poet, born at Stockholm and educated at the University of Upsala. He entered the diplomatic service in 1865, and held various secretarial posts until 1879, when he abandoned diplomacy for literature. His works include: *Orchideer* (1862), *Dikter* (1896); 4th ed. 1883), *Nya dikter* (1881), and *Dikter; 3e Samlingen* (1883), *Dikter: 4e Samlingen* (1887). He also published in 1876 a translation of Goethe's ballads.

SNOOK (from Dutch *snoek*, pike, jack). A fish: (1) A barracuda (q.v.) of Australian and South African waters (*Thyrsites altun*), important as a food-fish. (2) The robalo (q.v.).

SNORRI STURLUSON, snôr'rē stōōr'lōō-sôn (1179-1241). An Icelandic historian and statesman, remembered as the author of the *Heimskringla* or annals of early Norwegian Kings, and of the *Younger* or *Prose Edda*. Snorri, youngest son of a local chieftain, was reared in the train of the great chief Jon Loptsson. Snorri gained distinction as a poet and lawyer, and in 1215 was made head of the legislative assembly and the highest court, a position which he held at various times. King Haakon invited him to Norway in 1218, and later he negotiated a peace between Norway and Iceland, rather to the dissatisfaction of both parties. He returned to Iceland, where he used his power to his own advantage, and in 1239 political and domestic intrigue compelled his flight to Norway. He returned in 1240 and was, by King Haakon's orders, killed by Gissur, Snorri's son-in-law, at his home in Reykjaholt, September 22, 1241. The *Prose Edda*, finished in 1222, comprises the mythological *Gylfaginning*, the *Skáldskaparmál*, a sort of *Ars Poetica*, and the *Háttatal*, a commentary in 102 strophes on poems in honor of the author's Norwegian patrons, King Haakon and his tutor Skuli. The *Sagas* extend from the mythological kings to 1177, and are based on chronicles, tradition, and legend, all digested and fused with much critical and literary ability on principles expounded in his preface. The most important part of the *Heimskringla*, the *Olaf Saga*, he also elaborated separately. Snorri's *Works* have been edited by Peringskjöld (3 vols., Stockholm, 1697); Schöning and Saint Thorlacius (3 vols., Copenhagen, 1777-83); Unger (Christiania, 1868); and best by Finnur Jónson (Copenhagen 1893 et seq.). There are translations into Danish by Grundtvig (Copenhagen, 1818-22); Norwegian by Hall (Christiania, 1838-39); Swedish by Richert (Stockholm, 1816-29) and by H. Hildebrand (Oreboro, 1869-71); and German by Wachter (incomplete, Leipzig, 1835-36); and into English by Laing (London, 1844 and 1889), also by M. Morris (ib., 1895).

SNOUCK HURGRONJE, snuk hur-grôn'ye, CHRISTIAAN (1857—). A distinguished Dutch Orientalist, born in Oosterhout, North Brabant, and educated at Leyden, where he studied Arabic under De Geoje, and at Strassburg under Nöldeke. He taught Mohammedan law at Leyden in the civil service college for the Dutch Indian service, and in 1884 traveled in Arabia. Disguised as a native doctor of the civil law, he spent almost a year in Mecca. In 1888 he was sent on a governmental scientific expedition in the Dutch Indies, and soon afterwards settled in Java, where he assumed an official post as adviser to the Dutch Governor-General of Batavia. Among his works are: *Het Mekkaansche Feest* (1880, a doctoral thesis); *Mekka* (1888-89), with an atlas; *Bilder aus Mekka* (1889); *De beteekenis van den Islam voor zijne belijders in Oost-Indie* (1883); *Der Mahdi* (1885); "De Islam," in *De Gids* (1886); and *De Atjèhers* (1894).

SNOUT BEETLE, A weevil. See WEEVIL.

SNOW (AS. *snāw*, Goth. *snaiws*, OHG. *snēo*, Ger. *Schnee*, snow; connected with Lat. *niw*, Gk. (acc.) *νίφα*, *nipha*, OIr. *snechta*, OChurch Slav. *snĕgŭ*, Lith. *snegas*, Lett. *snegs*, Av. *sniž*, snow, Skt. *snih*, to be sticky or oily). Minute crystals of ice formed in the atmosphere when the aqueous vapor is condensed at temperatures below freezing. These crystals usually combine into groups that are sometimes large and flocculent, but more frequently are small and arranged with great regularity. The elementary ice crystals or spiculæ are prisms of six sides whose ends are perpendicular to their lengths. When the length of the crystal is very small as compared with its diameter these needles become thin flat plates. The early meteorological observers have recorded the figures of snow crystals, as observed under a magnifying glass, but later observers have secured photographs of the crystals as seen through the compound microscope. The longer rays that constitute the arms of the six-rayed stars are generally hollow tubes; they are evidently built up by additions to the edge of an original crystal.

When a mass of snow is melted to water the latter occupies much less volume than the original snow. It is customary to say that in a general way a depth of ten inches of snow is equivalent to a rainfall of one inch of water, but it is never safe to use any specific ratio for the conversion of snowfall into rainfall, but in all cases the snow should be freshly caught and melted and the exact amount of equivalent water properly measured. The white color of snow results from the fact that the snow crystals are so minute that each cell of the retina receives a general impression produced by the combination of different wave lengths reflected from innumerable minute facets. An analogous case is the white light produced by reflection from pounded glass or any foaming liquid or from a surface covered with hoar frost. Red snow, and more rarely other colors, such as green, blue, or black snow, are produced by the action of innumerable fungi, known as the *Micrococcus nivalis*. Snow rarely falls at sea level south of the parallel of 30 degrees north latitude, and on the Pacific coast of North America it occurs at sea level only north of 47 degrees north latitude. The melting of snow on the mountains adds a great deal to the drainage from the watershed into the river and the flooding of the rivers carries fertility into all regions.

The great accumulations of snow by sliding downward in ravines until they join together in the river valleys and form glaciers (q.v.), constitute an important factor in the study of physical geography. A heavy snowfall is not merely a question of low temperature, but of inflowing and uprising cool moist air. In this respect the physical processes that determine the formation of snow are entirely similar to those that determine the formation of rain. The ordinary limits of snowfall and glaciation at sea level are north of the parallel of 30° north and south of the parallel of 30° south. Snow is an exceedingly poor conductor of heat, owing to the non-homogeneous texture of the mass, which may be considered as composed of alternate thin layers of ice and air. A covering of snow on the ground, or a hut hastily built of blocks of snow, is a perfect protection against the cold storms from the north. The roots of the most tender vegetation prosper under a covering of snow, which, ordinarily, maintains them at a uniform temperature of about 32° F.

During the winter season snow falls at irregular intervals; sometimes in connection with rain, and a few days of dry air, clear sunshine, and strong wind cause the snow to evaporate and disappear. From an agricultural and a geological point of view the amount of snow lying on the ground at any time is highly important. The United States Weather Bureau publishes monthly maps showing this feature of climatology; a general map has also been compiled showing the normal amount of snowfall for the whole year as a help to the study of the conditions that favor the accumulation of snow and the possible occurrence of a glacial period in North America.

BIBLIOGRAPHY. The principal collection of snow photographs are those that we owe to Dr. Neuhauss, of Berlin, 1892-93; G. Nordenskiold, of Stockholm; A. A. Sigson, of Rybinsk, Russia; and, most important of all, those of W. A. Bentley, of Jericho, Vermont. See articles in *Appleton's Popular Science Monthly*, May, 1898, and in the *Monthly Weather Review* for May, 1901.

SNOW, LORENZO (1814-1901). An American official, president of the Mormon Church, born at Mantua, Portage County, Ohio. He studied at Oberlin College, in 1836 was converted to Mormonism, and in 1840-43 was a missionary to Great Britain. In 1852 he was elected to the Utah House of Representatives, and until 1882 continued as a member of either the House or the Council. He established Brigham City in Utah in 1855, and organized there a system of coöperative industry. He was sent on missions to Italy in 1849, and to the Sandwich Islands in 1864. In 1889 he was elected president of the Twelve Apostles, and in 1898 president of the Mormon Church. His publications include a translation of the *Book of Mormon* into Italian, *The Only Way to Be Saved* (1851), and *The Voice of Joseph* (1852).

SNOWBALL TREE. Another name for the Guelder rose (q.v.).

SNOWBERRY (*Symphoricarpos racemosus*). A bushy deciduous shrub of the natural order Caprifoliaceæ, a native of northern North America, and common in shrubberies. It has simple leaves, small flowers, white inedible berries, about the size of black currants, remaining on the bush after the leaves. The creeping snowberry (*Chiogenes serpyllifolia*) is a native of North American bogs.

SNOW-BIRD. Any species of bird, usually a finch, associated with snow. In the United States the name is most commonly applied to the juncos (q.v.), but also to the snow-bunting (q.v.). See Plate of SPARROWS.

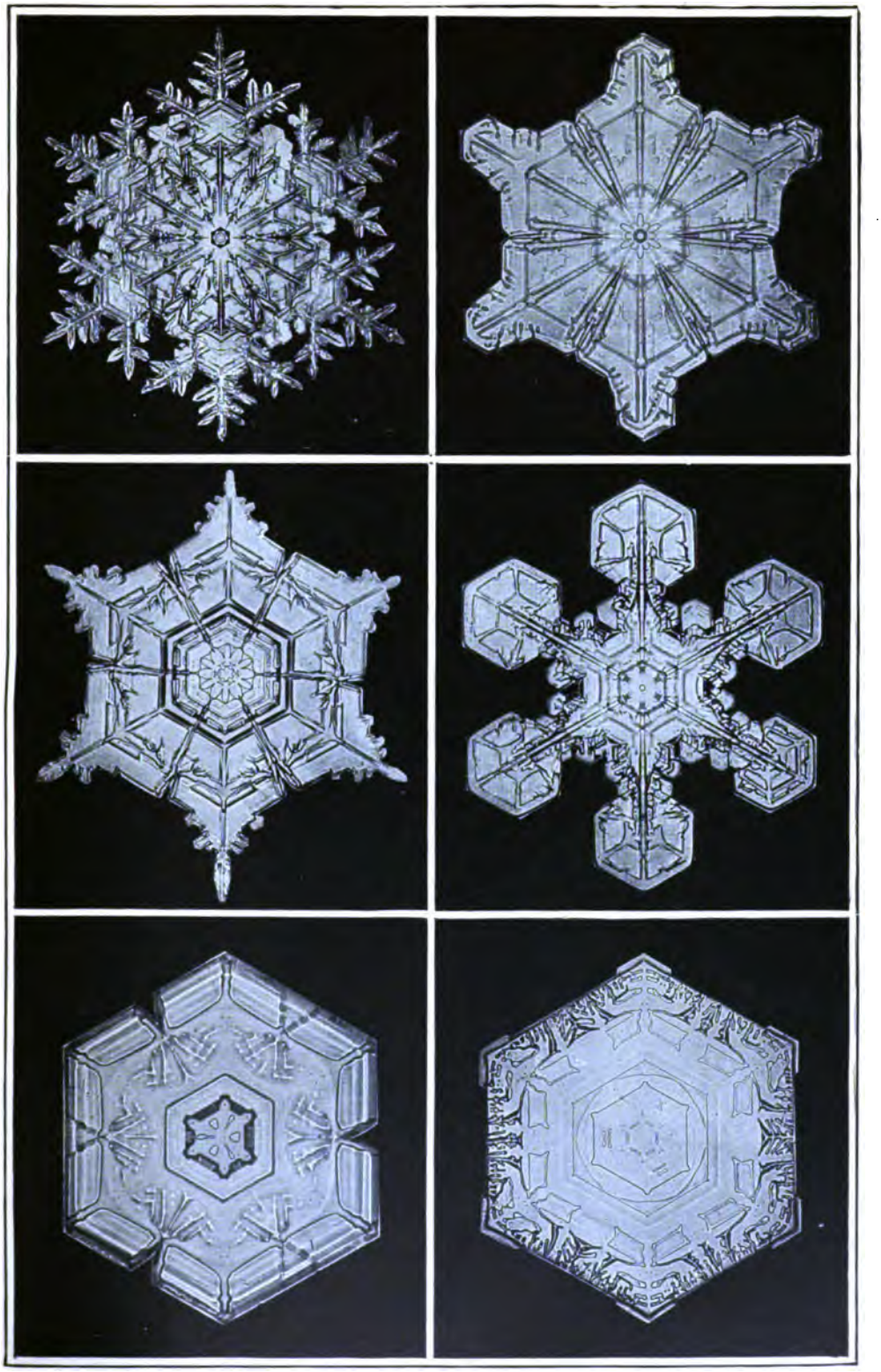
SNOW-BUNTING, or SNOW-FLAKE. A large finch (*Plectrophenax nivalis*) of a genus distinguished by the long lark-like straight claw of the hind toe and a similarity to the larks in habits; there is a similar ease and celerity in running along the ground, and the song is very different from that of any of the true buntings. The color of the plumage is very different from most fringilline birds, for white predominates. In summer plumage the back and parts of the wings and tail are black. In winter plumage all the upper parts are rusty brown. The length of an adult is seven inches. The snow-bunting abounds in summer in all parts of the arctic regions, and in winter migrates into the north temperate regions, but is rarely seen even in the Northern United States, except in severe winters, and when snow is plentiful. It feeds largely on the seeds of grasses and weeds, and is often seen in company with longspurs (q.v.). See Plate of BUNTINGS AND GROSBEAKS.

SNOW-COCK. A name given by Anglo-Indian sportsmen to two different birds found near the snow-line in the Himalayas. One is the Tibetan snow-pheasant, a large and active species frequenting the stony heights of all Central Asia. It is *Tetraogallus Himalayensis*. Other species are found in various other Asiatic mountain ranges. Another snow-cock is the 'jer-monal' (*Lerwa nivicola*) of the higher Himalayas and Western China.

SNOWDEN, snō'd'n, JAMES ROSS (1810-78). an American numismatist, born at Chester, Pa. After graduating at Dickinson College, he settled in Franklin. Subsequently he was State Treasurer (1845-47), treasurer of the United States mint (1847-50), and its director (1853-61). His publications include many pamphlets on coins and his *Description of Coins in the United States Mint* (1860); *Coins of the Bible* (1864); and an article on the coins of the United States in the *National Almanac* (1873).

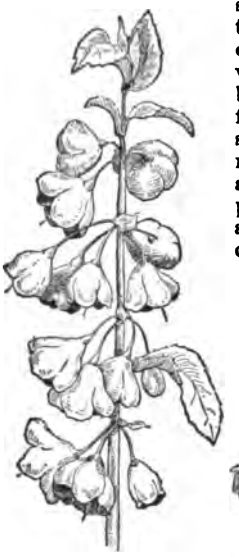
SNOWDON, snō'don. A mountain group in Caernarvonshire, North Wales (Map: Wales, B 3). It is broken by valleys into four minor groups, whose chief peak, Moel-y-Wyddfa ('the conspicuous peak'), is the highest mountain in South Britain, being 3560 feet above sea-level.

SNOW-DROP (so called from the color of the flower), *Galanthus*. A genus of plants of the natural order Amaryllidaceæ. The bulbous root produces two leaves and one single-flowered leafless stem. The common snow-drop (*Galanthus nivalis*) is found chiefly in the woods and pastures of Southern Europe. Various species are popular spring flowers in flower gardens.

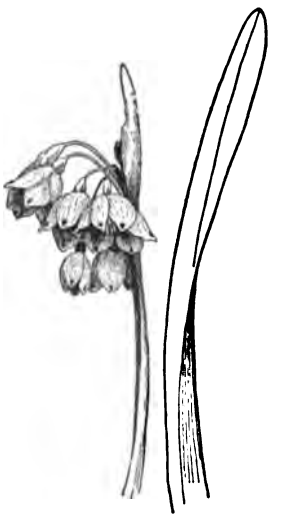


PHOTOMICROGRAPHS OF SNOW CRYSTALS SHOWING TYPICAL FORMS
Photographed by W. A. Bentley, Jericho, Vt.

SNOW-DROP TREE, or SILVER-BELL TREE (*Halesia tetraptera* and *Halesia diptera*). Two shrubs or small trees of the natural order Styraceæ, with large and veiny pointed deciduous leaves, and showy white flowers, drooping on slender pedicels in short racemes or clusters from axillary buds of the preceding year. They are beautiful shrubs for cultivation.



SNOW-DROP TREE (*Halesia tetraptera*).



SUMMER SNOWFLAKE.

SNOWFLAKE (so called from the color of the flower), *Leucojum*. A genus of nine species of bulbous herbs of the natural order Amaryllidaceæ, natives of the Mediterranean region. The spring snowflake (*Leucojum vernum*), the best known species, produces umbels of sweet-scented flowers in March or April. The summer snowflake (*Leucojum æstivum*) is a beautiful rapidly growing and freely spreading plant. *Leucojum autumnale*, a Portuguese species, produces drooping flowers in autumn. These plants make the best growth on rich sandy or loamy soils. Propagation is by offsets, obtained as soon as the leaves have become dry.

SNOWFLOWER. See FRINGE-TREE.

SNOW-GOOSE. An Arctic goose (*Chen hyperborea*) seen in the United States during its migrations, sometimes in vast numbers. It is pure white, except the black wing-quills, washed on the head with reddish; the beak, which is strongly 'toothed,' is pink and the feet reddish. An adult male measures 27 inches long, and weighs 5¼ pounds. Ross's snow-goose (*Chen Rossi*) is a miniature of the other, and is known all over the Hudson Bay country as 'horned wavey.' Consult Coues, *Birds of the Northwest* (Washington, 1874).

SNOW-LEOPARD. The ounce (q.v.).

SNOW LINE. The level on a mountain slope above which snow exists all the year round, or at least very nearly so. The height of this line above sea-level varies greatly both from year to year, and in different localities; it moves up and down within a broad zone, and is determined principally by the temperature, moisture, and average velocity of the prevailing winds. The average height of the snow line varies from 18,400 feet in the tropical Andes, and 19,000 feet in the Himalayas, down to 6000 feet in Patagonia, and 2000 feet in Greenland. See SNOW; MOUNTAIN; and the articles on the separate mountain ranges, as ALPS, HIMALAYA, etc.

SNOW-ON-THE-MOUNTAIN. A euphorbiaceous plant. See SPURGE.

SNOW-PLOW. A machine for clearing roads and railways of snow. The rotary steam snow shovel has been adopted by all the transcontinental lines of the United States and Canada. It consists of a wheel 9 feet in diameter set in a round casing with a flaring front 10 feet square which feeds the snow into the wheel. The wheel contains an inner and outer series of knives pivoted on radial pins, with their surfaces inclined to one another; when they encounter any snow, they are *canted*, or set so as to slice it off and feed it into the machine. Behind the knives is a fan wheel composed of a number of radial blades. When the wheel revolves the centrifugal force throws the snow to the outside of the wheel, where it meets the inclosing case, and is forced through an opening just behind the headlight. A hood to this opening regulates the direction in which the snow is thrown. The weight of the machine is about twenty tons.

SNOW-SHOEING. The original snow-shoe of America was a frame of light wood, made in the shape of a more or less elongated circle, across which were criss-crossed ligatures of leather, with a bow on the top, into which the foot could be slipped. Snow-shoes are of four permanent main varieties. One is long and narrow and sharp at each end, swelling only slightly in the middle, and slightly turned up at the toe. Another has a turned-up entry which meets the snow nearly squarely, and a trailing pointed after end. These are favorite patterns of all the far north; they are about five feet long and a foot wide in the centre, made of white birch and laced with fine caribou skin webbing, except immediately under the foot, where there is an open bed-cording of thick rawhide. A third kind is broader and shorter, with an oval entry at the fore end and a trailing, though shorter, after end. The fourth set are almost circular, with a stumpy beaver-like trail end. The last two styles are the true 'Montagnais' or mountaineers' shoes. In walking, the shoe is slightly raised and carried partly over and ahead of its fellow, and when the step is completed the swell of the centre of the frame of the rear shoe lies close to the inward curve of the hinder part of the leading shoe. The principal snow-shoe clubs of Canada are those of Montreal and Quebec. The time record for snow-shoeing is faster than the ordinary cross-country runs. The hundred-yard dash is covered in a little over twelve seconds, and the mile in five minutes forty seconds.

SNOWY OWL. A large owl (*Nyctea nyctea*) which inhabits the circumpolar region, and appears irregularly in winter in more temperate regions southward, occasionally visiting even the central parts of the United States. It has no 'horns,' is white suffused with reddish brown in summer, but in winter is pure white. Its habits are similar to those of other large owls (q.v.); and in arctic America it feeds mainly upon

ptarmigan. Many curious superstitions cling about it in the folk-lore of the northern peoples.

SNUFF. See TOBACCO.

SNUFF-TAKERS. See CONSCIENCE WHIGS.

SNYDERS, FRANS (1579-1657). A Flemish painter, born at Antwerp. He studied under Pieter Brueghel the younger and Hendrick van Balen. His talents won for him the admiration of Rubens, who frequently engaged him to paint fruit, game, and other accessories in his pictures; and in turn Rubens often contributed the figures to the canvases of Snyders. The chief works which they painted together are "Diana's Hunt" (Berlin Museum) and the "Prometheus and the Eagle" (Oldenburg Museum). As a painter of hunting episodes, scenes of violent action, and combats of animals, Snyders stands as very nearly the equal of Rubens. His pictures are seen in all the famous galleries of Europe, that of Madrid possessing no less than twenty-one. There are five of his pictures at the Stockholm Museum; fourteen at the Hermitage, Saint Petersburg; ten at Dresden; and seven at Munich. Among those at Munich is his masterpiece, "Two Lions Pursuing a Roebuck." A subject quite similar was bequeathed to the Metropolitan Museum, New York City, in 1871.

SOANE, sōn, Sir JOHN (1753-1837). An English architect, born at White Church, near Reading. In 1788 he was appointed architect to the Bank of England, which remains the best example of his work. He was elected to the Royal Academy in 1802, and became professor of architecture there in 1806. While lecturing he began the foundation of the Soane Museum, which he left to the British nation. It contains a valuable collection of pictures, casts, and antiquities. His written works include *Designs for Public Improvements in London and Westminster* (1827), and *Designs for Public and Private Buildings* (1828).

SOAP (AS. *sāpe*, OHG. *seifa*, *scipfa*, Ger. *Seife*, soap; probably connected with AS. *sipan*, MHG. *sīfen*, to drip, trickle, Lat. *sebum*, tallow). A term generally employed in chemistry to describe the metallic salts of the higher fatty acids. In commerce it has a more limited application, being confined to the potassium and sodium salts which are extensively used as detergents. These soaps are also used in a limited way as bases for various dyestuffs, and sometimes for medical purposes. The sodium compounds of fatty acids, being generally efflorescent, harden on exposure to air, and hence are known as *hard soaps*. The potassium compounds, on the contrary, absorb water under the same conditions and consequently tend to liquefy; hence they are called *soft soaps*.

The fats generally used in soap-making include various tallows and greases of animal origin, lard oil, palm oil, olive oil, cotton-seed oil, corn oil, cocoanut oil, stearin, red oil (crude oleic acid), etc. The alkali lyes are prepared either by dissolving caustic soda or potash in water to the desired strength, or, as is more often the case in large establishments, at least with the caustic soda lyes, they are made by dissolving carbonate of soda in hot water and then adding the requisite quantity of quicklime for causticizing, boiling and allowing the mass to cool, when the clear lye is drawn from the top. The solution thus obtained is often strengthened by evaporation or by addition of a further quantity of solid caustic alkali.

The soaps manufactured at present may be classified as follows: (1) Rosin or laundry, settled soaps; (2) toilet soaps, including settled, half-boiled, transparent, and floating varieties; (3) marine soaps; (4) medicated soaps; and (5) manufacturing soaps.

The materials required in manufacturing settled soaps include tallow (alone or mixed with grease and oil), caustic soda solution (18°-22° Baumé), and pickle (saturated salt solution). The operation is carried out in large sheet-iron kettles, circular or square in section, and heated by two steam coils lying on the bottom of the kettle. One coil is perforated with small holes and delivers free steam in fine jets (the 'open coil'); the other serves to heat the contents of the kettle but allows no escape of steam (the 'closed coil'). The various operations are known as stock change, rosin change, strength change, and finish stock change. The 'stock' (i.e. the fatty material) is pumped in liquid state into the kettle and partly spent lye from a previous operation is added, the open coil being used as a heater. A portion of the stock being always somewhat rancid, it unites at once with the lye to form soap, the soap in turn, with the aid of the live steam, emulsifying the rest of the fat. The open coil is now shut and the closed coil used. From time to time addition of strong fresh lye is made until the contents of the kettle are homogeneous, have a characteristic gummy appearance, and run in long strings from a wooden paddle which has been dipped in the hot liquid. Pickle is now added until the soap becomes insoluble ('grained') and floats on the surface. The contents of the kettle, being allowed to cool, separate into two layers, the granular imperfect soap floating on the brine. The latter, which contains glycerin, is drawn off from the bottom of the kettle and worked for glycerin and salt.

To the soap remaining in the kettle is added fresh strong lye and rosin to the amount of 50 to 100 per cent. of the stock originally used. This mixture is heated by the closed coil until the rosin is saponified and then the kettle is salted out as before. On standing, a lye separates which contains a little glycerin not extracted in the previous process; this lye, too, is worked for its glycerin and salt. The next operation (the 'strength change') is introduced in order to insure complete saponification. For this purpose fresh strong lye (at least 22° Baumé) is added and the mass is kept gently boiling for several hours in the grained condition, strong lye having the same effect on soap as pickle; viz. it renders the soap insoluble. At the conclusion of this operation the kettle contents are allowed to cool and settle, and the drawn off lye, which is not exhausted as in the previous operations, is used to start a new saponification in the stock change. The grained soap is finally reheated and enough cold water added to cause it to pass into solution ('close'). At this stage the heat is turned off, and the kettle contents slowly cool down and stratify in three layers: the soap on top, next an impure dark soap called 'nigre,' and finally a small quantity of strong dark lye too impure for further use. The process of making settled soap without rosin is the same, except that the

'rosin change' operation is left out. Many soap-makers, however, use very small quantities of rosin in making toilet soaps, believing that this tends to 'pitch the nigre,' i.e. clarify the product.

Rosin soap is allowed to cool in the kettle to about 140° C. (about 280° F.) and then run into the 'crutcher'—a horizontal iron cylinder provided with a shaft bearing paddle blades. These revolve and thoroughly mix the soap, yielding a product uniform in texture and color. In this operation it is also customary to make various additions, such as carbonate of soda to soften hard water, silicate of soda to harden the soap and prevent too rapid wasting, and many other substances, some of doubtful utility. After crutching, the warm mixture is run into large iron frames or molds and allowed to cool. When the soap is hard, the sides of the frame are removed and the soap is cut into slabs and bars with a steel wire. After a short drying operation, the soap is pressed and ready for use. An ordinary rosin soap freshly made has the following composition:

Fatty and rosin acids	66.24 per cent.
Free alkali	0.36 per cent.
Combined alkali	6.82 per cent.
Water	28.00 per cent.

Settled toilet soap is not crutched, but run at once into frames. When hard the soap is cut by wires into thin bars which are dried on racks in a warm, well ventilated room, and when the moisture is reduced to about 10 per cent., the slabs are cut into fine thin chips or shavings and dried once more. The required perfume and coloring matter having been added, the chips are fed into a roller mill, coming out in thin crêpe-like sheets. These are passed through again and again until the mass is homogeneous. The thin sheets then pass into the 'plotter,' a revolving screw press which is gently heated and delivers the soap in long slender bars. The bars are cut into short lengths and pressed into cakes by suitable dies. Often settled and half boiled soaps are mixed in the mills, but as a rule the finest grades of toilet soaps are made exclusively from settled soap which is entirely free from glycerin.

'Half boiled soap' is an evident misnomer, no higher temperature than that necessary to melt the fatty materials (50° to 65° C. = 120° to 150° F.) being used in the process. The operation is usually carried out in small cast iron jacketed kettles, in which the fat, which must be of good quality, and usually consists of tallow or tallow and cocoanut oil, is liquefied by heat. An exactly calculated quantity of strong lye (36° to 40° Baumé), consisting of soda alone or mixed with a small amount of potash, is now gradually added, and the mass vigorously stirred with a wooden paddle. When emulsification is complete and saponification is well under way, the mass is ladled into an iron frame and allowed to stand for several days, during which time the fatty matter is completely saponified, cools down to the normal temperature, and hardens. The frame may now be stripped and the soap cut and pressed in the usual manner.

Transparent soaps are made by remelting half boiled soaps with the addition of a small quantity of alcohol, some additional glycerin and cane sugar or glucose. This operation leaves the soap as a transparent jelly-like mass, which is cut up and allowed to stand until the alcohol has evaporated. The bars are then planed down, again cut, and pressed into any desired shape. Of late years it has been the custom of various manufacturers to introduce some form of saponified rosin into this class of soaps to increase the lathering quality.

Floating soaps were originally made exclusively from cocoanut oil. At the present time such soaps are extensively made by incorporating with the soft warm mass of any soap whatever enough air to reduce the specific gravity below that of water, the operation being usually conducted in a jacketed kettle provided with a screw stirrer. As a rule floating soap is now made from a mixture of tallow and cocoanut oil, 'half boiled,' with mixed potash and soda.

Marine or *salt water soap* is a 'half boiled' mixture made from pure cocoanut oil with potash and soda lye and a further addition of salt and carbonate of soda. The United States Navy specifications call for a soap of the following composition: the fatty matter shall consist of pure cocoanut oil only; water should not be present to an extent of more than 55 per cent.; the free alkali (NaOH) shall not exceed 0.5 per cent.; carbonated alkali (Na_2CO_3) may be present in quantities varying between 2 and 3 per cent.; foreign mineral matter should not exceed 0.5 per cent. Such a soap will wash freely in salt as well as in fresh water, a peculiarity due to the solubility of the alkali salts of lauric acid (a fatty acid present in cocoanut oil) in solution of salt. The soap, however, does not keep well, decomposition of the salts taking place during drying, which causes a liberation of free fatty acid and hence rancidity of the soap.

Soaps made from olive oil with soda or mixed soda and potash by the 'half boiled' process are known as *Castile soap*, a recognized standard. Such soaps, however, are now largely adulterated with cottonseed oil soap.

Marseilles soap is a settled olive oil soap made with rather more soda than necessary for saponification and then boiled down until the excess lye is strong enough to cause a precipitation of the soap. The mottled varieties receive an addition of copperas solution before boiling down. During the long continued boiling operation, the iron partially oxidizes and remains suspended in the hot mass, producing the characteristic blue, green, or red mottling.

Soft potash soaps are now rarely made, the soft soaps found in the market being soda soaps that contain an excess of water.

Medicated soaps are merely mixtures of pure neutral soaps with various remedial agents. The term 'antiseptic soap' is misleading, a pure settled soap being aseptic by itself and hardly anything being capable of improving this quality. Pure olive oil soap is used in medicine both internally and externally. It may be used as a laxative in the form of pills, or as an enema in children for the same purpose; or a plug of soap may be inserted into the rectum. Soap is also valuable as an emergency remedy in poisoning by the mineral acids. Externally soap is valuable as a stimulating liniment in psoriasis, lichen, eczema, and other chronic affections of the skin.

Manufacturing soaps, such as the wool and silk scouring soap, consist of neutral compounds of olive oil with potash. It is very essential that these soaps should be neutral and freely soluble. A strongly alkaline soap would injure the deli-

cate fibre and at the same time not prove so efficient a detergent.

THEORIES OF THE DETERSIVE ACTION OF SOAPS. Berzelius's theory formulates the dissociation and subsequent formation of an acid soap which forms the suds and free alkali uniting with any greasy matter present. This is the generally accepted theory to-day. On the other hand, Rotondi, who made a careful experimental investigation of the subject, maintained that soaps decompose in solution, not into acid soaps and free alkali, but into acid soaps and basic soaps, the latter being precipitated from solution, by common salt, without losing any alkali, while acid soaps are completely soluble in hot solutions of basic soaps. The basic soaps, according to Rotondi, have the power to emulsify, but not to saponify (unite chemically) with fatty bodies, and it is to this emulsifying power that the detergent value of soaps is due. Recent experiments (1903), conducted with fabrics impregnated with emulsifiable, but not saponifiable, materials—such as kerosene oil—seem to confirm Rotondi's opinions.

BIBLIOGRAPHY. Sadtler, *Handbook of Industrial Organic Chemistry* (Philadelphia, 1900); Christiani, *Soaps and Candles* (London, 1881); Carpenter, *Soaps and Candles* (ib., 1885); Watt, *The Art of Soap Making* (ib., 1887); Cameron, *Soaps and Candles* (ib., 1888); Gadd, *Soap Manufacture* (ib., 1893); Hurst, *Soaps, A Practical Treatise* (ib., 1899); Thorp, *Outlines of Industrial Chemistry* (New York, 1898); Gathmann, *American Soaps* (Milwaukee, 1901). See FATS; OILS; STEARIN; PALMITIN; OLEIC ACID; OLEIN; STEARIC ACID; PALMITIC ACID; LAURIC ACID; etc.

SOAPBERRY (*Sapindus Saponaria*). A West Indian tree of the natural order Sapindaceæ, occurring in Southern Florida. Its pulpy fruit, which contains saponin, is used instead of soap in washing, a use apt to injure linen. With the exception of *Sapindus marginatus*, a tree 30 to 40 feet in height, found in the Southern United States, the genus is entirely tropical. The fruits contain shining black very hard nuts, formerly used for making buttons. See SAPINDACEÆ.

SOAP BUBBLES. Many important applications of the mechanics of liquid surfaces can be studied very conveniently by means of soap bubbles and soap films. By measuring the diameter of a bubble and the pressure upon the air within the elastic strength of the film can be measured. Naturally the pressure in a small bubble is greater than in a large one, because the curvature of the surface is greater. This is very prettily shown when two bubbles of different sizes are joined as in Fig. 1, when it will be observed that the partition film *p* is always convex into the larger bubble A, being pushed to that form by the greater pressure in the smaller bubble B. In air quiet and free from dust two bubbles may be rested against each other as shown in Fig. 2 *a*, like two elastic balls, but if a stick of sealing wax be rubbed to electrification and brought near the bubbles, they will coalesce as in Fig. 2 *b*. One bubble may be blown inside of another as shown in Fig. 3 *a*. Then electrification will cause it to fall through the outer bubble to the form Fig. 3 *b*. Soap-bubble films on wire frames arrange themselves in a manner beautifully to confirm and illustrate the laws of the composition and equilibrium of forces. A wire frame, as Fig. 4 *a*, with a thread tied upon it, is instructive. If it is dipped in soap solution and a complete film put on it, the thread will move freely about in the film, but if the film on one side of the thread be broken, the film on the other side will pull the thread to the form *b*. If the thread have a loop in it the form *c* may be obtained, and the open ring will move freely about in the film. A good solution is made of fresh oleate of soda with a little glycerin, or Castile soap may be successfully used. Great care must be exercised to keep the solution free from dust, but it must not be filtered. For complete details, consult: Boys, *Soap Bubbles and the Forces Which Mold Them* (London, 1895), an interesting volume describing many simple and instructive experiments. See CAPILLARITY.

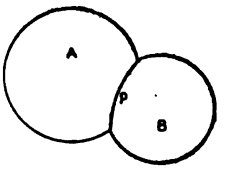


FIG. 1.



FIG. 2.

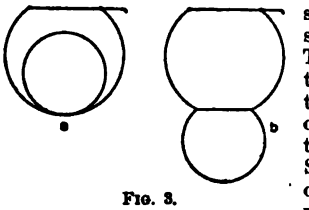


FIG. 3.

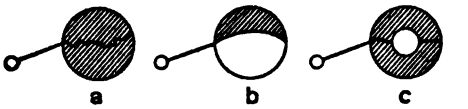


FIG. 4.

SOAPFISH (so called from the unctuous skin, due to smooth scales and an excessive flow of mucus). (1) A West Indian fish (*Rypticus saponaceus*), related to the sea-bass, and locally called 'jabon' and 'jaboncillo.' It is of small value. (2) See LIZARD-FISH.

SOAPSTONE, STEATITE, or TALC ROCK. A rock composed essentially of the hydro-magnesian mineral talc. Soapstones are produced by weathering agencies, are tough and durable, and often susceptible of taking a high polish. They are, however, very soft and easily marred. Soapstones are generally produced by the alteration, through weathering, of the ultra-basic or magnesian igneous rocks. In the Lake Superior region and elsewhere dikes of soapstone have played an important rôle in the concentration of bodies of ore. Soapstone is used to a small extent as a building stone, for monumental work, and for sinks, etc., and when ground it is employed in the manufacture of toilet powders, soaps, and as a lubricating material. See TALC.

SOAPWORT (*Saponaria*). A genus of plants of the natural order Caryophyllaceæ. *Saponaria calabrica* is a favorite garden annual. Common soapwort, bouncing Bet (*Saponaria officinalis*), is found on roadsides, in thickets, and on banks of streams, in many parts of Europe and America. Both the root and the leaves contain sapo-

nin, in consequence of which they are sometimes employed for washing; the bark of the root, however, is apt to redden white articles. Some species of Gypsophila, an allied genus, are called soaproot, and contain much saponin. Thus the Egyptian soaproot (*Gypsophila Struthium*) and the Spanish soaproot or jabonera (*Gypsophila Vaccaria*), which are in commerce, have been employed for washing from time immemorial, and the roots, not having a dark rind, can be used upon white articles and upon fabrics that will not bear the action of soap.

SOBAT, sō-bät'. A tributary of the Upper Nile. It is formed by several headstreams in British East Africa in the regions northwest of Lake Rudolf, and flows northward till it joins the Nile in about latitude 9° 30′ N. (Map: Africa, H 4). Its length is about 700 miles, and it has been ascended by gunboats over 200 miles. Several of its tributaries are also navigable. At high water it is 26 feet deep at the Nile confluence, and its volume of discharge is then so great that it forces back the current of the main river. Its whitish water, seen first in the main river below the confluence, is supposed to have given to the latter the name of White Nile.

SOBIESKI, sō'bē-ĕs'kē, JOHN. See JOHN III. SOBIESKI.

SOBK, or **SEB'EK** (Gk. Σοῦχος, *Souchos*). An Egyptian deity. He is represented either in the likeness of his sacred animal, the crocodile, or as a man with a crocodile's head. At Ombos he was combined with the sun-god Re, and in the Libyan nome he was regarded as a manifestation of Osiris, but it was in the Fayum (q.v.) that his worship especially flourished. There in a lake near the city of Crocodilopolis dwelt the incarnation of the god, the sacred crocodile Souchos, which was fed and ministered to by priests devoted to its cult. After death the body of the sacred reptile was carefully embalmed and was laid away in one of the crypts of the Labyrinth (q.v.). The worship of Sobk extended far down into the Roman period, and the god is mentioned in Fayum papyri as late as the third century A.D. Consult: Brugsch, *Religion und Mythologie der alten Aegypter* (Leipzig, 1888-90); Wiedemann, *Religion of the Ancient Egyptians* (trans., New York, 1897).

SOCAGE (OF. *socage*, from AS. *sōc*, jurisdiction, inquiry, from *sacan*, to contend, litigate, Goth. *sakan*, OHG. *sahhan*, to blame, upbraid). A tenure of lands in England, by which a 'tenant' or owner of land is obliged to render certain fixed services, or pay a fixed annual rent, to the lord of whom the lands are held. Some land was so held before the Conquest, but it was not a common tenure until about the reign of Edward I. Originally there were three distinct species of socage tenure: that 'in ancient tenure or demesne,' base or copyhold tenure, and frank tenure. The first two were considered 'base' tenures and the latter was called 'free and common' socage. Its incidents were usually a fixed rent, in money or certain articles; a *relief*, or sum paid by an heir on the death of his ancestor; an oath of fealty to the lord; *aids*, paid to the lord for certain ceremonies and attendance at court. The statute of 12 Car. II., c.24, abolished tenures by knight's service, and all the military tenures of estates in individuals, except copyholds and frankalmoigne or ecclesiastical tenures, were converted into tenures by free and common socage.

The above incidents are seldom enforced to-day, or are made of trifling nature, as a nominal rent. Tenure by free and common socage formerly prevailed in the United States, but has now been practically abolished. Consult: Blackstone, *Commentaries;* Williams, *Real Property* (19th ed., London, 1901).

SOCIAL BRETHREN CHURCH, THE. A religious body, represented chiefly in the States of Arkansas, Illinois, and Missouri. It was formed in 1867 by members of different churches, whose views diverged as to certain points of doctrine and discipline. Other societies were added and a book of doctrine and discipline was published in 1887. In the ten articles of the Confession of Faith, the doctrines of the Trinity, the authority of the Holy Scriptures, redemption, and regeneration are defined substantially as they are understood by the evangelical churches. Baptism and the Lord's Supper are regarded as ordinances that were made binding by Christ, and were instituted for believers only. Candidates are permitted to choose by what method they will be baptized. All the members are voters, and their right to speak freely is upheld. The voice of the church is taken on the admission of candidates to full membership. In addition to the regular preachers, exhorters, stewards, and ordained deacons are recognized. Consult Carroll, *The Religious Forces of the United States* (2d ed., New York, 1896).

SOCIAL CLASSES. See SOCIOLOGY.

SOCIAL CONTRACT, or SOCIAL COMPACT. Terms used interchangeably by many writers and having reference to a theory of the origin of human society. The theory was first systematically enunciated by Hobbes in the seventeenth century, but received its fullest development at the hands of Rousseau toward the middle of the eighteenth. It was discussed with much force also by Thomas Hooker and John Locke. The theory assumes that society is not a natural institution, but the result of convention among men. It assumes the existence of a pre-social state, in which men were in a state of nature without rights or obligations and subject to no law except the law of nature. Hobbes's view of a state of nature was that of a condition in which all men were at war with one another. Each individual was entitled to whatever he could appropriate and hold by physical force. The idea of justice had no place in such a state, nor had the conception of property yet arisen. Locke differed somewhat with Hobbes in his view of the state of nature, holding that it was one of perfect freedom, but limited by the fact that a man must perform every action in subservience to the law of nature. He did not regard it as a state of license or a condition of perpetual warfare. He recognized the individual right of property in the pre-social state. Similarly Rousseau maintained that pre-social men were not warlike, but averse to combat, if not actually timid. According to any view of the nature of the pre-social state the life of man was beset by many difficulties. To escape from these, men agreed to surrender certain of their so-called rights and to form a covenant for the protection of other

rights. Each, therefore, entered into a contract with all by which he agreed to divest himself of the natural liberty of hindering his fellow men in their efforts to obtain the same right. The will of an inchoate sovereign person or collection of persons was substituted for the individual will of each. Only so much power was surrendered as was deemed to be necessary for the common good.

The theory of the social compact as a means of accounting for the origin of existing institutions is now generally considered to be a legal fiction. The application of the theory as the starting point in the evolution of the State presupposes a highly developed State life, which is never consciously present in the minds of primitive individuals. Such a consciousness is attained only by historical development. Anthropology has proved that the pre-social savages described by the advocates of the social contract theory were totally incapable of conceiving the idea of contract as a means of State organization.

Consult: Hobbes, *Leviathan;* Locke, *Treatises on Government;* and Rousseau, *Contrat social,* and for a critical appreciation of this remarkable essay, Morley, *Rousseau* (London, 1873); also Fenton, *Theory of the Social Compact* (New York, 1891).

SOCIAL DEBTOR CLASSES. A term that has come into use in the literature of pauperism and criminology, and to some extent in the literature of social reform, to designate all of those elements in a modern population that either prey upon society or obtain from its bounty more than they give back in useful work. Not only criminals, paupers, and mendicants are included in the social debtor classes, but also the non-self-supporting defectives and degenerates, and those relatively inefficient members of the wages class who are continually being thrown out of employment because of carelessness, indifference, or other incapacity. Radical reformers who insist that most of the misery of the defective and degenerate is caused by social injustice deny that the classes designated as social debtors are such in fact, and say that if the term has any meaning at all it can most appropriately be applied to the idle rich who live on accumulated property and render no definite service to the community. See CHARITIES; CHARITY ORGANIZATION SOCIETY; DEPENDENTS, DEFECTIVES, DELINQUENTS; DEGENERACY; MENDICANCY; SOCIAL SETTLEMENTS; SOCIOLOGY; SOCIALISM.

SOCIAL DEMOCRACY. See SOCIALISM.

SOCIAL INSECTS. See INSECT.

SOCIALISM (from *social,* from Lat. *socialis,* relating to companionship, or association, from *socius,* companion, associate, from *sequi,* to follow; connected with Lith. *sekti,* Gk. ἕπεσθαι, *hepesthai,* Skt. *sac,* to follow, and ultimately with Eng. *see*). As the term is now used, socialism is an ideal economic system in which industry is carried on under social direction and for the benefit of society as a whole. It is contrasted with the competitive régime of existing society. The word socialism has been used to convey a variety of meanings, and is only gradually assuming a definite significance, as a result of the careful analysis of generations of socialistic thinkers and their critics. Moreover, the ideal organization of socialism has to a great extent been influenced by actual industrial changes.

An earlier term by which socialism was known is communism (q.v.). Efforts to distinguish communism from socialism cannot be said to have been successful. Sometimes communism is used to refer to the voluntary organization of small bodies of men who have common property, and who carry on production in common, sharing among themselves the fruits of their toil, as a rule, in such a way as to give each one an equal allotment of economic goods, but not of honors and consideration.

In this sense communism may be distinguished from socialism in that the latter implies a thoroughgoing reconstruction of society through political action, while the former calls upon men to separate themselves from general society, and to form communal societies for themselves.

Socialism is sometimes called collectivism. Those who employ this term feel that their schemes of social reform are more likely to secure a hearing if called by some other name than socialism. For a time in the United States the term nationalism, introduced by Edward Bellamy in his book *Looking Backward,* was synonymous with socialism.

The origin of the word socialism has been the subject of much discussion. It has been claimed that it was first used in 1840 by a French writer, Louis Reybaud, in his *Etudes sur les réformateurs contemporains ou socialistes modernes.* The word, however, was used in the early thirties in England, and the publications of the followers of Robert Owen show that it had become current before 1840. John Spargo in the *Comrade* of March, 1903, traces the word socialism back to 1833.

In addition to the terms socialist and socialism, we have the terms social democrat and social democracy very commonly used as synonymous. It was long supposed that these words were of German origin, but at least as far back as 1838 they were coined by Bronterre O'Brien, an early socialist, who took part in the Chartist agitation. The words were used by O'Brien in opposition to any aristocratic socialist schemes and in advocacy of democratic socialism.

The constituent elements of socialism and its most essential characteristic must next be examined. The lack of scientific accuracy in popular writings concerning socialism shows that this complex concept is not generally understood, although its formulation has become clear and precise enough, so that it should not be difficult to grasp its essential elements. Socialism implies, in the first place, a changed attitude towards property. Our economic life is dominated at the present time by private property, and in all cases, even where public property is largest in amount, it appears as an exception to a general rule. The world's work is carried on under the domination of private property. Socialism means that this process is to be reversed and that the world's work will ultimately be dominated by public property.

Accumulated wealth is divided by modern economists and socialists alike into productive goods and enjoyment goods. Productive goods, as the term suggests, signifies those kinds of wealth which are not used for immediate enjoyment, but

which are used in producing those things which are consumed and enjoyed. Enjoyment goods are those which yield immediate satisfaction, such as ordinary articles of consumption, dwelling houses, paintings, and books. We have also a further distinction between accumulated wealth and income wealth, the annual product of toil, which may be used up each year. Now, as understood to-day, socialism means that the instruments of production shall in the main be public or collective property. While the most conservative socialists do not insist upon public ownership of all land and capital, they consider it essential that the chief kinds of capital and the greater part of the land should be collective property. Socialists formerly held that all land should be owned by society, but lately the most conservative socialists have been inclined to make concessions to small landowners who cultivate their property and to concede to them private ownership so long as they find it desirable. On the other hand, modern socialism has emphasized strongly private property in income. It is on this account that socialists frequently deny most strenuously that they are opposed to private property, and claim that they wish to extend private property. They refer always to income. They wish each one to have his income, and to have that under his control.

The first constituent element of socialism may, therefore, be stated to be a substitution of collective property in the great material instruments of production in the place of private property to such an extent that public property shall dominate the world's work. The second constituent element is private property in income and private property in those goods which are used for the sake of enjoyment and not for the acquisition of an income by rent or hire to others.

Modern socialists desire to disturb existing arrangements as little as possible in attaining the main end of socialism: the abolition of the private receipt of rent and interest, the incomes from private property. Rent from land and interest from capital are the result of private ownership of these instruments of production. With collective ownership the income yielded by land and capital must also become collective. The purpose is the common enjoyment of the advantages yielded by land and capital, in order that there may be no income apart from personal effort, and that the income yielded by personal effort may be increased. The most advanced forms of capitalistic production are approved, and the extension of agricultural machinery and farming on a large scale are viewed with favor. The change which is advocated is a change in property, in order thereby to accomplish the great end which has just been described. The socialists desire to abolish what they call unearned income, meaning thereby personally unearned income, for the income which individuals receive from property they conceive to be unearned, and a deduction from the earnings due to personal effort. Socialists generally attempt to justify this view theoretically by the doctrine that all value is to be attributed to labor. The cruder forms of socialism have so emphasized manual labor as to imply an underestimation of intellectual services. With the rise of a higher class of socialistic thinkers, however, this crude view has lost its prominence. Socialists now generally fully understand that intellectual service is as important as manual labor, and they find a place for both in their plans for a future society.

Socialists and economists are alike agreed that production has become largely a social process, and that the socialization of production increases day by day. What the socialists complain of is that, while production is a social process, the control of production is in the hands of private owners. They discover an antithesis between social production and individual control, and demand accordingly that the socialization of production shall be accompanied by social or collective management. Modern socialism demands collective management of each industry, and it demands that all the industries should be associated together, in order thereby to secure perfect system, harmony, and unity of effort. Because individual producers do not act together, but act each one for himself, the socialists reproach present society with planlessness, which they say gives us industrial crises and stagnation—an argument less frequently advanced than formerly, owing to the formation of combinations and trusts which seem to overcome this weakness in the existing industrial order.

Finally, socialism means the distribution of income by some common authority. If organized society owns the instruments of production, and conducts production, necessarily the product of industry in the first instance falls to society, as it does now to the individual owners and managers. Society must then in some way divide up the income which results from our collective economic efforts, giving to each one his due share. Under socialism the great mass of men would be salaried functionaries of society, and the aim would be in one way or another so to adjust their salaries that in the aggregate they should equal the total wealth produced for consumption.

Formerly there was a greater inclination on the part of socialists than there is now to accomplish their ends by measures of compulsion. It was proposed that every one should be forced into the system of collective production and in return receive a subsistence. Modern socialism does not propose directly to force any one into the socialistic scheme. If any one is able to gain a livelihood by his private efforts, socialism is quite content that he should do so. He will not be able to gain an income from ownership of the chief instruments of production, as these will be public property. He may, however, own tools which he can use in production, if he can induce men to purchase his product. Socialism contemplates a public provision for education as at the present time, but it does not propose to throw any obstacles in the way of a man who desires to organize private schools. A public organization of medicine is contemplated by socialism, but the modern socialist does not see any reason why a physician who desires to engage in private practice should not do so, if he can find those who prefer his services to those of the public physicians. The modern socialist holds that most men will find it to their advantage to engage in public production, but does not insist upon absolute uniformity in this, or in other particulars.

Modern socialism is international and cosmopolitan. With the growth of the business unit

and the cheapening of transportation, the economic ties binding men together have extended geographically until the whole world may be said to have become a single economic unit. It is natural that socialism, influenced by the development of economic society, should also have become international. A further reason for the international character of socialism is to be found in the fact that the leaders of socialistic thought, having called in question and having rejected the existing economic order, are also in the mood to call in question the advantages of the existing political order. They see few or no advantages coming to the workers from the national boundaries and arrangements which separate men. They desire fraternity among the toilers, but as a result of national differences they see the toilers fighting each other, and they make the claim that all wars take place at the expense of the laborer and for the advantage of a small military and industrial class, who derive therefrom on the one hand glory, and on the other pecuniary profit.

The internationalism of socialism was one of the leading thoughts of Karl Marx (q.v.). The first noteworthy result of this internationalism was the organization in 1864 of the International Workingmen's Association (see INTERNATIONALE), which declared in the by-laws adopted in its first meeting that the emancipation of labor was a social problem, requiring the coöperation of the most advanced countries. Since 1889 the socialists have held international congresses once in three years, and in 1900 the International Bureau of Socialism was established at Brussels to serve as a common centre for socialism of all countries.

As socialism has grown in strength and become a political power, a more conservative and rational attitude toward nationality has been developed. Patriotism is no longer execrated as a device for blinding the workers to the evils of exploitation. Militant socialism is still far from the glorification of patriotism and does not seek anywhere to cultivate it, but its attitude might be described as at least neutral. The fraternity of workers the world over is still the great dominant idea. In the attitude taken toward the nation there is, however, a line of cleavage among the socialists. In every country there is a conservative, or right wing, of socialists who favor active participation in the national life and efforts to bring about improvement even in coöperation with older political parties. The Fabian Socialists of England (see FABIAN SOCIETY), the wing of the German Social Democracy, led by Eduard Bernstein (q.v.) of Berlin and G. H. von Vollmar (q.v.) of Munich, and the faction of the French Socialists, led by A. Millerand (q.v.), Minister of Commerce in the French Cabinet, and Jean Léon Jaurès (q.v.), are all representatives of this tendency and are the most conservative among all the active political socialists.

The attitude of socialism toward the State has, during the hundred years of its existence, undergone a development in which we may discover several distinct stages: (1) In the first stage we have as leaders of thought Robert Owen, Etienne Cabet, Count Henri de Saint-Simon, and Charles Fourier (qq.v.). These socialists, with the exception of Owen, did not call particularly upon the State for assistance in their efforts to achieve socialism, preferring generally coöperation based upon voluntary principles. They believed that by establishing communistic settlements they could demonstrate to the world the advantages of socialism, and that very soon all men would join communistic associations which would then, in one way or another, be federated together. (2) Louis Blanc (q.v.) in the middle of the nineteenth century may be regarded as the one who more than any other founded political socialism. He held that socialists should seek to gain control of political power, and he appealed directly to the State for aid in the establishment of socialism. He desired to found social workshops with subsidies from the State, which should gradually absorb private industries. Ferdinand Lassalle (q.v.) in Germany took a quite similar position, emphasizing most strongly the establishment of coöperative industrial undertakings with the aid of subsidies from the State. (3) A third stage is found in the attitude of the followers of Karl Marx and Liebknecht. These look askance upon existing governments, and the orthodox Marxist is strongly inclined to oppose Government ownership and operation of industries by the existing State, which is condemned for following capitalistic principles in the enterprises it manages. The German socialists have, then, no special enthusiasm for the State ownership and operation of the railroads in Prussia, and in the United States the municipal ownership and operation of public utilities is very frequently opposed by individual orthodox socialists, although this attitude of antagonism to municipalization has never received official indorsement, and as a matter of fact socialist officeholders are always instructed to vote for municipal ownership. The programme of the socialists is, first, the capture of the existing organs of government by the wage-earners, and then the inauguration of public ownership and operation of industries. The special point to be noticed is the insistence upon complete control of the machinery of government by the workers as the first step. The fourth stage is represented by the conservative or extreme right faction of the socialists, who are willing to coöperate with existing parties in reforms which are in general harmony with the socialist programme, such as municipal ownership of public utilities and Government ownership of railways. These socialists are called opportunists, and in France possibilists. The Fabian socialists are the best illustration, because they decide upon action in each case as it arises. We notice, then, that it is only as a concession on the part of the most conservative socialists that the extension of public ownership and management of industries is favored while the present State lasts. We notice also that democracy is an essential part of political socialism. Political socialism is not merely socialism, it is socialism plus democracy with an inclination to place democracy first. Democracy to the socialist does not mean the kind of government which we have in the United States, but the kind of government which is completely controlled by the workers. Direct legislation is favored, and the initiative and referendum as agencies of direct legislation are very generally advocated. As a rule, if not universally, the plan for the operation of industries is election of foremen, superintendents, and managers by the wage-earners.

Socialism in its first phase was not neces-

sarily democratic. Owen and Saint-Simon both appealed to those now in control of political and economic power to take the leadership in reform. Philanthropy played a great rôle in socialism in this stage, and it was hoped that socialism would be introduced by the ruling classes. Saint-Simonians emphasized the natural inequality of men, and Saint-Simon appealed to royalty to assist in the noble work of social reform. He had a place for the King in his socialist State, and the King was to be called the 'first industrial of his kingdom.' Even Ferdinand Lassalle was monarchically inclined.

Socialists take a view of the State which in some respects suggests the position of Herbert Spencer and other individualists. They hold that under socialism the functions of the State along many lines will be greatly diminished. Crime, they think, will very nearly disappear, and pauperism will entirely cease. Standing armies will be abolished and a popular militia substituted therefor. The functions of the law courts will also disappear, they maintain, with the abolition of private property in the instruments of production, which is the fruitful cause of litigation. The chief function of government will be found in the administration of industries. They have, therefore, a conception of the State so different from that of the present State that they dislike the expression 'the State,' and abhor 'State' socialism. The word 'official' is also objected to because it suggests present bureaucratic governments. The attitude of the orthodox socialist toward the State finds clear expression in the work of the German socialist August Bebel, *Die Frau und der Socialismus* (27th ed., 1896).

During the evolution of socialist thought which has just been sketched anarchism has become separated from socialism. (See ANARCHIST.) Among early socialists there were variations of opinions concerning government, and some like William Godwin (q.v.) were inclined to take an attitude of radical antagonism to government as such. We thus find anarchistic tendencies in socialism along with tendencies of a very different and altogether antagonistic sort. The cleavage gradually became more pronounced. Pierre Joseph Proudhon (q.v.) is frequently spoken of as the founder of anarchism, and in him we find the doctrines of anarchy reaching such a development that probably more than any one else he is to be designated as the founder, although his views are not worked out so clearly and systematically as those of his followers. For the sake of convenience we may take Proudhon's book *What is Property?* and the date of its appearance, 1840, as the beginning of modern anarchism. The form of anarchism founded by Proudhon is that of complete individualism. This type of anarchism has had some development in the United States under the leadership of Benjamin R. Tucker, who for some years edited an organ called *Liberty*.

The anarchists of whom we hear most are of quite a different stripe, and their anarchism is, by way of distinction, known as anarchist communism. This school of anarchy was founded by Mikhail Bakunin (q.v.), and may be regarded as an outgrowth of the International Workingmen's Association, to which Bakunin belonged. Bakunin and Marx for a time worked together; they both regarded themselves as socialists, Marx calling himself a communist, and Bakunin describing himself as a collectivist. Socialism and anarchism were not at first recognized as antagonistic principles, but the differences between them developed continuously. The anarchist communists held to the doctrine of associated effort and considered themselves as true communists, and not as individualists. They are radically opposed to public authority and believe that with the abolition of the State men will spontaneously form coöperative associations which will voluntarily form federations for mutual aid. Like the socialists, the anarchists advocate a coöperative commonwealth, but they differ from the socialists with respect to the organization of that commonwealth, and more especially in the methods whereby it is to be reached. The question of tactics has been largely instrumental in the growth of hostility between socialists and anarchists. Anarchists deny that the State rests upon any ethical foundation, and consequently there can be no wrong in opposing government and seeking its overthrow. Government to the anarchist means force and nothing more, and the question of resisting it is one of expediency only. If the anarchists believe that they have a superior force, they must necessarily attempt to overthrow organized government. Socialists, on the other hand, take no such attitude of antagonism toward the State, although they may think and do think that the socialist State will be something different from the present State. They hold, moreover, that changes must come about by evolutionary processes, and are opposed to insurrectionary movements where other means are open. Marx and Engels condemned violent methods very early in their career, and as socialists have taken a part in the work of government in the various countries of the civilized world, they have increasingly favored the maintenance of law and order, believing that their ends can be achieved by legal means, and that if revolution does take place it will be brought about, not by them, but by their opponents. Some Socialists think that the adherents of the present social order, when they see the coming triumph of socialism by legal means, will themselves inaugurate a revolution, but the more conservative hold that all classes will gradually adjust themselves to the changes leading to socialism. The socialist to-day is the strongest opponent of anarchism. It was the socialists, not the German Government, who really drove Johann Most (q.v.), one of the leaders of communist anarchism, from Germany, and it is the German Social Democrats who practically extinguished anarchism in their country.

The attitude of socialism toward the family has varied, but now it has become a definite one of neutrality. Early socialists were inclined to assume a general position of radicalism with respect to all institutions of society, seeing more quickly and easily the disadvantages of any present social arrangement than its advantages. Moreover, the early socialists found the family to be the basis of the economic society which they attacked. Marriage in its present form seemed to them to carry with it the oppression of woman. It cannot be said that socialism ever had a distinct doctrine of the family, but until recent

years it was inclined to what would be termed at least lax notions of the marriage tie, holding that the bond of union between man and woman should be love alone, and that when love disappeared, there disappeared with it the reciprocal obligations of marriage. Socialists of the present time do not see any reason why they should have a peculiar view of the family, and they are not in this particular distinguished from other people.

The attitude of socialism toward religion has undergone a similar change. The Church as one of the institutions of existing society long appeared to the socialist to be a bulwark of oppression. Modern socialism, however, has separated the economic question from the religious question, and now everywhere regards religion as a 'private matter.' The position of socialists toward religion the world over is much like that which finds expression in the constitutional system of the United States. Anything like a Church State, or public support of religion, is denounced, but it is not proposed to interfere with any individuals who may desire to maintain by their own voluntary contributions any church organization or religious sect.

Readers of current socialistic literature frequently find a sharp distinction drawn between what is termed Utopian socialism and scientific socialism. Socialism before the ascendency of Marx was very largely Utopian in character. The early socialist looked upon society as an artificial product and thought it possible to develop a scheme of society which, if introduced, would bring with it a real earthly paradise. It was thought that the very nature of man could be changed by a wisely devised scheme of socialism. Owen's most fundamental social doctrine was that circumstances form the character of man, and that right circumstances would give us right-minded and right-acting human beings. In the latter part of the eighteenth century the idea of society as a growth with laws of its own had not been clearly grasped, and adherents of private property, as well as communists, believed in the possibility of the most fundamental changes by means of a revolution which could take place over night. The result of this attitude was the elaboration of all sorts of fantastic schemes. Owen planned his communistic villages of two or three thousand, but the highest development of purely artificial plans is found in Fourierism (q.v.), with its phalanxes and phalansteries. The modern socialist plumes himself upon his science, and has a lofty scorn for all Utopian socialism. He may admit that it had its historical meaning, and have a certain toleration for it as something belonging to the past, but when he meets it at the present time he views it with even more contempt than does the ordinary economist. The modern socialist studies the laws of society, and is a careful student of English blue books and the statistical publications of the United States Census Office. He despises sentimentalism and desires to replace appeals to philanthropy with historical researches and carefully elaborated deductive reasoning.

An adequate treatment of the character of this alleged science which underlies socialism requires at least a brief examination of the socio-economic philosophy of Karl Marx, since it occupies a central position in the economics of socialism. The doctrines of Marx are still held in the main by the great body of socialists, and they underlie the platforms of socialist parties throughout the world. The variations in socialist doctrines appear as departures from Marx. Some of these variations are radical, but still they bear relation to Marx.

Marx opens his work on *Capital* with an explanation of value. He finds that the element in economic goods which gives and measures value is labor. Labor has its exchange value, and this is governed by the cost of labor, and the cost of labor is determined by the subsistence of the laborer in accordance with his standard of life. The employer of labor pays in wages the cost of labor, but the laborer, according to Marx, produces more than this cost, and the difference between what the laborer produces and the wages of labor he designates as surplus value. This surplus value Marx regards as the source of all rent, interest, and profits. All value, according to the doctrines of Marx, is produced by labor and belongs to labor. Labor receiving, however, only subsistence wages, Marx holds that it is robbed of surplus value, which, through the processes of production and exchange, is transferred to the non-wage-earning classes. Marx maintains that it is only through socialism that labor can receive the full value which it produces, so that surplus value will disappear. This doctrine, while still accepted by perhaps the majority of socialists, is rejected by some, and generally receives less emphasis than formerly.

The theory of Marx which just now is much more discussed is that commonly designated as 'the materialistic interpretation of history.' According to this theory, history is made up of successive stages, in each of which the social organization is determined by the methods of production and exchange. The ideal factors in history, such as religion and ethics, are a mere reflection of the underlying economic phenomena. Socialists themselves have been inclined to qualify, and have qualified in all their agitation this doctrine in such a way as to give a large place to the will of man. They hold that the development of society takes place in accordance with evolutionary laws, but that man himself is a part of the evolution and helps determine it. There is always, however, a marked distinction between this so-called scientific socialism and Utopian socialism, inasmuch as scientific socialism asserts that the will and desires of men can be effective only in so far as they act in harmony with the general tendencies of evolution.

It is important to notice, however, that, in accordance with the teachings of Marx, the evolution of society is such as to lead inevitably to monopoly. Marx believed that large-scale production has an advantage over small production; consequently that the large producers sooner or later must crush out the small producers, until each branch of production falls under monopolistic control. In the meantime the wage-earners are brought together in ever-increasingly large numbers; they are, to use his own words, "schooled, united, and disciplined by the mechanism of the capitalistic processes of production." The inevitable result, he held, would be such a concentration of productive wealth, and such great solidarity of the working classes, that the system would break down of its own weight, and

the laborers would gain possession of the means of production.

It is to be observed that each stage in economic development has its own place. Feudalism was once a suitable social organization, but in time it had to make way for capitalistic production. Capitalistic production has performed a service which Marx recognized as clearly as a modern economist, but Marx held that capitalistic production has very nearly run its course, and that it has rendered the chief services of which it is capable. Marx held that "along with each decrease in the number of magnates of capitalism there goes an increasing mass of misery and degradation." Belief in the increasing misery of the masses was an essential part of socialistic doctrine a generation ago; but it has to a great extent been abandoned, some socialists, like Bernstein, going so far as to claim that with capitalism there has been an increase in the economic well-being of the masses. Intelligent socialists now clearly see that from the masses of men sunk in misery there can come no able and vigorous recruits for socialism. An important practical consequence is that socialists now are more favorably inclined to take measures which elevate the masses, even while the present social order continues, because they hold that thereby men will become better prepared for socialism.

Another theory of Marx finds expression in what is now termed class-consciousness. It was, according to him, necessary that the wage-earners should become conscious of themselves as a class in the community having interests of their own, and that they should rely upon self-help and not upon the help of other classes for their emancipation. Class-consciousness is now the chief test, as it is the great rallying cry of organized socialism. Socialists frequently make a distinction now between socialism as a system and socialism as a principle of action. This is a distinction made by Sidney Webb (q.v.), the intellectual leader of the Fabian socialists, and also by Edmond Kelly. Kelly regards socialism, or, to use his own term, collectivism, as the method of attainment of justice rather than as a condition of society in which justice has been attained. He has little concern with collectivism as "an ideally perfect state of society," but he looks upon collectivism as a principle of action, pointing out a general line of growth which seems to him desirable, and which he believes can be aided by intelligent effort. In other words, socialism in the sense in which it has been defined forms a goal which we may not succeed in reaching, but it does point out a line of action.

Let us now turn to the criticism of socialism by economists. First of all, it should be noticed that no professional economist is a socialist unless it be the Italian economist Loria. Socialists claim that the opposition of all economists does not signify anything as to the correctness of socialism. They maintain that economists are generally blinded by their self-interest, their professional interests requiring them to keep aloof from socialism. The economists, on the other hand, maintain that the rejection of socialism by economists signifies its rejection by science truly conceived.

Economists are not generally inclined to deny the evils in the existing economic order, but they believe that there is better prospect of improvement under this order than under socialism. They are social reformers, not socialists. They hold, first, that there is no law of evolution carrying us inevitably to socialism; secondly, that the prospects of social reform are sufficiently promising to warrant us in the maintenance of private property in the instruments of production and private management of production; and, thirdly, that socialism carries with it dangers and disadvantages sufficiently grave to warrant us in opposing it until it is clearly seen that great improvements are not compatible with the present social order.

In its details the reasoning of economists against socialism is as varied as the reasoning of socialists in its support. To Marx's labor theory of value, economists oppose theories of value which differ in detail, but which agree in placing other forms of cost in coördination with labor in the determination of value. (See VALUE.) To the theory of class-consciousness and class-action on the part of wage-earners as the only means of reform, economists oppose what may be called a doctrine of social solidarity. They uniformly hold that all classes in society must work together for social improvement, and they do not believe that there is any such necessary antagonism of interests among classes as this theory of class-consciousness implies.

Modern economists recognize the evolutionary theory of society, and recently they have given generous recognition to Marx for his services in the formulation of this doctrine of evolution. Very few economists, however, hold that economic causes alone underlie all social development, and that the political and intellectual history of nations is a mere expression of a social organization resulting from the prevailing mode of economic production and exchange.

Socialism implies unified control of production, and economists believe that the disadvantages of such control outweigh the advantages. Economic theory still rests upon the assumption that competition is a principle of progress, and that the advantages which it brings to a society far outweigh the disadvantages. Economists seek to point out means for the elevation of competition to higher planes and the removal of the evils which it carries with it, while retaining the principle itself.

The difficulties in the way of the socialization of agriculture are emphasized in opposition to socialism. The economists claim that socialists have pointed out no method whereby agriculture can be advantageously carried on, except by private initiative and private effort. There can be little doubt that when agriculture is mentioned one of the weakest points in socialism is brought to our attention. Even should manufacturing industries, commerce, and transportation be carried on as public enterprises, so long as agriculture remains private industry, based upon private property, society must still be something very different from socialism.

Two other points only in the arguments against socialism can be considered in this place. The first is the danger to liberty. It is maintained by defenders of our present economic society that private property and private enterprise are necessary bulwarks of liberty, and that

with these removed or impaired to the extent that they would be, even by the most conservative socialism, those having control of the agencies of production would be given such vast power that liberty would be seriously threatened, and, indeed, overthrown by tyranny. A certain control of production would have to be exercised by individuals; and however these might be selected, they would have almost unlimited power in their hands over the destinies of other human beings. There seems to be strong ground for the belief that liberty is better protected in a society having the dualism which we know now, in accordance with which private property and private production on the one hand, and public authority with limited public production on the other, are reciprocal checks and restraints.

Finally, it is urged that under socialism there would be revolutionary discontent. In a world like ours men must necessarily be discontented with what they receive as an outcome of economic production and with the treatment accorded to them in the processes of economic production. At the present time this discontent is directed toward a great many different persons and bodies. On the other hand, socialism means public ownership and public production, and those having control would be blamed for all mistakes and also for misfortunes, even provided we assume that they should do their best, and provided also that that best should be much better than anything we know at the present time. Government would be blamed, and this concentrated discontent, it is held, would be revolutionary in character.

So much has been said about Christian socialism, that this article should not be concluded without at least a brief reference to it. Christian socialism has had many different meanings. Where the leaders of socialism have been irreligious, Christian socialism has sometimes simply signified socialism plus religion. Now that socialists have come to place religion among private matters in which they are not directly concerned, less is heard than formerly about Christian socialism. Christian socialism has sometimes signified simply a recognition of the principle of social solidarity, and a generous sympathy with those classes in society which are the least fortunately situated, more specifically with the wage-earning classes. About the middle of the nineteenth century a body of Christian socialists existed in England and attracted wide attention. They were led by men like Thomas Hughes, Charles Kingsley, James Ludlow, F. D. Maurice, and E. Vansittart Neale. Theoretically they opposed the principle of competition as a source of evil, and did so with great vehemence, and agitated in favor of coöperation in production and exchange. They attempted to organize society on a coöperative basis, and succeeded in establishing a number of coöperative undertakings which enjoyed only a temporary prosperity, and finally disappeared. They entered, however, into the coöperative movement in England, which had been theretofore largely supported by men acting under the influence of Owen, and they contributed very much to the success of English coöperation. The high character and the intellectual power of these men were such that they have been able to exercise a profound influence upon English thought, and to a less extent upon the thought of other countries. The outcome of their efforts is seen in the multiform attempts to improve social conditions.

Socialism of the chair, or professorial socialism, is frequently mentioned, but this also is something as indefinite as Christian socialism. It is not socialism at all, but simply a recognition of grave evils in existing society, a determination to remove these evils, and the conviction that the power of the State must be used to bring about desirable changes. The term socialism of the chair originated in Germany, and was applied in ridicule to the progressive economists who expressed sympathy with the aspirations of the wage-earning classes. Among the leaders may be mentioned Professors Adolph Wagner and Gustav Schmoller, now both of Berlin. These held that economics is an ethical science, and opposed the doctrines of the so-called Manchester school, which looked with little favor upon State action. The changes which have taken place among economists have been such as to lessen the differences among them with respect to economic improvement. Generally speaking, those who twenty years ago were most inclined to call upon the State for help have become somewhat more conservative, while at the same time those who most strongly antagonized public action have qualified their opposition thereto. The course of events has convinced practically all economists of the importance of labor legislation and of the necessity of state intervention at many points. Professorial socialism, then, never was socialism, and at the present time it can hardly be said that it indicates a line of cleavage among economists.

LITERATURE. The principal writers on socialism have been mentioned in the text, and their writings are mentioned in the articles dealing with them. The *Communist Manifesto* (London, 1848) is perhaps the most important single document in the history of socialism, and Marx, *Das Kapital* (3 vols., Hamburg, 1862, 1865, 1894), is possibly the most important single work. The works of Rodbertus and Lassalle are important historically. *Fabian Essays in Socialism* (London, 1889) is the best work presenting the conservative, opportunist socialism. One of the Fabians, Sidney Webb, has written a work entitled *Socialism in England* (2d ed., London, 1893), which best describes the advances of English socialism, as seen by a Fabian. Kelly, *Government or Human Evolution* vol. i., on Justice, London, 1900; vol. ii., on Individualism and Collectivism, London, 1901), gives the best presentation by an American author of socialism as a principle of action rather than as a system. Hyndman, *Economics of Socialism* (London, 1896), is regarded as one of the best explanations of the economics of the Marxist school. Laveleye, *Socialism Today* (Eng. trans. London, 1885), gives a sympathetic account of socialism by a progressive economist. Rae, *Contemporary Socialism* (new ed., London and New York, 1901), is a more critical account of socialism, and, like the preceding, has much historical material. Kirkup, *History of Socialism* (new ed., London, 1900), is a more recent work than Laveleye's, and perhaps even more sympathetic, going so far as to advocate a very conservative sort of socialism. Ely's *Socialism and Social Reform*

(New York and London, 1894) is an attempt to analyze socialism carefully, to examine its strong and its weak features, and to present, as opposed to socialism, a programme of social reform. It has a bibliography of several hundred titles. The same author's *French and German Socialism* (New York, 1883) is a brief historical presentation of socialism in these two countries. Consult also Woolsey, *Communism and Socialism, Their History and Theory* (New York, 1880).

SOCIALIST PARTIES.

Politically organized socialism or social democracy is a movement which is coextensive with modern industrialism. Wherever a system of production is found which is perhaps somewhat loosely termed capitalistic, we find a Social Democratic Party. In this article, however, attention will chiefly be given to the Social Democratic Party of Germany, since in Germany that party is more highly developed and far more powerful than in any other country, and has a position of intellectual leadership. Influences from the Social Democratic Party of Germany, both with respect to theory and tactics, radiate throughout the entire industrial world. Social democracy is not a German movement, but a world movement, which has, however, its highest development in Germany.

Several reasons may be adduced to explain the preëminence of German social democracy. Wage-earners in that country did not begin to share in political power until after the middle of the nineteenth century, and so, having formed no political affiliations, were more easily induced to attach themselves to socialism, which had already been eloquently presented to them by Ferdinand Lassalle. Again, the hostility of the Government to labor organizations had the effect of turning toward political action the energy that might otherwise have been expended in labor agitation. The third reason for the leadership of Germany is found in the fact that the great intellectual leaders of socialism have been Germans. Marx and Lassalle have already been mentioned, and we may also mention Rodbertus (q.v.), a man who belonged to the landowning class of Germany, and who did not take part in socialist agitation.

German social democracy represents an amalgamation of two movements, one starting from Ferdinand Lassalle, the other from Marx and Friedrich Engels (q.v.). Before the time of Marx and Lassalle, Wilhelm Weitling (q.v.) had exercised a certain influence in Switzerland, Germany, and the United States, but the socialism which he advocated was of the French Utopian character, and had little permanent influence.

The activity of Marx began in the forties, and was continuous from that time until his death. In 1846 Marx belonged to a secret international communistic society called the Kommunistenbund. It was for this society that, with Engels, he prepared the Communist Manifesto. In 1848 Marx was active in Germany, where a number of labor unions had been established which, united into a federation, came under socialistic influence. The chief field of his activity was the Rhine Province, and it was there that Marx conducted his celebrated *New Rhenish Gazette* (*Neue Rheinische Zeitung*). The reaction soon triumphed, and Marx finally found his way to England, where he made himself, in 1850, the head of a German communistic society, which, however, was short-lived.

We must now turn our attention to Ferdinand Lassalle, who is to be regarded as the real founder of the Social Democratic Party, although it soon passed under the influence of Marx and Engels. The agitation of Lassalle began in 1862. In 1863, under his influence, the Universal German Laborers' Union (Der allgemeine deutsche Arbeiterverein) was founded in Leipzig. The membership was small, and the chief demand was for universal and equal suffrage, although it soon became plain that this was demanded simply as a step toward socialism. Lassalle's chief practical economic demand was for Government subsidies to aid in the establishment of productive coöperative associations. Theoretically his arguments centred about the so-called iron law of wages: that wages under the capitalistic system of production naturally fall to a minimum, which barely supports the life of the laborer and his family. The practical demand and the theoretical argument of Lassalle have been rejected by the German Social Democrats, but his eloquence was instrumental in laying the foundation of the party. After the death of Lassalle, in 1864, the International Labor Association (Internationale Arbeiterassociation) was established in accordance with the principles of Marx, and the Social Democratic Labor Party (Socialdemokratische Arbeiterpartei) was founded in the same year. This party, under the leadership of Wilhelm Liebknecht and August Bebel (qq.v.), entered into opposition to the party established by Lassalle. The Social Democratic Labor Party met in Eisenach in 1869 and became known as the Eisenach Party. At the election for the Reichstag in 1874, when about 340,000 votes were cast, these were divided with approximate equality between the followers of Lassalle and those of Marx. In 1875 the two parties united and established what is known as the Gotha programme, which was a compromise. The year 1878 witnessed two attacks upon the life of the German Emperor, and then followed the Anti-Socialist Law, which repressed the public agitation of socialism. While the law was in force German socialist congresses were held on foreign soil, and their literature was largely printed in Switzerland. The party increased in power, however, the chief result of governmental repression being the welding together of the different factions into a compact party. The Anti-Socialist Law (*Ausnahmegesetz*) expired on October 1, 1890. A certain tendency to violence seems to have developed during this period, for at one of the congresses the expression to struggle for the attainment of ends "with all legal means" was changed to "all means." The first public congress of the German Social Democracy, after the expiration of the Law of Exception, was held in Halle, October 12-18, 1890. Liebknecht and Bebel dominated the congress and worked for a revision of the Social Democratic platform. This bore fruit the following year at the Erfurt congress, where the Erfurt Programme was adopted. The peculiar ideas of Lassalle were entirely expunged, and the doctrines of Marx gained a complete triumph. The Erfurt Programme is at the present day the most important official utterance of social de-

mocracy, and has a world-wide significance, serving as a fundamental basis for every social democratic platform since adopted throughout the world. This programme reads as follows:

"The economic development of industrial society tends inevitably to the ruin of small industries which are based upon the workman's private ownership of the means of production. It separates him from these means of production, and converts him into a destitute member of the proletariat, while a comparatively small number of capitalists and great land-owners obtain a monopoly of the means of production.

"Hand in hand with the growing monopoly goes the crushing out of existence of these shattered small industries by industries of colossal growth, the development of the tool into the machine, and a gigantic increase in the productiveness of human labor. But all the advantages of this revolution are monopolized by the capitalists and great land-owners. To the proletariat and to the rapidly sinking middle classes, the small tradesmen of the towns, and the peasant proprietors (Bauern), it brings an increasing uncertainty of existence, increasing misery, oppression, servitude, degradation, and exploitation (Ausbeutung). Ever greater grows the mass of the proletariat, ever vaster the army of the unemployed, ever sharper the contrast between oppressors and oppressed, ever fiercer that war of classes between bourgeoisie and proletariat which divides modern society into two hostile camps, and is the common characteristic of every industrial country. The gulf between the propertied classes and the destitute is widened by the crises arising from capitalist production, which becomes daily more comprehensive and omnipotent.

"Private ownership of the means of production, formerly the means of securing his product to the producer, has now become the means of expropriating the peasant proprietors, the artisans, and the small tradesmen, and placing the non-producers, the capitalists, and large landowners in possession of the products of labor. Nothing but the conversion of capitalist private ownership of the means of production—the earth and its fruits, mines, and quarries, raw material, tools, machines, means of exchange—into social ownership, and the substitution of socialist production, carried on by and for society in the place of the present production of commodities for exchange, can effect such a revolution that, instead of large industries and the steadily growing capacities of common production being, as hitherto, a source of misery and oppression to the classes whom they have despoiled, they may become a source of the highest well-being and of the most perfect and comprehensive harmony.

"This social revolution involves the emancipation, not merely of the proletariat, but of the whole human race, which is suffering under existing conditions. But this emancipation can be achieved by the working class alone, because all other classes, in spite of their mutual strife of interests, take their stand upon the principle of private ownership of the means of production, and have a common interest in maintaining the existing social order.

"The struggle of the working classes against capitalist exploitation must of necessity be a political struggle. The working classes can neither carry on their economic struggle nor develop their economic organization without political rights. They cannot effect the transfer of the means of production to the community without being first invested with political power.

"It must be the aim of social democracy to give conscious unanimity to this struggle of the working classes, and to indicate the inevitable goal.

"The interests of the working classes are identical in all lands governed by capitalist methods of production. The extension of the world's commerce and production for the world's markets make the position of the workman in any one country daily more dependent upon that of the workman in other countries. Therefore, the emancipation of labor is a task in which the workmen of all civilized lands have a share.

"The German Social Democrats are not, therefore, fighting for new class privileges and rights, but for the abolition of class government, and even of classes themselves, and for universal equality in rights and duties without distinction of sex or rank. Holding these views, they are not merely fighting against the exploitation and oppression of the wage-earners in the existing social order, but against every kind of exploitation and oppression, whether directed against class, party, sex, or race.

"Starting from these principles, the German Social Democrats demand, to begin with (i.e. of the present State):

"(1) Universal, equal, and direct suffrage by ballot, in all elections, for all subjects of the Empire over twenty years of age, without distinction of sex; proportional representation, and, until this system has been introduced, fresh division of electoral districts by law after each census; two years' duration of the legislature; holding of elections on a legal day of rest; payment of the representatives elected; removal of all restrictions upon political rights, except in the case of persons under age.

"(2) Direct legislation by the people by means of the right of initiative and of veto; self-government by the people in Empire, State, province, and commune; election of magistrates by the people, with the right of holding them responsible; annual vote of the taxes.

"(3) Universal military education; substitution of militia for a standing army; decision by the popular representatives of questions of peace and war; decision of all international disputes by arbitration.

"(4) Abolition of laws which restrict or suppress free expression of opinion and the right of meeting or association.

"(5) Abolition of all laws which place the woman, whether in a private or a public capacity, at a disadvantage as compared with the man.

"(6) Declaration that religion is a private matter; abolition of all appropriations from public funds for ecclesiastical and religious objects; ecclesiastical and religious bodies are to be regarded as private associations which order their affairs independently.

"(7) Secularization of education; compulsory attendance at public national schools; free education, free supply of educational apparatus, and free maintenance to children in schools, and to such pupils, male and female, in higher educa-

tional institutions, as are judged to be fitted for further education.

"(8) Free administration of the law and free legal assistance; administration of the law by judges elected by the people; appeal in criminal cases; compensation to persons accused, imprisoned, or condemned unjustly; abolition of capital punishment.

"(9) Free medical assistance, and free supply of remedies; free burial of the dead.

"(10) A graduated income and property tax to meet all public expenses which are to be raised by taxation; self-assessment; succession duties, graduated according to the extent of the inheritance and the degree of relationship; abolition of all indirect taxation, customs duties, and other economic measures which sacrifice the interests of the community to the interests of a privileged minority.

"For the protection of labor, the German Social Democrats also demand, to begin with:

"(1) An effective national and international system of protective legislation on the following principles:

"(a) The fixing of a normal working day, which shall not exceed eight hours.

"(b) Prohibition of the employment of children under fourteen.

"(c) Prohibition of night work, except in those branches of industry which, from their nature and for technical reasons or for reasons of public welfare, require night work.

"(d) An unbroken rest of at least thirty-six hours for every workman every week.

"(e) Prohibition of the truck system.

"(2) Supervision of all industrial establishments, together with the investigation and regulation of the conditions of labor in the town and country by an Imperial labor department, district labor bureaus, and chambers of labor; a thorough system of industrial sanitary regulation.

"(3) Legal equality of agricultural laborers and domestic servants with industrial laborers; repeal of the laws concerning masters and servants.

"(4) Confirmation of the rights of association.

"(5) The taking over by the Imperial Government of the whole system of workmen's insurance, though giving the workmen a certain share in its administration."

This is printed in the annual reports of the Proceedings of the Social Democratic Party of Germany, office of the *Vorwärts*, Berlin. The present translation is taken from the 'Blue Book,' giving the report of the Royal Commission on Labor in Germany, published in London, 1893. For the sake of greater accuracy, however, a few changes have been made by the author.

It is possible to state in a very few words the most essential facts in the history of social democracy in Germany, since the adoption of the Erfurt Programme. One of the main subjects which have agitated the party has been the attitude toward the peasant proprietors, the small farmers, and this same question has agitated social democracy in France and the United States. The support of the small proprietor is essential to the success of social democracy. A programme of confiscation of all land would arouse the hostility of the small farmer. The most conservative wing of the party, therefore, advocates concessions to small farmers, proposing to permit them to hold landed property even under socialism. G. H. von Vollmar, member of the Reichstag and a leader among the Bavarian Social Democrats, is foremost among those who advocate concessions of this sort. This conservative programme, however, has never been officially adopted. Eduard Bernstein, who has already been mentioned as a leader of the conservative Socialists, was elected to the Reichstag from Breslau in February, 1902.

So large a party must participate in practical politics in order to live, and must, therefore, have reforms to urge for the immediate future. We have thus, along with the statement of general principles, the so-called immediate demands. This separation of the social democratic platforms is found in all countries.

Considerable emphasis has been given to the immediate demands, but it is a mistake to suppose that the ultimate goal of complete socialism has been at any time lost sight of. All the leaders have this in mind, but doubtless there are many acting with the Social Democratic Party in Germany, as elsewhere, who are chiefly interested in immediate demands.

The vote of the Social Democratic Party, and the number of members elected to the Reichstag since the foundation of the German Empire up to the present time, are given in the following table, taken from Braun, *Die Parteien des Deutschen Reichstages* (Stuttgart, 1893):

ELECTION IN	Total number of Social Democratic votes	Percentage of total number of votes cast	Members elected
1871	124,655	3.	2
1874	351,952	6.8	9
1877	493,288	9.1	12
1878	437,158	7.6	9
1881	311,961	6.1	12
1884	549,990	9.7	24
1887	763,128	10.1	11
1890	1,427,298	19.7	35 *
1893	1,876,738	23.3	44
1898	2,107,076	27.18	56 †
1903	3,011,114	31.75	81

* In the by-election in the 22d district of Saxony, held in 1892, a thirty-sixth member was elected.

† Later elections to supply vacancies gave the Social Democrats two additional members, making 58 in all.

One or two comments upon the vote cast are needed. The vote fell off in 1881, owing to the severe repressive measures following the Anti-Socialist Law. In 1890 the Social Democratic Party became the largest in the German Empire, casting about 20 per cent. of the votes. With some fifteen parties in Germany, this is less significant than in a country with two great parties, but, nevertheless, it means a great deal. Another point to be considered is that the Socialists do not have a number of representatives in the Reichstag corresponding with the number of votes cast. This is due to the way the electoral districts are arranged, whereby the Conservatives (largely made up of landed proprietors and other favored classes) and Agrarians elect a much larger number of members relatively.

The official organ of the Social Democratic Party is the daily *Vorwärts* of Berlin, of which also a weekly edition, called the *Socialdemokrat*, is published. *Die neue Zeit*, a weekly magazine published at Stuttgart, is the so-called scientific organ of German social democracy, discussing questions of principles. Both these organs rep-

resent the dominant Marxian socialism. The more conservative opportunism is represented by the *Socialistische Monatshefte*, published in Berlin. Special mention may be made also of two illustrated comic papers, which advocate social democracy, namely *Der wahre Jacob* and *Der süddeutsche Postillon*. In 1903 there were fifty-two daily papers, nine appearing three times a week, three semi-weekly, and seven weekly papers all advocating socialism.

AUSTRIA. In Austria we find a very different condition of things from that which exists in Germany. Social democracy was later in gaining a foothold in Austria, and its growth has been far slower. Of late, however, the party has largely increased in numbers under the leadership of Dr. Victor Adler, who is a Marxian Socialist. The chief organ is the daily *Wiener Arbeiter Zeitung*, which claims a circulation of 40,000. There are in addition over twenty Socialist organs in the Empire. In 1903 the Socialists had ten seats in the Reichsrath.

HUNGARY. A labor party strongly influenced by the followers of Lassalle was formed in Hungary in 1868. The Marxians gained the upper hand during the following decade, however, but during the eighties the anarchists were a disturbing factor. They have, however, been reduced to insignificance, and social democracy is making advances in this kingdom as elsewhere. During the last decade of the nineteenth century the agitation was extended to the agricultural classes.

DENMARK. In Denmark the influence of the social democracy is comparable to that of the same party in Germany, but, owing to the minor rôle of Denmark in world politics, the party has attracted little attention. The social-democratic agitation began in the early seventies, but it was under dishonest leadership and the result was a collapse and temporary reaction. During the past ten years, however, there has been a very rapid growth of social democracy under Marxist leaders. In 1898 the Social Democrats polled approximately 32,000 votes, electing twelve Deputies. At the election in 1903, the Socialists elected sixteen members, polled 55,479 votes, and almost wiped the Conservative Party out of existence. The daily organ in Copenhagen, called the *Social Demokraten*, claims a circulation of 45,000, which is said to be larger than the circulation of any other paper in Denmark. One of the notable features of social democracy in Denmark is its participation in the trades union and coöperative movements, the latter of which has made very rapid progress.

NORWAY. The social-democratic agitation in Norway has made slow progress, and it has not as yet played a prominent part in political life. In 1901 the Socialist Party polled some 7000 votes in the Storthing elections. In the same year the Socialists claimed 150 organizations with nearly 11,000 members. Their chief political successes have been achieved in municipal elections.

SWEDEN. In Sweden social democracy has made considerable progress in recent years and has exercised marked influence upon the labor movement. Owing to a property qualification for the suffrage, however, they have succeeded in electing only one member of the national Parliament. The Social Democratic Party was formally organized in Sweden in 1899. The programme was Marxist in character and closely resembled that of the German Social Democracy.

SWITZERLAND. In Switzerland, owing to the success of political and social reforms, the social democratic agitation has found a barren field. In 1902 the Social Democrats elected six members of the National Council, and a few Social Democratic members have been elected to the cantonal legislatures and municipal councils. The Social Democrats have, however, exercised considerable influence upon other political parties.

ITALY. The poverty and ignorance of the masses of the Italian population and the impulsiveness of their character seemed to favor at first the growth of anarchism rather than of socialism. Under the influence of Bakunin, an anarchistic agitation was started in 1872.

The social democratic agitation began in the seventies, but it became powerful only during the last decade of the nineteenth century, having gradually succeeded, with the help of the Government, in superseding anarchism, which is still a troublesome factor. The socialistic vote rose from 76,400 in 1890 to 175.000 in 1900, and the number of Deputies from 5 in 1893 to 33 in the last year mentioned. The Socialist press consists of one daily newspaper, *Avanti*, and a large number of periodicals appearing less frequently. A monthly, *La critica sociale*, and a fortnightly, *Il socialismo*, are among the most prominent of these periodicals.

In Italy, as in so many other countries, we find two tendencies among the Socialists: the opportunist tendency, favoring compromise measures and seeking coöperation of non-socialists, and the orthodox Marxian tendency, uncompromising, pursuing the ultimate goal, and with little faith in reform measures which imply the continued existence of the present industrial society.

SPAIN. Social democracy effected an organization in 1882. During the past ten years the Social Democratic Labor Party has made progress and it has advanced, while anarchism, which first gained a foothold in Spain about 1870, has on the whole receded. The number of votes increased between 1891 and 1901 from approximately 5000 to over 25,000. No Socialists have as yet been elected to the Cortes, but in several cities they have succeeded in placing adherents in the municipal councils, achieving their greatest success in Bilboa. Their principal effort in recent years seems to have been to gain control of the labor organizations, and in this they have met with a considerable measure of success.

HOLLAND. The early Socialist agitators in Holland came from Belgium and founded a section of the International Workingmen's Association in 1868. The present Socialist activity is directly connected with the agitation begun in 1879 by Ferdinand Domela-Nieuwenhuis, who founded a socialist society, which soon fell under anarchist influence and showed a strong inclination to favor extreme and violent measures.

The more conservative Socialists organized a Social Democratic Party upon a Marxian basis in 1894, and this party has gradually gained a dominant position among Socialists, the old organization led by Domela-Nieuwenhuis having dwindled to insignificance; the anarchistic element has been practically extinguished.

The Socialists elected 7 members of Parliament in 1901. The Socialist vote was 39,000. A considerable number of Socialists have been elected to membership in municipal councils. The Social Democratic Party controls the radical and progressive elements in Holland, both in city and in country.

BELGIUM. A socialistic association was founded in 1866, and a labor party with a mixed socialistic and anarchistic programme was established in 1868. The International Workingmen's Association had sections in Belgium, but in 1872, when the schism between the Socialists and anarchists took place, the Belgian sections joined the anarchists under Bakunin. The modern social-democratic movement in Belgium may be said to date from 1876, when party groups were organized under a physician, Dr. DePaepe, who was a convert from anarchism. The present party, called Parti Ouvrier Belge, was formally established in 1885. In 1893 great socialist demonstrations took place, and a general strike was inaugurated with the purpose of securing universal suffrage. This effort was successful; and universal, but unequal, suffrage was granted to all males over twenty-five. Some of the voters, on account of educational or property qualifications, now have two or three votes. In the election which took place in 1894 the Socialists polled 335,000 votes and elected 32 members of the national Parliament. In 1902 the number of Socialist votes cast was, in round numbers, 476,000 and the number of Deputies elected 34. Another general strike was inaugurated under Socialist auspices in April, 1902, in order to coerce the Government to grant, not only universal, but equal suffrage. The demonstrations and strike were unsuccessful.

There are several peculiarities in the socialist agitation in Belgium which render this country one of the most interesting and important in the history of modern social democracy. First may be mentioned the close connection with the trades union movement. This, however, is not such a distinguishing feature of Belgian social democracy as is its connection with the coöperative movement. The Socialists in Belgium have started numerous coöperative establishments which have achieved a remarkable success. More than 200 of these are now affiliated with the Socialist Party, thus bringing it into connection with the daily economic life of the masses. The two chief coöperative establishments are the Maison du Peuple of Brussels and the Vooruit in Ghent. The Maison has a membership of 25,000 and property exceeding in value 2,000,000 francs. These are great retail establishments, resembling the modern department store. The masses show that they are closely attached to these coöperative stores, through which the Socialist agitation is actively carried on.

There are several strong Socialist periodicals in Belgium having a large circulation. The official paper in Brussels, *Le Peuple*, claims a circulation of 70,000. *L'Echo du Peuple*, an evening issue from the office of *Le Peuple*, is also an official organ. A monthly review called *L'Avenir Social* is published.

FRANCE. The Socialist Party in France did not gain any considerable following until after 1890. Its late appearance is doubtless due to the frequent revolutions in that country and its disordered and unsettled condition, which rendered it more favorable for anarchistic and revolutionary movements. With the firm establishment of the Republic and the lapse of a generation since the last revolution, the relatively ordered and legal means of modern social democracy have found a more fruitful soil, and anarchistic tendencies have been pressed into the background. The early Utopian socialism was practically dead in 1860. The International Workingmen's Association gained some influence in France during the uprising of the Paris Commune, which, however, was only partially socialistic. The International Association did not, however, exercise any considerable influence and soon disappeared. So far as it continued to exist, it fell under anarchist influences under the leadership of anarchists like Elisée Reclus and Prince Krapotkin. A Socialist paper published by a group of students made its appearance in 1876, and three years later Jules Guesde, who formerly had been anarchistically inclined, founded a Socialist Labor Party in France. He was soon joined by a former comrade in anarchy, Dr. Paul Brousse. In 1889 the total Socialist vote was only 91,000 in round numbers out of a total of 6,847,000 votes; two years later the vote rose to 549,000, or nearly 9 per cent. of the total vote cast. This vote includes those who voted for the so-called Socialist Radicals, who, while having strongly socialistic leanings and generally acting with the Socialists, may not be regarded as full socialists, inasmuch as they do not accept the entire socialist programme. In 1893 the Socialists increased their strength in the French Assembly threefold, the number of Deputies rising from fifteen to fifty. It thus became in that year a great political party.

The next great event in the history of French socialism was the appointment of A. Millerand to a Cabinet position as Minister of Commerce under Waldeck-Rousseau in June, 1899. This was the first time in the world's history that a socialist had attained such a prominent position in government. The acceptance by Millerand of this position gave rise to fierce dissensions within the Socialist ranks. His opponents held that he had placed himself outside the control of the party by participating in the actual administration of a capitalistic government. Millerand's position, however, was sustained by Jean Léon Jaurès (q.v.). It is noteworthy that the proposal to censure Millerand for his acceptance of a Cabinet position has not been indorsed by the Socialists in their convention.

There are four or five factions among the French Socialists. We have, first, the Ministerialists or independents led by Jaurès and Millerand; next, the Marxists under the leadership of Jules Guesde. The latter form the party called Parti Ouvrier Français. They constitute the two chief divisions and the other factions may be grouped about them in their tendencies. We have also a group called the Allemanists from their chief, Jean Allemane, taking, like the Ministerialists, a position of opportunism. There is, besides, a small group called the Blanquists, of a more revolutionary character. We have also the Socialist Radicals already mentioned, who act with the Socialists. The principal Socialist publication of France is *La Petite République*, a daily with an

enormous circulation. It is an organ of that wing of the party led by Millerand and Jaurès, and aims to harmonize and unite the various Socialist groups. There is also a daily paper, *L'Action*, Socialist, anti-Ministerialist, and violently anti-clerical. It has a large circulation. A monthly called *La Revue Socialiste* seeks to do an educational and scientific work among the French Socialists like that which *Die neue Zeit* aims to accomplish in Germany. *Le Socialiste*, the weekly organ of the Parti Ouvrier Français, and *Le Mouvement Socialiste*, are also important periodicals.

RUSSIA. For a half century most radical and revolutionary agitation of one kind or another has been carried on in Russia, and the two most familiar names among the international leaders of anarchism, Mikhail Bakunin and Peter Krapotkin, are those of Russian exiles. Early in the second half of the nineteenth century this agitation took the name of Nihilism (q.v.), which was a kind of political anarchism rather than economic anarchism. One aim which has in the past been prominent in Russia among radical economic reformers is to connect social and economic reconstruction with the Russian agricultural village called the mir (q.v.). It has been hoped by these leaders that Russia could pass directly from the early stage of economic development into socialism, without passing through modern capitalism as an intermediate stage. During the past few years, under the leadership of George Plekhanoff, a resident of Switzerland, Marxian socialism has made some progress. The Socialists, having no field for political activity, turn their attention to labor agitation, and it is said by them with apparent truth that the great strikes in Russia during the past ten years have to no inconsiderable degree been an outcome of modern social democracy.

The entire Socialist activity is secret and no names of Russians living in Russia can be mentioned. The agitation in large part proceeds from foreign countries, and the socialist literature is smuggled into Russia and secretly circulated. Russia is regularly represented at the International Socialist Congress.

ENGLAND. While Socialist ideas probably have as much influence in England as in any country, and possibly even a greater influence, they find expression rather in a molding of the thought of other political parties than in any distinct socialist party. The chief power of socialism has been seen in the social reforms which have been accomplished in England during the past twenty years. There are at present three organizations in England which may be regarded as at once political and Socialist. There is first the Fabian Society (q.v.), whose members aim, not only to carry on a propaganda for socialist thought, but to promote the election of Socialists in any way which may seem most feasible at the proper time and place. It is essentially an opportunist organization in its practical tactics. There is next the Independent Labor Party, formed in January, 1893, the object of which is "the collective ownership and control of the means of production, distribution, and exchange." Finally, there is the Social Democratic Federation, among whose adherents H. M. Hyndman (q.v.) and H. Quelch are prominent. This latter organization represents Marxist socialism in England and is the oldest body, dating from 1881. In this connection special mention must be made of the Labor Representation Committee, which seeks to promote "the representation of the interests of labor in the House of Commons."

The Socialists claim that they had about 50,000 votes in 1900. Keir Hardie represents the Socialists in Parliament and there are three other members with Socialist affiliations. In local elections, Socialists have frequently been successful, and for some time the London County Council has been to a very appreciable extent under the influence of Socialists. It may be said that the greatest trade unions have to some extent been brought under the influence of socialism. This is seen in the adoption by the Trade Union Congress at Belfast in 1893 of a resolution demanding collective ownership and operation of industries; in other words, pure socialism. This can be interpreted to mean more than it really does. It indicates a disappearance of avowed hostility to socialism on the part of trade unionists; it shows that the name socialism is no longer feared, and that it meets with a certain sympathy. The trade union movement has in England become in the main indifferent to active socialism, but may be described as having mild Socialist inclinations.

Hyndman and Quelch have been mentioned as leaders of the Social Democratic Federation. E. Belfort Bax may also be mentioned as prominent in this group. The *Social Democrat*, a monthly journal, and *Justice*, a weekly, edited by Quelch, are organs of the Social Democratic Federation.

Mr. and Mrs. Sidney Webb, G. Bernard Shaw (q.v.), and Edward R. Pease are leading members of the Fabian Society, the last named being its secretary. The organ is the *Fabian News*. Keir Hardie and J. Ramsay MacDonald are prominent members of the Independent Labor Party, the organ of which is the *Independent Labor Party News*, which, like the *Fabian News*, is a monthly periodical. Robert Blatchford, the editor of the *Clarion*, is a popular socialist writer without special affiliations for any one of these three groups.

JAPAN. A Japanese by the name of Tarui attempted to organize a Socialist party in 1882; in 1892 the Eastern Liberal Party, which manifested an interest in labor problems, was founded, but these early attempts at socialistic organization were of little importance. The Socialist Association was organized in 1900, taking as its model the English Fabian Society. This association founded a social democratic party, which issued its manifesto April 20, 1901, but was suppressed by the Government the same day. Fabian and opportunist socialism seem to have a stronger hold in Japan than Marxian socialism.

CANADA. A Canadian Socialist League, organized in 1901, is the chief representative of socialism in the Dominion. There are also in Canada several branches of the Socialist Labor Party of the United States. The Socialist movement, in general, in Canada, is closely connected with the trade union movement, over which it appears to be exercising increasing influence. The Socialists claim a vote of about 5000.

THE UNITED STATES. Although communism (q.v.) gained an early foothold in the United States, it exercised practically no influence upon the movement now represented by the Socialist

parties. American socialism proper begins with the German influence. As a result of the political disorders of 1848 many men of learning and character came to this country from Germany as refugees. There were radicals among them who took the leadership in the establishment of communism of a new type in this country. Among them we may mention Wilhelm Weitling (q.v.), a German tailor, who started a German newspaper called *Die Republik der Arbeiter*, and organized an Arbeiter Bund. He was essentially a Utopian socialist, and had plans for the establishment of a communistic settlement, and was for a time connected with one in Iowa. Nevertheless, his thought was more in line with modern socialism. Weitling lived until 1871, and was at the last somewhat interested in the Internationale of Marx. Next, mention may be made of the German gymnastic unions (Turnvereine), which, in the early days, were avowedly Socialist. The first Socialist Turnverein was established in New York in 1850. The Turnvereine formed an organization called the Socialist Gymnastic Union (Socialistische Turner Bund), and in 1850 the name Socialist Gymnastic Union was adopted. Since the Civil War the socialistic character of the Turnvereine has very largely but not entirely disappeared.

In 1857 a club of communists was formed. In 1868 the followers of Lassalle held a meeting, the purpose of which was to establish a Social Democratic Party, and an organization was effected in New York City. In 1869 the party became affiliated with the International Workingmen's Association. Several sections of the Internationale were formed in this country, and in 1872 the seat of the Internationale was transferred to New York City. Scattering sections existed here and there for a few years. The National Labor Union formed a party called the Labor Reform Party in 1868, and the Socialists supported this, but its life was of short duration. The Socialists formed a Social Democratic Workingmen's Party at a convention held in Philadelphia in 1874, and in 1877, at a convention in New Jersey, they adopted the name Socialist Labor Party, which is still preserved. The party for a long time had much trouble with the anarchists. The convention of the Socialist Labor Party in 1881, in New York City, witnessed a rebellion of the anarchists against the party, and one of the anarchist leaders, Justus Schwab, started a paper called *The Anarchist*. Johann Most came to this country in 1882 from London, having previously been expelled from the Social Democratic Party of Germany. The agitation of Most produced a crisis, and in 1883, in the convention at Baltimore, the Socialists decided not to connect themselves in any way with the anarchists, who had effected an organization at Pittsburg in the same year.

The next important events in the history of the Socialist Labor Party are connected with the candidacy of Henry George in 1886 for the Mayoralty of New York City, and in 1887 for the Governorship of New York. George was nominated by what was called the United Labor Party and ran against Abram S. Hewitt and Theodore Roosevelt. The votes received by the three candidates were as follows: Hewitt, 90,552; George, 68,110; Roosevelt, 60,435. The Syracuse Convention of the Union Labor Party, 1887, when George was nominated for the Governorship of New York, repudiated socialism. This formed an epoch in the history of American socialism, and in 1888 the Socialist Labor Party decided to have no affiliations thereafter with any other party, but to nominate an independent ticket and vote for that without compromise and without any bargains with other parties or factions of parties. It is from this time that organized political socialism has made progress in the United States.

We must next take up the introduction of distinctively American influences into political socialism in the United States. Dr. Daniel De Leon has long been one of the most influential factors in the Socialist Labor Party. Although not an American by birth, he was trained at Columbia University. Laurence Gronlund (q.v.), a Dane by birth, but naturalized in this country, wrote his *Coöperative Commonwealth* in 1884, and this helped spread socialism among native-born Americans. Edward Bellamy (q.v.), of long American ancestry, wrote *Looking Backward* in 1888. Bellamy's socialism was, as has already been stated, called nationalism, and the clubs organized were called nationalist clubs. As a distinctive factor nationalism soon ceased to exist. The specific work which Bellamy accomplished was the Americanization of socialism, in the sense that he helped the American people to understand its significance, and won over a great many to its support. In 1893 the *Coming Nation* was established at Greensburg, Ind., by J. H. Wayland. Wayland was for a time influenced by the older so-called Utopian socialism, and helped establish Ruskin, in Tennessee, a short-lived communistic settlement. Later he moved to Kansas, and there established the *Appeal to Reason*. It is now published at Girard, in that State, claiming a circulation of half a million. The establishment of the American Railway Union in 1893, and the Pullman strike in the following year, are epoch-making in the history of American socialism. Early in 1897 Eugene V. Debs announced his conversion to socialism, and he and Victor L. Berger, of Milwaukee, were largely instrumental in establishing the Social Democratic Party. After 1899 there were dissensions in the Socialist Labor Party, terminating in a serious split. The socialists who left the old party joined forces with the rival party, and formed what is now known as the Socialist Party, except in Wisconsin and New York State, where, for legal reasons connected with the laws concerning the ballot, it is still called the Social Democratic Party. Recently there has been organized by Pennsylvania socialists a new Socialist Labor Party, which hopes to effect a union of all Socialist parties.

It is interesting to trace the vote received by Socialist parties beginning with 1888, when an independent ticket was nominated in New York City and the resolution was adopted to form no alliances with other parties. In this election the vote received was 2068. In 1890 in New York State alone the party received 13,331 votes. In 1892 the socialistic vote of Connecticut, Maryland, Massachusetts, New Jersey, and New York was 21,159. In 1894 the party extended its influence to the Middle States, and in Connecticut, Iowa, Massachusetts, Missouri, New Jersey, New York, Penn-

sylvania, and Rhode Island received 33,133 votes. In 1896 the number of votes was 36,564. In 1898, in eighteen States, the Socialist Labor Party received 82,204 votes, and the Social Democratic Party, which was organized in 1897, 9545 votes, largely in Massachusetts, making a total of 91,749. In the Presidential elections of 1900 the Socialist Party received 97,730 votes and the Socialist Labor Party 33,450, making a total of 131,180. In 1902 State and Congressional elections the Socialist Party received 229,762, and the Socialist Labor Party received 53,763, making a total of 283,525.

The Socialists have not succeeded in electing any member of Congress. They have, however, met with some success in State and local elections, in 1898 electing John C. Chase Mayor of Haverhill, Mass., and James T. Carey and Louis M. Scates to seats in the Massachusetts Legislature. In 1903 three representatives of the Socialist Party were members of the Massachusetts Legislature. In the same year the Mayor of Haverhill, Mass., Parkman B. Flanders, and several of the municipal officers were Socialists. In Brockton, Mass., Charles F. Coulter was re-elected Mayor. The greatest victories of the Socialists were won in the April local elections of 1903. Socialists were elected to office in at least twenty cities; in five, mayors were elected; in several a considerable proportion of the other municipal officers. The city of Anaconda, Mont., was carried by the Socialists.

It may be mentioned that W. D. P. Bliss established an American Fabian Society at Boston in 1895. This society published the *American Fabian*, which continued to exist for several years, but has disappeared. The 'Society of Christian Socialists,' also under the leadership of Bliss more than any other man, was organized in Boston, April 15, 1889. The tendency in recent years has been for the Socialist Party to absorb all these minor organizations. Recently there has been organized a Collectivist Society in New York City. The aim of this society is evidently to do a work like that of the Fabian Society in England.

It is noteworthy that American socialism is probably more Marxian than the socialism of the other great countries of the world. There is also a tendency to lay less emphasis upon the 'immediate demands' or the reforms which can be accomplished while the framework of the existing order is retained. The 'immediate demands' were dropped altogether from the platform of the Socialist Labor Party at the convention held in New York City in June, 1900.

Political socialism has little influence upon organized labor in the United States, but here also the influence is growing rapidly. The Knights of Labor (q.v.) were in so far socialistically inclined that some of the planks in their platform were in general line with socialist thought. So far as there was socialism in the rank and file of the Knights of Labor it was sentimental and impulsive rather than the result of deliberate thought. Doubtless, however, the agitation which the Knights of Labor have conducted helped to prepare the soil in this country for socialism.

Most significant is the attitude of the American Labor Union (q.v.), which is avowedly and unreservedly committed to political socialism.

The Socialists have the support of a large and increasing number of periodicals. The number in June, 1903, was probably about one hundred. The Socialist Labor Party press consists chiefly of the daily, weekly, and monthly *People*, of New York City. The newly organized Pennsylvania branch of the Socialist Labor Party has as its organ the *Socialist Standard* of Pittsburg. The principal newspapers supporting the Socialist Party are *The Worker*, *The Comrade*, and the *Volkzeitung* of New York City; the *Cleveland Citizen*, of Cleveland, Ohio; the *American Labor Union Journal*, of Butte, Mont.; the *Social Democratic Herald*, of Milwaukee, Wis.; the *Coming Nation*, of Rich Hill, Mo.; the *Appeal to Reason*, of Girard, Kan.; and the *Chicago Socialist*. Especially noteworthy is the *International Socialist Review*, which is the organ of scientific socialism in this country.

LITERATURE. The information concerning the socialist parties of the world must be sought in the periodical press representing these parties, and this has already received mention. Especially noteworthy as sources of authority are the *Socialistische Monatshefte*, of Berlin; the *International Socialist Review*, of Chicago; and *L'Avenir Social*, of Brussels, in which the international secretary has each month a review of the 'labor movement and international socialism.'

SOCIAL PSYCHOLOGY. A term used to describe the branch of investigation which deals with those modifications of consciousness that result from the reciprocal relations of individuals in a community. As used at present, the term includes only human groups or societies. It adds few if any new mental processes, but it examines a host of new functions which the individual consciousness fulfills by virtue of its relation to other minds more or less like itself. This branch of psychology is to be distinguished from the science of sociology, which deals with the formation, structure, and development, as well as the practical betterment of society. Sociology studies society objectively as an organization with certain laws of growth and change. Social psychology, on the other hand, regards the phenomena of society subjectively; i.e. it studies the springs of action which determine the movements of society, and also the conscious modifications which individual minds produce in one another. It inquires into the state of mind in a mob, and the causes which produce it; the mental disposition of the criminal and the motives which lead him to criminal acts; the mental characteristics of different peoples and races; the effects of climate and of scenery upon the temper of a community; the analysis of imitation, of invention, and of suggestion, and the part that these factors play in developing and maintaining society. The problem of social psychology may be regarded either (1) genetically or (2) statically. One may (1) trace the development of society by the interpretation of language, religion, myths, customs, arts, and laws in various stages of development from the earliest primitive peoples down to the present time. Such an investigation produces both psychological and sociological results. The problem which is of interest to the social psychologist concerns the modification of perception, idea, feeling, emotion, sentiment, and action which is traceable directly to the social environment and the reciprocal effect of these mental formations upon the community as a

whole. One may (2) take society as one finds it at present and analyze the mental factors which control the complex interrelations of men. See LANGUAGE; MYTHOLOGY; CUSTOM; LAW; SOCIOLOGY.

Consult: Wundt, *Human and Animal Psychology*, translated (New York, 1894); Le Bon, *The Crowd* (ib., 1896); id., *The Psychology of Peoples* (ib., 1898); Baldwin, *Social and Ethical Interpretations in Mental Development* (ib., 1897); Tarde, *Etudes de psychologie sociale* (Paris, 1898).

SOCIAL SCIENCE. See SOCIOLOGY.

SOCIAL SCIENCE ASSOCIATION, AMERICAN. A society for the study of social questions. It was organized in Boston, Mass., in 1865, and meets annually in such cities as may be selected. Its work is classified in five departments: education and art; health; trade and finance; social economy; and jurisprudence. Its membership is about 1000, of whom thirty corresponding members are distinguished sociologists of England and Continental Europe. The association publishes the annual *Journal of Social Science*.

SOCIAL SERVICE, AMERICAN INSTITUTE OF. An American educational and research society. It was organized in New York in 1902 and is the outgrowth of the League for Social Service founded by Josiah Strong and W. H. Tolman in 1898. It is modeled largely after the Musée Social (q.v.) of Paris. Its purposes are: (1) To gather facts bearing on social and industrial betterment; (2) to interpret these facts by scientific study; and (3) to disseminate information freely for the education of public opinion by means of monographs, lectures, and various publications. At the request of the National Government, the League prepared for the Paris Exhibition of 1900 an excellent exhibit of social economy which attracted much attention abroad. *Social Service*, the organ of the League, is published by the Institute.

SOCIAL SETTLEMENTS. The name given to those houses, situated in the poorer districts of certain great cities, where educated men and women live, that they may come into contact with the poor and better the conditions of that class. The social settlement movement represents an attempt to establish closer relations between the higher and lower social classes, with the aim of giving to the poor opportunities for culture, while securing for the rich a broader view of life through closer contact with the people. Many settlements have become outposts for other institutions, social observatories and statistical laboratories. The movement originated in the enthusiasm of certain Oxford students, influenced by the philosophy of Dr. Arnold and Frederick D. Maurice, and by Thomas Hill Green, who felt the need of a better understanding of the life of the people.

In 1867 Edward Denison, a wealthy student, began to work in the parish of Saint Philips in Stepney. Early death prevented him from carrying out his plan of establishing homes similar to the present settlement. In 1875 Arnold Toynbee, then tutor at Oxford, spent his summer in Whitechapel, where he became a leader among workingmen. He, too, met an early death, but his influence was so strongly felt that the first settlement was named after him. Toynbee Hall was founded in 1884 by Rev. Samuel A. Barnett, in whose parish Toynbee had worked. The movement spread rapidly and by 1890 there were promising university settlements in London, Glasgow, and Edinburgh. In the United States, Hull House (Chicago) and the College Settlement in New York City were opened in October, 1889. The Neighborhood Guild of New York, a forerunner of the settlement, now took on this new form as the University Settlement. The revised bibliography (see below) lists 44 settlements in Great Britain, 101 in the United States, one regular settlement in Paris, and several institutions with settlement activities, one in Berlin, and several in Holland. The movement has even spread to Japan, India, and New South Wales. The larger settlements are usually managed and supported by regularly incorporated associations. A head worker, who receives a salary, is engaged. The expenses are met by money raised in various ways. Buildings and special equipments are obtained by gifts. In order to create independence, a nominal fee is charged for some classes. A characteristic feature of the settlement is residence, more or less temporary, on the part of the workers both volunteer and paid. Except the head worker and occasionally an assistant, the residents, however, pay their expenses.

The activities may be summed up as follows: (1) Physical. Gymnasium, baths, military drill, baseball, basketball, and playgrounds are provided. Efforts are made to improve the sanitary conditions of the neighborhood. Many settlements have summer homes. (2) Educational. As an educational agency the settlement maintains circulating libraries, reading-rooms, and home libraries; lectures; musical instruction; art instruction; classes for those who desire business training and law; for those whose education has been neglected, or for foreigners to learn English; for the study of literature, history, and economics; for industrial training, including domestic service, kitchen gardening, dressmaking, etc. (3) Æsthetic. Special picture exhibits and concerts are given and pictures are loaned. Encouragement is given to the growing of plants, and to other methods of beautifying individual homes. (4) Religious. Religious instruction is usually avoided, although Sunday talks, concerts, or open discussions are frequent. A few settlements—as the Chicago Commons or Oxford House—aim to exert a religious influence. (5) Philanthropic. In this field the settlement aims to coöperate with existing organizations. Relief is very seldom given except as a personal matter. A dispensary, a day nursery, or an employment bureau is, however, frequently attached to a settlement. Flower distributions are made, and the University Settlement in New York cooperates with a model pawnshop and a legal aid bureau. (6) Social. Numerous clubs are established for adults—smoking, debating, athletic, and political clubs; dramatic, literary, and reading clubs; and all manner of clubs for girls and boys. Women's clubs and mothers' meetings are common.

Additional features are the stamp savings bank for children, coffee houses, the publication of a newspaper or bulletin, and the promotion of boarding clubs, especially for working girls. Some settlements are especially interested in work with

children or boys; others try to reach families or men, or to Americanize a foreign element. Some are distinctly homes; others are institutional. The settlement workers are interested in the labor problem and the settlement is often a headquarters for economic discussions, or, occasionally, a meeting place for labor organizations. Civic interests are stimulated, and residents sometimes hold positions on State and municipal boards. From time to time investigations are made from the settlement, and scholarships are sometimes given to further such work. See HULL HOUSE; SOCIAL DEBTOR CLASS; TOYNBEE, ARNOLD; UNIVERSITY EXTENSION.

BIBLIOGRAPHY. Montgomery, *Bibliography of College, Social, University, and Church Settlements* (4th ed., Boston, 1900); *New York Bureau of Labor Statistics* (18th Annual Report, New York, 1900); Coit, *Neighborhood Guilds* (2d ed., London, 1892); Woods, *English Social Movements* (New York, 1891).

SOCIAL WAR (Lat. *bellum sociale*). A desperate struggle between Rome and her Italian allies (*socii*), which lasted for two years (B.C. 90-88). The races of Central Italy, the Samnites, Pelignians, Marsians, and Lucanians, had long been bound to Rome by a forced allegiance, without enjoying the rights of Roman citizenship, which brought with them great social and political advantages. They had long sought in vain an amelioration of their condition, for while their men fought side by side with the Romans in the wars of the Republic, they were denied all semblance of equality. The hardy and vigorous mountaineers chafed under this oppression, and when, in B.C. 90, their Roman champion, M. Livius Drusus, was murdered for his attempted reforms, they broke out in an extensive and well-organized revolution and aimed at a confederation of all Italy to crush the growing power of Rome. It was the first dream of a united Italian nation. The union was to be called *Italia*, its capital was to be Corfinium, in the Pelignian country, under the new name of *Italica*, and its government was to be a republic administered by two elective consuls, as at Rome. Their armies were very successful for a time, and Rome met some serious reverses; but by giving her coveted citizenship to those allies who remained loyal, and promising it to such as would return to her allegiance, she succeeded in breaking the strength of the revolution, which was virtually crushed in B.C. 88. But, though the Italians lost their independence, they gained their original demands, for they were enrolled in eight new Roman tribes, and soon became assimilated to the Roman body politic. From the part borne by the Marsians in this struggle it is often called the Marsian (Marsic) War.

SOCIETARIANS. A name not infrequently bestowed on the followers of Charles Fourier (see FOURIERISM), whose doctrines taught the reconstruction of society on a mathematical basis and the supplanting of wasteful individual effort (technically 'parceled' effort) by associated or 'societarian' activity. Consult: *Compte-rendu de l'exposition du système sociétaire de Fourier faite par M. Victor Considérant* (Dijon, 1841); Pellarin, *The Life of Charles Fourier*, translated by Shaw (New York, 1848).

SOCIÉTÉ DES CONCERTS DU CONSERVATOIRE, sô'syā'tā dā kôn'sâr' dụ kôn'sâr'vā'twär', LA (Fr., the society of the concerts of the conservatory). The foremost concert institution of France. The origin of this society in reality dates back to the time of Louis XV., when Philidor established the *concerts spirituels*. Operatic representations were forbidden on holidays, Sundays, and during Lent. Accordingly, Philidor established concerts on Sunday nights, which he called *concerts spirituels*. In 1828 Habeneck organized an orchestra from among the pupils of the Conservatoire, and on March 9th began a series of six Sunday concerts on the same plan as those of the *concerts spirituels*. It was through this orchestra that Habeneck introduced the works of Beethoven into France. The conductors have been Habeneck, Girard, Tilmant, Hainl, Deldevez, Lamoureux.

SOCIÉTÉ EN COMMANDITE, äN kô'mäN'dēt' (Fr., limited liability company), or LIMITED PARTNERSHIP (q.v.). An expression used for at least two centuries in France as the name of a partnership in which one may advance capital without taking charge of the business, or becoming liable as a true partner for its debts. The term owes its origin to the old meaning in the commercial nomenclature of France of the word command, which was applied to one person authorizing another to transact business for him. The working partner had a *commande* from him who merely advanced capital. This form of partnership existed in Louisiana while it was a French dependency, and was continued after it became a part of the United States; but New York was the first common-law State to adopt this institution. That was done in 1822, and now limited partnerships are authorized by statute in most of the States. They do not exist in England.

SOCIETIES (Lat. *societas*, from *socius*, companion, associate). Organizations of individuals for the attainment of a common end through common action. Coöperation dates from the earliest times, and whether for the conquest of some material object or for the inner improvement of the individual himself, is met with in all parts of the world. In the present work the subject of societies has received a twofold treatment; general articles have been devoted to a discussion of various definite classes of organizations as differentiated by purpose, while at the same time special articles treat of the best known individual organizations within such classes. Here it is sufficient to give a brief indication of how extensive the subject is and the manner in which it has been dealt with. Probably the oldest forms of organization are the cult societies, which are found among many primitive tribes, as, for instance, the Duk-Duk (q.v.) of the island of New Britain in the Pacific, or the Mumbo Jumbo societies of West Africa. These are mainly religious in character, but add certain political characteristics and possess an elaborate ritual and the feature of secrecy. Far advanced are the religious societies of the classic world like the Eleusinians of the Greeks or the priestly colleges of the Romans. Further still we have the various organizations which arose with the Christian Church and which, aside from the purely monastic aggregates, included asso-

ciations formed for numerous secular purposes (see BROTHERHOODS, RELIGIOUS), as the care of the sick (see HOSPITALERS), the building of bridges (see BRIDGE-BUILDING BROTHERHOOD), the protection of pilgrims, and a combination of some of these duties as exemplified in the great Orders (q.v.), such as the Templars or the Knights of Saint John of Jerusalem (qq.v.). Pre-eminent among societies formed for the defense of faith stand the Jesuits (q.v.).

Political organizations begin very early and take the form of public associations, working for their purposes in the open (e.g. the Anti-Corn Law League, q.v.), or secret associations wherever the objects or the methods of the societies are regarded with disfavor by governments or were even hostile to government. The latter type would include the great revolutionary societies which have played an important part in European affairs, especially since the beginning of the nineteenth century. See BURSCHENSCHAFT; CARBONARI; FENIAN SOCIETY; NIHILISM; YOUNG ITALY; etc.

The primitive cult societies were largely social in their nature, and social organizations constitute at the present day an important class of societies. Such are clubs (q.v.) and college fraternities (see FRATERNITIES, COLLEGE), wherein, in general, there is no further aim than the bringing into contact of a certain number of individuals of congenial tastes and character. Or the interests of the association may centre in some one line of amusement or some single pastime, as with athletic organizations, sporting clubs, etc. (See ALPINE CLUBS.) Where the element of sociability is supplemented by some attempt at self-instruction in one of the various arts, we have the large class of musical societies, choral societies, literary societies, art societies, etc. Noted for its broadness of scope in combining the social, the educational, and the religious elements is the Young Men's Christian Association (q.v.). The social element is largely overshadowed by a common professional interest in the class of organizations known specifically as learned societies, embracing every field of science and liberal learning. (See, for example, ACADEMY; INSTITUTE OF FRANCE; ROYAL SOCIETY; HISTORICAL ASSOCIATION, AMERICAN; etc.) Of great importance, in the United States especially, are the fraternal organizations combining the elements of sociability and mutual assistance rendered either in an informal way, as among the Free Masons (see MASONS, FREE), or in a more definite form, as by life, sickness, and accident insurance, as practiced by various other organizations. As typical of the great class of benevolent and fraternal societies, see ODDFELLOWS; PYTHIAS, KNIGHTS OF; ELKS, ORDER OF; etc. Finally, mention must be made of a class of societies devoted to the amelioration of social conditions and directing their efforts to the advancement of the general welfare or to the cure of some specific evil in society. For the one type see CHARITY ORGANIZATION SOCIETY; BOYS' CLUBS; WORKINGWOMEN'S CLUBS; WORKINGMEN'S CLUBS; etc. Typical of the second are the various temperance societies in the United States. See TEMPERANCE; WOMAN'S CHRISTIAN TEMPERANCE UNION. See also PATRIOTIC SOCIETIES.

SOCIETIES FOR ETHICAL CULTURE, THE. The first Society for Ethical Culture was formed in New York City in May, 1876, by Prof. Felix Adler and several associates. The purpose of the movement was to provide a centre for persons who had lost their attachment to the traditional creeds and desired to aid in seeking what is good and in promoting the moral development of the individual and of society. A second society was formed in Chicago in 1882; a third in Philadelphia in 1885; and a fourth in Saint Louis in 1886. A few years afterwards the first society in London was organized by Dr. Stanton Coit. Other societies have since been formed in England, and in Germany (where there are 16), Austria, Switzerland, and Italy. The most important of these societies are those in the United States, England, and Germany, and at Zurich, Switzerland. An Ethical Congress and a convention of all the Ethical Societies in America were held in connection with the tenth anniversary of the fourth society, in Saint Louis, in 1896. A congress of American and European societies was held at Zurich, Switzerland, in the same year, when the office of International Secretary was instituted. The societies in America seek less to gain adherents than to establish their principles and perfect their organization. Not affirming any creeds and not hostile to any, the Society for Ethical Culture teaches that moral ends are supreme above all human ends and interests, and that the authority of the moral law is immediate and not dependent upon religious beliefs or philosophical theories. Meetings are held on Sundays and are devoted to addresses, with exclusion of audible prayer and all forms of ritual. Special importance is attached to the ethical training of children, and important schools have been established in New York and other cities. The New York Ethical Culture School was the first to introduce manual training as a regular branch of the curriculum in elementary schools. Young men's societies, women's conferences, Sunday ethical classes, and the like come within the sphere of activity of the societies. The New York society had 900 members in 1901.

BIBLIOGRAPHY. *The Ethical Record* (bimonthly) and a 'lecture supplement,' *Ethical Addresses* (monthly), are issued by the Society for Ethical Culture of New York. *The International Journal of Ethics* (quarterly, Philadelphia), while not the official organ of the societies, owes its origin and main support to them. *Ethics* (weekly, London) is the organ of the English societies, and *Ethische Kultur* (weekly, Berlin) represents the German movement. Consult the writings of Felix Adler, such as *The Moral Education of Children* (New York, 1898); *Creed and Deed* (ib., 1877); *Life and Destiny* (ib., 1903); W. M. Salter, *Ethical Religion* (Boston, 1889); W. L. Sheldon, *An Ethical Sunday School* (New York, 1900); id., *An Ethical Movement* (ib., 1896); Stanton Coit, *Neighborhood Guilds* (London, 1892).

SOCIETY (from Lat. *societas*, from *socius*, a companion). A naturally formed group, as a tribe, a village, a nation, organized to achieve the common good—a community, a commonwealth. The basis of society is mental agreement and pleasure in association. An entire population occupying a defined territory becomes,

through developing communication and assimilation, increasingly like-minded. Through developing coöperation, cultural, economic, legal, and political, it becomes highly organized. Such a socially developed and organized population is a natural society, and it is within a natural society that all lesser or subordinate societies appear, as incidents of its evolution. These are of two broadly distinguished kinds, the component and the constituent. The component society is a group in which both sexes and all ages dwell together. The name is indicative of the fact that all the larger natural societies, like modern nations, are compound, having been produced by the federation of smaller component groups. The series of component societies is, in uncivilized or ethnic communities, the family, the horde, the tribe, the federation of tribes; and in civilized societies, the family, the village, the commune or city, the county, the commonwealth, the federal nation, the federated empire. The constituent society is an association of selected persons, formed to carry on a particular work. It represents the principle of division of labor, of specialization. The name is expressive of the fact that society as a whole is constituted of such specialized associations. Collectively they are the social constitution. They include all societies for amusement, religion, education, philanthropy, business, the promotion of justice, and political activity. See SOCIOLOGY.

SOCIETY. An assemblage of plants growing in a common habitat under similar life conditions. See ECOLOGY.

SOCIETY ISLANDS, or TAHITI ARCHIPELAGO. A colonial possession of France in the South Pacific, consisting of an archipelago of eleven islands, extending from 16° to 18° south latitude, and from 148° to 153° west longitude (Map: The World, Western Hemisphere, L 6). It is divided into the Leeward and Windward groups, the former including the islands of Raiatea, Huahine, Tahaa, Borabora, Maupiti, Tubai, and a few smaller islets, and the latter group comprising Tahiti (q.v.), Morea, and a few others. Total area, estimated at 650 square miles, of which Tahiti covers about 600. The islands are volcanic, mountainous, and surrounded with coral reefs which form coast lagoons. The highest peak, on the island of Tahiti, has an elevation of over 7,000 feet. The climate is hot and moist, but not unhealthful. The flora is luxuriant and especially rich in trees. Bananas grow in abundance and are found in altitudes of from 3000 to 5000 feet. The fauna is rather poor. The chief agricultural products are cocoanuts, bananas, sugar, and vanilla. Only a small part of the agricultural land is tilled, and the colony is in a general state of backwardness. The exports are mainly copra, mother-of-pearl, vanilla, and fruits, the commerce amounting to a little over $1,000,000 a year. Administratively, the group forms the chief of the French establishments in Oceania.

The discovery of the Society Islands dates probably from 1606, when they were visited by the Spaniard Pedro Fernandez de Quiros. Although several explorers visited the group before Captain Cook, it is chiefly the latter who gave to the world the first detailed description of the islands. At the time of Cook's visits (1769, 1773, 1774, and 1777) the islands were under the rule of a king who exercised both civil and ecclesiastical authority, and the government had more or less of a feudal character. The natives, who all belong to the Christian faith, are of a stately and fine Polynesian type. They are kind and very mild, and were readily inclined to adopt Western civilization. The discoverers found that they built comfortable dwellings and manufactured iron. They were ruled formerly by minor hereditary kings, whose influence was curbed by an influential nobility. In 1788 the island of Tahiti was visited by the *Bounty*, and soon after became the place of refuge for the mutineers of that vessel, some of whom were subsequently taken to Great Britain by the *Pandora*. The first attempt toward introducing the Gospel among the natives was made by Spain in 1774. The opposition of the natives to the doctrines of Christianity was partly overcome by the conversion of the King, Pomare II., and the new religion soon gained a firm foothold among the natives. The rivalry between the French and English missionaries led to the interference of France in 1838 and to the subsequent official annexation of the group in 1880. Consult: Meinecke, *Die Inseln des Stillen Oceans* (Leipzig, 1875-76); Brassey, *Tahiti* (London, 1882); Bässler, *Neue Südseebilder* (Berlin, 1900).

SOCIETY OF AMERICAN ARTISTS, THE. An organization of painters and sculptors, representing rather advanced and radical ideas in art, as opposed to the more conservative tendencies of the National Academy of Design (q.v.). It was founded in 1877 by some of the younger American artists who had been trained abroad. It has more than a hundred members governed by a president, a board of control made up of the officers, and an advisory board. Annual exhibitions are held in New York City. The work of both members and outsiders is passed upon by a committee on selection. The Webb prize of $300 for landscape or marine, the Carnegie prize of $500 for an oil painting, portraits excepted, and the Julia A. Shaw Memorial prize, for the best work produced by an American woman, are awarded each year. The Shaw Fund of $1500 is devoted to buying one or more works of art by American artists. The society originally stood for development and breadth, and the expression of personality, which it was maintained had been previously hampered by academic traditions. The line of division between the Society and the Academy is now less marked. A number of artists exhibit at both, and belong to both organizations. The Society of the Ten American Painters is composed of members of the Society of American Artists, who organized themselves into an independent body in 1898. They hold annual exhibitions in New York City, the note of which exhibitions is impressionistic.

SOCIETY OF AMERICAN AUTHORS. A society incorporated in May, 1892, in New York City, for the purpose of assisting authors in their dealings with publishers and generally improving the condition of the craft. It is formed on the same basis as, and is in close touch with, English, French, and Spanish societies of authors. The society is also committed to the agitation for the transmission of authors' manuscripts through the mails at printed matter rates,

according to the arrangements existing in England and other countries. It publishes a bulletin, *The American Author*.

SOCIN, sō'tsIn, ALBERT (1844-99). A German Orientalist, born at Basel, and educated there and at Geneva, Göttingen, Leipzig, and Berlin. He traveled in the Orient in 1868-70, and in Syria in 1873. In 1876 he was appointed professor of Semitic languages and literature at Tübingen, and in 1890 was called in a similar capacity to Leipzig. Among his numerous works may be named: *Die Gedichte des 'Alkama alfahl'* (1867; with translation); *Arabische Sprichwörter und Redensarten* (1878); *Die Inschrift des Königs Mesa von Moab* (with R. Smend, 1886); *Zum arabischen Dialekt von Marokko* (1893); *Der arabische Dialekt der Houwara* (with Stumme, 1894); and *Arabische Grammatik* (3d ed. 1894; trans. into Eng.). Socin collaborated also in Kautzsch's translation of the Old Testament (1890), and in Gesenius's *Handwörterbuch über das alte Testament* (Buhl's 12th ed. of 1895).

SOCI'NUS. The Latinized form of the name of two Italian Protestants of the sixteenth century, celebrated as the founders of the liberal sect called Socinians, and precursors of the modern Unitarians. Both men were born in the Tuscan town of Siena, the elder, LELIO SOZZINI (Lælius Socinus), in 1525, the younger, FAUSTO (Faustus), nephew of the preceding, in 1539. Lelio was destined for the profession of the law, but his tastes led him to theology instead. He applied himself to the study of Greek, Hebrew, and Arabic, that he might better understand the Scriptures. At the age of twenty-one he is reported to have joined a society at Vicenza, whose aim was free discussion of religious subjects, but which, after its heretical tendency had been discovered, was compelled to disband. Socinus fled from Vicenza, visited France, England, and Holland in his travels, and came into friendly contact with many Protestant leaders, including Calvin. He finally settled in Zurich, where he died at the early age of thirty-seven (1562). His views on Christian theology, for the most part unpublished, were eagerly read in manuscript by his nephew, who became their champion.—FAUSTUS SOCINUS had received a rather unsystematic education, but a developing interest in religious matters, due largely to his uncle's influence, led him in manhood to Basel for further study, thence to Transylvania, where anti-trinitarians were already numerous, especially among the nobility, and finally (1579) to Poland, which was to be the chief centre of his influence. As a theological disputant, writer, and preacher, Faustus exhibited both zeal and ability, but he encountered vigorous opposition from Roman Catholics and Protestants alike, on account of his attacks upon fundamental Christian doctrines. His position was that, although the Bible was authoritative and the Gospel history miraculous, no doctrine contrary to reason should be retained. This led him to modify greatly the current teaching respecting the nature of man, sin, and the deity of Christ. But he did not deny that, although other parts of Christian faith were above reason, they were nevertheless to be accepted, or that Christ possessed a superhuman nature and character. After a theological disputation with several Protestant leaders, in which his peculiar tenets were brought forward, Socinus was charged with sedition and forced for a time to withdraw from Cracow, taking refuge at the country estate of a friendly Polish noble, whose daughter he married. His views finally aroused such intense antagonism that popular outbreaks occurred, in which Socinus was shamefully handled. His last days were spent in retirement in the village of Luclawice, where he died in 1604.

Among the most important writings of Faustus Socinus are his *De Jesu Christo Servatore* and *De Statu Primi Hominis ante Lapsum*. In the former he discusses the person and work of Christ; in the latter, the doctrines of sin and grace. Both works were controversial in their origin. The *Racovian Catechism* (1605), a formal and elaborate statement of Socinian theology, was based largely upon outlines which he had made. The *Works* of Socinus are printed in the *Bibliotheca Fratrum Polonorum*, vols. i. and ii. (Amsterdam, 1656). Consult further: Rees, *The Racovian Catechism* (London, 1818); Bonet-Maury, *Des origines du christianisme unitaire* (Paris, 1882); Fock, *Der Socinianismus* (Kiel, 1847); Allen, *History of the Unitarians* (New York, 1894); Beard, *The Reformation of the Sixteenth Century in Its Relation to Modern Thought* (London, 1883); Harnack, *History of Dogma*, vol. vii. (Eng. trans., London, 1899); Ritschl, *Justification and Reconciliation* (Eng. trans., Edinburgh, 1902). See UNITARIANISM.

SOCIOLOGY (from Lat. *socius*, companion, associate + Gk. *-λογία, -logia*, account, from *λέγειν, legein*, to say). The science of society, comprehending the analysis and classification of social facts, the scientific description and history of society, and the explanation of society in terms of simpler phenomena. Sociology is conveniently divided into general and special sociology. General sociology is the study of the universal and fundamental phenomena of society. It investigates the facts and correlations found in all societies, the types of society, and the stages of social development. It seeks to discover the general laws and the causes of social evolution. Special sociology consists of the entire group of social sciences, including culture, history, economics, jurisprudence, and politics, each of which deals minutely with some one phase of social organization, social activity, or social development. Sociology includes social statistics, and so much of history as may truthfully be said to repeat itself, that is to say, those constant facts of coöperation, institutional life, and social welfare which recur in all communities and in all ages. The methods of sociology are inductive. Its chief dependence is upon comparative historical studies and upon statistics. It draws largely upon psychology also for data and for principles of explanation.

HISTORY.

The philosophy of social relations is one of the most ancient parts of human wisdom. The sacred books and the laws of Egypt and of Babylonia, of Palestine, and of Greece abound in empirical maxims of domestic and public economy, social justice, and statecraft. In the *Republic* and the *Laws* of Plato, and especially in the *Politics* of Aristotle, we have the beginnings of a scientific classification of social facts, and a

number of important generalizations. In the writings of Aquinas and Dante, of Machiavelli and Vico, of Bodin, Althusius, Spinoza, Hobbes, Locke, Hume, and Rousseau, we have acute interpretations of social phenomena in terms of human nature, i.e. of motives. Montesquieu (q.v.), in *L'Esprit des lois*, laid the foundations of an interpretation in terms of external conditions or environment, and this interpretation was further developed in a few special directions by the Physiocrats. In none of these writings, however, were scientific methods of investigation strictly followed, and in none of them after Aristotle did there appear the conception of a comprehensive social science. They were penetrating studies of special phases of social phenomena, not explanations of society as a whole.

The conception of a comprehensive social science we owe to Auguste Comte, who invented for it the objectionable name 'sociology.' Comte felt strongly that all social studies until his day had been fragmentary and polemical, and metaphysical rather than scientific. He regarded society as a perfect unity and protested against the attempt to investigate religious, economic, or political phenomena apart from one another, as necessarily misleading. His chief interest, however, was to include the study of society within a scheme of positive philosophy, from which all theological conceptions and speculative methods should be eliminated. Beyond these ideas of what the science ought to be Comte's own contribution to sociology amounted to little.

The concept of a general sociology left little impression upon scientific thought until Herbert Spencer wrote *The Study of Sociology* (1873), and made the 'principles of sociology' an integral part of his system of 'synthetic philosophy.' Beyond the general idea and the name, Spencer's sociology has nothing in common with Comte's. Spencer's system is an explanation of society in terms of evolution. He regards society as an organism, which undergoes integration and differentiation. It has a sustaining system analogous to the alimentary system of the animal, a distributing system analogous to the circulatory system, and a regulating system analogous to the nervous system. This social organism conditions the life of the individual. In the struggle for existence social groups like individuals come into conflict. Fear, born of conflict, for countless ages is a controlling emotion. Dominated by fear and its sister passion vengeance, men precipitate conflicts which are not forced upon them by necessity, and which often assume the proportions of war. Character is molded to militarism. Cruelty and treachery toward enemies is a virtue. Submissive obedience to authority is exacted, and the whole social organization is pervaded by coercion. From the fear of the living have arisen a ceremonial and a political control, and from the fear of the dead, growing out of the belief that the spirit, surviving the body as a ghost, continues to interfere in the affairs of the living, has arisen a religious control. The ceremonial, political, and religious systems are the regulative mechanism of society. Captives taken in war, or whole populations reduced to serfdom, constitute the sustaining system. Militarism consolidating small groups into petty States, and these into nations, achieves social integration; but by widening the area within which peace prevails it brings about its own decline. The transition from militarism to industrialism, thus made possible by social integration, transforms human nature and social institutions. These principles Spencer has applied to the interpretation of domestic, ceremonial, ecclesiastical, political, and industrial institutions. His system is a coherent scientific whole, yet it lacks one important feature of a growing science. It does not develop and apply any distinctive method of investigation.

Such a method had already been contributed by Quetelet, the Belgian statistician. In his *Sur la théorie des probabilités appliquées aux sciences morales et politiques* (1846), *Du système sociale et des lois qui le régissent* (1848), and *Sur la statistique morale et les principes qui doivent en former la base* (1848) he set forth the one method of research by which the study of social phenomena will in time be brought to that exactness which characterizes older sciences.

Thus far, however, systematic treatises on sociology have been devoted almost wholly to the further exploitation of general concepts, and little progress has been made toward correlating these with statistical method. Sociological systems may be classified as physiographic, biological, psychological, and ethnographic. The physiographic systems attempt to explain all social evolution in terms of the action of environment upon character, conduct, and institutions. Montesquieu's *Esprit des lois* and Buckle's *History of Civilization in England* are the great classics among such works. Many of the so-called economic interpretations of history also belong in this group, while others fall into a different class. If by economy we mean the direct relation between organisms and their environment, the subsistence of plants, animals, and men upon the bounty of nature, and the whole struggle for existence, then the economic interpretation of history becomes identical with physiographic sociology. If, however, by economy we mean technical processes and industrial organization as in the social-economic philosophy of Karl Marx, the economic interpretation of history is an explanation of one phase of history by another phase. In strictness we ought to distinguish between an organic economy, meaning thereby the whole scheme of adjustment between organism and environment, and an industrial or business economy, a comparatively late development of human evolution. Social evolution is an incident of organic economy; industrial economy is an incident of social evolution. The writings of Simon N. Patten, *The Theory of Social Forces* (Philadelphia, 1896), *The Theory of Prosperity* (New York, 1901), and *Heredity and Social Progress* (New York, 1903), are essays in the explanation of society in terms of the organic economy.

What may be called the biological-organic conception of society presupposes more or less of the physiographic, but it does not accept the usual account of the influence of environment upon the community as adequate. Granting that social processes are in the last analysis to be accounted for by the relations of organism to environment, including competing organisms, the biologists raise the question of the nature of society itself, and answer that society is a compound organism, having its own anatomy and physiology, its pathology also, and assume that

these are the true subject matter of social science. Such conceptions have been developed by A. Schäffle, in the *Bau und Leben des socialen Körpers* (Tübingen, 1875), and Guillaume De Greef, in his *Introduction à la sociologie* (Brussels, 1886-89), as well as by many lesser writers.

In like manner the psychological conception of society presupposes the physiographic explanations, and it does not deny that in a general sense society may be regarded as organic. But it prefers Spencer's word, superorganic, because it insists that social relations are essentially facts of mind. Consequently it denies that society is explained until we know how the mental operations of individuals are combined in the common sentiments and opinions and expressed in the collective will of the community.

A psychological conception of society has been elaborated by Lester F. Ward in his *Dynamic Sociology* (New York 1883), *Psychic Factors of Civilization* (Boston, 1893), *Outlines of Sociology* (New York, 1898), and *Pure Sociology* (New York, 1903). The psychological conception has been further developed by Gabriel Tarde, *Les lois de l'imitation* (Paris, 1890), *La logique sociale* (Paris, 1895), and in numerous other writings. Tarde finds the elementary and distinctive social fact in imitation. Emile Durkheim, *De la division du travail social* (Paris, 1893), and Le Bon, *Psychologie des foules* (Paris, 1895), find it in the impression which the crowd makes upon the individual or the strong personality upon the crowd. Psychological interpretations also are those found in Edward A. Ross, *Social Control* (New York, 1901).

To the ethnographic systems of sociology belong those interpretations which emphasize the ceaseless struggles among tribes, nations, and races, and find ultimate explanations of social integration and differentiation in conquests and absorptions of the weak by the strong. A noteworthy system of this description is that of Ludwig Gumplowicz, *Der Rassenkampf* (Innsbruck, 1883), and *Grundriss der Sociologie* (Vienna, 1885). In these works the origins of social evolution are found in the conflicts, amalgamations, and assimilations of heterogeneous ethnic groups. To the same class of studies belongs the work of J. Novicow, *Les luttes entre des sociétés humaines* (Paris, 1893), in which the phenomena of conflict and alliance are treated as fundamental.

An obvious criticism upon the ethnographic schemes of sociology is that they take society already existent for granted. They do not account for the origins of society as such. The immediate antecedents of all social relations are facts of the psychological order. But these facts, of course, are themselves conditioned by biological and physiographic relations. It appears, therefore, that sociological theories should start from psychological premises, but that the correlation of all processes with the character of the physical environment should be recognized throughout. This is attempted by Franklin H. Giddings, *Principles of Sociology* (New York, 1896), *Elements of Sociology* (New York, 1898), and *Inductive Sociology* (New York, 1901). He derives all social phenomena from the like responses of a plural number of individuals to the same or like stimuli. Habitual like response constitutes mental and moral resemblance. Those who are mentally and morally alike become aware of their similarity. Awareness of resemblance beginning in mere feeling or sympathy, but becoming perceptive and rational, is called the consciousness of kind. Those who share the consciousness of kind develop their like responses to stimuli into a concerted volition which becomes a practical coöperation for useful ends, and systematic coöperation develops into the more or less enduring forms of social organization. This chain of processes has antecedents in the density and composition of the population, which, in turn, are determined by the character of the physical environment. Certain regions maintain homogeneous populations only. Others attract heterogeneous populations, the composition of which determines the possibilities of common response to stimuli.

SYSTEMATIC SOCIOLOGY.

Systematic sociology is naturally divided into four parts, namely: (1) The critical examination of data, methods, and problems, including the delimitation of sociology from other sciences; (2) descriptive sociology, an analysis and classification of contemporaneous social facts, with generalizations concerning social processes; (3) historical sociology, a study of the evolution of society from animal groupings and the communities of primitive men, down to the civilized nations of modern times; (4) theoretical or explanatory sociology, an attempt to derive from the description and history of society, and from the general principles of evolution, a theory of social causation.

CRITICAL EXAMINATION. Some of the chief topics falling within the first of these divisions of systematic sociology have been touched on in the foregoing account of the history of the science.

DESCRIPTIVE SOCIOLOGY. A few words of analysis of the subject matter, namely, social phenomena, may fitly introduce an account of the second division, descriptive sociology. A fact of the physiographic order is the starting point. Throughout the universe as known to man, objects of like kind are commonly grouped or segregated in space, and not scattered in a disorderly distribution. This is more particularly true of living organisms, all species of which have their respective geographic areas, and within these their favorite habitats or haunts. Plants of any given variety are usually found massed in particular places. Animal organisms are commonly found in swarms, bands, or flocks. Human beings live in hordes, tribes, and nations.

From this purely physical fact, we pass in the analysis of society to facts correlated with mental activity, and then to facts psychological. Of all the resemblances which may be observed in the units or individuals constituting a normal aggregation of living creatures, the two of chief importance are (1) morphological and physiological similarities produced by common descent and interbreeding, and therefore correlated with degrees of kinship; (2) similarities of nervous organization and mental activity which may or may not be closely associated with degrees of kinship. On the functional side the most general phase of like nervous organization is a like responsiveness to the same stimulus or to like stimuli. Under the same or like circumstances two or more animals or human be-

ings of like nervous organization behave in like ways.

The physical and mental resemblances of animals or of men thus alike are more or less distinctly known to the resembling individuals themselves. Animals sympathetically feel them. Human beings both feel them and intellectually perceive them and reflect upon them. This awareness of resemblance, in whatever degree it exists, is the consciousness of kind.

Human beings who intellectually as well as sympathetically apprehend their common nature find pleasure in communication and acquaintance. They discover that, responding to the same impulses, they form common purposes and can work together for common ends. Systematic coöperation thus arising holds men together in those relatively permanent relationships which constitute social organization. Social organization reacts upon the welfare of the community, furthering survival and individual happiness.

A complete description of society should comprise the following parts: (1) An account of the *social population* regarded as a physiographic phenomenon, an aggregation of organic units determined by the situation and resources of its habitat. (2) An account of the mental qualities and the conduct of the social population, its subjective resemblances and differences; its types of intellect and character; its antipathies and sympathies; its purposes, its choices, its collective will. These phenomena together are the *social mind.* (3) An account of the *social organization* which the social mind creates, and through which its purposes are achieved. (4) An account of the *social welfare* resulting from the policies which the social mind has approved, and from the normal functioning of the social organization.

(1) *The Social Population.*—An account of the social population must always be prefaced by a physical description of the territory occupied, although, strictly speaking, this is no part of sociology proper. This necessity has been recognized by the National Census Bureau. Since the census of 1890 an account of the dominant geographical features of our national domain has been included in the reports, and the distribution of population with reference to these features and to altitude, drainage basins, rainfall, and temperature, has been shown. Still more important would it be to show the distribution of population with reference to natural resources, namely agricultural fertility, mineral wealth, commercial and industrial opportunities.

Density of population is determined by the combination of two factors, namely the birth rate and the migration rate. No community of large dimensions is a purely genetic aggregation, maintained wholly by its birth rate. It is at the same time a congregation, a group brought together in part by the incoming of individuals or families born in other parts. Genetic aggregation itself is more or less complicated by variation, and this, in combination with the results of migration, gives rise to a composition of the population of elements more or less unlike. The physical differences thus comprised include organic variation, differences of age, the difference of sex, and the degrees of kinship. The degrees of kinship include consanguinity, or the nearest degree of blood relationship; propinquity, the somewhat remoter degree of neighboring communities that have much intermarried; nationality, the kinship of those who from their birth have been of the same speech and political association; potential nationality, or nationality in the making; ethnic race, glottic race, chromatic race, and cephalic race.

These compound race terms are used to avoid confusion. Ethnic race includes those nearly related nationalities which speak closely related languages and exhibit common psychological characteristics. For example, the Teutonic race includes the Saxon-English, the Dutch, the Germans, and the Scandinavians, all related nationalities. The glottic race is a yet broader kinship which includes those related ethnic races which at some remote period had a common culture and spoke the same language, as, for example, the Aryan glottic race, which includes the Teutons, the Celts, the Latins, and the Slavs. Chromatic race is that remote degree of relationship which includes all glottic races of the same general color of the skin and type of hair. Cephalic race is that most remote degree of kinship which is manifested in peculiarities of cranial structure. There are various gradations from the dolichocephalic, or long head of the negro, to the brachycephalic, or broad head of the Mongol.

The influence of the physical environment is seen in the degrees to which a population is heterogeneous, no less than in the degree of density. The causation, however, is perhaps more indirect. Naturally isolated regions, and regions that offer no great temptation to immigration, remain relatively homogeneous. Agricultural regions remain more homogeneous in population than mining regions or points of commercial or industrial opportunity. Regions of great agricultural fertility which share also in other advantages have usually in the world's history become heterogeneous in population through another cause also besides immigration. Armed invasion and conquest have brought differing, often alien, races into enduring contact, and their relations have commonly been determined more directly than has generally been supposed by the physical environment, which has caused a scattering or a concentration of the invaders or of the invaded, or of both. Sooner or later, whatever the admixture of nationalities and races, a large degree of amalgamation takes place in every population through intermarriage. While external influences may be tending to make a social population composite, its own internal forces work toward homogeneity and unity.

(2) *The Social Mind.*—The evolution of the social mind is determined by those physical facts of the density and composition of a social population which condition its subjective life. The more homogeneous a population is the more certainly will its individuals be moved by common impulses. Heterogeneous populations have varied interests, which is another way of saying that they respond to differing stimuli. Again, the variety and intensity of the stimuli themselves are determined partly by the environment, and partly by the demotic composition.

The like responses from which social activities are developed are temporary or habitual, and the stimuli of temporary like responses include nearly all of the initial causes of association. Where the stimuli are persistent and lead to habitual

conduct the whole nervous organization is molded accordingly. Mental and practical resemblances are created. The stimuli presented by external nature create types of emotion and of intellect. The stimuli of economic opportunity, leading to activities of utilization, create types of disposition. The stimuli which impel men to adapt themselves to their environment, when they have failed to adapt the environment to themselves, create types of character. Types of emotion, intellect, disposition, and character in their various combinations make up the various types of mind.

The important types of intellect are (1) those in which judgment is determined subjectively, by instinct, habit, and auto-suggestion; (2) those in which it is objectively determined, by external suggestion; (3) those in which it is subjectively determined, by emotion, mood, and temperament; and (4) those in which it is objectively determined, by evidence. The types of disposition are (1) the aggressive; (2) the instigative (which, instead of directly attacking, commanding, or inventing, tries to achieve the purposes of life by working through other men by suggestion, temptation, or persuasion); (3) the domineering (the disposition of those who have the power to impress others, and who love to assert authority); and (4) the creative, the disposition of those who assume responsibility and convert ideas into realities. The types of character are (1) the forceful, directly created by the struggle for existence which eliminates weaklings; (2) the convivial, which emerges when the struggle for existence has been so far successful that men may relax their efforts and devote themselves to pleasure; (3) the austere, which is produced by reaction against the excesses of the convivial; and (4) the rationally conscientious, which is produced by reaction against the excesses of the austere. The types of mind are (1) the ideo-motor, the activities of which are for the most part instinctive; (2) the ideo-emotional, which is emotional (rather than physically active), imaginative, suggestible, instigative, and convivial; (3) the dogmatic-emotional, marked by an extreme development of preferential attention, devotion to a dominant idea or belief, intolerance, domineering disposition, and austere character; (4) the critical-intellectual, in which the ideo-motor, ideo-emotional, and dogmatic emotional activities, always present in combination, are habitually kept under the control of a critical and vigilant intellect, and in which disposition is creative and character rationally conscientious.

These various mental and moral types found in any large population of civilized men have been produced by varying degrees of responsiveness to differing stimuli, and in their turn they determine the degree to which the whole population, or large sections of it, can share a common impulse. The more highly differentiated a population is into intellectual and character types the fewer are the stimuli which can move all to common purpose and action.

Each type affords the basis for a consciousness of kind, especially if the type is correlated with a tie of kinship, as nationality, or ethnic or color race, or a tie of local or class interest. The consciousness of kind is a complex state of mind, including sympathy, perceptions of resemblance, affection, and the desire for recognition. The consciousness of kind is almost as influential as the resources of the environment in determining the ethnic composition of a population. Thus, for example, the overwhelming preponderance of Teutonic elements in the foreign-born population of the North Central States of the United States is largely to be accounted for by the selective attraction of kinship.

Little if any less important than the perfect consciousness of kind is that consciousness of potential resemblance, of mental approach, which is the subjective side of assimilation. In a mixed population the different ethnic elements are continually undergoing changes which tend to break down their differences, and to establish a community of feelings and ideas. In like manner, differentiated types of mind and character when brought into close association tend to become alike, just as when under unlike influences they tend to become differentiated.

The causes of assimilation are conflict, toleration, and imitation. Gabriel Tarde, as we have seen, has undertaken to derive the entire social process from *imitation*. He recognizes in society, and in the universe at large, *conflicts* of action, as well as repetitions or similarities, and in his important work, *La logique sociale*, he develops the social aspect of a process of *adaptation*, whereby conflicts of action and repetitions of action are reconciled. This is to identify all similarities or repetitions of action with imitation. It would seem to be more accurate to recognize both original (or simultaneous) similarities, and repetitious (or sequent) similarities, and to identify imitation with the latter only. Moreover, inasmuch as it is through the establishment of sequences of similarity that adaptation or adjustment is brought about, imitation must necessarily be identified with adaptation. All of these processes are seen in perfection in a society of mixed elements. Conflicts sometimes result in the subjection of the weaker, sometimes in an equilibrium of strength, which is the basis of toleration, and sometimes in good feeling and imitation. So far, then, from being an original social process (which simultaneous like response to stimulus is), imitation is practically the auxiliary process of assimilation, whereby conflicts are softened and unlike elements are made alike.

Given, now, similarities of mind and character in a population, and a consciousness of kind, conditions are present for the formation of agreeing purposes, a concert of wills, and cooperation. Together these processes may be called concerted volition. The degree of resemblance, the consciousness of kind, the character of the stimuli, determine the extent of concerted action. This may be a temporary concerted volition, such as is seen in festivals, crusades, strikes, panics, insurrections, and political campaigns, or it may be a relatively enduring cooperation. Coöperation grows by indistinguishable gradations out of momentary like responses which may begin accidentally, as, for example, when bystanders run simultaneously to a person hurt or in trouble. The consciousness of kind is necessary to supplement such beginnings by making it evident to each of the participating individuals that they are working toward the same end, and that they are sufficiently alike to work together successfully. There must, how-

ever, be yet another factor. The purpose achieved by the combined action must be of mutual benefit, and the utility must be perceived.

Coöperation is public or private. It is public when all individual members of an entire natural society act together with one purpose and authority, either because all have the same desire, or because one or a few take the lead and others acquiesce or obey. An entire natural society viewed as coöperating is a State. When only a part of the social population responds to the same stimulus, and engages in coöperation without the participation or command of the State, although not without its tacit or implied consent, the coöperation is private or voluntary. Coöperative activities, whether public or private, are of four kinds, namely cultural, economic, moral or legal, and political. The order in which these activities have been named is the order of their genesis and evolution. Seemingly, but not in reality, this order denies the primitive; fundamental character of economic relations. Betrayed by a misconception of cultural activities, many sociologists have placed them wrongly in the series. Their true nature and history can be understood only when we remember the distinction already mentioned between organic and industrial economy. The organic economy of the world of vegetation shades into the instinctive economy of animals, and that in turn into the rational economy of mankind. For ages before it becomes an industrial or business economy, the practical life of man in his struggle with the forces of nature is a ceremonial economy, consisting chiefly of magic, incantations, and formal rites. Cultural activities are neither more nor less than ideas and practices of the early economies surviving in an industrial age. Language and manners begin among the lower animals as products of their efforts to appropriate the bounty of nature and of their struggles with hostile natural forces and with one another. Animistic ideas, the plastic and poetic arts, religious ideas and practices, originate in primitive human society, in attempts to understand and to master or propitiate the powers upon which man's life and comfort depend. They are all a part of the primitive economy.

It is out of these primitive economic activities that systematic industrial and commercial activities constituting the modern business economy are developed.

Coöperation in the development of moral thought and activity, including juristic activity, which is the public development of moral activity, has antecedents in both cultural and economic interests, but it also has characteristic stimuli of its own, chiefly injuries and wrongs.

Political coöperation on its public side is the governmental activity of the State. Private political coöperation includes all such lawful activities as the functions of political parties, and the conduct of campaigns, and such unlawful activities as insurrections and revolutions. Among the stimuli of political coöperation are superior power, to which enforced obedience is yielded, the impressive power of a strong personality manifested in leadership, and danger from foes. These are familiar causes that come readily to mind, but others less obvious are as important. Among them are those definite aims which political action seeks to achieve. They include the preservation of the group, its safeguarding, the maintenance of a certain character or kind in the population (an aim revealed, for example, in our immigration laws), and certain ideals of the preferred distinction or attainment of the community, as, for example, power, or prosperity and splendor, or justice, or liberty and enlightenment. Approximate political ends, or means to the attainment of the remoter ends just named, also are stimuli of collective action. Among them are the permanent possessions of the community, especially its territory, and policies in respect of population, or in respect of the habits, customs, and activities of the people.

Political coöperation itself, as distinguished from its stimuli or causes, is always a policy of some kind. Policies involve social choices, and these involve social valuations. The various ends which political action seeks to achieve are more or less useful to the community and such utilities are variously valued. Highest in value are ranked those objects for which the society exists, namely the concrete living individuals who compose the community, the social type or ideal, and the attainment of the community. Lower in the scale of values are placed all those political relations and possessions which are but means to the attainment of social ends.

The dominant stimuli of concerted volition are of the utmost importance in their relation to the unity, cohesion, and liberty of a people. A very large number of individuals resemble one another in only a few points, but some such points there always are, and a few stimuli are of such universal influence that they can bind very miscellaneous elements in a common purpose and action. Men differ widely in their response to the aspects and forces of nature, which appeal to emotion and to intelligence. They are more nearly alike in their response to economic opportunity, although some natures are more appealed to by the dangerous and exciting opportunities, others by the safe and uneventful ones. There is one stimulus which above all acts upon minds otherwise most unlike. This is the impressive power of a strong personality. The impassive and the emotional, the dull and the keen, the dogmatic and the critical, all yield to the man of daring and resourceful leadership. Accordingly, we find that highly miscellaneous aggregations of human beings are usually bound together by personal allegiance rather than by agreeing ideas and sympathies. Their social organization is authoritative rather than democratic.

The character of concerted volition thus varies with the stimuli to which men most easily and in large numbers respond. It is instinctive if the stimuli touch only the ideo-motor processes, as in many of our responses to natural forces, to danger, to menace, or to injury; obedient if the responses are of the ideo-motor sort and to a power which it is useless to resist, as in the relations of a conquered people to its conquerors; spontaneous if the responses are chiefly ideo-emotional and to stimuli more or less sensational or exciting; deferential or loyal if the responses are dogmatically emotional to authority, to belief, or to dogma; independent and idealistic if the responses are deliberative and to such stimuli as ideals or intelligently made plans.

When the like responses of many individuals have developed through the consciousness of kind

into concerted volition, the total resemblance thus established may be called like-mindedness. According as instinctive, sympathetic, dogmatic, or critical elements predominate does concerted volition vary in character from an almost instinctive action up through impulsive and contagious action to formal or fanatical action and ultimately to deliberative action. Like-mindedness, as a whole, may therefore be described as instinctive, sympathetic, dogmatic, or deliberative. Instinctive like-mindedness is found only in those ignorant populations in which the ideomotor type of mind predominates. Sympathetic like-mindedness, widely prevalent in all nations, is characterized by impulsiveness, suggestibility, susceptibility to the stimuli of emblem and shibboleth, imitativeness, and contagious emotion. Association in crowds is highly favorable to its genesis. Among the chief forms that sympathetic like-mindedness assumes are revivals, panics, sympathetic strikes, riots, and insurrections. Dogmatic like-mindedness is marked by dogmatically held belief, deference to authority, and fanatical action. It finds expression in zealous agitations, strong partisanship, and reliance on governmental power to regulate private conduct. Deliberative like-mindedness is characterized by inductive research, discussion, freedom of speech and of meeting, and rational action. It substitutes evidence for irrational modes of proof, and it is creative of the highest institutional activities.

The chief social bonds vary according to the situation, size, and composition of the population, its degree of mental and moral homogeneity, and the dominant stimuli of its activities. In small and comparatively isolated populations, ethnically and mentally homogeneous, there is a strong consciousness of kind, and the community is held together largely by acts of imitation and kindness. In the small and heterogeneous community, as a mining camp, for example, where men, strangers to one another at first, congregate in the pursuit of economic well-being, the sympathetic elements of the consciousness of kind, and imitation, are relatively unimportant factors. Conflict, sharp and decisive, between man and man, brings about a general condition of toleration and spontaneous justice, gradually supplemented by good will and helpfulness. In such a community there is always spontaneous allegiance to daring leadership and it becomes a social bond of great strength. Contagious emotion also is often a bond supplementing the others.

In a compound population, so made by invasion and conquest, the bond that ties the social system is the power of the conquerors and the submission and obedience of the conquered. The permanence of this bond depends upon that physiographic concentration and practical cohesion of the conquerors which insures the maintenance of their sovereignty. If the character of the country and the stimuli of economic opportunity and of opportunity for adventure are such that the invaders become dispersed, various personal efforts to establish sovereignty result in the creation of those untrustworthy bonds of intrigue and conspiracy which are made to appear of universal importance in the chapters of Machiavelli's *Prince*, and generally in the records of turbulent times. With the establishment of equilibrium through conflict, which eliminates excessively unlike and unequal elements from the population, conspiracy gives place to relations of contract, which thenceforward remains an important, or even the chief, social bond. Finally, in a complex population of highly differentiated elements which are undergoing assimilation, and which are already mentally alike in the important respect that they cherish common ideals, especially ideals of liberty and enlightenment, the chief social bonds may come to consist in fidelity, honesty, and social service.

Thus it appears from descriptive sociology that many of the theories of the origin and nature of society which appeared in political philosophy from the days of Aquinas and Dante down to those of Rousseau were within limits true. The sympathy or fellowship theories of the early Christian writers are true of small homogeneous communities. The natural justice theories of the early legal writers are true of small heterogeneous communities. The sovereignty theories which found full expression in the writings of Bodin are true of the compound communities formed by invasion and conquest. The intrigue and conspiracy theories of Machiavelli are true of compound populations which have been reduced to disorder by the disintegrating influence of chronic conflict. Society in this condition is the 'state of nature' of Hobbes, while the state of nature of Locke and Hooker exists when the elements of the population are sufficiently alike to live in toleration, if not in sympathy. Given conditions of toleration and natural justice, the creation of a higher social order through good understanding and contract may always be looked for.

(3) *The Social Organization.*—The social organization is the outcome of two conditions, namely (1) permanent relations of domicile and coöperation, and (2) the approval and sanction of such relations by the general will. Social organization is therefore an expression of like-mindedness in the population. Peculiarities in its development are partly accounted for by the passion of like-minded people to make the community more and more homogeneous in mental and moral qualities, and partly by a growing appreciation of the value of unlike-mindedness as a means of variation and progress.

The forms of organization are (1) the private and the public, (2) the authorized and the unauthorized, (3) the unincorporated and the incorporated, (4) the component, and (5) the constituent. Authorized forms are institutions, and an institution may be defined as a social relation that is consciously permitted or established by adequate and rightful authority, that is, in the last resort, by sovereignty. The social composition is that grouping of individuals by dwelling place which makes up the series of component societies named below. A chief characteristic of the social composition is the commingling in each group of both sexes and all ages, and the consequent ability of each component society to perpetuate itself and live an independent life if it were cut off from all the rest of the world.

Component societies are of two great types, the ethnic or tribal, and the civil or demotic. Ethnic societies are almost purely genetic aggregations. A real or fictitious blood relationship is their chief social bond. Civil societies are partly genetic, but also largely congregate associations.

Each consists of individuals bound together by habitual intercourse, mutual interests, and coöperation, emphasizing their mental and practical resemblance, and giving little heed to their blood relationships. Ethnic societies may be metronymic or patronymic. A metronymic group is one in which all relationships are traced through mothers. A patronymic group is one in which all relationships are traced in the male line through the fathers. The series of component groups in ethnic society is: family, horde, tribe, confederation. The horde is a small aggregation of families, usually a wandering camp, comprising twenty-five to a hundred persons in all. The tribe is a community created by the consolidation of hordes, or by the growth and differentiation of a single horde, occupying a defined territory, speaking one language or dialect, and conscious of its unity. The confederation is a number of tribes united for war or other purposes, but maintaining a social organization on the basis of kinship, and therefore not developed into a true civil State. In civil society the composition series is: families, hamlets, villages or parishes, towns, communes or cities, counties or departments, kingdoms, republics or other commonwealths, federal States or empires.

The combination of small into large groups is made possible by the broadening consciousness of kind and the passion to perfect a mental and moral homogeneity throughout a widening area. This passion has both a sentimental and a practical aspect, the latter being found in a relatively greater security and the diminution of conflict through the extension of mental agreement.

The social constitution embraces all those specialized and correlated associations which carry on diversified social activities. Each has a defined object in view, and its members are selected with reference to their interest in its purpose and their ability to contribute to its realization. The social constitution is made possible by the differentiation of ideas and habits.

Constituent societies, like component, are ethnic or civil. In tribal communities the constituent society is usually not entirely differentiated from the component. The family, or the tribe, or a segment of one or the other, does duty in discharging some special function which, in civil society, might be performed by an association quite separate from the component group and specially organized for the purpose. The most interesting partially differentiated organization in tribal society is the clan. The clan is constituted of those persons who are descended from a common ancestor or ancestral group in a single line, through the mother or through the father. It is therefore only half of a natural group of consanguinii. Its functions are cultural, economic, and juridical. It preserves traditions, it owns common property, and enforces rights and obligations among its members, especially in matters of marriage and vengeance. The clan is known by various names in ethnology and in history, more familiarly by its Roman name *gens* (q.v.).

Often in tribal society is found a brotherhood of related clans which is called, from its Greek form, the *phratry*. The tribe, primarily a component group, is a military organization, and the confederation is a political organization.

Besides these component-constituent groups there are in tribal society certain special associations, almost always secret in their organization and functions. The most important are religious secret societies.

In civil society the household, the incorporated village, the municipality, the county, and the State are all component-constituent groups. They are purposive associations with definite functions, each approximately but not completely identical with a compound group. The State, for example, the supreme political organization, is never precisely identical with the commonwealth or the nation regarded as a component society, since the latter always includes inhabitants who are neither voters nor even citizens in the State. As in ethnic, so in civil society, the associations which are completely differentiated from the social composition are voluntary organizations. They include cultural associations, the most important of which is the Church; economic associations, the most important of which are business corporations; moral and juristic associations, the most important of which are philanthropic organizations, and voluntary boards of arbitration; and political associations, the most important of which are the great political parties.

The stability of organization depends upon a recognition by the community that organization must benefit the organized, and that in a highly specialized social constitution expert knowledge is of vital importance.

(4) *The Social Welfare.*—In studying the social welfare we investigate the social functioning. The sum of the ends for which society exists is social warfare. Such ends are approximate or ultimate. The immediate results of efficient social organization are certain general conditions of well-being, in which all members of the community may share. They include the security of life and property which the political system maintains; the liberty and the justice which it is the business of the legal system to maintain; the material well-being which is created by the economic system; and the knowledge and the command over nature which are created by the cultural system. Collectively these proximate ends are public utilities. The ultimate end of society, as Plato and Aristotle so clearly recognized, is the perfection of personality, the creation of the social man. In the evolution of the social personality all phases of the life of the individual are affected. Vitality, mentality, morality, and that special aspect of morality which may be called sociality, are broadened and strengthened, or they are diminished, by the relations which man bears to his fellows. No two individuals are affected by social conditions in quite the same way or degree, and therefore the population is differentiated, in respect of these matters, into classes.

The primary distribution of the population according to vitality is into physically normal persons and defectives, and the normal are conveniently graded into the high, the medium, and the low vitality classes. In the high vitality class are those individuals who have a high birth rate, a low death rate, and a high degree of bodily vigor and mental power. This class is found chiefly in the well-to-do agricultural sections of the population. The medium vitality class roughly corresponds to the business and professional men of the large towns and great cities. The low vitality class is created chiefly

by unsanitary conditions in great cities, but it is found also in an ignorant, uncleanly part of the rural population. The defective include the blind, the deaf and dumb, and the congenitally deformed.

In respect of mentality the population is differentiated into the normal and the mentally abnormal or defective. In respect of morality it is differentiated into the moral and the immoral, and in respect of sociality into the social and the unsocial. The mentally normal, the moral, and the social are conveniently divided into the low, medium, and high classes. The mentally abnormal include the neurotic, e.g. the emotionally unbalanced and the hysterical, the intellectually unbalanced or insane, and the idiotic. The immoral include those to whom the word is ordinarily applied, also the vicious and the depraved. Morality is here used to mean objectively that conduct which the community as a whole approves, and subjectively self-respect and that desire for the good opinion of others which Spencer has called ego-altruism. Viciousness is that degree of variation from the prevailing practical resemblance in matters of conduct which the community disapproves and informally punishes. Sociality as here used means objectively a willing and efficient sharing in the acquaintance and coöperation of society, and subjectively altruism, thoughtfulness for others, sympathy, kindliness, and helpfulness. The opposite of sociality is criminality—that degree of variation from the prevailing practical resemblance in matters of conduct which the community disapproves and formally punishes. The low sociality class is composed of those in whom the social nature is positive but undeveloped. In the medium sociality class this nature is highly developed. Those who belong to this class are socialized. In the high sociality class the social nature is developed in the highest degree. Those who belong to this class are both socialized and individualized. They not only participate in altruistic activities, but they also plan and lead them. The unsocial include the de-individualized, who contribute nothing to society, but are dependent upon it; the desocialized, who have become hostile to society and forcibly prey upon it; and the degraded, who are both de-individualized and desocialized. The de-individualized include paupers, and the desocialized include criminals.

The supreme achievement of society and the final measure of the success or failure of any State is its contribution of great personalities, great creations of art, great thoughts and ideals, to that universal society which embraces all mankind and endures through the ages of history. Measured by this standard some petty city States, like Athens and Florence, have been among the supreme examples of social evolution.

Historical Sociology. In historical sociology we again study the phenomena of the social population, the social mind, the social organization, and the social welfare, but on a larger scale. We inquire into the evolutionary origins of society and we find that long before man appeared upon the earth social relations had become established in the animal world, and that man undoubtedly began his career with an endowment of social instinct. Social relations and mutual aid influenced natural selection, and thereby affected the whole course of animal evolution. Association in its beginnings, therefore, was zoögenic. Through a further development of association, language, animistic ideas, arts, and religions came into existence, and the animal mind was converted into the human mind, and the animal body into the human body. This stage of evolution was anthropogenic. A higher evolution of the consciousness of kind created tribal instincts and customs, and gradually built up the highly complex system of ethnic society. This was ethnogenic association. Finally, through the recognition of mental and practical resemblance irrespective of kinship, civil or demotic society came into existence. The demos or people, as distinguished from the tribe, appeared, and with it civilization.

In animal societies all the essential phenomena of a social population may be observed, but those of the social mind are of the most rudimentary sort. There is no social organization beyond the slight beginnings of family life, and a loose formation of bands or flocks.

In anthropogenic association the phenomena of the social mind begin to assume importance. Language is a product of association and reacts upon it. Vocal signs become conventionalized through imperfect imitation. The power of conceptual thinking, correlated with the evolution of language, is correlated also with association, for every true concept is a product of more than one mind. Conceptual thinking and self-consciousness enormously multiply the possible responses to stimuli and bring into the consciousness of kind all its higher reflective elments.

The great problems of ethnogenic association are those of the genesis of family, clan, tribe, and confederation; of the priority of relationship through mothers over relationship through fathers; and of that gradual disintegration of organization based on kinship, by the growth of an essentially feudal association based on personal allegiance, which prepared the way for civilization.

The primitive family, we may now feel reasonably sure, was an unstable pairing arrangement, usually of short duration. From this form were differentiated polyandry (q.v.), polygamy (q.v.), and monogamy. (See Family; Marriage.) The steps by which the clan was formed perhaps cannot be quite clearly traced. Primitive man counts relationships in one line of descent only. This fact accounts for the exclusion from the kindred of one-half of all those persons who are equally near in blood. The development of the tribe and the confederating of tribes is a consequence chiefly of warfare, which often brings weak groups under the domination or protection of the strong, or leads related tribes to combine against their common foe. When new tribes are formed by the subdivision of one that has grown too large for subsistence on the tribal domain, families from each clan of the older tribe may go into the new tribe. In this way a cluster of tribes may be closely related in blood and speak dialects of a common language, conditions highly favorable to confederation and subsequent evolution as a nation.

Tribal confederations that have become civil States have undergone a further evolution, however, which has destroyed many of the characteristic features of tribal organization. To begin with, the metronymic system is superseded by

the patronymic. The transmission of property and office from father to son thus made possible leads to the differentiation of certain families as of superior rank. If a primitive agriculture has been supplemented by pastoral industry, wealth in cattle becomes one of the chief temptations to engage in tribal wars. Chieftains as leaders of successful expeditions receive an exceptionally large number of stolen cattle, and the privilege of pasturage on the border lands of tribal territory. They obtain also as retainers and herdsmen the broken and ruined men of other tribes, whose clans have been destroyed, and whose future position in society is secured only by their allegiance to a powerful protector. From such beginnings a rude tribal feudalism develops, which encroaches steadily upon the earlier kinship system. (Consult Sir Henry Maine, *Lectures on the Early History of Institutions.*) Evidences of this stage of evolution are found in various bodies of barbarian law, but especially in the Irish and Welsh codes.

When a confederation of tribes becomes thoroughly consolidated by war or otherwise, the chieftaincy of the confederation, having become hereditary, may develop into a kingship through the uniting into one of the offices of chief military leader, supreme judge, and high priest.

At this stage the ethnic society is on the point of passing over into civilization. If it is tempted by the pressure of population upon the means of subsistence to migrate to a more productive region, and after conquering the occupiers of a coveted territory, reduces them to task work, and establishes itself permanently on the soil, it undergoes a further development of feudal organization, and in the course of time begins to include as members of the settled clans and tribes any newcomers who come to reside among them.

Civilization once established develops through three stages, which are well marked so far as the structure, policy, and activities of society are concerned, but which to some extent overlap and run into one another chronologically. The breakdown of the kinship system, and the intermingling of men of diverse origin at centres of industrial and commercial activity, are presently followed by the beginnings of assimilation and amalgamation. When this process is perceived, the possibility of creating a new ethnic unity on a broad scale—the unity of a people, one in language, in religion, and in standards of conduct—is seized upon, and a passion for homogeneity begins to express itself in certain great policies. The attempt is made by military campaigns to bring into one political organization adjacent peoples nearly related in blood, in language, and in tradition, and to annex any territory which may form with that already occupied a geographic unity. The militarism thus developed is of itself a powerful unifying agency, and it is supplemented by policies of religious unification, and by harsh systems of sumptuary legislation and of criminal law.

When the work of nation-making by policies of unification has been completed, the first stage of civilization yields to a second, which is a result of the liberation of energies no longer demanded in military activity. Commerce, travel, and learning receive a new impulse. The comparative study of peoples and institutions leads to criticism and discussion. The authoritative régime is subjected to review; it begins to disintegrate under impeachment and resistance. Rationalism and liberalism create the great institutional products of civil liberty and constitutional law. Men no longer care as of old for perfect mental agreement; they encourage the growth of independence and variety. This is the age of progress, of the liberal-legal civilization.

Presently, however, wide liberty, divergence of mental type, and the multiplication of differing interests begin to threaten social cohesion. Powerful and unscrupulous men abuse their liberty, using it to take an unfair advantage of others and to curtail the liberties of the weak. Freedom of enterprise and of contract are followed by an enormous increase of wealth and of population. But the wealth is concentrated in relatively few hands and increasingly large numbers of working men find that they are not receiving a proportional share of well-being. Growing inequality places the severest strain upon the social system, and compels the community to limit liberty in some measure by equality. Political and legal equality come first, but measures of economic equality also are demanded, and great educational enterprises try to achieve an equality of cultural opportunities. This is the modern democratic movement, and the third stage of civilization.

Explanatory Sociology. This department is as yet in a very incomplete state of development. So far as the physical side of social evolution is concerned, it exhibits the same phenomena of integration, differentiation, and increasing definiteness of organization, that material bodies undergo. The cause also is the same, namely the equilibration of energy between bodies overcharged and contiguous bodies undercharged. There is such an equilibration between a population and its environment, and all the energy that society is enabled to expend it derives from the bounty of nature, supplemented by industrial activities. There is such an equilibration of energy between strong and weak States and between strong and weak races. The transformation of the weak by the strong can never cease until equilibrium is established. The transformation need not be a military conquest, however, or even an economic exploitation. So far as physical law is concerned, it may equally well be an uplifting of the weak to higher planes of sympathy and intelligence by the hands of the strong. The extent to which the process may thus be philanthropic depends upon the growth of the consciousness of kind. Originally limited to the kindred of horde and clan, it has broadened into tribal and at length into a national consciousness. To-day it is becoming a human consciousness. In all this transformation every change obeys the laws of parsimony. Motion follows the line of least resistance and human activities try to achieve given results with the least expenditure of effort. In is only a corollary of this law that activity is conditioned by the consciousness of kind, since strangeness and antipathy are resisting conditions. It is only another corollary again that dogmatic like-mindedness develops out of sympathetic, and deliberative like-mindedness out of dogmatic; for the results achieved by the lower forms of concerted volition, namely the instinctive and the

sympathetic, are wastefully accomplished as compared with those achieved by the higher forms. These laws are otherwise formulated as the great laws of diminishing and increasing returns, long familiar to economic science, but equally true in the realm of social phenomena. When the lower forms of activity are carried far they begin to yield diminishing returns. When old channels of activity are obstructed energies break through into new channels, and for a time new adjustments yield increasing returns. By these laws we account for the substitution of reason for impulse, of deliberation for mob-like action. The substitution is in a broad sense a natural selection. Social activities and forms begin unconsciously. In the course of time men, becoming aware of the social relations that have spontaneously developed, try to perfect them. They create institutions and carry out policies. The unconscious operations of nature now again assert themselves. Some of the products of man's invention, proving useful, and promoting his welfare, survive. Others perish and are forgotten. Those social forms survive which, like organisms successful in the struggle for existence, yield on the whole increasing returns of useful conversions of energy.

BIBLIOGRAPHY. See works quoted in text.

SOCKEYE (corruption of Indian name *sauqui* or *sawkeye*). One of the most prominent of Pacific salmon, the blueback. See SALMON.

SOCLE. A plain plinth, forming a pedestal for the support of a statue, column, etc.

SOCORRO. A town of the Department of Santander, Colombia, formerly its capital, 145 miles northeast of Bogotá (Map: Colombia, C 2). It has crooked streets and flag pavements. Its chief industries are the weaving of mantles and the manufacture of straw hats. Its population in 1886 was about 20,000. The town was founded in 1540 and after its destruction in 1681 moved to its present location. In 1781 a formidable revolt took place here, and in 1810 there was issued a formal declaration of independence from Spain.

SOCOTRA, or **SOKOTRA,** sō-kō'trȧ or sōk'ō-trȧ. An island in the Indian Ocean, at the entrance to the Gulf of Aden, about 147 miles east of Cape Guardafui (Map: Africa, K 3). It is 80 miles long and 55 miles broad. Area, 1382 square miles. The centre of the island is occupied by the Haghier chain, attaining nearly 5000 feet. The coasts are partly fringed by cliffs, mostly low. There is a long plain of drifted sand along the southern shore. The valleys are well watered and rich in vegetation. The climate is hot and dry. The dry season lasts from May to October, during which time there is practically no rain in the lower parts of the island, and many of the rivers dry up entirely. The flora is of great variety and abounds in many aromatic species, such as dragon's-blood, myrrh, frankincense, aloe, etc.

There is little agriculture. The principal products of the island are butter and incense which are exported to Bombay, Zanzibar, and Arabia. The natives keep extensive herds of goats and cows. Politically Socotra is a protectorate of Great Britain, but foreign control extends hardly beyond the collection of taxes. The population is estimated at 10,000—a mixed race of Arabs and Hindus who are found along the coasts, and the Sokotri, the aborigines of the island, who are also believed to be of Arabic origin, and are confined principally to the mountainous districts. Alexander is credited by the Arab geographers with having founded a settlement in Socotra, which came later under Persian influence. It was occupied by the Portuguese at the beginning of the sixteenth century and now forms a part of the Sultanate of Kishin. It was annexed by Great Britain in 1886.

SOCRATES (Lat., from Gk. Σωκράτης) (B.C. 469-399). An Athenian philosopher. He lived through the age of Pericles, the Peloponnesian War, and the tyranny of the 'Thirty,' and was condemned to drink the hemlock cup by the restored democracy. He was of humble but genuine Athenian stock. Plato makes him compare his own art of delivering pregnant minds of their conceptions to the profession of midwife exercised by his mother. He received as a boy only the old-fashioned elementary education in music and gymnastics, but later familiarized himself with the modern education of the Sophists in rhetoric and dialectics, with the speculations of the Ionic philosophers, and all the new culture of which Periclean Athens was the focus. Plato represents him as veiling behind an ironical profession of ignorance an ingenuity and resourcefulness that made him more than a match for the most distinguished specialists. Xenophon, while affirming that Socrates held the proper study of mankind to be the moral life of man, adds that he was by no means unversed in the curious inutilities of mathematical and physical speculation. He followed at first the craft of his father, a sculptor, and tradition attributed to him a group of the three Graces draped, which Pausanias saw on the Acropolis. The greater part of his mature life, however, was spent in the market place, streets, and public resorts of Athens in conversation with all who cared to listen, or whom he could lure to render an account of their souls and submit themselves to his peculiar style of interrogation. In Plato and Xenophon he has no other occupation, except, of course, the normal civic duties of every free-born Athenian. He served as a hoplite with conspicuous bravery at Potidæa (B.C. 432), Delium (424), and Amphipolis (422). In B.C. 406 the chances of the lot made him a member of the senate of the 500 and presiding prytanis on the day when the illegal motion was offered to condemn to death by one vote the generals who had neglected or been unable to rescue the wounded after the naval battle of Arginusæ. He refused to consent to the putting of the vote, defying the anger of the mob, even as a few years later he withstood the tyrants and refused to execute the command of the 'Thirty' bidding him assist in the arrest of an innocent citizen, Leon of Salamis. By his wife, Xanthippe, he had three sons, one of whom was a lad at the time of his father's death. The tradition of Xanthippe as the scolding wife and typical shrew is ignored by Plato, who merely mentions her presence in the prison on the last day before and after the dialogue on immortality.

In the *Apology* or defense which Plato puts into his mouth on his trial, Socrates half seriously affirms that his peculiar way of life was a mission imposed upon him by God. The oracle of Delphi (the story presupposes that he was already well known), in response to the question

of a more enthusiastic than judicious disciple, had pronounced Socrates the wisest of men. Conscious that his only wisdom was self-knowledge, the knowledge that he knew nothing, he proceeded to test those reputed wise at Athens, the poets, the statesmen, the artists. He found in each case that the value of the specialist's particular talent was more than nullified by his inability to render a rational account of it, and the false conceit of a larger knowledge not possessed, and he inferred that it was his divinely appointed mission to force upon his fellow men self-knowledge and conviction of ignorance as the first step toward self-betterment. Such a profession exercised for thirty or forty years amid a gossipy and jealous population brought him more notoriety than popularity.

The effect was heightened by the startling contrast, to Greek feeling, between Socrates's exterior and the dignified and impressive demeanor to be expected of a great teacher and leader of men. The ungainly figure; the protuberant belly; the Silenus-like masque with bald head, prominent eyes, and wide, upturned nostrils; the beggarly garb; the vulgar instances and homely parables in which his wisdom disguised itself; the personal oddities of the man; his hour-long fits of staring abstraction; his ingenious art of cross-examination entrapping the cleverest into self-contradiction; the mysterious admonitions of his 'Dæmon' or inner voice; the habitual asceticism of this barefoot philosopher, content with bread and water and one garment summer and winter, yet able on occasion to outdrink and outwatch and outtalk the boldest revelers and most brilliant wits of Athens—all these traits as felt by the inner circle of disciples and portrayed by Plato's art only add piquancy to the demoniac personality thus half revealed and half concealed. But to the multitude they only made up a figure of comedy. In the *Clouds* of Aristophanes (423), the man whom we conceive as the anthithesis of the Sophistic rhetoric and the founder of moral and mental as opposed to physical philosophy appears as the master of a 'thinking shop' in which pale-faced disciples burrow into the bowels of earth, and where unscrupulous fathers can have their sons taught the art of making the worse appear the better reason, while he himself aloft in an aërial basket "treads the air and contemplates the sun." The comedian is not bound to make nice distinctions. For Aristophanes, Socrates was an apt comic embodiment of the new learning which the conservative poet detested. Like the Sophists, he occupied the young men with something else than the care of healthy bodies, and he resembled the Sophists in the unsettling effect of his questioning of the established order. Plato, for artistic reasons, puts these attacks of comedy as manifestations of the popular prejudice in the forefront of the *Apology*. The immediate causes of Socrates's condemnation were probably the hostility aroused by his ironical comments on the democratic method of deciding great questions by the lot or the show of hands, and the distrust felt by the average man for the leader of the traitor Alcibiades, the tyrant Critias, and the Philo-Laconian Xenophon. In 399 a poet, Meletus, a demagogue, Anytus (a prominent democratic politician), and an orator, Lycon, presented a formal charge in the Court of the King (Archon): "Socrates is guilty of rejecting the gods of the city and introducing new divinities. He is also guilty of corrupting the youth." The first charge relates to the 'Dæmonion,' or divine something of Socrates about which a large and unprofitable literature exists. In Plato, it is merely the voice of an inward spiritual tact always operating negatively as a check to actions, however trifling, opposed to the true interests of the soul. Other writers have reported it with superstitious, psychological, or pathological flourishes after their kind. Corruption of youth was the serious charge. The case came before a jury of about 501 members. Socrates declined (the story goes) the professional aid of the orator Lysias, and defended himself in a speech of which the spirit is preserved in the Platonic *Apology*, a masterpiece of art in its seeming simplicity. Condemned by a small majority, he took still higher ground when it came to fixing the penalty, and proposed, so Plato says, that it be maintenance in the Prytaneum as a public benefactor. At the solicitation of Plato, Crito, and other friends, he finally proposed to pay a fine. The jury naturally voted by an increased majority for the alternative penalty of death, which Socrates doubtless expected and was willing to accept as an appropriate crown of martyrdom and a release from the approaching infirmities of age. The rest is told in two immortal dialogues of Plato. The *Crito* shows us Socrates in the interval of respite caused by a religious festival and the absence of the sacred ship at Delos, resisting the importunities of his friends that he should escape by bribing his jailers, and so, as he says, in very deed teaching young men by his example to violate the law. The *Phædo* depicts the long final day spent with friends in conversation on the immortality of the soul, and the last scene of all, "how bravely and cheerfully the first great martyr of intellectual liberty met his doom."

The self-control which he exemplified and the self-knowledge which he inculcated are the keynote of Socrates's philosophy. The basis of his ethics was the principle or paradox that all vice is ignorance, and that no man is willingly bad. In logic Aristotle tells us that there are two things which we may justly attribute to him: inductive arguments and the quest for general definitions. But, as he left no writings, we cannot tell what system of thought, if any, he constructed on these presuppositions and by this method. We may divine that he was much more than the homely Johnsonian moralist of Xenophon, and something less than the poetic dialectician and metaphysician of Plato. But we cannot know. Plato was a cunning dramatic artist, and the seeming simplicity of Xenophon's *Memorabilia* is no warrant of its historical fidelity. Ten years of adventure presumably separate Xenophon from the conversations which he professes to record. Both the *Memorabilia* and the minor Platonic dialogues doubtless contain many genuine reminiscences of the 'real Socrates.' But we cannot use them to construct a body of doctrine for him. The tremendous influence of his personality remains one of the great facts of history. Through the 'complete Socratic' Plato and his pupil, Aristotle, he determined the entire subsequent course of speculative thought. The 'imperfect Socratics,' the founders of the other schools of ancient philosophy, drew their in-

spiration from partial aspects of his character. The Socrates who wore one garment summer and winter, walked barefoot on the snow, and exclaimed at the fair: "How many things there are that I do not need," became through Antisthenes the author of the Cynic way of life and the Stoic philosophy. The Socrates who was all things to all men, and outdrank Aristophanes at Agathon's banquet, was the model of Aristippus, the founder of the Cyrenaic (and Epicurean) philosophy of experience and pleasure. The ideal Socrates depicted in the Platonic *Apology, Crito, Gorgias,* and *Phædo* became, in the decay of the old religions, the chief religious type of the ancient world, and to such moralists as Epictetus, Seneca, Dio Chrysostomus, and Marcus Aurelius the very embodiment and guide of the higher life.

The best authority accessible to the English reader is Zeller's *Socrates and the Socratic Schools* (Eng. trans., 1877). Joel's *Der echte und der Xenophontische Socrates* (Berlin, 1901) is an ingenious attempt to extract the 'real Socrates' from Xenophon's *Memorabilia.*

SOCRATES, Prison of. The name popularly given to three chambers hewn in the face of the hill of Philopappus at Athens. The chambers are of small dimensions, and one of them is connected with a vaulted rotunda, the circular opening of which was originally closed by slabs. The arrangement in general is similar to that of the so-called Treasury of Athens at Mycenæ.

SODA (It. *soda,* soda, saltwort, glasswort, contracted from *solida,* fem. of *solido,* from Lat. *solidus,* hard, solid; connected with OLat. *sollus,* Gk. *ὅλος, holos,* Skt. *sarva,* whole, entire), or Sodium Carbonate, Na_2CO_3. A white solid substance having a strong alkaline reaction and crystallizing with ten molecules of water, $Na_2CO_3+10H_2O$. In commerce it appears both with and without water. Crystallized, hydrated sodium carbonate, also called 'sal soda,' is the common washing-soda; sodium bi-carbonate, or 'acid' sodium carbonate, $NaHCO_3$, is the common cooking-soda, an important constituent of all baking powders. The dry carbonate, Na_2CO_3, is used in enormous quantities in the manufacture of glass and soap. Native sodium carbonate, or 'sodium sesquicarbonate,' $Na_2CO_3.2NaHCO_3+2H_2O$, is found to some extent in all dry regions, notably in Hungary, Egypt, and the deserts of Africa, Asia, and North and South America, but in no other country does it occur in greater quantities than in the region lying east of the Sierra Nevada Mountains. The mineral is known as *trona.* Formerly most of the sodium carbonate of commerce was derived from the ashes of certain plants, chiefly barilla and kelp, but at the present time the quantity derived from all other sources is insignificant when compared with that manufactured from common salt.

Natural soda, which is the residue obtained by the evaporation of natural alkaline waters without the aid of artificial heat, occurs as white incrustations on the alkali plains; the most important deposits, however, are in the form of 'sinks' or lakes without outlet, in which the leachings and drainings of the alkali plains have been collected and concentrated. In the United States the waters of three lakes only, Albert Lake in Oregon and Mono and Owens lakes in California, are estimated to contain more than 118,000,000 tons of sodium carbonate and nearly 30,000,000 tons of sodium bi-carbonate. Owing to the great distance from large Eastern markets and the consequent high freight charges, this immense supply of raw material for the manufacture of the various sodium salts has not entered into successful commercial competition with the brine deposits of the Eastern States. The production of soda ash (sodium carbonate), sal soda (hydrated), sodium carbonate, sodium bi-carbonate, and caustic soda (sodium hydrate), from 50 works in the United States during 1902, aggregated more than 500,000 tons, which involved in the manufacture approximately 1,000,000 tons of salt. The quantities and values of these sodium compounds produced in the United States during 1900, according to the Twelfth Census, are given in the subjoined table:

	Pounds	Value
Soda ash	781,306,000	$4,559,656
Sal soda	126,498,000	875,243
Sodium bicarbonate	138,712,000	1,332,765
Caustic soda	233,566,000	3,170,280
Total	1,280,082,000	$10,237,944

Manufacture of Sodium Carbonate. Sodium carbonate is manufactured commercially by several processes, of which only two are of importance—the Leblanc process and the Solvay process, each named from its respective inventor. The *Leblanc process* consists of three stages: (1) The conversion of common salt (sodium chloride) into sodium sulphate by the action of sulphuric acid, accomplished by the aid of heat in a reverberatory furnace. This stage is called the salt-cake process, 'salt cake' being the technical name applied to the sodium sulphate product. Two chemical reactions are involved in this stage, viz.:

$$NaCl+NaHSO_4=Na_2SO_4+HCl$$
$$NaCl+H_2SO_4=NaHSO_4+HCl$$

(2) The decomposition of the sodium sulphate, by means of calcium carbonate and coal, at a high temperature in a furnace, the result being a crude product known as 'black ash,' which consists of sodium carbonate, calcium sulphide, calcium oxide, calcium carbonate, and small quantities of other substances. The principal reactions taking place in this stage of the process may be expressed by the following chemical equations:

$$5Na_2SO_4+10C=5Na_2S+10CO_2$$
$$5Na_2S+7CaCO_3=5Na_2CO_3+5CaS+2CaO+2CO_2$$

(3) The extraction of the sodium carbonate by treating the black ash with water to dissolve the sodium salt, which yields a solution called 'tank liquor,' containing also sodium hydrate. The crystals of sodium carbonate are obtained ultimately by evaporation, and, when calcined, yield the dry sodium carbonate of commerce, technically known as soda ash. The calcium sulphide remaining undissolved in the residues is treated for its sulphur content, and the hydrochloric acid produced in the first stage of the Leblanc process is saved for use partly as such, partly for making bleaching powder. In this manner from first to last there is practically nothing wasted except the calcium.

The transformation of the salt cake into black ash is generally carried out in a reverberatory furnace (Fig. 1), called a 'black-ash' or 'balling

furnace.' Usually 100 pounds of salt cake, 100 pounds of calcium carbonate, and 50 pounds of coal dust form a charge. The hand-worked furnace is a long reverberatory with a hopper in the roof through which the charge is dropped into the first hearth near the flue where the heat is not

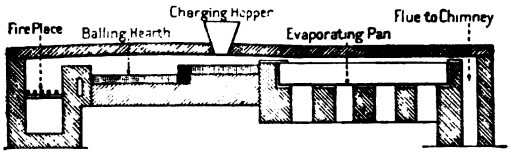


FIG. 1. LONGITUDINAL SECTION OF A BLACK-ASH FURNACE.

very high; after thorough drying and heating, the materials are raked down onto the second or 'balling hearth,' where the temperature is usually about 1000° C., and thoroughly rabbled until it becomes a thick, pasty mass from which carbonic acid gas escapes freely. As soon as the salt cake is decomposed, the charge begins to stiffen and carbonic acid gas (CO) is evolved, as is shown by jets of blue flame (the carbonic oxide is produced by the action of coal on the excess of calcium carbonate present). The charge is then raked into a ball and removed from the furnace to an iron truck, the escaping bubbles of gas causing the pasty mass to become porous. The shallow iron pan between the furnace hearth and the flue to the chimney is used for the evaporation of the tank liquor obtained by the lixiviation of the black ash in the third stage of the process. The furnace operation is quite difficult, and although the heavy tools are suspended by chains, the temperature is so intense that the quantity a man can handle at one time is limited to 300 pounds. In order to eliminate expensive hand-labor and to work larger charges, revolving cylindrical black-ash furnaces are used; the common size, 16 feet long and 10 feet diameter, can treat as much as two tons of salt cake in a single charge. The lixiviation of the black ash is accomplished in a series of terraced tanks each with a false bottom perforated with small holes. The uppermost tank is charged with black ash, and water added to cover the charge; the solution of sodium carbonate formed, being heavier than water, sinks to the bottom of the tank and is passed through the perforations, and is withdrawn by means of a pipe which delivers it to the second tank in the series, through which it passes to the third tank, etc. The operation is continuous, fresh water being added to the nearly exhausted ash in the uppermost tank to yield an unbroken flow of strong liquor. Good tank liquor contains approximately 23.5 per cent. of sodium carbonate and sodium hydrate.

The French Academy of Sciences in 1775 offered a prize for a method of making sodium carbonate from salt. Among the processes submitted was that of Nicolas Leblanc, which was of promising merit, and, being granted a patent in 1791, he began the manufacture on a commercial scale. The Leblanc process is regarded as the most important discovery in the entire range of chemical manufactures, and has furnished about one-half of the world's supply of soda. The fact that it produces both hydrochloric acid and bleaching powder as by-products has enabled it to survive competition, but the recent introduction of electrolytic processes, which also yield bleaching powder as a by-product, is a serious menace to its future.

The *Solvay process*, or 'ammonia-soda process,' is based on the fact that hydrogen-ammonium carbonate, $(NH_4)HCO_3$, is decomposed by a strong solution of common salt, yielding sodium bi-carbonate and ammonium chloride, as shown by the equation:

$$(NH_4)HCO_3+NaCl=NaHCO_3+NH_4Cl.$$

The brine is first saturated with ammonia gas, and the cooled ammoniacal liquor is subsequently charged in carbonating towers with carbonic acid gas under moderate pressure; the sodium bi-carbonate, being much less soluble, separates out and leaves the more soluble ammonium chloride in solution, from which the ammonia is subsequently recovered by treatment with lime. The sodium bi-carbonate is converted into sodium carbonate by calcination, and the carbonic acid gas evolved is again utilized to carbonate a second quantity of ammoniacal brine. In this cycle of operations no sulphuric acid is required and no hydrochloric acid is evolved.

The reactions involved in the ammonia-soda process were discovered by H. C. Dyar and T. Hemming about 1838, but the process was not perfected until 1873. In 1863 Ernest Solvay, a Belgian, constructed the first successful plant, which has led to an enormous development of the industry.

SODIUM HYDROXIDE, SODIUM HYDRATE, OR CAUSTIC SODA, NaOH. This is of importance next to sodium carbonate only, on account of its use in enormous quantities in refining fats and vegetable oils, and in the manufacture of soap. In appearance it is a white solid, strongly caustic and highly deliquescent. It is readily soluble in water, with evolution of heat, and by cooling a concentrated solution to 8° C., a deposit of crystalline sodium hydrate ($2NaOH + 7H_2O$) is obtained.

Sodium hydroxide is one of the strongest alkalies known. On a large scale it is manufactured by the action of milk of lime (calcium hydrate) upon a boiling solution of sodium carbonate, whereby calcium carbonate is precipitated, and sodium hydrate remains in the solution. The reaction is

$$Na_2CO_3+Ca(OH)_2=CaCO_3+2NaOH.$$

After the removal of the solid calcium carbonate the solution is evaporated, and finally yields the solid sodium hydrate. One of the chief sources of supply is the tank liquor, produced in the manufacture of sodium carbonate by the Leblanc process (see above). The tank liquor, containing essentially sodium carbonate and sodium hydrate, is heated to boiling and an excess of lime is stirred into the mixture. The sodium sulphide present in the tank liquor is oxidized to sodium sulphate by the combined action of air injected into the mixture and of sodium nitrate, which is added for the purpose. The solid calcium carbonate is separated by filtration. The action of sodium nitrate is shown by the following equation:

$$NaNO_3+2H_2O=NaOH+NH_3+4O.$$

The oxygen set free reacts upon the sodium sulphides present, and converts them into the sulphate.

In recent years sodium hydrate has been manufactured to a considerable extent by the electrolysis of brine, also by the direct electrolysis of fused common salt. The two most recent electrolytic processes are the Aussig 'bell process' and

the Acker process. The former has been under development at Aussig. The broad features of the method are illustrated in Fig. 2. In this diagram, *a* represents the anode, *b* the solution of

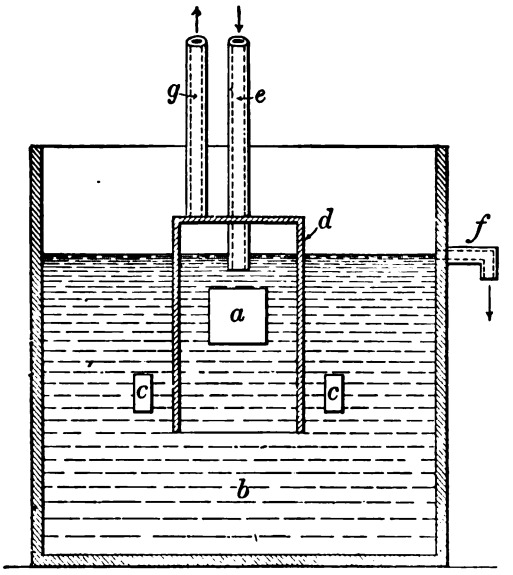


FIG. 2. DIAGRAMMATIC SKETCH OF THE 'BELL' TYPE OF GRAVITY CELL.

common brine which forms the electrolyte, *d* the bell, and *c* the cathodes; *e* is the pipe through which fresh brine is supplied and *g* serves to carry away the chlorine gas. The caustic alkali solution overflows through the pipe *f*. A current efficiency of from 85 to 90 per cent. is claimed and the strength of the alkali solution varies between 100 and 150 grams of caustic soda per liter.

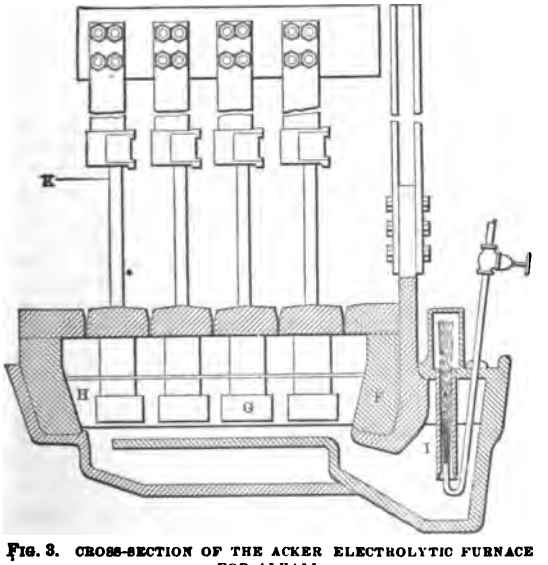


FIG. 3. CROSS-SECTION OF THE ACKER ELECTROLYTIC FURNACE FOR ALKALI.

In the Acker fusion process, which is employed at Niagara Falls, N. Y., the electrolyte consists of fused salt and the cathode of molten lead; a diagrammatic sketch of the cell is shown in Fig. 3. K represents the connections between the bus bar and the anodes G, F the cell walls, H the upper level of the fused salt electrolyte, which overlies the molten lead cathode I. A steam jet at the side of the cell circulates the molten lead cathode, and the decomposition of the lead-sodium alloy produced is accomplished in a separate vessel.

SODA WATER. See AËRATED WATERS.

SODEN, zō'den, HERMANN, Baron (1852—). A German Protestant theologian, born in Cincinnati, Ohio. He was educated at Esslingen, Urach, and Tübingen, and was a vicar in various places from 1875 to 1880. From 1880 to 1882 he was a pastor in Dresden, then in Chemnitz (1882-86), and in 1887 he took charge of the Jerusalemskirche in Berlin. In 1893 he was appointed professor of theology in the University of Berlin. His publications include: *Philipperbrief* (1889); *Was thut die evangelische Kirche?* (3 eds., 1895); and *Palästina und seine Geschichte* (1899). He also contributed vol. iii. to the *Handkommentar zum Neuen Testament* (1890), of which he was one of the editors.

SÖDERHAMN, sē'dēr-hämn'. A seaport of Sweden on a small inlet of the Gulf of Bothnia, 135 miles north of Stockholm (Map: Sweden, G 6). It has flour and saw mills, iron works, breweries and woodpulp factories, and exports timber, iron, and woodpulp to the value of nearly $5,000,000 annually. Its harbor has recently been enlarged and improved, and is entered each year by vessels aggregating about 300,000 tons. Population, in 1901, 11,258.

SÖDERTELJE, sē'dēr-tĕl'ye. A town of the Län of Stockholm, Sweden, 15 miles southwest of the city of Stockholm, of which it is practically a suburb (Map: Sweden, G 7). The town is on the Södertelje Canal, which connects Lake Mälar with the Baltic. It is a noted summer resort, with mineral springs. There are machine shops, match factories, and spinning and weaving mills. Population, in 1900, 8207.

SODIUM (Neo-Lat., from It. *soda*, soda, saltwort, glasswort). A metallic element isolated by Sir Humphry Davy in 1807. (See POTASSIUM; CHEMISTRY.) Compounds of sodium occur distributed in large quantities, especially sodium chloride, which is found in nature as halite or rock salt, and in solution in sea and other natural waters. Sodium also occurs in the form of nitrate (soda nitre, or Chile saltpetre), which is found abundantly in superficial deposits in the rainless districts of the Pacific coasts of Chile, Peru, and Bolivia; as the sulphate (Glauber's salt) or mirabilite; as the carbonate; and in numerous minerals of more complex composition, such as cryolite, the various feldspars, including albite, labradorite, oligoclase, and the zeolites. Sea plants, as well as animal organisms, likewise contain sodium salts. The preparation of the metal itself may be accomplished by decomposing sodium hydroxide by electrolysis. It was first prepared on a large scale by Sainte-Claire Deville, who reduced sodium carbonate with coal and chalk at a white heat, and collected the resulting metallic sodium under coal oil in suitable condensers. A commercial process now extensively employed was

invented in 1886 by Castner, and consists in reducing sodium hydroxide by an iron carbide prepared by adding finely divided iron to melted pitch and coking the mixture in large cylinders. The metal is distilled over into condensers and is purified by passing through linen under petroleum at about 100° C. (212° F.).

Sodium (symbol, Na; atomic weight, 23.05) is a very soft white metal possessing a silvery white lustre when freshly cut. Its specific gravity is 9.85, and its melting point is 95.6° C. (204° F.). It is one of the best conductors of heat and electricity, and is one of the most electro-positive metals. Its vapor is colorless when seen in thin layers, but has a purple or violet tinge by transmitted light when seen in quantity. Sodium burns with a bright yellow flame when heated in the air. When thrown into cold water it decomposes it, liberating hydrogen, but not with sufficient heat to ignite the latter, unless the temperature of the water is above 60° C. (140° F.). The metal readily takes up oxygen, and in consequence finds its chief use in the preparation of aluminum, boron, magnesium, and silicon by reduction from the oxides. Sodium forms alloys with many metals, and the amalgam with mercury is employed in the extraction of gold. It combines with oxygen to form a monoxide (Na_2O) and a peroxide (Na_2O_2), of which the former may be obtained by heating sodium hydroxide with sodium, yielding a gray mass, which melts at a dull red heat; while the latter, which is a white solid that deliquesces in the air, is formed by heating metallic sodium in oxygen.

The salts of sodium are among the most important of the commercial chemicals. Chief among them is *sodium acetate*, which is prepared by treating acetic acid or vinegar with sodium carbonate, filtering the solution and concentrating to crystallization. *Sodium arsenate* is prepared by fusing arsenious acid, sodium carbonate, and sodium nitrate, dissolving the resulting mixture in hot water, filtering, and crystallizing. The colorless crystals thus obtained are official in the pharmacopœia and are used in skin diseases and as a substitute for arsenic. Mixed with sugar this salt is frequently employed as a poison for flies. *Sodium bromide* and *sodium iodide*, which are prepared by decomposing, respectively, ferrous bromide and ferrous iodide with sodium carbonate, are white crystalline compounds that find some use in medicine as nervous sedatives. *Sodium carbonate*, which is the soda of commerce, is a colorless crystalline odorless compound with a strong alkaline taste, which is found native in many mineral waters and as efflorescences in the neighborhood of soda lakes. *Sodium bicarbonate* or 'acid' sodium carbonate is made by passing a current of carbon dioxide through a strong solution of sodium carbonate until it is saturated and then allowing the mixture to crystallize, yielding a colorless compound which finds extensive use in the manufacture of baking powders and of artificial mineral waters, and also in medicine as an antacid. *Sodium hypophosphite* is prepared by treating calcium hypophosphite with sodium carbonate and recrystallizing the resulting product from alcohol. It forms small colorless crystals that are deliquescent and finds some use in medicine as a restorer in exhausted conditions of the nervous system, and as an ingredient in the syrup of hypophosphites. *Sodium hyposulphite*, or more correctly *sodium thiosulphate*, is prepared by decomposing soluble calcium thiosulphate with either sodium sulphate or sodium carbonate, resulting in the formation of a colorless crystalline compound that is efflorescent in dry air, and is used in photography as a solvent for the unaltered silver chloride or bromide on the film, and in medicine as an alterative and resolvent. *Sodium silicate* is prepared commercially by fusing sodium carbonate with sand and a small quantity of charcoal in a reverberatory furnace and then dissolving by prolonged boiling in water. (See WATER-GLASS.) *Sodium sulphite* is obtained by passing gaseous sulphur dioxide into a solution of sodium carbonate and evaporating the mixture to dryness or crystallization, resulting in a colorless, transparent, efflorescent compound that is used as a bleaching agent under the name of *antichlore*, in the manufacture of paper, for the purpose of removing the last traces of chlorine from the bleached pulp; it is also employed in medicine as an antiferment. See also SODA; SALT; SALTPETRE; GLAUBER'S SALT; etc.

SODOM (Heb. *Sĕdōm*) and **GOMOR'RAH** (Heb. *'ămōrāh*). Two ancient cities near the Dead Sea, almost invariably spoken of together in the Bible. With Admah, Zeboiim, and Bela or Zoar, they formed the five 'cities of the plain,' which on account of the wickedness of their inhabitants are said to have been destroyed by a rain of brimstone, perhaps also accompanied by an earthquake. Lot and his family were the only ones who escaped. His wife, however, for disobedience was turned into a pillar of salt (Gen. xix. 1-29; Deut. xxix. 23; Zeph. ii. 9; Isa. i. 9). Some scholars say the cities were at the northern end of the Dead Sea, others at the southern end. Names like Jebel Usdum (Sodom) and Zoara or Zughar (Zoar), at the southern end, point to a tradition of the existence of the cities there. The biblical story of the destruction of the cities is considered by many critics similar to tales found among Arabs (and other nations) regarding the sudden disappearance of places. Those who thus deny the literal truthfulness of the narrative call attention to the weird character of the district around the Dead Sea, fatal to plant and animal life, as naturally suggesting the thought of some catastrophe. See LOT.

SODOM, APPLE OF. A name sometimes given to the fruit of Solanum sodomæum. Many unsatisfactory attempts have been made to determine the source of the true apple of Sodom or mad apple of the Dead Sea region mentioned by Strabo, Tacitus, and Josephus, and described as beautiful to the eye, but filling the mouth with bitter ashes if tasted. One explanation is that it is a kind of gall (q.v.) growing on dwarf oaks. These beautiful, rich, glossy, purplish-red galls are about 2 inches long and 1½ inches in diameter, and are filled with an intensely bitter, porous, and easily pulverized substance.

SO'DOMA, IL, properly GIOVANNI ANTONIO BAZZI (1477-1549). An Italian painter of the High Renaissance. He was born at Vercelli (Piedmont) and studied for six years with Martino de Spanzattis, a painter on glass. He then came under the influence of Leonardo da Vinci, probably at Milan, and though he maintained an

individual quality, his work took color from that master. In 1501 he was established at Siena, the city with which he was chiefly identified for the remainder of his life. In 1507 or 1508 he visited Rome and was commissioned by Pope Julius II. to paint frescoes in the Camera della Segnatura of the Vatican. Only a fresco on the ceiling remains, all the rest having been removed when he was superseded by Raphael. His relations with Raphael were friendly, however, and he thereafter showed traces of Raphael's artistic influence. Raphael painted Sodoma's portrait beside his own in "The School of Athens." Sodoma visited Rome a second time, where he lived with Agostino Chigi and painted in Chigi's Villa Farnesina the "Marriage of Alexander and Roxana," his most beautiful picture of an antique subject, and "Alexander in the Tent of Darius." For his portrait of the Roman Lady Lucretia he was made a knight by Leo X. In 1515 he returned to Siena, and his movements for the succeeding ten years are but vaguely recorded. From 1525-37 he resided at Siena, where he died February 15, 1549.

Sodoma is to be seen at his best in his frescoes at Siena, where, after his Roman period, he painted a large "Flagellation" for San Francesco, the "Ecstasy" and the "Swoon of Saint Catharine" in San Domenico, a "Nativity" in Sant' Agostino, and a large altarpiece in Santo Spirito. In the Convent of Monte Oliveto, near Siena, is a series of twenty-five scenes from the life of Saint Benedict, belonging to the artist's early period. His panel paintings include a "Saint Sebastian" in the Uffizi, a perfect representation of "suffering, refined and spiritual, without contortion or spasm;" an "Ascension" at Naples; a "Sacrifice of Abraham" at Pisa; a "Caritas" at Berlin; and a "Leda" in the Borghese Gallery, Rome. Sodoma's influence on the Sienese school was very great and resulted in a new manner practiced at Siena. The popularity of his work has increased with recent writers. His merits are the power to express tenderness, sensuous grace, and an exalted sweetness and suffering. He was often inferior in the composition of his pictures, weak in the handling of draperies, and uncertain in the setting-up of individual figures. Consult: Jansen, *Leben und Werke des Malers Giovanantonio Bazzi von Vercelli* (Stuttgart, 1870); Frizzoni, in *Nuova Antologia* (August, 1871).

SODOMY. The unnatural carnal intercourse of persons with each other or with beasts; so called from the form of vice practiced in the ancient city of Sodom. It is punished by death or long terms of imprisonment in all civilized countries.

SOEMMERRING, *zē'mĕr-ing*, SAMUEL THOMAS VON (1755-1830). A German anatomist and physiologist of note, born at Thorn, educated at Göttingen, and chosen professor of anatomy at Mainz in 1784. He defended the theory that the nerves act independently of the brain, and he considered the brain as not essential to life. His division of the cranial nerves into twelve pairs instead of nine is generally adopted. His principal works were: *De Basi Encephali et Originibus Nervorum*, etc. (1778); *Von Hirn- und Rückenmark* (1788); *Vom Baue des menschlichen Körpers* (1791); *Ueber das Organ der Seele* (1796); and *De Morbis Vasorum Absorbentium Corporis Humani*, etc. (1795). Consult his biography by Stricker (Frankfort-on-Main, 1862), also *Lancet*, vol. ii., p. 243 (London, 1830); Wagner, *Soemmerrings Leben und Verkehr mit seinen Zeitgenossen* (Leipzig, 1844).

SOEST, *zĕst*. A town in the Province of Westphalia, Prussia, 34 miles southeast of Münster (Map: Prussia, C 3). Relics of its mediæval splendors still survive in its churches. Of these the finest is the "Meadow Church," restored in 1850-52. The tenth-century Romanesque cathedral has excellent mural paintings. The manufactures include machinery, cigars, tinware, bricks, sugar, and lamps. There are markets for cereals and cattle. In the Middle Ages Soest was an important member of the Hanseatic League, and had a population of over 25,000. Its municipal law, the *jus Susatense*, was the oldest in Germany and served as the model for the other Imperial free towns, Lübeck, Hamburg, etc. Population, in 1900, 16,724.

SOETBEER, *zĕt'bâr*, ADOLF (1814-92). A German economist, born at Hamburg. After studying at Göttingen and Berlin he returned to Hamburg, where in 1839 he published a monograph on the customs duties of that city. In 1840 he became librarian, and in 1843 secretary of the Hamburg Chamber of Commerce, where he laid the foundation of the excellent system of commercial statistics for which Hamburg is still noted. In 1846 he published *Denkschrift über Hamburgs Münzverhältnisse*. Subsequently he published a great number of monographs and pamphlets, defending the cause of gold monometallism. Until his death he ranked as the leading defender of the single gold standard. The adoption of the gold standard by Germany was due in no small measure to his efforts. Among his most important works are: *Denkschrift betreffend die Einführung der Goldwährung in Deutschland* (1856); *Zur Frage der deutschen Münzeinheit* (1861); *Beiträge zur Geschichte des Geld- und Münzwesens in Deutschland* (1862); *Edelmetallproduction und Wertverhältnis zwischen Gold und Silber seit der Entdeckung Amerikas bis zur Gegenwart* (1879); *Materialien zur Erläuterung und Beurteilung der wirtschaftlichen Edelmetallverhältnisse und der Währungsfrage* (1885).

SOFALA, *sō-fä'lä*. A name applied formerly to a considerable part of Portuguese East Africa (q.v.), but confined at present to a single district under the administration of the Mozambique Company. The seaport of Sofala, in latitude 20° 10′ S., has a population of about 1300.

SOFIA, *sō'fē-ä*, or **SOPHIA** (Bulg. *Sredetz*). The capital of the Principality of Bulgaria, situated in a plain between the Vitosha Mountains and the main Balkan chain, 206 miles southeast of Belgrade and 300 miles northwest of Constantinople (Map: Balkan Peninsula, D 3). It has been largely rebuilt since 1878 and presents the appearance of a modern city with electric lighting and street railways and creditable public buildings. In old Sofia are the ruined Sofia Mosque, the Mosque of Buyuk-Jami, now used as a national museum and library, and the vast baths with hot springs. The principal modern buildings are the palace of the Prince, the university buildings, the new cathedral of Saint Alexander, the house of Parliament, and the various administration buildings. Sofia has a university (founded in 1888) with about 500

students, colleges for boys and girls, and a military school and college. It is the industrial centre of Bulgaria and has manufactures of silk, cloth, tobacco, etc. Situated at the converging of the principal highways of the principality and connected by rail with Constantinople, Belgrade, and Saloniki, the city is well adapted for its prominent position as a commercial centre, and has an extensive export trade in agricultural products, hides, and attar of roses. The population was 30,400 in 1887 and 67,920 in 1900, principally Bulgarians. Sofia is identified with the *Serdica* or *Sardica* of the Romans, which became the capital of *Dacia Ripensis*, and about 344 was the seat of a Church council. The town was plundered by the Huns in the fifth century, and at the beginning of the ninth century it was taken by the Bulgarians. In 1382 it passed to Turkey, and in 1878 it was occupied by the Russians under Gurko.

SOFTA (Turk. *sōfta*, from Pers. *sōxtah*, *sūxtah*, burned [with zeal], p.p. of *sūxtan*, Av. *saoc*, Skt. *śuc*, to burn). The name applied in Turkey to the students of the theological schools. They are drawn largely from the lower classes and are as a rule opposed to Occidental ideas. Because of this they have often opposed the Turkish Government. From them are appointed the Mollahs and the Ulemas (qq.v.). There are now about 16,000 Softas in Constantinople.

SOFT GRASS (*Holcus.*) A small genus of grasses. The English name is derived from the soft and abundant pubescence of the two British species, creeping soft grass (*Holcus mollis*) and woolly soft grass, meadow soft grass, or velvet grass (*Holcus lanatus*). The latter is found most abundantly on damp soils, on which it is sometimes sown for forage. The former is generally found on dry, sandy, or other light soils. The roots sometimes extend five or six feet in a season. These grasses are seldom planted for forage, except in situations little suited to more valuable species.

SOFT-GROUND ETCHING. A species of etching in which the ground ordinarily used is softened by a mixture with tallow. In ordinary etching (q.v.) the subject to be represented is scratched directly upon the ground by means of the needle; but in soft-ground etching it is drawn with a lead pencil upon a piece of fine-grained paper stretched over the ground. The impression thus produced upon the ground, when bitten, gives the effect of pencil or chalk lines in the proof. Soft-ground etching is not much used, because the same effects can be obtained by lithography and heliographic processes.

SOFT-SHELLED TURTLE. Any of various fresh-water turtles of the family Trionychidæ, represented in the United States by the two genera Amyda and Aspidonectes. These turtles take their name from the characteristic leathery consistency of the shell, well seen in the common soft-shell (*Aspidonectes ferox*), which is about twelve inches long. Another species, the 'leather turtle,' is *Amyda mutica*. They are carnivorous, strongly web-footed, and entirely aquatic, with long serpentine necks. The eggs are laid in the ground near shore. Times of drought and winter are spent in the mud underneath water. The flesh of these turtles is said to be of superior quality.

SOGDIA'NA (Lat., from Gk. Σογδιανή, *Sogdyanē*, Av. *Sγγδa*, OPers. *Suguda*, Pers. *Sγγd*). An ancient country in Central Asia, comprising part of modern Turkestan, bounded on the northeast by the Jaxartes, which separated it from Scythia, and on the southwest by the Oxus, which separated it from Bactria. It was conquered by the Persians in the reign of Cyrus and was invaded by Alexander the Great, after whose time it fell into the power of the Seleucidæ (q.v.).

SOGNE FJORD, sŏg'nē fyōrd. An inlet in the Province of North Bergenhus, in the eastern part of Norway. It pierces the land for a distance of nearly 90 miles, and in some places has a depth of 4000 feet. The region through which it extends is remarkable for its many glaciers and the wild grandeur of its scenery.

SOHN, zōn, KARL FERDINAND (1805-67). A German painter of the Düsseldorf school. He was born in Berlin and studied there under Wilhelm von Schadow, whom he followed to Düsseldorf and afterwards accompanied to Italy. He treated principally mythical and poetic subjects of a highly romantic character, and attained great proficiency in color, especially in treatment of the nude. In 1832 he was made professor in the Düsseldorf Academy, where he exercised an important influence in the development of German painting. Among his best-known works are: The "Rape of Hylas" and the "Lute Player" (1832), both in the National Gallery, Berlin; "Romeo and Juliet" (1836); "Tasso and the Two Leonoras" (1839, Düsseldorf Gallery); "Rinaldo and Armida," "Loreley," and "Donna Diana" (1840, Leipzig Museum). His nephew and pupil, WILHELM (1830-99), born in Berlin, painted at first biblical subjects, such as "Christ Stilling the Tempest" (1853, Düsseldorf Gallery), then devoted himself to genre scenes, masterly in characterization and drawing and of great coloristic charm, in the manner of the Belgian school. Among these are: "A Question of Conscience" (1864, Karlsruhe Gallery); "Consultation at the Lawyer's" (1866, Leipzig Museum); and "Warrior of the Seventeenth Century" (1869, Dresden Gallery).

SOHO SQUARE. A square in London, dating from the time of Charles II. and once called King's Square, from the name of its builder. It was at one time one of the fashionable quarters of the city.

SOHRAB AND RUSTUM. A narrative in blank verse by Matthew Arnold, based on the Persian legend of Rustam (q.v.).

SOIL (OF., Fr. *sol*, from Lat. *solum*, ground, soil, foundation, sole). A term applied to the superficial unconsolidated portion of the earth's crust (regolith), which is composed of broken and disintegrated (weathered) rock mixed with varying proportions of decayed and decaying organic matter (humus). The processes by which soils are formed from the parent rocks are mechanical and chemical, and in some cases biological. The fertility of a soil will, therefore, be determined to a considerable extent by the character of the parent rock and the stage of its decomposition. Thus granite, being richer in the elements of plant food, yields a more fertile soil as a rule than the siliceous sandstones.

According to the method of their formation

soils are classed as sedentary or transported. When a soil is found resting on the parent rock from whose decay it has originated it is spoken of as *sedentary soil*. It may show a gradual transition from the fully formed soil at the surface to the solid rock beneath. With this class may be grouped the humus or peaty soils due to accumulations of organic matters in bogs, swamps, and marshes. In many cases the residual products have been removed from the place of their formation by the action of water, ice (glaciers), and wind and deposited elsewhere in the form of clayey, sandy, or loamy soils, often representing the mingling of material from several different sources. This type is termed *transported soil*, and, though naturally very variable in character, includes some of the most productive soil in the world. The most important soils of this class are the alluvial soils, which often form a broad flood-plain (q.v.) bordering a river or a delta (q.v.) at the mouth, as in the case of the Nile and the Mississippi rivers. In the northern half of the United States much of the soil is of the *glacial drift type* and represents the débris of decayed rocks of various kinds brought down from the north during the glacial period (q.v.).

Æolian soils are formed by wind action. They include: (1) Sand dunes, those shifting, sandy soils heaped up by wind action upon many ocean coasts and the shores of inland seas. (See DUNE; DUNE VEGETATION.) (2) Ash soils, the accumulations of ashes ejected by volcanoes. The deposits are often of considerable extent and are frequently very fertile. Much of the highly productive region around Mount Vesuvius, in Italy, is of this kind. Such soils are found in Nebraska, Colorado, and Montana. Soils derived from disintegration of volcanic lava are of frequent occurrence, as, for instance, in the Hawaiian Islands, in Idaho and other Northwestern States. The loess soils of China and other countries are of æolian origin, although the so-called loess soils of America are believed to be for the most part of alluvial origin. Soils containing an excess of soluble salts are found scattered throughout regions of deficient or irregular rainfall and are known as alkali soils (q.v.).

Humous, peaty, or moor soils are composed largely of organic matter. The purest types are represented by the accumulations of peat (q.v.) formed in ponds and swamps; marine marshes, and muck soils represent a less pure variety. When properly drained and aërated and, in the case of marine marshes, freed from excess of soluble salts, they often prove very productive.

In practice soils are classified as gravelly, sandy, loamy, calcareous, humus, or peaty, etc., distinctions based on the fineness of the soil particles and the relative proportions of sand, clay, lime, and humus, which they contain. Soils are also frequently classed as light and heavy, according as they are easy or difficult to till. In this sense a sandy soil is termed 'light' (easy to till), although actually having greater weight than a clayey soil, which is termed 'heavy' (difficult to till). The productiveness of a soil depends chiefly upon its chemical composition and its physical properties. Chemical and physical or mechanical analysis separates soil constituents into two general classes: (1) food constituents, and (2) physical constituents. The food constituents necessary to plant growth are nitrogen, silicon, sulphur, phosphorus, chlorine, aluminum, calcium, magnesium, potassium, sodium, and iron in various forms of chemical combination. The mechanical constituents include clay, silt, sand, humus, etc., which act as a physical support to plants and have an indirect fertilizing value. They form as a rule the large proportion of the soil mass, usually 90.95 per cent.

CHEMICAL PROPERTIES. The average chemical composition of soils of humid and arid regions is shown in the following table prepared by Kilgard:

AVERAGE CHEMICAL COMPOSITION OF SOILS OF HUMID AND ARID REGIONS

CONSTITUENTS	Humid region (average of 466 soils)	Arid region (average of 313 soils)
	Per cent.	*Per cent.*
Insoluble matter	84.031 } 87.687	70.565 } 76.135
Soluble silica	4.212 }	7.266 }
Potash	.216	.729
Soda	.091	.264
Lime	.108	1.362
Magnesia	.225	1.411
Iron oxid	3.131	5.752
Alumina	4.296	7.888
Phosphoric acid	.113	.117
Sulphuric acid	.052	.041
Carbonic acid	.....	1.316
Water and organic matter	3.644	4.945
Humus	2.700	.750
Nitrogen in humus	5.450	15.870
Nitrogen in soils	.122	.101

The proportions of actual fertilizing constituents in soils, viz. potash, phosphoric acid, nitrogen, lime, etc., are relatively small, arid soils showing somewhat larger proportions than humid soils. Other mineral constituents are usually present in sufficient quantity to supply the needs of plants. Humus (q.v.) is of special importance as a soil constituent not only on account of its beneficial effect on the physical properties of soils, but because it is an important source of nitrogen, as well as of phosphoric acid, potash, lime, etc. The proportions of the latter constituents found in humus in the form of humates represent to a large extent the amounts available in the soil for plant food. The nitrogen of humus is converted into a form (nitrate) available for plants by the process of nitrification (q.v.).

PHYSICAL PROPERTIES. The physical properties of soils which are of special importance are color, weight, fineness of division or texture, structure or arrangement of particles, adhesiveness, and relations to gases, heat, moisture, and dissolved solids. Variations in these properties determine to a large extent the productiveness of soils. Good tilth and texture with their accompaniments of good water conditions, aëration, and temperature are fully as essential to plant growth as an adequate supply of plant food. Physical properties of soils are, however, so largely dependent upon their natural character, and can be modified to such a limited extent by man, that it is of the greatest importance in practice carefully to select soils with special reference to the suitability of their physical characteristics to the crop to be grown.

The physical properties of soils are determined to a large extent by the proportions they con-

tain of stones, gravel, sand, clay, lime, and organic matter. A soil containing much sand is dry, warm, and easy to work, but as a rule is naturally poor and has little absorptive power for water and fertilizing matter. A soil in which clay predominates is apt to be cold, wet, and difficult to till, but to have a high absorptive power not only for water, but for fertilizing matter as well. Clayey soils generally contain more plant food than sandy soils. Humus makes soils light in weight and dark in color and greatly increases their absorptive power. Lime not only has value as a plant food, but improves the structure of both clayey and sandy soils and corrects acidity. It also promotes the decomposition of organic matter and aids nitrification.

Mechanical analysis, which separates the particles of a soil into six or more grades of fineness ranging from stones and gravel through sand and silt to clay, furnishes a valuable means of securing data for judging of the physical properties of soils. The productiveness of a soil depends very largely upon its texture and structure, i.e. the size of the particles and their arrangement. These determine very largely the circulation of water and gases, the solution and retention of plant food, and the growth of plant roots. When the grains are single or separated the soil is said to have a puddled structure, while a compounding of the soil grains gives a flocculated structure. The latter is desirable in all good soils, as it increases the pore space and facilitates the circulation of air and water through the soil mass. Flocculation may at times be caused by frost action, but more frequently is produced by the action of lime. Fertilizers vary in their action on soils, some, like nitrate of soda, producing puddling, while others produce flocculation. The finer the soil particles the greater the injurious effects of puddling, clay soils suffering from this cause more than sandy soils. Puddling increases the water-retaining power, and thus retards percolation, but may accelerate capillary rise of water in the soil layers. Flocculation of the particles decreases the retention of water, aids percolation, and may retard evaporation. Water passes more easily from a coarse to a fine layer than from a fine to a coarse one, a fact taken advantage of by the farmer when he firms the soil by rolling and then loosens the surface by harrowing, which destroys the capillary spaces and so checks the escape of water into the air. The water is thus held near the surface, where it is readily accessible to the roots of plants. The action of the mulch (q.v.) depends upon this principle. In humid regions the clay particles of the soil are usually washed down to a layer several inches below the surface, the surface layer being called the soil proper, and the lower one the subsoil. In arid regions this difference does not exist, but the fine clay particles are evenly distributed throughout the soil layers.

Soils vary widely in their absorption power for water and for fertilizing matter, a property frequently due in clayey and humus soils to the presence of colloid substances. Of the three principal fertilizing constituents—nitrogen, phosphoric acid, and potash—soils apparently have the least retentive power for nitrogen (in the form of nitrate) and the greatest for phosphoric acid.

The temperature of soils is modified by a variety of conditions, e.g. a dark-colored soil is usually warmer than a light-colored one; soils so exposed as to receive a large amount of the direct rays of the sun are warmer than those not thus exposed; dry soils are warmer than wet. The relation of soils to water probably more than any other one factor determines their productiveness. Water is not only necessary as a constituent of plant tissue, but it performs a most important function as a solvent and carrier of food in both soil and plant, and the amount required in plant growth is very large—from 250 to 500 pounds for each pound of dry matter produced by the plant.

BIBLIOGRAPHY. Shaler, *Origin and Nature of Soils* (Twelfth Annual Report United States Geological Survey, 1890-91, part i., Geology, pp. 213-245); Merrill, *Rocks, Rock Weathering, and Soils* (New York, 1897); King, *The Soil* (ib., 1898); Stockbridge, *Rocks and Soils* (ib., 1895); Hall, *The Soil* (London, 1903); Fream, *Soils and Their Properties* (London, 1895); Warington, *Physical Properties of Soils* (Oxford, Eng., 1900); Ramann, *Forstliche Bodenkunde und Standortslehre* (Berlin, 1893); Brooks, *Agriculture*, vol. i. (Springfield, 1901); Roberts, *The Fertility of the Land* (New York, 1897); McConnell, *Elements of Agricultural Geology* (London, 1902); Risler, *Géologie agricole* (Paris, 1884-95); Hilgard, *The Relations of Soil to Climate* (United States Department of Agriculture, Weather Bureau Bulletin 3, Washington, 1892); Whitney, *Some Physical Properties of Soils in Their Relation to Crop Production* (United States Department of Agriculture, Weather Bureau Bulletin 4, Washington, 1892); King, *The Principles and Conditions of the Movements of Groundwater* (United States Geological Survey, Nineteenth Annual Report, pt. ii., Washington, 1899); the reports and bulletins of the Bureau of Soils of the United States Department of Agriculture, especially Bulletins 4, 10, 15, 17, 18, 19 and 22, and reports on Field Operations of the Bureau of Soils, beginning with the year 1899.

SOIL AMENDMENTS. Substances, such as lime, gypsum, salt, muck, etc., which increase the productiveness of soils without directly supplying any constituent which the plant needs. They act mainly by improving the physical condition of soils, collecting and conserving moisture, setting free latent plant food, and correcting certain faulty conditions, such as acidity and alkalinity. Some of them, like muck, contain considerable amounts of available fertilizing ingredients. In all cases, however, they are used mainly for their secondary or incidental effects.

SOILING, SOILING CROPS. Soiling consists in feeding grazing animals in inclosures or in barns with green forage grown especially for the purpose, instead of turning them out to pasture; and soiling crops are the crops grown for this purpose. Soiling is a feature of intensive farming and small holdings, but it is also practiced with profit in regions where the agricultural resources are in process of development. Under European conditions stock is frequently fed in barns the year round, but in the United States soiling is usually combined with pasturing, stock being less frequently fed in barns during the sum-

mer. In some instances, however, as in the case of dairy farms in the immediate vicinity of large cities, complete soiling is not infrequent and is on the increase.

American farmers began to turn their attention to soiling early in the nineteenth century, and agricultural literature shows that about the middle of the century the practice had become general in the Eastern and Southern States. The crops used for green forage at that time were grass, clover, corn, oats, cabbage, and root crops. In the West, where large tracts of wild grass land afford unlimited pasturage, there is no need to resort to soiling; but as soon as the land is settled and the natural pastures become confined to individual farms, soiling has not only been found expedient, but oftentimes necessary. Its advantages are many. It requires far less land to sustain a given number of farm animals than under pasturing; feeding green forage in the barn or yard eliminates the expense of constructing and keeping up pasture fences, at the same time greatly diminishing the waste of food, and animals are assured sufficient feed at all times. Practically the only serious disadvantage is the extra labor involved.

Since animals kept in the barn seem to require exercise, the two systems of soiling and pasturing are often combined in the United States. In such cases the soiling crops should be grown remote from the pasture, so that the animals may not become restless and disinclined to graze. The fodder should not be fed in open racks, and the quantity given should never be more than will be eaten at the time.

Nearly all farm crops can be utilized in soiling, corn being considered one of the best. The soil, the climate, and the kind of stock to be fed naturally determine the kinds of crops to be grown. The purpose of soiling crops is to afford abundance of succulent forage. This is best accomplished with rapidly growing plants that produce large amounts of foliage. The list of soiling crops generally grown includes rape, turnips, sorghum, kafir corn, millet, many cereals such as rye, barley, oats, and many legumes such as clover, cow-peas, alfalfa, and combinations of oats and peas, and barley and peas. Consult: Peer, *Soiling, Soiling Crops, and Ensilage* (New York and London, 1900); *United States Department of Agriculture, Farmers' Bulletin No. 16.*

SOISSONS, swä'sôN'. An episcopal city and the capital of an arrondissement in the Department of Aisne, France, 65 miles northeast of Paris, on the Aisne River (Map: France, K 2). The principal building is the cathedral of Notre Dame, a composite of the Romanesque and Gothic styles of architecture, founded in the twelfth century. There are also some remains of the great castellated Abbey of Saint Jean des Vignes, where Thomas à Becket found refuge when in exile. A short distance from Soissons is an institute for the deaf and dumb, which occupies the site of the famous Abbey of Saint Médard. Other features of the town include the town hall with a library of 50,000 volumes and a museum; the mediæval Abbaye Notre Dame (built on the site of a convent dating from 660), now utilized as barracks; and the seminary occupying the old Abbaye Saint Léger. Soissons is in a region extensively engaged in farming, and carries on a large trade in grain, haricot beans, live stock, etc. The principal manufactures are leather, foundry products, lumber, flannel, and farm implements. Population, in 1901, 13,240. Soissons is one of the oldest towns in France. In the time of the Romans it bore the names of *Noviodunum, Augusta Suessionum,* and *Suessiona.* It is famous for the victory obtained in the vicinity by Clovis in 486 over the Roman general Syagrius, which put an end to Roman dominion in Gaul. It was the capital of the Frankish kingdom of Neustria. It has undergone numerous sieges. On October 16, 1870, after a bombardment of four days, it surrendered to the Germans.

SOISSONS, Louis de Bourbon, Count of (1604-41). A French noble, born in Paris. Succeeding to the office of grand master of France and Governor of Dauphiné, he took the part of the Queen Mother, Maria de' Medici, while at the same time making approaches to the Huguenots. He conspired against Richelieu, who had opposed his marriage to Mlle. de Montpensier, and was obliged to flee to Savoy. He was, however, recalled by Louis XIII. and took part in the siege of La Rochelle in 1627. In 1636 he again formed a plot against Richelieu, and after its failure fled to Sedan, where he joined an alliance with the Duke de Bouillon, Duke de Guise, and the Spaniards against Richelieu. In July, 1641, they met the royal forces at Marfée, near Sedan, and vanquished them; but at the moment of victory Soissons was killed.

SOKO'TO. One of the largest States of Central Sudan, extending with its dependencies eastward from the Lower Niger, above the confluence with the Benue, to the Kingdom of Bornu and the borders of French Congo, and embracing the larger part of Northern Nigeria (see Nigeria) (Map: Africa, E 3). Area, estimated at over 100,000 square miles. Its population is composed principally of Hausas (see Hausa States), but includes also the Fulbe, who are the ruling class, as well as Tuaregs, Arabs, etc. The total population is believed to number about 10,000,000. The Sokoto Empire took its rise in the nineteenth century. It originally formed a part of the great Fulah Empire established by Othman in Central Sudan at the beginning of the same century. It remained in the possession of the family of Othman until the conclusion of the commercial treaty with the Royal Niger Company in 1885, since when the territory has gradually come within the British sphere of influence, with the exception of Adamawa (q.v.), which is partly within the German sphere. The city of Sokoto, formerly the capital of the empire, with a population of over 100,000, is now an insignificant place, and the capital has been transferred to Wurnu, a small town about 25 miles northeast. The commercial centre is Kano (q.v.).

SOKOTRA, sō'kō'trȧ *or* sōk'ō-trȧ. An island in the Indian Ocean. See Socotra.

SO'LANA'CEÆ (Neo-Lat. nom. pl., from Lat. *solanum,* nightshade), or The Nightshade Family. A natural order of mostly offensively smelling tropical and subtropical herbs and shrubs, and a few trees. There are 70 genera and about 1500 species, most of which are found in Central and South America; a few in the temperate zones, but none in the cold regions. The principal genera are Nicandra, Lycium, Atropa, Hyoscyamus, Physalis, Capsicum, Solanum, Lyco-

persicum, Mandragora, Datura, Petunia, Nicotiana, Salpiglossis, and Schizanthus.

SOLAN GOOSE. See GANNET.

SOLANO. See SIMOOM.

SOLANUM (Lat., nightshade). A genus of widely distributed spiny, downy, or smooth herbs or shrubs of the natural order Solanaceæ, containing several hundred species, particularly abundant in tropical South America and the West Indies. The species almost always contain more or less solanin, an alkaloid said to occasion distress when the plants are eaten too freely. By far the most important of all the species is *Solanum tuberosum*, the potato (q.v.), in which solanin is found in considerable quantity. Of the species with edible fruit, the principal is *Solanum melongena*, the egg-plant. *Solanum Dulcamara*, the bittersweet, and *Solanum nigrum*,



HORSE-NETTLE (*Solanum Carolinense*).

the common nightshade, are both common in the United States, having been introduced from Europe. The berries of *Solanum saponaceum* are used as a substitute for soap, and in Australia those of several species are eaten by the natives, some with and others without cooking. In the United States there are a dozen or more indigenous species, some of which, as *Solanum Carolinense*, the horse-nettle, and *Solanum rostratum*, are very spiny troublesome weeds.

SOLAR. An upper chamber or loft. The only private apartment in the old baronial halls was so called. It was placed over the pantry, at one end of the hall, and served as parlor and sleeping apartment for the baron and his family.

SOLAR CYCLE. See PERIOD.

SOLARI, sō-lä'rē (**SOLARIO**), ANDREA (c.1460-1515). A Lombard Milanese painter of the High Renaissance. He is frequently called Andrea del Gobbo, after his elder brother Cristoforo, the sculptor, who seems to have brought him up and whose artistic influence may be seen in Andrea's delicate modeling of the heads. Together they went to Venice, where Andrea executed many paintings in the manner of Bellini. On his return to Milan he fell completely under the influence of Leonardo da Vinci, and his standing was such that in 1507, when Cardinal George d'Amboise summoned Leonardo to France, Andrea was sent in his stead. He finished his decorations of the Cardinal's chapel at Gaillon in 1509, after which he seems to have gone to Flanders. The latter part of his life was not passed in Southern Italy, but probably at Milan.

In color, chiaroscuro, and subtle modeling of heads, Solari approached nearer Leonardo than any other of his disciples. His portraits display a characterization and strength that suggest Holbein, and his execution is of great delicacy. His principal paintings include the portraits of a Venetian senator and of Longoni (1503), in the National Gallery (London); a "Madonna," "John the Baptist," and "Saint Catharine" (1499), in the Brera (Milan); a "Crucifixion" (1503), a "Male Portrait," and the "Madonna of the Green Cushion," in the Louvre; a "Riposo" (1515) and "Ecce Homo," in the Poldi Collection, Milan, which is especially rich in his works; and the altarpiece of the Certosa at Pavia.

SOLARI (SOLARIO), CRISTOFORO (called IL GOBBO, the hunchback) (c.1450-1523). A Lombard sculptor and architect of the Renaissance. The events of his life are little known. Of the works which he executed while with his brother Andrea at Venice a "Saint George" survives in the Church of the Carità. In 1495 he was appointed ducal sculptor to Ludovico Sforza, and in 1498 he executed his masterpiece, the tomb of Duke's wife, "Beatrice d'Este," in Santa Maria delle Grazie. The monument was destroyed after the fall of the Duke, but the recumbent figures of himself and wife were taken to the Certosa of Pavia. They are charmingly realistic, and thoroughly in the style of the Early Renaissance. For the Certosa, Cristoforo also executed a "Pietà," and probably many of the figures of the façade. The sculptures which he executed for the cathedral at Milan cannot be distinguished among the myriads of others, but his statue of "Christ" in the sacristy shows the influence of Michelangelo. In 1519 he was appointed chief architect of the cathedral. His chief architectural work is the cupola of Santa Maria della Passione (1509).

SOLAR MICROSCOPE (Lat. *solaris*, relating to the sun, from *sol*, sun; connected with Gk. *ἥλιος, hēlios*, Skt. *sūra, svar*, AS. *sōl*, Goth. *saiwil*, Ir. *sul*, Lith., Lett., OPruss. *saule*, sun, and ultimately with Eng. *sun*). An instrument for projecting magnified images of minute objects on a screen, through the agency of the sun's rays. The microscope consists of a brass tube which is fastened to the interior side of a closed window-shutter over a hole in the latter, and a reflector so placed that the rays of sunlight falling on it are reflected into the tube. They are then collected by a powerful double convex lens, and brought to a focus on the object, which is placed on a stage at the opposite end of a tube. An enlarged image of the object thus illuminated is then produced by a second lens or system of lenses upon a white screen. Should the object be opaque, the rays of light reflected from the mirror are concentrated by the double convex lens on another mirror near the opposite end of the tube; they are then reflected upon the back of the object, and diverge on the system of lenses which form the image.

Instead of the sun's rays, the oxyhydrogen limelight and the electric arc have been employed, the rays being thrown on the double convex condenser by means of a reflector.

SOLAR PARALLAX. See PARALLAX.

SOLAR SYSTEM. The planets and comets pursuing orbital revolutions round the sun combine with it to form a system to which is given the name of *solar* system. It is not impossible that many stars are the centres of somewhat analogous systems. This, however, is merely a matter of speculation. No change of much magnitude can take place in the elements of the planets' orbits without having effect on the earth and its inhabitants, on account of the mutual attractions of the planets for each other; in fact, they appear as members of one isolated family, bound together by common ties, which could not be ruptured in the case of one individual without communicating a general shock to the others. (See ASTRONOMY.) The various members of the solar system are noticed under PLANETS (and each planet under its own name), PLANETOIDS, COMET, SUN, MOON, SATELLITES, METEORS; their motions are treated of under GRAVITATION, CENTRAL FORCES, PRECESSION, ORBIT, PERTURBATIONS; and their probable origin under COSMOGONY, NEBULÆ; so that it only remains here to give the more interesting numerical facts connected with them:

NAME OF PLANET	Diameter in miles	Density, earth's being 1	Mass, earth's being 1	Distance from sun in millions of miles	Period of revolution, in days
Mercury	3,030	0.85?	$\frac{1}{17}$	36.0	88
Venus	7,700	0.89	$\frac{1}{1}$	67.2	225
Earth	7,918	1.00	1	92.9	365
Mars	4,230	0.71	$\frac{1}{3}$	141.5	687
Planetoid Ceres	488?	?	?	257.1	1,681
Jupiter	86,500	0.24	318	483.3	4,333
Saturn	73,000	0.13	95	886.0	10,759
Uranus	31,900	0.22	15	1,781.9	30,687
Neptune	34,800	0.20	17	2,791.6	60,181

SOLDER (*souldure, soudere*, Fr. *soudure*, solder, from *soulder, souder*, to solder, consolidate, from Lat. *solidare*, to make firm, from *solidus*, solid, connected with OLat. *sollus*, Gk. ὅλος, *holos*, Skt. *sarva*, whole, entire). Any fusible alloy that may be used for joining metals. Solders vary widely in composition according to the metals which it is desired to unite. Soft solder consists of tin 1 part and lead 2 parts; while a finer variety consists of tin 2 parts and lead 1 part. Spelter solder is copper 2 parts and zinc 1 part. In addition there are numerous solders for special metals, such as gold, platinum, silver, etc. (See ALLOY.) When solders are to be applied in the common work of plumbers and tinmen, a tool called a *soldering iron* is used, which is heated red hot, and affords a convenient means of applying the heat direct to the solder, the parts to be united, and the flux, which may be borax, rosin, zinc chloride, etc. In place of a soldering iron a blowpipe is often used to advantage. For brass soldering, see BRAZING.

SOLDIER BEETLE. A name in the United States for any beetle of the tribe Telephoridi of the family Malacodermidæ. The name is partly derived from the trim appearance and colorational markings, which suggest an army uniform. The larvæ are predatory and feed extensively upon soft-bodied insects, such as plant-lice and small caterpillars. The Pennsylvania soldier beetle (*Chauliognathus Pennsylvanicus*) is a common species in the Eastern United States and is considered very beneficial. The adults are commonly found upon flowers, where they probably feed upon the pollen, and are of value to agriculture as cross-fertilizers of plants.

SOLDIER BUG. A name given to certain predatory stink-bugs (q.v.) of the family Pentatomidæ, especially such forms as *Podisus spinosus, Stiretrus anchorago, Nezara hilaris*, and *Euschistus servus*, which are common enemies of caterpillars.

SOLDIER FLY. Any one of the broad, flat-bodied flies of the family Stratiomyiidæ, called 'soldier flies' on account of the brightly colored stripes with which some species are marked. As a rule they are dark-colored and smooth. About 1000 species are known, and 200 of these are found in North America.

SOLE (OF., Fr. *sole*, from Lat. *solea*, sole, slipper, from *solum*, ground, soil). A flatfish (q.v.) of the family Soleidæ. The common sole of Europe (*Solea vulgaris*) attains a length of from 10 to 20 inches and is highly esteemed for food. The American sole (*Achirus fasciatus*), or 'hog-chocker,' is only about six inches long and is of less value. See Plate of FLATFISH AND FLOUNDERS.

SOLEILLET, sȯ'lâ'yâ', PAUL (1842-86). A French explorer, born at Nîmes. In 1873-74 he attempted to find a route for a commercial road between Algeria and the Niger. He failed in this, but his explorations convinced him of the practicability of a trans-Saharan railroad. He went to Senegambia in 1878 in the interests of this project, but his operations were frustrated by the Governor. In 1881 he went to Kaffa by way of Shoa and laid the way for French approach to the southern borders of Abyssinia. Then he was intrusted with founding the French colony of Obok on the Gulf of Aden. He died while on a new expedition to Shoa. His most important publications are: *Exploration du Sahara central* (1874); *Voyage à Ségou* (1878-79); *Voyages en Ethiopie* (1885); and *Une exploration en Ethiopie* (1886).

SOLEMN LEAGUE AND COVENANT. The agreement between the Scotch and Parliamentarians during the great Civil War in England. See COVENANTS, THE.

SOLENHOFEN (zȯ'len-hō'fen) **LITHOGRAPHIC STONE.** A deposit of limestone of Upper Jurassic age, which, on account of its fine-grained character and homogeneous texture, is admirably adapted for lithographic purposes. The most important quarries occur at Solenhofen, near Pappenheim, in Bavaria. The beds of good

stone aggregate about 50 feet in thickness and are found in the lower portions of the quarries, many of which are 100 feet deep. Most of the lithographic limestone used in the world is obtained from this district. See ARCHÆOPTERYX.

SOLENOID (from Gk *σωληνοειδής, sōlēnoeidēs*, pipe-shaped, grooved, from *σωλήν, sōlēn*, pipe, channel + *εἶδος, eidos*, form). A cylindrical coil of wire used for producing magnetic effects by electric currents. The coil when traversed by a current possesses all the qualities of a magnet. See MAGNETISM.

SO'LENT. The west portion of the strait between the Isle of Wight and the mainland of England (Map: England, E 6). It is 17 miles long by 2 to 5 miles wide, is a favorite yachting ground, and affords safe anchorage. Hurst Castle guards its entrance on the southwest.

SOLEURE, sô'lēr'. The French name of Solothurn (q.v.).

SOLEY, sō'lĭ, JAMES RUSSELL (1850—). An American jurist and author. He graduated at Harvard in 1870 and was admitted to the bar in Washington, D. C. From 1872 to 1882 he was professor of history and law at the Naval Academy at Annapolis. From 1876 to 1890 he was professor in the United States Navy. In 1882 he was transferred to Washington to arrange the Naval Library, and until 1890 was engaged in preparing the Naval Records of the Civil War. From 1890 to 1893 he was Assistant Secretary of the Navy. He afterwards practiced law in New York, and was counsel for Venezuela at the Paris arbitration of the Venezuela-British Guiana boundary in 1899. His publications include: *History of the Naval Academy* (1876); *Foreign Systems of Naval Education* (1880); *The Blockade and the Cruisers*, in the "Campaigns of the Civil War Series" (1883); with Commodore Schley, *Rescue of Greely* (1885); *Boys of 1812* (1887); and *Admiral Porter* (1903), in the "Great Commanders Series." He also edited *Autobiography of Commodore Morris* (1880), and contributed to *The Battles and Leaders of the Civil War* (1887), and F. Winsor's *Narrative and Critical History of America.*

SOLFATARA, sôl'fà-tä'rà (It. *solfatara*, from *solfo*, sulphur). A dormant volcano near Naples. The word is used as a common name for a volcanic vent which emits only vaporous materials. Volcanoes after periods of violent activity frequently pass into a stage of gaseous eruption when steam, sulphureted hydrogen, carbon dioxide, and hydrochloric acid are given off, usually without explosive effects. Sulphur and chlorides are sometimes deposited around the vents as sublimation products. Solfataras are quite numerous in the old volcanic regions of Italy. The Soufrière on the island of Saint Vincent is a notable example of a solfatara which at times becomes violently eruptive.

SOLFEGGIO, sôl-fĕd'jô. See SOLMIZATION.

SOLFERINO, sôl'fe-rē'nô. A village in the Province of Mantua, Italy, 20 miles northwest of Mantua (Map: Italy, E 2). It is famous as the scene of a bloody battle on June 24, 1859, in which the allied French and Sardinians, under Napoleon III., defeated the Austrians. The Tower of San Martino, commanding a splendid view, and containing a military museum, commemorates this victory, which was decisive in securing Italian independence.

SOLICITOR. Under the laws of Great Britain, a person duly admitted to practice law under the provisions of the Solicitor's Acts, and who thereby becomes an officer of the Supreme Court and entitled to certain privileges and immunities. Before the Judicature Act (1873) the term was applied only to persons who conducted litigation in the Court of Chancery, but by the above act all solicitors, attorneys, and proctors authorized to practice in any division of the High Court of Justice are known as solicitors of the Supreme Court. The Incorporated Law Society was appointed 'Registrar of Solicitors' in 1843, and in 1877 that society was given control of the examination of candidates for admission as solicitors. Candidates must serve an articled clerkship under a practicing solicitor for five years, and pass three rigid examinations, unless they are university graduates, writers to the signet, or Scotch solicitors or advocates, in which cases three years is sufficient. A barrister of five years' standing may procure himself to be disbarred, and on passing the final examination be admitted as a solicitor. Colonial solicitors of seven years' standing are exempted from this examination if they have already passed one in their own colony. Each solicitor must obtain annually a certificate of his right to practice from the Registrar of Solicitors. A solicitor can practice in the High Court of Justice, the Court of Appeal, the House of Lords, Privy Council, and all inferior courts. They have a monopoly on certain legal business, as, for example, the attestation of documents required by the Land Transfer Act. A solicitor has a general lien on his client's papers for his charges; has peculiar and extensive powers with reference to binding his client in litigation which he conducts; and has certain personal privileges, as exemption from service in the militia, etc. The fees and costs of solicitors are fixed and regulated by statute in great detail and must be observed. Special provisions are made for the collection of these statutory fees. They are held to a strict accountability for reasonable skill in advice and the management of any matters intrusted to them, and are liable for any negligence or lack of reasonable skill and learning whereby a client is prejudiced. As a solicitor is an officer of the court the latter can exercise summary jurisdiction over him in case of a breach of duty. A solicitor who permits another to practice in his name will be disbarred and can never be readmitted. Where a solicitor is struck off the rolls for other misconduct, he may be subsequently readmitted in the discretion of the court. Consult, Christian, *A Short History of Solicitors* (1896); Cordery, on *Solicitors* (1888).

SOLICITOR-GENERAL. One of the important law officers of the English Crown, appointed by letters patent. He is always a member of the House of Commons, and is *ex officio* a Minister of the Crown and a member of the General Council of the bar. He is not, however, a member of the Cabinet. He is next in rank to the Attorney-General and represents him in his absence. His term of office expires with the fall of the Ministry of which he is a member. The Solicitor-General of Scotland is next in rank to the Lord Advocate.

SOLINGEN, zō'ling-*en*. A town in the Rhine Province, Prussia, 18 miles north-northeast of Cologne (Map: Prussia, B 3). It has long been famous for its steel and ironware manufactures, especially sword blades, helmets, cuirasses, knives, scissors, and hand bells. Population, including the town of Dorp, in 1900, 45,249.

SOLIPSISM (from Lat. *solus*, alone, only + *ipse*, self). A term applied, usually by opponents, to any system of philosophy the principles of which do not logically warrant the belief in any other being than the mind of the thinker. It is a subjective idealism (q.v.) which is so subjective as to leave no valid ground for belief in objectivity.

SOLIS, sō-lēs', JUAN DIAS DE (c.1470-1516). A Spanish navigator. He is said, although without good authority, to have discovered Yucatan with Vicente Yañez Pinzon in 1506. After the death of Vespucci in 1512 he was appointed pilot-major of Spain. In October, 1515, he sailed in command of an expedition in search of a southwest passage to India. He discovered the entrance to the Rio de la Plata and explored the river as far as the region of the Charrua tribe, by whom he was killed, and it is reported, eaten, before September, 1516. His brother-in-law, Francisco de Torres, conducted the survivors of the expedition back to Spain.

SOLITAIRE, sŏl'ĭ-târ' (Fr., solitary). An extinct dodo-like bird (*Pezophaps solitarius*), differing from the dodos in a smaller bill and longer legs. It inhabited Rodriguez, and appears to have been peculiar to that small and lonely island. François Leguat, in his *Voyages et aventures* (London, 1708), has left an interesting and trustworthy account of the solitaire. He describes it as a large bird, the male sometimes weighing 45 pounds, the head of the male without comb or crest, that of the female with something like a widow's peak above the bill; the wings small, and the bird incapable of flying, but using the wings to flap itself or to flutter when calling for its mate, or as a weapon of offense or defense. He further describes the plumage as very full and beautiful, but the tail was a roundish mass of feathers. It became extinct about 1775, but many skeletons are preserved in European museums. See DODO; EXTINCT ANIMALS.



THE SOLITAIRE (After a drawing by Leguat).

In America the name solitaire is given to the flycatching thrushes of the genus Myadestes, species of which occur in Jamaica, Martinique, and other West Indian islands, as well as on the continent. One species, *Myadestes Townsendi*, dwells in the Western United States from the Rocky Mountains to the Pacific. It is about 8 inches long, and dull brownish ash in color, and is a superb singer, as indeed are all the members of the genus. The name 'solitaire' refers to the habit of several species of hiding in the most solitary and out-of-the-way depths of the forests, especially when singing.

SOLITAIRE. A game played by only one person. The date and place of its origin is not known, but it is supposed to have been invented by a prisoner in the Bastille some time during the sevententh century. It is played with 37 balls (usually of glass) on a circular board which has 37 hemispherical cups or depressions. The game is played by removing one ball from the board and then placing an adjoining ball into the vacancy, passing over one intervening ball. The ball passed over is then taken from the board. This process is then continued till only one ball remains, when the game is said to be won. Should two or more balls be left and they more than one space apart, and consequently isolated so as not to be liable to capture by each other, the game is lost.

SOLITAIRE WITH CARDS, or PATIENCE. The pack or packs (sometimes with the exception of certain cards, which are laid face upward on the table) are first shuffled. The player then takes the cards, backs uppermost, and plays them one by one, turning them face upward as he does so. His object is to arrange the cards in 'families,' each family being a complete series from ace to king, although not necessarily of the same suit. They may be formed by building upward, i.e. placing a higher card on the one next below it, or vice versa. The cards may be taken from the pack in the player's hand as already described, or they may be taken from an arrangement of card-piles on the table, or from either. If the player places any top card of these piles (should he elect to arrange the game that way) on any other just above or below it in rank, he is said to be making a marriage, by which he frees the cards underneath and utilizes them in 'building.' Cards that the player is unable to use at the time are laid aside and constitute 'stock.' Thus the stock may be used over again once or twice, but must first be shuffled. There are several other varieties of solitaire played with cards.

SOLLOGUB, sŏl'o-gōōp', VLADIMIR ALEXANDROVITCH, Count (1814-82). A Russian author, born at Saint Petersburg. He graduated at the University of Dorpat (1834) and held various diplomatic and official positions. He made his literary dêbut in 1837 with the novelettes *Two Students* and *Three Fiancés*, but attracted general attention with his *Story of Two Rubber Shoes* (1839), and still more so with his *Tarantas* (1845). Of his numerous works for the stage the farce *Grief from a Tender Heart* (1850) and *The Official* (1856) are the best known. His works of fiction appeared in five volumes (Saint Petersburg, 1855-56).

SOLL UND HABEN, zŏl ụnt hä'ben (Ger., Debit and Credit). A noted romance by Gustav Freytag (1855). It is based on a study of modern industrial conditions, and is a glorification of the German merchant class at the expense of the worn-out nobility.

SOLMIZATION (from *sol* + *mi*, names of two notes of the gamut), or SOLFEGGIO. A peculiar method in use for centuries for teaching musical intervals and scales by means of certain syllables. The syllables are *ut* (or *do*), *re*, *mi*, *fa*, *sol*, *la*, and *si*. The first six are the commencement of the lines of an ancient hymn to John the Baptist,

which had this peculiarity, that the first syllable of each line (with the exception of the last) was sung to a note one degree higher than the first syllable of the line that preceded, so as to present the type of a scale.

These syllables are said to have been first made use of by Guido of Arezzo in the eleventh century. As Guido employed a hexachord, six syllables were sufficient. But when the importance of the leading tone was recognized the heptachord superseded the old hexachord. Then Le Maire, a French musician of the seventeenth century, added to them *si*, for the seventh of the scale. When applied to the key of C, their equivalents, in the ordinary musical nomenclature, are:

Do re mi fa sol la si do
C D E F G A B C.

These syllables may, however, be applied to other keys, with *do* always as the key-note, so as to express, not the absolute pitch of a note, but its relation to the key-note.

SOLMONA, sôl-mō'nȧ, or **SULMONA**, sōōl-mō'nȧ. A city in the Province of Aquila, Italy (Map: Italy H 5). Solmona manufactures wine, paper, cloth, and strings for musical instruments. Population (commune), in 1901, 17,988.

SOLMS-LAUBACH, zōlms lou'bȧG, HERMANN, Count (1842-1904). A German botanist, born near Giessen and educated there and at Berlin, Freiburg, and Geneva. He became professor extraordinary at Strassburg in 1872 and professor of botany and director of the Botanical Garden at Göttingen in 1879, and was called to a similar position at Strassburg in 1888. His publications include: *Ueber den Bau und die Entwickelung der Ernährungsorgane parasitischer Phanerogamen* (1867-68); *Corallina* (Naples, 1881); *Herkunft, Domestikation und Verbreitung des gewöhnlichen Feigenbaums* (1882); *Die Geschlechterdifferenzierung bei den Feigenbäumen* (1885); and *Einleitung in die Paläophytologie* (1887).

SOLO (It., alone). In music, a piece or passage for a single voice or instrument. In orchestral compositions 'solo' indicates that one instrument is to take the leading part.

SOL'OMON (Heb. *Shĕlomōh*, peaceable). A son of David and Bathsheba (II. Sam. xii. 24), successor of David on the throne of Israel. The date of his reign may be stated approximately as B.C. 977-937. The biblical account of Solomon is found in I. Kings, chapters i.-xi., and its parallel II. Chronicles, chapters i.-ix. The facts furnished by these passages may be briefly summarized as follows: When David was old, his son Adonijah set himself up as a pretender to the throne, but Bathsheba interceded for Solomon. David granted her request and Solomon became King. One by one the new King had his enemies, Adonijah, Joab, and Shimei, put to death, so that he rested securely on his throne. He took to wife a daughter of Pharaoh and at the time of his marriage he worshiped in the 'high places.' Solomon divided Israel into twelve parts for administrative purposes, and we are told that his territory extended from the river (Euphrates) unto the land of the Philistines, and unto the border of Egypt, and that he made bondsmen of the Canaanites who remained in the land. He made an alliance with Hiram, King of Tyre, and, in return for food, furnished him with timber; the ships of the allies went out trading together. The temple was built in great splendor with Hiram's aid and dedicated with much magnificence. The King also built a house for his Egyptian wife and a palace in the Lebanon. The temple took from the fourth to the eleventh year of Solomon's reign for its completion; the palace in the Lebanon from the seventh to the twentieth year. Several cities also were built by the King. Many strange women were in his household, who are said to have influenced him to worship alien gods; and for this sin the historian assigns as a punishment Solomon's troubles at the hands of enemies in his lifetime, and the division of the kingdom between Rehoboam and Jeroboam after his death. (See JEROBOAM I.; REHOBOAM.) Almost all other details about Solomon are amplifications either of his wisdom or his splendor. We are told that the Lord appeared to him in a dream and asked him to choose a gift, whereupon Solomon chose neither riches nor power, but wisdom, and as a reward was given both what he chose and what he resigned. A proof of his wisdom immediately follows (I. Kings iii. 16-25), and it is never lost sight of afterwards (cf. I. Kings iv. 29 et seq., where he is said to be "wiser than all men;" v. 7-12; x. 1-3, where Solomon answers the 'hard questions' propounded by the Queen of Sheba, and x. 24). The entire narrative is a recital of the magnificence of the King, especially the description of his building operations (I. Kings iv. 22-28; ix. 26-29; x. 1-13, the story of the Queen of Sheba, who voluntarily pays the King tribute; II. Chron. ix. 9).

The narrative in Kings concerning Solomon is based upon earlier documents, such as the "Book of the Acts of Solomon" (I. Kings xi. 41). Although the main facts are authentic in the opinion of many Bible critics, they are so entwined with legendary lore and colored by a traditional view of Solomon belonging to a period many centuries later, that it is difficult to determine the exact position to be assigned to him in Hebrew history. This traditional view is still more consistently carried out in the narrative in Chronicles, which has no independent historical value. In the Book of Kings there are still traces of a conception of Solomon which did not hold him up in a favorable light. The extension of power is made responsible for the introduction of foreign religious customs, and the blame for the rebellion immediately following upon the death of Solomon is in part, at least, put upon the King. In Chronicles, however, all these unfavorable features are suppressed and the King is held up as a marvel of piety and wisdom, as well as a great ruler under whom the kingdom rose to its highest point of glory.

Solomon's distinguishing quality was as an administrator. He kept the confederacy of the Hebrew tribes intact during his reign, though not in such a condition that his successor could continue his policy. An important step was his strengthening the fortifications of the country, and no less significant was his foreign policy, which involved alliances with surrounding nations such as the Phœnicians. He kept the Egyptian power at bay by becoming the vassal of the Egyptian King. Through this international intercourse, an impetus was given to commerce in Solomon's days, which prompted the tale of Sol-

omon's personal achievements as a great marine merchant. Contact with other nations also had its result in a marked intellectual advance, and it is probably safe to date from Solomon's days the beginnings of a genuine literary activity in Israel, though several centuries elapsed before the movement assumed important dimensions. The new epoch thus marked by Solomon's reign is sufficient to account for the view taken by the later tradition, which makes Solomon himself an author of high rank and prodigious fertility. The books ascribed to him, Proverbs, Canticles, and Ecclesiastes (qq.v.), belong to various periods which, however, are all considerably subsequent to his days. That the simpler sanctuary of former days was replaced in his reign by a more ambitious edifice was a natural consequence of a general political growth, but the description of the new edifice is colored by the desire to extol the grandeur of Solomon's achievements, while the account of the ceremonies, including the prayer, is probably a post-exilic production. Similarly the visit of the Queen of Sheba is a bit of folk lore brought by tradition into connection with Solomon as the most commanding figure in the annals of Hebrew royalty. Consult the chapters on Solomon in the Hebrew histories of Guthe, Stade, Kent, Wellhausen, Piepenbring, Kittel, and Cornill; also McCurdy, *History, Prophecy, and the Monuments* (New York, 1894-1901).

SOLOMON, WISDOM OF (Gk. *Σοφία Σαλομῶντος, Sophia Salomōntos*, Lat. *Liber Sapientiæ*, Book of Wisdom). One of the apocryphal books of the Old Testament, sometimes called also the Book of Wisdom. Solomon is introduced as the speaker (cf. chaps. vii.-ix.), whence the name first mentioned. The book consists of three parts: (1) chapters i.-v. commend wisdom to rulers and incidentally attack Greek philosophy, particularly the Epicurean school, and show how absorption in worldly affairs leads to spiritual ruin; (2) chapters vi.-ix. teach how wisdom, which is above all other benefits, may be gained, and Solomon relates how he came to choose wisdom as his life's companion; the section closes with Solomon's prayer for wisdom; (3) chapters x.-xix. illustrate the influence of wisdom on Israel's history, the miracles in the history are ascribed to wisdom, and, by way of contrast, the results of folly in the history of heathen nations are held up to scorn.

SOLOMON BEN GABIROL, bĕn gā'bē-rōl'. A Jewish philosopher and poet, best known as Avicebron (q.v.).

SOLOMON ISLANDS. A group of islands in the Pacific Ocean, extending in a direction from northwest to southeast between latitudes 5° and 11° S., and longitudes 154° 40′ and 162° 30′ E. (Map: Australasia, J 3). It is about 120 miles distant from the Bismarck Archipelago on the west. Area, estimated at over 16,000 square miles. The principal islands are Bougainville, Choiseul, New Georgia, Ysabel, Malaita, Guadalcanar, and San Cristoval. Most of the islands are oblong in shape, mountainous, and lined with coral reefs along the coast. Traces of the volcanic origin of the group are found in the shape of craters, hot springs, etc. There are some active volcanoes, and earthquakes are of frequent occurrence. The flora is luxuriant and many of the islands have dense forests of ebony and sandalwood. The fauna is essentially Papuan in character, and the climate hot, moist, and unhealthful. The value of copra, pear-shell, and vegetable ivory exported is about $150,000 per annum.

The population, estimated at over 176,000, belong to the Melanesian division of the Papuan Melanesian stock. Their physical type is not uniform, the people of the islands on Bougainville Strait being taller, darker, more robust, and more brachycephalic, those of San Cristoval and the islands adjacent shorter, lighter, less vigorous, and more dolichocephalic. The languages of the islands (very little intercommunication exists between some of them) show great variation, amounting sometimes to mutual unintelligibility. Traces of Malay and Polynesian influences occur in speech, institutions, etc. Headhunting, slavery, cannibalism, and taboo (here tambu) are among the native institutions now mostly on the wane.

With the exception of the island of Bougainville and a few smaller islands, belonging to Germany, in the northwestern part of the archipelago, Great Britain controls the group. The discovery of the Solomon Islands is attributed to the Spanish navigator Mendaña (1567). By an agreement in 1885 the group was divided between Great Britain and Germany and by that of 1899 Great Britain acquired a large part of the German share. Consult: Guppy, *The Solomon Islands and Their Natives* (London, 1887); id., *The Solomon Islands, Their Geology, etc.* (ib., 1887); Woodford, *A Naturalist Among the Head Hunters* (ib., 1890); Reclus, *Nouvelle géographie universelle*, vol. xiv. (Paris, 1889).

SOLOMON'S-SEAL (*Polygonatum*). A genus of plants of the natural order Liliaceæ, differing from lily of the valley chiefly in the cylindrical tubular perianth, and in having the flowers joined to their flower-stalks. Of several European species, the common Solomon's-seal (*Polygonatum multiflorum*) has a stem about two feet high, the upper part of which bears two rows of large, ovate-elliptical, alternate leaves. The flower-stalks are generally branched; the small flowers white and drooping. The young shoots of *Polygonatum officinale* are eaten by the Turks like asparagus. The root is white, fleshy, inodorous, with a sweetish, mucilaginous, acrid taste. It has been applied to bruises to prevent or remove discoloration and has been made into bread in times of scarcity. Among the American species *Polygonatum giganteum*, the great Solomon's-seal, and *Polygonatum biflorum*, smaller Solo-



SOLOMON'S-SEAL (*Polygonatum*).
A fruiting spray of Solomon's-seal, with a terminal piece of a root-stem; *s*, showing the scars or "seals."

mon's-seal, occur from the Atlantic Coast to the Great Plains region. The name is derived from the curious seal-like markings left upon the knotted rootstocks by the falling of the annual stems. Medicinal virtues were once attributed to the dried rootstocks of this plant. *Smilacina racemosa*, an allied plant, is called false Solomon's-seal.



FALSE SOLOMON'S-SEAL (*Smilacina racemosa*).

SOLOMON'S SONG. See CANTICLES.

SO'LON (Lat., from Gk. Σόλων) (c.639-559 B.C.). An Athenian law-giver and patriot, son of Execestides, and descendant from the noble line of the Codrids. In his earlier years Solon engaged in trade and in the course of his commercial undertakings probably visited the Eastern Ægean, where he learned much from progressive Ionia. He acquainted himself with the Ionic literature, and trained himself to write verse in the Ionic dialect; indeed, he was the first Athenian to win renown by his poetry. Solon's life fell in the time of great social and economic change in Greece. As a result of the growing importance of commerce, capital was becoming concentrated in the hands of a few, while the small farmers and agricultural laborers were crushed beneath the increasing weight of debt. The small proprietors were deprived of their lands, and many free Athenians who could not pay what they owed were sold into slavery. The law favored the rich and powerful, and a revolution seemed imminent, when, in the year 594-3 (or 592-1), Solon was elected archon, probably by the more moderate of both parties, and given full power to reform the oppressive conditions. He began with two radical measures: he forbade the borrowing of money on the person of the debtor, and also annulled all mortgages and debts in which the person of the debtor had been pledged. Probably he reduced debts in general and lowered the rate of interest. This great reform was called the *Seisachtheia* (σεισαχθεία) and was celebrated by a public festival. He then restored by general amnesty all who had lost civil rights before his archonship, with the exception of those who had been punished for murder or attempted tyranny. The next remedial measure which he adopted was to forbid the export of all products with the exception of oil, thereby securing a sufficient supply of grain for Athens at a moderate price. He seems also to have limited the amount of land which might be held by a single person. Of great importance was the substitution of a standard of coinage closely resembling the Eubœan for the prevailing Æginetan standard. Seventy of the new drachmæ equaled one hundred of the old. This secured to the poor great relief, and emancipated Athens from her rivals, Ægina and Megara, and gave her the advantage of trade with the colonies in Sicily and Italy. Solon abolished Draco's laws with the exception of that portion of his ordinances which referred to murder. In place of the old four classes, which had been based on the amount of capital possessed, he divided the citizens into four classes on the basis of income. The political offices were open only to the members of the first three classes; the treasury and archons were reserved for the first. The fourth class had simply the right to take part in the assembly (Ἐκκλησία) and the public law courts. But the gaining of this privilege was a most important step in the direction of the democracy, for before the popular courts every magistrate might be accused when he laid down his office, and in this way the people had a control over the administration. For the selection of officials Solon introduced a peculiar combination of choice and lot. The Senate (Βουλή) was composed of 400 members, 100 from each tribe. This body and the popular assembly undoubtedly received many of the rights formerly possessed by the Areopagus, which now retained jurisdiction only in murder cases, together with general censorial power over the guardianship of the laws. Tradition says that after his year of office Solon bound his fellow citizens by an oath to keep the laws and withdrew from Athens for a period of ten years. Although many details of his reforms are obscure and disputed, it is undoubted that Solon emancipated the individual and took the first decisive step toward complete democracy. It is true that after his year of office internal disorder broke out within the State, and Solon lived to see, thirty years later, a tyranny established at Athens by one of his own kinsmen. (See PISISTRATUS.) Consult the Greek histories by Grote, Busolt, Beloch, Abbott, and Eduard Meyer; also Schömann, *Griechische Altertümer* (4th ed., Berlin, 1897); Hermann, *Griechische Staatsaltertümer* (6th ed., Freiburg, 1889); Gilbert, *Griechische Staatsaltertümer* (Leipzig, 1893; English trans. London, 1895); Busolt, *Griechische Staats- und Rechtsaltertümer* (Munich, 1892).

SOLOTHURN, zō'lō-tōōrn (Fr. *Soleure*). A canton of Switzerland, bounded by Basel on the north, Basel and Aargau on the east, and Bern on the south and west (Map: Switzerland, B 1). It is traversed lengthwise by the main ridge of the Jura, reaching a maximum height of 4754 feet. The northwestern part is covered by the minor Jura ridges and parallel mountain valleys, while along the southeastern boundary extends the valley of the Aar. The climate is somewhat severe. Almost the entire area is utilized for grain and stock raising, and the output of cereals is above the domestic demand. Fruit, dairy products, wood, marble, gypsum, and building stone are exported. The chief manufactured article is matches. The Constitution of the canton dates from 1875, and, as amended in 1895, provides for a legislative assembly elected for four years at the rate of one member for every 800 inhabitants. The 5 members of the executive council are also elected by the people for the same period. The canton returns 5 members to the National Council. Capi-

tal, Solothurn. Population, in 1888, 85,621; in 1900, 100,762, of whom the Catholics form over three-fourths. German is the predominating language.

The history of the canton centres chiefly around its capital, Solothurn, which dates from pre-Roman times, and which in 1218 became a free Imperial city. The burghers were associated with Bern in the struggles against the petty princes of the region. Solothurn was formally admitted into the Swiss Confederation in 1481, by which time it had extended its rule over the region now constituting the canton. The aristocratic régime which had long existed in the canton came to an end in 1830.

SOLOTHURN. The capital of the Canton of Solothurn, Switzerland, on the Aar, about 20 miles north-northeast of Bern (Map: Switzerland, B 1). It is a walled city with broad streets and numerous churches. The Cathedral of Saint Ours (the cathedral church of the Bishopric of Basel) is a cruciform structure of the eighteenth century, built on the site of an old church dating from 1050. Other interesting architectural structures are the ancient clock-tower and the cloth hall with its collection of weapons. The town library contains about 40,000 volumes. There is a natural-history museum with valuable zoölogical and paleontological collections. The environs of the town are exceedingly picturesque and abound in villas and resorts. The chief industries are watchmaking and stone-quarrying. Population, in 1900, 10,100.

SOLOVIEFF, sō'lô-vyĕf', SERGEI MIKHAILOVITCH (1820-79). An eminent Russian historian, born and educated at Moscow. From 1842 to 1844 he was abroad as tutor in Count Stroganoff's family, attending the lectures of Ranke, Böckh, and Michelet. His thesis, *The Relations Between Novgorod and the Grand Princes* (1845), and his dissertation, *History of the Relations Among the Princes of the House of Rurik* (1847), established his reputation, and he was appointed professor of Russian history at Moscow. Subsequently he was dean of the Historico-Philological Faculty and rector of the university for a number of years. His *History of Russia* in 29 volumes (7th ed., 1879) was the first thorough treatment of the subject from the earliest period to 1774. He wrote also a number of historical text-books, including *Historical Letters* (1858), *History of the Fall of Poland* (1863), and *Political and Diplomatic History of Alexander I.* (1877).

SOLSTICE (Lat. *solstitium*, from *sol*, sun + *sistere*, to stand, reduplication of *stare*, to stand). That point in the ecliptic (q.v.) at which the sun is farthest removed from the celestial equator, and where it is consequently at the turning point of its apparent course. There are two such points in the ecliptic, one where it touches the Tropic of Cancer, the other where it touches that of Capricorn. (See TROPIC.) The former is the *summer* and the latter is the *winter* solstice to those who inhabit northern latitudes, and vice versa. The term is also employed to signify the date at which the sun attains these two points in its orbit, viz. June 21st and December 21st.

SOLUBLE GLASS. See WATER-GLASS.

SOLUTION (Lat. *solutio*, from *solvere*, to loose, dissolve, from *so-*, *se-*, apart, away + *luere*, Gk. λύειν, *lyein*, to loose). In chemistry, a term applicable to any mixture that can be formed by the interdiffusion of two or more substances, gaseous, liquid, or solid. A mixture so formed is invariably homogeneous, i.e. its ingredients do not exist alongside of one another in separate masses, and therefore cannot be distinguished separately even by means of a powerful microscope. For the distinction between a homogeneous mixture and a chemical compound, see the article CHEMISTRY.

GASEOUS MIXTURES. The formation of these is not limited to any particular set of substances, as is the case with liquids and solids; all gases are capable of mutual interpenetration by diffusion and hence of forming homogeneous mixtures. In a gaseous mixture the properties of each ingredient are practically unaffected by the presence of the other ingredients. Therefore, provided no chemical reaction takes place, a gaseous mixture obeys the laws of gases (viz. those relating to the mutual dependence of volume, pressure, and temperature) as if it were an isolated gaseous substance.

LIQUID SOLUTIONS. These may be formed by liquids with gases, by liquids with other liquids, and by liquids with solids.

The mass of any gas absorbed by any liquid is proportional to the pressure of the gas (Henry's law) and diminishes with increasing temperature. Of course, even under the same conditions of pressure and temperature the solubility of different gases in some liquid is not the same; thus carbonic acid gas is much more soluble in water than oxygen. The solubility in the case of each system consisting of a gas and a liquid is termed by Bunsen the 'coefficient of absorption.' To understand clearly the meaning of this term imagine some gas in contact with a given liquid and maintained at some temperature *t*, under a pressure equal to the normal pressure of the atmosphere; imagine that when no more of the gas is being absorbed, all the gas contained in one cubic centimeter of the solution is driven out of it, confined separately, and cooled off to 0° Cent.; the volume that the gas will then occupy is its coefficient of absorption with respect to the given liquid at the temperature *t*. In the case of gases (such as ammonia, with respect to water) that are copiously soluble, i.e. whose coefficient of absorption is very large, that coefficient itself is variable, not only with the temperature, but also with the pressure of the gas; in other words, such gases fail to obey Henry's law—probably because they enter, to a greater or less extent, into chemical combination with the solvent liquid. Why the coefficient of absorption should be exactly what it is, whether Henry's law is obeyed or not, is not yet understood. Nor do we understand clearly the state of a gas when absorbed by a liquid. Are its molecules combined with those of the solvent in the form of hydrates, or do they exist in the solvent independently? On the other hand, it has been demonstrated that if a gas obeys Henry's law its molecules in solution are neither dissociated into simpled molecules nor associated with one another. It has also been shown that dilute solutions of gases in liquids obey the laws of osmotic pressure as

well as do dilute solutions in general (see further below).

Passing now to solution of liquids in liquids, we find, first of all, that some liquids (e.g. water and alcohol) are miscible in all proportions, that the mutual solubility of others (e.g. water and ether) is limited, and that still others are practically insoluble in each other. There are strong reasons for assuming that the third of these classes is really identical with the second; only the amounts dissolved are so small that they cannot be detected by the analytical means at our disposal. One of the most important properties of solutions of liquids in liquids is their vapor-tension, which plays an important part in processes of fractional distillation. (See DISTILLATION.) When two liquids, A and B, are mixed, the vapor-tension of either undergoes a diminution: A in the solution is less volatile than in the free state, and so is B. The vapor-tension of each in the solution is termed its 'partial vapor-tension,' and the total vapor-tension of the solution is equal to the sum of the diminished, partial vapor-tensions of its ingredients. If A and B are mutually soluble to a limited extent, two solutions may be formed (viz. A in B and B in A), of which the partial as well as the total vapor-tensions are respectively equal. Take, for instance, water and ether; if shaken up in sufficient relative quantities and then allowed to stand undisturbed they will form two distinct liquid layers, the upper a saturated solution of water in ether, the lower a saturated solution of ether in water; the partial vapor-tension of the water in the upper equals the partial vapor-tension of the water in the lower solution; the partial vapor-tension of the ether in the upper equals the partial vapor-tension of the ether in the lower solution; and hence, the total vapor-tension of the upper solution equals the total vapor-tension of the lower. Analogous relations are found in all cases examined.

The solubility of solids in liquids is invariably limited. As a rule it increases with the temperature, but cases are known (e.g. that of sodium sulphate, with respect to water) in which an elevation of temperature may cause a decrease in solubility. A fact important to remember is that if a solid is capable of existing in two or more different modifications (e.g. in different allotropic forms, in an anhydrous form and one or more forms containing water of crystallization, etc.), each modification has its own solubility, and a solution exactly saturated with the more soluble modification is more or less 'supersaturated' with the less soluble one. Bearing in mind that the supersaturation of a solution is destroyed, with rapid separation of the excess of dissolved substance, when a trace of the latter is introduced into the solution, the following experiment may serve to illustrate the point under consideration: Let ordinary Glauber's salt, i.e. sodium sulphate containing 10 molecules of water of crystallization ($Na_2SO_4.10H_2O$), be heated to boiling with about one-half its weight of water. in a flask whose mouth is loosely closed with a plug of cotton (to keep out particles of Glauber's salt that may be floating in the air). If the solution thus obtained be cooled to —10° C., a sodium sulphate containing seven molecules of water of crystallization ($Na_2SO_4.7H_2O$) will separate out, and when the separation is complete the mother-liquor will be exactly saturated with respect to this salt. Now, $Na_2SO_4.7H_2O$ has a greater solubility than $Na_2SO_4.10H_2O$. Hence, the saturated mother-liquor of $Na_2SO_4.7H_2O$ must evidently be supersaturated with respect to $Na_2SO_4.10H_2O$. As a matter of fact, if a trace of the latter be now introduced into our mother-liquor, a new crystallization will set in, a mass of $Na_2SO_4.10H_2O$ separating out and leaving the solution exactly saturated with respect also to this form of the salt. Such, as well as a host of other phenomena, complicate exceedingly the problem of discovering a precise relationship between the solubility of substances in various solvents and their nature.

SOLID SOLUTIONS. The existence of solutions in the solid state has only been recognized within recent years. It was mentioned in the article on diffusion (q.v.) that cases of that phenomenon have now been actually observed in solids. But there is also an increasing number of indirect proofs that many homogeneous solid mixtures are true solutions, i.e. might be formed by the inter-diffusion of their ingredients, although actually such a process would of course be very slow. Isomorphous crystalline mixtures, while homogeneous, may not be solutions at all; for it is possible that in them free diffusion cannot take place, the molecules of either of the ingredients being controlled by the forces that determine the crystalline form of the whole; but this is not certain. Among solid solutions containing fluids may be mentioned the well-known case of metallic palladium and hydrogen gas. The two were formerly supposed to combine chemically, forming the compound Pd_2H. But the composition of this substance has now been shown to vary with the temperature. Hence it cannot be considered as a chemical compound (see CHEMISTRY), and as it is formed by direct diffusion of hydrogen into palladium, it must be considered as a true solid solution.

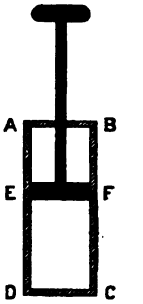
OSMOTIC PRESSURE. It may be seen from the above that a theory of solutions does not yet exist. Some of the most important questions with regard to solutions remain unanswered and the known facts are mostly uncorrelated; in brief, the subject is largely not yet rationalized.

In one of its phases, however, the subject of solutions has, within recent years, received a development which must be counted among the most brilliant scientific achievements of our time. The achievement in question is based on the most characteristic property of solutions, viz. the capacity of the 'solute' (i.e. the dissolved substance) to diffuse within the solution until the concentration of the latter is the same at all its points. Let an aqueous solution of sugar, for instance, be placed at the bottom of a vessel, and let some pure water be introduced over it, cautiously, so as not to disturb the solution; the result will be that the sugar will gradually diffuse upward, and after a certain length of time the liquid will have a perfectly uniform composition throughout. Now, to cause this motion of the sugar upward, against gravity, there must obviously be some force. An analogous case that readily suggests itself to the mind is that of gases. A gas, too, will flow upward, and, like a substance in solution, will distribute itself evenly within an available volume. Of course,

when a gas is evenly distributed within a vessel, it still exercises pressure on the walls, while in the case of a substance in solution, once diffusion is over, there would seem to be no evidence of the existence of a pressure. Yet there, too, a pressure must exist; for let a new volume of pure water be placed over our diluted solution of sugar, and diffusion upward against gravity, as well as in all other directions from points of higher to points of lower concentration, will recommence.

All this suggests that, in general, the properties of matter in a highly dilute state (i.e. when a small mass occupies a large volume) may be the same whether the dilute state is that of a gas or that of a substance in solution. For in either of those states matter possesses the most important characteristic of gases, viz. the capacity for expanding indefinitely. The problem therefore arises, to ascertain whether the laws of the interrelation of pressure, volume, and temperature of substances in solution are not similar to, or identical with, the corresponding laws of gases—a problem that can be solved only by experimental inquiry. The volume and temperature are evidently those of the solution and can be easily measured. So the solution of the problem depends on a method for measuring the pressure of the solute. To measure this directly, it is obviously necessary to employ an apparatus by means of which it would be possible to exert pressure upon the solute without at the same time exerting pressure upon the solvent—in other words, an apparatus for separating the solvent and the solute. Such an apparatus would show the resistance offered by the solute alone and would thus furnish a measure of its pressure. Let, for instance, an aqueous solution of sugar be placed in a cylindrical vessel with a tight-fitting piston just touching the solution. If the piston is made of a solid *impermeable* material, then external pressure upon it will be resisted by the solution as a whole, most of the resistance being of course offered by the water, which is highly incompressible. If, on the other hand, the piston is made of some ordinary, *permeable*, filtering material, then external pressure upon it will scarcely be resisted at all, the solution as a whole passing through it. Evidently, to answer our purpose, the piston must be made of a *semi-permeable* material, through which the water, but not the sugar dissolved in it, could pass freely. By means of such a piston alone could we compress the sugar without compressing the water and thus ascertain the resisting pressure of sugar within the volume of the solution, as we might ascertain the pressure of a gas within an ordinary vessel.

The best artificial semi-permeable material thus far discovered, especially well adapted for separating water from dissolved sugar, is a membrane of ferrocyanide of copper, formed by the action of potassium ferrocyanide upon copper sulphate. Pfeffer, who was the first to employ this substance for measuring the pressure of substances in solution, proceeded as follows: He filled a porous clay cylinder with a solution of copper sulphate and immersed it in a solution of potassium ferrocyanide; the two solutions, penetrating into the clay from the opposite sides, yielded a precipitate of copper ferrocyanide where they met within the walls of the cylinder, the walls serving to impart to the precipitated membrane considerable mechanical resistance. The cylinder was now filled with a solution of sugar, its upper end was tightly closed with a lid bearing an ordinary mercury manometer, and the apparatus was placed in pure water so that the level of the latter was precisely the same as that of the solution within. To understand the phenomenon that followed, imagine a cylindrical vessel ABCD in which, say, air has been compressed within the volume EFCD, while the space ABFE is empty; if we relieve the piston EF, it will be driven up by the expansive power of the air until it is stopped by AB or by some other resistance; if, instead, we hold up the cylinder in the air by the handle, the expansive power of the compressed air will cause the entire volume ABCD to move over, the result being, again, a larger space occupied by the air. Precisely analogous phenomena would be observed if EFCD were filled with a solution of sugar and ABFE were pure water, while EF were a semi-permeable membrane: Either the piston would move upward or the entire liquid volume (pure water *plus* solution) would move in the direction of the dissolved sugar; in either case the cause would be the expansive power of the sugar and the result an increase of the volume occupied by it, i.e. an addition of pure water to the solution. As a matter of fact, in Pfeffer's apparatus, the semi-permeable walls being fixed, the expansive power of the dissolved sugar caused pure water to enter the clay cylinder. The increasing amount of liquid naturally caused an increasing compression of the air within the cylinder, and finally a point was reached when the expansive power of the sugar was no longer capable of overcoming the resistance of the air, the latter having grown precisely equal to it. Then equilibrium ensued, the mercury manometer showing the pressure of the air within the cylinder, and hence the equal of that pressure—the 'osmotic pressure' of the sugar in solution. Similar experiments showed: (1) That the osmotic pressure of sugar and other substances in dilute solutions is proportional to the concentration, i.e. inversely proportional to the volume of the solution; (2) that the osmotic pressure of sugar and other substances in dilute solution is proportional to the absolute temperature (i.e. the centigrade temperature *plus* 273 degrees); (3) that the osmotic pressure of substances in dilute solution is equal to the pressure that the solute would exert if removed from the solution, vaporized, and inclosed within an empty volume equal to that of the solution, at a temperature equal to that of the solution. In brief, the laws of gases, viz. the law of Boyle and Mariotte, the law of Charles and Gay-Lussac, and Avogadro's rule, hold good in the case of dilute solutions as they do in the case of gases. Further experiments have shown, besides, that the osmotic pressure in solutions is the same no matter what the solvent.



The importance of these results will be evident to those who realize that the science of chemistry is based on the laws of the gaseous state, Avogadro's rule, which embodies those laws, being the only sure guide in finding those comparable

units of compounds—their molecular weights. (See CHEMISTRY; MOLECULES — MOLECULAR WEIGHTS; AVOGADRO'S RULE; ATOMIC WEIGHTS; GASES, GENERAL PROPERTIES OF; etc.) Yet a majority of compounds are non-volatile, and therefore our theoretical knowledge of them remained uncertain, and in many cases vague, until the above results proved that what we can learn of a substance by studying it in the gaseous state we can learn with equal certainty by studying it in dilute solution. Very few indeed are the substances that are neither volatile nor soluble in any liquid. Direct methods for measuring osmotic pressure, like the one described above, have been of importance only in demonstrating the fundamental laws; the experimental difficulties involved render their use for determinations of molecular weights practically impossible. But, on the other hand, it has been shown that the depression of the freezing-point or the elevation of the boiling point caused by dissolving a substance in a given liquid is proportional to the osmotic pressure in the solution; and so, molecular weights are now generally determined by observing the freezing-points or the boiling-points of solutions. (See MOLECULES—MOLECULAR WEIGHTS; FREEZING-POINT; BOILING-POINT.) At first, experimental research seemed to show that compounds of three important classes, viz. acids, bases, and salts, do not obey the laws of osmotic pressure; their osmotic pressure was found to be much higher than it should be theoretically. But Arrhenius's theory of electrolytic dissociation (see DISSOCIATION) soon came to add itself to the theory of osmotic pressure, and, instead of disproving it, only furnished further proof of its correctness, just as the phenomena of chemical dissociation, when correctly understood, had once furnished additional proof of the reliability of Avogadro's rule for gases. See AVOGADRO'S RULE.

HISTORY. The history of our subject commences perhaps with Graham's researches on the diffusion of substances in solution, dating back to 1851. Ten years later Graham investigated the well-known method of dialysis, based on the fact that many animal and vegetable membranes are permeable to water and the so-called 'crystalloids,' but impermeable to 'colloids' (q.v.). In 1867 Traube discovered that copper ferrocyanide is permeable to water, but impermeable to sugar, and more or less impermeable to many other substances. Ten years later Pfeffer published the researches mentioned above (*Osmotische Untersuchungen*, Leipzig, 1877). Finally, in 1886, on the basis principally of the experimental researches of Pfeffer, De Vries, and Raoult, Van't Hoff worked out the theory of dilute solutions, which has extended the domain of rational chemistry as few general ideas had done before. The principal names connected with the further development of the theory are those of Nernst, Ostwald, and Arrhenius. In this country Arthur A. Noyes has made a number of original contributions of recognized importance. For an account of the physiological importance of osmotic phenomena, see OSMOSIS.

SOL'WAY FIRTH. An inlet of the Irish Sea, separating Cumberland from Scotland, and forming in its upper part the estuary of the Esk (Map: Scotland, E 5). Its length is 33 miles and its width increases gradually, although irregularly, to upward of 20 miles. It is noted for its spring tides, which rush in as a bore from three to six feet high at the rate of eight to ten miles an hour.

SOL'YMAN (or **SULEIMAN**) **II.** (c.1495-1566). Sultan of the Turkish Empire, surnamed 'The Magnificent.' In September, 1520, he succeeded his father, Selim I. (q.v.). He overthrew the rebellious governor of Syria, repressed the Egyptian Mamelukes, and concluded a treaty with Persia. In 1521 he took Belgrade, the key to Hungary. He next drove the Knights of Saint John from Rhodes (1522) after a five months' siege. In the succeeding years he devoted himself to improvements in the administration and to military preparations for a great onslaught upon Hungary. On August 29, 1526, he overwhelmed the army of King Louis II. at Mohács. (See HUNGARY.) In 1529 he was summoned to Hungary in aid of his protégé, John Zápolya, Waywode of Transylvania, who was contesting the crown with Ferdinand, brother of the Emperor Charles V. He invaded that country with a great army, and laid siege to Vienna, but after a number of unsuccessful assaults he was compelled to retreat. In 1532 he laid Styria waste and again advanced to the neighborhood of Vienna, but his arms were baffled by the resistance of the little Hungarian fortress of Güns, and the advance of the Imperial army under Charles V. forced him to retreat. Soon after this the Sultan waged a successful war against Persia. In 1535 Solyman concluded with Francis I. the famous treaty which opened the commerce of the Levant to the French flag alone. By 1541 the Turks were in permanent possession of the heart of Hungary. In 1542 the combined French and Turkish fleets ravaged the Italian coasts and pillaged Nice. The Turks were now supreme in the Mediterranean; in 1551 Tripoli fell into their hands. A second and third war with Persia, which was now in a state of semi-subjugation, a brilliant naval victory (1561) over the Knights of Malta and their allies, the Spaniards, an unsuccessful siege of Malta (1565), and a fresh expedition to Hungary (1566), were the chief events of the remainder of Solyman's reign. He died during this last expedition, while besieging the little town of Sziget (whose defenders had stayed the advance of the Turkish host) September 5, 1566. Solyman encouraged literature, and did much for the improvement of the laws as well as for the military organization of the State. He was a ruler of many great qualities, and under him the Ottoman Empire reached the height of its power. Consult the works referred to under TURKEY.

SOMA (Skt., from *su*, to press). An Oriental plant identified, but not certainly, with the *Sarcostemma acidum*. It was at first deified in India on account of the intoxicating nature of its juice, and was then identified as a divine being with the moon, which it resembled in color and in its swelling, as well as in its magical maddening effect. The plant is plucked up by the roots by moonlight in the mountains and is crushed between two stones, after being carried on a goat-car to the place of sacrifice. It is then strained through a sieve into a tub, where it is allowed to ferment; and being thickened with meal and sweetened, it is drunk by the priests after being offered to

the gods. Only the priests at the present day may drink of it. The Vedic hymns (see VEDA) are chiefly concerned with the Soma cult. In the later Vedic hymns the identification with the moon is already complete, and Soma and the war-god Indra are regarded as two allied divinities. The deification of the plant had already begun before the separation of the Indo-Iranians. In the Persian cult, *haoma*, the Iranian equivalent of the Indian *soma*, is a god, but also the tree of life. It is probable that the name has been applied to different plants even in India. Consult: Windischmann, *Ueber den Soma-cultus der Arier* (1847); Muir, *Original Sanskrit Texts*, vol. ii. (London, 1871); Hillebrandt, *Vedische Mythologie*, vol. i. (Breslau, 1891).

SŌMADĒVA, sō'mȧ-dā'vȧ (eleventh century A.D.). A Sanskrit author. Of his life nothing is known. He composed but one work, the *Kathāsaritsāgara*, or 'Ocean of the Streams of Story,' which he began about 1070. This is the longest and most important collection of stories which has been preserved in Sanskrit. It contains a series of tales which are of considerable importance to students of comparative literature. They are told in the main for their intrinsic interest, not to point a moral. Although in the main Brahmanistic in spirit, Buddhistic influence is frequently apparent. The *Kathāsaritsāgara* was edited and translated into German by Brockhaus (Leipzig, 1839-66), edited by Durgaprasad and Parab (Bombay, 1889), and translated into English by Tawney (Calcutta, 1880-87).

SOMALI, sō-mä'lē. A Hamitic or Ethiopian people in the extreme eastern part of Africa, partly in Italian, partly in British territory. They are tall (1.725m.), dark-skinned, and dolichocephalic. The infusion of Negro and later of Semitic blood causes much variation in color. Their activities are the raising of grains, coffee, and spices, camel-breeding, and coastwise industries. The chief clothing of the men is a toga-like robe of cotton. They are not mechanical nor artistic. Being always at strife, they pride themselves on their weapons, which are of African pattern, lances, edged weapons, and rawhide shields. Their social organization is patriarchal, the clans and chieftains being innumerable. Their religion is fanatical Mohammedanism.

SOMALILAND. A region on the east coast of Africa. See BRITISH SOMALILAND; FRENCH SOMALILAND; ITALIAN SOMALILAND.

SOMASCHIANS, sō-mȧs'kĭ-anz. A Roman Catholic congregation of priests founded by Saint Jerome Emiliani (1491-1537). The mother-house of the congregation was at Somasco, Italy, between Milan and Bergamo, whence it took its popular name. It was confirmed by Paul III. in 1540; after it had been for a short time united with the Theatines, Pius V. enrolled it among the religious Orders in 1568, assigning it the rule of Saint Augustine. From 1616 to 1647 the French *Doctrinaires* (see DOCTRINE, FATHERS OF CHRISTIAN) were united with them. They have greatly diminished in numbers and now have only about ten houses. Consult Heimbucher, *Die Orden und Congregationen der katholischen Kirche* (Paderborn, 1897).

SOMATOLOGY (from Gk. *σῶμα, sōma*, body, + *-λογία, -logia*, account, from *λέγειν, legein*, to say). That division of anthropology which treats of the anatomy and physiology of mankind, especially by a comparative survey of different races from this point of view. Anatomical somatology deals with stature, tegument, pigmentation, measurements of the body, and the anatomy of special portions of it. Under physiological somatology are included discussions of the functions of nutrition, respiration, circulation, communication, reproduction, and the influence of environment, as well as various problems of a psychological or a pathological nature. Stature, the first anatomical division of somatology, treats of the height of mankind, and thus of giants (q.v.) and dwarfs (q.v.) also, while the tegumentary study concerns itself with the varying phenomena presented in the skin and pelage of different races. Pigmentation deals with the complexion (q.v.) or color of the skin, the colors of the eyes and hair, and with such deviations from the normal type as the albino (q.v.). One of the most important provinces of somatology is the measurement of the body, thus affording ratios for comparative study. These ratios form the basis of the anthropometric indexes, of which the chief ones are the cephalic, cranial, nasal, facial, dental, maxillary, and pelvic. The anatomy of special parts of the body is of less importance excepting in the case of the brain, yet there is scarcely a part of the body which does not undergo ethnic variation.

Physiological somatology shows as marked a diversity as the anatomical division, although it has been far less studied. The functions of nutrition and the temperature of the body show comparatively slight variations, while respiration and circulation are noticeably divergent. The functions of communication, including the expression of emotions, the acuteness of the senses, and similar phenomena, differ to a degree which is remarkable and important. Susceptibility to environment is also marked by great variation, and the same statement holds regarding pathological features, such as relative predisposition to or immunity from diseases. Psychological divergencies, like reproductive variations, while manifestly existent, have not yet been reduced to scientific classification. Consult: Roberts, *Manual of Anthropometry* (London, 1878); Deniker, *Races of Man* (ib., 1900); Livi, *Anthropometria* (Milan, 1900). See ANTHROPOMETRY; INDEX.

SOMBRERETE, sôm'brȧ-rā'tȧ. A town of Mexico in the State of Zacatecas, situated 85 miles northwest of Zacatecas, in a mountainous district celebrated for its rich silver mines, from which Sombrerete derives all its importance (Map: Mexico, G 6). Population, in 1895, 10,082.

SOMERS, sŭm'ẽrz, or **SUMMERS**, Sir GEORGE (1554-1610). An English mariner, born at or near Lyme Regis, Dorsetshire. He was an active promoter of the London company formed to colonize Virginia, and in 1609 he sailed for America in command of a small fleet. His squadron was scattered by a hurricane and Somers's vessel was wrecked on the Bermuda Islands, which Somers took possession of in the name of England. He died there while on a second visit. One of the many contemporary versions of his shipwreck is said to have given Shakespeare the setting for *The Tempest*.

SOMERS, JOHN, Lord (1651-1716). An English lawyer and statesman. He was born in Worcester and educated in private schools and at Trinity College, Oxford. He was called to the bar in 1676, distinguished himself in the trial of the seven bishops, became leader in the negotiations of the discontented nobles with William III., and was an important member of the first Parliament after the revolution of 1688-89. The Bill of Rights was drafted by a committee of which he was chairman, and its chief defence in Parliament was intrusted to him. He was made Solicitor-General in 1689, Attorney-General three years later, and Lord Keeper in 1693, and became Speaker of the House of Lords a few months later. In 1697 he was appointed Lord Chancellor of England. At this time he was raised to the peerage. Somers was closely associated with John Locke and Sir Isaac Newton in the measures looking to the reform of the coinage. He was removed from the Chancellorship in 1700, impeachment proceedings being begun against him, which, however, were soon dropped. His literary reputation is most closely associated with the great library he collected, from which was afterwards edited the *Somers Tracts* by Sir Walter Scott (13 vols., London, 1809-13).

SOMERSET, sŭm'ẽr-sĕt, EDWARD SEYMOUR, Duke of (c.1506-52). See SEYMOUR.

SOMERSET, FITZROY JAMES HENRY, Lord; First Baron Raglan. See RAGLAN.

SOMERSETSHIRE. A maritime county in the southwest of England, bounded on the northwest by Bristol Channel, and in other directions by Devonshire, Dorsetshire, Wiltshire, and Gloucestershire (Map: England, C 5). Area, 1615 square miles. Population, in 1891, 484,337; in 1901, 508,104. The surface is diversified with lofty hills and barren moors, rich vales and marshy levels, many thousands of acres of the latter being below high-water mark, and depending for security on sea banks and sluices. The hills are divided into several ranges running from east to west, the most conspicuous being the Mendips. In the extreme west is the wild district of Exmoor (q.v.). The chief river, the Bristol Avon, rises in Wiltshire and for some miles divides Somersetshire from Gloucestershire. The wheat and barley grown around Bridgewater are famous; grazing and dairy farming form the leading branches of husbandry; and the cheese of Cheddar has a great reputation. The hilly districts are rich in minerals, especially iron, with some lead and freestone. The manufactures are woolen cloth, coarse linens, lace, silk, and gloves. Capital, Taunton. British camps are numerous on the hills, and extensive remains of stone circles are visible at Stanton Drew, near Bristol. Consult Cooke, *Topography of Great Britain* (London, n. d.).

SOMERS (sŭm'ẽrz) **ISLANDS.** A group of islands in the Atlantic Ocean. See BERMUDA.

SOMERSWORTH, sŭm'ẽrz-wûrth. A city in Strafford County, N. H., five miles north of Dover, on Salmon Falls River, and on the Boston and Maine Railroad (Map: New Hampshire, L 8). There is a public library. Somersworth is chiefly noted for its manufacture of cotton cloth and woolen goods, but has also important boot and shoe interests. The water-works are owned and operated by the municipality. Settled in 1729, Somersworth was incorporated as a town in 1754, and was chartered as a city in 1893. Population, in 1890, 6207; in 1900, 7023.

SOMERVILLE, sŭm'ẽr-vĭl. A city in Middlesex County, Mass., adjoining Boston, on the Mystic River, here spanned by two bridges, and on the Boston and Maine Railroad (Map: Massachusetts, E 3). It is largely a residential city. Many places of historic interest add to its attractiveness. Broadway, over which Paul Revere passed on his famous ride; Central Hill, occupied by a redoubt during the siege of Boston; the old Powder House, where the powder for the American Army was stored; Prospect Hill, said to be the scene of the first unfurling of the American flag, and the headquarters of Generals Greene and Charles Lee, are especially noteworthy. The city has a public library with 56,000 volumes, Somerville Hospital, Catholic Home for the Aged, Somerville Home for the Aged, a State armory, and a fine city hall. In the census year 1900 the various industrial establishments of Somerville had an invested capital of $10,131,596, and a production valued at $21,776,511. Slaughtering and meat packing, cloth bleaching and dyeing, the distillation of liquors, and the manufacture of metal tubing, desks, pictures and frames, and jewelry are the leading industries.

The government is vested in a mayor, chosen annually, and a unicameral council. Of the subordinate officials the majority are appointed by the mayor subject to the confirmation of the council; the school board, however, is elected by popular vote. The assessed valuation of real and personal property in 1902 was $55,485,370, and the net debt (January 1, 1903) $1,477,000. The city spends annually for maintenance and operation about $1,000,000, the main items being: For schools, $300,000; for streets, $159,000; for the police department (including amounts for jails, workhouses, reformatories, etc.), $69,000; for the fire department, $68,000; for municipal lighting, $63,000; for water-works, $52,000; and for interest on debt, $51,000. The water-works are owned by the municipality. Population, in 1890, 40,152; in 1900, 61,643. Settled about 1631, Somerville was a part of Charlestown until separately incorporated in 1842. In 1871 it was chartered as a city. Within the limits of the present city a large body of Hessian prisoners were quartered in 1777-78. Consult: Samuels (editor), *Somerville, Past and Present* (Boston, 1897); and Hurd, *History of Middlesex County* (Philadelphia, 1890).

SOMERVILLE. A town and the county-seat of Somerset County, N. J., 36 miles west by south of New York City, on the Raritan River, and on the Central Railroad of New Jersey (Map: New Jersey, C 2). It is an attractive residential place and has a public library. The principal manufactures are woolen cloth, clothing, and brick. Population, in 1890, 3861; in 1900, 4843.

SOMERVILLE, MARY (1780-1872). A writer on mathematics and physical science, born at Jedburgh, Scotland. In 1804 she married Captain Greig of the Russian navy, and removed to London. After three years of married life she was left a widow and free to devote herself to study. In 1812 she married her cousin, Dr. William Somerville. After presenting

a successful paper on the *Magnetic Properties of the Solar Spectrum* to the Royal Society in 1826 Mrs. Somerville was invited by Lord Brougham in the following year to try to popularize for the English public Laplace's great work, the *Mécanique Céleste*. This was published as the *Celestial Mechanism of the Heavens* in 1831. *The Connection of the Physical Sciences* was published in 1834, *Physical Geography* in 1848, and *Molecular and Microscopic Science* in 1866. The Mary Somerville scholarship in mathematics for women was founded at Oxford University in her honor. An autobiography, edited and supplemented by a daughter, Martha Somerville, was published in 1873.

SOMERVILLE, WILLIAM (1675-1742). An English poet of an ancient family, born at Colwich, in Staffordshire. In 1690 he was sent to Winchester School, whence he passed to New College, Oxford (1694). He obtained a fellowship, which he kept till 1705, though he was for a time student at the Middle Temple (1696). On his father's death (1705) he inherited the family estate at Edstone, Warwickshire, where he settled and passed his life with his books and his hounds. Somerville is remembered mainly for his blank-verse poem *The Chase* (1735), which vividly depicts his favorite sport. He also wrote some good verse fables (1725, 1727), a burlesque of rural games entitled *Hobbinol* (1740), and *Field Sports* (1742). His poems with a *Life* are in the collections of Johnson and Chalmers. Consult also *The Chase*, with memoir by G. Gilfillan (Edinburgh, 1859).

SOMME, sôm. A small river of Northern France, entering the English Channel through an estuary which is navigable for ocean steamers to Saint-Valery (Map: France, H 1). From that point a lateral canal follows the river past Amiens to Saint-Simon, whence two other canals communicate with the Oise and the Scheldt.

SOMME. A northern maritime department of France, bounded on the north by the English Channel, south by Pas-de-Calais, and northeast by Seine-Inférieure (Map: France, J 2). Area, 2443 square miles. Population, in 1896, 543,279; in 1901, 537,848. The chief river is the Somme, which traverses the department from southeast to northwest. Somme is mostly level, but in some parts is marshy. The department produces corn and garden fruits. The raising of cattle is carried on to a great extent. The chief manufactures are velvets, chemicals, woolens, cottons, linens, silk, leather, and tapestries. Capital, Amiens. The department was formed mainly out of the old Province of Picardy.

SOMNAMBULISM (from Lat. *somnus*, sleep + *ambulare*, to walk). A state intermediate between those of sleeping and waking, characterized by the performance of various acts apparently indicative of conscious control, by absence of the usual reaction to stimuli, and usually by inability to recall on awakening any of the thoughts or movements which have taken place during the abnormal condition. Somnambulism may be self-induced, spontaneous, or idiopathic, or artificially induced, as in the hypnotic trance. In the latter sense, the term is popularly used as a synonym of hypnosis, but strictly speaking it should be limited in accordance with its definition by the 'Paris school,' who apply the term only to the 'third stage' of the hypnotic state. (See HYPNOTISM.) In this, the final stage, the subject is almost completely anæsthetic, obeys orders by movement and perception, and, when awakened, has no memory at all of what has elapsed during the somnambulistic period.

Spontaneously induced somnambulism of a mild or imperfect type is frequent. It is most obviously, though perhaps not most strikingly, manifested by persons who walk at night during sleep. A slight stimulus, enough to catch the attention, will restore the normal condition. In its pronounced form, often exhibited by patients suffering from hysteria, somnambulism approaches, if it does not cross, the border-line between the merely anomalous and the abnormal or pathological. Psychologically, sleep-walking is only a dream carried one step beyond its usual limitations. In dream-walking the barrier to execution is partially lifted, and the conditions of normal connection between idea and movement are fulfilled. Somnambulism further differs from normal sleep in that, within certain limits, there is in it cognizance of external objects. The somnambulist may walk the ridge-pole thinking it a boulevard, but his actions are confined to relatively simple acts, which, like walking, have become automatic by practice.

Consult: Tuke, *Sleep-Walking and Hypnotism* (London, 1884); Liégois, *De la suggestion et du somnambulisme dans leur rapport avec la jurisprudence et la médecine légale* (Paris, 1889); W. Wundt, *Lectures on Human and Animal Psychology*, trans. (New York, 1894).

SOMNATH, sŏm'nāth, or PATAN. A town in Gujurat, Province of Bombay, India, on the Kathiawar Peninsula; 38 miles northwest of the island of Diu, on the Arabian Sea (Map: India, B 4). Its port is Verawal, 3 miles to the northwest. Of great antiquity as an important commercial centre and pilgrimage resort, the town was captured by Mahmud of Ghazni in 1025 and its celebrated temple despoiled of its vast riches. Population, about 6600.

SOM'NUS (Lat., sleep). The Latin god of sleep, son of Night and twin brother of Death, corresponding to the Greek Hypnos. His home was in the far west, from which he brought sleep to gods and men alike. In art he is variously represented, with eagle's wings, a butterfly, a poppy stalk, with a horn from which he poured out slumber.

SONATA (It., *sonata*, sonata, p.p. fem. of *sonare*, to sound, from Lat. *sonare*, to sound, from *sonus*, sound). In music, an instrumental composition in cyclical form, originally any instrumental work as opposed to a cantata or vocal work. At first the sonata was almost identical with the suite (q.v.), but it soon abandoned the pure dance forms which the suite embodied. The violin sonata attained a somewhat perfected form before that of any of the keyed instruments. Its slow introductory first movement generally shows traces of ecclesiastical influence; the second movement, an allegro, which corresponds to the first movement of a modern sonata, was derived from vocal madrigals or part music; the third movement, which is characteristically slow, was evolved from solo vocal music, while the last movement showed elements of dance music, and was therefore a pure suite

movement. Of the popular dance forms, the minuet survived the longest but was ultimately supplanted by the scherzo, while the gigue and chaconne, of which Bach left so many examples, were succeeded by the finale or rondo. The first noteworthy advance is in a set of seven sonatas for the clavier, *Frische Klavierfrüchte* (1703), by Johann Kuhnau, in which he shows a partial recognition of the relation and balance of keys. Johann Mattheson chose the gigue for the concluding movement of his sonatas, and both he and Alessandro Scarlatti did much to define and unify the sonata form. In the works of Domenico Scarlatti are found the first traces of a distinct secondary subject in the first allegro. The domain of the sonata was long monopolized by writers for the violin, and through the advances made by Locatelli, Geminiani, and Tartini the sonata finally reached the four-movement type. Johann Sebastian Bach wrote many sonatas for various instruments and for combinations of instruments, but he did not aid in the direct development of the form. His son, Philipp Emanuel Bach, established the number of movements as three. Haydn is important principally for having clearly indicated the outlines and for having made the use of the minuet and the rondo imperative. Mozart adds to Haydn's unemotional forms symmetry, grace, and more mature and elaborate themes and harmonies. Beethoven brought the sonata to its greatest perfection. In the Kreutzer sonata, for violin and pianoforte, and in the pianoforte sonatas, in D minor (Op. 31), C major (Op. 53), F minor (Op. 57), B flat (Op. 106), and C minor (Op. 111), he attains to such a command of technical resource and emotional expression that the form seems incapable of further development.

SONATA FORM is a term applied to the form of the first movement of a sonata, symphony, or chamber-music composition. The first movement of a sonata or kindred cyclical form consists of three sections: (1) the exposition, (2) the development, (3) the repetition. The first section begins with the principal subject in the tonic key. An episode consisting of some development of the principal subject leads into the secondary subject. This appears in the key of the dominant, if the movement is in major. If the movement is in minor the secondary subject is announced in the key of the relative major. Then follows some slight development of the secondary subject. After this the entire exposition section is repeated literally. The second or development section is devoted to a full thematic working out of either one or both the themes announced in the previous section. In the development section episodes built upon new themes may also be introduced. The third or repetition (also recapitulation) section is a repetition of the exposition section, though composers generally vary the instrumentation. In this section the secondary subject appears in the key of the tonic. A more or less extended coda, constructed either upon the material already introduced or upon new material, closes the movement. Frequently the movement is preceded by a shorter or longer introduction in slow tempo. (See INTRODUCTION.) The essential features of this form have not been changed since Beethoven's time. Consult Shedlock, *The Pianoforte Sonata* (London, 1895).

SONATINA, sō'nȧ-tē'nȧ (It., little sonata, diminutive of *sonata*, sonata). In music, a short sonata. There are generally two or three movements, and the themes are much lighter in character than those of the regular sonata. Sonatinas are designed especially for young players as a preparation to the study of a sonata.

SONDERBUND, zŏn'dĕr-bụnt. A league formed in the fall of 1843 by the Swiss cantons Lucerne, Fribourg, Zug, Uri, Schwyz, and Unterwalden for the protection of the interests of the Church, then threatened by a powerful liberal movement in many cantons of the Confederation. The Canton of Valais joined the league in 1845. In 1847 the Liberal majority in the National Assembly decreed the dissolution of the Sonderbund, and this was accomplished by force of arms in the same year. See SWITZERLAND.

SONDERBURG, zŏn'dĕr-bo͝orK. A town on the island of Alsen (q.v.).

SONDERSHAUSEN, zŏn'dĕrs-hou'zen. The capital of the Principality of Schwarzburg-Sondershausen, Germany, 33 miles northwest of Weimar, on the Wipper (Map: Germany, D 3). The Prince's castle, in a beautiful park, contains a natural history collection and a museum of antiquities. Sondershausen was founded in 525 and passed to Schwarzburg in 1248. Population, in 1900, 7054.

SONG (AS. *song*, *sang*, Goth. *saggws*, OHG. *sang*, Ger. *Gesang*, song, from AS. *singan*, Goth. *siggwan*, OHG. *singan*, Ger. *singen*, to sing). A short lyric or narrative poem set to music in such a manner that the music reproduces the mood of the poem, and at the same time lends more impassioned utterance to the words. The term song should properly be applied only to compositions for one or two voices with instrumental accompaniment. The art-song (Kunstlied) was developed in Germany from the folk-song. The form has been received with universal favor. See BALLAD; FOLK-MUSIC; LIED; MEISTERSINGER; MINNESINGER; MUSIC; NATIONAL HYMNS; ROMANCE.

SONG-BIRDS. The song-birds of the world belong almost entirely to the order Oscines, which is that of the highest organization, and distinguished as a group by the possession of vocal organs of a specialized and peculiar sort. Yet all Oscines are not capable of singing, and some birds which utter melodious notes are to be found in other groups. The principal singers are to be found among the thrushes, wrens, warblers, pipits, larks, starlings, and in the great family of finches. These are largely birds of temperate climates, and the popular idea that the birds of the tropics are not singers has a basis in fact, though it is by no means true that no tropical birds utter melodious strains.

SONGEESH, sŏn-gēsh'. A tribe of Salishan stock (q.v.) occupying a territory on the southeastern end of Vancouver Island, B. C. Their proper name is *Lkungen*, the other being a corruption of one of the subtribal names. Their general culture is that of the coast Salishan tribes. Their houses are large communal dwellings of cedar planks, carved and painted with symbolic figures, and divided inside into family

compartments separated by rush mats. They wear blankets of dog and goat hair and duck down, cleaning the material of grease by means of native white clay, the spinning and weaving being by the simplest hand process. Cordage for nets is spun from nettle fibre. Their chief dependence is upon fishing, and the catching and drying of salmon constitutes the main industry, with the usual number of connected taboos and ceremonies. They have several clans, each of which has its own fishing coast and its own set of personal names. Women are subject to many taboos. Head-flattening and tattooing are practiced. The dead are laid away in canoes in the forest or rolled in mats which are deposited in the branches of the trees. Slaves were formerly buried with the dead chief. They have the potlatch custom (q.v.) and two principal secret societies. The majority are now professed Catholics, but the old customs still survive among the others. No tribal census is taken, but their different bands may number 500, and are known to be on the decrease.

SONGHAY, sôŋ-gī′, **SONRHAY,** or **SURHAY.** A Sudanese Nigritian people numbering two millions, living in the bend of the Niger, below Timbuctoo, with separate speech. They are mixed at the north with Moors, and at the south with Fulahs, and are Moslem.

SONG-KOI, sông′koi′. A river of Indo-China. See RED RIVER.

SONG OF SOLOMON. See CANTICLES.

SONG-SPARROW. See SPARROW.

SONG-THRUSH. Any of several thrushes locally conspicuous for their song. In the United States the wood-thrush (q.v.) is most often the one meant. In Great Britain it is the thrush (*Turdus musicus*) called 'mavis,' provincially, and very often kept caged for the sake of its melody. It is a permanent resident of all temperate Europe, and in its ground-hunting and hardy habits resembles its congener, the American robin; its nesting habits are similar, too, though it uses less mud and its blue eggs are spotted with brown. The adult male is dark brown above, tinted with golden brown; throat buff; under parts yellowish white, closely spotted with brown. It is a most pleasing songster, and especially a favorite in Scotland and Scandinavia. See THRUSH.

SONNEBERG, zôn′e-bĕrk. A town and summer resort in the Duchy of Saxe-Meiningen, Germany, on the Röthen, 13 miles northeast of Coburg (Map: Prussia, D 3). Its principal industry is the manufacture of toys. Masks, grindstones, slates, and pencils are also manufactured. Population, in 1900, 13,317.

SONNENFELS, zôn′en-fĕls, JOSEPH VON (1732-1817). An Austrian author, born in Nikolsburg. He served in the Austrian Army in 1749-54, was then for a time a lawyer's clerk, and became particularly active in endeavors toward the improvement of the Vienna stage, in connection with which he wrote the *Briefe über die wienerische Schaubühne* (1768; new ed. 1884). His *Abschaffung der Tortur* (1775) effectively secured the abolition of the torture throughout Austrian domains. In 1763 he was appointed professor of political science in the University of Vienna, and subsequently received various posts, including that of president of the Academy of Fine Arts. His collected writings appeared at Vienna in thirteen volumes (1783-87). Consult the biography by Müller (Vienna, 1882).

SONNENSCHEIN, zôn′en-shīn, WILLIAM SWAN (1855—). An English publisher and compiler, born in London. He was educated in London at University College. In 1878 he established there a publishing business which in 1895 became a limited company with himself as chairman. He collected an important library in bibliography and literary history, and published *The Best Books* (1887; 5th ed. 1901), a classified list of about 50,000 available works, and *A Reader's Guide to Contemporary Literature* (1894; 2d ed. 1901), supplementary to the foregoing.

SONNENTHAL, zôn′en-täl, ADOLF VON (1834—). An eminent Austrian actor, born in Budapest. He first worked as a journeyman tailor, but after some experience on the provincial stage was engaged at the Court theatre in Vienna, one of whose brightest ornaments he became, excelling equally in tragic rôles and in comedy. In 1881 he was knighted by the Emperor. In 1885, on a visit to New York, he was most cordially received by the public. He visited the United States again in 1899 and 1902. Consult Eisenberg, *Adolf Sonnenthal* (Dresden, 1896).

SONNET (Fr. *sonnet*, OF., Prov. *sonet*, song, diminutive of *son*, sound, song, from Lat. *sonus*, sound). As perfected by the Italian humanists, a stanza of fourteen hendecasyllabic verses, rhyming according to a clearly defined plan. The stanza is divided into two unequal parts. The first part, called the octave, is composed of two quatrains (or four-line strophes). The second part, called the sestet, is composed of two tercets (or three-line strophes). The octave runs on two and the sestet on two or three rhymes. According to a common type, the rhymes are arranged thus: *abba, abba, cde, cde.* This rhyme-scheme may vary considerably, especially in the sestet. An important point to observe is that the four divisions—particularly the octave and the sestet—are kept distinct. In this most rigid of all metrical forms, the idea, mood, or sentiment of the poet is developed by stages. Stated in the first, the idea is elaborated in the second quatrain; and then, gathering emotional intensity in the first tercet, it flows on full to the conclusion. The result in the hands of the masters is absolute unity. The sonnet was primitively a lyric sung with musical accompaniment. Indeed, the Provençal and French poets employed the word *son* or *sonet* to designate a lyric in the vernacular. It is now generally held that the sonnet originated in Sicily. Some philologians, however, find its germ in the Provençal *cobla esparsa.*

The sonnet, widely cultivated in Italy and Provence during the thirteenth century, assumed its highest art under the hand of Petrarch (1304-74). The form was also practiced by Lorenzo de' Medici, Michelangelo, Tasso, and many others. From Italy the sonnet spread over Western and Northern Europe. In Spain it was naturalized by Juan Boscan (c.1493-c.1542). Portugal had the great Camões (q.v.). The form seems to have been introduced into France by Mellin de Saint-Gelais, and at once adopted by his master Marot. It received an immense vogue from the Pléiade. Du Bellay produced nearly

two hundred sonnets, and Ronsard more than nine hundred. The fashion, after dying out in the eighteenth century, came in again with the romantics. Among recent French adepts in the sonnet are Sully-Prudhomme and Hérédia.

The sonnet was introduced into England by the Earl of Surrey and Sir Thomas Wyatt. Their collection, numbering thirty-six altogether, first appeared in Tottel's *Miscellany* under the title *Songes and Sonnetes* (1557). Between 1591 and 1597 were published, according to the conservative estimate of Sidney Lee, more than two thousand English sonnets. Of the vast Elizabethan product, the sonnet-sequences of Sidney, Daniel, Spenser, and Shakespeare stand out prominently. The Elizabethans did not follow strictly the Petrarchan type. Spenser and Shakespeare, though logically developing the idea, reduced the sonnet to three quatrains clinched by a final couplet. With rich musical effect Spenser interlaced his rhymes thus: *abab, bcbc, cdcd, ee.* Shakespeare further simplified the sonnet by employing a distinct set of alternating rhymes in each quatrain. His rhyme-scheme is *abab, cdcd, efef, gg.* After 1600 the sonnet impulse, though weakened, was still a force. And then came Milton, with his small but grand group. Scholar as he was, he held very closely to the Italian octave, sestet, and rhyme scheme. For a century after Milton, few English sonnets were written, but with the romantic revival the sonnet returned (about 1750), though even Wordsworth, as late as 1827, thought it necessary to defend the form against the critics. Among the great English poets of the nineteenth century who practiced the sonnet, in the Petrarchan, Shakespearean, or some modified form, are Wordsworth, Coleridge, Keats, Mrs. Browning, and the Rossettis. In Germany, though the sonnet appeared as early as the seventeenth century, with Weckherlin (1585-1653) and Opitz (1597-1639), it was not much cultivated till taken up by the romantics and a few poets just preceding them: Bürger, A. W. Schlegel, Arnim, Voss, Goethe, Rückert, Eichendorff, Heyse, Geibel, and Redwitz. Consult: Biadene, "Morfologia del Sonetto," in *Studj di Filologia Romanza* (Rome, 1889); Welti, *Geschichte des Sonettes* (Leipzig, 1884); Schipper, *Grundriss der englischen Metrik* (Vienna, 1895); Tomlinson, *The Sonnet, Its Origin, Structure, and Place in Poetry* (London, 1874); Corson, *A Primer of English Verse* (Boston, 1892); Théodore de Banville, *Petit traité de poésie française* (Paris, 1891); Lee, *A Life of Shakespeare*, containing chapters on Italian, French, and English sonnets (London, 1898); Vaganay, *Le sonnet en Italie et en France au XVIème siècle* (Lyons, 1902); Noble, *The Sonnet in England* (London, 1896); Main, *A Treasury of English Sonnets* (Manchester, 1880); *The Book of the Sonnet*, edited with essays by L. Hunt and S. A. Lee (Boston, 1867); *Sonnets of Europe*, trans., ed. by Waddington (London, 1886); and Herrick, *A Century of Sonnets* (New York, 1902).

SONNINO, sôn-nē'nō. A town in the Province of Rome, Italy, 64 miles southeast of the city of Rome. Its chief feature is the Convent of Fossanova, an exceptionally fine specimen of early Gothic architecture. Population, about 3000.

SONORA, sō-nō'rȧ. A northwestern State of Mexico, bounded by Arizona and New Mexico on the north, the Mexican State of Chihuahua on the east, Sinaloa on the southeast, and the Gulf of California on the west (Map: Mexico, D 3). Area, 76,900 square miles. Along the coast extends a low arid region rising gradually toward the interior. In the east rises the Sierra Madre with its numerous offshoots inclosing deep valleys. The rivers of the State are few, the Yaqui being the most important. The climate differs considerably in the different parts of the State, but the rainfall is generally scanty, and agriculture can be carried on only with irrigation. The mineral deposits of Sonora are among the richest in Mexico, and include silver, lead, gold, copper, coal, iron, and graphite. Mining is carried on extensively and a large proportion of the mineral products is exported to the United States. Sonora is crossed by a railway line from Guaymas, its chief port, to the United States frontier. Population, in 1900, 220,553. Capital, Hermosillo (q.v.).

SONORAN REGION. An American faunal region whose bounds are very widely extended by some writers, but which is more intelligibly restricted to the high and dry plateau region of the northern interior of Mexico and to the contiguous arid region of the Southwestern United States, reaching eastward into Texas and northward into Colorado, Utah, and Nevada between the mountain ranges. It is characterized by a large variety of small animals adapted to a desert life, and has been most studied and described by Merriam.

SONS OF LIBERTY. In American history, a name applied to an organization extending throughout all the colonies, opposing first the Stamp Act, and afterwards advocating separation from Great Britain. When the Stamp Act (q.v.) was proposed in 1764, loose secret organizations, chiefly of workingmen, were formed in the various colonies to concert resistance. Col. Isaac Barré (q.v.) in a speech in Parliament in February, 1765, used the phrase 'Sons of Liberty,' which was at once adopted by these societies. With the passage of the Stamp Act they took the lead in opposition to its enforcement, and prevented its execution by force. Committees of correspondence were formed and each colony was kept in touch with the sentiment in the others. Though there was no central organization, the activity of John Lamb (q.v.), Isaac Sears (q.v.), and others in New York made the Sons of Liberty in that colony perhaps more important than in any other. With the repeal of the Stamp Act in 1766, the organization was dissolved in some towns, but in others was active in supporting the Non-Importation Agreement. As sentiment favoring entire separation grew in strength, the secrecy was discarded, and the name was given to the younger and more active patriots. In New York they controlled the Committee of Safety, and in 1774 the calling of a Continental Congress was, in part, due to them. In Georgia they were called Liberty Boys, and finally drove the royal Governor from the State. In colonies where there was a large Loyalist element the organization was efficient in preserving American supremacy, and was kept up during the Revolution. Afterwards many of the leaders were prominent Anti-Federalists and opposed the adoption of the Constitution. The name was also applied during the Civil War to the Knights of the Golden Circle (q.v.). Con-

sult: Leake, *Life of Gen. John Lamb* (Albany, 1850); and Dawson, *Sons of Liberty in New York* (Poughkeepsie, 1859).

SONS OF THE AMERICAN REVOLUTION, SOCIETY OF THE. An hereditary patriotic society organized in New York City on April 30, 1889, by representatives of the Society of the Sons of the Revolution, and of the Sons of Revolutionary Sires. The latter had been organized in San Francisco, Cal., on October 22, 1875, and after April 30, 1889, became the California State Society of the Sons of the American Revolution. Membership in this society is restricted to lineal descendants of an ancestor who rendered actual service in the cause of American independence, either as an officer, soldier, seaman, marine, militia, or minute man in the armed forces of the Continental Congress, or of any one of the several colonies. The total membership was about 10,500 in 1903.

SONS OF THE CLERGY MUSICAL FESTIVAL. A musical festival held in Saint Paul's Cathedral. It was first organized in 1709, the proceeds being devoted to the needs of the Sons of the Clergy Corporation. The Royal Society of Musicians for a long time supplied the orchestra.

SONS OF THE REVOLUTION. A patriotic hereditary society originally organized in New York City on February 22, 1876, and reorganized on December 4, 1883. It admits to membership any male lineal descendant from an ancestor who actively assisted in establishing American independence during the War of the Revolution between April 19, 1775, and April 19, 1783. This society has been specially active in marking historic localities with tablets, especially in New York City. Noteworthy among these monuments are the tablets commemorating the battle of Long Island and that marking the site of the battle of Harlem Heights. The statue of Nathan Hale in City Hall Park, New York, was also erected by this organization.

SONS OF VETERANS. A patriotic society organized in Philadelphia, Pa., on September 29, 1879. It admits to membership lineal male descendants of honorably discharged soldiers, sailors, and marines who served in the Civil War. The insignia consists of a bronze bar on which are the words 'Filii Veteranorum;' and pendant from this bar is a red, white, and blue ribbon attached to a medallion containing a monogram of the letters 'S. V.' in relief on a wreath over crossed cannons, surmounted by a spread eagle. Of similar character is an organization known as Daughters of Veterans, which admits to membership daughters of honorably discharged soldiers, sailors, and marines, and daughters of Sons of Veterans, who are fifteen years of age and upward.

SONS OF WAR VETERANS, SOCIETY OF. A patriotic society founded in 1893, having for its objects to preserve and perpetuate the principles for which the Federal soldiers fought in the Civil War; to assist surviving veterans and their widows; and the mutual benefit and advancement of its members. It admits to membership any male lineal descendant of an honorably discharged Union soldier, sailor, or marine who served during the Civil War for a period of not less than six months, part of which service must have been at the front.

SONSÓN, sôn-sōn′. A town of the Department of Antioquia, Colombia, 110 miles northwest of Bogotá, on the Sonsón River, at an altitude of 8300 feet (Map: Colombia, C 2). In the vicinity are extensive mines of gold, silver, and salt. The industries include weaving of cotton and woolen mantles, and the manufacture of straw hats. Population about 16,000.

SONSONATE, sôn′sō-nä′tā. A town of Salvador, situated 32 miles west of San Salvador (Map: Central America, C 4). It is the capital of a department of the same name, and is regularly built. It is the centre of a rich agricultural district. Population about 9000. It was founded in 1524 by Pedro de Alvarado.

SONTAG, zôn′täg, HENRIETTE (1806-54). A German operatic soprano, born at Coblenz. She was engaged upon the stage from her earliest childhood. In 1824 she sang at Leipzig in *Der Freischütz* and *Euryanthe,* in which latter opera she created the title rôle. Her success was immediate and sensational, and in 1824 she accepted a call to the Königstädter Theater, Berlin. Two years afterwards she sang the part of Rosina in *Il Barbiere di Seviglia,* in which her remarkable powers of coloratura gave her a distinct triumph over Catalani. In 1827 she was engaged at the Paris Italian opera, and a year afterwards married Count Rossi. She sang in all the musical centres of Europe, and in 1852 visited the United States. In 1854 she was engaged for the Italian opera in Mexico, but was stricken with cholera and died there.

SOO-CHOW, sōō′chou′. A town of China. See SU-CHOW.

SOPHIA, sō′fē-ȧ. The capital of Bulgaria. See SOFIA.

SOPHIA DOROTHEA (1666-1726). Consort of George I., King of England, and Elector of Hanover. She was the heiress of Duke George William of Brunswick-Luneburg-Celle, and married her cousin, the Crown Prince of Hanover, in 1682. She bore her husband two children, who became King George II. of England and Queen Sophia Dorothea of Prussia, mother of Frederick the Great. Her life at the Hanoverian Court was made miserable by the intrigues of her father-in-law's mistress, the Countess von Platen, who accused her of a liaison with Count Philip Christopher von Königsmarck. The Count, a wealthy young Swedish nobleman, had been a page at her father's Court, and was then colonel of the guards at Hanover. One night as he left the Crown Princess's apartments he was set upon by four soldiers stationed there to arrest him, and accidentally killed. The body was hastily concealed and his disappearance long remained a matter of mystery. Soon afterwards the Crown Princess was arrested, tried before a court appointed for the purpose, and her marriage annulled. She was then sent to the little Castle of Ahlden, where she was confined until her death, thirty-two years later. Her guilt or innocence has long been a matter of controversy. Consult Wilkins, *The Love of an Uncrowned Queen* (London, 1900). See KÖNIGSMARCK.

SOPHIOLOGY (from Gk. *σοφία, sophia,* wisdom, from *σοφός, sophos,* wise; connected with *σαφής, saphēs,* clear, and perhaps with Lat. *faber,* smith + *-λογία, -logia,* account, from *λέγειν, legein,* to say). The science of philosophies; one

of the principal divisions of anthropology. All peoples in every stage of development produce philosophies, or general systems of thought designed to explain the phenomena coming within their observation. To some extent these systems are the product of individual minds, yet each philosophy is in no small measure a collective product. The development of philosophic systems is outlined in the article MAN, SCIENCE OF.

SOPHISTS (Lat. *sophista*, from Gk. *σοφιστής*, *sophistēs*, wise man, teacher of arts and sciences for money, sophist, from *σοφίζειν*, *sophizein*, to make wise, from *σοφός*, *sophos*, wise). A class of thinkers and teachers who appeared in the fifth century B.C. in Greece, and especially at Athens. Unfortunately, we have little information concerning them except such as has come to us from their opponents. We can perhaps form a fair estimate of the character and significance of their work if we keep in mind the fact that much of what is said of them in extant Greek writings is extravagant satire. The change of political institutions following upon the Persian and Carthaginian wars, the growth of democracy with an increasing opportunity for the orator, the inevitable distrust in the inviolable character of social rules which were now seen to differ in various countries, all conspired to create a demand for up-to-date instruction which should qualify men for life under the new conditions. The Sophists arose to meet this demand. They popularized the results of the investigations of previous philosophers. Of the earlier Sophists some were Eleatic, some Heraclitean, some Pythagorean, and some atomistic in their views, but they laid more emphasis on equipping their pupils for the tasks of public life than for philosophic or scientific work. Philological studies, rhetoric, and argumentation by which the worse could be made to appear the better reason, were their leading interests. In the history of philosophy their significance, apart from the fact that their activity called forth the philosophical activity of Socrates, and through him that of Plato and Aristotle, is mainly epistemological and ethical. The readiness with which all their arguments were received by their listeners made them distrustful of human knowledge. They came to believe that any proposition could be proved as satisfactorily as any other. When every statement is demonstrable none can command absolute credence, and skepticism (q.v.) is the foregone conclusion. This skepticism found a theoretical confirmation in views then becoming current as to the origin of knowledge. Against the older rationalism (q.v.), which distinguished between sense and thought, Protagoras, the leading Sophist, maintained that sensations were the sole content of consciousness. But if this is true and if sense impressions of one and the same object vary, there is no court to which appeal can be made to adjust the disputes of sense. One sensation is as good as another; everything is just what it appears to be at the moment. There is no ascertainable identity underlying the differences of appearance. The unity of phenomena in their laws is lost sight of, and each individual man becomes the measure of the universe. Opposite conclusions have been drawn from this sensationalism. Gorgias argued that nothing is, inasmuch as everything is full of contradictions. Euthydemus, on the contrary, denied that there can be contradiction. If subject and predicate mean different things, then what seems to be contradiction is mere difference. Lycophon went so far as to advise the omission of the copula in propositions, presumably because all judgments are supposed to be mere unrelated sequences of words. In ethics the upshot of the sophistic teaching was an ultra-individualism with consequent license in practical life. But this result was only gradually reached. At first the distinction was made between the natural and the conventional in human usages; but when the distinction was once made gradually everything institutional and social came to be regarded as conventional, with nothing natural left except unscrupulous self-seeking. Protagoras recognized the rationality of justice and of regard for social approval (*αἰδώς*). But other Sophists were not so conservative. Callicles, in Plato, is made to say that all laws are created by the strong and enforced on the weak, while Thrasymachus contends that no man but a fool is willingly just. It is obvious that where the whole of morality is brushed aside as a trick whereby the strong make the weak do their will, religion cannot stand untouched. Protagoras prudently claimed that he knew nothing about the gods, while his successors ran the whole gamut from skepticism to avowed atheism.

It is interesting to note the unanimity with which Socrates, Plato, and Aristotle condemned the Sophists for accepting pay for their teaching. The reason for this is no doubt the same reason which nowadays makes some conservative educators look with apprehension upon large endowments given by living benefactors to colleges and universities. Fear is expressed that in such institutions not what is true, but what is pleasing to the donor, will be taught. In like manner, Socrates, Plato, and Aristotle doubtless had apprehension for the cause of what, to use a modern phrase, we may call academic freedom. And it was with them in many cases something more than a mere apprehension. The truth was that by many of the Sophists learning was prostituted; and yet no universal condemnation may properly be passed on the Sophists as a class, as was done by modern historians till the appearance of Hegel's *History of Philosophy*. On the other hand, Grote in his *History of Greece*, vol. viii., has gone to the other extreme and has failed to appreciate the subversive tendency of much of the sophistic activity. Among the Sophists are to be mentioned Protagoras, Gorgias, Prodicus, Hippias, Polus, Thrasymachus, Euthydemus, Dionysodorus, Callicles, and Antiphon. Consult: Grote, *History of Greece;* Sidgwick, *Journal of Philology*, vols. iv. and v.; and the histories of philosophy by Ueberweg-Heinze, Windelband, Erdmann, Zeller, Gomperz, Benn, and Schwegler (for titles and dates of these works, see article on PHILOSOPHY); also Schanz, *Die Sophisten* (Göttingen, 1867).

SOPHOCLES, sŏf'ō-klēz (Lat., from Gk. *Σοφοκλῆς*, *Sophoklēs*) (c.496-406 B.C.). An Athenian dramatist, born of a prosperous family at Colonus, a beautiful suburb of Athens. His long and happy life coincided with the period of the Imperial greatness of Athens. His dramas are the most perfect exemplars of Attic art. His statue in the Lateran is the ideal type of Greek manhood. All the prizes of youth, maturity, and

old age fell to him in their season. At the celebration of the victory of Salamis (B.C. 480) he was selected to lead the chorus of dancing and singing youths. His grace and youthful beauty in the rôle of the Princess Nausicaa playing ball with her attendant maidens were long remembered. In another part he served as the model of the painter Polygnotus for his ideal picture of the bard Thamyris. He composed the music of his beautiful choric odes, and in addition to his plays wrote many poems, including a Pæan to Æsculapius, which was still sung in the third century A.D. He served his country in various capacities as ambassador, treasurer of the tribute, and general. He was noted for his piety, held a minor priesthood in his old age, and was worshiped with heroic honors after death. His cheerful temper and agreeable manners made him a universal favorite, against whom even the scurrilous comedians found little to say. He was the friend of Herodotus, who wrote an ode in his honor, and the associate and colleague of Pericles. His life is a verification of the Periclean boast that grace and versatility in varied service stamp the true Athenian.

In the year 468, at the age of twenty-eight, he produced his earliest play, the *Triptolemus*, which won the first prize against the veteran Æschylus. For the remaining years of Æschylus's life the two mighty rivals contended, with varying success, each learning much from the art of the other. The first recorded contest with Euripides occurred in the year 438, when the younger poet's *Alcestis* won the second place. In the contests of the next thirty-two years Sophocles was generally successful, bearing away the first prize about twenty times and never falling below the second place.

He held public office not as a professional politician, but "like any other good Athenian." In the year 440 he was elected one of the board of generals for the Samian War with Pericles, according to the legend, because of the popularity or political wisdom of the *Antigone*. The great poet as general was the theme of many anecdotes, some of which have been preserved by the writer of memoirs, Ion of Chios, who met him in Chian society and at a banquet, where he debated the proprieties of poetic diction with a pedantic schoolmaster and triumphantly displayed his 'strategy' in the capturing of a kiss from a pretty child. His old age is said to have been clouded by the attempt of his son, Iophon, to deprive him of the management of his estate on the ground of mental incapacity. The legend adds that Sophocles refuted the charge by reading to the jurors the magnificent chorus in praise of Colonus from the *Œdipus at Colonus*, his latest play, produced after his death by his grandson and namesake. If the tale is true it is strange that Aristophanes makes no allusion to it in the *Frogs* (B.C. 405). There the relations between father and son are so friendly that Dionysus is unwilling to bring back Sophocles to the upper world until he has had an opportunity to test Iophon's poetic powers when unaided by his father. On the death of Euripides in the spring of 406 Sophocles assumed mourning and ordered his chorus to appear without wreaths. A few months later he himself followed his younger rival.

The chief changes in the external form of tragedy attributed to Sophocles are the raising of the number of members of the chorus from twelve to fifteen and the introduction of a third actor, which made possible the complication of the action and the more effective portrayal of character by contrast and juxtaposition. He also abandoned the Æschylean fashion of composing plays in groups of three about a central myth or motive and made each play an independent psychological and dramatic unity. The chorus participates very slightly if at all in the plot, and the length of the choric odes relatively to the dialogue diminishes, though they never become mere musical interludes, as is too often the case in Euripides. The Sophoclean chorus is the ideal spectator and interpreter of the ethical and religious significance of the action. The great choric odes of the *Antigone* and the *Œdipus* unite the grace of the Greek lyric to the moral earnestness of the Hebrew psalm.

Sophocles composed about 120 plays, of which seven are preserved, together with fragments of eighty or ninety others. (1) *Ajax*, brooding upon the dishonor done him by the awarding of the arms of Achilles to Odysseus, is bereft of his reason by Athena, whom he has offended by presumptuous speech. In his frenzy he wreaks his wrath upon the cattle of the Greeks. At this point the action begins. Awakening to the intolerable humiliation of his position, he slays himself after a touching farewell to his infant son and a noble apostrophe to earth and sea and sky. The debate on the question of granting him honorable burial, which fills the last third of the play, is an anticlimax to modern feeling, but effectively displays the conciliatory temper of the sagacious Odysseus and the vindictive spirit of Menelaus. (2) The *Antigone*, perhaps the first problem play in literature, presents the moral antinomy that arises from a conflict between political authority and the law of the individual conscience. Antigone, in obedience to Greek religious feeling and the dictates of her woman's heart, bestows the rites of burial upon her rebel brother Polynices in defiance of the edict of King Creon, and so brings about her own death, and, by tragic complication, that of her lover, Hæmon, the King's son. (3) The *Electra* corresponds to the middle play of Æschylus's trilogy the *Oresteia*, and to the *Electra* of Euripides. It treats of the slaying of Clytemnestra and her paramour, Ægisthus, by her children, Orestes and Electra, in revenge for the murder of their father, Agamemnon. The psychological interest centres in the character of Electra, a sort of ancient Colomba, nerving her brother to the prosecution of the blood feud. (4) The *Œdipus Tyrannus* is the most ingeniously constructed of Greek plays and a typical example of the so-called Sophoclean or dramatic irony. The plot turns on the gradual inevitable revelation to Œdipus, through his own insistent inquiry, of the dreadful truth, already known to the audience, that he has unwittingly fulfilled the oracle which doomed him to slay his father and live in incestuous marriage with his mother. (5) The *Trachiniæ*, named from the Trachinian maidens of the chorus, treats of the poisoning of Hercules by the Nessus robe sent to him as a love charm by his jealous wife, Deianira, and his translation to heaven from the funeral pyre on Mount Œta. (6) The *Philoctetes* was produced in 409. Philoctetes, bitten by a serpent and afflicted with a

disgusting wound, had been abandoned by the Greeks on the desert shore of Lemnos. After many years an oracle declares that he, the possessor of the bow of Hercules, is indispensable to the besiegers of Troy. Odysseus and Neoptolmeus, the son of Achilles, are sent to fetch him if need be against his will. Very beautiful are the descriptions of nature and the account of Philoctetes's lonely life. But the chief interest of the play lies in the psychological study of the final revolt of the frank nature of Neoptolemus against the treachery which Odysseus requires him to practice upon the unsuspecting Philoctetes. (7) The *Œdipus at Colonus* (first produced in 401) depicts the reconciliation of Œdipus with destiny and his sublime and mysterious death at Colonus after years of wandering as a blind exile, sustained by the loving tendance of his daughter, Antigone.

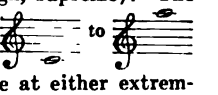
As a poet Sophocles cannot vie with the imaginative sublimity of Æschylus. As a thinker he may be less fertile in suggestion than the ingenious Euripides. But regarded as a Greek artist, shaping Greek legends in the conventional molds of Attic tragedy, he holds the just and perfect mean between the titanic symbolism of the older poet and the sentimental, rhetorical realism of the younger. He is reported to have said that Æschylus did right without knowing it, and that Euripides painted men as they are, while he himself represented them as they ought to be. A slight plot suffices him for the creation of a masterpiece because his subtle dramatic art and his exhaustive psychological analysis elicit from a simple situation a complete revelation of character and destiny. Fate, the prime motive of ancient tragedy, is no longer felt as a capricious external power, but as the inevitable outcome of character and the unavoidable condition of life. Tragic pathos is refined to a sense of the universal human fellowship in frailty and suffering. And beauty, the all-pervading, gracious serenity of an unfailing and unobtrusive art, takes from pathos and tragedy their sting and dismisses us from the scene calmed, elevated, and reconciled. 'Sophocles is the most truly Hellenic of the Greek tragedians, and for those who have drunk deeply of the Hellenic spirit the most human too.'

The best edition is that of Jebb, in seven volumes, with elaborate commentary and English translation facing the Greek. There is a good annotated edition by Campbell, and an excellent monograph by the same author. Plumptre's verse translation is much esteemed. That of Whitelaw is perhaps better.

SOPHOCLES, EVANGELINUS APOSTOLIDES (1807-83). A Greek-American scholar, born at Tsangaranda, near Mount Pelion, in Thessaly. As a youth he spent much time in Egypt, and received his earlier education at the Convent on Mount Sinai. In 1829 he emigrated to the United States and continued his studies at Amherst College. He was tutor at Harvard College, with a short intermission, from 1842 to 1849. In this year he was appointed assistant professor of Greek, and in 1860 he became professor of Ancient, Byzantine, and Modern Greek. His publications include a *Greek Grammar* (1838; 3d ed. 1847), *First Lessons in Greek* (1839), *Greek Exercises* (1841), *Greek Lessons for Beginners* (1843), *Catalogue of Greek Verbs* (1844), *History of the Greek Alphabet* (1848), *Glossary of Later and Byzantine Greek* (1860), revised and published under the title, *Greek Lexicon of the Roman and Byzantine Periods* (1870).

SOPHONIS'BA (Lat., from Gk. Σοφόνισβα). The daughter of the Carthaginian Hasdrubal, son of Gisco. When young her father promised her in marriage to the Numidian prince Masinissa (q.v.), but subsequently gave her to Masinissa's rival, Syphax. When Masinissa in the Second Punic War overthrew Syphax, Sophonisba fell into his hands and he soon made her his wife, to the displeasure of Scipio, who insisted that he should surrender her. In order to save her from captivity, her husband sent her poison with which she put an end to her life. Her history forms the theme of a large number of tragedies, among them, in English, those by Thomson (1729), Nathaniel Lee (*Sophonisba, or Hannibal's Overthrow*, 1676), Marston, (*Sophonisba, or The Wonder of Women*, 1602); in French, under the title *Sophonisbe*, by Mairet (1630) and by Corneille (1663); in Italian, as *Sofonisba*, by Galeotto del Carretto (1502), Trissino (1529), and Alfieri (1783).

SO'PHRON (Lat., from Gk. Σώφρων) **OF SYRACUSE** (B.C. 460-420). A Greek writer of mimes. Though from time immemorial the Greeks of Sicily had practiced the mimes at their public festival, Sophron was the first to reduce them to the form of a literary composition. They consisted in the representation of scenes from actual life, chiefly in the lower classes, brought out by a dramatic dialogue, interspersed with numerous colloquial forms of speech. These pieces of Sophron, which were in the Doric-Greek dialect and in a kind of cadenced prose, were great favorites with Plato, who made use of them for the dramatic form of his dialogues (Quint., i. 10, 17; Diog. Laert., iii. 13). It is said that Theocritus borrowed his second and fifteenth idyls from Sophron. Very unsatisfactory fragments have been preserved. Consult Botzon's collection (Marienburg, 1867) and his *De Sophrone et Henarcho Mimographis* (Lyck, 1856).

SOPRANO (It., treble, high, supreme). The highest species of female voice, whose range normally extends from  to

With the exception of those at either extremity, all the tones are common to both the head and chest registers. A voice sometimes distinguished as intermediate between alto and soprano is the *mezzo-soprano*. See MEZZO.

SO'RA. A city in the Province of Caserta, Italy, on the Garigliano, 62 miles east-southeast of Rome (Map: Italy, H 6). The river is here spanned by two bridges. There are remains of walls and castle ruins above the town. It manufactures woolen cloth and paper and trades in wine, oil, fruits, and cattle. Sora, originally a Volscian town, was colonized by the Romans in B.C. 303. Population (commune), in 1881, 13,208; in 1901, 16,001.

SORA. A small rail (q.v.); especially, in the Middle States, the Carolina rail (*Porzana Carolina*), which is very abundant in the marshes of the Atlantic Coast in the early fall and gives fine sport and a welcome delicacy. It is eight or nine inches long, olive brown above varied

with black and white, and beneath (in the fall) it is plain brownish. In breeding plumage the face and throat are black, the other under parts slate-gray. The sora breeds from the Middle States northward to Hudson Bay, and winters from the Carolinas southward to South America. The nest is of grass on the ground in swamps and the eight to fifteen eggs are buffy, spotted with brown. See Plate of RAILS, ETC.

SORATA, sō-rä'tà, or ILLAMPU. The highest mountain of Bolivia and one of the highest of the South American continent (Map: Bolivia, D 7). It is situated in the Bolivian Department of La Paz, about 16 miles east of Lake Titicaca, and reaches an altitude of 21,500 feet. It was first ascended by Sir William Martin Conway in 1898.

SORAU, zō'rou. A town in the Province of Brandenburg, Prussia, on the Sorebach, 60 miles south-southeast of Frankfort-on-the-Oder (Map: Prussia, F 3). It has an old castle (now a prison) and a new castle (the seat of the magistracy). There are important bleach-fields, print-works, color-works, iron foundries, and manufactories of cloth, machinery, glass, porcelain, tubing, waxwares, wooden shoes, and glazed bricks. In the neighborhood are deposits of lignite. Sorau, the oldest town of Lusatia, received municipal privileges in 1260. It was ceded by Saxony to Prussia in 1815. Population, in 1900, 15,945.

SORAUER, zō'rou-ĕr, PAUL (1839—). A German botanist, born at Breslau. In 1871 he became director of the experiment station at the Proskau Pomological Institute, and in 1892 he was made professor. In 1893 he went to Berlin as secretary of the International Phytopathological Commission. He became distinguished for his investigations in the diseases of plants, and founded the *Zeitschrift für Pflanzenkrankheiten* (Stuttgart), besides writing such books as: *Das Handbuch der Pflanzenkrankheiten* (ed. 1886; its atlas, 1887-93); *Die Obstbaumkrankheiten* (1879); *Die Schäden der einheimischen Kulturpflanzen durch Schmarotzer*, etc. (1888); *Populäre Physiologie für Gärtner* (1891); *Pflanzenschutz* (with Frank, 1892 and 1896).

SORBONNE, sôr'bôn', LA. An institution of learning in Paris, founded by Robert de Sorbon. Robert was born October 9, 1201, in Sorbon, near the town of Rethel, not far from Rheims. During the subsequent centuries and even to the present day, the place-name of this man has been attached to the focus of intellectual activity in France. Robert pursued his studies in Paris, looking forward to the priesthood. He became a priest, a doctor of theology, and a canon, first in the Cathedral of Cambrai, and then in that of Paris. By his eloquence and piety he soon won renown and was presently made chaplain, and perhaps confessor to King Louis IX., known as Saint Louis. Impressed by the importance of theological science and by the necessities of poor young men who might need support while engaged in the study of theology, Robert de Sorbon established a society of secular ecclesiastics. The King and some of the ecclesiastical dignities favored this enterprise; and in the year 1257 a site was secured by royal bounty for the home of the society. It was near the Palais des Thermes, in the heart of what has long borne the name of the Latin Quarter. There were other similar associations or colleges, but this was destined to perpetuity and distinction. The founder called the establishment *La Communauté des pauvres maîtres étudiant en théologie;* but the public shortened this long phrase, and before the close of the century the college was called, from its founder's name, La Sorbonne, which it has borne amid all the changes of social and intellectual life from that day to the present. Its Latin title was Domus Sorbonnæ. The House was a hall of residence and of study—not a place for systematic instruction and lectures. For the work of Robertus, the Papal approbation was secured in 1268. Several years later, to this theological seminary the founder added a college for the humanities and philosophy, and he died soon afterwards, at Paris, seventy-three years old (1274).

His life is full of interest and may be read in a memoir by Jadart, published at Rheims, in 1880. The principal incidents are well presented in the *Biographie générale*, and by Baroux in *La grande cyclopédie* (vol. XXX.). The early muniments of this foundation may be found in Denifle's masterly compendium of *Documents relatifs à l'Université de Paris* (Paris, 1883), and in the *Cartularium Universitatis Parisiensis*, tom. i., (Paris, 1889).

From its origin until the present time the Sorbonne has been the centre of intellectual activity, and until the French Revolution it was recognized as especially the seat of theological learning. The Faculty pronounced their opinions on the most important questions and their decisions were recognized as of great authority. The reader need only consult the *History of France* by Henri Martin to discover many illustrations of this statement. The Faculty intervened in the trial of Jeanne d'Arc; it condemned the views of Luther and showed great hostility toward reformers; censured many noteworthy books and writers; opposed the Cartesian philosophy; and addressed the Czar in regard to a reunion of the Greek and Latin churches. Among the books which it condemned were the treatise of Helvetius, *De l'Esprit*, the fourth volume of Buffon's *Natural History*, and Rousseau's *Emile*. Among the glories of the Sorbonne was its encouragement of printing in France, by giving quarters for their presses to Ulric Gering and other early printers.

The buildings of the Sorbonne were reconstructed at the beginning of the seventeenth century by Richelieu, who merits the distinction of a second founder. The church which he caused to be built as the college chapel is one of the celebrated monuments of ecclesiastical architecture in Paris. His tomb is there, not far from the tomb of Robert de Sorbon. The Sorbonne was given to the city of Paris in the middle of the nineteenth century, and the construction was begun of a magnificent building for the departments of science and letters. This edifice, called La Nouvelle Sorbonne, was completed in 1889, and it is perhaps the finest university building in the world. Its lecture-rooms and laboratories are well equipped, and the mural decorations (especially the great picture of Puvis de Chavannes) are of rare beauty. In the transition from the old to the new Sorbonne

M. Gréard published a noteworthy pamphlet, entitled *Nos adieux à la vieille Sorbonne.*

The changes in the interior administration due to the progress of science and to the increase of funds are too complex for presentation here. The most radical are the disappearance, after the French Revolution, of the Faculty of Theology, which was once the sole authority, so that a Sorbonnist was of course a theologian; the consequent supremacy of literature and science, evinced by the organization of the Ecole des Hautes Etudes, and by the founding of libraries and seminaries; and likewise by the establishment, in the immediate neighborhood, of schools of medicine and law. The faculties of Science and Letters of the University of Paris are installed in the New Sorbonne and *Minerva* for 1901-02 reports that their libraries contain 263,590 volumes.

At a recent date, connected more or less closely with the New Sorbonne, there were 10,000 students, 100 professorships, and many accessory positions for associates and assistants. In addition to the works above named, consult Franklin, *La Sorbonne: ses origines, sa bibliothèque,* etc. (Paris, 1875).

SORCERY. See WITCHCRAFT.

SORDEL'LO. An Italian troubadour of the thirteenth century who wrote in Provençal. He was a native of Goito, Mantua. The earliest mention of him has reference to a tavern brawl, which took place about 1220, and the last document in which his name appears is dated 1269. While living at the Court of Richard of San Bonifazio, he carried off his master's wife, Cunizza, at the instigation of her brother, Ezzolino da Romano. Soon afterwards he fled to Provence, where, with the exception of visits to Spain and Portugal, he seems to have spent the greater part of his life. Here he took part in important public events, his name appearing as that of a witness in various treaties and other documents. In his old age he returned to Italy as a knight in the train of Charles of Anjou, and received from him several castles in Abruzzo as a reward for his services. As a poet he rises little above mediocrity. His political, moral, and personal sirventes show vigor and spirit, but his love songs are purely conventional, and his didactic poem *Documentum Honoris* has no unusual merit. His great reputation depends upon Dante's treatment of him in *Purgatorio,* vi. and vii., where he becomes a type of high-minded nobility and patriotism. This conception is founded upon a sirvente on the death of Blacatz, in which Sordello imagines his patron's heart divided among the various princes who need its virtues. Dante has put into the mouth of his shade in Purgatory a similar invective. The poem of Browning which bears his name has but the slightest historical foundation. Consult: Cesare de Lollis, *Vita e poesie di Sordello di Goito* (Halle, 1896).

SOREL'. The capital of Richelieu County, Quebec, Canada, on the Richelieu River at its mouth in Lake Saint Peter, and on the Montreal and Sorel Railroad, 45 miles northeast of Montreal (Map: Quebec, C 4). It has large shipbuilding and manufacturing interests. It derives its name from the captain of a French regiment, who established a fort here in 1665. Population, in 1891, 6669; in 1901, 7057.

SOREL. A river of Canada. See RICHELIEU.

SOREL, AGNES. Mistress of Charles VII. of France. See AGNES SOREL.

SOREL, ALBERT (1842—). A French author, born at Honfleur. He became professor of diplomatic history in the School of Political Sciences at Paris in 1872. In 1896 he was made a member of the French Academy. Some of his works are *La grande falaise* (1871), *Histoire diplomatique de la guerre franco-allemande* (1875), *La question d'Orient au XVIII. siècle* (1878), *L'Europe et la révolution française* (1885), *Montesquieu* (1887), *Madame de Staël* (1890), and *Bonaparte et Hoche en 1797* (1896).

SOREL, CHARLES (c.1599-1674). A French burlesque romancer, of whose life little is known. In 1622 appeared anonymously his *Histoire comique de Francion,* first in seven, later (1641) in eleven books. This work, reprinted more than forty times in the seventeenth century, made merry with the pastoral and chivalric romances then so popular. In *Le berger extravagant* (1621), an imitation of *Don Quixote,* Sorel likewise mocked the 'ideal' romance. His *Polyandre* (incomplete, 1648) portrays the well-to-do Parisian bourgeoisie with some accuracy. Consult Körting, *Geschichte des französischen Romans im XVII. Jahrhundert* (Leipzig, 1885), and Roy, *La vie et les œuvres de Sorel* (Paris, 1853).

SORGHUM (Neo-Lat. *sorghum, sorgum,* from Sp. *sorgo,* ML. *surgum, surcum, suricum,* Indian millet, sorghum, probably of Oriental origin), *Sorghum vulgare* or *Andropogon sorghum,* var. *saccharatus.* A tall, earless maize-like grass with a terminal head of small seeds. It is supposed to be a native of Africa, but has long been cultivated in Southern Europe and China as a forage plant (see below), and for the syrup made from its sweet juice, which does not yield a profitable quantity of sugar. See SUGAR, paragraph *Manufacture.*

SORGHUM, NON-SACCHARINE. A group of varieties of sorghum, deficient in sugar. The plants, which are very leafy, grow from 4 to 8 feet high and are cultivated for food and forage. All varieties are closely allied and belong to the above-named species. The most common varieties are Kafir corn, millo maize, durra, Egyptian rice corn, Jerusalem corn, and broom corn (q.v.). They are extensively grown in Africa, India, and China for the seed, which forms a staple human food. In Europe they are sometimes planted, but they do not ripen seed in regions remote from the Mediterranean countries. In the United States they are grown as forage plants in the semi-arid Western States, where, owing to their drought-resisting qualities, they have become important crops. Soil, climatic requirements, and cultural methods are practically the same for all varieties.

Kafir corn, the most important variety for the American farmer, was introduced by the United States Department of Agriculture about 1885 and widely distributed. It has become a valuable and important crop in California, Kansas, and Oklahoma. It succeeds on a variety of soils, but the best returns are obtained on rich soils suitable for corn. Profitable yields, however, are often

obtained on land too poor for corn. The preparation of the soil consists in deep plowing and fine surface pulverization to insure best conditions for the young plants, which are at first feeble and slow to grow. The seed is sown broadcast in hills or drills after the soil becomes warm. When it is grown in hills or drills it is treated like corn, when broadcasted like hay crops. As soon as the grain is ripe the plants are cut by hand or with a corn harvester, put up in shocks, and left to cure. When the curing process is completed the heads are threshed for the seed and the stalks and leaves used as fodder. Frequently the entire plants are used for feeding. From 35 to 50 bushels of seed per acre and from 5 to 10 tons of fodder are obtained under ordinarily favorable conditions.

Millo maize requires a longer season of growth then Kafir corn, and is therefore liable to injury by frost in many localities. Durra, also sometimes called Egyptian corn, grows vigorously and stools profusely. The heads are heavy, short, and thick, and hang downward from a short curve in the upper part of the stalk. The name is often written dhoura or doura. Egyptian rice corn differs from the other varieties in stooling very little and having a smaller amount of foliage. The seeds are white, large, and sweet. Jerusalem corn produces heavy yields of grain. Its seeds are nearly free from husk and shatter easily. None of these varieties are materially affected by either plant diseases or insects. See SMUTS.

The saccharine sorghums are favorably regarded for silage and soiling purposes and for forage. Growing animals thrive upon them, and dairy cattle produce a large flow of excellent milk. The bagasse or refuse from the press in syrup-making is also fed advantageously. According to experiments 40 per cent. of the protein, 71 per cent. of the nitrogen-free extract, and 42 per cent. of the crude fibre of sorghum forage is digestible.

The average composition of sorghum products follows:

AVERAGE COMPOSITION OF SORGHUM PRODUCTS

	Water	Protein	Fat	Nitrogen free extract	Crude fibre	Ash
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Whole plant fresh	72.7	1.4	1.7	15.2	7.4	1.6
Whole plant cured	43.6	3.9	3.3	25.8	20.2	3.2
Sorghum silage	75.5	1.5	1.2	11.9	8.0	1.9
Sorghum seed	12.8	9.1	3.6	69.8	2.6	2.1
Sorghum bagasse	11.3	3.4	1.4	50.5	30.5	2.9

Although sorghum furnishes excellent pasturage for all stock, it is especially valuable for sheep and pigs, but until the animals become accustomed to it they should have only small amounts. It is best adapted for fall and early winter feeding, since it does not keep as well as many other coarse fodders. Sorghum silage has a greater tendency to develop acidity than corn. When in good condition it is an excellent feeding stuff. The seed is a concentrated feed, and quite similar in composition to shelled corn, though regarded as somewhat inferior in feeding value. When sorghum is grown for making syrup, the seed heads are often fed whole; otherwise they are frequently left on the stalk and fed as forage. It is believed that grinding increases the digestibility of the seed. Since Kafir corn is the most important non-saccharine sorghum, and since other varieties resemble it, it is taken as a type of the group. (See table.)

COMPOSITION OF KAFIR CORN PRODUCTS

	Water	Protein	Fat	Nitrogen free extract	Crude fibre	Ash
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Whole plant, green	76.1	2.8	0.6	11.7	7.2	1.6
Cured fodder, whole plant	10.9	3.3	2.5	47.4	30.4	5.5
Stover cured fodder (without heads)	9.0	5.8	1.7	48.2	30.1	5.2
Heads (mature)	16.2	6.9	2.9	65.2	6.8	2.0
Seed	9.3	9.9	3.0	74.9	1.4	1.5

In composition, the Kafir corn products closely resemble similar products of maize. Studies at the Kansas Experiment Station have shown that as the plant ripens there is a decrease in albuminoids, but an increase in the percentage of other constituents and in the total weight of the seed. It is believed, therefore, that the best time to harvest Kafir corn is when the crop is ripe or nearly so. The stover, which has practically the same feeding value as corn stover, should be run through a cutting machine to obtain the best results. It has been found an excellent coarse fodder for cattle. The seeds have also given very satisfactory results, though it has not been found in tests at the experiment stations to be quite equal to corn, as is sometimes claimed. To obtain the best results the grain should be ground, as otherwise the small hard seeds are not thoroughly masticated and pass through the animal undigested. According to the Kansas Experiment Station, a bushel of Kafir corn will produce 10 pounds of pork, a bushel of corn 12 pounds, an acre of the former, however, producing more pork than an acre of the latter. Animals tire of Kafir corn alone more quickly than they do of corn alone. Digestion experiments with chickens have shown that about 88 per cent. of the total organic matter, 53 per cent. of the protein, and 96 per cent. of the nitrogen-free extract of whole Kafir corn is digestible. Similar values have been obtained for the ground grain. In experiments with Kafir corn stover fed to sheep about 42 per cent. of the protein, 67 per cent. of the nitrogen-free extract, and 54 per cent. of the crude fibre was digested.

Flour, which is said to be especially good for pancakes and has also been used for bread, is ground from Kafir corn, which is, however, not extensively used as food in the United States. The seeds of the closely related durra are much

eaten by the Abyssinian and other African races, and those of other non-saccharine sorghums in India and China. Kafir corn flour or meal has the following percentage composition: Water, 16.8; protein, 6.6; fat, 3.8; nitrogen-free extract, 69.5; crude fibre, 1.1; and ash, 2.2.

Consult: *Farmer's Bulletin No. 37* of the United States Department of Agriculture; *Handbook of Experiment Station Work*, United States Department of Agriculture (Washington, 1893).

SORIA, sō'rê-ȧ. The capital of the Province of Soria, Spain, 110 miles northeast of Madrid, on the right bank of the Duero (Map: Spain, D 2). The town, still surrounded by thick walls, and dotted with many ancient palaces, presents a mediæval appearance. The church of San Pedro, its principal structure, has a Latin portal of the twelfth-century style. The bridge over the Duero is a solid mediæval structure. The town has manufactures of chocolate, leather goods, and linens. Population, in 1900, 7296.

SORITES (Lat., from Gk. *σωρείτης*, *sōreitēs*, *σωρίτης*, *sōritēs*, logical sophism formed of an accumulation of arguments, from *σωρεύειν*, *sōreuein*, to heap, from *σωρός*, *sōros*, heap). A logical term with a two-fold meaning. It is the name of a series of syllogisms so arranged that the suppressed conclusion of each preceding syllogism is a premise of the succeeding; e.g. A is B, B is C, C is D, D is E, and therefore A is E. The term sorites is also used to designate a fallacy wherein it is argued that as the addition of each single object to a collection of objects does not change the character of the collection up to a certain point, therefore such addition can be made indefinitely without altering the character of the collection.

SORLEY, sôr'lĭ, WILLIAM RITCHIE (1855—). An English educator, born in Selkirk, Scotland. He was educated at Edinburgh University and at Trinity College, Cambridge, and held a fellowship in both places. From 1888 till 1894 he was professor of logic and philosophy at University College, Cardiff; from 1894 till 1900 professor of moral philosophy in Aberdeen; and in 1900 became Knightbridge professor of moral philosophy in the University of Cambridge. His works include *Hulsean Essay on Jewish Christians and Judaism* (1881), *Shaw Fellowship Lectures on the Ethics of Naturalism* (1885), and *Mining Royalties, a Report of an Inquiry Made for the Toynbee Trustees* (1889).

SORMA, zôr'mȧ, AGNES (AGNES MITO VON MINOTTO) (1865—). A German actress, born in Breslau. She appeared first in children's rôles, at the age of fourteen, at the Stadttheater in Breslau. From 1880 to 1882 she played successively in Görlitz, Posen, and Weimar, and in 1882 was engaged by the management of the Deutsches Theater at Berlin. During the spring of 1897 Sorma visited the United States, where she appeared with success in Hauptmann's *Versunkene Glocke*, and as Nora in Ibsen's *Doll's House*. In the following year she made a second visit.

SOROCABA, sō'rô-kȧ'bȧ. A town of the State of São Paulo, Brazil, 53 miles west of the city of that name, with which it has railway communication (Map: Brazil, H 8). Coffee and sugar are produced, but the main interest centres in a live-stock fair, when the sale of horses and mules sometimes reaches 70,000. Population, about 12,000.

SOROKI, sô-rô'kê. The capital of a district in the Government of Bessarabia, Russia, situated on the Dniester, 116 miles north of Kishinev. It contains the ruins of an old castle and remnant of the Genoese settlement of Olchionia, which stood there in the twelfth and thirteenth centuries. There are numerous vineyards in the surrounding country. Population, in 1897, 15,800, chiefly Jews and Moldavians.

SOROSIS (Neo-Lat., from Gk. *σωρός*, *sōros*, a heap). The first woman's club in America, organized with twelve members in March, 1868, by Mrs. Jane Cunningham Croly, in New York City, and incorporated in January, 1869. Its object is to further the educational and social activities of women, and to bring together for mutual helpfulness representative women in art, literature, science, and kindred pursuits. The first officers, Mrs. James Parton (Fanny Fern), Mrs. J. C. Croly (Jennie June), and Miss Katie Field, with Madame Botta and the Misses Alice and Phœbe Cary as members, gave the club a literary tone, but the 83 members enrolled during its first year included, besides authors and editors, artists, teachers, physicians, and philanthropists. Meetings occur once or twice a month and are conducted by two of the ten working committees.

SORREL (OF. *sorel*, Fr. *surelle*, from OF. *sur*, sour, from OHG., AS. *sūr*, Ger. *sauer*, sour; connected with OChurch Slav. *syrŭ*, rough, harsh, Lith. *sūras*, salty, perhaps akin to Gk. *ξυρός*, *xuros*, *sour*), *Rumex*. A genus of plants of the natural order Polygonaceæ. Common sorrel (*Rumex acetosa*) is a perennial herb with erect stems one to two feet high and arrow-shaped leaves, found in meadows and pastures throughout Europe. Its leaves are used in soups and sauces, as a salad, and as a pot-herb, for which purposes it is cultivated. French sorrel, or Roman sorrel (*Rumex scutatus*), a native of France and Italy, has broader and blunter leaves, and is more frequently cultivated than common sorrel, being considered of finer flavor. Sheep's sorrel (*Rumex acetosella*) is a smaller similar plant with widely-spreading roots, on account of which it often becomes a troublesome weed in dry soils. Cultivation and the addition of lime and other fertilizers to the soil quickly eradicate it. Compare OXALIS; HIBISCUS; DOCK.

SORREL TREE (*Oxydendrum arboreum*). A tree of the natural order Ericaceæ, remarkable for its size, which contrasts with its small shrubby relatives. It grows chiefly from Virginia to Georgia, attains a height of 50 feet, a trunk diameter of 12 to 15 inches, and bears peach-like acid leaves, which are sometimes used for dyeing wool black. The principal use of the tree is as an ornamental. Its wood is of little or no use.

SORREN'TO. A town in the Province of Naples, Italy, situated on a promontory on the southeast side of the Bay of Naples, 16 miles south-southeast of Naples (Map: Italy, J 7). Its beautiful situation and mild, dry climate have made it a much frequented resort. It has a cathedral, a seminary, and a marble statue of the poet Tasso, who was born here. There is a trade in the famous wine of Sorrento, and

in olive oil and fruits. Sorrento was originally a Grecian colony. It was called *Surrentum* by the Romans, who embellished it with temples, the ruins of which still remain. Population (commune), in 1901, 8933.

SORROWS OF WERTHER (Ger. *Leiden des jungen Werther*). A romance by Goethe (1774), embodying some of the author's own experiences. Just previous to the time of its production Goethe was battling against his unrequited love for Charlotte Buff, and was greatly affected by the suicide of a young man, Jerusalem, who committed suicide because of an unfortunate love affair and a fancied slight. The recognition of the possible results in his own similar case led to the creation of Werther (representing himself) and Jerusalem, and of Lotte, typifying the object of the love of each. The romance at once created a sensation and established Goethe's fame. Its influence on sentimental natures was profound and led some to follow the hero's example, so that Goethe was obliged in a subsequent edition to add a warning note.

SORSOGÓN, sôr'sô-gōn'. A province of the Philippine Islands, occupying the extreme southeastern portion of the island of Luzon (Map: Philippine Islands, H 7). Area, 675 square miles. It is surrounded by water on three sides, and almost cut into halves by the large Bay of Sorsogón. It is traversed lengthwise by a forest-covered mountain range culminating in the volcano of Bulusan. Sorsogón is a great hemp-producing province. Its export of hemp in 1899 amounted to 14,014,639 pounds. Copra is also a staple product. The province was created by the Philippine Commission in 1901, having previously been a district of the Province of Albay. Population, estimated, in 1901, 98,650, belonging to the Vicol tribe. Capital, Sorsogón.

SORSOGÓN. The capital of the Province of Sorsogón, Southern Luzon, Philippines. It is situated at the head of the Bay of Sorsogón, 30 miles from the southeastern extremity of the island (Map: Philippine Islands, H 7). The bay, which measures 6 by 12 miles, is entirely land-locked, with a narrow entrance from the Visayan Sea; it is one of the best harbors in the archipelago, and is very favorably situated near the Strait of San Bernardino on the route from Manila to the United States. Population, estimated, in 1899, 10,720.

SORTES (sôr'tēz) **VER'GILIA'NÆ.** See SORTILEGE.

SORTILEGE (ML. *sortilegium*, divination by lot, from Lat. *sŏrs*, lot + *legere*, to read). The casting of lots. This method of division was an ancient way of distributing shares among several claimants. At the bottom is a religious idea. The choice of lots was performed in the presence of a deity, as represented by his image, and was accompanied with prayer and sacrifice, being often accomplished in the temple and by a priest. It was, therefore, presumed that the god determined the order in which the lots would fall and was responsible for the decision. The common practice was to use slips of wood, pebbles, potsherds, or arrows, which were drawn from a helmet, quiver, or pail, and in order that they should be indicative, they were usually marked in some manner. A favorite mode of forecasting was to open at random a sacred book and mark the passage on which the eyes first rested, the significance of which would serve as a token of the destiny awaiting the inquirer. As Vergil's *Æneid* came so to be used, the consultation was called *Sortes Vergilianæ*. The Scriptures were so employed by Christians, while the Arabs use the Koran and the Persians the poems of Hafiz.

SOSIA. In the *Amphitruo* of Plautus, a servant of the title character. He is made doubtful of his own identity by Mercury, who, assuming Sosia's form, plays the part of his double.

SOSTENUTO, sôs'tă-nōō'tô (It., sustained). A term used in music to indicate a sustained tone or a uniform rate of decreased speed.

SOTHEBY, sŭTH'bĭ, WILLIAM (1757-1833). An English translator, educated at Harrow and at the military academy at Angers in France. He was in the English army for a short period, but retired on his marriage in 1780. Henceforth he followed the career of a man of letters, dividing his time between his London house and Fair Mead Lodge by Epping Forest. In original composition Sotheby left nothing of value. His numerous volumes of poems and his twelve historical tragedies have long since been forgotten. He survives as the translator of Vergil's *Georgics* (1800). With less success he turned into English heroic verse the *Iliad* (1830-31) and the *Odyssey* (1834). Of some interest is his early translation (1798) of Wieland's *Oberon*.

SOTH'ERN, EDWARD ASKEW (1826-81). An English comedian. He was born in Liverpool, and was educated for the Church, but the stage was more congenial to his tastes, and he made his début in Jersey in 1849. In 1852 he came to the United States and appeared at the National Theatre of Boston in the character of Dr. Pangloss. In 1854 he joined Wallack's company and afterwards that of Laura Keene. In the character of Lord Dundreary in Tom Taylor's comedy *Our American Cousin* (1858) he made his great success. In 1864 he appeared in *David Garrick*, which was regarded as, next to Dundreary, his best part. His other chief successes were in *Brother Sam*, written for him by Oxenford (1865), Sidney Spoonbill in Byron's *Hornet's Nest*, and Fitzaltamont in *The Crushed Tragedian*, with which he appeared in London in 1878, soon after his return from a prolonged tour in America. Consult: Pemberton, *Memoir of E. A. Sothern* (London, 1890); Scott, *The Drama of Yesterday and To-day* (ib., 1899).

SOTHERN, EDWARD H. (1859—). An American actor, the second son of E. A. Sothern. He was born in London, England. In 1879 he made his début as an actor with his father in New York. His first real success was in *One of Our Girls* at the Lyceum, New York, in 1885. This was followed in 1887 by his success in *The Highest Bidder*, and later he was popular in many romantic plays. In 1900 he appeared in *Hamlet*. He married in 1896 the actress Virginia Harned. Consult: McKay and Wingate, *Famous American Actors of To-day* (New York, 1896); Strang, *Famous Actors of the Day in America* (Boston, 1900).

SOTTEVILLE-LÈS-ROUEN, sôt'vēl' lā rōō'ĕN'. A town in the Department of Seine-Inférieure, France, one mile south of the city of Rouen, of which it is a suburb (Map: France, H 2). Population, in 1901, 18,535.

SOU, sōō (OF. *sou, sol*, It. *soldo*, from ML. *solidus*, sort of coin, Lat. *solidus*, solid, firm). A former French coin, originally of gold, subsequently of silver, and then of copper; toward the end of the eighteenth century large numbers were struck in bell metal. At various times there were fourth (liard), half, two, and three sou pieces. The value of the sou was 12 deniers, or one-twentieth of a livre tournois or one-twenty-fifth of a livre parisis. The copper sou of the eighteenth century weighed 12.238 grains, and while its nominal value remained 12 deniers, it was actually worth only about two. The coinage of the sou ceased upon the adoption of the present decimal monetary system, but the word sou is popularly applied to the five-centime piece, which is one-twentieth of a franc and worth about one cent.

SOUBISE, sōō'bēz'. An ancient French family which became extinct in the male line in 1566, the female survivor marrying in 1575 Vicomte René II. de Rohan. Two sons were the offspring of this marriage, of whom the elder was Henri, Duke de Rohan (q.v.), a celebrated leader of the Huguenots. The younger son, Benjamin, Sieur de Soubise (1583-1642), served under Maurice of Nassau in the Netherlands, joined his brother in the leadership of the Huguenots, and gained his greatest distinction in the defense of La Rochelle (1627-28) against Richelieu. He died without issue and the title passed to François de Rohan, of whose descendants the best known was Charles de Rohan, Prince de Soubise (1715-87). He served in the War of the Austrian Succession and was made lieutenant-general in 1748. In the Seven Years' War he held important commands and was at the head of the French and Imperial forces in the disastrous battle of Rossbach (1757). He was made a field-marshal in 1758. In the following year he became a Minister of State. After the Peace of Paris he retired from active participation in military affairs. He had the favor of Mme. de Pompadour and afterwards that of Mme. du Barry. He died July 4, 1787, the last of the line of Soubise-Rohan. See ROHAN.

SOUDAN, sōō-dän'. A region in Northern Africa. See SUDAN.

SOUFFLOT, sōō'flō', JACQUES GERMAIN (1713-80). A French architect, born at Irancy (Yonne). In 1734 he went to Rome as a pensioner of the Academy. After studying in Italy and Asia Minor he returned to Lyons, where he soon gained distinction. At this period he either constructed or collaborated in the design of every building of importance that was undertaken in Lyons. In 1749, having become a member of the Royal Academy of Architecture, he removed to Paris. In 1772 he was appointed controller of the monuments and embellishments of Lyons, and in 1775 controller of the buildings of Paris. He is chiefly noted as the architect of the Pantheon, one of the largest and finest cupolas in existence. Among his other works are the sacristy of the Cathedral of Notre Dame and the Ecole de Droit in Paris, the Hôtel Dieu in Lyons, the Hôtel de Ville in Bordeaux, and the Cathedral of Rennes.

SOUFRIÈRE, sōō'frē-âr', LA. A volcano situated near the northern end of the island of Saint Vincent (q.v.) in the West Indies. Its height is 3700 feet. It has had three violent eruptions within the last two centuries. In 1718 there was a terrific explosive eruption which covered the whole island with débris. In 1812 another devastating outbreak took place in which a new crater was formed immediately beside the old one. During the next ninety years the volcano was dormant, the old crater being occupied by a lake. On May 7, 1902, there occurred, simultaneously with the eruption of Mont Pelée (q.v.) in Martinique, a violent outburst in which immense clouds of steam charged with hot volcanic dust rushed down the sides of the mountain in all directions with the velocity of a hurricane, while large quantities of red-hot stones were showered over the northern part of the island. The entire northern third of the island was devastated, all vegetation being destroyed and the ground covered with dust and rocks to the depth of from 1 to 25 feet. Two villages were annihilated and 1500 persons killed. On September 3d there was another outburst almost as violent as the first.

SOUL (AS. *sāwl, sāwul*, Goth. *saiwala*, OHG. *sēula, sēla*, Ger. *Seele*, soul; possibly connected with Lat. *sæculum*, generation, age). A term which is used for at least three conceptions. In the most primitive sense the soul is conceived as a refined and intangible material being, often as a sort of diaphanous double of the physical body. In a later sense the term designates the human spirit, conceived to be an immaterial (and usually an immortal) being, which is the source of human life, intelligence, and personality. In a third sense it is used by psychologists to designate the totality of psychical phenomena connected with one individual or one body. In this sense the soul is equivalent either to consciousness considered as a whole or to those factors of consciousness which may be said to constitute the ego. It is not, however, asserted to have any existence outside of or apart from consciousness.

By primitive man the soul was not carefully distinguished from the body; the conception was probably the result of observing the phenomena of death. A man is alive, he dies, and his body, which has still the same appearance, has suddenly lost all power of motion and feeling. The soul has gone out of it like a breath of air, or a phantom or a dream, or like a subtle essence pervading things. Beyond this primitive man does not seem to have gone in defining what soul means. Advance is shown among Oriental peoples. Thus the Hindus teach in their Vedas that the human soul is a portion of the Supreme Being, which fills all things. Being pantheists, most Oriental people fail in their conceptions of individual personality. Hence the Hindus hold that all finite differentiations of Brahma are ultimately absorbed. There is, therefore, only a negative belief in the soul.

Among the Egyptians transmigration provides a background for more distinct ideas. According to this theory the soul lives primarily in the body of an animal and passes from it, after wandering for 3000 years through all the species of animals, into a human body, unless the priests shorten this period. In the Book of the Dead a vague belief in immortality is foreshadowed; but it is doubtful if this belief is dissociated entirely from the corresponding idea of the survival of the body. We find traces of this uncer-

tainty and confusion specially in the earlier tradition of the Hebrews. In the later tradition, and especially under the influence of prophetism, more refined conceptions followed the preaching of ethical monotheism. A trichotomy of body, soul, and spirit appears among the later Jewish and early Christian thinkers, in which 'body' (σῶμα) is the material, 'soul' (ψυχή) and 'spirit' (πνεῦμα) the spiritual part of the human personality; but the tendency is to resolve this threefold division into a dualism in which body and soul are joined *against* the spirit. The whole weight of Christianity was thrown on the side of the soul conceived of as that part of man that is under divine law. This part was regarded as having absolute worth, inasmuch as it is the seat of the divine spirit, and is opposed to the 'flesh' (σάρξ), i.e. to human nature in estrangement from the divine. The salvation of the soul is negatively its deliverance from bondage to the 'flesh' in this broad signification, and, positively, union and communion with God, the essence of the soul's life.

We find a similar gradual distinction between body and soul in the history of Greek thought. In Homer the soul is a kind of image of the body (εἴδωλον), which escapes in death through the mouth or through an open wound. All natural objects are supposed to have souls. The Ionic philosophers, incapable of making this distinction clear, sought for some physical principle to define what they meant by the soul, and found it in water, air, fire, or the 'infinite' (hylozoism); and when later reflection added to this the notion of *reason* it was only as 'thinking air' that the soul was conceived even then. Nor did Parmenides with his absolute unity, or the Pythagoreans with their doctrine of numbers, attain a clear differentiation of body and soul; and Democritus is openly materialistic, maintaining that, inasmuch as matter is eternal, there is no need to distinguish body from that which moves it. Anaxagoras (born B.C. 499) was the first of the Greek thinkers to formulate the distinction in question in his theory of intelligence (νοῦς), which, he contended, is different from body because it is simple, mixes with nothing, is never passive, is infinite, and has absolute power over matter. Though this cannot be taken as a clear definition of the soul as an individualized thinking substance, it is an advance in thought. Socrates added to this theory of Anaxagoras the idea of the good, which he regarded as equivalent to the absolute or God, and from it derived the soul of man as a small part, clearly recognizing the distinction between it and the body, together with the implication of immortality, which, on his hypothesis of the good, was contained in it. The deeper reflection of Plato and Aristotle naturally discloses more satisfactory evidence of positive ideas. Plato in particular was much influenced by his general metaphysical theory. Thus in the *Timæus* he teaches that the soul is one of many modes of 'the one and the many,' by which he means the absolute mind and the phenomenal world of related things ruled by the *demiurgus*. The highest of these incarnations is in the stars, the next in man (*Philebus*). The soul of the world is created intelligent by God, and it is this soul that is in our bodies. As such it has the principle of movement in itself: it is self-moved; has reality (οὐσία), and partakes of the harmony and beauty of the world as created by God, and also leads to all true knowledge. According to Aristotle the soul is the formal, efficient, and final cause (ἐντελέχεια πρώτη) of the body (*De Anima*), the unity of three kinds of causality; and he distinguishes three kinds of soul, the vegetable, the sensitive, and the intellectual, which respectively represent the spiritual life of plant, animal, and human beings. As the 'final cause' of the body, man's soul cannot be indeterminate; it must have individuality to organize it, direct its movements, and lead it to its true end. Here we approach very near to the modern conception of the soul as an individualized, self-conscious, self-determining reality; but not quite, for this idea was not fully attained by Greek thought.

Among the early Christian philosophers we find a mixture of Greek and Christian ideas. The characteristics of this period show the tremendous hold which the spiritual ideas of Christianity had taken on the strongest minds. The writings of the Apologists, the Church Fathers, particularly Clement of Alexandria and Origen, while they do not reveal any systematic doctrine of the soul, are replete nevertheless with the keenest insight. The profound analysis of Augustine, however, made positive contributions to the problem. Anticipating Descartes, he maintained that it is impossible for thought to be an attribute of that which does not think; even if I doubt, the doubt itself must be an act of the soul and therefore a real fact of spiritual significance. If the soul were corporeal, its functions would be limited to the perception of body; but now it has the power of reflection, of knowledge, of love, and is, above all, conscious of itself, and therefore cannot be an attribute of extended substance merely (*De Trinitate*). The theories developed under Scholasticism are for the most part adaptations of the later Greek ideas to the necessities of Church doctrine and authority. Hence we find some inclining to take the view of Plato that the finite soul is part of a world-soul, as that idea was developed in Stoicism and later Jewish Hellenism; others incline to Aristotle's teleological conception of the soul as a cause realizing itself in the different grades of reality.

It was Descartes who brought reflection back from the region of scholastic metaphysics to the subjective side of the problem. Descartes discovered, as Augustine and William of Auvergne had discovered before him, that to doubt the existence of the soul is to contradict one's self; for doubt is a mental fact, and as such has reality. I that doubt, think; I may imagine that I have no body, but as long as I think I have real existence; I think, therefore I am (*cogito ergo sum*). If it be replied that my thinking does not imply reality then the reply is: God cannot deceive us, and His omnipotence can realize everything we conceive; therefore every *clear* and *distinct* idea we have must be real, and since I have a clear and distinct idea of myself and of my body in their distinction, it follows that soul and body *are* distinct and may exist without each other. Thought and extension are two attributes, and it is thought alone which it is impossible for us to doubt. Thus body and soul are left opposed to each other, so far, at any rate, as man is con-

cerned. Spinoza sought to obtain a unity of the two (thought and extension) and formulated the conception of an underlying soul-substance which, as God, differentiates itself in infinite and eternal modes or attributes which are characterized under the categories of thought and extension. Thus body and soul are ultimate realities of one and the same substance, the ever-changing counterparts of each other, and yet the modes of one infinite reality. Leibnitz, not satisfied with the pantheism of Spinoza, sought, in his theory of atoms or monads, to retain the rights of finite personality and things and yet to avoid the crude dualism of Descartes. All things have souls according to Leibnitz; the world consists of an infinite number of them, in all degrees of perfection. If we ask for the nature of their life, inner experience reveals to us an active, real force, namely, our souls, and this is the type of all substance; so that in the world both kinds of reality, thought and extension, consist of perceiving soul-life. With this view may be compared that of Berkeley, who carried idealism to its extreme expression in his dictum that the being of things is in their being perceived (*esse* = *percipi*).

The Empiricists, Hobbes, Locke, Hume, and Mill, developed their views of the soul along the lines laid down by Bacon. Hobbes is openly materialistic; but he is offset by the cautious psychology of Locke, who finds that inner feeling undoubtedly gives us the consciousness of self, though not the substance which underlies it, which is an unknown quantity whose real existence we can neither dogmatically affirm nor deny. These ideas Hume carried to their logical conclusion by denying any existence to the soul as a real or permanent subject: the only reality we know is the phenomenal stream of impressions and ideas. It was the merit of this analysis of Hume that it finally woke up Kant, whose views have greatly influenced recent thought. By an analysis of the human reason Kant sought to show that the real significance of the soul consists in the moral or practical activity, which an accurate knowledge of the laws of thought could do nothing successful to overthrow. If the system of Kant caused a theoretical schism between the reason as the knowing activity and the will as the moral activity, the reflections of Fichte, Schelling, and Hegel, together with the labors of the modern school of psychology, have done much to heal the breach. On the whole, therefore, we may say that the hypothesis of a soul seems to be demanded both as a ground of the unity of self-consciousness and also of the universe. It seems, moreover, to be justified, with sufficient reason, as the real principle of the harmony of the subjective and the objective. It seems also to be required as the subject of the changing states of thought, feeling, and volition, revealed in the phenomena of consciousness.

SOULE, sōōl, GIDEON LANE (1796-1879). An American educator, born at Freeport, Me. He studied at Phillips Exeter Academy from 1813 to 1816, and then entered Bowdoin College, where he graduated in 1818. Nearly all of the remainder of his life was passed at Exeter as teacher and principal. This latter office he held from 1838 until within three years of his death. The school under his management took a high rank among American fitting schools. Consult an article in the *Unitarian Review*, vol. xii. (1879).

SOULE, JOSHUA (1781-1867). A bishop of the Methodist Episcopal Church South, born at Bristol, Me. He began to preach at the age of seventeen, and was admitted to the New England Conference in 1799. He was elected book agent in 1816, and during his incumbency founded and edited the *Methodist Magazine*, since developed into the *Methodist Review*. He became bishop in 1824. When the Church divided in 1845 he adhered to the Southern section and continued in the bishopric.

SOULÉ, sōō'lā', PIERRE (1802-70). A French-American statesman, born at Castillon, France. He was trained for the priesthood at Toulouse, and afterwards studied at Bordeaux. He was involved in a conspiracy against the Bourbons in 1817, and for some time took refuge in Béarn. Later he was permitted to return to France, but in 1825 was sentenced to imprisonment for articles in a radical newspaper reflecting on the ministry. He escaped and settled in New Orleans. There he was admitted to the bar. In 1847 he was appointed to the United States Senate to fill a vacancy, and was elected for the full term in 1849. He represented extreme Southern views, and was prominent in the debates on the compromise measures of 1850. President Pierce appointed him Minister to Spain in 1853. At Madrid he became notorious for fighting several duels, one with Turgot, the French Ambassador. He favored the insurrection in Madrid in 1854 and united with Buchanan and Mason in the Ostend Manifesto (q.v.) of October of the same year relating to the annexation of Cuba. He returned to the United States in 1855. He at first opposed the secession of Louisiana, but afterwards joined the secessionists, and was arrested in 1862 for disloyalty and imprisoned. He was released on condition of leaving the country, but ran the blockade at Charleston, and for a short time served on the staff of General Beauregard. In 1863 he went to Havana, but after the close of the war he returned to New Orleans, where he died.

SOULIÉ, sōō'lyā', MELCHIOR FRÉDÉRIC (1800-47). A French dramatist and novelist, born at Foix. He was expelled from the law school in Paris on account of his radicalism. In 1824 he published a volume of poems, *Amours français*, and in 1828 his drama *Roméo et Juliette* was produced at the Odéon. In 1832 his play *Clotilde* was performed, and this was followed by several other successful pieces, the best known of which is perhaps *La closerie des genêts* (1846). Among his many novels may be cited especially his first, *Les deux cadavres* (1832), *Mémoires du diable* (1837-38), *Le maître d'école* (1839), *Eulalie Pontois* (1842), and *Saturnin Fichet* (1847-48). Consult Champion, *F. Soulié, sa vie, ses ouvrages* (Paris, 1847).

SOULOUQUE, sōō'lōōk'. Emperor of Haiti. See FAUSTIN I.

SOULT, sōōlt, NICOLAS JEAN DE DIEU, Duke of Dalmatia (1769-1851). A French marshal. He was born at Saint-Amans-la-Bastide, Department of Tarn. He entered the army as a private in 1785, rose by his soldierly qualities, and in 1794 was made a general of brigade for his conduct at

Fleurus. From 1794 to 1799 he was employed on the eastern frontier, and in the retreat after the defeat of Stockach (March 25, 1799) he prevented the annihilation of the French army. Appointed general of division (April 21, 1799), and put under Masséna, whom he ably seconded in Switzerland and Italy, he was afterwards appointed by Napoleon to one of the four colonelships of the consular guards and became an ardent supporter of the First Consul. He was created marshal of France in 1804. He justified his appointment by his brilliant achievements in the subsequent campaign against the Austrians, especially at the battle of Austerlitz (December 2, 1805), which he decided by piercing the Russian centre. He did good service in the Prussian campaign of 1806, took part in the battle of Eylau in 1807, and in the latter year was appointed governor of Berlin and created Duke of Dalmatia. Soult was next placed at the head of the Second Corps in Spain, pursued the retreating British forces under Sir John Moore, attacked them at Corunna (January, 1809), and, though repulsed, forced them to abandon their baggage and munitions of war. He then occupied Oporto and Northern Portugal, but the sudden arrival of Wellesley made him retreat rapidly to Galicia. In September, 1809, he became commander-in-chief in Spain, gained a brilliant victory at Ocaña on November 19th, and at the commencement of the following year subdued Andalusia. In attempting to succor Badajoz, which he had captured and garrisoned, he was defeated by Beresford at Albuera (May 16, 1811). After the battle of Salamanca and the advance of the British on Madrid, Soult, on the rejection of his plans for transferring the theatre of war to Andalusia, demanded and obtained his recall. In 1813 he fought in Germany, but when the news of the defeat of the French at Vitoria reached Napoleon Soult was restored to the command of the army of Spain. It was not in Spain, however, but in France, that the contest had to be waged; and the advantages were all on the enemy's side; nevertheless, by a system of military tactics which has been universally admired, he neutralized the strategy of Wellington, and reduced the campaign, during the seven months it lasted, to a mere trial of strength. He continued the struggle after the entry of the Allies into Paris, unsuccessfully opposing Wellington at Toulouse on April 10, 1814. He became an ardent royalist after the abdication of Napoleon, and was made Minister of War; but on the return of the Emperor from Elba he abandoned Louis XVIII. and joined the Imperial army. After Waterloo he was banished and not recalled till May, 1819. He was finally restored to his honors, and took an active part in politics. In 1827 he was created a peer of France, and under Louis Philippe he repeatedly held high State offices. In 1845 he retired from active duty, and in 1847 he was honored with the appointment of marshal-general of France. Soult passed the rest of his days at his residence of Soultberg, near Saint-Amans. His *Mémoires* were published, in part, by his son (3 vols., Paris, 1854). Consult also Sallé, *Vie politique du maréchal Soult* (Paris, 1834).

SOUND. See ACOUSTICS.

SOUND, RECORDING OF. See PHONOGRAPH.

SOUND, SOUNDING (OF., Fr. *sonder*, probably from Lat. *sub*, under + *undare*, to undulate, from *unda*, wave; less plausibly from AS., Icel. *sund*, Ger. *Sund*, sound, strait). The operation of ascertaining the depth of water. In shallow waters (less than 20 fathoms) the depths are ascertained with the lead and line (see LEAD, SOUNDING); in greater depths the deep-sea lead and line are used or else a sounding machine. Beyond a depth of 200 fathoms soundings are not useful for the purpose of navigating vessels; but 'deep-sea' soundings are taken in all depths in order to ascertain the shape and character of the ocean bottom and its organisms, living and dead. See DEEP-SEA EXPLORATION.

Few attempts to ascertain the depth of the ocean were made before the beginning of the nineteenth century, and it was not until toward the middle of it that the investigations were at all systematic. The disadvantges under which the earlier expeditions labored were such as to preclude not only rapid but reliable work. For the lines rope of ordinary character was used, and the sinkers employed were generally too light. The weight of the rope after it became water-soaked was very great, and its bulk, together with that of the reels, very troublesome. The inadequate sinkers caused the line to run out very slowly, and the reeling in was both laborious and tedious. Owing to the difficulty of holding a large sailing ship in a fixed position for the requisite time and the amplitude of her movements on the waves, many of the soundings were made from boats, which still further reduced the speed, especially that of preparing to cast and of reeling in. The first attempt (so far as known) to use wire for the line was that of the well-known 'exploring expedition' sent out by the United States Navy Department in 1838. The wire was of copper, about 3-32 of an inch in circumference, with soldered and twisted splices. Owing to lack of proper appliances for handling, it always broke at 500 to 1000 fathoms, and its use was abandoned. In August, 1894, Captain Barnet, R. N., made a sounding in 2000 fathoms with iron wire. This also broke, and no more attempts with it were made. Three months later. Lieut. J. C. Walsh, U. S. N., in the United States schooner *Taney*, tried to use steel wire, but his efforts were unsuccessful, the wire being too large and the sinkers too small. He reported soundings of 5700 fathoms and no bottom, but the depth was actually less than half as great.

Much work continued to be done with rope lines both before and after these experiments, but more especially afterwards. In 1840 Captain James F. Ross first noted time intervals in sounding; he also used very heavy sinkers, and his results were exceedingly accurate for those days. The question of time intervals was taken up and perfected by Lieutenant (afterwards Admiral) Taylor, and other officers of the United States Navy, and their observations were of great importance in determining the accuracy of deep-sea work before the invention of the Thomson sounding machine. For a time the United States Navy Department abandoned the use of both wire and rope, and, at the instance of Lieutenant Maury, adopted waxed flax twine, weighing only nine pounds to the statute mile. Between 1851 and 1853 much of the Atlantic was explored by United States vessels and hundreds of soundings

taken (using the twine mostly) with fairly accurate results, though, as no specimens of the bottom were obtained, they were open to question. In 1853-54 Passed Midshipman J. M. Brooke, U. S. N., brought out his cup and detachable sinker, which enabled specimens of the bottom to be obtained while using a heavy weight to keep the line taut when running out. Brooke also developed his table of 'standard casts' utilizing the time interval and weight of line out, and he much improved the sounding apparatus.

The Civil War put an end to the deep-sea work of the United States Navy for many years, but it was carried on most successfully by the British, especially by Captain (afterwards Admiral) F. P. Shortland, who improved the Brooke sounding machine, and was one of the first, if not the first, to enunciate the important rule in regard to tension on the line, viz., "A sounding line should not be permitted to run free, but should be resisted by a force equal to the weight in water of a length of the line equal to the depth to be determined." The success of the Brooke device and its modifications in bringing up specimens of the bottom and its organisms attracted the attention of naturalists and geologists, and their curiosity caused dredging in great depths to be attempted. The results of the early (1867-69) work of Count Pourtalès under the direction of the United States Coast Survey brought about renewed interest by showing, as Pourtalès says, "that animal life exists at great depths in as great an abundance as in shallow water." In 1872 the British Government fitted out the celebrated *Challenger* Expedition (q.v.) for investigating everything connected with the ocean depths. Strange to say, although Sir William Thomson had invented his sounding machine and submitted it to the British Admiralty several months before the *Challenger* was ready, it was rejected for imperfections which might have been easily corrected, and the *Challenger* sailed with her antiquated outfit of sounding material, whereby a vast amount of time was lost as well as space for supplies and specimens. The United States ship *Tuscarora* under Captain Belknap sailed from San Francisco only four months after the *Challenger*, but the United States Navy Department was wise enough to supply her with one or more Thomson machines in addition to the ordinary rope outfit. The new machines were not entirely satisfactory at the start, but were easily brought into working shape by the *Tuscarora's* officers, and after very few trials entirely superseded the old apparatus. Since that time all deep-sea work has been done by machines, and thousands of soundings have been taken to determine the location of the submarine cables which have now become so numerous.

The Thomson sounding machine is of two types, deep-sea and coasting. The latter is now used by nearly all large steamers and by many small ones. It consists of an iron-braced wooden framework or casing which incloses a steel drum about 18 inches in diameter and three inches thick. The disks forming the sides of the drum project beyond the circumference, forming a broad deep groove for carrying the wire (3-stranded galvanized wire rope is now generally used). On each side are cranks for winding in, and on one side there is a friction brake and clutch, while on the other there is a dial, showing the number of fathoms (0 to 200) out, which is operated by gearing from the axle of the drum. The sinker consists of a lead of the usual shape, weighing about 22 pounds, through which is thrust an iron rod, the whole sinker being 46 inches long from bottom of lead to top of rod. The wire rope is made fast to a fathom or two of small soft line, which is secured at the other end to an eye in the upper end of the sinker rod. The manner of obtaining the depth is independent of the length of wire out, and the depth is registered by means of a Thomson chemical tube, a Tanner-Blish tube, or the depth recorder. The Thomson tube is a slender glass tube, about two feet long, closed at one end, and filled with chromate of silver. It is placed in a slightly larger brass tube, which has holes in it to admit the sea water freely and is lashed to the sinker. The machine is installed near the stern or on the ship's rail. To sound, the sinker is lowered over the stern, the line dropped in a fair leader to insure free running, and when all is ready the brake is tripped by a movement of the crank. The sinker drops rapidly to the bottom and the moment it reaches it the line slacks perceptibly and the reel is stopped. The line is then reeled in. If the Thomson tube is used, it is removed from the brass receptacle and laid against a special scale. The sea water has forced itself in the open end to a distance depending upon the pressure (i.e. the depth); as far as it reaches the chemical in the tube is discolored, and this point falls abreast the division of the scale which corresponds to the depth of water. Since the measurement is independent of the amount of wire out, the sounding may be taken with the ship going at full speed if the depth is not too great. The Tanner-Blish is similar to the Thomson tube, except that it contains no chemical. If the tubes are kept carefully dried the distance the water has risen is easily noted; and by redrying the tubes they may be used over and over again. The depth recorder works on a similar principle, and is attached to the sinker in the same way. The pressure of the water acts against a piston which compresses a spring and carries a sliding index. When the pressure is slacking the piston returns to its initial position under pressure of the spring, but the index remains at the point of the scale to which it is pushed, so that the depth is read off at once.

The Thomson sounding machine for great depths is similar to the small one, but has a special form of brake which adjusts the tension in accordance with Captain Shortland's rule, and has of course a much greater length of line. The Sigsbee machine is much used in the United States Navy. It differs from the Thomson chiefly in having an automatic spring governor to ease the strain on the wire due to the motion of the ship; though there are other points of dissimilarity. It is the invention of Captain C. D. Sigsbee, of the United States Navy, who has done much deep-sea, depth, and current work in the Atlantic and Gulf of Mexico. See DEEP-SEA EXPLORATION; OCEANOGRAPHY.

SOUSA, sōō'zȧ, JOHN PHILIP (1854—). An American bandmaster and composer. He was born in Washington, D. C., and was educated there. He held the position of bandmaster of the United States Marine Corps at Washington from 1880 until 1892, and during that period

made the organization one of the finest military bands in America. In 1892, in conjunction with David Blakely, he formed the organization now known as Sousa's Band. His compositions, both operatic and instrumental, have been eminently successful. His ability as a composer of marches soon secured for him the popular title of 'the March King.' His compositions include the following operas: *The Smugglers* (1879), *Désirée* (1884), *The Queen of Hearts* (1886), *El Capitán* (1893), *The Bride Elect* (1897), *The Charlatan* (1898); marches: "The Washington Post," "High School Cadets," "The Liberty Bell," "Manhattan Beach," "Directorate," "King Cotton," "El Capitán," "Bride Elect," "The Stars and Stripes Forever." His collection of arranged "National, Patriotic, and Typical Airs of All Countries" has been officially adopted by the United States Navy Department, and is in the collection of service bands throughout the civilized world.

SOUSA, sō'zȧ, or **SOUZA,** MARTIM AFFONSO DE (c.1500-64). A Portuguese colonizer and administrator, born at Bragança, Province of Trasos-Montes. In 1530 he was dispatched with five ships and a force of 400 to explore the coast of New Lusitania (Brazil), of which he was appointed Governor, and to found there a colony and distribute land. It has been said that he was the discoverer of the bay which he entered on January 1, 1531, and which, supposing it to be a river, he named Rio de Janeiro. He surveyed the coast, and on January 22, 1532, founded on São Vicente Island, near the present Santos, the first Portuguese colony in Brazil. The colony of Piratininga, the present São Paulo, on the bank of the Piratininga River, was founded under his direction. In 1533 he returned to Portugal, where he received São Vicente, the foremost of the captaincies into which Brazil was divided. This he ruled as absentee proprietor.

SOUTH, Sir JAMES (1785-1867). An English astronomer, born in Southwark. He was a member of the College of Surgeons and displayed great professional abilities, but later inclined to astronomy. In conjunction with the younger Herschel (q.v.) he undertook a series of observations which were presented to the Royal Society in a memoir containing micrometrical measurements of 380 double stars, and confirming the elder Herschel's inferences regarding orbital motion. For this he was awarded the gold medal of the Royal Astronomical Society in 1826. In 1835 he removed his observatory to Passy, near Paris. Here he made a series of observations on 458 compound stars, of which 160 were new, and convinced Laplace of the reality of revolving stars. South was one of the founders of the Astronomical Society and its first president. He was knighted in 1830. He observed Encke's comet (1828 and 1838), Mauvais's (1844), and Vico's (1845). His observing a sharp occultation by Mars of a small star in Leo disproved the existence of an extensive Martian atmosphere.

SOUTH, ROBERT (1634-1716). A famous preacher of the Church of England, born at Hackney. In 1651 he became a student of Christ Church, Oxford, and was ordained in 1658. In 1660 he was made domestic chaplain of the Lord Chancellor Clarendon. In 1663 he was promoted to a prebendal stall at Westminster, and in 1670 became a canon of Christ Church, Oxford. The rectory of Islip, in Oxfordshire, was later conferred upon him, and he was chaplain in ordinary to Charles II. When the revolution of 1688 was accomplished he gave his adhesion to it, but refused perferment. A stanch adherent of the Church of England, he continued to wage unsparing war from the pulpit and with his pen against Puritanism and every other form of dissent, occasionally occupying himself with discussion more strictly theological. He is now chiefly remembered by his sermons; they are masterpieces of vigorous sense and sound English, and abound in lively and witty matter. The best edition of his sermons is that by W. G. T. Shedd (New York, 1866-71), with a memoir.

SOUTH, UNIVERSITY OF THE. An institution of learning at Sewanee, Tenn., founded in 1857 by the Protestant Episcopal Church in the South. A tract of nearly 10,000 acres was secured as a site, $500,000 was subscribed for an endowment fund, and the cornerstone of the central building was laid when the Civil War broke out. At the end of the war the pledges of an endowment could not be realized. Funds were secured to begin the institution on a small scale, largely through the efforts of Bishop C. T. Quintard of Tennessee, and it was opened in 1868 with a grammar school and an academic department. A theological department was opened about 1878, a medical department in 1892, and a law department in 1893. The college domain, mostly covered with original forest, is situated on a plateau of the Cumberland Mountains, about 1000 feet above the surrounding valleys. The permanent buildings, eight in number, stand in a domain of 1000 acres, and are valued at $350,000. The college year is divided into three terms—Trinity, Advent, and Lent. The vacation is taken from December to March. The academic department embraces 15 schools, a certificate and diploma being given in each school. The degrees conferred are B.A. (60 courses), M.A. and M.S. (15 courses of an advanced character), and C.E. The work is mostly prescribed. In theology the degrees of B.D. and Graduate in Divinity are given; in law, LL.B.; in medicine, M.D. A school of pharmacy, with the degree of Graduate of Pharmacy, and a training school for nurses are connected with the medical school. All members of the professional schools and such academic students as have passed a certain number of university examinations and have sufficient maturity in age and character are formed by the governing board into an order of Gownsmen. These are distinguished by the academic dress (the Oxford cap and gown) and enjoy certain privileges and immunities. In 1903 the faculties numbered 41, and the student body 556, divided as follows: theological, 26; medical, 227; law, 17; academic, 122; preparatory, 164. The library contained 41,000 volumes.

SOUTH AFRICA. The part of Africa south of the Zambezi River; physically it is a distinct geographic unit. With an area of 1,100,000 square miles and a seaboard of more than 3000 miles, it is commercially a single trade region. Its collective commerce is known technically as the 'Cape trade.' The business interests of every part of it are closely related to or interwoven with those of the other parts, and the best means of introducing civilization and commerce

into tropical Africa is through the gateways that connect the equatorial regions with the wide regions which white men are developing in South Africa. The colonies and protectorates which are wholly or in part in South Africa are: Portuguese East Africa, German Southwest Africa, Cape Colony, Orange River Colony, Transvaal Colony, Natal (including Zululand Province), Rhodesia (Southern), Basutoland, and Bechuanaland Protectorate (qq.v.), all except the first two belonging to Great Britain.

TOPOGRAPHY. The coasts, like those of the rest of Africa, are chiefly straight and unbroken. They are deficient in good harbors and girdled by a tempestuous ocean with a never-ceasing surf. The west shore is very different in aspect from the south and east coasts. Nearly the whole of the west coast is low and sandy and the lands behind the shore line are barren and dismal. The south and east shores, however, though on the whole as regular and unbroken as the west coast, are attractive instead of repellent in appearance, with their evergreen slopes, picturesque bays, and wooded kloofs. All the ports of the west coast are roadsteads excepting Saldanha Bay, a splendid natural harbor still undeveloped, and Cape Town, which, at enormous expense, has been made safe for shipping. None of the ports on the south coast is naturally good, but those of Port Elizabeth and East London have been made available for large trade by artificial improvements. The east coast has in Delagoa Bay the only first-class harbor in Africa, and one of the finest in the world. The port of Durban on this coast has been rendered good artificially, and the port of Beira and the Chinde branch of the Zambezi delta are also available for large shipping. Most of the interior of South Africa consists of high plateaus, elevated so far above the sea level that the influences of the temperate zone are extended hundreds of miles to the north of the Tropic of Capricorn. Johannesburg enjoys a temperate climate, while Rio de Janeiro, in nearly the same latitude, is a tropical city. The high elevation of the most of South Africa is the chief element in its geographic unity. It is estimated that the area of the region which, in respect of temperature, is well adapted to become a home of the white race, is one-fifth as large as the area of the United States (exclusive of Alaska).

The entire coastal plain is only 20 to 50 miles wide excepting where it broadens to 100 miles or more in the neighborhood of Beira and the Zambezi. Behind the plain the land begins to ascend in terraces. In the extreme south the coastal plain rises to 600 feet above the sea. Just north of it in Cape Colony are the Southern Karroo and the Bokkevelt, 1000 to 2000 feet high. Next come the Great Karroo with an average altitude of 3000 feet; then the loftiest of the Cape plateaus, the Northern Karroo, from 2700 to 6000 feet; then the diamond fields country and the wide plains of the Orange River Colony, from 4000 to 5000 feet; the still more extensive plateau of the Transvaal, from 5000 to 7000 feet; and the more diversified uplands of the Matabeleland and Mashonaland region at a little lower level, sloping gradually to the plain of the Zambezi. In the west the irregular highlands of Damaraland and Namaqualand rise steeply from the Atlantic coast plain, and merge indefinitely with the vast central plains of Bechuanaland and the dreary expanse of the Kalahari Desert, once the floor of an inland sea and now about 4000 feet above the sea level. In the east and southeast the lowlands of Portuguese East Africa and the coast plain and plateau of Natal are skirted inland precipitously by the mighty rampart of the Drakensberg and other ranges that wall in the lofty interior plateaus. Many of the mountains lining the periphery of the plateaus or rising within them have an altitude of 6000 to 10,000 feet. The culminating points appear to be the Montaux Sources, Champagne Castle, and Mount Hamilton, all three probably upward of 10,000 feet in elevation, and the last perhaps not much short of 12,000 feet.

HYDROGRAPHY. The Zambezi alone is important for navigation. Most of the rivers are small and their mouths are hopelessly blocked by sand and rocks, excepting the Buffalo River, which with great difficulty has been made available for ocean steamers to East London, near its mouth. The Zambezi is navigable for about 260 miles from the sea. The north central portion of the region is an area of interior drainage, the waters disappearing in many so-called salt pans, where evaporation leaves an incrustation of salt on the surface.

CLIMATE. There are only two seasons: summer (October to March) and winter (April to September). Except in the south and east coastal regions the low average of atmospheric humidity is a marked characteristic. Pulmonary invalids from Europe prolong their lives in the dry, bracing air of the plateaus. January is usually the hottest month, with average maximum temperatures of 82° to 100° F. July is usually the coldest month, with temperatures ranging from 20° to 10° F. The Transvaal Colony, although partly within the tropics, stands so high above the sea that the mean annual temperature is only 68.64° F., or only about 6.30° above the mean summer temperature of England. Although entirely within the tropics, the annual temperature range in Matabeleland and Mashonaland is from 36° to 86°, so that these regions are by no means tropical. The Zambezi Valley and Portuguese East Africa are low, moist, and very unhealthful. More than half of South Africa is deficient in rainfall. The semiarid region includes the entire western half of the country, which is dry because South Africa depends for rain upon the winds of the Indian Ocean, and the east coastlands and highlands receive the larger part of the precipitation, as the winds move westward. The Great Karroo and Great Namaqualand have less than 6 inches of rain in the year. With the exception of the Portuguese coastlands and the Zambezi belt, South Africa is one of the most healthful and salubrious regions in the world.

FLORA. The veldt and the karroo are the distinctive features of South Africa. The word veldt (= field) is applied to the enormous areas of rolling pasture lands found in Cape Colony, the Orange River Colony, the Transvaal Colony, and parts of Bechuanaland, covered with rough scrubby grass, mimosa, acacia, and other bushes; also to the herbage itself, as the sweet veldt and the sour veldt. The name karroo is taken from the little karroo plant, relished by sheep and

goats and the best kind of bush for the domesticated ostrich. The largest tract of karroo is a region about two-thirds as large as Scotland, in the interior of Cape Colony. All South African plains and plateaus that are intermediate between the grass and bush-covered veldt and absolute desert are karroos. Both the karroo and the Kalahari desert need only the rain that sometimes falls on them to be quickly clothed with grass and shrubs. The plant-life common to deserts, and the vegetation of the veldt and the karroo, are the distinctive features of the flora; to which are to be added the tropical vegetation which girdles South Africa along its low, hot northern and eastern fringes, and the belt of European flora, including the northern cereals and the vine, across the south end of Africa.

FAUNA. The animal life is perhaps matchless, and is certainly unsurpassed. It includes the lion, elephant, hippopotamus, rhinoceros (black and white), buffalo, zebra, numerous varieties of antelope, the giraffe, wart hog, hyæna, and jackal. The slaughter of wild animals has been reckless and ruthless all over the settled parts of the country, but there are still wide areas that are known as 'sportsmen's paradises.' In Cape Colony nearly all the domesticated ostriches in the world (260,672 in 1899) are herded on large ostrich farms (dry veldt).

GEOLOGY AND MINERAL RESOURCES. The discovery of diamonds and gold had a profound effect upon the condition and prospects of South Africa, uplifting the country in a few years from obscurity into universal notice. Gold and diamonds are the foundation of the country's prosperity. Many millions of dollars have been disbursed in wages and local expenses at the mines. (For geology, gold, and diamonds, see CAPE COLONY, TRANSVAAL COLONY, KIMBERLEY, etc.) The copper mines of Namaqualand are unsurpassed in richness of yield. The principal silver mine worked is 50 miles east of Johannesburg, 6 miles from coal fields, but indications of silver have been found in many parts of South Africa. Enormous deposits of coal and iron have been discovered in Cape Colony and Natal in close proximity. Coal is also mined in the Transvaal and the Orange River colonies, and extensive coal measures have also been found in Rhodesia, near the Zambezi. Platinum, plumbago, manganese, and the finest of marble, building stone, and lime are also among the mineral resources.

AGRICULTURE. Farmers have already followed the miners far toward the Zambezi. Scotchmen and Englishmen in Mashonaland and Matabeleland are producing the food supplies required by the settlements and mining camps. The soil is extraordinarily productive wherever rainfall is sufficient; but the chief interest is stock-raising, the country, as a whole, being better suited for pastoral pursuits than for agricultural operations. Wool is the staple source of wealth, the grasses of the veldt and the pasture plants of the karroos being well suited for growing the finest wools. Many millions of sheep are pastured in the Cape, Natal, Orange River Colony, the Transvaal Colony, Bechuanaland, etc. Angora goats (mohair) and cattle also abound. The 'Cape horse' is not handsome, but is hardy and keeps in good condition on the veldt. Across the south end of the country is a strip of fine farming land, where wheat, maize (mealies), and all the crops of the temperate zone are very successful. The best wheat is grown along the southern border of Orange River Colony. In Cape Colony vine growing, ostrich farming, and cattle raising are important industries. It is to the advantage of South Africa that its great variety of climate enables it to grow nearly every cultivated crop. Sugar-cane and tea-planting in Natal have passed beyond the experimental stage. Sugar is now exported, and the tea is of excellent flavor. Coffee and arrowroot also thrive on the moist coastlands.

MANUFACTURES. Little attention has been given to the manufacturing industries, chiefly on account of the sparsity of the white population. A large quantity of Cape wine and brandy is produced, but they are of inferior quality and are consumed chiefly by the black natives. The chief centres of the manufacturing industries are in Cape Colony, where, in 1891, there were 2230 industrial establishments employing 32,735 persons, flour mills, tobacco factories, tanneries, diamond-washing and gold and copper reduction works being most prominent; and in the Transvaal Colony, where before the war there were 69 establishments, including saw-mills, brick and lime works, and machine shops.

COMMERCE. Prominent among the 'makers' of the country are still the traders who load their heavy wagons carrying three to four tons with all kinds of goods desired by the black population, and trek from tribe to tribe, returning to town or port after many months to dispose of the ivory, horns, skins, and feathers received in exchange for their wares. The trekking trade has been the means of diverting most of commerce, even of the Zambezi region, to the southern ports. The circulation of goods is to and from the seacoast, there being little trade between town and town, as all are supplied from the seaport centres. Except during the recent war the 'Cape trade' has been steadily growing. The annual import and export traffic of the region south of the Zambezi is now over $200,000,000 a year, Great Britain controlling nearly all the exports, those which reach other countries being mainly through British channels. Gold, diamonds, and wool are the great export staples, with hides, mohair, wine, and ostrich feathers next in importance. Many of the imports (general manufactures, machinery, etc.) come from countries other than Great Britain. In 1902 the imports from the United States amounted to over $26,000,000, while the exports to it were less than $1,000,000.

TRANSPORTATION AND COMMUNICATION. In the more settled districts there are fairly good roads with substantial bridges across the rivers. Mail carts, coaches, and in some cases bullock wagons, ply between the railroad stations and all the larger towns that are not on the rail lines. There is now rail connection between all the important ports of the south and east coasts and the larger interior towns and mining districts. One may travel by rail from Cape Town to Salisbury, in Mashonaland, and thence to the port of Beira. It is confidently expected that before many years the railway system of South Africa will be connected with that of Egypt. Regular communication is maintained with Europe, America, and Australia.

POPULATION AND HISTORY. The population is only about 6,000,000, of whom only about 750,-

000 are white. For exploration and history, see AFRICA, BOERS, NATAL, TRANSVAAL, and SOUTH AFRICAN WAR.

SOUTH AFRICA COMPANY, BRITISH. See RHODES, CECIL; RHODESIA.

SOUTH AFRICAN REPUBLIC. A former republic of South Africa. See TRANSVAAL.

SOUTH AFRICAN WAR. The conflict for supremacy in South Africa between Great Britain and the Boer republics of the Transvaal and the Orange Free State in the years 1899-1902. The causes that led up to the struggle and the diplomatic negotiations that preceded its outbreak are treated under TRANSVAAL. The following account will deal exclusively with the history of military operations and the terms of peace that ended the war. On the outbreak of war, October 11, 1899, the British strength in South Africa comprised a body of about twelve thousand men in Natal; a second force (2500) at Kimberley, on the western frontier of the Orange Free State; a third (1000) at Mafeking, on the Bechuanaland border; and about 1000 men on the Rhodesian frontier. The railway crossings on the Orange River and the northern part of Cape Colony were guarded by some 5000 men. The number of Boers mobilized on the Natal frontier in the early days of October was about 20,000. On the day following the declaration of war the forces of the Transvaal and the Orange Free State entered Natal. Laing's Nek and Ingogo Heights, in the extreme northern part of the colony, were seized, and the Boers pressed down the Durban Railway and attacked the British line extending from Ladysmith to Dundee. On October 20th the British drove a Boer force from Talana Hill, near Dundee, and on the following day they routed the Boers at Elaandslaagte, but on October 30th they met with a serious reverse at Nicholson's Nek, and by November 2d the Boers, under Petrus Joubert (q.v.), had succeeded in completely investing Ladysmith, which was held by about 10,000 troops under Sir George White. At the same time Kimberley was besieged by a Boer force of 6000 under Prinsloo, and 1000 British under Col. Baden-Powell were locked up in Mafeking by Cronje (q.v.) at the head of 6000 men. The unfortunate beginning of the war aroused great alarm in Great Britain, and preparations were made for carrying on a struggle which it now became apparent was to be of a nature far more serious than had been anticipated. Large reinforcements were dispatched to South Africa under the command of Sir Redvers Buller, who, at the head of 16,000 men, was intrusted with the task of relieving Ladysmith, while Lord Methuen with 9500 was to make his way to Kimberley from the south, and a force of some 5000 men under General French and 4500 men under General Gatacre were sent to operate against the Boers in the north of Cape Colony. On November 23d Lord Methuen defeated the Boers at Belmont, and on the 25th he won a victory at Enslin or Graspan, but on the 28th he suffered severely in his attempt to cross the Modder River near its junction with the Riet, and on December 11th was decisively defeated by Cronje in an attempt to storm the Boer position at Magersfontein. On December 10th General Gatacre met with a serious setback at Stormberg Junction, in Cape Colony. The most obstinate fighting, however, occurred around Ladysmith, and at Colenso on December 15th the British encountered a severe reverse at the hands of the Boer riflemen.

This succession of disasters spurred on the British authorities to greater exertions. In the latter part of December Lord Roberts of Kandahar was ordered to Africa as commander-in-chief, with Lord Kitchener of Khartum as his chief of staff. The fighting thus far had revealed on the part of the British officers great ignorance of the nature of the country and of the enemy. The Boers were all excellent marksmen and many of them were mounted, thus combining the rapidity of cavalry with the stability of infantry. The British, on the contrary, were handicapped by the absence of cavalry, and for want of adequate transport facilities were compelled to cling to the lines of railway, thus narrowing greatly their field of operations. Before the end of January, 1900, the English forces in South Africa were estimated at about 130,000 men. Lords Roberts and Kitchener arrived at Cape Town on January 10th, and a month's time was devoted to organizing the newly landed troops and establishing the transport and train on an adequate basis. The cavalry was made an important arm and much attention was devoted to the mounted infantry, composed of volunteers from Australia, New Zealand, and Canada. The new plan of campaign provided for the invasion of the Orange Free State by the main army under Lord Roberts, which, after relieving Kimberley, was to advance upon Bloemfontein. At the same time three smaller forces setting out from Cape Colony were to advance northward across the Orange River and to converge on Bloemfontein. The Boer forces thus crowded up in the northern part of the Orange Free State were then to be driven across the Vaal and cooped up in the mountains of Eastern Transvaal, where the united English strength might easily crush them. No attempt was made greatly to reinforce the troops operating around Ladysmith, for it was thought that a successful advance on Bloemfontein and Pretoria would compel the Boers to raise the siege of that town. At Ladysmith, meanwhile, desperate fighting had taken place during the month of January. On the 6th the Boers made a fierce assault on the redoubts to the south of the town, but were repulsed. On the 11th Sir Redvers Buller began a great flanking movement westward along the Tugela River, with the object of compelling the Boers to abandon their position on the north side of the stream and south of Ladysmith. On the 18th a division under General Warren crossed the Tugela, and on the night of the 23d-24th stormed Spion Kop, which was considered the key of the enemy's position. While encamped on the hill, however, the British were exposed to a murderous fire from the surrounding hills, and on the evening of the 24th were compelled to abandon the position, with the loss of 1700 men. On the 27th General Warren recrossed the Tugela.

Lord Roberts's advance on Kimberley began on February 11th. He had under him about 23,000 infantry, 11,000 mounted men, and 98 guns. On the 13th of February the cavalry under General French forced the passage of the Modder River, and on the 15th entered Kimberley. Cronje, who was now in danger of

being cut off from Bloemfontein, abandoned his position at Magersfontein, and retreated rapidly to the northeast. He was pursued by the British cavalry and mounted infantry, and from the 16th to the 18th carried on a fierce rear-guard fight. On the 19th he was finally brought to a standstill at Paardeberg, on the Modder River. There the Boers intrenched themselves in the bed of the stream. From the 19th to the 27th the Boer position was bombarded by the British artillery, and Cronje's men found shelter largely by burrowing into the banks of the river. The British lines were finally advanced within eighty yards of the Boer position, and on the morning of the 27th Cronje surrendered with 4000 men and six guns. The British advance on Bloemfontein was quickly begun, the cavalry and mounted infantry operating in advance and on the wings, the infantry holding the centre. On the flat level of the veldt the British superiority in numbers was decisive, and the Boers could make no effective stand. On March 7th they offered battle at Poplar Grove, some 60 miles west of Bloemfontein, but were outflanked and driven from behind their intrenchments. On March 10th a hard fight occurred at Driefontein, about 30 miles from Bloemfontein. On March 13th Roberts entered the capital, President Steyn having fled on the preceding day to Kroonstadt. For more than a month and a half Lord Roberts remained at Bloemfontein before resuming the advance upon Pretoria, the chief reason being the lack of horses for the mounted troops. The Boers for a time made no attempt at any demonstration in force, but contented themselves with carrying on an active guerrilla warfare which inflicted considerable loss on the British. On May 1st the British began the advance on Pretoria. On May 12th they entered Kroonstadt after encountering the Boers under General Louis Botha on the Vet River May 5th, and on the Zand River on the 10th. From Kroonstadt the British army advanced in the form of a crescent forty miles across, driving the Boer forces before them. The Vaal River was crossed between the 24th and 27th of May, Johannesburg was entered on May 31st, and on June 5th Pretoria was occupied. President Kruger fled to Machadodorp, while General Botha with about eight thousand men took up a strong position fifteen miles east of the capital. On June 11th-12th he was attacked by the British advance guard and slowly driven back. On July 23d Lord Roberts set out from Pretoria for the final campaign.

In Natal, meanwhile, General Buller, on February 5th, had made a third attempt to cross the Tugela and to break through the Boer lines. He failed, and on the 7th was driven back across the river. On the 14th the fourth and final dash for Ladysmith was begun. The Boer positions at Horsar Hill, Cingolo, Monte Cristo, Hlongwane, and Colenso were taken between the 14th and the 20th; the Tugela was crossed on the 21st; Peter's Hill, the key of the enemy's position, was taken on the 27th; and on the following day the British cavalry entered Ladysmith. General Buller's forces advanced northward into the Transvaal, where they coöperated with Lord Roberts in the final campaign. On May 18th Mafeking, the last of the three towns invested by the Boers at the outbreak of the war, was relieved.

In the Eastern Transvaal the main Boer force under General Botha was rapidly driven into the mountains bordering on the Portuguese frontier. The Boers made a desperate stand at Bergendal, August 27th, but were driven from their position by General Buller. At Spitzkop, southeast of Lydenberg, General Botha fought the last set battle of the war on September 8th. The Boers were defeated, and the greater part of them, about 3000 in number, crossed into Portuguese territory on September 14th and surrendered to the authorities there. On October 19th President Kruger sailed for Holland from Lourenço Marques on a Dutch man-of-war.

From this time until the termination of the war in May, 1902, the struggle on the part of the Boers took on the form of a desperate resistance waged by the guerrilla bands against immensely superior forces and inevitable defeat. It was the task of the British under Lord Kitchener, who succeeded Lord Roberts in the command of the British forces, November 29, 1900, to pacify the country they had overrun, and for this purpose was employed a plan of campaign adapted to the conditions under which the conflict was now to be fought out. Flying columns traversed the Orange Free State and the Western Transvaal in an effort to hunt down the Boer commandos, which, under leaders like Christian De Wet and Jacob Hendrik De la Rey (qq.v.), displayed sufficient ability to cause the British forces much annoyance, if not actual harm. De Wet especially, evinced splendid talents as a partisan leader, and his astonishing rapidity of movement, boldness in attack, and marvelous good fortune in eluding capture served to make the end of the South African War dramatic.

The activity of the Boers was limited to the repeated capture of isolated outposts or of comparatively small detachments of the enemy, whom, however, they were invariably compelled to release for absolute lack of facilities to keep them captive. At times, indeed, the danger of a rising among the Dutch inhabitants of Cape Colony seemed imminent, as when a number of Boer commandos entered Cape Colony in the winter of 1900-01, and threw the inhabitants of Cape Town into alarm, but probably the leading motive that actuated the Boer leaders in continuing their resistance was the hope of foreign intervention as the result of some untoward event. To a less degree they may have depended on the strong sentiment of opposition to the war which prevailed among a large portion of the English people. The struggle ultimately resolved itself into a campaign of so-called 'attrition' on the part of the English, a process, that is, of steadily weeding out the enemy by the unceasing pursuit and capture of one Boer commander after another. The task of the British was made more difficult by the active assistance rendered the Boers by the non-belligerent population, and because of this concentration camps were established in the Transvaal, Cape Colony, and the Orange River Colony, into which were gathered all Boer non-combatants, as well as those British loyalists who desired the protection of the authorities. The high rate of mortality that prevailed among the children in the concentration camps aroused bitter criticism of British methods in the foreign press.

The uselessness of protracting the struggle was recognized by a number of the Boer leaders be-

fore the beginning of 1902, and negotiations for peace were begun in January of that year. The British Government declined to take into consideration the question of the independence of the Boer States, and the articles of peace as signed at Pretoria on May 30th were substantially those offered by the Government in 1901. By the terms of the treaty the Boers in the field agreed to lay down their arms and to acknowledge Edward VII. as their lawful sovereign, on condition that no burgher should be deprived of his liberty or property, or be subjected to civil or criminal proceedings, for acts committed during the war. It was provided that the Dutch language be taught in the public schools and the use of it permitted in the courts. Military administration in the colony was to be succeeded by civil rule at the earliest opportunity, to be followed by the ultimate establishment of representative government. No special tax was to be imposed on landed property to defray the expenses of the war. The number of Boers who surrendered after the conclusion of peace was more than 20,000.

Figures issued by the War Office showed that the English forces engaged in South Africa during the war numbered nearly 450,000, of which number 9940 were in South Africa on August 1, 1899. The reinforcements after that date dispatched to South Africa from Great Britain included nearly 247,000 regular troops and 110,000 volunteers, militia and yeomanry. The number of volunteers from the British colonies was nearly 31,000, and more than 52,000 men were raised in South Africa. The casualties, as given by the War Office, were 1072 officers and 20,973 men dead or missing, and 3116 officers and 72,514 men sent home as invalids. The cost of the war in money was placed by the authorities at £206,224,000. The Boer enlistment from first to last, according to estimates made by the Red Cross Society, did not exceed 75,000. Their casualties were placed at 3700 killed or dead of wounds, and 32,000 prisoners.

BIBLIOGRAPHY. Amery (ed.), *Times History of the War in South Africa, 1899-1902* (vols. i., ii., London, 1900—); De Wet, *Three Years' War* (New York, 1902); Viljoen, *Die Transvaaler im Krieg mit England* (Munich, 1902); *Amtliche Berichte des Generals J. H. de la Rey—sowie andere Urkunden über den Südafrikanischen Krieg* (ib., 1902); Hillegas, *The Boers in War* (New York, 1900); Estorff and Gerneth, *Der Burenkrieg in Südafrika* (Berlin, 1901); Mahan, *The War in South Africa—to the Fall of Pretoria* (New York, 1900); Danes, *Cassell's History of the Boer War, 1899-1901* (London, 1901); Doyle, *The Great Boer War* (New York, 1902); Davitt, *The Boer Fight for Freedom* (ib., 1902); Ogden, *The War Against the Dutch Republics in South Africa* (Manchester, Eng., 1901); Cunliffe, *History of the Boer War* (London, 1901); Hiley and Hassell, *The Mobile Boer* (New York, 1902); Davis, *With Both Armies in South Africa* (ib., 1900); Steevens, *From Capetown to Ladysmith* (ib., 1900); Burleigh, *Natal Campaign* (London, 1900); Churchill, *London to Ladysmith via Pretoria* (New York, 1900); Kinnear, *To Modder River with Methuen* (Bristol, Eng., 1900); Ralph, *Towards Pretoria* (New York, 1900); id., *An American with Lord Roberts* (ib., 1901); Goldmann, *With General French and the Cavalry in South Africa* (ib., 1902); Nevinson, *Ladysmith, the Diary of a Siege* (ib., 1900); Ashe, *Besieged by the Boers in Kimberley* (ib., 1900); Young, *The Relief of Mafeking* (London, 1900); Wilkinson, *Lessons of the War* (ib., 1900).

SOUTH AMBOY. A borough in Middlesex County, N. J., on the Raritan River and Bay, directly opposite Perth Amboy, and on the Pennsylvania, the Central of New Jersey, and the Raritan River railroads (Map: New Jersey, D 3). A long drawbridge connects it with Perth Amboy. The borough is important as the centre of a region containing large quantities of sand and clay. Pottery, terra-cotta, asphaltum, and brick are the most important manufactures. Coal is extensively shipped from this port by the Pennsylvania Railroad. The government is vested in a mayor, elected biennially, and a unicameral council. South Amboy was incorporated in 1898. Population, in 1890, 4330; in 1900, 6349.

SOUTH AMERICA. See AMERICA.

SOUTHAMPTON, sŭth-hămp'ton. A civic county, municipal and Parliamentary borough, and seaport, in the south of Hampshire, England, 79 miles southwest of London (Map: England, E 6). The town occupies a peninsula at the head of Southampton Water, between the estuary of the Test or Anton on the west and south and the mouth of the Itchen on the east.

The Domus Dei, or God's house, dates from the end of the twelfth century, and is one of the oldest hospitals in England. In the vicinity are the picturesque ruins of Netley Abbey, a Cistercian foundation of the thirteenth century, and the Netley Military Hospital, accommodating 1,000 patients. Southampton was incorporated by Henry I., and received several privileges confirmed by subsequent monarchs. Henry VI. constituted the town a county in itself, and its area included a 'little' place called Portsmouth. The guild merchants controlled affairs and the municipal transactions are recorded in the famous 'oak book,' the most treasured object in the town archives. The Mayor is Admiral of the Port and chairman of the town council's twenty committees. The town has owned its markets since its incorporation, and the water supply since 1420, and its slaughter houses since 1698. It receives a fine revenue from corporate property and harbor dues, and owns Southampton Common, 300 acres in extent. The borough's boundaries were extended in 1895, since when much economic progress has been made. Artisans' dwellings and a municipal lodging house have been built, sewage and draining works carried out, and an electric lighting plant and street railways acquired. The town maintains a large isolation hospital, fine public baths, a free public library, a cemetery, and extensive parks, and makes abundant provision for technical instruction.

Yacht and ship building and engine-making are actively carried on, and there is an extensive general trade. Southampton is a fashionable summer resort. It owes its importance to its sheltered harbor and to the phenomenon of double tides, which prolong high water for three hours. (See ENGLISH CHANNEL.) There is considerable traffic between Southampton and the Channel Islands and French coast, and also a

large cattle trade with Spain and Portugal. Its docks include five large dry docks, two tidal basins (16 and 18 acres in area), and a closed dock. An average of 11,500 vessels enter, and clear a gross tonnage of 5,441,000 annually.

Southampton supplanted the ancient *Clausentum*, which stood one mile to the northeast, and its foundation is ascribed to the Anglo-Saxons. A great part of it was burned by the combined French, Spanish, and Genoese fleets in 1338, and in the following year its defenses were strengthened. Population, in 1901, 105,000. Consult Davis, *History of Southampton* (Southampton, 1883).

SOUTHAMPTON. Another name for the English county of Hampshire (q.v.).

SOUTHAMPTON, HENRY WRIOTHESLEY, third Earl of (1573-1624). An English statesman and the patron of Shakespeare. He was born at Cowdray House, near Midhurst, was educated at Saint John's College, Cambridge, and studied law at Gray's Inn. He was early attached to Queen Elizabeth's suite, and received the dedications of various poets, including Shakespeare, who in 1593 addressed to him *Venus and Adonis* and the following year *The Rape of Lucrece*. Southampton is also supposed by some to be the anonymous patron of Shakespeare's *Sonnets*. He was a friend of the Earl of Essex, whom he accompanied in the expedition to Cadiz and afterwards to Ireland. He took part in Essex's insurrection and was attainted and condemned to death. Elizabeth commuted the sentence to imprisonment for life, and the penalty was reversed by Parliament early in the reign of James I. In 1605 he became active in the colonization of America, and was Governor of the Virginia Company from 1620 until its dissolution in 1624. In 1621 he was imprisoned in the Tower for opposing the arbitrary measures of Charles I. After his release he commanded a regiment for the Dutch against the Spanish, and both he and his son died of fever contracted in the Netherlands.

SOUTHAMPTON INSURRECTION. See TURNER, NAT.

SOUTHARD, sŭth'ĕrd, SAMUEL LEWIS (1787-1842). An American legislator and Cabinet officer, born at Basking Ridge, N. J. He graduated at Princeton in 1804, and was admitted to the bar in 1809. In 1811 he settled in Flemington, N. J. From 1814 to 1819 he was a justice of the Supreme Court of New Jersey, and in 1821 was elected to the United States Senate. In that body he was in 1821 a member of the joint committee on the Missouri Compromise. In 1823 he resigned to become Secretary of the Navy, and he held this position throughout J. Q. Adams's administration. In 1830 he was elected Attorney-General of New Jersey and in 1832 Governor. From 1833 until soon before his death, he was again a member of the United States Senate. He attained high rank in the Senate, and was looked upon as one of the most influential Whig leaders in the nation. In the 27th Congress (1841-43) until his resignation he was president *pro tempore*, and he presided over the body after the death of William Henry Harrison had called Vice-President Tyler to the Presidential chair. He published *Reports of the Supreme Court of New Jersey 1816-20* (1820); *Centennial Address* (1832); and *Discourse on William Wirt* (1834).

SOUTH AUSTRALIA. A State of the Commonwealth of Australia occupying the central part of the continent, and bounded on the north by the Timor and Arafura Seas, east by Queensland, New South Wales, and Victoria, south by the Indian Ocean (Great Australian Bight), and west by Western Australia (Map: Australia, F 5). It crosses the continent from the north to the south coast in a band for the most part 550 to 700 miles wide, with a length of 1850 miles. Its area is 903,690 square miles. It is divided into South Australia proper and the Northern Territory, the latter having an area of 523,620 square miles.

PHYSICAL FEATURES. The State has no sharply differentiated geographical divisions. It is, as a whole, a vast plain of no great elevation, in some places lying even at or below sea-level. A mountain range but slightly exceeding 3000 feet in its highest summits runs north from Cape Jervis, near Adelaide, and minor ranges or isolated hills are found in the interior and northern portions, becoming quite rugged, though not high, in the extreme north. The State has practically no drainage system. The Murray enters the southeastern corner, but from its mouth in Encounter Bay to the western boundary not a single river reaches the ocean. In the interior there are a number of river courses, which are dry for a great part of the year, and even in the wet season are lost in marshes or salt lakes. The extreme northern portion, however, is comparatively well watered. In the great depression north of Spencer Gulf there are a number of large lakes, several of them being 100 miles in length. They are brackish and shallow, being reduced during the dry season to marshes or mud-flats covered with salt crusts.

CLIMATE, SOIL, AND FLORA. Considering the fact that the State has a range of nearly 27 degrees of latitude, its climate is remarkably uniform. It is in general very hot and dry; the temperature even on the south coast may remain at 110° or 115° for several days at a time. The annual rainfall in the southeast, at Adelaide, is about 24 inches, but may in some years fall to 15 inches. In the interior it is always very scanty, but on the north coast it is more abundant, sometimes reaching 60 to 70 inches. Rain is generally confined to the winter, which is mild and pleasant. There are considerable areas of good agricultural and pastural land in the south. The interior consists largely of treeless plains, in some parts absolutely barren, stony or sandy, or covered with a dry scrub, but here and there producing good pasture grass during the wet season. Large areas are covered with spiny grass unfit for pasture. Trees are found only near the mountains or larger river courses, but the hilly region east of the southern range is well timbered. The flora is not so rich as that of the eastern States. The main timber trees are Eucalyptus and Acacia, with some pines, while Pandanus and palms are found in the north.

GEOLOGY. The greater part of the surface is covered with recent formations, Cretaceous in the east, but in the main Tertiary. There are, however, numerous outcrops and some extensive areas of ancient rocks. Thus the mountain region from Spencer Gulf northward consists mainly of Silurian strata. Granite crops out in numerous places in the mountains of the interior, and the extreme northern portion, between the Roper and

Victoria rivers, is a complex of granites and metamorphic and Paleozoic rocks, with numerous intrusions of trap and recent volcanic rocks. The Paleozoic limestones are very rich in copper, and argentiferous lead, bismuth, and gold are also found. Iron exists in large quantities, but it cannot be worked, as there are no coal beds.

MINING. Copper is the chief mineral mined, the average annual output being a little less than 100,000 hundredweight between 1894 and 1900 and the value in the latter year £371,920.

AGRICULTURE. South Australia ranks second among the Commonwealth States in acreage under cultivation. It amounted in 1900-01 to 3,279,406 acres. Of this, 1,913,247 acres were under wheat, the chief source of wealth. In the same year there were 15,352 acres of barley, 27,988 of oats, 341,330 of hay, 35,323 of green fodder, 6628 of potatoes, and 31,841 of minor crops, including fruits. Vine cultivation is a prosperous industry, the area having increased from 12,314 acres in 1891 to 20,158 in 1901, the wine production in the latter year amounting to 1,388,847 gallons. The small rainfall confines farming mainly to the southeastern part of the State. The disposal of the public land by perpetual lease has become common. The State has adopted the policy of repurchasing large estates and leasing them to farmers. Some progress has been made in irrigation, the water being drawn from both rivers and artesian wells. The number of sheep declined from about 7,000,000 in 1890 to 5,283,247 in 1901. Cattle increased during that period, being 472,428 in 1901. In that year there were 179,352 horses.

MANUFACTURES. In 1901 there were 17,513 persons employed in 1047 factories. The manufacturing industry is confined mainly to production for local consumption, or of food products, especially flour, for export.

COMMERCE. Almost from the beginning railroads were constructed and operated by the Government, and in 1901 all but 14 miles of the 1916 total mileage belonged to the State. The greater part of this was in the southeast, only 166 miles being in the Northern Territory. The Government realizes a profit of about 3 per cent. upon its railways. The imports and exports are of about equal value and have each amounted for more than a decade to about eight million pounds sterling in annual value. Adelaide, the chief port, ranks third among the Australian ports. Less than half the exports are of domestic produce. The most valuable export is wool, after which rank wheat and flour, and minerals. The other Australian States and the United Kingdom handle nearly all the trade.

GOVERNMENT. The Governor is appointed by the British Government. The Executive Council is composed of six members. The Legislature consists of a Legislative Council of 18 elected members and a House of Assembly of 42 elected members. The State has extended the right of suffrage to women. The Northern Territory is administered by a commissioner delegated by the State. Adelaide (q.v.) is the capital.

FINANCE. There is a progressive land and income tax. The tax levy is increased upon land held by absentees. The State also collects death duties and stamp duties. The total revenue in 1902 was £2,667,560, and the expenditure £2,650,876. The customs revenue for the fiscal year 1901-02 was £605,000. The public debt in 1902 amounted to £27,272,545, the bulk of which is represented by assets of productive public utilities.

STATE ACTIVITIES. The Government has been very progressive with enterprises that are generally left to private initiative. The telegraph and telephone lines, including the transcontinental line from Adelaide to Port Darwin, the postal system, and water works are owned and operated by the Government. The State has tried to foster industries by the establishment of produce depots, and by performing the function of agent in the marketing of produce; and also by the establishment of cyanide works and smelters. A State bank supplies capital to farmers on easy terms. Laws have been passed to secure the compulsory settlement of industrial disputes.

POPULATION. The population increased from 14,600 in 1840 to 319,145 in 1890 and 362,604 in 1901. The majority are in the southeastern part of the State. Only 4096 persons were reported in the last census for the Northern Territory. Nearly the whole population is of British origin. In 1901 Adelaide and its suburbs had about 162,200 inhabitants and Port Pirie 7983.

RELIGION. In 1901 the membership of the principal churches was: Church of England, 106,987; Roman Catholic, 52,193; Methodist, 90,125; Lutheran, 26,140; Baptist, 21,764; Presbyterian, 18,357; and Congregationalist, 13,338.

EDUCATION. Primary education is free, and is compulsory between the ages of 7 and 13. Religious instruction may be given, but not during ordinary school hours. In 1901 there were 69,115 scholars enrolled in the State schools. There is a secondary school for girls at Adelaide, and fees are charged. All other secondary schools are private or denominational. In 1901 there were 11,310 scholars enrolled in private schools. The University of Adelaide and a number of technical schools are aided by the State.

HISTORY. The explorations of Flinders in 1802 and of Sturt in 1830 first called attention to South Australia. Its real settlement was due to an association formed to put into operation the colonization theories of Edward G. Wakefield (q.v.); but its early application for a charter, in 1831, was rejected, and it was not until 1835 that permission was given for the formation of the province on condition that no expense should attach to the home Government. A year later settlers landed and founded the town of Adelaide. South Australia became a crown colony in 1841. The early basis for the prosperity of South Australia was agricultural, though in 1841 galena deposits were discovered and in 1842 copper. The population was 19,000 in 1844 and 92,500 ten years later, and the exports increased from £100,000 to £1,300,000 during the same period. The Torrens land system was adopted in 1858. A separate colonial constitution dates from 1856, the year of the opening of the first railway from Adelaide to its port. The explorations of Eyre in 1840 opened up the cattle region of the interior, and those of Stewart in 1859-62 the way to the Indian Ocean. The Northern Territory was annexed in 1863. The telegraph line, opened in 1872, followed substantially the line of Stewart's explorations and gave Australia cable communication with the rest of the world.

BIBLIOGRAPHY. Hodder, *The History of South Australia* (London, 1893); Woods, *The Province of South Australia* (Adelaide, 1894); Gouger, *The Founding of South Australia*, ed. by Hodder (London, 1898); H. Y. L. Brown, *A Record of the Mines of South Australia* (Adelaide, 1899); Gill, *Bibliography of South Australia* (ib., 1888).

SOUTH BEND. The county-seat of Saint Joseph County, Ind., 86 miles east by south of Chicago, Ill.; on the Saint Joseph River, and on the Lake Shore and Michigan Southern, the Chicago and Grand Trunk, the Indiana, Illinois and Iowa, the Terre Haute and Indiana, and other railroads (Map: Indiana, C 1). Notre Dame, two miles north of the city, is the seat of the University of Notre Dame (q.v.), a Roman Catholic institution opened in 1842, and of Saint Mary's Academy. Saint Joseph's Academy is within the city limits. Noteworthy are the court house, city hall, Oliver Hotel, Epwerp Hospital, Saint Joseph's Hospital, and the Northern Indiana Medical and Surgical Institute. South Bend is the centre of a rich farming section, and is an important industrial city. In the census year 1900 its various industries had an invested capital of $18,156,638 and an output valued at $14,-236,331. The Studebaker Wagon Works and the Oliver Plow Works are among the most noted concerns of their kind in the world. There are lumber and flouring mills, foundries and machine shops, wood-turning plants, and manufactories of shirts, sewing machines, agricultural implements, toys, patent medicines, woolens, and paper and wood pulp. The government is vested in a mayor chosen every two years and a unicameral council, and in administrative officials nearly all of whom are appointed by the mayor. The city spends annually for maintenance and operation about $306,000. The water works, which represent an expenditure of $457,974, are owned by the municipality. Population, in 1890, 21,-819; in 1900, 35,999.

The site of South Bend was occupied by the Miami and Potawatami Indians and was a favorite resting place for French traders and explorers. In 1824 Alexis Coquillard established a trading post here; in 1831 a town was laid out, which in 1835 was incorporated; and in 1865 South Bend was chartered as a city.

SOUTH BETH'LEHEM. A borough in Northampton County, Pa., 56 miles north by west of Philadelphia; on the Lehigh River, opposite Bethlehem, and on the Lehigh Valley and the Philadelphia and Reading railroads (Map: Pennsylvania, F 3). Lehigh University (q.v.), a non-sectarian institution opened in 1866, occupies a site overlooking the borough. Noteworthy are the Bishop Thorp Seminary for Girls and Saint Luke's Hospital. South Bethlehem is known for its iron and steel manufactures. The total capital invested in the various industries in the census year 1900 was $8,713,185, and the value of their output was $10,964,911. There are the large establishment of the Bethlehem Iron Company, and brass works, zinc works, and manufactories of silk, knit goods, brick, etc. Population, in 1890, 10,302; in 1900, 13,241.

SOUTH'BRIDGE. A town, including two villages, in Worcester County, Mass., 20 miles south by west of Worcester; on the Quinebaug River, and on the New York, New Haven and Hartford Railroad (Map: Massachusetts, C 3). It has manufactories of spectacles and eyeglasses, shuttles and shuttle-irons, knives, and cotton and woolen goods. The government is administered by town meetings. Population, in 1890, 7665; in 1900, 10,025. Originally a part of Charlton and popularly called 'Honest Town,' Southbridge became a parish in 1801 and was incorporated as a town, under its present name, in 1816. Consult Davis, *A Historical Sketch of Sturbridge and Southbridge* (Brookfield, 1856).

SOUTH CAR'OLI'NA (popularly called the 'Palmetto State'). A South Atlantic State of the United States. It lies between latitudes 32° 4′ and 35° 19′ N., and between longitudes 78° 28′ and 83° 18′ W., and is bounded on the north by North Carolina, on the southeast by the Atlantic Ocean, and on the southwest by Georgia. It is triangular in shape, with a base measuring 190 miles in a straight line fronting the ocean, and an apex 240 miles inland. Its area is 30,570 square miles, of which 30,170 square miles, or 19,308,800 acres, are land surface. It ranks thirty-sixth in size among the States.

TOPOGRAPHY. South Carolina is divided about equally between the coastal and Piedmont plains, the line of division running nearly parallel with the coast and presenting an abrupt transition between the distinctive features of the two regions. The coast presents first a continuous firm, sandy beach from the northern boundary to Winyah Bay. South of that point it becomes more and more broken by inlets and estuaries, and is fringed with sandy islands (the Sea Islands), inclosing irregular lagoons lined with salt marshes. The coastal plain, extending 100 miles inland, is low, being everywhere less than 500 feet above the sea, and consists in general of a light sandy soil. Large areas are swampy, and pine forests predominate. Along its western margin runs a particularly sandy belt known as the Sand Hills or Pine Barrens, consisting of loose sand dunes partly covered with pine forests. To the west of this belt the land rises abruptly to the upland or Piedmont Plain, which rises gradually from an altitude of 500 feet at its eastern margin to 1000 feet in the extreme northwest. Here the Blue Ridge, whose crest forms the northwestern boundary, rises abruptly 2000 feet higher, Mount Pinnacle, the highest point in the State, being 3436 feet.

HYDROGRAPHY. Several large rivers traverse the State from northwest to southeast, all the larger ones rising in the mountains of North Carolina. They are the Great Pedee, which, with the Little Pedee and the Lynches, flows into Winyah Bay in the north; the Santee, formed by the Wateree and the Congaree, traversing the centre; and the Savannah, marking the entire boundary between South Carolina and Georgia. The rivers cross the upland or Piedmont Plain as rapid and turbid streams; they generally have falls or rapids as they descend from the hard upland rock over the 'fall line' into the alluvial coastal plain. In the latter they become clear and sluggish, frequently overflowing wide areas. The larger rivers are navigable for steamers to the 'fall line,' and at the line they furnish considerable water-power.

CLIMATE. The climate is mild, resembling

that of Southern Europe. It is especially healthful in the uplands and pine barrens, but unhealthful in the low swamp regions. The mean annual temperature for the State is 61°; the mean for January is 44.6°, and for July 79.5°. The maximum is about 106°, and a temperature of 1° was observed in the northwestern highlands in 1900. Snow in measurable amounts generally does not fall on more than two or three days in a year, except in the mountains, where there is a considerable snowfall. The average annual rainfall is 47 inches, fairly evenly distributed both as to localities and seasons, though there is a maximum in summer and a minimum in autumn. Hurricanes visit the coast occasionally, and sometimes do considerable damage. In 1886 the State suffered from a severe earthquake which caused great destruction at Charleston.

FLORA. The coast islands present a distinct semi-tropical aspect, the palmetto, live oak, and magnolia being here the characteristic plants. In the coastal plain the long-leaf pine is the predominating species in the great forests, covering the sandy regions, while the cypress grows in the swamp lands. In the upper pine belt, except in the sand hills, oaks and hickories begin to appear, and these, together with elms, maples, chestnuts, and other deciduous trees common to the Northern States, predominate in the upland. The persimmon, locust, and plane tree grow in this State. Wild grapes are abundant, as well as strawberries and fruit shrubs and trees common to the Eastern States.

For FAUNA, see paragraph under UNITED STATES.

GEOLOGY AND MINING. South Carolina is nearly equally divided between the most ancient and the most recent of geological systems, the division corresponding to the topographical division into the Piedmont and coastal plains. The western half or Piedmont Plain belongs to the great Archæan belt, which flanks the eastern slope of the Appalachians. Granite predominates here, with gneiss and mica-slate in the higher regions. The eastern half belongs to the coastal plain formation, consisting of unindurated Tertiary and recent sands and clays. The granite industry is the most important of the mining industries, the output having increased rapidly from $37,820 in 1897 to $996,084 in 1901, the production in the latter year having been exceeded in only four States. Limestones are also quarried, but the mineral next in importance is rock phosphate, used as an artificial fertilizer, in the production of which the State ranked first until 1894, when larger beds were exploited in Florida. The product in 1893 was 502,564 long tons, valued at $2,157,014; in 1901 it had decreased to 321,181 tons, with a value of $961,840. Clay products rank next in value. Gold and silver are mined in small quantities, and the iron ores, though existing in considerable quantities, are but little worked.

FISHERIES. In 1897 there were 2139 persons engaged in the fisheries, of whom 1865 were employed on inshore or boat fisheries. The figures for the yield for that year were $210,456. The most valuable species are oysters, whiting, shad, and sea-bass.

AGRICULTURE. In 1900, 72.4 per cent. of the land area was included in farms, and of this 41.3 per cent. (5,775,741 acres) was improved—a large increase over all earlier years. The average size of farms in 1900 (90 acres) was only one-sixth as large as the average size in 1850. In 1900, 36.7 per cent. of the farms were let for cash rent, and 24.3 per cent. share rent. Considerably over half of the farms are operated by negroes, and only 18.2 per cent. of these properties are owned by them. In probably no State is the cotton crop so predominant as in South Carolina. In area it annually exceeds every other crop and is several times as important as any other crop with respect to value. The acreage in 1900 was larger than for any other census year, as was also the number of bales produced (881,422), the crop being nearly three times as great as in 1850. Of the total area of cotton, 23,902 acres were in the sea-island variety.

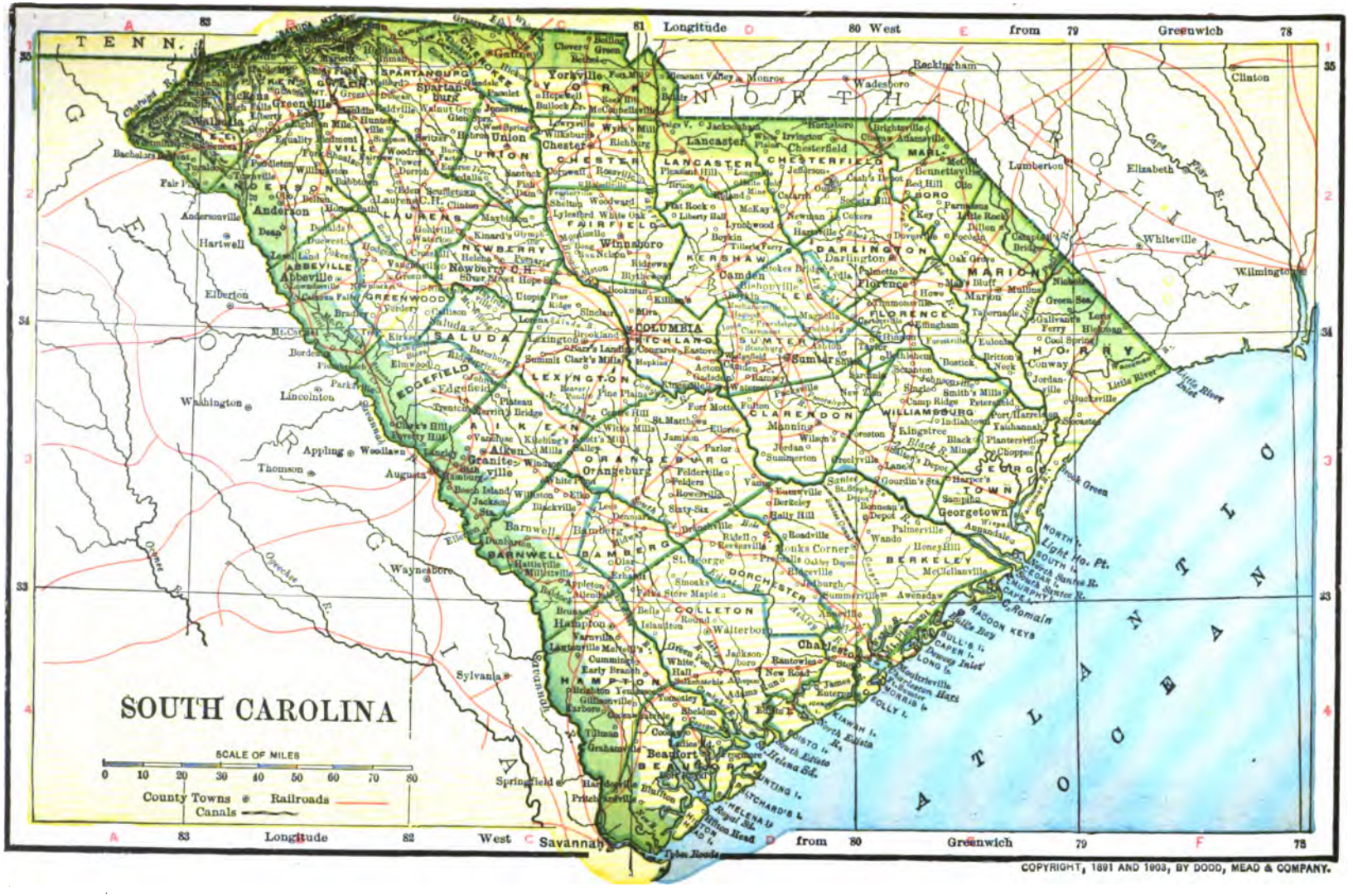
Corn, the second crop in importance, made large gains in the decade 1890-1900. During that period there was also a revival in wheat culture and a decrease in the cultivation of oats, but neither crop is of great importance. Rice is the only other cereal worthy of mention. It has been grown in South Carolina since 1700, and the State took first rank in its cultivation until 1861. The increasing destructiveness of the freshets since the deforestation of the mountain slopes has greatly hampered the growth of the industry. However, in the decade 1890-1900 it almost regained the ground which it had lost in the preceding ten years. The State is now exceeded by Louisiana alone in rice production. The acreage in hay increased 264.3 per cent. in the decade 1890-1900. Considerable attention is given to the raising of peas, and tobacco and sweet potatoes are products of some importance. The area devoted to tobacco in 1900 was 65 times as great as in 1890. The following table shows the acreage of the leading crops:

CROPS	1900	1890
Cotton	2,074,081	1,987,469
Corn	1,772,057	1,345,990
Oats	222,544	308,056
Wheat	174,245	115,510
Rice	77,657	42,238
Dry peas	143,070	.....
Hay and forage	106,124	29,132
Sweet potatoes	48,831	46,086
Tobacco	25,993	394

STOCK-RAISING. In 1890-1900 there was a large increase in the number of all kinds of domestic animals except sheep. There is a smaller number of all varieties of live stock (except mules) than in 1850—less than half as many cattle and less than one-fifth as many sheep. The following table shows the number of domestic animals on farms:

ANIMALS	1900	1890
Dairy cows	126,684	107,184
Other cattle	216,214	161,109
Horses	78,419	59,888
Mules and asses	117,616	86,306
Sheep	52,436	79,421
Swine	618,995	494,696

MANUFACTURES. Prior to 1880 the manufacturing industry had been quite insignificant. Its growth has since been rapid. The total value of products increased 90.7 per cent. from 1880 to 1890, and 84 per cent. in the following decade, being estimated in 1900 at $58,748,731. The


SOUTH CAROLINA
SCALE OF MILES
0 10 20 30 40 50 60 70 80
County Towns
Railroads
Canals
Longitude 83 West from Greenwich
Longitude 82 West from Greenwich
TENN.
N. CAROLINA
GEORGIA
ATLANTIC OCEAN
Anderson
Greenville
Spartanburg
Union
Chester
Yorkville
Lancaster
Chesterfield
Darlington
Florence
Marion
Horry
Abbeville
Greenwood
Newberry
Laurens
Fairfield
Winnsboro
Kershaw
Camden
Columbia
Richland
Lexington
Saluda
Edgefield
Aiken
Orangeburg
Clarendon
Sumter
Williamsburg
Georgetown
Barnwell
Bamberg
Colleton
Dorchester
Berkeley
Charleston
Hampton
Beaufort
Augusta
Savannah
Charleston Harb.
Port Royal Sd.
Broad R.
Pee Dee R.
Santee R.
Cooper R.
Edisto R.
Savannah R.
Saluda R.
Catawba R.
Little R.
Lumber R.
Waccamaw R.
Black R.
Great Pee Dee R.
Little River Inlet
Bull's Bay
Capers I.
Dewees Inlet
Long I.
Morris I.
Folly I.
Kiawah I.
Seabrook I.
Hilton Head
Tybee Roads
Bachelor's Retreat
Fair Play
Andersonville
Hartwell
Elberton
Washington
Lincolnton
Appling
Thomson
Waynesboro
Sylvania
Springfield
Rockingham
Wadesboro
Clinton
Lumberton
Elizabeth
Whiteville
Wilmington
Conway
Georgetown
Charleston
Beaufort
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AREA AND POPULATION OF SOUTH CAROLINA BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Abbeville	B 2	Abbeville	682	46,854	33,400
Aiken	C 3	Aiken	1,096	31,822	39,032
Anderson	B 2	Anderson	756	43,696	55,728
Bamberg	C 3	Bamberg	363	.....	17,296
Barnwell	C 3	Barnwell	870	44,618	35,504
Beaufort	D 4	Beaufort	943	34,119	35,495
Berkeley	D 4	Monks Corner	1,316	55,428	30,454
Charleston	E 4	Charleston	687	59,903	88,606
Cherokee	C 2	Gaffney	361	.....	21,359
Chester	C 2	Chester	592	26,660	28,616
Chesterfield	D 2	Chesterfield	823	18,468	20,401
Clarendon	D 3	Manning	710	23,283	28,184
Colleton	D 4	Walterboro	1,351	40,298	33,452
Darlington	D 2	Darlington	649	29,134	32,388
Dorchester	D 3	St. George	564	....	16,294
Edgefield	D 2	Edgefield	715	49,259	25,478
Fairfield	C 2	Winnsboro	776	28,599	29,425
Florence	E 2	Florence	630	25,027	28,474
Georgetown	E 3	Georgetown	827	20,857	22,846
Greenville	B 2	Greenville	745	44,310	53,490
Greenwood	B 2	Greenwood	495	.....	28,343
Hampton	C 4	Hampton	936	20,544	23,738
Horry	E 3	Conway	1,075	19,256	23,364
Kershaw	D 2	Camden	705	22,361	24,696
Lancaster	D 2	Lancaster	501	20,761	24,311
Laurens	B 2	Laurens	684	31,610	37,382
Lexington	C 3	Lexington	865	22,181	27,264
Marion	E 2	Marion	993	29,976	35,181
Marlboro	E 2	Bennettsville	509	23,500	27,639
Newberry	C 2	Newberry	594	26,434	30,182
Oconee	A 2	Walhalla	641	18,687	23,634
Orangeburg	D 3	Orangeburg	1,345	49,393	59,663
Pickens	B 2	Pickens	531	16,389	19,375
Richland	D 2	Columbia	605	36,821	45,589
Saluda	C 3	Saluda	438	.....	18,966
Spartanburg	B 2	Spartanburg	762	55,385	65,560
Sumter	D 3	Sumter	860	43,605	51,237
Union	C 2	Union	495	25,363	25,501
Williamsburg	E 3	Kingstree	991	27,777	31,685
York	C 2	Yorkville	669	38,831	41,684

NOTE.— Lee County (D 2), with Bishopville as county seat, has been established, since the census was taken in 1900, from parts of Sumter, Darlington, and Kershaw counties.

wage-earners engaged in manufactures in the latter year numbered 48,135 (3.6 per cent. of the total population), of whom 8,560 were children under 16 years of age. The State's abundant supply of raw materials, its excellent water-power, facilities for transportation, and low cost of living, are greatly to the advantage of the manufacturing industry. The recent development is confined largely to manufactures of cotton. Absolute increase in value of cotton products between 1890 and 1900 exceeded that in any other State, and gave South Carolina first rank among the Southern States and second in the Union. In 1900 the amount of cotton used by the local mills was considerably over half the total yield of the State. The manufacture of cottonseed oil and cake also made a marked gain in the decade 1890-1900. The State's supply of phosphate rock and cottonseed meal has given rise to the manufacture of fertilizers, and Charleston is the second largest manufacturing centre of this product in the country. Flour-milling scarcely meets the local demand.

The following table shows the figures for the leading industries:

INDUSTRIES	Year	Number of establishments	Average number wage-earners	Value of products, including custom work and repairing
Total for selected industries in the State	1900	1,640	39,066	$48,041,940
	1890	1,169	15,565	21,927,098
Increase, 1890 to 1900	.....	471	23,501	$26,114,842
Per cent. of increase	.....	40.3	151.0	119.1
Per cent. of total of all industries in the State	1900	43.6	81.2	81.8
	1890	49.1	68.4	68.7
Cotton goods	1900	80	30,201	29,723,919
	1890	34	8,071	9,800,798
Fertilizers	1900	22	1,772	4,882,506
	1890	20	1,102	4,417,658
Flouring and grist mill products	1900	556	281	2,347,790
	1890	512	630	2,083,126
Lumber and timber products	1900	729	4,585	5,207,184
	1890	352	2,590	2,146,750
Lumber, planing mill products	1900	53	490	1,016,328
	1890	27	370	711,838
Oil, cottonseed, and cake	1900	50	734	3,103,425
	1890	17	416	927,772
Rice, cleaning and polishing	1900	18	112	973,132
	1890	6	143	315,056
Turpentine and rosin	1900	132	886	787,656
	1890	201	2,243	1,524,100

FORESTS. It is estimated that the woodland covers 20,500 square miles, or 68 per cent. of the State's area. In the Piedmont region the hard woods predominate. South of this region lies an extensive belt of yellow pine. Cypress covers the low coast lands. Lumbering made little progress prior to the decade 1890-1900. The increase for that period is shown in the above table. The greater part of the timber cut is of the yellow-pine variety. The value of planing-mill products is increasing, but the manufacture of turpentine and rosin is decreasing in consequence of the exhaustion of the timber from which the product is obtained.

TRANSPORTATION AND COMMERCE. The coast waters and navigable rivers offer excellent advantages for water transportation. The Savannah River is navigable for 158 miles; the Santee, for its entire length; the Pedee, for 120 miles; the Congaree, nearly to the city of Columbia; and the Wateree, to Camden. Railroad mileage has increased from 973 miles in 1860 to 1427 in 1880, 2289 in 1890, and 2919 in 1900. The railroads are mostly owned or controlled by three large systems—the Southern, the Seaboard Air Line, and the Atlantic Coast Line. A considerable foreign trade, principally exports, passes through the port of Charleston, which ranks tenth among the Atlantic coast ports.

BANKS. The State Bank of South Carolina had an exceptionally successful career. It was established in 1812 to remedy the financial disturbances caused by the impending war with England. It was entirely under State control, and its president and directors were chosen by the Legislature. The capital was furnished by the State and the bank was the repository for all State funds. All State expenditures were paid through the medium of the bank. It was free to do a regular banking business, but its debts could not exceed twice the capital exclusive of deposits. Branch banks were established at Columbia, Camden, and Georgetown. The work of the bank is best illustrated by the official report of 1848, which showed that it had received and paid out State moneys to the amount of $28,000,000 without any loss. In 1852 its charter was renewed and it continued to do a most satisfactory business until 1870, when it was put in liquidation. The following table gives the State banking statistics as reported as to principal items in 1902:

	National banks	State and stock savings banks
Number	18	46
Capital	$2,048,000	$2,269,000
Surplus	691,000	451,000
Cash, etc	510,000	708,000
Loans	8,346,000	9,400,000
Deposits	5,810,000	9,828,000

GOVERNMENT. The Constitution now in force was ratified in convention December 4, 1895. Voters must have resided in the State two years, in the county one year, in the polling precinct four months, and must have paid all taxes collectible during the previous year. A residence

of only six months in the State, however, is required of ministers and of teachers in the public schools. Every elector must enroll once in ten years, but enrollment may be secured in any year for those not previously registered. It was required of those registering prior to January 1, 1898, that they should be able to read any section of the State Constitution or understand and explain it when read to them. Those applying for registration after that date must be able to read and write any section of the State Constitution or to show that they own and have paid all taxes collectible during the previous year on property in the State assessed at $300 or more. The capital is Columbia.

LEGISLATURE. There are 124 Representatives elected upon the basis of population from county districts every two years. Each county elects a Senator, who serves four years. Elections are held on the Tuesday after the first Monday in November of even years. Revenue bills must originate in the Lower House. Sessions of the Legislature are held annually.

EXECUTIVE. A Governor, Lieutenant-Governor, Secretary, Comptroller-General, Attorney-General, Treasurer, Adjutant and Inspector-General, and Superintendent of Education are elected for terms of two years each. The Lieutenant-Governor and president pro tem. of the Senate are in the line of succession to the Governorship in case of vacancy. The Governor is given the usual pardoning power and the authority to call extra sessions of the Legislature. The Governor's veto of a bill or of any item of an appropriation bill may be overridden by a two-thirds vote of each House. An act of the Legislature becomes a law if not returned within three days.

JUDICIAL. The Supreme Court consists of the Chief Justice and three associate justices, who are all elected by the General Assembly for terms of eight years. The State is divided into judicial circuits and for each a judge is elected by the General Assembly to serve for four years. There are two circuit courts, namely, a Court of Common Pleas and a Court of General Session. There is a Court of Probate at Charleston.

FINANCES. The debt of South Carolina at the outbreak of the Civil War amounted to but $3,814,862 and the State was on a firm financial basis. In 1867 the debt had increased to about $5,500,000. This debt was increased until in 1870 it reached $6,314,000. At this time there were also outstanding against the State bonds to the amount of $20,827,608 and a railroad debt of $6,787,608. The financial condition of this period is also shown by the fact that in 1872-73 appropriations aggregating $2,418,872 had been made, while the receipts from all sources were but $1,719,728. An act authorizing an annual tax sufficiently large to pay the interest on the State debt failed to have the desired effect. In 1880, however, it was enacted that holders of consolidated bonds, stock, or interest-bearing coupons which were due and unpaid before July 1, 1878, might exchange them for new bonds with interest at 6 per cent. and in every respect equal to the value of the bonds, stock, or interest coupons surrendered. This proved to be an efficient remedy, and the credit of the State was restored. In 1880 the public debt was $7,175,454 and in 1902 it had been reduced to $6,514,674. In the latter year the total receipts were $3,976,659 and the expenditures $3,783,605, which, together with the money on hand at the beginning of the year, left a total cash balance of $430,797.

STATE DISPENSARY. The State abolished the old saloon system for the sale of liquors and substituted in its place a State dispensary system. At the dispensaries sealed packages of liquor containing not less than one-half pint are sold, but cannot be opened at the dispensary. Profits accruing are divided between the State, county, and municipality. In 1902 the dispensaries sold liquors (exclusive of fresh beer) to the amount of $2,406,213, and purchased liquors to the amount of $1,664,870. The total net earnings were $566,898. Of this amount $443,198 was divided equally between towns and counties, and $142,755 was paid into the school fund.

MILITIA. In 1900 there were 236.767 men of militia age. The militia in 1901 numbered 3029.

POPULATION. The population increased from 249,073 in 1790 to 502,741 in 1820; 668,507 in 1850; 703,708 in 1860; 705,606 in 1870; 995,577 in 1880; 1,151,149 in 1890; and 1,340,316 in 1900. In the last year the State ranked twenty-fourth in population. There were 44.4 persons to the square mile. Only one other State in the Union had a smaller foreign-born population, this element numbering only 5528 in 1900. South Carolina ranks fourth in negro population, it having been increased from 688,934 in 1890 to 782,321 in 1900. The number of towns exceeding 4000 inhabitants increased from 4 in 1890 to 16 in 1900, constituting in the latter year 11.7 per cent. of the total population. In 1900 the largest cities were as follows: Charleston, 55,807; Columbia, 21,108; Greenville, 11,860; and Spartanburg, 11,395. South Carolina sends 7 members to the National House of Representatives.

RELIGION. The Methodist Church is the largest, followed closely by the Baptist. These two represent the bulk of the church membership of the State.

EDUCATION. South Carolina has a negro population greatly in excess of the white, and has consequently had to deal with most serious problems in the matter of providing adequate educational facilities. The considerable success attained is shown by the decrease in illiteracy. In 1900, 35.9 per cent. of the total population above ten years of age could not read, as against 55.4 per cent. in 1880. The percentage of illiteracy among the native whites is only 13.6, as compared with 52.8 for the colored population; but the colored illiteracy has been reduced from 78.5 per cent. in 1880. The length of the school term is short, but is becoming longer. In 1901 the average term for the white schools was 21.17 weeks, for the negro schools 14.12 weeks. No compulsory attendance law has been passed. The State Governor appoints the State Board of Education. This board appoints the county boards, and the latter in turn appoint the trustees in the small districts. Educational progress is seriously handicapped by a lack of financial support and the resulting inadequacy of teachers' wages. In 1901 white teachers received an average annual wage of $188.91 and the negro teachers $80.30. The new Constitution increased the State school tax from two to three mills, and in the school year 1900-01 the receipts from this source amounted to $520,294. In 1900-01 the expendi-

ture for white schools was $726,825 and for negro schools $211,287. Any school district may levy special taxes for schools, but only a small number have availed themselves of this privilege. In 1900 there were 281,891 pupils enrolled and 201,295 in average attendance. There were 2422 male and 3142 female teachers. Normal school education for females is provided by the State at the Winthrop Normal and Industrial College at Rock Hill. The State provides higher education for both sexes at the South Carolina College (q.v.), located at Columbia. There are also a number of small denominational and coeducational colleges. Of the nine colleges and seminaries for females Converse College, a non-sectarian institution at Spartanburg, is the largest. The State has an agricultural college at Clemson College, at which also courses in civil, electrical, mechanical, and textile engineering are given.

CHARITABLE AND PENAL INSTITUTIONS. The State Hospital for the Insane and the State Penitentiary are at Columbia, and the State Institution for the Deaf and Blind at Cedarspring, near Spartanburg. The State maintains convict farms.

HISTORY. In 1562 Jean Ribaut (q.v.), acting for Admiral Coligny, attempted to form a colony of French Huguenots at Port Royal. The colony, however, was abandoned the next year, and other attempts were made farther south. Charles I. granted in 1630 to Sir Robert Heath all the territory between 31° and 36° extending from sea to sea. No settlement was made, and in 1663 Charles II. granted the same to eight Lords Proprietors, favorites at Court. In 1665 the limits were extended to 29° and 36° 30′. Full proprietary rights were given, but the Proprietors were to legislate "by and with the advice, assent, and approbation of the freemen." Permission to grant religious freedom was given, and subinfeudation was allowed. The terms to settlers were at first liberal, but in 1669 the attempt was made to put into effect the 'Fundamental Constitution' drawn by John Locke. (See NORTH CAROLINA.) An expedition consisting of 200 persons under William Sayle settled upon the Ashley River in 1670. A 'parliament' consisting of the five deputies of the Proprietors and twenty members elected by the freeholders was established in 1671. In 1680 the settlement was removed to the present site of Charleston. Immigration was rapid, and by 1700 the colony contained 5500 inhabitants.

The colony was turbulent from the beginning. It refused to adopt the Fundamental Constitutions, quarreled over the quit-rents, and in 1693 secured the right of initiative in legislation. In May, 1704, the Proprietors ordered the enforcement of the Test Act requiring conformity to the Church of England, but an appeal to the Whig House of Lords led to the annulment of the Test Act in the colony in 1706, though the Church was still established. The colony was divided into North and South Carolina in 1710. The Yemassee Indians, instigated by the Spanish at Saint Augustine, attacked the settlements in 1715, and the Proprietors refused to grant aid. When appeal was made to the Crown it was shown that no aid could be given unless the government was vested in the King. Numerous other grievances led to the assembling of a convention which assumed the powers of government, and James Moore (q.v.) was chosen to act as Governor until the King's pleasure was known. The Royal Governor, Sir Francis Nicholson, arrived in 1721 and in 1729 the Crown purchased the proprietary rights. From this time the assembly never relinquished a single right it gained, and before the Revolution claimed all the rights and privileges of the British Parliament. The first printing press was set up in 1730, and the *South Carolina Gazette* was established two years later. The colony joined Oglethorpe's unsuccessful expedition against the Spaniards in 1740, and was occupied with Indian troubles in 1755, 1760, and 1765. The Cherokees ceded their lands in 1755, and the Scotch-Irish began to fill them up. The colony was prompt in its resistance to the Stamp Act, and troops were quartered in Charleston. It agreed to the non-importation agreement in 1769-70, and sent money and supplies to Boston in 1774. Delegates were sent to the Continental Congress in 1774 and the Provincial Congress met January 11, 1775. At the second session in June, 1775, troops were voted, and Lord William Campbell tried in vain to restore royal authority. In March, 1776, sovereignty was claimed and a government was established. Fort Moultrie (q.v.) was unsuccessfully attacked by the British June 28th. Several battles (among them Camden, King's Mountain, Cowpens, and Eutaw Springs) were fought during the Revolution within the State. Famous leaders of irregular bands of patriots were Sumter and Marion. Charleston was captured by the British in 1780, and held until 1782. The State adopted the Federal Constitution May 23, 1788, Columbia was made the capital in 1790, and a new constitution was adopted which gave the Legislature practically all power. The differences between the sections began to be apparent. The eastern part of the State had the wealth and was strongly Federalist. The western part had the population and was strongly Anti-Federalist. In 1808 a compromise was effected which lasted until 1868. By its terms the Lower House of the Legislature was to consist of 124 members, 62 to represent population and 62 wealth. Each district was given as many Representatives as it had sixty-seconds of population and wealth. With the adoption of this compromise State politics practically ceased.

The State early became dissatisfied with the tariff policy of the general Government, and as early as 1828 the 'South Carolina Exposition' was adopted by the Legislature. On the passage of the Clay Tariff Bill in 1832, a convention was called which declared, November 24th, that no duties should be collected after February 1, 1833. President Jackson was resolved to enforce the law, but an actual conflict was averted by a compromise. (See CALHOUN, JOHN C.; NULLIFICATION.) On the election of President Lincoln in 1860, a convention was called on December 20th, which unanimously passed an ordinance of secession. The attack on Fort Sumter in April, 1861, precipitated the Civil War. (See CIVIL WAR.) The State furnished 60,000 soldiers to the Confederate armies, though her voting population was only about 47,000. Charleston withstood the Federal attacks until February, 1865, when the Confederates were finally compelled to evacuate it. South Carolina suffered from Sherman's march northward. A provisional Governor was appointed at the close

of the war and a new constitution adopted. On the refusal of the State to ratify the Fourteenth Amendment, a military government was established. In 1868 another constitution allowing negro suffrage was adopted and the State was re-admitted June 25th. The next years were a carnival of official crime and corruption. Illiterate negroes and carpetbaggers filled the highest offices and the debt increased from $5,407,306 in 1868 to $20,333,901 in 1873. The campaign of 1876 was of unexampled bitterness. Intimidation and bloodshed were called into play. Both sides claimed the victory, and there were for a time rival State governments. When President Hayes withdrew the Federal troops from the State the Republican claimant, Governor Chamberlain, gave up the contest and Wade Hampton (q.v.) was recognized as Governor. Several of the State officers were tried on charges of malfeasance and sentenced to varying terms of imprisonment. Since this time, by various methods, the negro majority in the State has been kept powerless in all elections. A severe earthquake, of which Charleston seemed to be the centre, destroyed property valued at $5,000,000, August 31, 1886. In 1893 a great storm on the coast caused the loss of more than 1000 lives. The growth and development of the Farmers' Alliance led to the capture of the Democratic Party in 1890, when B. R. Tillman was elected Governor after a campaign of bitterness second only to that of 1876. In 1901-02 the South Carolina Interstate and West Indian Exposition was held at Charleston. In national elections the State has been always Democratic, except in 1792, when the Federalists secured the electors, and during the Reconstruction period, 1868-76, when the vote was given for the Republican candidates. See ELECTORAL COMMISSION.

GOVERNORS OF SOUTH CAROLINA

UNDER THE PROPRIETORS

Sir John Yeamans, Lieutenant-General and Gov.		1665
William Sayle		1669-70
Joseph West (acting)		1670-72
Sir John Yeamans		1672-74
Joseph West		1674-82
Joseph Morton		1682-84
Richard Kyrle		1684
Robert Quarry (acting)		1684-85
Joseph West		1685
Joseph Morton		1685-86
James Colleton		1686-90
Seth Sothell (Southwell)		1690-91
Philip Ludwell		1691-93
Thomas Smith		1693-94
Joseph Blake (acting)		1694
John Archdale		1694-96
Joseph Blake		1696-1700
James Moore (acting)		1700-02
Sir Nathaniel Johnson		1702-08
Edward Tynte		1708-09
Robert Gibbes (acting)		1709-12
Edward Craven		1712-16
Robert Daniel (acting)		1716-17
Robert Johnson		1717-19
James Moore (chosen by convention)		1719-21

UNDER THE CROWN

Sir Francis Nicholson		1721-25
Arthur Middleton (acting)		1725-30
Robert Johnson		1730-35
Thomas Broughton (Lieutenant-Governor)		1735-37
William Bull (acting and Lieutenant-Governor)		1737-43
James Glen		1743-56
William Henry Littleton		1756-60
William Bull, 2d, (Lieutenant-Governor)		1760-61
Thomas Boone		1761-64
William Bull, 2d, (Lieutenant-Governor)		1764-66
Lord Charles Greville Montagu		1766-68
William Bull, 2d, (Lieutenant-Governor)		1768
Lord Charles Greville Montagu		1768-69
William Bull, 2d, (Lieutenant-Governor)		1769-71
Lord Charles Greville Montagu		1771-73
William Bull, 2d, (Lieutenant-Governor)		1773-75
Lord William Campbell		1775

STATE

John Rutledge	President	1776-78
Rawlins Lowndes	"	1778-79
John Rutledge	Governor	1779-83
John Mathews		1782-85
Benjamin Guerard		1783-87
William Moultrie		1785-89
Thomas Pinckney	Democrat-Republican	1787-82
Charles Pinckney	" "	1789-94
Arnoldus Vanderhorst		1792-96
William Moultrie		1794-98
Charles Pinckney	Democrat-Republican	1796-90
Edward Rutledge	Federalist	1798-1802
John Drayton	Democrat-Republican	1800-02
James B. Richardson	" "	1802-04
Paul Hamilton	" "	1804-06
Charles Pinckney	" "	1806-08
John Drayton	" "	1808-10
Henry Middleton	" "	1810-12
Joseph Alston	" "	1812-14
David R. Williams	" "	1814-16
Andrew Pickens	" "	1816-18
John Geddes	" "	1818-20
Thomas Bennett	" "	1820-22
John L. Wilson	" "	1822-24
Richard I. Manning	" "	1824-26
John Taylor	" "	1826-28
Stephen D. Miller	Democrat	1828-30
James Hamilton	"	1830-32
Robert Y. Hayne	"	1832-34
George McDuffie	"	1834-36
Pierce M. Butler	"	1836-38
Patrick Noble	"	1838-40
B. K. Hennegan (acting)		1840
John P. Richardson	Democrat	1840-42
James H. Hammond	"	1842-44
William Aiken	"	1844-46
David Johnson	"	1846-48
W. B. Seabrook	"	1848-50
John H. Means	"	1850-52
John L. Manning	"	1852-54
James H. Adams	"	1854-56
Robert F. W. Allston	"	1856-58
William H. Gist	"	1858-60
Francis W. Pickens	"	1860-62
M. L. Bonham	"	1862-64
A. G. Magrath	"	1864-65
Benjamin F. Perry	Provisional	1865
James L. Orr	Democrat	1865-68
Robert K. Scott	Republican	1868-72
Franklin J. Moses, Jr.	"	1872-74
Daniel H. Chamberlain	"	1874-77
Wade Hampton	Democrat	1877-79
W. D. Simpson (acting)	"	1879-80
T. D. Jeter (acting)	"	1880
Johnson Hagood	"	1880-82
Hugh S. Thompson	"	1882-86
John C. Sheppard (acting)		1886
John P. Richardson	Democrat	1886-90
Benjamin R. Tillman	"	1890-94
John Gary Evans	"	1894-97
William H. Ellerbe	"	1897-99
M. B. McSweeney	"	1899-1903
Duncan C. Heyward	"	1903 —

BIBLIOGRAPHY. Hemphill, "Climate, Soil, and Agricultural Capabilities of South Carolina and Georgia," in *U. S. Department of Agriculture Special Report 47* (Washington, 1882); Hammond, *South Carolina, Resources, Population, Institutions, and Industries* (Charleston, 1883); Whitney, "Bibliography of the Colonial History of South Carolina," in *American Historical Association Annual Report for 1894* (Washington, 1895); Smith, *South Carolina as a Royal Province* (New York, 1903); McCrady, *History of South Carolina Under Proprietary Government, 1670-1719* (New York, 1897); id., *Under Royal Government, 1719-76* (ib., 1899); id., *In the Revolution, 1775-80* (ib., 1901); Ramsay, *History of South Carolina* (2d ed., Newberry, S. C., 1858); Houston, *Critical Study of Nullification in South Carolina* (New York, 1896); Pike, *The Prostrate State* (ib., 1874).

SOUTH CAROLINA COLLEGE. A nonsectarian, coeducational college in Columbia, S. C., chartered in 1801 and opened in 1805. It

was closed in 1863 and was reopened in 1866 as the University of South Carolina. In 1878 the university was divided into two branches; one the South Carolina College, the other Claflin College, for negroes, at Orangeburg. Its charter was again amended in 1887 and 1890, and in 1894 women were admitted to all courses. It has a system of accredited schools, the certificate of which admits students without examination. The college has a department of law. In 1902 the students numbered 215, with a faculty of 18. The library contained 33,783 volumes. Its income was $35,454.

SOUTH CAROLINA INTER-STATE AND WEST INDIAN EXPOSITION. An exposition held in Charleston, South Carolina, from December 1, 1901, to June 2, 1902. The site chosen covered an area of about 250 acres. The principal buildings were: Administration, Agriculture, Art, Auditorium, Commerce, Cotton Palace, Fisheries, Machinery, Mines and Forestry, Negro, Transportation, and Women's. The larger buildings were constructed in the Spanish Renaissance style of architecture, and were finished in staff, coated with a dull white tint that gave the name of Ivory City to the grounds. There were also State buildings erected by Illinois, Maryland, Missouri, New York, and Pennsylvania, city buildings representing Cincinnati and Philadelphia, and special structures devoted to the exhibits of Cuba, Porto Rico, and Guatemala. The grounds were adorned with statuary, among them six original historical groups, situated in the Court of Palaces, and including "The Aztec," by Louis A. Gudebrod; "The Negro," by Charles A. Lopez; and "The Huguenot," by Miss Elsie Ward. The total attendance was 674,086; the cost of the exposition was $1,250,000, while the receipts were $313,000.

SOUTH'COTT, JOANNA (1750-1814). A religious visionary, born at Gittisham, in Devonshire, England, of humble parentage. In youth she was a domestic servant, chiefly in Exeter. In 1792 she declared herself to be the woman driven into the wilderness, the subject of the prophecy in Rev. xii., and began to claim the gift of prophecy. She gave forth predictions in prose and verse, and, although very illiterate, wrote numerous letters and pamphlets. When over sixty years of age she imagined that she was destined to give birth miraculously to a second Shiloh or prince of peace. Her writings include *The Strange Effects of Faith* (1801), with continuations (1802-20); books of *Prophecies and Visions* (1803); *Letters* (1804); *The True Explanation of the Bible* (1804-10); the *Book of Wonders* (1813-14). Consult her *Memoirs* (London, 1814).

SOUTH DAKO'TA. Popularly called the 'Coyote State.' A north central State of the United States, lying on either side of the middle Missouri, between latitudes 42° 28′ and 45° 57′ north and between longitudes 96° 26′ and 104° 3′ west. It is bounded on the north by North Dakota, on the east by Minnesota and Iowa, on the south by Nebraska, and on the west by Wyoming and Montana. With the exception of an irregular salient angle in the southeast between the Missouri and Big Sioux Rivers, and a reëntering angle in the northeast formed by Lakes Bigstone and Traverse, the boundaries of the State are straight lines running along meridians and parallels, and forming a rectangle 200 miles wide and 380 miles long. The area is 77,650 square miles, of which 76,850 square miles, or 49,184,000 acres, are land surface. South Dakota ranks twelfth in size among the States.

TOPOGRAPHY. The State lies within the region of the Great Plains, and, broadly considered, consists of a rolling upland plain sloping gradually from an altitude of 3500 feet in the west to about 1400 feet in the southeast. The entire State lies above 1000 feet, with the exception of a very narrow belt along the shores of Lakes Bigstone and Traverse in the extreme northeastern corner. The eastern half is smooth, with the broad, gently sloping valley of the James River traversing it from north to south. In the western half denudation by running water has been very active compared with atmospheric erosion, so that numerous buttes and ridges remain to show the former level of the plateau. In the southwestern part the effect of denudation is especially shown in the remarkable region known as the Bad Lands. They consist of a labyrinth of deep ravines, steep hills, and precipitous bluffs of white clay carved out by rapid erosion, and are in parts almost destitute of vegetation. The most prominent diversifying feature of the State, however, is the elliptical, dome-like uplift of the Black Hills, rising near the western boundary between the two forks of the Cheyenne River, and covering about 5000 square miles. The highest point is Harney Peak, with an altitude of 7216 feet.

HYDROGRAPHY. The Missouri River traverses the State in a winding course from the middle of the northern boundary to the southeastern corner, forming for some distance a part of the southern boundary. Its valley is comparatively narrow, and rises in terraces (which are more abrupt on the eastern bank) to the general level of the plain, which lies 200 to 300 feet above the stream. The western tributaries, chief of which are the Grand, Moreau, Big Cheyenne, and White Rivers, flow nearly due east in similar narrow terraced valleys. On the other hand, the two eastern tributaries, the James and the Big Sioux, flow southward parallel with the main stream, and their valleys are broad and gently sloping. In the eastern half of the State there are numerous glacial lakes, none of which, however, are of great size except the above mentioned Lakes Bigstone and Traverse on the northeastern boundary.

CLIMATE, SOIL, AND VEGETATION. South Dakota, occupying almost the very centre of the continent, has, of course, a continental climate with great extremes of temperature. The mean annual temperature is 44.3° F. The mean for January is 15° and for July 72.2°, while the absolute extremes may rise to more than 115° above or fall to more than 40° below zero. But the heat of summer and the cold of winter are much more endurable than the more moderate temperatures of the Eastern States, owing to the dryness of the atmosphere, which renders the climate bracing and pleasant. The winter is often tempered by the dry and warm chinooks, but occasionally, though fortunately not often, the State is visited by blizzards—severe northern gales laden with fine floating snow. The snowfall is less than that of New York or New England. The average annual rainfall for the State is 20 inches, being 30 to 40 inches in the eastern third, 20 to 30 inches in

the centre, and 15 to 20 inches in the west, where it is insufficient for agriculture. The other parts of the State also suffer occasionally from drought. The soil in the greater part of the State is of excellent quality, and when sufficiently watered is rendered highly productive. In the east there is a subsoil of glacial till covered with a dark alluvial loam rich in nitrogen and again covered with many inches of black vegetable mold. A large part of the west has also a fine alluvial soil, but large areas here are stony and barren. The bottomlands of the Missouri and the terraced floors of its valley are very fertile. The State is as a whole a treeless prairie country. Forests are found only in the Black Hills above an altitude of 4000 feet, where there is a good growth of pine. Here and there along the river valleys there are more or less extensive groves of cottonwood, ash, elm, and maple.

GEOLOGY. Although the geological structure of the State is nearly homogeneous over the greater part of its area, there is nevertheless found represented every age from the Archæan to the Pleistocene except the Devonian. There are two Archæan nuclei, one in the east and one in the west. The former is a broad tongue of Sioux quartzite belonging to the Huronian system and extending westward to the James River from the neighborhood of Sioux Falls. To the north near Bigstone Lake is a smaller area of Laurentian granite. In the centre of the Black Hills is exposed the core of schists, slates, and granite. This is surrounded by narrow bands forming the denuded sections of the upturned Paleozoic strata, successively Potsdam sandstone of the Cambrian, Silurian limestone, and a broader band of Carboniferous limestone. Around this appear the sand and limestones, clays and marls of the Jura-Trias, and the whole is enveloped in the Cretaceous strata which cover four-fifths of the area of the State. The principal members are the Colorado marls, clays, and limestones covering nearly the whole of the eastern half, the Laramie formation occupying the northwestern quarter, and the Dakota sandstone underlying the valley of the James. The southwestern quarter of the State is covered with Miocene clays and conglomerates. Igneous rocks in the form of dikes of diabase and porphyry occur in both the eastern and western Archæan areas. The Pleistocene age is represented by the immense sheet of glacial drift covering the eastern half of the State to a line nearly coinciding with the Missouri River, and veiling the older formations. West of this line the Pleistocene deposits consist of aqueous drift.

MINING. The mineral wealth of the State appears chiefly in the Archæan area of the Black Hills, where there are more or less extensive deposits of copper, gold, silver, argentiferous lead, iron ores, manganese, nickel, tin, mica, and some graphite. The Triassic clays contain beds of gypsum, and beds of lignite as well as reservoirs of natural gas have recently been found. The Archæan and Paleozoic areas also yield a great variety of building and ornamental stone such as the red quartzite or jasper in the east. The Dakota sandstone of the James Valley is especially noticeable as a water-bearing stratum supplying powerful artesian wells. The mining activities consist mainly of quartz gold mining carried on in the southwest corner of the State. Difficulties in securing water have operated against the development of gold-mining, but elaborate and expensive schemes have been undertaken to secure adequate water supplies, and the output of gold is becoming larger. The value of the product increased from $4,006,400 in 1893 to $6,479,500 in 1901. The granite production in 1901 was valued at $99,941. Limestone and sandstone are also quarried. Portland cement was produced in 1900 to the value of $76,000, and clay products in the following year represented a value of $59,365.

AGRICULTURE. Agriculture is almost wholly confined to the eastern half of the State. Facilities for irrigation are not extensive. In 1899, 43,676 acres were irrigated, principally from the tributaries of the Cheyenne River. In 1900, the total farm area was 19,070,616 acres, or 38.8 per cent. of the State's land area. Of the farm land 59.2 per cent. was improved, and about two-fifths of this amount was brought under improvement in the decade 1890-1900. South Dakota is one of the few States in which the size of farms is increasing, the average size in 1890 being 227.2 acres, and in 1900, 362.4 acres. In 1900, 3.4 per cent. of the farms were rented on the cash system, and 18.4 per cent. on shares. South Dakota is in the great wheat belt, and the cultivation of this crop has rapidly advanced until the State ranks among the first wheat States in the Union. The acreage in corn is also rapidly increasing, but the production of this crop is largely confined to the southeastern section. Oats are grown throughout the farming region, as is also barley, the latter crop being three times as great in 1900 as in 1890. The State stands third in the area devoted to flax. The acreage in hay and forage increased 47.1 per cent. in the decade 1890-1900. Potatoes are the principal vegetable grown. The following table embraces the leading crops:

CROPS	1900	1890
Wheat	3,984,659	2,259,846
Corn	1,196,381	753,309
Oats	691,167	580,289
Barley	299,510	97,370
Rye	39,253	9,229
Flaxseed	302,010	354,951
Hay and forage	2,287,875	1,554,913
Potatoes	33,567	35,440

STOCK-RAISING. The State has excellent grazing facilities. The number of cattle in 1900 was more than twice as great as in 1890, and there was a large increase in the number of horses, sheep, and swine, as shown in the following table:

ANIMALS	1900	1890
Dairy cows	270,634	210,240
Other cattle	1,276,166	477,679
Horses	480,768	250,305
Mules and asses	6,999	7,671
Sheep	507,338	238,448
Swine	823,120	590,465

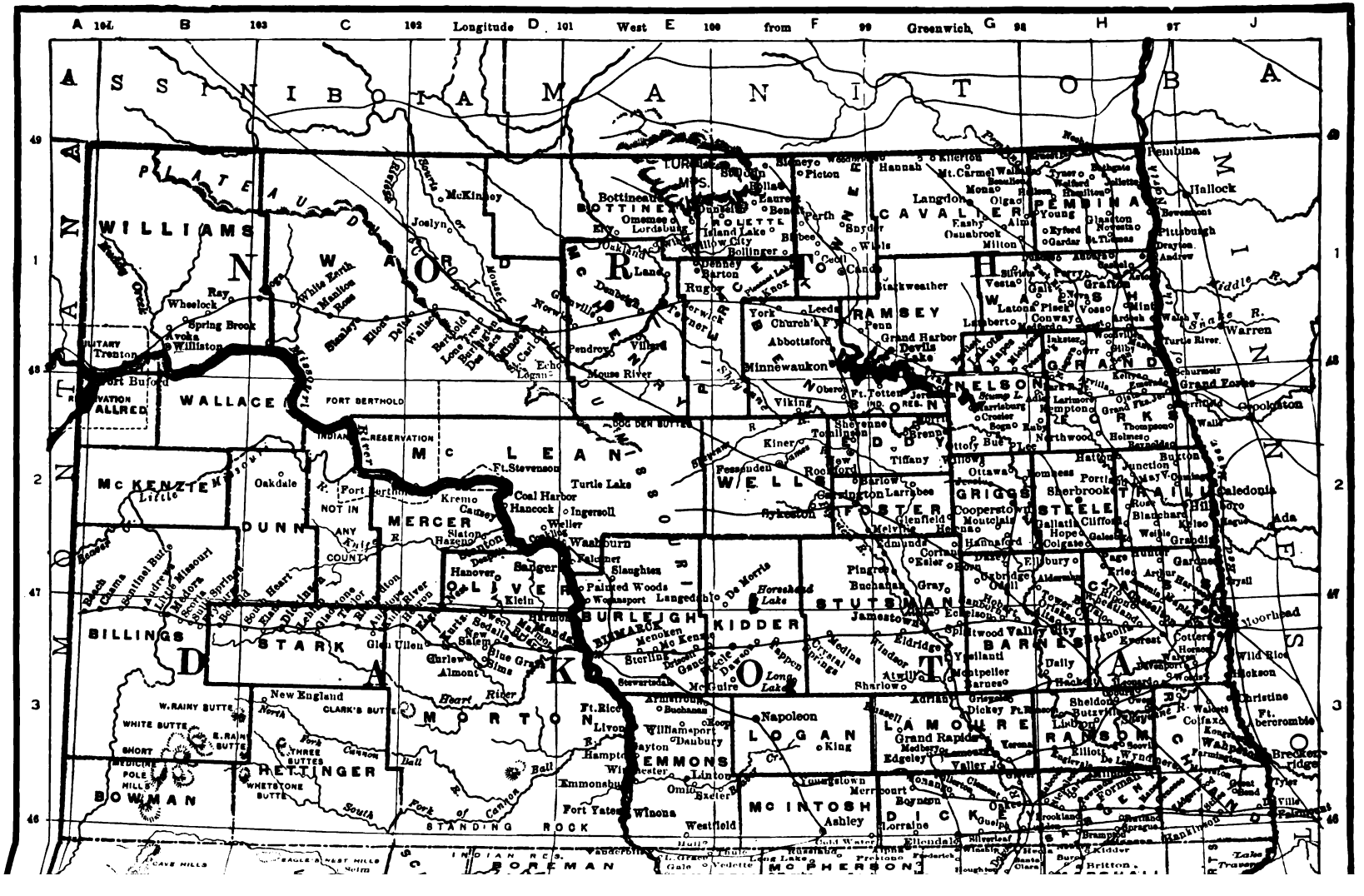
MANUFACTURES. Manufactures are limited mainly to neighborhood industries. In 1900, $7,578,895 was invested as capital and 3121 persons were engaged as wage-earners in the manufactures of the State.

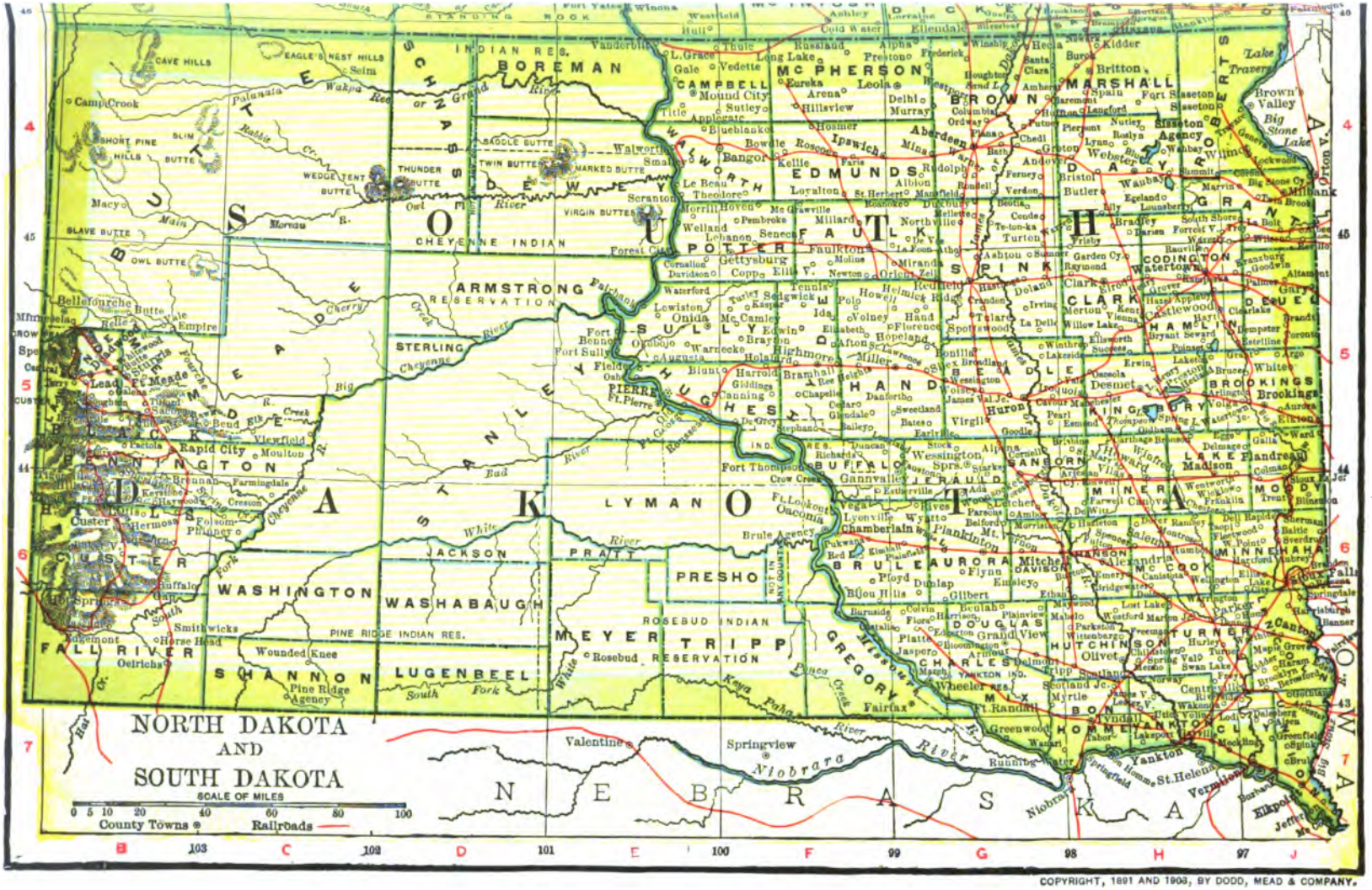
TRANSPORTATION. The railroads are confined to the region east of the Missouri River and to the mining region in the southwest corner, there

AREA AND POPULATION OF SOUTH DAKOTA BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
*Armstrong	D 5		1,460	.....	.....
Aurora	G 6	Plankinton	724	5,045	4,011
Beadle	G 5	Huron	1,270	9,586	8 081
Bonhomme	H 7	Tyndall	569	9,057	10,379
*Boreman	D 4		1,231	.....	.....
Brookings	J 5	Brookings	817	10,132	12,561
Brown	G 4	Aberdeen	1,745	16,855	15,286
Brule	F 6	Chamberlain	808	6,787	5.401
Buffalo	F 5	Gannvalley	483	993	1,790
Butte	B 5	Bellefourche	7,834	1,037	2,007
Campbell	E 4	Mound City	765	3,510	4,527
Charles Mix	G 6	Wheeler	1,123	4,178	8,498
Choteau	..	Now belongs to Butte Co.	.....	8	. ...
Clark	H 5	Clark	973	6,728	6,942
Clay	H 7	Vermilion	408	7,509	9,316
Codington	H 4	Watertown	786	7,037	8,770
Custer	B 6	Custer	1,612	4,891	2,728
Davison	G 6	Mitchell	486	5,449	7,483
Day	H 4	Webster	1,077	9,168	12.254
Deuel	J 5	Clearlake	621	4,574	6,656
*Dewey	D 4		2,219	.	.....
Douglas	G 6	Armour	445	4.000	5,012
Edmunds	F 4	Ipswich	1,176	4,390	4,916
Ewing	....	Now belongs to Butte Co.	.....	16	.....
Fall River	B 6	Hot Springs	1,757	4,478	3,541
Faulk	F 4	Faulkton	1,010	4,062	3.547
Grant	J 4	Millbank	694	6,814	9,103
Gregory	F 6	Fairfax	1,004	295	2.211
Hamlin	H 5	Castlewood	543	4,625	5,045
Hand	F 5	Miller	1,416	6.546	4.525
Hanson	H 6	Alexandria	486	4,267	4,947
Hughes	E 5	Pierre	765	5,044	3.684
Hutchinson	H 6	Olivet	817	10,400	11.897
Hyde	F 5	Highmore	875	1,800	1,492
*Jackson	D 6		...	30	.....
Jerauld	G 5	Wessington Springs	548	3,005	2,708
Kingsbury	H 5	Desmet	834	8,562	9,897
Lake	H 5	Madison	549	7,503	9,12
Lawrence	B 5	Deadwood	814	11,673	17,897
Lincoln	J 6	Canton	570	9,143	12,161
*Lugenbeel	D 6		1,066	. ...	...
Lyman	F 6	Oacoma	3,456	233	2,632
McCook	H 6	Salem	575	6,448	8.682
McPherson	F 4	Leola	1,146	5.940	6,327
Marshall	H 4	Britton	880	4,544	5,942
Meade	B 5	Sturgis	3,008	4,640	4,907
*Meyer	E 6		1,407	. ...	.....
Miner	H 6	Howard	569	5,165	5,864
Minnehaha	J 6	Sioux Falls	802	21,879	23,926
Moody	J 6	Flandreau	517	5,941	8.326
Pennington	B 5	Rapid City	2,596	6,540	5.610
Potter	E 4	Gettysburg	900	2,910	2,988
*Pratt	....		. ...	28	.....
Presho	....		.....	181	.....
*Pratt	....		. ...	34	.....
Roberts	J 4	Sisseton Agency	1,102	1,997	12,216
Sanborn	G 5	Woonsocket	576	4,610	4,464
Schnasse	D 4		1,563	.....	.....
*Shannon	C 6		1,066	.....	....
Spink	C 5	Redfield	1.518	10,591	9,487
Stanley	E 5	Fort Pierre	4,882	1,028	1,349
*Sterling	D 5		.....	96	.....
Sully	E 5	Onida	1,052	2,412	1,715
Todd	....		. ...	188	.....
*Tripp	E 6		1,480	.....	. ...
Turner	H 6	Parker	624	10,256	13.175
Union	J 7	Elkpoint	447	9.130	11,163
Walworth	E 4	Bangor	745	2,153	3,839
*Washabaugh	....		1,228	....	.....
*Washington	C 6		1,540	40	.....
Yankton	H 7	Yankton	515	10,414	12,649
Ziebach	C 5		....	510	.....
Cheyenne River Indian reservation	D 4		....	.....	2,357
Pine Ridge Indian reservation	C 6		....	.....	6,827
Rosebud Indian reservation	E 6		....	.....	5,201
Standing Rock Indian reservation	D 3		....	.....	1,058

*Counties as yet not fully organized; parts of Indian reservations.


Longitude West from Greenwich
ASSINIBOIA MANITOBA
NORTH DAKOTA
WILLIAMS
MONTANA
PLATEAU
MISSOURI
McKENZIE
DUNN
MERCER
OLIVER
BURLEIGH
KIDDER
BILLINGS
STARK
MORTON
OLIVER
MERCER
BURLEIGH
KIDDER
STUTSMAN
BARNES
STEELE
TRAILL
GRIGGS
FOSTER
WELLS
SHERIDAN
WARD
MOUNTRAIL
RENVILLE
BOTTINEAU
ROLETTE
TURTLE MTS.
PEMBINA
CAVALIER
RAMSEY
NELSON
GRAND FORKS
WALSH
PEMBINA
WALLACE
FORT BERTHOLD
INDIAN RESERVATION
FORT BUFORD
ALLRED
McLEAN
SIOUX
GRANT
EMMONS
LOGAN
McINTOSH
DICKEY
LAMOURE
RANSOM
SARGENT
RICHLAND
HETTINGER
BOWMAN
STANDING ROCK
SOUTH FORK OF CANNON BALL
CANNON BALL
HEART RIVER
KNIFE RIVER
MISSOURI RIVER
SOURIS RIVER
TURTLE MOUNTAIN
DEVILS LAKE
LAKE ASHTABULA
LAKE TRAVERSE
Minnewaukon
Devils Lake
Grand Harbor
Abbottsford
Church's Ft.
Penn
York
Leeds
Rugby
Bottineau
Omemee
Lordsburg
Island Lake
Willow City
Bellinger
Dunseith
Barton
Cando
Langdon
Mt. Carmel
Hannah
Mona
Olga
Fashy
Osnabrock
Milton
Hallock
Pembina
Drayton
Pittsburgh
Andover
Hamilton
Glasston
Young
Ryder
Gardar
Mountain
Edinburg
Park River
Grafton
Minto
Warren
Turtle River
Williston
Trenton
Ray
Wheelock
Spring Brook
Wakwa
Manitou Road
White Earth
Stanley
Elliot
Dejar
Wallace
Berthold
Lone Tree
Burlington
Des Lacs
Sherwood
Carpio
Logan
Mouse River
Velva
Fendrod
Sawyer
Kenmare
Upham
Donnybrook
Granville
Mohall
Glenburn
Maxbass
Bantry
Lansford
Westhope
Newburg
Bottineau
Omemee
Lordsburg
Island Lake
Willow City
Bellinger
Dunseith
Barton
Cando
Rugby
Knox
Penn
Leeds
York
Church's Ft.
Abbottsford
Grand Harbor
Devils Lake
Minnewaukon
Ft. Totten
Jerusalem Res.
Harriet
Harriet Lake
Warrenburg
Crosier
Regan
Tolna
Sheyenne
Tolnlinson
Brenna
Kiner
Fessenden
Rockford
Tiffany
Willow
Ottawa
Thomesse
Portland
Halstad
Buxton
Junction
Mayville
Caledonia
Hillsboro
Ada
Blanchard
Kelso
Grandin
Gardner
Erie
Arthur
Hunter
Argusville
Wheatland
Horace
Wild Rice
Hickson
Christine
Ft. Berrendrie
Breckenridge
Wahpeton
Colfax
Wyndmere
Lidgerwood
Cogswell
Forman
Milnor
Havana
Gwinner
Sheldon
Butzville
Dickey
Ft. Ransom
Grand Rapids
Medberry
Edgeley
Yerona
Valley
Elliott
Scott
Wyndmere
Lidgerwood
Cogswell
Forman
Milnor
Havana
Gwinner
Sheldon
Butzville
Dickey
Ft. Ransom
Grand Rapids
Medberry
Edgeley
Yerona
Valley
Elliott
Scott
Napoleon
King
Emmons
Linton
Hampton
Winchester
Omio
Exeter
Winona
Fort Yates
Westfield
Ashley
Lorraine
Ellendale
Oakes
Merricourt
Monango
Forbes
Gackle
Streeter
Dawson
Sterling
Menoken
McKenzie
Moffit
Wilton
Braddock
Hazelton
Judson
Glen Ullen
Almont
Curlew
Elms
Blue Grass
New England
Clark's Butte
White Butte
W. Rainy Butte
E. Rainy Butte
Short Medicine Pole Hills
Whetstone Butte
Cave Hills
Eagle Nest Hills
Scim
Bull Moose
Bull Moose Creek
Bull Moose Valley
Bull Moose Valley
Bull Moose Creek
Bull Moose Valley
Bull Moose Creek
Bull Moose Valley
Bull Moose Creek


NORTH DAKOTA
AND
SOUTH DAKOTA
SCALE OF MILES
0 5 10 20 40 60 80 100
County Towns
Railroads
NEBRASKA
SOUTH DAKOTA
NORTH DAKOTA
BOREMAN
CAMPBELL
MC PHERSON
BROWN
MARSHALL
EDMUNDS
FAULK
SPINK
CLARK
HAMLIN
CODINGTON
ARMSTRONG
RESERVATION
POTTER
SULLY
HYDE
HUGHES
HAND
BEADLE
KINGSBURY
BROOKINGS
STERLING
PIERRE
BUFFALO
JERAULD
SANBORN
MINER
LAKE
MOODY
LYMAN
BRULE
AURORA
DAVISON
MINNEHAHA
PRATT
JACKSON
PRESHO
DOUGLAS
TURNER
WASHINGTON
WASHABAUGH
ROSEBUD INDIAN
MEYER
TRIPP
HUTCHINSON
CHARLES
MIX
BON
HOMME
YANKTON
CLAY
UNION
PENNINGTON
LAWRENCE
CUSTER
FALL RIVER
SHANNON
LUGENBEEL
GREGORY
PINE RIDGE INDIAN RES.
ROSEBUD RESERVATION
CHEYENNE INDIAN
INDIAN RES.
Missouri
Cheyenne
Moreau
Grand
Bad
White
Niobrara
Rapid City
Pierre
Fort Pierre
Fort Sully
Chamberlain
Mitchell
Aberdeen
Watertown
Sioux Falls
Yankton
Valentine
Springview
Fairfax
Wheeler
Wounded Knee
Pine Ridge
Agency
Oelrichs
Hot Springs
Custer
Deadwood
Lead
Spearfish
Belle Fourche
Newell
Faith
Timber Lake
Mobridge
Gettysburg
Highmore
Miller
Huron
Redfield
Clear Lake
Madison
Flandreau
Brookings
Canton
Elk Point
Vermillion
Burbank
Big Stone City
Milbank
Britton
Webster
Sisseton
Agency
Lake Traverse
Big Stone Lake
Brown Valley
Watertown
Summit
Garden City
Raymond
Castlewood
Hazel
Bryant
Estelline
Hendricks
Lake Preston
Arlington
Volga
Elkton
Colman
Egan
Trent
Dell Rapids
Garretson
Baltic
Sioux Falls
Harrisburg
Canton
Lennox
Worthington
Luverne
Rock Rapids
Doon
Hull
Orange City
Sioux Center
Alton
Hawarden
Sioux City
Le Mars
Akron
Westfield
Standing Rock
Cannonball
Solen
Fort Yates
Winona
Ashley
Eureka
Leola
Frederick
Ipswich
Mina
Andover
Bristol
Waubay
Webster
Sisseton
Agency
Wilmot

AREA AND POPULATION OF NORTH DAKOTA BY COUNTIES.

County.	Map Index.	County Seat.	Area in square miles.	Population.	
				1890.	1900.
Barnes	G 3	Valley City	1,506	7,045	13,189
Benson	F 1	Minnewaukon	1,380	2,460	8,390
Billings	B 3	Medora	6,150	170	975
Bottineau	E 1	Bottineau	1,137	2,893	7,582
Bowman	....			6	.....
Buford	....			803	.....
Burleigh	E 3	Bismarck	1,680	4,247	6,061
Cass	H 2	Fargo	1,752	19,613	28,625
Cavalier	G 1	Langdon	1,512	6,471	12,580
Church	....		.....	74	.....
Dickey	G 3	Ellendale	1,146	5,573	6,061
Dunn	....		.....	159	.....
Eddy	F 2	New Rockford	648	1,377	3,330
Emmons	E 3	Williamsport	1,550	1,971	4,349
Flannery	....		.....	72	.....
Foster	F 2	Carrington	641	1,210	3,770
Garfield	....		.....	33	.....
Grand Forks	H 1	Grand Forks	1,482	18,357	24,459
Griggs	G 2	Cooperstown	730	2,817	4,744
Hettinger	....		.....	81	.....
Kidder	F 3	Steele	1,398	1,211	1,754
Lamoure	G 3	Lamoure	1,148	3,187	6,048
Logan	F 3	Napoleon	960	597	1,625
McHenry	E 1	Towner	1,468	1,584	5,253
McIntosh	F 3	Ashley	1,000	3,248	4,818
McKenzie	....		.....	3	.....
McLean	D 2	Washburn	3,348	860	4,791
Mercer	C 2	Mannhaven	1,980	428	1,778
Morton	D 3	Mandan	4,740	4,728	8,069
Mountraille	....		.....	122	.....
Nelson	G 2	Lakota	990	4,298	7,316
Oliver	D 2	Sanger	727	464	990
Pembina	H 1	Pembina	1,134	14,334	17,869
Pierce	F 1	Rugby	1,008	905	4,765
Ramsey	F 1	Devils Lake	1,200	4,418	9,198
Ransom	H 3	Lisbon	864	5,393	6,919
Renville	....		.....	99	.....
Richland	H 3	Wahpeton	1,445	10,751	17,387
Rolette	F 1	Rolla	943	2,427	7,995
Sargent	H 3	Forman	864	5,076	6,039
Sheridan	....		.....	5	.....
Stark	C 3	Dickinson	6,002	2,304	7,621
Steele	H 2	Sherbrooke	720	3,777	5,868
Stevens	....		.....	16	.....
Stutsman	F 2	Jamestown	2,296	5,266	9,143
Towner	F 1	Cando	1,048	1,450	6,491
Traill	H 2	Hillsboro	872	10,217	13,107
Wallace	....	Grafton	.....	24	.....
Walsh	G 1		1,308	16,587	20,288
Ward	C 1	Minot	6,690	1,681	7,961
Wells	F 2	Fessenden	1,296	1,212	3,310
Williams	B 1	Williston	3,512	109	1,530
Standing Rock Indian reservation	D 3		.....	.....	2,208
Unorganized territory	....		.....	511	.....

being no line crossing the State from east to west. Railway construction was greatest in the decade 1880-1890. The mileage in the latter year was 2610, which figure had increased in 1900 to 2961 miles. The Chicago, Milwaukee and Saint Paul, the Great Northern, and the Chicago and Northwestern have the greatest mileage.

BANKING. In 1872 the first national bank was organized in Yankton. In the following twenty years banks multiplied, and in 1889, when division came and the Territory was organized as a State, South Dakota had 33 national and over one hundred private banks, which figures included also the banks organized under the general incorporation law. This rapid organization of small banks was due to the high rate of interest on mortgages, often amounting to 14 per cent. and 15 per cent. The bad crops of 1889-91 reduced the value of real estate, made foreclosure of many mortgages necessary, and caused the failure of many banks. The necessity of some regulation of the banking business became evident, and in 1891 the first banking law of the State was passed, making the shareholders responsible for an amount equal to their stock in addition to their actual investment, allowing dividends on net profits only, etc. Between 1890 and 1900 the national banks diminished both in number and in the volume of transactions, and the State banks have now the larger part of the business. The condition of the banks in 1902 is shown in the following table:

	National banks	State and private banks
Number	47	229
Capital	$1,958,000	$2,579,000
Surplus	253,000	398,000
Cash, etc	791,000	1,552,000
Deposits	10,899,000	17,089,000
Loans	8,409,000	12,574,000

GOVERNMENT. The State Constitution was adopted by popular vote in October, 1889. Proposed amendments must secure the approval of a majority of the members elected to each House, and a majority of the electors voting at a popular election. Upon the approval of two-thirds of the members elected to each House and a majority of the people voting at a popular election the Legislature shall call a constitutional convention. Voters must be citizens, or foreigners who have declared their intention of becoming citizens and have resided in the United States one year, in the State six months, in the county thirty days, and in the election precinct ten days. Pierre is the capital.

LEGISLATIVE. The Legislature convenes on the first Tuesday after the first Monday of January in the odd years. It consists of a Senate of 45 members and a House of 87 members. The people have the right to propose measures, which the Legislature must submit to a vote of the electors. The people may further require that, with certain exceptions, any laws enacted must be submitted to the people, and not more than five per cent. of the electors are required to invoke these initiative or referendum rights. The Governor's veto does not extend to matters referred to the people.

EXECUTIVE. The executive power is vested in a Governor and Lieutenant-Governor, elected for two years, the latter being, *ex officio*, president of the Senate. The Governor has a veto power on legislation, which may be overridden by a two-thirds vote of both Houses. He may veto items of an appropriation bill and approve the rest. The other officers are a Secretary of State, Auditor, Treasurer, Superintendent of Instruction, Commissioner of School and Public Lands, and Attorney-General—all holding office for two years.

JUDICIAL. There are five Supreme Court judges, elected for four years. The State is divided into judicial court districts, in each of which a judge is elected for four years.

FINANCES. The larger part of the public debt was incurred in 1883-89, before the admission to Statehood, and for the construction of hospitals, normal schools, and college buildings. At the time of admission the debt amounted to $710,200 in 4½ per cent. and 5½ per cent. bonds, but in addition South Dakota was obliged to pay to North Dakota in settlement of accounts more than $150,000. The Constitution limited the borrowing power of legislation to $100,000, but this limit was soon reached. In 1892 the debt was more than one million dollars, and in 1895 $1,562,800, of which $424,000 were in warrants. In 1902 the bonded indebtedness was $417,500 and the outstanding warrants were $250,000, making a total debt of $667,500. The income in the beginning came mainly (almost 85 per cent.) from a State tax. Later the sale and lease of public lands developed into an important source of income, which by a special provision of the Constitution must go into the permanent school fund, while the interest on deferred payments must be devoted to current school expenses. During the fiscal year 1901-02 the total income was $2,174,257, and the total expenditure $2,098,620, almost 60 per cent. of which was for school purposes. There was a balance of $840,525 in the treasury, of which $633,000 lay in the school fund.

MILITIA. In 1900 there were 87,505 men of militia age. The organized militia in 1901 numbered 949.

POPULATION. The population in 1890, according to the first State census, was 328,808, and the figure increased in 1900 to 401,570. In the latter year South Dakota ranked thirty-seventh in population. The foreign-born population was 88,508, among whom the Norwegians, Germans, Russians, and Swedes were the most numerous. There were 9293 Indians taxed and 10,932 not taxed. There were only 5.2 persons to the square mile in the State. There are five towns having (1904) more than 5000 inhabitants each. In 1900 Sioux Falls had a population of 10,266, Lead City 6210, Yankton 4125, Aberdeen 4087, and Mitchell 4055. South Dakota sends two members to the National House of Representatives.

RELIGION. The Catholic Church includes about one-thirteenth of the inhabitants. The Lutherans are the strongest Protestant denomination.

EDUCATION. In 1900 only five per cent. of the population over ten years of age were illiterate. There were then 129 days in the school year. Owing to the large scattered rural population, the educational difficulties have been extreme. In 1900 there were only 176 graded schools, as against 3191 ungraded, the former being almost wholly in the towns. Only the towns have high

schools. In 1900 there were 96,822 pupils enrolled, of whom 68,000 were in average attendance. There were in that year 1172 male and 3630 female teachers. The average monthly wage received was $33 for the male teacher and $30.25 for the female teacher. The cost of the public schools was $1,598,757, of which $1,026,126 was paid as salaries to teachers and superintendents. The most important source of financial support is the district tax. The State has the advantage of large Congressional land grants, which aggregated 2,823,320 acres. There are four State normal schools located respectively at Aberdeen, Madison, Spearfish, and Springfield. Higher education is provided at the State University, situated at Vermillion, and at the following denominational co-educational institutions: Huron College (Presbyterian), at Huron; Dakota University (Methodist Episcopal), at Mitchell; Redfield College (Congregational), at Redfield; and Yankton College (Congregational), at Yankton. There are a school of mines at Rapid City and an agricultural college at Brookings.

CHARITABLE AND PENAL INSTITUTIONS. A State insane asylum is situated at Yankton, a school for the deaf at Sioux Falls, an institution for the blind at Gary, and a soldiers' home at Hot Springs. The State penitentiary is at Sioux Falls, and the Reform School at Plankinton.

HISTORY. The State was formed on the division of Dakota Territory and was admitted to the Union November 3, 1889. (For early history, see NORTH DAKOTA.) The convention which met July 4th adopted the 'Sioux Falls Constitution,' framed in 1885, with a few necessary changes. A prohibitory amendment was adopted at the first election in October, 1889, but, on account of the 'original package decision' of the United States Supreme Court, did not go into effect. The Sioux Indians by treaty ceded large tracts of land, which were opened for settlement in February, 1890. Other reservations were opened in 1892 and 1895.

GOVERNORS OF SOUTH DAKOTA

Arthur C. Mellette	Republican	1889-93
Charles H. Sheldon	"	1893-97
Andrew E. Lee	Populist	1897-1901
Charles N. Herreid	Republican	1901—

BIBLIOGRAPHY. Child, *South Dakota: Resources, People, Statehood* (New York, 1888); Hagerty, *The State of South Dakota; a Statistical, Historical, and Political Abstract* (Aberdeen, S. D., 1889); Beadle, *Dakota* (Saint Paul, 1889); Finerty, *War Path and Bivouac* (2d ed., Chicago, 1890); Todd, "Hydrographic History of South Dakota," in *Geological Society of America Bulletin*, vol. xiii. (Rochester, 1902).

SOUTH DAKOTA, UNIVERSITY OF. A co-educational State institution at Vermillion, S. D., organized in 1882, and maintained almost wholly by appropriations of the Legislature. Its endowment consists of 86,000 acres of land, yielding in 1902-03 an income of $5600, the total income of the university being $60,000. The tuition is $6 per semester, except to students who have served in the Spanish War, who are exempted from tuition charges. The university has established a loan fund for the assistance of needy students. Military science and tactics form part of the course. The degrees conferred are those of Bachelor of Arts, Law, Commerce, and Music. The estimated value of the property under control of the university in 1903 was $300,000, its grounds, buildings, and equipment being valued at $295,000. The institution carries on the State geological survey. The faculty in 1903 numbered 34 and the students 450, distributed as follows: College of Arts and Sciences, 150; Law, 30; Music, 50; Commerce, 40; Engineering, 30; Preparatory, 150. The library contained about 8000 volumes.

SOUTHDOWN. An English breed of sheep, bred for their superior mutton. See SHEEP.

SOUTH DOWNS. A ridge of hills in England. See under DOWNS.

SOUTHEND-ON-SEA, sŭTH'*ĕnd*-. A municipal borough and seaside resort in Essex, England; at the mouth of the Thames, 42 miles east of London (Map: England, G 5). It is a popular holiday and residential resort of Londoners. The town owns fine municipal buildings, promenade piers, a concert pavilion, electric street railways, pleasure grounds, and a cemetery, and maintains technical schools, a sanatorium, and an isolation hospital. Population, in 1901, 28,850.

SOUTHERN CROSS. A famous constellation near the South Pole. Of its four principal stars, one, the southernmost, is of the first magnitude; two, the eastern and northern, of the second; and one, the western, of the third. The stars are not arranged very accurately in a cruciform position; and, on the whole, it must be said the constellation is much overrated.

SOUTHERN CROSS, ORDER OF THE. The highest Brazilian order, founded by Dom Pedro I. in 1822, in commemoration of his accession to the throne. The order has four classes, and until 1889 the members received pensions. The decoration is a white enameled cross of five arms, with a wreath of coffee and tobacco leaves. The effigy of Dom Pedro on the medallion is surrounded by the inscription *Petrus I., Brasiliæ Imperator.* On the reverse is a cross composed of nineteen stars, with the words *Bene Merentium Præmium.* The decoration is suspended from a crown and is worn on a blue ribbon.

SOUTHERNE, sŭTH'ĕrn, THOMAS (1660-1746). An English playwright. He was born in Ireland, and was educated at Trinity College, Dublin. Entered at the Middle Temple in London, he abandoned law to write for the stage, his first play being *The Loyal Brother, or the Persian Prince* (1682). His two best known pieces are the tragedies of *The Fatal Marriage* (1694), which was afterwards revised by Garrick, and *Oroonoko, or the Royal Slave* (1696), founded on a novel of the time and remarkable as including one of the earliest English condemnations of the slave trade.

SOUTHEY, *south'ĭ or* sŭTH'ĭ, CAROLINE ANNE (1786-1854). An English poet, daughter of Capt. Charles Bowles, a retired officer. She was born at Lymington, Hampshire. After the death of her mother (1816) and the loss of her property, she turned to literature. She sent the manuscript of a narrative poem, *Ellen Fitzarthur* (published 1820), to Robert Southey, who approved of it. A correspondence followed which led to marriage (1839). In the meantime Miss Bowles wrote *Tales of the Factories* (1823) in verse; *Solitary Hours* (1826) in verse and prose; *Chapters on Churchyards* (1829), a group

of tales which gained for her wide attention; and *The Birthday* (1836), a poem recalling Cowper. She also collaborated with Southey on a poem entitled *Robin Hood* (never completed). Soon after her marriage, Southey's mind completely broke down, and she passed three miserable years. After his death (1843), she lived in retirement. Consult the interesting *Correspondence of Robert Southey with Caroline Bowles*, ed. by Dowden (Dublin, 1881).

SOUTHEY, ROBERT (1774-1843). An English poet and miscellaneous writer, born August 12, 1774, at Bristol, where his father was a linen-draper. Southey passed much of his boyhood with an aunt at Bath, read through her library, containing Spenser, Sidney, Shakespeare, and many other writers, and tried his own hand at the drama. In 1788 he was sent to Westminster School, from which he was expelled four years later, on account of an essay against flogging. Aided by an uncle living at Lisbon, he entered Balliol College, Oxford (1792), where he remained for only two years. He met Coleridge in 1794; and in conjunction with another friend, Robert Lovell, they formed a socialistic scheme, which they called 'pantisocracy.' They were to take wives and emigrate to the banks of the Susquehanna. They all married sisters, but the scheme went no further. After secretly marrying Edith Fricker, at Bristol (November 14, 1795), Southey immediately left to visit his uncle at Lisbon. On returning (1797) he studied law at Gray's Inn, but soon abandoned the pursuit. He settled with his wife first at Westbury, between Bath and Salisbury, and then at Burton, in Hampshire; and after another trip to Portugal and a short period at Bristol, he joined Coleridge at Keswick in the Lake district (1803). Here at Greta Hall he passed the rest of his life amid his books. Besides the income from his pen, which eventually became large, he received, between 1796 and 1806, an annuity of £160 from a school friend named Wynn. Its place was soon filled by a Government pension of the same amount, to which was added, in 1835, another pension of £300. In 1813, then as strongly conservative as he had once been republican, he was appointed poet laureate. In this capacity he wrote *The Vision of Judgment* (1821), an apotheosis of George III. in hexameter verse. The incident is made memorable by Byron's brilliant parody under the same title. Southey's wife died in 1837, and two years later he married Caroline Anne Bowles. His mind was already giving way and soon became a blank. He died at Keswick, March 21, 1843, and was buried in the Crosthwaite churchyard. A recumbent statue was placed in the church. When a schoolboy Southey formed the plan of a series of narrative poems on the mythologies of the world. Under the inspiration of this idea, subsequently modified, he wrote a number of epics, comprising *Joan of Arc* (1796); *Thalaba, the Destroyer* (1801), an Oriental tale; *Madoc* (1805); *The Curse of Kehama* (1810), founded on Hindu legend; and *Roderick, the Last of the Goths* (1814). Though they contain many noble passages and interesting experiments in versification, they are in the main only rhetorical. His prose is best represented by *Letters from England by Don Manuel Alvarez Espriella* (1807), a view of England from the assumed standpoint of a Spanish gentleman; *The Doctor* (1834-37), containing the nursery classic, "The Three Bears," the lives of Wesley (1820) and of Nelson (1813); and his delightful letters. Of his other miscellaneous work may be cited *History of Brazil* (1810-19), part of a contemplated history of Portugal; *History of the Peninsular War* (1823-32); *Colloquies on Society* (1829), unnecessarily ridiculed by Macaulay; *Naval History* (1833-40); and a revolutionary drama, *Wat Tyler* (written in 1794, and surreptitiously published in 1817). As a conservative in religion and politics Southey sustained many bitter attacks from the leaders of rising liberalism. In unflagging literary industry he was one of the most notable figures of his time. His prose, far more than his poetry, is a contribution of permanent value to English letters.

Consult: The *Life and Correspondence*, by his son, Rev. C. C. Southey (London, 1849-50), containing the fragment of an autobiography; *Selections from Southey's Letters*, ed. by Warter (ib., 1856); *Correspondence with Caroline Bowles*, ed. by Dowden (Dublin, 1881); Dennis, *Southey: Story of His Life*, an excellent selection from letters (Boston, 1887); *Southey*, a memoir and estimate by Dowden, "English Men of Letters" series, new ed. (New York, 1895); and poems with memoir by S. R. Thompson, in the "Canterbury Poets" series (London, 1888).

SOUTH FORELAND. See FORELAND, NORTH AND SOUTH.

SOUTH GEORGIA, jôr'jâ. An island in the South Atlantic Ocean belonging to Great Britain, and situated in latitude 54° 30′ S., longitude 37° W., 800 miles east by south of the Falkland Islands (Map: World, Western Hemisphere, P 17). Area, about 1600 square miles. The island consists of mountains of Archæan formation from 6000 to 8000 feet high. Several permanent glaciers exist in the deep gorges on the mountain slopes, and the climate is damp and chilly. The lower slopes are covered with grass, but the flora is poor. The island is uninhabited. It was discovered in 1675 by Laroche.

SOUTH HADLEY. A town in Hampshire County, Mass., three miles northeast of Holyoke, on the Connecticut River (Map: Massachusetts, B 3). It is the seat of Mount Holyoke College (q.v.) and has a public library. There are manufactures of writing paper, brick, fertilizers, and lumber product. The government is administered by town meetings, held annually. Population, in 1890, 4261; in 1900, 4526.

SOUTH HOLLAND. A province of the Netherlands, bounded on the north by North Holland, and on the west by the North Sea (Map: Netherlands, C 3). Area, 1166 square miles. Population, in 1899, 1,144,448, more than half of whom lived in the larger cities. The capital and largest city is Rotterdam. The Hague also is in this province.

SOUTHINGTON, sŭTH'ĭng-tŏn. A borough in a town of the same name, in Hartford County, Conn., 20 miles south of Hartford; on the New York, New Haven and Hartford Railroad (Map: Connecticut, D 3). It is engaged principally in manufacturing pocket cutlery, general and carriage hardware, carriage bolts, tools, and wood screws. Population, in 1900, 3411. Originally a part of Farmington and called Panthorn, South-

ington was settled about 1697 and became a separate parish in 1724. It was incorporated as a town in 1779. The borough of Southington was incorporated in 1889.

SOUTH KEN'SINGTON, NATIONAL ART SCHOOLS OF. The schools of South Kensington (London) were founded in 1852 for the application of art to industry. The nucleus of an art industrial museum was also formed. (See SOUTH KENSINGTON MUSEUM.) The central school for the systematic training of art teachers and students in all departments of design was afterwards established at South Kensington. Aid is furnished in the teaching of art in elementary schools, in night classes for artisans, and in regular schools of art. The same body controls the provincial schools connected with South Kensington, which have grown extensively in number since their first establishment. Many national, local, and free scholarships are also open to British subjects.

SOUTH KENSINGTON MUSEUM. An important London museum, under the charge of the Department of Science and Art of the Committee of Council on Education. It was opened in 1857 and is contained in buildings at Brompton, South of Hyde Park. It includes the extensive Museum of Ornamental or Applied Art, one of the most valuable in the world, with 45,000 works of modern and mediæval art and numerous reproductions; the National Gallery of British Art; the Art Library, with 70,000 volumes and nearly 200,000 engravings, drawings, and photographs; the India Museum (q.v.); the National Art Training Schools; and the Royal College of Science. It maintains as a branch the Bethnal Green Museum for the benefit of the working classes in the East End. The museum is visited annually by about 2,000,000 persons.

SOUTH KINGSTOWN, kings'ton. A town, including West Kingston, the county seat, and several other villages, in Washington County, R. I., 23 miles south of Providence; on the New York, New Haven and Hartford, and the Narragansett Pier railroads (Map: Rhode Island, B 4). The Rhode Island College of Agriculture and Mechanic Arts is in the village of Kingston; also a public library with 7000 volumes. Other noteworthy features include the Narragansett Library, at Peacedale, and the Robert Beverly Hale Memorial Library at Matunuck. Matunuck is a popular watering place. South Kingstown is a rich farming district and also has fishing interests. The leading manufactured products are woolens and worsteds. The first power loom in the United States was established at Peacedale in 1814. Population, in 1890, 3415; in 1900, 4972.

SOUTH McAL'ESTER. A town of the Choctaw Nation, Indian Territory, about 85 miles southwest of Fort Smith, Arkansas; at the junction of the Missouri, Kansas and Texas and the Choctaw, Oklahoma and Gulf railroads (Map: Indian Territory, H 4). There are extensive coal mines. The town is engaged in coke-making and is a centre for wholesale trade. There are cotton gins, a large cotton compress, iron foundries, brick plants, a flour mill, etc. Population, in 1900, 3479.

SOUTH MOUNTAIN, BATTLE OF. A battle fought September 14, 1862, during the Civil War, at Crampton's Gap and Turner's Gap in the South Mountain range, near Sharpsburg, Md., between a Confederate force of about 18,000 under the immediate command of Generals McLaws and D. H. Hill, and a Federal force of about 28,000 under the immediate command of Generals Franklin and Reno. The two forces formed parts respectively of the Army of Northern Virginia, under Lee, and the Army of the Potomac, under McClellan. The Confederate troops, who had the advantage of position, resisted with great stubbornness the advance of the Federals, but were finally driven back, and on the 16th the Army of Northern Virginia and the Army of the Potomac met at Antietam (q.v.). The loss of the Federals in killed, wounded, and missing was about 1800; that of the Confederates about 2600.

SOUTH NOR'WALK. A city in the town of Norwalk, Fairfield County, Conn., 14 miles west by south of Bridgeport; at the mouth of the Norwalk River, on Long Island Sound, and on the New York, New Haven and Hartford Railroad (Map: Connecticut, B 5). Its beautiful situation, on rising ground overlooking the Sound, makes it a very attractive residential city. There are two libraries; the Public and the Roth and Goldschmidt. South Norwalk has a good harbor, and a large coastwise trade is carried on. Its manufactures include hats, locks, and various iron products. The government is vested in a mayor, elected annually, and a unicameral council. The water works and electric light plant are owned and operated by the municipality. (For history, see NORWALK.) Population, in 1900, 6591.

SOUTH OMAHA, ō'mȧ-hȧ. A city in Douglas County, Neb., adjoining Omaha; on the Missouri River, and on the Union Pacific, the Chicago, Rock Island and Pacific, the Burlington and Missouri River, and other railroads (Map: Nebraska, J 2). It has a public library. South Omaha ranks third among the cities of the United States in its slaughtering and meat-packing interests, being surpassed only by Chicago and Kansas City. In the census year 1900 the five establishments connected with that industry had an invested capital of $15,635,418 and an output valued at $67,716,724. The city government, under the revised charter of 1901, is vested in a mayor, elected biennially, and a unicameral council, and in administrative officials, the majority of whom are appointed by the mayor, with the consent of the council. The board of education, however, is chosen by popular vote and the fire and police board by the State Governor. South Omaha was settled in 1882 and was incorporated in 1886. Its rapid growth dates from the establishment in 1884 of the Union Stock Yards. Population, in 1890, 8062; in 1900, 26,001.

SOUTH OR'ANGE. A village in Essex County, N. J., 4 miles west of Newark; on the Delaware, Lackawanna and Western Railroad (Map: New Jersey, D 2). The main portion is picturesquely situated on a gentle eminence facing Orange Mountain. It is a residential suburb of Newark and New York. Seton Hall College (q.v.), a Roman Catholic institution, was opened here in 1856. The village has a public library and a handsome town hall. Population, in 1890, 3106; in 1900, 4608. South Orange was settled about 1670, and until erected

into a township, in 1861, was a part, first of Newark, and then, after 1806, of Orange. Consult Whittemore, *Founders and Builders of the Oranges* (Newark, 1896).

SOUTH'PORT. A municipal borough and watering place in Lancashire, England, at the mouth of the Ribble Estuary, 15 miles southwest of Preston (Map: England, C 3). It is a handsome town, with fine public buildings and institutions. There are artificial lakes and marine parks on the shore for bathing and model-yacht sailing. Southport owns the gas and electric lighting works, markets, and cemeteries, and maintains a free library, art gallery, and technical schools. Its rise dates from 1830. Population, in 1891, 41,400; in 1901, 48,000. Consult Stephenson, *Southport* (Southport, 1898).

SOUTH PORT'LAND. A city in Cumberland County, Me, on Casco Bay, opposite Portland, with which it is connected by ferry and four bridges, and on the Boston and Maine Railroad (Map: Maine, C 8). It is the seat of the State School for Boys, formerly known as the State Reform School. Noteworthy are the Government fortifications, the town hall, Masonic Building, and the Soldiers' Monument and grounds. The city has iron works, acid works, ship railway and machine shops, etc. The government is vested in a mayor, chosen annually, and a unicameral council. South Portland was a part of Cape Elizabeth until 1895, when it was set off as the town of South Portland. In 1889 it was chartered as a city. Population, in 1900, 6287.

SOUTH SEA. A name formerly applied to the Pacific Ocean.

SOUTH SEA CHESTNUT. See INOCARPUS.

SOUTH SEA COMPANY, THE. An English commercial company incorporated in 1711. It was a financial scheme organized by the Lord Treasurer Harley for the purpose of extinguishing the national debt, which then amounted to £10,000,000. The company assumed the debt on condition of receiving from the Government an annual payment of £600,000 for a certain number of years and a monopoly of trade to the South Seas. It also secured from the Spanish Government the contract of supplying the Spanish-American colonies with slaves, and proposed to engage in whale fisheries. On the strength of its purely prospective profits, the value of the company's stock increased enormously. In the spring of 1720 it proposed to assume the entire national debt, which was at that time over thirty millions, on being guaranteed five per cent. per annum for seven and a half years. At the end of this time the debt might be redeemed, if the Government chose, and the interest reduced to four per cent. The directors used every means to increase the value of the stocks, until in the beginning of August, 1720, the shares were quoted at 1000, when the chairman and some of the principal directors sold out. This flagrant conduct and the failure of Law's Mississippi Scheme in France opened the eyes of the public, and at the end of 1720 the crash came. Thousands of innocent stockholders were ruined. Parliamentary investigation revealed a scandalous complicity on the part of a number of the Cabinet. By the able manner in which he afforded relief to the unfortunate stockholders, Sir Robert Walpole (q.v.), the new Chancellor of the Exchequer, acquired great popularity. The directors were deprived of their ill-gotten gains and almost one-third of the original capital was saved for the stockholders. Consult: Mackay, *Memoirs of Extraordinary Popular Delusions* (London, 1852); Coxe, *Memoirs of Sir Robert Walpole* (London, 1802).

SOUTH SHET'LAND ISLANDS. An Antarctic archipelago lying about 600 miles south of Cape Horn, between 61° and 63° 20′ south latitude, and 54° and 63° west longitude, and separated from Graham's Land and Louis Philippe Land by the Bransfield Strait (Map: Antarctic Regions, A 4). The islands are twelve in number, the chief of which are George, Livingston, Smith, Deception, Elephant, and Clarence. The total area is about 880 square miles. They were discovered in 1599 by Dirk Gherritz. The region was explored by Sir John Ross in 1842, and in 1893 by Laskar in the *Jason*, who determined the coast-line of Graham's Land to the 69th degree south latitude.

SOUTH SHIELDS. A seaport of England. See SHIELDS, SOUTH AND NORTH.

SOUTH VICTORIA LAND, or VICTORIA LAND. A portion of the Antarctic land regions, whose coast extends in a north and south direction between latitudes 71° and 79° south, and along the 170th meridian east of Greenwich, the meridian of New Zealand. It is a mountainous country, falling in steep snow-crowned cliffs to the sea, and rising in Mount Melbourne to a height of over 14,000 feet. It also contains the volcanoes of Erebus and Terror, the latter 11,000 feet high. Several hundred miles inland is the Magnetic South Pole. Victoria Land was discovered by Ross in 1841, and explored and mapped by Borchgrevink in 1899.

SOUTHWARK, sŭTH'ẽrk. A Parliamentary borough in London (q.v.), on the southern side of the Thames.

SOUTH'WELL. A town of the Newark Parliamentary division of Nottinghamshire, England, 27 miles by rail southwest of Lincoln. The magnificent mediæval Minster of Saint Mary, founded on the site of a church said to have been erected by the first Archbishop of York in 630, still retains its three towers. The building is cruciform, the towers, nave, and transept are twelfth-century Norman, and the choir is a beautiful example of the English Gothic. It was renovated in 1882. Population, in 1901, 3160.

SOUTHWELL, ROBERT (c.1561-95). An English poet and martyr, son of Richard Southwell, of Horsham Saint Faith's, in Norfolk. Having studied at Douai and at Paris, he went to Rome, where he was received into the Order of Jesuits (1578), and ordained priest (1584). He was immediately sent to England as a missionary, where he became chaplain to the Countess of Arundel (1589). As a native-born subject ordained to the Roman Catholic priesthood, he was guilty of treason. He was not molested, however, till 1592, when he was arrested. After three years' imprisonment, with frequent tortures, he was tried, condemned, and executed (February 21, 1595). During his residence in England, Southwell wrote and circulated, usually in manuscript, several Catholic tracts, and a considerable body of choice verse (published after his death). His most ambitious poem is the long popular

Saint Peter's Complaint in 132 six-line stanzas; his best is perhaps the brief *Burning Babe*. Consult his *Poetical Works*, ed. by Turnbull (London, 1856); *Complete Poems*, ed. by Grosart ("Fuller's Worthies Library," ib., 1872); and *A Four-fould Meditation* (not in Grosart), ed. with bibliography by Edmonds (ib., 1895).

SOUTH'WICK. A town in Durham, England, 1 mile northwest of Sunderland (Map: England, E 2). It has shipbuilding industries, glass works, and potteries. Population, in 1901, 12,640.

SOUTH'WORTH, EMMA DOROTHY ELIZA [Nevitte] (1819-99). An American novelist, born at Washington, D. C. She wrote tales for the *National Era* of Washington, in which she published her first novel, *Retribution* (1849), and she wrote nearly sixty popular novels. They dealt principally with Southern life and were highly wrought in color and emotion, but had little literary value. A uniform edition of her works was brought out in 1872 at Philadelphia.

SOUVESTRE, sōō'vĕs'tr', EMILE (1806-54). A French novelist and dramatist. His best works, *Les derniers Bretons* (1835-37), *Le foyer Breton* (1844), deal with his native Brittany. More noted is the sentimentally cheerful *Philosophe sous les toits* (1851).

SOVEREIGN. An English gold coin of the value of a pound sterling, the standard weight of which is 123.374 grains troy. The sovereign is worth approximately $4.85.

SOVEREIGNTY (OF. *sovrainte*, Fr. *souveraineté*, from OF. *sovrain*, *soverain*, *suverain*, *souverain*, from ML. *superanus*, principal, supreme, from Lat. *super*, above, over). Several uses of the term sovereignty must be distinguished. Of these the principal are internal sovereignty and external sovereignty. Internal sovereignty touches the relation between a State and its citizens or subjects; external sovereignty relates to the position of a State among other States. The essence of internal sovereignty is supremacy over subjects; that of external sovereignty is independence of other States.

INTERNAL SOVEREIGNTY. Under the head of internal sovereignty another distinction is made between what is termed 'legal' sovereignty and 'political' sovereignty. Political sovereignty is the ultimate controlling power resident in any political society. Legal sovereignty is the organized power which at any given time must be regarded as legally supreme. Political sovereignty arises out of the very nature of the State as an organization for the purposes of social control. A supreme power enabling the State to preserve a form of public order, protect the community, and otherwise promote the general welfare is necessary to the life of organized society, and its absence is anarchy. Political sovereignty, then, is that power in the State the will of which is ultimately obeyed. At any given time this supreme will may or may not be accurately expressed by the existing legal or governmental authority.

Legal sovereignty refers to the supreme power of the State as embodied in some legal or governmental organ or agency. Thus the King in Parliament is termed a sovereign body in England; a Constituent Convention is so called in France; or a king in some cases is called the sovereign. This legal sovereign may not, although it generally does, represent the actual sovereignty in the State, but it is none the less supreme from the legal or governmental point of view. For example, the political sovereignty may actually belong to the mass of the people while the legal sovereignty may be vested in an aristocracy or a monarch; and, on the other hand, the actual power may be vested in a few while the government is democratic in form. Again, the legal sovereign, as for example the Parliament in Great Britain, may pass a law opposed by the majority of the people, but the enactment is none the less law and legally enforceable until repealed, or until the Government is overthrown by a revolution.

The *origin* of sovereignty has been explained in various ways by different schools of political philosophy. It has been asserted that the ruling authority holds by divine appointment or sanction; that the right to rule is a property right descending as other property in regular line of succession; that the sovereignty is created by a voluntary contract either between ruler and ruled or between independent individuals, as in the social contract (q.v.); that sovereignty is the prerogative of superior force and belongs to the strongest claimant. In modern times it is generally believed that sovereignty is a product of political necessity arising out of the essential nature of political association, and the tenure of the particular holders of the political sovereignty is a result of historical evolution. This process has thrown the supreme power in most civilized States into the hands of the mass of the people.

CHARACTERISTICS OF SOVEREIGNTY. In the narrower sense, sovereignty is generally regarded as absolute. There is no limitation of a legal or governmental character upon the exercise of its power. Legally speaking, all governments, whether monarchical, aristocratic, or democratic in form, are absolute. There are physical and moral limitations upon it, but, so far as the legal organization is concerned, there is no other organization or association within the limits of the State which can resist in any legal way the commands of the sovereign. In the broader sense of the term, political sovereignty is not absolute, since the ruling element in the State, however powerful, is never strong enough to be absolute in all things. It is also pointed out by some authorities that there may be and actually are legal limitations on the sovereign power. Thus in the United States there is no legal way of depriving the States of their equal suffrage in the Senate without their consent (Const., Art. v.), and in Germany the special rights of the States are likewise protected (Art. lxxvii.). It has also been strongly urged that the self-limitation of a State through its own Constitution gives rise to inviolable rights against the supreme power, and that therefore, although limited only by its own act, the sovereignty of a State should be regarded as legally limited, and hence not absolute in character.

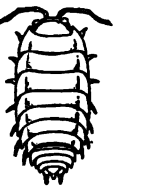
Furthermore, sovereignty in the narrower sense of the term is indivisible. There cannot be two sovereign powers acting on the same territory in an organized State. Two supreme powers having jurisdiction over the same persons and things would be logically impossible in a unified State. One must be sovereign and the other subordinate. Both cannot be the highest, the supreme authority. The King cannot be half-sovereign and

the people half-sovereign, nor in a federal system can the various members of the union be partly sovereign and the central authority also partly sovereign. What seems like the division of sovereignty in a 'federal State' is, on closer analysis, found to be either the actual sovereignty of the political society as a whole, as in the United States, or the complete sovereignty of a number of independent States, associated for certain common purposes, as in the Confederate States. The practical difficulty arises from uncertainty as to the degree of centralization in the given system.

The *location* of sovereignty has been a vexed question, especially in connection with the rise of modern constitutionalism. The sovereignty of the King and that of the people have been stoutly and ingeniously defended by the partisans of court and commonalty. In general the theory of popular sovereignty has triumphed, although in Germany the doctrine of State sovereignty has been accepted as a compromise. There the State, including both King and people, is declared to be the repository of supreme power by most publicists. The location of sovereignty has also been a subject of discussion as well as actual warfare in Germany and the United States, and in both instances decision has been against the individual States. See STATES' RIGHTS.

EXTERNAL SOVEREIGNTY. States possessing certain powers, such as that of negotiating treaties, declaring war, and regulating their internal administration, are called sovereign powers and are the parties to international law, entitled to its rights and privileges and liable to its duties and responsibilities. In international law sovereignty is not regarded as absolute, since no State is wholly independent of the other members of the family of nations. Some States frequently receive commands from and are practically in subjection to other nations, but are nevertheless treated as sovereign powers for the purposes of international law. Such are Turkey, Servia, and Egypt. Moreover, in international law, sovereignty is generally looked upon as divisible in nature. Certain States are termed half-sovereign or semi-sovereign. A State may yield up its right to negotiate with other powers, or the right to make war, or may surrender the control of a large part of its internal administration, and yet remain in the eyes of international law at least a semi-sovereign State. We may thus have a State which is sovereign internally—that is, over its own subjects—and at the same time subordinate to the commands of some other State externally, as was Madagascar. In fact, the territorial expansion of the Great Powers has given rise to a variety of complicated relations between strong and weak States, such as the protectorate, suzerainty, and the 'sphere of influence,' which make exceedingly difficult the logical application of the conventional idea of sovereignty, and, indeed, can be explained only by reference to the category of international law.

In recent years it has been maintained that sovereignty has no place among the concepts of political science, and should properly be eliminated from its terminology. Sovereignty and absolutism are regarded as identical in nature, and it is declared that constitutionalism, federalism, and imperialism alike require that this concept, born in the days of the struggle with feudalism, should now be abandoned. Other publicists maintain that a State may exist as a State although devoid of the attribute of sovereignty. There may be, in other words, a non-sovereign State, of which such communities as Bavaria and Saxony would be types. Such 'States' possess true political power, governing in their right, and not by delegated authority, but are to be classed as non-sovereign States, inasmuch as they are subordinate to the Empire as a whole. The same position has been claimed for the members of the American Union by Woodrow Wilson.



SOW-BUG.

SOW-BUG. A small carnivorous crustacean of the family Oniscidæ, the species of which live under logs in the woods and in similar places. It is an isopod. See CRUSTACEA; ISOPODA; and compare GRIBBLE.

SOWER, sour (or **SAUR**), CHRISTOPHER (1693-1758). An early American printer and publisher, born at Laasphe, near Marburg, Germany. After receiving a university education, and studying medicine at Halle, he emigrated to Pennsylvania in 1724, and in 1731 settled at Germantown. There in 1738 he set up a printing press and began the publication of an almanac in German, which was continued by his descendants for sixty years. In 1739 he issued the first number of *Der Hoch-Deutsch Pensylvanische Geschichte-Schreiber*, a quarterly magazine, the first of the sort published in Pennsylvania. In 1743 he published a quarto edition of Luther's translation of the Bible in German, which was, with the exception of Eliot's Indian Bible, the first to be published in America. He continued his activity in publishing both English and German works, and in connection with that business established a type foundry, the first in America, a paper mill, and an ink factory. He is also generally credited with being the inventor of cast-iron stoves.

SOWERBY (sou'ĕr-bĭ) **BRIDGE.** A manufacturing town in the West Riding of Yorkshire, England, 3 miles southwest of Halifax. Its chief buildings are Christ Church, dating from 1526 and rebuilt in 1819, the town hall, and municipal offices. The town owns the gas works, slaughter houses, and public baths. Woolens are manufactured. Population, in 1901, 11,500.

SOW THISTLE (AS. *sugu istel*, from *sugu*, sow + *istel*, thistle), *Sonchus*. A genus of about 30 species of Old World plants of the natural order Compositæ. Several species have been introduced in the United States. The common sow thistle (*Sonchus oleraceus*) is a somewhat branching annual weed 2 to 3 feet tall, with small yellow flowers, common in richly cultivated soils. The tender tops and leaves are much used in Northern Europe as greens. The field sow thistle (*Sonchus arvensis*) is a perennial with large yellow flowers and found in similar soils. The Alpine blue sow thistle (*Lactuca alpina*) is a native of the mountainous parts of Europe.

SOXHLET, zōks'lĕt, FRANZ (1848—). A German agricultural chemist, born at Brünn, Austria, and educated at Leipzig. In 1879 he was appointed professor of agricultural chemistry at the Polytechnic Institute in Munich and superintendent of the principal Bavarian agri-

cultural experiment station. There he became distinguished for his experiments in the chemistry of milk and its action. He put forth a new theory of the formation of butter and devised a method of extracting fats by means of ether. His investigations, embracing such subjects as the difference between human and bovine milk, the sterilization of milk, and the determination of the percentage of fat contained therein, the organic changes of tissue in the sucking calf, the varieties of sugars, and the formation of fats from carbohydrates, are all valuable.

SOY BEAN (Jap. *si-yan*, Chin. *shi-yu*, soy), *Glycine hispida*. An upright bushy annual leguminous plant 2½ to 4 feet tall, a native of Asia, where it has long been cultivated, especially in China and Japan, and whence it has been introduced into Europe and America. The name soy is derived from the Japanese *shoyu*, a food prepared from the seeds. The numerous varieties in cultivation vary principally in the color, shape, and size of the seed and the length of the growing period. Besides its use as a forage plant (see below) this crop is also frequently grown as a soil-improver on soils deficient in nitrogen. It thrives best under conditions favorable to corn culture and on soils of medium texture well supplied with potash, phosphoric acid, and lime, although it also gives good returns on light poor soils. If planted for hay or fodder the seed is sown broadcast or closely in drills in the spring when the soil has become thoroughly warm; if for the beans, in drills about three feet apart and cultivated like corn. When used for hay, ensilage, or green fodder the crop is cut when the plants are in bloom, when harvested for the seed, before the pods become ripe enough to burst and scatter the seeds. From eight to ten tons of green forage are obtained from an acre. About 40 bushels of seed per acre is considered a satisfactory yield, but sometimes from 75 to 100 bushels are obtained. Insect enemies and plant diseases do not seem to be troublesome.

Soy-bean hay cut at the proper season and well cured has a high feeding value, but since the stems become woody and the leaves fall off badly, the crop is put into the silo either alone or mixed with corn ensilage. The seed, being a very concentrated feed, is usually ground and mixed with other feeding stuffs. Fed alone or with other materials the meal is quite thoroughly digested; experiments with sheep showed that 91 per cent. of the protein and 84 per cent. of the total organic matter was assimilated. Similar values of the seed were 87 and 85 per cent.

Though the soy bean is eaten more extensively in China and Japan than in any other countries, so far as can be learned it is never eaten there as a vegetable, but as more or less complex food products of which natto, tofu, miso, yuba, and shoyu are commonly made in Japan and similar products in China. The composition of these foods is given in the following table:

COMPOSITION OF FOOD PRODUCTS MADE FROM SOY BEANS

SOY-BEAN FOOD PRODUCTS	Water	Protein	Fat	Nitrogen free extract	Fibre	Ash
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Fresh tofu	89.00	5.00	3.40	2.10	.....	0.50
Frozen tofu	18.70	48.50	28.50	2.60	.....	1.70
Natto	15.32	41.42	23.65	15.05	1.48	3.08
Yuba	21.85	42.60	24.62	7.65	.....	2.82
White miso	60.70	5.70	24.40		12.60	6.60
Red miso	60.40	10.08	18.77		8.25	12.50
Shoyu (soy sauce)	63.29	8.31	5.10		.....	19.45

Most of these soy-bean products, which have been popular from ancient times, are fermented. The cell walls and other carbohydrate materials are broken down, the cell contents rendered more accessible to the digestive juices, and at the same time peculiar and pleasant flavors are developed.

The statement is frequently made that the Orientals live almost exclusively upon rice, eating little or no meat. It is not, however, generally known that the deficiency of protein in the rice is made up by the consumption of large quantities of these soy-bean products, which are said to take the place in the Japanese dietary of meat and other animal nitrogenous foods too costly to be eaten by the populace. They are eaten in some form by rich and poor at almost every meal. A large number of dietary and digestion experiments have been made in Japan in which soy-bean preparations formed a considerable part of the food consumed. Generally speaking, the nitrogen was well assimilated. The beans are sometimes used for bread-making, and when roasted as a substitute for coffee.

SOYER, swä'yā', ALEXIS BENOÎT (1809-58). A French cook and writer on cookery, born at Meaux-en-Brie. After the Revolution of 1830 he went to England, where he became chief cook to the Duke of Cambridge. In 1837 he became chef at the Reform Club. In 1847 on a Government appointment he proceeded to Ireland, where a serious famine prevailed, and there erected and conducted a large number of kitchens from which food was served at half the regular price. In 1855 he went to the Crimea, where, in conjunction with Florence Nightingale, he directed reforms in the dietaries of the military hospitals. This work he continued after his return to England at the close of the war, with the result that a radical dietary reform both in the hospitals and in the ordinary barrack rations was effected. He wrote extensively on cookery, among his published works being: *The Gastronomic Regenerator* (1846), *The Modern Housewife* (1849), *A History of Food in All Ages* (1853), *A Shilling Cookery Book for the People* (1855), *Soyer's Culinary Campaign with the Plain Art of Cookery for Military and Civil Institutions* (1857), *Instructions for Military Hospitals* (1860). Consult also Volant and Warren, *Memoirs of Alexis Soyer* (London, 1858).

SOYESHIMA, sō-yĕsh'ĭ-mȧ, TANÉOMI. A Japanese statesman and scholar, born at Saga, in the Province of Hizen, in Kiushiu, and educated in the local school for samurai. In 1866

at Nagasaki he came under the influence of Guido F. Verbeck (q.v.), an American missionary, by whom he was taught, particularly in the New Testament and the Constitution of the United States. Giving his special attention to the study of law, he was in 1868 made a commissioner by the new Government for framing laws and later an Imperial councilor. In 1871 the Mikado sent him to Russian Siberia to settle the boundary question concerning the island of Saghalien, and in the following year he was an ambassador to the Emperor of China regarding Loo-choo. As Minister of Foreign Affairs he was instrumental in releasing the Chinese coolies from a Peruvian vessel at Yokohama and thus ending the coolie traffic. (See MACAO.) On his return to Japan he resigned his office because of differences on the Korean War question, but in private life continued to be influential in agitation for constitutional government, and later was invited to reënter the Cabinet. He revisited China in 1876, was welcomed and lauded by the mandarins for his scholarship, and became a trusted private adviser of the Emperor, especially in his library.

SO'YOTS. A people of the Sayan-Altai region, Mongolian in race, usually classed with the Samoyeds. They are of rather low stature, with brachycephalic head form. They are at present a mixed people, with the anthropological type of the Samoyed most prominent. They are hunters and nomads, and number some 35,000 or 40,000 in the Chinese Yenesei basin.

SOZ'OMEN (Gk. *Σωζομενός, Sōzomenos*), HERMIAS SALAMINIUS. A Church historian of the fifth century. He came from a wealthy family of Palestine and spent at least a part of his life as a lawyer at Constantinople. He wrote a history of the Church, covering the period from 323 to 439. The latter portion, dealing with the years from 423 to 425, is lost. He follows Socrates, but has some independent material, especially upon monastic matters. The work was edited by Hussey (Oxford, 1860), and there is an English translation by Hartranft (New York, 1891).

SPA, spä. A famous watering place in the Province of Liège, Belgium, 20 miles southeast of the city of Liège (Map: Belgium, D 4). It is attractively situated in a hilly region. The waters of the Pouhon spring are largely exported. It is in an inclosure erected to commemorate the visit of Peter the Great in 1717. The *Etablissement des Bains*, a handsome modern structure, is in the Place Royale adjacent to the Casino. There are noted manufactures of woodenware, which is stained brown by being steeped in the mineral waters. Population, in 1900, 8192. Spa gained prominence in the sixteenth century and reached its greatest popularity in the eighteenth century, when it was the favorite resort of the European nobility. It declined in importance after the French Revolution, but is rapidly regaining its former prestige. About 15,000 people visit the place annually. 'Spa' as applied to mineral springs originated in the name of this town.

SPACE (OF., Fr. *espace*, from Lat. *spatium*, space; connected with *spes*, hope, OChurch Slav. *spěti*, to result, Lith. *spėti*, to have leisure, AS. *spōwan*, OHG., *spouan*, to succeed, Skt. *sphay*, to fatten). A term denoting the physical basis for dimension and magnitude. From ancient times it has occupied a large place in philosophical discussions. Parmenides and Plato make it equivalent to non-being. Leucippus, on the contrary, recognizes its reality. Space of course is presupposed as a fundamental reality in all materialistic atomism. Aristotle defines place as limit, thereby committing himself to the denial of empty space. In modern philosophy the nature of space is one of the central questions. Descartes considered it one of the two attributes of reality, and Spinoza followed him in making it one of the two known attributes. Leibnitz cannot recognize space as an original attribute of his monads, else they become material and not spiritual. Space is therefore only the order of possible coexistent phenomena of sense. When thought clarifies away the obscurities of sense space is no longer left as a relation in which realities stand to each other. Natural science, however, and materialism have vigorously maintained the ultimate reality of space. Berkeley practically reduces space to time and Hume makes it the disposition of colored points. Kant taught that space is a form of perception; phenomena appear in space simply because the mind gives them a local habitation, and, he argues, we may not say that things in themselves are spatial. He tries to prove the *a priori* character of space from its inevitableness in our experience; and according to his view whatever is *a priori* must be of subjective origin. Hegel regards it as 'the first or immediate characteristic of nature,' and yet it is an abstract characteristic, not an independent entity. At the present time there are advocates of almost all theories that have in the past been broached. There are transcendentalists (Kantians); there are realists, who attribute an independent reality to space as if it were a vessel to be filled with objects; there are those who believe that our idea of space is so full of contradictions that it has no ultimate value; and there are those who believe it is a real quality of experienced objects and a real relation between such objects, but who refuse to attribute to it an existence entirely apart from the objects it qualifies or correlates. The last mentioned view seems to be in closer agreement with the facts than any of the others. According to this view pure space is an abstraction having no actual existence. Space is always in experience the figure of some object or the distance between some objects, or in some way an attribute or a relation, not a self-existent thing. The question of the origin of our spatial ideas is psychological. A question that has always been much mooted is that as to the finitude or the infinity of space. Kant tried to cut the Gordian knot by denying the reality of space as a thing in itself, whereby he thought to be able to say that the whole trouble was removed. Space is, therefore, for Kant neither infinite nor finite, but there is no limit to our power to produce space. It is indefinitely producible. Taking, however, the view that space is a real but not an independent element in the objective world, the question as to the infinity of space becomes one to be answered only on the basis of induction (q.v.); and, if we may judge from past experience, we should say that there is no definite indication that experienceable spatial objects are limited. But the data are not sufficient for a dogmatic judgment. But even if an end of perceptible objects were found imagination would add further objects, and thus remove the limits. See Baumann, *Die Lehre vom Raum, Zeit*

und Mathematik in der neuen Philosophie (Berlin, 1868-69); Deichmann, *Das Problem des Raumes in der griechischen Philosophie bis Aristoteles* (Leipzig, 1893); Hodgson, *Time and Space* (London, 1865); Lechalas, *Etude sur l'espace et le temps* (Paris, 1896); Saleta, *Exposé sommaire de l'idée d'espace* (ib., 1872); also consult the metaphysical works of Kant, Hegel, Lotze, Bradley, Bowne, Hobhouse.

SPACH, späch, Ludwig Adolf (1800-79). An Alsatian historian, born and educated at Strassburg. In early life he was a tutor and traveled extensively. He was Librarian of the Department of Bas-Rhin, Alsace, and head of the prefect's cabinet (1840), and in 1872 became honorary professor at Strassburg. His writings include *Moderne Kulturzustände im Elsass* (1873-74); *Dramatische Bilder aus Strassburgs Vergangenheit* (1876); *Zur Geschichte der modernen französischen Litteratur, Essays* (1877). Spach, under the pseudonym Louis Lavater, also wrote the novels *Henri Farel* (1834), *Le nouveau candide* (1835), and *Roger de Manesse* (1849).

SPADEFOOT. A 'toad' of the family Pelobatidæ, prominently characterized by the inner bone of the ankle (tarsus) being covered with a hard, sharp-edged horny sheath, which forms an effective tool for digging. Three species belong to Western Europe and the Mediterranean region, of which the best known is *Pelobates fuscus*,



FOOT OF A SPADEFOOT.
Under surface of a left foot, showing the 'spade' (a).

which makes deep holes in the sand, where it hides during the day, coming out to hunt at night. The very numerous eggs are laid in strings in water, and the tadpoles grow to a disproportionately large size, shrinking greatly when they change into young toads. American representatives of the family are several species of the genus Scaphiophus, one of which (*Scaphiophus solitarius*), common from New Jersey southward in all suitable places, is renowned for the remarkably loud noise it makes when calling in the spring. Other species are found in Mexico. Consult: Gadow, *Amphibia and Reptiles* (London, 1902); Abbott, *A Naturalist's Rambles About Home* (New York, 1884).

SPAETH, spāt, Adolph (1839—). A German-American theologian, born at Esslingen and educated at Tübingen. In 1864 he came to the United States and for ten years was pastor of a church in Philadelphia. He then became professor of New Testament exegesis in the theological seminary of the Lutheran Church at Philadelphia. He published the American edition of Bücher's *Hand-Konkordanz* and his own *Saatkörner* (1893).

SPAGNA, spä'nyȧ, Lo (c.1480-c.1530). A Spanish painter domiciled in Italy, known as Giovanni lo Spagnuolo or Giovanni di Pietro. Although one of the most distinguished pupils of Pietro Perugino, with whom—and with his own fellow pupil Raphael—he has often been confused, little is known of this Raphaelesque painter, save that he was born in Spain, was established in Umbria after 1500, studied under Pintoriccino, and was made head of the Painters' Guild of Spoleto in 1517. His chief works are in Assisi, Perugia, Spoleto, and Todi. In the National Gallery in London there is also a fine example, "The Agony in the Garden," and at Caen is the "Marriage," long attributed to Raphael, and a "Saint Jerome."

SPAGNOLETTO, spä'nyȯ-lĕt'tȯ, Lo. The familiar name of the painter Jusepe de Ribera (q.v.).

SPAHIS (Fr. *spahi*, from Hind., Pers. *sipāhī*, soldier, horseman, from Pers. *sipāh, supāh*, army). Native Algerian cavalry, originally formed from the Turkish spahis serving in the country when it was conquered by the French. The uniform is like that of the Arabs. The natives cannot hold any rank higher than captain.

SPAHR, spär, Charles Barzillai (1860-1904). An American author and journalist, born at Columbus, Ohio. He was educated at Amherst College, at Leipzig, and at Columbia University. In 1886 he became an associate editor of *The Outlook*. His publications include "Essay on the Present Distribution of Wealth in the United States" (1896), in the *Library of Economics and Politics*, and *America's Working People* (1900).

SPAIN (Sp. *España*, from Lat. *Hispania*). A kingdom occupying about six-sevenths of the area of the Iberian peninsula. Lying between latitudes 36° and 44° N. and longitudes 9° 15′ W. and 3° 20′ E., it is bounded by France, the Atlantic (in the north the Bay of Biscay), Portugal, and the Mediterranean. At the extreme south the narrow strait of Gibraltar separates it from Morocco. Its continental area is 192,004 square miles. Including the Canary and Balearic islands and the small possessions on the north and west coasts of Africa, its total area is 194,783 square miles. The gorges of the Miño (Minho in Portuguese), the Guadiana River, and the cañons of the Duero (Douro) and Tagus (Sp. Tajo) constitute to a great extent a natural demarcation between Spain and Portugal.

Topography. The predominating natural feature of Spain is the great Iberian tableland which occupies the middle and much of the northern portion of the peninsula—a very compact, lofty, and mainly treeless plateau sloping as a whole to the west. The surface of the tableland rises from 1000 to 3000 feet above the sea, and in its highest part, on the edge of the Iberian Mountains, which wall in Castile on the east, it is 3500 to 5000 feet high. This lofty plateau is crossed by many mountain ridges called sierras, the most important of which are the Castilian Mountains in the centre of the kingdom (Sierra de Guadarrama and Sierra de Gredos), which divide the extensive high plains of Old Castile from those of New Castile. The northern limits of the tableland are the Cantabrian Mountains, the western continuation of the Pyrenees, and the southern limits are the Sierra Morena, which is nothing more than the steep edge of the plateau separating Castile from Andalusia. The highest mountains of the tableland are those of the central region, such as the Plaza Almanzor (8730 feet) in the Sierra de Gredos, and the Pico de Peñalara (7890 feet) in the Sierra de Guadarrama; but these summits rise scarcely 5000 feet above the general level of the plateau. Some of the depressions between the mountain ranges are narrow valleys drained by many


AZORES ISLANDS.
(PORTUGUESE)
SCALE, 140 MILES TO ONE INCH.
Longitude 8 West from Greenwich
BAY OF BISCAY
ATLANTIC OCEAN
MEDITERRANEAN
AFRICA
GALICIA
ASTURIAS
CANTABRIA
PORTUGAL
ESTREMADURA
ANDALUSIA
MADRID
CASTILE
Strait of Gibraltar
Cape St. Vincent
C. Trafalgar
Gibraltar (Br.)
Europa Pt.
Tarifa
Ceuta (Sp.)
Tetuan
Cape Spartel
Cadiz
Malaga
Cordova
Seville
Granada
Lisbon
Oporto
Coimbra
Evora
Badajoz
Salamanca
Valladolid
Segovia
Toledo
Santander
La Coruña
Vigo
Madrid



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rapid rivers, and communication across the sierras from valley to valley is difficult.

The long unbroken chain of the Pyrenees forms a mighty barrier on the side of France. They form a wall of exclusion over which no highways have been built, the mountains being circumvented only by roads at their extreme ends. The highest peak of the Pyrenees (which is situated on the Spanish side of the boundary) is the Pico de Aneto (Pic d'Anethou), whose summit is about 11,160 feet above the sea. The Sierra Nevada, in the extreme south, close to the coast, attains an elevation of 11,420 feet, in Mulahacén, the highest mountain in Europe (regarding the Caucasus as not belonging to Europe) outside of the Alps.

The alternation of mountain and river valley in Spain is very conspicuous—first the Cantabrian Mountains and the Duero River in the north; then in succession the Guadarrama Mountains and the Tagus, the Toledo Mountains and the Guadiana, the Sierra Morena and the Guadalquivir, with the Nevada Mountains, in the south. The coast throughout nearly its whole extent is bordered by mountains, giving it a very rugged character, and there are few openings that may be converted into good harbors. The coasts are further impaired for shipping by dangerous currents which tend to throw vessels on the shore. Barcelona has the only really first-class harbor. Spain contains two great low plains. One is the plain of Aragon in the northeast, through which flows the Ebro, which drains the greater part of Northeastern Spain. This plain extends between the Pyrenees and the Iberian Mountains, and is walled in from the Mediterranean by the Catalonian Mountains. The other is the Andalusian plain in the southwest, traversed by the Guadalquivir River and extending between the Sierra Morena and the Sierra Nevada. These plains, like the narrow and comparatively short coastal plains, are among the most fertile regions of Europe, but are of small extent compared with the wide-spreading tableland.

HYDROGRAPHY. All the long rivers, excepting the Ebro, empty into the Atlantic, as the main water parting is nearer to the Mediterranean than to the ocean. Most of the rivers are for the greater part of the year very deficient in water and not navigable, and, therefore, of small value for shipping. They lie too far below the general level to be of much use even for irrigation. The Miño, Duero, Guadiana, and Tagus are not navigable in Spain, though they are useful for commerce to some extent in Portugal. Of the 800 miles of waterways in Spain only 300 miles are available the year around. The Guadalquivir, which flows through a part of the Andalusian plain, is the deepest river in Spain; vessels ascend it as far as Seville, and small boats reach Cordova. It draws most of its water supply from the high mountains of Andalusia. The Miño and Duero flow across the plateau of Old Castile; the Tagus, the longest of the rivers, courses through New Castile. These rivers with the Guadiana flow in deep rocky valleys. The Ebro reaches the Mediterranean through a tortuous gorge. With its largest tributaries, which bring much water from the slopes of the Cantabrian Mountains and the Pyrenees, it is of great value for irrigating the fertile low lands of Aragon. There are no important lakes, the small lake of Albufera, near Valencia, being the largest.

CLIMATE AND SOIL. Spain has almost a continental climate notwithstanding the great length of its coast line. The range of temperature between summer and winter and the diurnal variations are great and rapid. Spain has often been misconceived as a land of eternal spring, in which groves of olives and oranges thrive. The climatic conditions adapted for these fruits are found, however, only in the coast districts, and in Andalusia, in the extreme south, and Galicia in the northwest. The summers of the tableland are so hot that nearly all the rivers are dried up and the earth becomes so parched and unproductive that whole villages are sometimes compelled to migrate. The nearness to the Sahara, across the narrow Mediterranean, exposes the southern part of the country to intense heat. On the other hand, the height of the tableland causes the winter temperature to be low. At Madrid, in the centre of the peninsula, there is often skating in winter, although in summer the temperature may rise to 107° F. in the shade, making the climate of Madrid the most extreme in Western Europe. On the southern coast, by contrast, the mean temperature in January is 55°, and frost and snow are extremely rare. The mean temperature at Malaga, on the south coast, is in summer 77° and in winter 57°; at Barcelona, in the northeast, on the Mediterranean, the summer and winter means are respectively 77° and 50°, and at Madrid, in the centre, 75°, and 44.6°. The climate is also one of the driest in Europe, and has been made still drier by the destruction of the forests. The rainfall is very small, only 8 to 12 inches per annum in the interior. The evil of deficient precipitation is increased by the fact that, as in all Mediterranean lands, the largest rainfall is in the winter months after the growing season. Irrigation is, therefore, the basis of agriculture. The soils need only moisture to make them very fertile. The hot south wind of Andalusia, known as the Solano, and the cold north wind, called the Gallego, are peculiar to Spain.

FLORA. The vegetation is that of Central Europe. It is, however, very monotonous on the whole, for the number of plants capable of supporting great extremes of temperature is naturally limited. Herbs and shrubs predominate on the plateau, but a greater variety of plants is found in ascending from the plains to the mountain summits. Woods are met with only on the slopes of the mountains, where chestnut trees and oaks of various species occupy the lower zone and conifers extend to the tree limit. The elm is found in many river valleys, and is planted with success in some cities. The poplar is one of the cultivated trees, and the beech forms large forests on some of the mountain slopes. The vine flourishes on stony soil, and the olive tree is an important element in the national wealth. The cork tree, from which the bark may be stripped every ten years, is found in Granada and southwest of the Pyrenees, and also in various other districts. Esparto, or alfa, and rushes, largely used for baskets and mats, are grown on the coast and in the interior; sugar cane is cultivated in Andalusia and Valencia; European and Mediterranean fruits and nuts, such as apples, pears, oranges, lemons, almonds, chestnuts, and

figs, grow in abundance; the southern provinces also raise maize and rice; and Spain is the chief saffron-producing country in the world.

FAUNA. The remnants of the forests still harbor wolves, lynxes, wildcats, foxes, and even wild goats. The bear is now rare. Deer, hares, and other game abound, and wild boars of great size and strength are hunted in the oak forests.

GEOLOGY AND MINERAL RESOURCES. The tableland is a very ancient and much altered block of the earth's crust, chiefly composed of Archæan and Paleozoic rocks, for the most part of Cambrian, Silurian, and Devonian formation. On the north and south margins of the tableland two younger land masses were upheaved into lofty bordering ranges, the Pyrenean-Cantabrian on the north, and the Andalusian on the south. The Pyrenees are an example of a young folded mountain system built up of parallel belts usually in a northwest and southeast direction. The crust folds of the Andalusian system have a low outer zone of folded Mesozoic and Tertiary strata and a lofty inner girdle, in which the Archæan and Paleozoic rocks rise high above the Mediterranean. Spain had the reputation till the discovery of America of being the richest metal-producing country in the world. It is the most metalliferous land of Europe, not excepting the Ural mining district. The rapid development of mining has been impeded by insufficient fuel and defective means of communication; but the chief reason for the inferior condition of the mining industries is found in the lack of enterprise and skill among the Spaniards. Foreign capital and energy have brought about most of the development in recent years, and the greater part of the ore is exported to foreign countries in its raw state. The rich iron ore and the copper ore go to England and Germany, and Spanish gold and silver ores are melted at Freiberg in Saxony. The great iron fields of North Spain have been chiefly tributary to Great Britain, whose iron-makers have imported from first to last about 100,000,000 tons of this ore, chiefly through the port of Bilbao. It is especially desired in Great Britain and Germany because it is hematite of the best steel grade. These mines along the Bay of Biscay are now nearly exhausted, but iron of excellent quality is also found in considerable quantities in Andalusia, the Sierra Morena, and Leon. In 1903 a fresh source of oxide of iron ore, discovered 85 miles from Malaga, began to enter into commerce.

Nearly every province contains coal measures, the resources of the country being estimated at 13,000,000,000 tons. Coal is worked chiefly in Asturias, Leon, and Lérida, but the amount mined is comparatively small and the railroads, even in the coal-producing provinces, burn English coal. The quicksilver mines of Almaden are the richest in the world. Spain produces more lead than any other country of Europe, and lead-mining in recent years has given new life to Granada, most of it being obtained from the mines of the Alpujarras (q.v.) and those of Linares in Jaén. Copper is found in inexhaustible quantities on the Rio Tinto, in Southern Spain, where mines have been worked by British and German capital since 1873. The ore is also mined in Murcia, Oviedo, Jaén, and Zamora. Salt is chiefly obtained by evaporation of sea water at Cadiz, Valencia, and the Balearic Islands, though Catalonia and New Castile abound in rock salt. Among the other important minerals are sulphur, soda, saltpetre, alum, graphite, and potter's clay. Mineral springs are numerous, the best known being the thermal sulphur springs of Mombuy, in Catalonia. In 1901 there were in Spain 2291 productive mines employing 87,409 workmen. The output of raw minerals in the same year was valued at $26,960,328. The quantities and values of the more important minerals produced in 1901 (the peseta being valued at 14.28 cents) were as follows:

CRUDE MINERALS	Tons	1,000 pesetas
Iron	7,906,517	40,833
Coal	2,556,591	28,932
Copper	2,672,365	45,756
Lead	174,326	13,666
Silver-lead	207,188	33,578
Quicksilver	28,367	5,200
Zinc	119,708	4,029
Manganese	60,235	1,008
Salt	345,090	3,000

AGRICULTURE, LIVE STOCK, AND FISHERIES. Spain's largest interests are agricultural, over half the people living by farming, which supplies about two-thirds of the exports. In general the husbandry of Spain is of an antiquated character. Farm methods and implements are primitive, and the special disadvantages are that much of the land is owned by the nobility in large holdings, the taxes are high, and communications poor. Four-fifths of the area is classed as productive; 33.8 per cent. is devoted to general agriculture and gardening, 3.7 to vineyards, 1.6 to olive-growing, 19.7 to natural grasses, and 20.8 to fruit. Pasturage is abundant, even the great plains of the dry tableland being covered in summer with aromatic herbage on which sheep thrive, while in winter the flocks are driven down to the lower districts, especially to Estremadura. Although about 250,000 of the holdings are in large estates, the subdivision of the soil has been rapidly advancing in recent years. As in all countries in which winter rains prevail, irrigation, as stated above, is necessary during the rainless months. Artificial watering in a wide belt along the Mediterranean coast transformed a great area into a region of remarkable fertility. These lands are called huertas or gardens. All available fertilizers, including street sweepings, are used, with the result that no land in the world is more productive than the huertas. Here are produced southern fruits, vegetables, sugar cane, maize, and other crops requiring abundant moisture. Only about nine per cent. of the country, however, is artificially irrigated. The Government in 1900 took steps to enlarge the agricultural area by the construction of reservoirs and irrigation canals. The plans adopted for the irrigation system cannot fully be carried out for many years. Lands now irrigated in the valleys of the Ebro and Tagus are yielding twelve times as much fruit as the dry lands.

The most profusely watered and the best cultivated region is Valencia, where three or four crops are harvested every year. The level parts of Catalonia, Murcia, and Andalusia are also very fertile, while Asturias and Galicia, though less productive, are carefully cultivated. A

large part of the dry lands of the interior is untilled, though where subterranean waters are near the surface wheat and other cereals are grown. In good years the northern provinces export cereals, though the wheat crop does not always meet the home demand. A region extending widely around Valladolid is called the granary of Castile. The swampy lands bordering the Gulf of Valencia yield fine crops of rice. Oats are little grown; rye is the chief breadstuff in the part of Spain fronting on the Atlantic; and barley is grown for cattle food.

The areas in acres devoted to the cereal crops in the year of 1901 were as follows: Wheat, 9,172,196; barley, 3,301,115; rye, 1,968,989; oats, 944,198; maize, 1,156,126; rice, 84,463.

The most important branch of husbandry is the cultivation of the vine, and wine at times forms as much as a third of the total exports. As much as 700,000,000 gallons is sometimes produced, but most of the wines are poorly made. In the African climate of the south are produced the famous wines of Malaga, Alicante, and Jerez (Sherry). These wines are highly valued both for medicinal and table purposes. Besides wine Valencia, Malaga, and Alicante also export great quantities of raisins and grapes. The most profitable crop of the huertas is fruits. Oranges and lemons thrive best along the Gulf of Valencia and in the Balearic Islands. Large quantities of the peel of the bigarade or bitter orange are sent to Holland to be used in the manufacture of the liqueur Curaçao. Olives and olive oil are large products, though somewhat less important than oranges in the export trade. No other country produces so much olive oil as Spain, and most of the product is consumed at home. The industry is chiefly developed in the southern provinces, Seville supplying the greater part of the olives for table use, while the oil comes from Cordova. As a large amount of the home product is poorly made, much of the oil is refined in France; but efforts have been made in recent years to improve the quality of the oil, so that it may compete in foreign markets with French and Italian oils. Leguminous vegetables, a staple article of food in Spain, are raised in sufficient quantity to provide a surplus for export. Esparto, which thrives in droughty lands, grows in the southeast and is sent in large quantities to England. Tobacco is cultivated, but much is also imported; the tobacco industry, which is a Government monopoly, is an important source of revenue. Hemp and flax are grown chiefly in the northern provinces.

Though the area in forests is said to comprise 7,500,000 acres, the timber supply is deficient and large quantities must be imported from Scandinavia and North America.

The breeding of domestic animals was once of great importance in Spain, but the industry has retrograded. The most famous domestic animal is the fine-fleeced merino sheep, now not so numerous as formerly. Though Spain raises more sheep in proportion to population than any other country of Europe, the number has been reduced from 23,000,000 to 16,500,000 since 1890; and the famous fine-wool merinos have been largely replaced by coarse-wool breeds. In the mountain districts about 2,600,000 goats are reared for their milk, flesh, and skins. A single peasant in Sierra Nevada sometimes owns as many as 3000 or 4000 goats. The best horses, originally of Arab stock, are raised in Andalusia and Asturias; but horse-breeding is much neglected in favor of the highly prized mule, the kingdom containing only about 400,000 horses. On the other hand, there are 1,521,000 mules and asses, which are bred with great care in most parts of Spain. The number of cattle amounts to barely 2,217,000 head. They are most numerous on the pastures of the northwest, where the rain from the Atlantic is abundant. To this region dairy farming is confined. The wild cattle specially raised for bull-fighting are obtained from the Sierra Guadarrama and the Sierra Morena. Hogs, about 2,000,000 in number, are reared chiefly in the mountainous parts of the kingdom, especially in the north and in Estremadura. Silkworm culture is only one-tenth as large as half a century ago, and is chiefly confined to the regions around the Gulf of Valencia. The yield of cocoons in 1901 amounted to 2,190,000 kilograms. Most of the raw silk is sold to France and large quantities of silk goods are imported. The sea fisheries are important. The home industry does not begin to supply the demand and much fish is imported from Norway. The total number of boats engaged in the industry in 1892 was 14,726; fishermen, 67,197. The chief catches are sardines, tunny, and cod.

MANUFACTURES. The manufacturing industries do not supply the home demand. Catalonia has always been the home of the greater part of Spanish manufactures. Next in order come those districts of Galicia, Asturias, and Vizcaya in which water power abounds and also a few towns in the interior, such as Madrid, Seville, and Toledo. Barcelona, in Catalonia, is the leading manufacturing town and the chief seat of the textile, metal, paper, and leather industries and lace-making. The cotton industry, which is improving on the whole eastern coast, depends for its patterns upon France and England and does not satisfy the home demand. The silk industry of Valencia, Murcia, and Andalusia and the woolen industry of Barcelona, Alicante, and Burgos also fail to supply the local consumption. Cordova, once famous for its horse-hide leather (Cordovan leather), no longer leads in the leather industry. The manufacture of tobacco is carried on extensively in the royal factories of Madrid, Valencia, Seville, and other towns, about 50,000 families being supported on the wages disbursed. Alcoy manufactures much cigarette paper, and paper-making is steadily growing in importance. The metal industry is most flourishing in Catalonia and the northern provinces near the largest sources of iron, but meets the domestic demand in no department. In the iron and steel industry, however, Spain is making every effort to supply the entire home demand. Large wire mills have been erected, and in 1903 the largest plant for the production of all classes of steel was completed at Badalona. Gold and silver wares are produced in large quantities in Madrid, Toledo, Seville, and Barcelona; and Gijón, Seville, and Madrid are noted for their glass and porcelain. In the manufacture of cotton goods 2,614,500 spindles and 68,300 looms were employed in 1901; the woolen manufactures used 662,000 spindles and 8800 looms; about 150 paper mills make printing, packing, writing, and cigarette paper; 47 mills produce beet, and 22 cane sugar, the total output in 1901 having been

86,243 tons. Under Government encouragement the production of the sugar beet is growing. More than 30 factories make glass; about 33,000 tons of corks are manufactured every year; and there are over 60 mills for expressing olive oil. The pickling of green olives is an important branch of industry; in addition to the large home consumption, some 6000 to 7500 tons are annually exported. There are about 400 factories engaged in sardine-canning, with about 16,500 workmen.

COMMERCE. The trade consists chiefly in the export of raw produce and the import of the larger part of the manufactures consumed. Wine, minerals, and fruits form the larger part of the exports. The imports are chiefly confined to cotton, coal, foodstuffs, textiles, lumber, and machinery. The domestic trade is seriously hampered by natural and artificial obstacles. The rivers are navigable only to a very small extent, the canal system is very deficient, the different provinces are separated from one another by lofty mountains, the common roads are very poor, and excessive rates are charged for freightage by rail. Spain's commerce with foreign lands is chiefly maritime, and England and France are the most important factors in it. The imports and exports, exclusive of gold and silver bars, in three years were as follows:

EXPORTS

DESCRIPTION	1900	1901	1902
Raw materials	$42,413,783	$43,563,968	$45,666,832
Manufactures	24,431,365	21,344,998	20,516,587
Food supplies	37,788,873	32,839,108	39,114,447
Total	$104,634,021	$97,748,074	$105,297,866

The following table shows in greater detail the various classes of goods which entered into the import and export trade, including precious metals, in two years, in pesetas (average value, 14.28 cents):

DESCRIPTION	Imports		Exports	
	1900	1901	1900	1901
	Pesetas	Pesetas	Pesetas	Pesetas
Stone, minerals, glassware, and pottery	106,480,129	112,686,699	159,124,433	150,298,509
Metals and their manufactures	45,849,988	34,952,014	101,422,310	98,912,374
Drugs and chemical products	76,340,119	79,996,894	20,154,902	20,651,895
Cotton and its manufactures	94,211,048	108,225,041	34,056,899	29,001,152
Other vegetable fibres and manufactures	25,224,672	23,396,478	1,308,698	922,467
Wool and hair and their manufactures	27,061,270	26,466,035	9,780,502	11,636,039
Silk and its manufactures	25,280,134	24,333,578	4,979,960	5,071,664
Paper and its applications	11,345,657	11,582,591	8,463,849	8,305,112
Timber and its manufactures	60,846,964	61,716,512	60,658,103	47,715,308
Animals and their products	82,320,185	70,867,651	65,498,346	61,478,108
Machinery, vehicles, and vessels	135,198,181	97,553,930	792,952	797,322
Alimentary substances, including grain, sugar, wine, etc	139,238,556	136,222,950	264,627,966	233,475,688
Various	8,398,878	8,214,438	1,865,811	2,192,731
Gold and silver (bar and coin)	5,566,400	7,987,283	20,854,768	21,612,215
Other articles (special)	31,443,631	42,574,855	.....	.....
Total	874,805,812	846,776,949	753,589,499	692,070,584

The following table shows the distribution of the more important foreign trade in two years:

COUNTRY	Imports from (1899)	Imports from (1900)	Exports to (1899)	Exports to (1900)
	Pesetas	Pesetas	Pesetas	Pesetas
France	144,564,896	137,386,661	213,666,360	187,750,220
Great Britain	240,687,682	246,107,975	279,340,901	274,801,514
United States	119,558 539	105,834,020	13,195,777	17,415,050
Germany	64,543,730	77,792,154	25,436,218	31,804,682
Belgium	35,349,215	43,017,270	28,213,103	25,046,872
Russia	46,043,435	42,663,843	1,867,944	2,679,615
Italy	23,200,446	24,015,794	15,524,072	23,199,680
Sweden and Norway	21 091,476	24,783,175	2,702,859	2,482,547
Portugal	26,594,170	37,271,048	29,627,197	32,385,749
Argentina	24,843,715	30,553,983	13,042,623	12,607,616
Cuba	21,375,477	5,335,477	73,778,216	56,796,054
Philippine Islands	21,181,983	15,849,846	11,653,148	22,374,782
Porto Rico	9,751,437	3,227,480	13,042,623	12,607,616

Cotton, petroleum, staves, and lumber are the chief imports from the United States. The United States sales of raw cotton to the mills in the Barcelona manufacturing district averaged 267,093 bales in the three years 1900-1902. Wine, fruits, and cork wood are the chief exports from Spain to the United States. The following table shows the value of the total trade with the United States in three years:

	1900	1901	1902
Imports into Spain	$13,399,680	$15,480,288	$15,511,987
Exports from Spain	5,950,047	5,409,301	8,270,546

IMPORTS

DESCRIPTION	1900	1901	1902
Raw materials	$59,589,346	$61,146,277	$63,068,206
Manufactures	44,654,776	37,566,175	34,892,771
Food supplies	19,883,248	19,790,997	16,062,014
Total	$124,127,370	$118,503,449	$114,022,991

TRANSPORTATION AND COMMUNICATIONS. Much of the domestic trade is carried by coasting vessels, as Spain possesses more than 100 harbors large and small on its two seas. The home merchant marine is inferior, and most of the shipping is under the British and French flags. The merchant marine in 1900 comprised 449 steamers of 430,966 tons net and 693 sailing vessels of

110,968 tons net; total, 1142 vessels of 541,964 tons. In 1901 18,241 vessels of 14,503,348 tons entered and 17,118 vessels of 14,302,589 tons cleared from the Spanish ports. There is excellent communication with the chief Atlantic and Mediterranean ports of Europe and with the Philippine Islands and Cuba, and regular steamer service between New York and Barcelona and the north and south coast ports of Spain. New Orleans has regular steam communication with Barcelona and Bilbao. The most important Spanish ports are Barcelona, Cadiz, Malaga, Bilbao, Santander, Alicante, and Valencia. The railroad system connects all the chief towns with one another and unites Spain with France by two routes around the ends of the Pyrenees. Madrid is the centre of the Spanish broad-gauge railroad system. In 1900 the length of the railroads open for traffic was 8315 miles.

BANKING. The chief financial institution is the Bank of Spain. Its note issue up to 1,200,000,000 pesetas is guaranteed by a metallic reserve of one-third the amount of the issue, half of which must be in gold. If the note issue exceeds this amount it must, up to 1,500,000,000 pesetas, be guaranteed by metallic reserves of at least 40 per cent. in gold and 60 per cent. of the remainder in silver. For issues exceeding 1,500,000,000 and up to 2,000,000,000 pesetas, 50 per cent. must be guaranteed in gold, and 70 per cent. of the remainder in silver. On January 21, 1903, the notes in circulation amounted to 1,634,504,000 pesetas; capital and reserve, 170,000,000; deposits and accounts current, 617,431,000; property, 11,305,000; portfolio, 1,542,825,000; cash in hand, 901,924,000.

FINANCE. The revenue of Spain in 1901 amounted to $170,998,000 and the expenditure to $174,752,000. Revenue is raised by direct taxes on land, trade, mines, Government salaries, etc.; indirect taxes are derived from imports, articles of consumption, tolls, and bridge and ferry dues; other sources of revenue are the tobacco monopoly, the lottery, mint, and receipts from the sales and rentals of national property. The detailed estimates of revenue and expenditure for 1903 were as follows:

REVENUE

	Pesetas
Direct taxes on land, trade, mines, Government salaries, registration, etc	421,967,930
Indirect taxes, customs, excise, etc	328,710,000
Tobacco monopoly, lottery, mint, and minor sundries	164,870,000
National property: Revenue	19,997,797
" " Sales	2,770,000
From the public treasury	12,862,500
Total	951,178,227

EXPENDITURE

	Pesetas
Civil list	9,200,000
Cortes	1,838,085
Public debt	409,092,054
Various	1,365,900
Pensions	71,780,500
Council of Ministers	735,883
Ministry of State	5,002,212
" Justice and Worship	54,171,544
" War	144,012,982
" Marine	35,936,201
" Interior	51,543,426
" Instruction, etc	43,122,259
" Public works, etc	73,283,908
" Finance	16,500,845
Tax-collecting	29,076,099
Colonial	2,000,000
Total	948,661,898

In 1901 the outstanding debt amounted to $1,727,994,620 bearing interest at 4 and 5 per cent. Details of the outstanding debt on March 31, 1902, are as follows:

	Pesetas
Recognized debt to the United States	3,000,000
External 4 per cent	1,226,878,704
Perpetual internal 4 per cent	5,903,208,270
Redeemable internal 5 per cent	1,190,085,000
Convertible internal, Cuba and Philippine	87,009,000
Guarantee stock	2,000,000,000
Total	10,410,180,974

GOVERNMENT. The present Constitution of Spain was proclaimed June 30, 1876. It declares the government to be a constitutional monarchy with the executive power vested in the King. The King is forbidden to alienate or exchange Spanish territory, or to admit foreign troops into the realm, or to make treaties of alliance, of commerce, or of subsidy or such as impose burdens on Spaniards, or to abdicate the crown in favor of a successor without special authorization by the Legislature. The sovereign is declared to be inviolable and irresponsible. He is aided by ministers who countersign all his official acts and who thereby assume the responsibility for them. Since the abolition of the Colonial Department in 1899 the Ministry has been organized as follows: President of the Council; Minister of Foreign Affairs; Minister of Justice; Minister of Finance; Minister of the Interior; Minister of War; Minister of Marine; Minister of Agriculture, Commerce, and Public Works; Minister of Education. The Ministers have seats in the national legislature and are permitted to take part in the debates.

The legislative power is vested in the King and a Cortes composed of a Senate and a Chamber of Deputies, the two Houses having substantial equality of powers in legislation. The Senate is composed of three classes of Senators: First, those entitled to seats in their own right (*Senadores de derecho propio*); secondly, 100 life Senators nominated by the Crown from certain designated classes; and thirdly, 180 Senators elected by communal and municipal delegates and by the provincial estates, the Church, the universities, learned societies, etc., and by the largest taxpayers. The first two groups must not exceed 180 members. Senators by right embrace the adult sons of the King and those of the immediate heir to the throne; Spanish grandees who have an annual income of at least $12,000; captain-generals of the army, admirals of the navy, the patriarch of the Indias and the archbishops, and the presidents of the councils of State, of war; of the navy, of the Supreme Court, and of the tribunal of accounts. One-half the elective Senators retire every five years; and all retire whenever the King dissolves the Senate. The Chamber of Deputies is composed of 431 members chosen for a term of five years by popular election. Eighty-eight Deputies are elected by general ticket in 26 districts, provision being made for minority representation. The members are apportioned on the basis of one to every 50,000 of the inhabitants. They must be twenty-five years of age. By a law of 1890 all male Spaniards twenty-five years of age who are in the full enjoyment of their civil rights and who have been citizens of a municipality for at least two years are qualified voters. The Depu-

ties receive no compensation for their services and are disqualified from holding office while serving in the Parliament. Annual sessions of the Parliament are held; it is summoned by the King, and may be prorogued or dissolved by him, subject to the limitation that the new Cortes must be summoned within three months after the dissolution of the old. The sessions are public; each Chamber regulates its own procedure, and is the judge of the election and qualification of its own members. Both Senators and Deputies are responsible only to their respective Chambers for any words spoken in debate or votes cast. They are also privileged from arrest except in case of flagrant crime. The seat of government is Madrid.

For purposes of local government Spain is divided into provinces and communes, each with its own elected assembly. The Ayuntamiento or elected assembly of the commune consists of from 5 to 39 Regidores and is presided over by an Alcalde chosen from the body of the Ayuntamiento, except in some of the large towns, where he is appointed by the King. The term of the members of the Ayuntamiento is four years, one-half the membership being renewed biennially. The provincial deputations meet once a year and are represented during the interval by a permanent committee. These two local assemblies have entire control of the local government in their respective jurisdictions and are free from interference of the central Government except when they exceed their powers to the detriment of the general interest.

The judiciary consists of a Supreme Court of Cassation, which sits at Madrid; a number of district courts or *audiencias* immediately under the jurisdiction of the Supreme Court; tribunals *de partidos* below the audiencias; justices of the peace; and municipal courts. The audiencias serve as courts of appeal in civil matters and as courts of first and last resort for crimes and certain misdemeanors. The tribunals *de partidos* have jurisdiction in first instance of civil causes and in first and last resort of misdemeanors. They also have appellate jurisdiction in cases decided by the inferior courts. The *partido* is divided into circumscriptions, usually two, in each of which is a *juez de instrucción*, with civil and criminal jurisdiction in cases assigned to them by the higher courts of a Minister. The circumscriptions are subdivided into communes, in each of which is a municipal judge with jurisdiction of petty offenses.

COLONIES. The colonial possessions of Spain are confined to Africa and are represented in the following table:

POSSESSIONS	Area, sq. miles	Population
Rio de Oro and Adrar	243,000	100,000
Bata (Rio Muni) and Cape San Juan	9,000	302
Fernando Po, Annobón, Corisco, Elobey Chico, Elobey Grande	850	23,709
Total	252,850	124,011

The Rio de Oro Colony and Adrar are administered by the Governor of the Canary Islands. The national expenditure on account of the above possessions far exceeds the revenues derived from them. About $300,000 had to be provided by the Spanish Government to supply the deficiency for 1902, the revenues being only about $19,000. For an account of the colonies, see the respective headings.

WEIGHTS, MEASURES, AND MONEY. Spain maintains the double gold and silver standard. The unit of coinage is the peseta, nominally worth 19.3 cents or 1 franc, but actually valued at an average of about 14.28 cents. The value of the money coined in Spain from 1868 to 1901 was: gold, 920,537,615 pesetas; silver, 1,285,010,511 pesetas. Metric weights and measures were introduced in 1859, but in addition to these the old Spanish weights and measures are still largely used.

DEFENSE. See ARMIES and NAVIES.

POPULATION. The population of Spain proper by the census of 1900 was 18,607,674, with a density of 95.5 inhabitants to the square mile. In 1850 it was about 14,000,000. The population in 1900 consisted of 9,087,821 males and 9,530,265 females. Emigration from Spain is chiefly to Brazil, Uruguay, and Argentina, the emigrants in 1900 numbering 63,020. The cities with a population of over 90,000 each are: Madrid, the capital, 539,835; Barcelona, 533,000; Valencia, 213,530; Seville, 148,315; Malaga, 130,109; Murcia, 111,539; Cartagena, 99,871; and Saragossa, 99,118. The following table gives the area and population of each of the 49 provinces according to the census of 1900:

PROVINCE	Area, sq. miles	Population, 1900
Alava	1,175	96,385
Albacete	5,737	237,877
Alicante	2,185	470,149
Almería	3,360	359,013
Avila	3,042	200,457
Badajoz	8,451	520,246
Baleáres (Balearic Islands)	1,935	311,649
Barcelona	2,968	1,054,541
Burgos	5,480	338,828
Cáceres	7,667	362,164
Cadiz and Ceuta	2,834	452,659
Canarias (Canary Islands)	2,807	358,564
Castellón	2,496	310,828
Ciudad-Real	7,620	321,580
Córdoba (Cordova)	5,299	455,859
Coruña	3,051	653,556
Cuenca	6,636	249,696
Gerona	2,264	299,287
Granada	4,928	492,460
Guadalajara	4,676	200,186
Guipúzcoa	728	195,850
Huelva	3,913	260,880
Huesca	5,848	244,867
Jaén	5,203	474,490
León	5,936	386,083
Lérida	4,690	274,590
Logroño	1,946	189,376
Lugo	3,814	465,386
Madrid	3,084	775,034
Malaga	2,812	511,989
Murcia	4,453	577,987
Navarra (Navarre)	4,055	307,669
Orense	2,694	404,311
Oviedo	4,205	627,069
Palencia	3,256	192,473
Pontevedra	1,695	457,262
Salamanca	4,829	320,765
Santander	2,108	276,003
Segovia	2,635	159,243
Sevilla (Seville)	5,428	555,256
Sória	3,983	150,462
Tarragona	2,505	337,964
Teruel	5,720	246,001
Toledo	5,919	376,814
Valencia	4,150	806,556
Valladolid	2,922	278,561
Vizcaya (Biscay)	836	311,361
Zamora	4,097	275,545
Zaragoza (Saragossa)	6,726	421,843
Total	194,800	18,607,674

RELIGION. The national Church is the Roman Catholic, and in few countries has it so powerful an influence. The whole population adheres to that faith excepting about 30,000 Protestants, Jews, and others. The Constitution requires the nation to support the clergy and religious buildings and institutions, the State expending for these purposes annually about 41,000,000 pesetas. Only restricted and private liberty of worship is permitted to Protestants. In 1884 there were 32,435 priests, 18,564 churches, 11,202 other buildings of a religious character, 1684 monks, and 14,592 nuns. The religious Orders are numerous and influential, and many of them have schools and teach industries of all kinds.

EDUCATION. Instruction was almost entirely neglected until quite recent times. The older generations of the poorer classes are, for the most part, unable either to read or to write. The middle schools and the once famous universities are far inferior in their standards to corresponding institutions in most European countries. Spaniards seldom learn any language but their own, excepting the nobility, who usually can converse in French. In 1889 68.1 per cent. of the population could neither read nor write, though by the law of 1857 education was made compulsory. Improvements in the educational system have been in progress for some years. It is now under charge of a Minister of Education with a council. The public primary schools are supported chiefly by the municipalities, with a small contribution from the Government; and the average sum now spent on primary education (most of the children being educated free) is about $5,000,000 a year. By a law passed in 1902, the schools are now regularly inspected, and rules regarding sanitation, discipline, and the appointment of qualified teachers are enforced under Government authority. In 1901 there were 25,340 public schools, with 1,617,314 pupils, and 6181 private schools, with 344,380 pupils. The secondary schools, of which there must be one in every province, prepare for the universities and are largely attended, but they are still regarded as inefficient. There are nine universities, with about 16,000 students, the largest being at Madrid, which has upward of 5000 students. The Government also supports special schools for instruction in engineering, agriculture, fine arts, music, and other branches. The sum set apart in the budget of 1903 for education was 43,122,259 pesetas.

ETHNOLOGY. The perspective of Spanish ethnology extends back to the Chellean Epoch, implements of that type having been dug up in the ancient alluvium at San Isidro and other stations near Madrid. Solutrean implements were found in the grotto of Altamira, Province of Santander. In the same grotto Magdalenian implements and characteristic objects in bone were discovered, and relics belonging to this epoch come from the Basque Provinces, from the basin of the Ebro, and from Catalonia. In historic times all the great divisions of the Caucasian race have mingled their blood in Spain in greater or less proportion—Hamite, Semite, Teuton, Celt, and Mediterranean. The fundamental type bears the name of Celtiberian, and is a result of a mixture of the earliest long-headed Mediterraneans and the later-coming brachycephalic Celts producing a cranial index of 76-79. Keane and Ripley call attention to the uniformity of this index in Spain and in Britain, associated with tall stature and blondness in the latter, with dark color and low stature in the former. Spain has been invaded in historic times by Phœnicians, Carthaginians, Romans, Visigoths, Vandals, Arabs, and Moors. It is generally believed that these conquerors modified the original type but little, simply because many of them were already short of stature, dark in skin, hair, and eyes, as well as dolichocephalic.

HISTORY. Spain, the *Iberia* of the Greeks, and the *Hispania* (q.v.) of the Romans, is supposed to have been originally inhabited by a distinct race called Iberians, upon whom, however, a host of Celts appear to have descended from the Pyrenees. In the earliest times of which we have any record, these two races had already coalesced and formed the mixed nation of the Celtiberians, who were massed chiefly in the centre of the peninsula, in the western districts, and on the north coasts. In the Pyrenees and along the east coast were to be found pure Iberian tribes, while unmixed Celtic tribes occupied the northwest. On the south and east coasts were Phœnician, Carthaginian, Rhodian, and other colonies. In the second half of the third century B.C. a large territory was brought under subjection to Carthage by Hamilcar Barca (q.v.), who, according to Roman tradition, founded the city of Barcelona. After the death of Hamilcar, in B.C. 228, the Carthaginian interest was advanced, and the power of Carthage further strengthened by Hasdrubal (died B.C. 220), son-in-law of Hamilcar, who founded Carthago Nova (the modern Cartagena) and concluded a treaty with the Romans whereby it was stipulated that he should not advance his standards north of the Iberus (Ebro). Hannibal (q.v.), son of Hamilcar, after the death of Hasdrubal attacked and destroyed Saguntum (q.v.), in B.C. 219, and thus initiated the Second Punic War. (See CARTHAGE; ROME; HANNIBAL.) After the Romans had driven the Carthaginians from the peninsula, in B.C. 206, the country was made into two Roman provinces (B.C. 197), *Hispania Citerior*, including the eastern and northern districts, and *Hispania Ulterior*, including the southern and western districts. The conquest of the native tribes proved an arduous task for the Romans. (See LUSITANIA; NUMANTIA.) It was not till B.C. 19 that the Cantabri and Astures in the extreme north of the country laid down their arms to Augustus. Under Augustus the peninsula was divided into the three provinces of Hispania Tarraconensis, Bætica, and Lusitania. (See HISPANIA.) From the time of the establishment of the complete supremacy of the Romans till the death of Constantine the condition of Spain was eminently prosperous. Its fertile fields formed for a considerable time the granary of Rome, and from its metal-veined sierras an immense amount of treasure in gold and silver flowed into the Roman coffers.

In A.D. 409 hordes of barbarians, Alans, Vandals, and Suevi crossed the Pyrenees and swept over and desolated the peninsula. About 414 the Visigoths invaded the country, and their King, Athaulf, who acknowledged a nominal dependence on the Roman Emperor, established the Gothic monarchy in Catalonia. (See GOTHS.) The best known of the kings were Wallia (415-

419), who greatly extended the Gothic monarchy, making himself master of a great part of Aquitania (where a century later the Visigoths were overcome by Clovis); Euric (465-485), who, besides increasing his territory, introduced and enforced a body of laws, and did much for the advancement of civilization in Spain; Leovigild (569-586), who effected the subjugation of the Suevi; Wamba (672-680), who built a fleet for the protection of the coasts; and Roderic (q.v.), who was killed at Jerez de la Frontera in 711, in battle with the Arabs (Saracens). The battle of Jerez gave the Arabs almost undisputed mastery of nearly the whole of Spain, as well as of Septimania (Languedoc) in France. The remnant of the Goths betook themselves to the highlands of Asturias, Burgos, and Biscay, where they maintained their independence.

The Arabs held Spain for the first few years of their rule as a dependency of the Province of North Africa; but after the downfall of Musa (q.v.) the country was governed (717) by *emirs* appointed by the Caliph of Damascus. These emirs were intent upon the extension of their conquests into Gaul, to the neglect of the rising power of the Goths in Asturias. Their northward progress was arrested in the battle of Poitiers by Charles Martel (q.v.) in 732. The *walis*, or local governors of districts and provinces, frequently rebelled against the emir, and drew swords against each other. Within a period of forty years no fewer than twenty emirs had been called to the direction of affairs; but a revolution at Damascus, which unseated the Ommiads, and placed the Abbassides in possession of the caliphate, put an end to this state of misrule in Spain. The last of the emirs, Yusuf, was in favor of the Abbassides, but the walis and alcaydes, being chiefly of the Ommiad faction, invited one of this family, Abd-er-Rahman, who was in concealment among the Zeneta Arabs in Barbary, to become an independent caliph in Spain. (See OMMIADS.) Thus was founded (756) the *Emirate of Cordova*. By 778 the Franks had wrested from the Arabs all their possessions north of the Pyrenees and northeastern Spain to the Ebro. The latter acquisition, subsequently denominated the *Spanish March*, was for a time alternately in the hands of the Moslems and dependent upon France.

During the early period of Arab-Moorish domination the small independent Kingdom of Asturias, founded by Pelayo (q.v.), grew in power and extent. Alfonso the Catholic, son-in-law of Pelayo, conquered nearly all of Galicia and recaptured Leon, together with Salamanca and other cities. Alfonso the Great (866-910) by his victories greatly extended the Asturian dominions, which soon after his reign figure as the Kingdom of Leon. In the course of the ninth century Navarre struggled into existence as a separate State. The Kingdom of Leon was for a long time distracted by bitter and bloody strife among the members of the royal line, and with its neighbor, Navarre, would have fallen an easy prey to the powerful Ommiads had not the latter directed their chief attention to the subjugation of Morocco. During this relaxation of the constant warfare between Moors and Christians another independent State, Castile, an offshoot from Leon, came into existence, at first under the rule of the famous Count Fernán González. In 1033 it was erected into a kingdom. Castile, from its central position, and consequently greater facilities for expansion, soon became the most powerful of the Spanish States. A considerable part of Aragon was wrested from the Moors by Sancho the Great of Navarre (1000-35), and at his death this part of his dominions passed as a separate kingdom to his son Ramiro, who added to it the districts of Sobrarbe and Ribagorza, and a considerable extent of country which he conquered from the Moors. In 1151 the territory of the counts of Barcelona (Catalonia) was united with Aragons. The last Christian kingdom to be founded in the Iberian Peninsula was Portugal (q.v.).

The Ommiads ruled Mohammedan Spain for about 275 years. The greatest of this dynasty was Abd-er-Rahman III., who ruled from 912 to 961, and who in 929 assumed the title of Caliph. His capital, Cordova (q.v.), was the greatest city in Europe except Constantinople, and was unrivaled in the splendor of its edifices. The civilization of Spain during the Moorish supremacy was far in advance of that of the rest of Europe. At the great Mohammedan universities medicine and mathematics were cultivated, and Aristotle was studied there long before he was well known to Christian Europe. An extensive literature was developed, the caliphs themselves often being poets and authors of note. Commerce and agriculture were fostered, and the stranger marveled at the splendid system of irrigation, which made the country like a garden. The Moorish fleets controlled the Mediterranean and carried on an extensive trade. For the art which was developed in Spain by the Moors, see MOHAMMEDAN ART.

The Ommiad dynasty came to an end in 1031, and a number of independent Moorish kingdoms were formed—Cordova, Seville, Toledo, Lisbon, Saragossa, Tortosa, Valencia, Murcia, Badajoz, and others of less note. The kings of Castile and Aragon did not fail to benefit by this disruption of the Mohammedan realm, for by well-directed and unremitting attacks they subdued some States and rendered others tributary. A few years more might perhaps have destroyed the Moorish domination in Spain had not the rulers, hard pressed by Alfonso VI. of Leon and Castile, who in 1085 conquered the Kingdom of Toledo (New Castile), applied for aid to the ruler of the sect of the Almoravides (q.v.) in Morocco. The Almoravides crossed over to Spain, but after defeating the Christians they turned their arms against the Spanish Moors, and by the beginning of the twelfth century the Almoravide sovereign was acknowledged the ruler of Mohammedan Spain. The power of the Almoravides was extinguished by the Almohades (q.v.), a fanatical sect who passed over from Morocco just before the middle of the twelfth century, and conquered the territories of the Mohammedans. In a great battle fought on the plains of Tolosa (*las navas de Tolosa*), in 1212, the kings of Castile, Navarre, and Aragon broke the Almohade power in Spain. Soon nothing was left out of the wreck of the Almohade realm but the Kingdom of Granada, which was forced to acknowledge the overlordship of Castile. This last Moorish kingdom rose to great splendor.

Prominent among the late Castilian monarchs were Ferdinand III., who extended the dominions of Castile far into Andalusia, conquering Cordova in 1236 and Seville in 1248; Alfonso X., the Wise, famous as a legislator, writer, and patron of learning; Alfonso XI.; Peter the Cruel; and Isabella, whose marriage with Ferdinand the Catholic (1469) brought about the union of Castile and Aragon in 1479. Among the sovereigns who raised Aragon to the position of an important power and extended its dominion beyond the bounds of the Iberian Peninsula were James I. (1213-76), who conquered Valencia and the Balearic Islands; Pedro III. (1276-85), who obtained Sicily (1282); James II. (1291-1327), who annexed Sardinia; Alfonso V. (1416-58), who conquered Naples; and Ferdinand V., the Catholic (1479-1516), who became the ruler of the whole of Spain. The mediæval history of Castile and Aragon is marked by a vigorous development of constitutionalism as embodied in the assertion of their power by the estates of the realm. (See CORTES.) In both kingdoms the cities enjoyed great political freedom, of which they were gradually deprived after the consolidation of Spain into a single monarchy.

The union of Castile and Aragon enabled the Christians of Spain to undertake the subversion of what remained of Moorish dominion in the peninsula. In 1482 Ferdinand and Isabella entered upon a war for the subjugation of the Kingdom of Granada, and at the beginning of 1492 the sovereigns made their entry into the Moorish capital. All Spain, with the exception of Navarre, was now practically one power. The shrewd policy of Ferdinand the Catholic, who followed the tendency of the age and strengthened the royal power at the expense of the privileges both of the feudal nobility and the people, enabled Spain to grow in external power and influence, and to assume a military preëminence among the countries of Europe. In Italy the arms of Spain, under Gonsalvo de Córdova, triumphed over those of France. In 1512 Ferdinand made himself master of Navarre, with the exception of the district north of the Pyrenees, and thus completed the unification of Spain. The discovery of the New World by Columbus and his successors under Spanish auspices in the closing years of the fifteenth century made Spain the pioneer colonial power, and for a considerable period the greatest. The expulsion of the Jews from the Spanish dominions in 1492 deprived them of a large body of industrious citizens. In 1516 Charles I. (from 1519 Holy Roman Emperor as Charles V.), the grandson of Ferdinand and Isabella, and of Maximilian of Austria and Mary of Burgundy, inaugurated the Hapsburg dynasty on the throne of Spain. He was the ruler of the Netherlands, which became part of the Spanish realm, and he acquired the Duchy of Milan (embracing most of Lombardy), which was made a Spanish possession. Mexico and Peru, whose mines poured the precious metals into Spain in an inexhaustible supply, were acquired during his reign. Charles was the most powerful Christian monarch of his time. His reign was taken up with endless contests with the French, and, as German Emperor, with efforts to suppress Protestantism, as well as with war against the Turks. (See CHARLES V., HOLY ROMAN EMPEROR.) His son Philip II. (q.v.) (1556-98), who succeeded to the Spanish possessions of the House of Hapsburg, prepared the way by his narrow and bigoted policy for the decline of Spain. He developed the Inquisition, which had been introduced by Ferdinand and Isabella, into a powerful engine for the repression of religious and political dissent, and his attempt forcibly to root out the Reformation in the Netherlands brought about a rising which resulted in the severance of the Dutch provinces from Spain. With England he waged long wars, which were disastrous to the Spanish naval power. (See ARMADA; DRAKE.) In 1580 Philip II. conquered and annexed Portugal. The Spaniards took possession of the Philippines in his reign. Under Philip III. (1598-1621), in whose reign the Moriscos were expelled, and under Philip IV. (1621-65), in whose reign the Dutch Netherlands were definitively given up and Portugal reasserted its independence, the decadence of the nation proceeded at a rapid rate. The male line of the Hapsburgs became extinct in Charles II. (1665-1700) and the conflicting claims to the throne produced the war of the Spanish Succession (see SUCCESSION WARS), in which England and Holland were allied with Austria, Prussia, the German Empire, and Savoy against Louis XIV. to prevent the aggrandizement of France by the acquisition of Spain as an appanage of the House of Bourbon. When the rival Austrian claimant became Emperor and head of the Austrian dominions as Charles VI., in 1711, a similar objection existed to his obtaining the throne of Spain, and the allies conceded the succession to Philip of Anjou, who had been proclaimed King of Spain as Philip V. in 1700, and was confirmed by the Peace of Utrecht in 1713. This was the beginning of the Bourbon dynasty in Spain. Spain emerged from the War of Succession stripped of the Belgian Netherlands, Naples, Sicily, Sardinia, and her Lombard territories. She had to cede Gibraltar to the English, who had captured it in 1704.

A few years later Spain, whose policy was at this time directed by Alberoni, made an effort to recover some of her lost possessions, but her aggressions were promptly met by the Quadruple Alliance of 1718 between Great Britain, France, Austria, and Holland, and the schemes of the able Prime Minister came to naught. In the War of the Polish Succession, however, Don Carlos, son of Philip V., wrested the Two Sicilies from Austria and established the Bourbon dynasty there.

Philip was succeeded by his son, Ferdinand VI. (1746-59), in whose reign numerous reforms were introduced in the administration. Ferdinand was succeeded by his half-brother Charles III. (1759-88), who, on ascending the Spanish throne, relinquished the Two Sicilies to his son, Ferdinand IV. Charles brought into Spain from his Italian domains a new spirit, and initiated reforms in the internal administration, foreign policy, and economics of the State. As a result of the Seven Years' War, in which Spain joined France, Florida was ceded to Great Britain and Louisiana acquired from France (1763). In 1767 the Jesuits were expelled from the Spanish dominions. In 1779 Spain became the ally of France in the war against England, and in 1783 she recovered Florida, which in 1819 was ceded

to the United States. Charles IV. (1799-1808) was incapable of continuing his father's vigorous policy. He was under the control of the notorious Godoy (q.v.), the Queen's favorite, who played into the hands of Napoleon for his own profit. In March, 1808, the King abdicated in favor of his son, Ferdinand, and the latter was compelled to renounce his claims to the crown in favor of his father, who then handed his right over to Napoleon. The latter then conferred the Spanish crown upon his brother Joseph Bonaparte. Deserted by their rulers, the Spanish people organized resistance, declared for Ferdinand VII., and refused to recognize the Bonapartes. A supreme junta of leading Spaniards was established at Seville and subordinate juntas were formed in each of the provinces.

It was the obstinate resistance of Spain and the efficient work of the supporting English armies in the Peninsular War that first checked Napoleon and showed Europe that he was not invincible. (See PENINSULAR WAR.) Meanwhile the Spanish colonies in America revolted, and after a fierce warfare of sixteen years the Spanish dominion on the American mainland was completely extinguished (1826). After the expulsion of the French King, Ferdinand VII. returned to Spain and entered Madrid May 14, 1814. The liberal Constitution of 1812 enacted by the Cortes was at once abrogated, the religious Orders were restored to their earlier predominance, the Cortes were abolished, and the Inquisition was reëstablished. A popular reaction aided the King and his Ministers in this course. A liberal revolution in 1820 restored the Constitution of 1812 and instituted a Cortes which was notable for its extreme liberalism. The Inquisition was abolished and the privileges and exemptions of the Church were invaded. The clergy and the peasants opposed the revolution, but it was received with favor by the army and the educated classes. In 1822 the Holy Alliance (q.v.) took note of the Spanish situation, and France was commissioned to suppress the liberal movement. A French army of nearly 100,000 men invaded the peninsula and the Spanish forces were entirely unable to meet the attack. On May 24, 1823, the French entered Madrid, established a regency, drove the Cortes from Seville to Cadiz and out of the country, and restored Ferdinand, who had been declared of unsound mind by the Cortes. The King at once revoked all of the liberal measures, except the abolition of the Inquisition. Repression and wholesale punishment followed. The French army remained in occupation until 1827. Bermudez, the Prime Minister, adopted finally a moderate policy, but this satisfied neither absolutists nor liberals. The clerical party guided by the Apostolic Junta rallied around Ferdinand's brother, Don Carlos, as the representative of extreme absolutism and clericalism, and a number of insurrections were started by the Junta in his interest. In 1831 Ferdinand, having no male heir, decreed the revival, on behalf of his daughter Isabella, of the old law admitting female succession. Ferdinand died in 1833 and Queen Maria Christina became Regent for her daughter Isabella II. The Carlists proclaimed their candidate as Charles V., and there was an immediate division of parties in the kingdom into Carlists and Cristinos. The Queen Regent was compelled to turn to the liberals for support. A royal charter, in lieu of a constitution, was promulgated in 1834, but it did not give real popular government, and the Ministry and the Chambers were both under the control of the Crown. Civil war broke out and the Carlists were at first successful. An alliance was concluded by the Regent with England, France, and Portugal, for the purpose of maintaining the crowns of Spain and Portugal against the pretenders, Carlos and Miguel (qq.v.). The death of Zumala-Carreguy (q.v.), the only Carlist leader of ability, and the accession to the command of the Government forces of General Espartero (q.v.) turned the tide. Maroto, the Carlist commander, concluded the convention of Vergara with the Government in 1839 and returned to his allegiance with his army. By this treaty Navarre and the Basque Provinces, which had been the strongholds of Carlism, were confirmed in their ancient privileges. Espartero defeated the remnants of the Carlists in Catalonia, and Don Carlos went into exile, handing over his pretensions to his son.

In the meanwhile the struggle for a liberal constitution was being waged in the kingdom, and a revolutionary movement at the palace of La Granja in 1836 forced Maria Christina to swear to the Constitution of 1812. In 1840 Espartero, the liberal leader, was made the head of the Ministry on his own terms. Maria Christina resigned the regency October 12, 1840, and the Cortes made Espartero Regent and guardian of Isabella and her sister. The Regent's firm government made enemies, and in 1843 a revolutionary movement, headed by Narvaez and Prim (qq.v.), drove him from power. In November, 1843, Isabella was declared of age and assumed the crown, with Narvaez, the leader of the Moderates (Moderados), as Prime Minister. Maria Christina was recalled and the Constitution modified on reactionary lines. Narvaez exercised practically dictatorial powers until 1851. Parties gradually readjusted themselves, the old Absolutists, with whom the Moderates tended to assimilate, grouping themselves about Queen Isabella and her mother, and the liberal elements joining the Progressists. In March, 1851, a concordat was arranged with the Pope by which all ecclesiastical affairs were to be canonically regulated and all religions but Catholicism were forbidden in the kingdom, the Church in return yielding its secular jurisdiction and recognizing the sale of church lands. A Cabinet of personal supporters was made up by the Queen mother. They attempted in 1852 a modification of the Constitution in the direction of absolutism. This led in 1854 to a new outbreak. A coalition of the more liberal Moderates under Narvaez and Progressists under O'Donnell was formed and was joined by Espartero, now again recognized as one of the Progressist leaders. Maria Christina left the country and a Government was formed with Espartero as President of the Council and O'Donnell as Minister of War. The latter was now at the head of a new party, the Liberal Union, which favored a liberal constitutional monarchy. In the coalition Government the Progressists were at first the dominant factor, but before the new Constitution of 1855 was promulgated they lost control. There were republican risings in the northeast and Carlist risings in the northwest, and the suspen-

sion of popular liberties by the Government, while engaged in the suppression of these revolts, gave an opportunity to O'Donnell and his party. Their control was short-lived, and in 1856 Queen Isabella appointed a Moderate Ministry under Narvaez, which adopted a reactionary policy. In 1858 the Queen recalled O'Donnell and he held office for five years. A war with Morocco (1859-60) had no result except to test the efficiency of the Spanish army. Spain joined France in the ill-advised Mexican expedition, but Prim, in command of the Spanish forces, signed a convention with Juarez and refused to support the French. Napoleon III. was indignant with his ally, and in Spain there was bitter discussion of Prim's course. The Progressists made it a handle for a partisan attack on the Government and the Moderates also took a hostile attitude. The O'Donnell Government, which had added vastly to the national debt, went down in 1863.

With the passing of the Liberal Union there was a gradual return to absolutism. The Miraflores Government, which succeeded that of O'Donnell, attempted to govern constitutionally, but the absolutist pressure in Court circles was too strong, and this Ministry gave way to successors more pliable. The Government really fell into the hands of the *camarilla*, a group of personal favorites who had influence with the Queen. The Liberal groups were forced more and more into a hostile and revolutionary attitude. Castelar (q.v.), then a professor in the University of Madrid, raised his eloquent voice against the extravagance of the Crown and was supported by the university. The Government attempted to suppress such agitation. The Cortes was dissolved in 1866 and Marshal Serrano (q.v.), president of the Senate, was sent into exile. Narvaez, who had represented all shades of political opinion at different times, was now called to the head of affairs and maintained a strong Government, which was really a military dictatorship, until his death in 1868. An open revolt, headed by Prim, failed, but a little later Prim, Serrano, and Admiral Topete (q.v.) began a better organized and better supported revolutionary movement. The fleet at Cadiz under Topete declared for national sovereignty. Serrano marched toward the capital, defeated the Government forces at Alcolea on September 28, 1868, and on October 3d entered Madrid, already in a state of insurrection. Isabella in the meanwhile escaped into France and the revolution was accomplished.

A provisional government was established by the revolutionists under the presidency of Serrano. A liberal monarchical constitution was put through by a combination of Republicans under Castelar and Progressists under Prim, and was promulgated June 6, 1869. Serrano was made Regent, with Prim as Prime Minister. Carlists, Republicans, and Constitutional Monarchists all aspired to profit by the upheaval in the government. Several foreign princes were invited to take the crown—among them Prince Leopold of Hohenzollern, whose candidacy (July, 1870) gave rise to irritation between France and Germany, and in a measure provoked the Franco-German War. At last, in December, 1870, Amadeus, Duke of Aosta, son of King Victor Emmanuel, accepted the crown (see AMADEUS I.), but before his arrival in Madrid Prim, the king-maker, was assassinated. King Amadeus thus lost a strong support, and he abdicated February 11, 1873, after a brief and uncomfortable reign, distracted at the end by a great rising in favor of the young Don Carlos (Charles VII.) and disturbed by an insurrection in Cuba, which had broken out in 1868. A republic was then declared. Figueras was the first president of the Ministry, with Castelar as Minister of Foreign Affairs. A constituent Cortes was summoned in June, and prepared a constitution making Spain a federal republic. Several Ministries attempted vainly to cope with the situation, which, in addition to the Carlist insurrection in the north, was complicated by the risings of the Intransigentes (see INTRANSIGEANTS) and Internationals in the cities of Andalusia, Murcia, and Valencia. On September 7th Castelar was made President of the Executive with dictatorial powers, and the Cortes adjourned until January, 1874. The wise and positive course of Castelar in enforcing order and recognizing conservative interests displeased the extremists, and when the Cortes reassembled a vote of lack of confidence was passed. Castelar resigned, and Serrano became nominally President of the Executive, but in reality a military dictator. He carried on with vigor the war against the Carlists, but he had hardly secured recognition for his Government from the European powers when Gen. Martinez Campos (q.v.) proclaimed Alfonso XII., son of Isabella, King (December, 1874). The army declared for Alfonso. The Serrano Government, of which Sagasta (q.v.) was then Prime Minister, gave way, and Cânovas del Castillo (q.v.) headed a provisional government. Alfonso, then seventeen years of age, assumed the government on January 14, 1875, guided by Cânovas del Castillo. The Carlist revolt was completely suppressed in 1876. Don Carlos went into permanent exile, and Navarre and the Basque Provinces were deprived of their ancient privileges and *fueros* (q.v.). A constitution of a decidedly illiberal character was adopted in 1876, and its provisions were enforced with severe literalness by the Ministry of Cânovas del Castillo. By 1878 order had been reëstablished throughout most of Cuba. Martinez Campos, who was sent to the island to put down the insurrection, came back in 1879 an advocate of a reform policy toward Cuba, and attempted to form a Ministry on that issue, but failed and went into the opposition. Much of his programme, including abolition of slavery in the Antilles, was carried out by Cânovas del Castillo. In 1881 a more liberal régime was inaugurated under Sagasta.

The government under the restored monarchy was nominally in the hands of a Ministry responsible to the majority in the Cortes, but personal factions and rivalries disintegrated parties to such an extent that this was not so in practice. There were two leading parties—Conservatives, and Liberals or Constitutionalists, both upholding the constitutional monarchy. The remnant of the Carlists could do little but agitate. The Republicans lacked a leader, since Castelar had given up the republican programme as impracticable. Cânovas del Castillo returned to power in 1884, after having been out of office for three years. On November 25, 1885, Alfonso XII. died, and his widow, Christina, who was pregnant, became Regent of the kingdom, the Pre-

miership being intrusted to Sagasta. On May 17, 1886, Christina gave birth to a son, who became King as Alfonso XIII. Sagasta governed with vigor, energetically repressing military uprisings, and brought about the enactment of a measure providing for universal suffrage. A Conservative Ministry under Cánovas del Castillo was in office from July, 1890, to December, 1892. The succeeding Liberal Ministry under Sagasta was unpopular because of its attempt to apply needed economies and its severe measures to repress anarchism, which had become rampant in Catalonia. In 1895, when a new revolt broke out in Cuba, the Conservatives returned to power under Cánovas del Castillo. The army officers were dissatisfied with the growth of the civil power and restive under the criticism of an increasingly independent press. Premier Cánovas del Castillo was assassinated in 1897, and Sagasta took his place at the helm, in time to face the problems of a war which was already imminent. The Cuban revolt, which consumed the flower of the Spanish army, and in the effort to suppress which the most cruel military measures were instituted, produced complications which led in 1898 to a conflict with the United States. (See CUBA; SPANISH-AMERICAN WAR; UNITED STATES.) This unequal struggle was brought to a close by a treaty of peace negotiated at Paris, December 10, 1898, by which Spain relinquished her sovereignty in Cuba, Porto Rico, and the Philippine Islands. Later the Caroline, Pelew, and Ladrone Islands were sold to Germany.

The military party under Weyler (q.v.) made the peace treaty an issue, and forced Sagasta out of office. A Conservative Ministry headed by Silvela came in but resigned in October, 1900, and a reconstruction was effected under General Azcarraga on distinctly military lines. A congress of the Spanish-American States was held in Madrid in November, 1900, at the instance of the Sociedad Unión Ibero-Americana, for the purpose of establishing more cordial relations with these offshoots of the older Spain. Anti-clerical disturbances in 1901 pointed to a growing spirit of liberalism and independence. A new government was organized under Sagasta, March 6, 1901, and adopted a stern attitude toward the religious Orders. King Alfonso XIII. came of age May 17, 1902, and the regency was terminated. For several months Sagasta retained office with great reluctance, and on December 6, 1902, the Ministry retired and an entirely new Cabinet was constituted by Silvela.

GENERAL BIBLIOGRAPHY. Reclus, *Géographie universelle*, vol. i. (Paris, 1879); Foresta, *La Spagna da Irun a Málaga* (Bologna, 1879); Eschenauer, *L'Espagne* (Paris, 1884); Mariana y Sanz, *Diccionario geográfico, estadístico municipal de España* (Valencia, 1886); Lawson, *Spain of To-day* (London, 1890); Castillo, *Gran diccionario geográfico, estadístico é histórico de España* (Barcelona, 1889-92); Wallis, *Spain, Her Institutions, Politics, and Public Men* (Baltimore, 1896); Root, *Spain and Its Colonies* (London, 1898); Plummer, *Contemporary Spain* (ib., 1899).

TRAVEL: DESCRIPTION. Hay, *Castilian Days* (Boston, 1882); F. Hopkinson Smith, *Well-Worn Roads of Spain, Holland, and Italy* (Boston, 1886); Finck, *Spain and Morocco: Studies in Local Color* (New York, 1891); de Amicis, *Spain and the Spaniards*, trans. (New York, 1892); Hare, *Wanderings in Spain* (6th ed., London, 1892); Wood, *The Romance of Spain* (London, 1900); Bates, *Spanish Highways and Byways* (ib., 1900); Higgin, *Spanish Life in Town and Country* (New York, 1903); and for the people, Rose, *Untrodden Spain and Her Black Country* (ib., 1875); id., *Among the Spanish People* (ib., 1877).

Consult also for economics, government, etc., Carey, *Constitutional Government in Spain* (New York, 1889); Seignobos, *Histoire politique de l'Europe contemporaine* (Paris, 1897); Zimmerman, *Die Kolonialpolitik Portugals und Spaniens* (Berlin, 1896); Diercks, *Spanien. Kulturgeschichtliche und wirtschaftspolitische Betrachtungen* (ib., 1901); and for flora and fauna, Chapman and Buck, *Wild Spain* (London, 1893); Colmeiro, *Enumeración de las plantas de la peninsula hispano-lusitana é Islas Baleares* (Madrid, 1885-89); Willkomm, *Grundzüge der Pflanzenverbreitung auf der iberischen Halbinsel* (Leipzig, 1896).

For history: Lafuente, *Historia general de España*, 28 vols., extends to the death of King Ferdinand VII.; Dunham, *The History of Spain and Portugal* (London, 1832), covers the field down to the French Revolution. Other general histories are Burke, *History of Spain* (2d ed. by Hume, New York, 1900); and Lembke and Schäfer, *Geschichte von Spanien* (Hamburg, 1831-61). Works on special periods are: Mommsen, *Provinces of the Roman Empire* (Eng. trans., New York, 1887); Lane-Poole, *Story of the Moors in Spain* (ib., 1891); Watts, *The Christian Recovery of Spain* (ib., 1894); Irving, *The Conquest of Granada* (many editions); Prescott, *History of the Reign of Ferdinand and Isabella;* id., *History of the Reign of Philip II.;* Coxe, *Memoirs of the Kings of Spain of the House of Bourbon from the Accession of Philip V. to the Death of Charles III.* (London, 1815); Baumgarten, *Geschichte Spaniens vom Ausbruch der französischen Revolution bis auf unsere Tage* (Leipzig, 1860-71); Hume, *History of Modern Spain 1788-1898* (London, 1899).

SPALATIN, spä'lâ-tēn', GEORG BURCKHARDT (1484-1545). A German reformer and friend of Luther. He was born at Spalt, near Nuremberg, and studied law and theology at Erfurt and Wittenberg. In 1508 he was ordained priest. He became one of the trusted advisers of the Elector Frederick the Wise of Saxony. He continued to enjoy Court favor after the death of Frederick, and was made Canon of Altenburg in 1525. He wrote biographies of the electors Frederick the Wise (ed. by Neudecker and Preller, Weimar, 1851) and John the Constant, *Christliche Religionshändel* or *Religionssachen* (extracts from which were published as *Annales Reformationis* by Cyprian, Leipzig, 1818), and a history of popes and emperors of the Reformation period. Many of his manuscripts are still unpublished. Consult Seelheim, *Georg Spalatin als sächsischer Historiograph* (Halle, 1876).

SPALATO, spä'lâ-tō. A seaport of Dalmatia, charmingly situated on a peninsula in the Adriatic Sea, 74 miles southeast of Zara (Map: Austria, E 5). High mountains lie to the north

and east. Fort Grippi is on the east. The harbor, protected by a long mole, is ample and safe. In the vast and remarkable palace of Diocletian, to which the town owes its name, the Emperor lived after abdicating. The remains are interesting—the loggia, with its red columns, and a ruined rotunda, both being especially noteworthy. The old town, with its narrow streets, is mostly inclosed in the confines of the palatial ruins. The new town, with wide thoroughfares, lies to the west. The cathedral is an attractive octagonal structure of Roman origin. Spalato has a naval school, an episcopal seminary, a Serbo-Croatian national Realschule and Gymnasium, and a public garden. Spalato exports olive oil, fruit, and especially wine. A railroad connects the town with Sebenico and Knin. There are manufactures of wool and silk. Population, in 1900, 27,198, mostly Serbo-Croatians.

SPALDING, spâl'dĭng, JOHN FRANKLIN (1828-1902). An American bishop of the Protestant Episcopal Church. He was born at Belgrade, Me., educated at Bowdoin College, and at the General Theological Seminary, New York. Ordained priest, he was first stationed at Saint James's, Old Town, Me. In 1873 he was consecrated Missionary Bishop of Colorado, with jurisdiction in Wyoming. Later the missionary territory became a diocese and was divided. His principal publications are: *The Church and Its Apostolic Ministry* (1887); *The Threefold Ministry of the Church of Christ* (1864; 2d ed. 1887); *The Best Mode of Working a Parish* (1888); *Jesus Christ the Proof of Christianity* (1891).

SPALDING, JOHN LANCASTER (1840—). An American Roman Catholic bishop. He was born at Lebanon, Ky., and educated at Mount Saint Mary's College, and at the University of Louvain, Belgium; was ordained priest in 1863; was appointed secretary and chancellor of the diocese of Louisville (1869), and of Peoria (1877). He took a prominent part in various social and educational movements, and his position as an authority in the former class of questions was recognized by his appointment in 1902 as a member of the President's commission to investigate the coal strike. Among his works are: *Education and the Higher Life* (1890); *Things of the Mind* (1894); *Means and Ends of Education* (1895); *Thoughts and Theories of Life and Education* (1897); *Opportunity and Other Essays and Addresses* (1900); *Socialism and Labor* (1902); *Religion, Agnosticism, and Education* (1902).

SPALDING, MARTIN JOHN (1810-72). An American Roman Catholic bishop. He was born near Lebanon, educated at Saint Joseph's, Bardstown, Ky., and in Rome, where he was ordained priest in 1834; became Coadjutor Bishop of Louisville in 1848; Bishop 1850, succeeded Dr. Kenrick as Archbishop of Baltimore in 1864. He published *Early Catholic Missions in Kentucky* (1846), *Lectures on the General Evidences of Christianity* (1847; 4th ed. 1866), *Life of Right Rev. B. J. Flaget*, his predecessor at Louisville (1852), *History of the Protestant Reformation* (1860). Consult his *Life* by his nephew, Bishop J. L. Spalding (Baltimore, 1872).

SPALLANZANI, späl'lân-zä'nê, LAZZARO (1729-99). An Italian naturalist. He was born at Scandiano, and educated at Modena and Bologna. In 1754 he became professor at Reggio, in 1761 at Modena, and in 1768 professor of natural history at Pavia. He was distinguished in experimental physiology, where he showed the falsity of the doctrine of the spontaneous generation of life, demonstrated the physiology of digestion, and the true nature of the spermatic fluid and of the spermatozoa. His works are: *Opuscoli di fisica animale e vegetabile* (1780); *Expériences pour servir à l'histoire de la génération des animaux et des plantes* (1786); *Viaggi alle Due Sicilie ed in alcune parti degli Apennini* (1792).

SPANDAU, spän'dou. A town in the Province of Brandenburg, Prussia, situated at the confluence of the Havel and the Spree, nine miles west-northwest of Berlin (Map: Prussia, E 2). Through extensive improvements in its fortifications and the construction of numerous detached forts Spandau has been made a stronghold of the first rank for the protection of Berlin. In the citadel, which is also used as a Government prison, is kept the Imperial military reserve fund. Spandau has an infantry rifle-practice school, an artillery construction bureau, and a Gymnasium. The State ammunition, rifle, and artillery works are located here. The city owns the gas works. Its manufactures include porcelain, woolens, and military tents. The town is the shipping centre for a large trade between Berlin and Hamburg. There are fisheries and important horse and lumber markets. Spandau received municipal privileges in 1232 and was strongly fortified in the fourteenth century. Population, in 1900, 65,014.

SPANDREL. The flat wall space comprised between the extradoses of two adjoining half-arches and a horizontal line or molding touching, or nearly touching, their crowns; or, at the end of an arcade, and in structures having arches set between vertical piers or pilasters or columns, the space included between such vertical feature, the adjacent half-arch, and the molding or line immediately above the arches. This space is approximately triangular, and in decorative architecture offers an admirable field for decoration. It may be adorned with figures in relief, as in Roman triumphal arches, or with medallions, as in the Ospedale degli Innocenti at Florence and many other Renaissance buildings; with surface enrichments in color or with incised surface carving. In certain types of steel arched bridges the spandrels are formed by series of columns or other supports for the upper chord of the truss or the roadway. The term is also applied in the engineering of steel-skeleton buildings to the rectangular space between two columns from the head of a window to the sill of the window next above it.

SPANGENBERG, spăng'en-bĕrk, AUGUSTUS GOTTLIEB (1704-92). A bishop of the Moravian Church. He was born at Klettenberg, Prussia, and educated at Jena. In 1732-33 he was a member of the theological faculty of the University of Halle. He then allied himself with the United Brethren and was sent to the West Indies and North America as a missionary, receiving in 1735 a grant of land near Savannah, Ga., and establishing a colony there. The Moravians made him bishop in 1744 and for nearly twenty years

he exercised his jurisdiction principally in America. In 1760 he was called to the supreme council of the sect; four years later was appointed supreme inspector in Upper Alsatia, and in 1789 was made president of the general directory. He died at Berthelsdorf, Saxony. His principal work is *Idea Fidei Fratrum, oder kurzer Begriff der christlichen Lehre in den evangelischen Brüdergemeinden* (1782), translated into English by Benjamin La Trobe. Consult Ledderhose, *Leben Spangenbergs* (Heidelberg, 1846; Eng. trans., London, 1855).

SPANIEL (abbreviation of OF. *chien espagnol*, Fr. *chien épagneul*, Spanish dog, from Sp. *Español*, Spanish, from *España*, Spain). A short-legged, long-haired variety of the domestic dog. Two groups may be made: (1) Hunting spaniels, (2) fancy or toy spaniels. The first contains the field spaniel, clumber, cocker, Norfolk, Sussex, and the English and Irish water dogs; the second has the King Charles, Prince Charles, Ruby, Blenheim, and the Japanese spaniels. All the spaniels are exceedingly close hunters on a ground scent, and although for rapidity of action and range they have been largely supplanted by the pointer and setter, they are unsurpassable in a rough, tangled country. They neither 'point' nor 'set,' but (except the clumber) give tongue when their nose has discovered the game. The difficulty with them is to keep their eagerness in control. They will not only find game, but will retrieve it, especially from water. The chief characteristics of all varieties are length of body and shortness of legs, which in modern dogs has been greatly exaggerated, a great abundance of beautiful silky coat, and a placid disposition.

FIELD SPANIEL AND COCKER. Although of different origin, these may well be considered together. Both in form are long and low, with shapely, gracefully carried heads, and straight strong front legs. The coat is straight, dense, and silky, heavily fringing the ears, the back of the legs, and the toes. The color most preferred is solid black. The cocker usually weighs from 18 to 24 pounds, while the field spaniel is twice as heavy.

THE CLUMBER. This is a large dog weighing up to 65 pounds, with a predominance of white in its color. It takes its name from the seat of the Duke of Newcastle, who introduced the breed into England from the kennels of the Duc de Noailles of France, early in the eighteenth century. Unlike other spaniels, these hunt in silence. They are handsome, grave-looking dogs. Their heads are massive, and marked with a furrow between the eyes. The nostrils are large, open, and flesh-colored; the eyes large and deeply set, and show a 'haw.' The coat is not very long, except the profuse 'featherings,' properly lemon and white with few markings. The tail is usually docked. The Sussex spaniel is a variety of clumber which must be a rich golden liver color. It is faster in the field, and, although not mute, is less noisy than any other kind. The Norfolk is another variety of this type which arose in the English county of that name as a pheasant dog. In the days of hawking this spaniel was the falconer's special assistant. See Plate of DOGS.

IRISH WATER SPANIEL. This dog is of very ancient lineage and great value as a retriever. Its general appearance is that of a large spaniel, with a top-knot of hair falling down over the eyes. The tail tapers like that of a pointer; the face is long and the hair on it is quite free from curling, although that on the body is closely curled, and the small, dark amber eyes are set flush and have no eyebrows. The color is a rich dark liver, and the weight from 50 to 60 pounds.

TOY SPANIELS. The best known of the small pet or 'fancy' spaniels is the King Charles—a black and tan breed, which was maintained pure-blooded for many generations with jealous care by the dukes of Norfolk. In early times they were broken to hunt. Now they are only pets. They are in the main simply miniature spaniels, weighing from 7 to 10 pounds, with eyes large, wide apart, and level, and ears long, drooping, and silky. The Blenheim resembles the King Charles, but its ears are shorter and it differs in color, being a pure pearly white, with bright chestnut or ruby red markings, evenly distributed in large patches. Both the ears and cheeks are red, with a blaze of white between them, in the centre of which is one small red spot. The breed derives its name from the estate of the first Duke of Marlborough, by whose family it was bred. They were in those days trained for the hunt as well as highly prized in the house. The Prince Charles, Charles I. spaniel, or tricolor, resembles the Blenheim, except that where the Blenheim is red he is black, and he has no 'blaze.' The 'ruby' is a King Charles spaniel, with a black nose, and is wholly red. The Japanese spaniel is pure white, parti-colored with black or red or lemon, and of very small size. It may weigh 8 to 12 pounds, or only one pound, as do some of the 'sleeve-dogs,' so called in Japan because they may be carried in the coat sleeve. The Japanese spaniels have a very compact body, large, highly arched head, and their dark eyes are set high and wide apart. The nose is short and pug-like; the legs are slender; and the tail is well feathered and carried in a tight curl over the back. They are very alert and affectionate. A similar dog is highly esteemed in China, especially when solid fawn or silver in color.

Consult authorities cited under Dog; also Spicer, *Toy Dogs* (London and New York, 1903).

SPANISH-AMERICAN LITERATURE. THE COLONIAL PERIOD. Spanish-American literature owes almost nothing to the few fragments of Nahua and Inca literature that survived the destruction of hieroglyphs by the Spanish conquerors. The early literature centres largely around the City of Mexico. (See MEXICAN LITERATURE.) As subsidiary literary centres, Bogotá, Quito, Lima, and Guatemala became noted during the later colonial era.

The subject matter of intellectual colonial effort consists largely of the preparation of grammars and dictionaries of native languages (Menéndez y Pelayo in *La ciencia española* gives a list of fifty-nine of the principal ones), and of catechisms and sermons in both Spanish and the native vernacular. This work was largely utilitarian in object, and, save for the occasional translation of some fragment of native hieroglyphs, is merely of philological interest. Another branch of literary activity was the writing of the history of the conquest and early settlement of America, or the compiling of materials for that purpose. During the later colonial period works

on natural and political science began also to appear. The remaining literary effort, directed toward what is generally called pure literature, produced a few works of merit (so recognized by the mother country), which were of importance in the further literary development of America. These writers (largely ecclesiastics, though occasionally some *conquistador* handled the pen equally well with the sword), described the conflicts of the Spaniards with the natives, as did the Chilean epic poet Pedro de Oña (born c.1571) in his *Araucano domado* and Pedro de Peralta y Barnuevo (d. 1760; of Spanish birth) in his *Lima fundada;* or they depicted the beauties of natural scenery and the happenings of agricultural life, as did the Guatemalan Rafael Landívar (1731-93), in his bucolic Latin poem, *Rusticatio Mexicana;* or they collected the materials for history and wrote excellent accounts of the pacification and settlement of America, as did Juan de Velasco, of Ecuador, in his *Historia del reino de Quito*, and the Jesuits Ovalle and Rosas in Chile. Fr. Juan de Barrenechea y Albis, of the latter country, in his *Restauración de la Imperial* (1693), made a solitary attempt at novel-writing. There appeared also some worthy attempts at devotional writing, both in prose and verse, such as the *Sentimientos espirituales* of Sor Francisca Josefa de la Concepción (d. at Tunja, 1742), and *La Cristiada* of Diego de Hojeda (who lived in Lima early in the seventeenth century). Juan de Castellanos (sixteenth century), of New Granada, in his *Elegias de varones ilustres*, not only celebrated in hendecasyllabic verse the deeds of the early explorers of America and of his native viceroyalty, but also achieved the doubtful distinction of writing the longest poem in the language. The crowning glory of New Granada, however, lies in the intellectual movement which, under the leadership of José Celestino Mutis (1732-1808), the "illustrious patriarch of botanists of the New World," and the many-sided José de Caldas (1741-1816), became memorable in the Spanish-American scientific literature of the latter half of the eighteenth century. During this same period the Ecuadorean Antonio de Alcedo (died 1812) produced his *Diccionario geografico-histórico de las Indias occidentales* (1786-89), a translation of which, by G. A. Thompson, with numerous additions, was published in London (1812-15).

THE PERIOD OF INDEPENDENCE. The revolutionary days of the early nineteenth century, which, in Spanish America, substituted the radical philosophy and sentiment of the progressive French branch of the Latin stock for the unswerving loyalty and religious mysticism of the conservative Spaniard, did not wholly release American writers from dependence upon Peninsular schools of thought. It is true that through translation and imitation it is possible to trace the influence of Byron, of Hugo, of Heine, and of the other great leaders of the romantic school of literature; but in the majority of cases these and other writers are introduced to Spanish America indirectly, and above all through the writings of the Spanish romanticist Zorilla, who has exerted a most profound influence upon American authors. The one great bond that unites the separate republics and, though perhaps unwillingly, keeps them in touch with the thought of the mother country, is the 'sonorous Castilian language,' which its best writers have preserved in all its grammatical and rhetorical purity of diction; but to which they have given a buoyancy and flexibility lacking in the original, and a greater freedom of thought and a more revolutionary and virile spirit that together have rendered this 'offshoot of French art and of Latin culture' a vigorous literary product.

During the early decades of the nineteenth century themes suggested by the revolutionary conflict, in which so many of the writers took an active part, naturally formed the greater portion of the literary output. The period which followed is marked by literature of a more contemplative and personal tone. Within recent years there has arisen the new school of 'Creolism,' whose devotees show in the faithful portrayal of native customs, generally of a rustic character, many elements of rugged strength that promise well for the originality of future literature. During the century there has also occurred a shifting of literary centres in South America. Lima, Quito, and Bogotá have been relegated to a secondary rank, while Buenos Ayres, early brought under the direct influence of the French romantic school, and Caracas, influenced as profoundly by Zorilla and his followers, and Santiago, at present the centre of the most inspiring literary productions of the South American continent, far outstrip their rivals of colonial fame.

The chief literary figure of Latin America is that of Andrés Bello (q.v.), whose mastery of Castilian is illustrated in his many-sided career and whose reputation as a poet rests chiefly upon his georgic *La agricultura en la zona tórrida*. José Antonio Maitín (1792-c.1859), an other native of Venezuela, was one of the first of the ardent followers of Zorilla. Rafael María Baralt (1810-1860), in his *Historia antigua y moderna de Venezuela*, in style and method compares favorably with the best of modern Spanish historians, and also ranks high as a linguist and poet. Among others who have shed lustre on the literary reputation of Venezuela are the members of the gifted Calcaño family; the lyricist Jacinto Gutierrez Coll (1836—), made famous by his *A mi angel guardián* and *Sueño de amor;* Francisco de Sales Perez (1836—), whose *La vida del campo* is a faithful portrayal of the customs of his native *llanos;* and the present day Diaz Rodriguez, whose artistic romance, *Sangre patricián*, recalls the Italian D'Annunzio. Colombia was the home of the lyric poet José Eusebio Caro, whose *Lara* (published in 1834) marked an important literary period in the history of his native land. His associate, Julio Arboleda (died 1862), essayed in *Gonzalo de Oyón* a notable attempt at epic-writing, but achieved a greater success in his brilliant romance *Casimiro el Montañés*. The realistic poet José Joaquin Ortiz is favorably known because of his masterpiece, *Los colonos*. The most noted Spanish-American novel, *María*, is the work of the Colombian Jorge Isaacs; while the *Historia de la revolución de Nueva Granada* (1827) of José Manuel Restrepo is but one of the many historical works that have brought honor to the northern republic. Her southern neighbor, Ecuador, boasts of the statesman poet José Joaquín de Olmedo (1782-1847), whose *Canto de Junín* is the most stirring of revolutionary poems, but

whose work has been rivaled by the more recent verse of Juan Leon Mena, famous also as a critic and for his novel *Cumanda*, and Julio Zaldumbide, a poet of the contemplative school. Lima, in Peru, was the home of the political satirist Felipe Pardo de Aliaga, famous also for his dramas, *Frutos de la educación* and *Una huérfana en Chorillos*. From the middle of the century Peruvian writers have largely followed the Spanish school of romantic literature, and one of the most inspiring of this class of writers is Fernando Velarde, whose collected poems, *Flores del desierto*, appeared in 1848. José Arnaldo Marquez (1825-81) is regarded as the leading lyric poet of modern Peru. The *Noche de dolor en las montanas* of Numa Pompilio Llona (born 1832) is one of the best poems of recent Spanish-American literature. In fiction *El Padre Orani* of Narciso Aréstegui occupies a prominent place, and the dramatists Corpancho and Segura take a high rank. As under the political régime of viceroyalty days, Bolivia has continued to be in a literary sense the appendage alternately of Peru and of Argentina, but the lyric poetry of Ricardo J. Bustamante (born 1821) and the *Ensayo sobre la historia de Bolivia* of Manuel José Cortés (1811-65) have received favorable notice, as has also the *Ultimos dias coloniales en el Alto-Peru* (1896), written by Gabriel René-Moreno.

Chile, long the most backward of the South American republics, was greatly aroused by the long residence of Bello and by the coming of many exiled Argentines. Of the succeeding generation the publicist and poet Arteaga Alemparte (1835-1880) achieved a poetic triumph in his hymn *Al Amor*. Isaias Gamboa, in his *Poemas* (1902); the rare and strange Antonio Bórquez Solar, in his *Campo lírico* (1900); and Carlos Walker Martinez in *Poesías* (1894) and *Romances Americanos* (1899) exhibit an elevation of thought and a beauty of versification unequaled elsewhere in Spanish-America and hardly surpassed in Europe. Chilean writers of history and political science, among whom are reckoned Arana and the Amunâteguis, likewise enjoy an international reputation, while *Alberto el jugador*, a novel by Rosario Orrego de Uribe, and *Contra la marea*, by Alberto del Solar, attest the worth of her writers of fiction.

With the dawn of independence the classic translations and imitations of Valera, Quintana, and Cienfuegos inaugurated the literary history of Argentina, a history which includes that of her neighbor, Uruguay. In Argentina Estéban Echeverría, one of the first American lyricists, known for his *La cautiva*, introduced romanticism directly from the French, and liberated the thought of his own countrymen. His fellow citizen José Rivera Indarte produced the stirring poem *El festín de Baltasar*, and his pupil Juan Maria Gutierrez the lyrics *Recuerdo* and *A mi caballo*. Following these came a host of littérateurs, with centre at Buenos Ayres, or, in time of political proscription, at Montevideo, whose work in poetry and prose has greatly influenced the political thought and literature of their own and neighboring republics, and has rendered famous the names of the historian Vicente Fidel Lopes, the dramatist José Marmol (author also of the novel *Amalia*), and the poet José Hernandez, whose *Martín Fierro* has been the most widely sold poem of the southern continent. The *Flores silvestres* of the dramatist Francisco Javier de Acha, of Uruguay, have also met with a favorable reception, and the *Libro extraño* of Francisco Sicardi is one of the best of recent novels. The *Historia Argentina* (1894) of Mariano A. Pelliza is a monumental work of great merit. In the department of criticism the *revistas* of Buenos Ayres have occupied a leading place, and one of their most famous contributors was Juan Bautista Alberdi, whose *Escritos póstumos* appeared during the last decade. Bartolomé Mitré's *Historia del general Belgrano* is one of the most successful attempts at biographical history that the century has produced. During recent years the prevailing commercialism of the Plata valley has undoubtedly exerted a pernicious effect upon its literature. Central America, in addition to a number of political writers, has contributed to the field of letters the satirist José Batrés y Montúfar, and the writers of fables García Goyena and Matías Córdoba of Guatemala.

BIBLIOGRAPHY. Lagomaggiore, *América literaria* (Buenos Ayres, 1883); *Antología de poetas Hispano-Americanos* (Madrid, 1893); Menendez y Pelayo, *La ciencia española* (ib., 1889); Rojas, *Biblioteca de escritores venezolanos contemporáneos* (Paris, 1875); Durón, *Honduras literaria* (Tegucigalpa, 1896); *La Vénézuéla littéraire* in *La Revue*, vol. xliv. (Paris, 1903); Beristaín de Souza, *Biblioteca hispana-americana septentrional*, edited by Medina (Santiago, 1897); *Revista crítica de historia y literatura*, vol. vii. (Madrid, 1902); Torres-Caicedo, *Ensayos biográficos y de crítica literaria sobre los principales poetas y literatos hispano-americanos* (Paris, 1863); Palma, *Lira americana* (ib., 1865).

SPANISH-AMERICAN WAR. The war between Spain and the United States in 1898. After more than a century of unrest in the island of Cuba, and intermittent struggles between the Cubans and their home Government, when the increase of bloodshed, starvation, and general devastation had attracted world-wide attention, and when the rights of American citizens had been systematically disregarded by the Spanish authorities, the United States decided to interpose its friendly offices. After the 'Ten Years' War' (1868-78) in Cuba, there had been a period of comparative peace (see CUBA), but in February, 1895, the Cubans again rebelled, and the Spanish Government resorted to repressive measures of unusual severity and cruelty. The island was devastated, famine and death were everywhere, American interests suffered greatly, and the condition of affairs fast became intolerable. On April 6, 1896, Secretary of State Olney represented to Spain that American commerce was being greatly damaged, and that the Cubans were threatened with 'absolute impoverishment,' and vaguely offered the friendly offices of the United States, his 'offer,' however, falling short in definiteness to that of a resolution passed, on April 4th, by the American Congress. Olney's offer was immediately declined by Spain, and in December, 1896, President Cleveland, in his annual message, spoke of 'higher obligations' than those due to Spain, which would devolve upon the United States if conditions should grow worse in the island and if Spain's inability to deal

successfully with the insurrection should become manifest. In Congress feeling was much more radical, and the President's 'timidity' was vigorously criticised. President McKinley, at the outset of his administration, devoted special attention to the situation in Cuba. In May, 1897, Congress appropriated $50,000 for the relief of the Cubans, and on May 20, 1897, the Senate passed a resolution recognizing the belligerency of Cuba, which, however, was never acted upon by the House. Meanwhile, the activity of Cuban agents in the United States caused almost constant diplomatic friction between the two governments. A new Ministry under Sagasta in Spain made an effort to ameliorate conditions, and on October 6, 1897, recalled Captain-General Weyler, who had been held responsible for much of the Spanish cruelty to the Cubans, General Blanco being sent out in his stead. Stewart L. Woodford, of New York, had been sent as United States Minister to Spain, with special instructions to urge that country to establish civil order in Cuba, and to announce that the United States could not view with indifference the indefinite prolongation of the existing conditions. The representations of the American Minister were met with promises from Spain to give Cuba local autonomy and to ameliorate the conditions which the war methods had created. In view of these assurances, the President, in his annual message of December, 1897, recommended to Congress the postponement of action until Spain had been given ample opportunity to redeem her promises. On December 24th an appeal was issued by Secretary Sherman in the President's name, calling for contributions for the relief of the Cuban *reconcentrados*. This appeal met with a hearty response. At the opening of 1898 the Government began to concentrate its naval forces, and to accumulate war supplies. The tone of the press and the expressions of public opinion generally showed that the nation was ready for war. The relations with Spain were further strained on February 8th, when a Cuban sympathizer purloined from the mail a letter from the Spanish Minister at Washington, Señor Dupuy de Lome, addressed to a Spanish editor, and containing severe strictures on President McKinley and his policy. The Minister at once admitted that he had written the letter and resigned. The prompt disavowal on the part of Spain of any sympathy with the Minister's conduct closed the incident so far as official circles were concerned. On the evening of February 15th the battleship *Maine* (Captain Charles D. Sigsbee), which had been sent to Cuba on the representation of Fitzhugh Lee, the American Consul at Havana, but not for unfriendly purposes, according to official announcement, was blown up in Havana harbor and 266 of the crew killed. The United States and Spain at once appointed separate boards of investigation. Congress immediately appropriated $50,000,000 for national defense. On March 28th the American commission reported. It attributed the catastrophe to the explosion of a submarine mine in the harbor, but in view of the lack of evidence declined to fix responsibility. Public opinion, however, at once decided that the Spanish officials in Cuba were responsible for the disaster. On the day before the report of the *Maine* commission, the President made overtures to Spain for a cessation of hostilities and a peaceable settlement of difficulties. He tendered his good offices in the negotiation of peace and proposed a dissolution of the concentration camps and the relief of the suffering Cubans by the United States through the mediation of Spanish officers. In reply, Spain offered to leave the peace negotiations to the Cuban Parliament appointed to meet on May 4th, and to cease hostilities when the Cuban insurgents asked for it. Spain added that the concentration orders had been revoked, agreed to a joint relief of distress, voted $600,000 for that purpose, and offered to arbitrate the *Maine* case. The President regarded this reply as unsatisfactory and announced his intention of submitting the whole matter to Congress in the forthcoming message. Meanwhile, in anticipation of the war, American inhabitants left Cuba, the Cuban Government declared against interference on the part of the United States, the Cuban 'junta' demanded recognition of independence before intervention, and Spain on April 10th declared a general armistice. On the following day the President's message, describing the situation in Cuba and giving an account of the state of diplomatic relations with Spain, was laid before Congress. The President did not favor the recognition of Cuban belligerency or independence, but advocated intervention as a neutral. At all events, he declared, the war in Cuba must be ended, and he accordingly asked Congress for authority to use the army and navy to secure the formation of a Cuban government capable of discharging its international obligations and maintaining internal order. Congress promptly replied by a joint resolution declaring the people of Cuba free and independent, demanding the surrender of all Spanish authority over the island, and directing as well as empowering the President to enforce the resolution by the army and navy. Congress further declared that the United States was not "to exercise sovereignty, jurisdiction, or control over said island except for the pacification thereof." The President signed the measure, and on April 20th sent the ultimatum to Spain, fixing the hour of noon, April 23d, as the last date for a satisfactory reply. This was a practical declaration of war, for the Spanish Government had already announced its intention to oppose the policy outlined in the President's message. Both Powers at once defined their attitude on questions of international law, and preparations that had been going on in both countries were quickened, the United States devoting special attention to the equipment of the navy.

Almost immediately the Spanish Minister demanded his passports and the American Minister at Madrid was notified by the Spanish Government that diplomatic relations between the two nations had ceased. On April 23d President McKinley called for 125,000 volunteers and ordered the North Atlantic squadron to blockade Havana and other Cuban ports. Formal declaration of war by Spain on the 24th and by the United States on the 25th inst. were followed by the proclamations of neutrality by Great Britain and other foreign Powers.

The first gun of the Spanish-American War was fired (April 23d) by the U. S. S. *Nashville* across the bows of the *Buena Ventura*, a Spanish merchantman, and the first action occurred on the 27th, when three vessels of the United States

Navy under Captain Sampson bombarded the defenses of Matanzas.

Spain had an army of 60,000 men distributed throughout Cuba, and had fleets near that island and in the Philippines. Commodore Dewey, U. S. N., commanding the Asiatic squadron, then in Chinese waters, had completed the equipment and coaling of his ships, when the cable brought him orders to "proceed to the Philippine Islands; commence operations at once against Spanish fleet; capture vessels or destroy." Entering the harbor of Manila (April 30th) under cover of darkness, with his fleet (131 guns, 1678 men), made up of the *Olympia* (flagship, Captain C. V. Gridley), the *Baltimore* (Captain N. M. Dyer), the *Raleigh* (Captain J. B. Coghlan), the *Boston* (Captain F. Wilder), the small cruiser *Concord* (Commander A. Walker), the gunboat *Petrel* (Commander E. P. Wood), the revenue cutter *Hugh McCulloch*, and two colliers, he attacked the ships of Admiral Montojo, ten in number (120 guns, 1796 men), supported by land batteries. The action, which lasted from 5.41 A.M. (with an interruption of three hours) till 12.30 P.M., ended in the destruction of the Spanish vessels and the silencing of the fortifications. The American casualties were 6 wounded; Spain admitted a loss of 634 killed and wounded.

The mobilization of the United States land forces proceeded rapidly, and on May 25th a second call was made—for 75,000 volunteers. While camps of instruction were established near Tampa and Chickamauga, the Navy was watching the seacoast and preparing the way for a combined attack by the land and naval forces upon Cuba.

In the meanwhile the movements of a Spanish fleet of four cruisers and three torpedo-boat destroyers under Admiral Cervera, which sailed from Saint Vincent on April 29th, for some time puzzled the Americans. But finally (May 29th) the Spanish ships were discovered by Commodore Schley (q.v.) at anchor in the Bay of Santiago, and a carefully organized blockade of the bay was planned and rigorously conducted by Admiral (then Captain) Sampson, the commander of the American fleet in Cuban waters, who had arrived at Santiago and had superseded Schley in actual command on June 1st. In Sampson's fleet was the *Oregon* (Captain Charles E. Clark), which to join the fleet had made a wonderful trip from Puget Sound to Key West between March 6th and June 4th. A daring attempt by Lieutenant R. P. Hobson (q.v.) on June 3d to lock the door upon Cervera's fleet, by sinking the collier *Merrimac* in the entrance to the harbor, was only partially successful. The harbor of Guantanamo was occupied as a coaling station by the Americans after several collisions with the Spanish troops.

Finally, an expedition consisting of 32 transports bearing 819 officers and 15,058 enlisted men under Major-General Shafter, U. S. V., left Tampa, June 15th. The force was composed almost entirely of regulars—18 regiments of infantry, 6 regiments of cavalry (dismounted), 1 battery of engineers, 4 batteries of light artillery, 2 batteries of siege guns, and 1 balloon detachment—together with 1 regiment of cavalry and 2 regiments of volunteer infantry (subsequently increased to 4 regiments).

General Shafter's instructions from his Government were to "go with your force to capture garrison at Santiago and assist in capturing the harbor and fleet." Arriving off Guantanamo (June 20th), he communicated with the Cuban forces (5000 strong) under General Garcia, whose coöperation was secured. It was estimated that there were about 12,000 Spanish soldiers in Santiago and vicinity. A plan having been agreed upon between the United States land and naval forces, a landing was effected (June 22d) at Daiquiri of 6000 men, and on the three following days the remainder of Shafter's troops disembarked there and at Siboney, without opposition. The rainy season having set in increased the natural difficulties of an advance over a soft clay surface, covered with a tough undergrowth, interspersed with cow-paths in lieu of roads. The Spaniards had withdrawn to their intrenchments near Santiago, protected by an entanglement of barbed wire.

Although orders had been issued to the American advance to await the completion of the disembarkation and landing of supplies, the leading division under General Wheeler (June 24th) attacked the Spanish troops at Las Guasimas and after a sharp engagement dislodged them, with casualties of 68 Americans and 36 Spaniards. When the preparations had been completed for a general advance, the United States troops on July 1st, having taken up positions on the slopes of the hills in front of Santiago with a detachment of Cubans protecting their flanks, opened fire with a field battery, which, using black powder, became a target for the Spanish gunners. A battery of rapid-fire guns, however, did much execution. The character of the ground, the absence of roads, and the stout resistance of the garrison of El Caney (q.v.) retarded the advance of a part of the American force under General Lawton, but by sundown Shafter's troops were in full possession of the line of hills along the San Juan River, one and a half miles from the city. These engagements were fought chiefly by regulars, but efficient services were rendered by the First Volunteer Cavalry, popularly known as the "Rough Riders," under Colonel Leonard Wood and Lieutenant-Colonel Theodore Roosevelt. The following day was utilized by both sides in strengthening the lines and by the Americans in bringing up ammunition and rations. The exposed position of the American forces rendered an immediate advance or temporary withdrawal necessary.

On the morning of Sunday, July 3d, Cervera, taking advantage of the operations on land, had sought to escape from the harbor of Santiago. The appearance of the leading ship was the signal for every ship in the American squadron to close in upon the fugitives with a hot fire, which was returned with spirit, but without material effect. Within two hours the six Spanish ships were totally destroyed, with a loss of about 350 men killed and about 1700 men and officers captured, including Admiral Cervera. Early in the morning Sampson in his flagship *New York* had started for Siboney, where he had planned to hold a conference with General Shafter, and Schley was thus left as the ranking officer. At the beginning of the battle, however, Sampson, about ten miles away, started back, arriving before the battle was over. During the battle the Americans lost only one man killed and ten wounded. The seven American vessels engaged had a total

of 225 guns, while the Spanish fleet had only 146; the weights of metal the two fleets could throw per minute were 6720 and 4827 pounds respectively. On the same day as that on which the naval battle occurred General Shafter notified the Spanish commander, Toral, that unless he surrendered by the morning of the 4th, the city would be shelled. After several communications had passed between these officers, and the request of foreign consuls for an extension of time had been complied with, a final demand brought the truce to an end on the 10th and the joint attack by ships and troops was resumed. On the 11th another demand upon the besieged was made, culminating on July 15th in articles of capitulation providing for the surrender of all forces, material, and territory of the district of Santiago, and the transportation of all Spanish soldiers to Spain. The Spanish forces in the captured territory numbered 23,500 and of these 10,000 defended the city. Their losses aggregated nearly 1000, while the Americans killed and wounded numbered 1614, of whom 114 were officers. The American regulars bore the brunt of the action. On Sunday (July 17th) at noon the Stars and Stripes were hoisted in the plaza of Santiago. On July 27th General Miles, U.S.A., at the head of an expedition landed at Ponce, Porto Rico, and a few days later formally took possession of the island. On the 25th General Merritt arrived at Manila to assume command of 20,000 United States troops, of which the advance guard had already been sharply engaged with the Spanish forces stationed there. On August 7th Admiral Dewey and General Merritt united in a demand for the surrender of the city and the islands. This being refused, a combined attack was made, and 7000 regular and 4000 volunteer Spanish soldiers fell into the hands of the Americans, who lost 50 men killed and wounded. Meanwhile, the Filipinos had been organized by Aguinaldo, who subsequently conducted hostilities against the American troops for the purpose of gaining independence. See PHILIPPINE ISLANDS.

On July 26th Spain made overtures for peace through the French Ambassador at Washington, M. Cambon, who was authorized to act as Minister Plenipotentiary for Spain during the coming negotiations. On August 12th the peace protocol and preliminary arrangements were concluded. It was provided that the final treaty should be made by a commission to meet at Paris not later than October 1st. The representatives of the United States were William R. Day (chairman), Senator Cushman K. Davis, Senator William P. Frye, Whitelaw Reid, and Senator George Gray. After prolonged discussions and threatened failure, the treaty was signed on December 10th. It was ratified by the United States Senate on February 6, 1899, signed by the Queen Regent of Spain on March 17th, and final ratifications were exchanged on April 11th. Diplomatic relations were soon resumed. By the treaty, Porto Rico and the other Spanish West Indian Islands, Guam in the Ladrones, and all of the Philippines were ceded to the United States, which in return agreed to pay $20,000,000 and to yield some temporary commercial privileges in the Philippines. The political status of the inhabitants of the new possessions was to be determined by the new Government.

The finances for the war were provided by special taxes. On June 13, 1899, an act was approved for that purpose. Internal taxes were increased and a stamp tax imposed on certain papers and articles. A popular loan was also negotiated. This war tax continued in force until March 2, 1901, when a reduction was made, and on April 14, 1902, the remainder was repealed. The total expenses for the war from the opening to October 31, 1898, were estimated at $165,000,000. During that period the lives of 2910 American soldiers were lost, all but 306 from disease. The enormous death rate in the camps brought out serious charges of maladministration against the War Department that culminated in the appointment of a committee of investigation, which after a thorough examination of charges reported in general in favor of the department, laying most of the blame upon the want of preparation at the time war broke out. For further details concerning the results of the war, see UNITED STATES; CUBA; PORTO RICO; PHILIPPINE ISLANDS.

Consult: Lodge, *The War with Spain* (New York, 1899); Bigelow, *Reminiscences of the Santiago Campaign* (ib., 1899); Alger, *The Spanish-American War* (ib., 1901); Sigsbee, *The Maine* (ib., 1899); Hobson, *Sinking of the Merrimac* (ib., 1899); Kennan, *Campaigning in Cuba* (ib., 1899); Miley, *In Cuba with Shafter* (ib., 1899); Spears, *Our Navy in the War with Spain* (ib., 1898); Joseph Wheeler, *Santiago Campaign, 1898* (Philadelphia, 1899); Atkins, *The War in Cuba; the Experiences of an Englishman with the United States Army* (London, 1899); Bonsal, *The Fight for Santiago* (New York, 1899); Morris, *The War with Spain* (Philadelphia, 1899); Roosevelt, *The Rough Riders* (New York, 1899); and Titherington, *History of the Spanish-American War of 1898* (New York, 1900).

SPANISH-AMERICAN WAR, NAVAL AND MILITARY ORDER OF THE. A patriotic and hereditary society organized in New York City on February 2, 1899. It admits to membership any man of good repute who served on the active list, or performed active duty as a commissioned officer, regular or volunteer, in the United States Army, Navy, or Marine Corps, during the war with Spain, or in the subsequent insurrection in the Philippines, or who participated in the war or insurrection, prior to April 1, 1901, as a naval or military cadet, or as an officer in the Revenue Cutter Service on any vessel assigned to duty under the control of the Navy Department.

SPANISH BARBER, THE. A comedy by George Colman, the elder, produced in 1777, based on Beaumarchais's famous comedy *Le barbier de Séville.*

SPANISH BAYONET. See YUCCA.

SPANISH FLY. See BLISTER-BEETLE.

SPANISH FOWL. The black Spanish fowls constitute one of the oldest varieties of domestic poultry, and are renowned for their exceptionally fine laying qualities. The white face is a distinguishing feature, and should be long, smooth, free from wrinkles, rising well over the eyes in an arched form, extending toward the back of the head and to the base of the beak, covering the cheeks and joining the wattles and ear-lobes. The color of the plumage is rich, glossy black, and any gray is considered a serious defect. Shanks

and toes are blue, or dark leaden blue. The comb is single, and bright red in color; wattles, bright red, except the inside of the upper part, which is white; ear-lobes, pure white.

SPANISH FRIAR, THE. A drama by Dryden, produced in 1681, written against the Roman Catholic priesthood. Two plots, one serious, the other comic, are combined in the story, connected by Dominick, the friar, a fat amusing rascal.

SPANISH GYPSY, THE. (1) A romantic comedy by Middleton, assisted by Rowley, printed in 1653. Two stories are combined, one from Cervantes's *Fuerza de la Sangre* and the gypsy tale from his *La Gitanilla*. (2) A long dramatic poem by George Eliot (1868). A duke of mediæval Spain is about to marry Fedahua, a beautiful girl, who discovers that she is the daughter of the gypsy chief Zarco. The call of race and duty conquers, followed by a tragic renunciation of her love.

SPANISH LANGUAGE. A Romance language, evolved out of Latin in the Iberian Peninsula and carried by Spanish colonists to the Canaries, the Antilles, the Philippines, Mexico, portions of the United States, Central America, the greater part of South America, and a few places on the coast of Africa, and by the Jews into Turkey and other regions in which they settled after their expulsion from Spain. In the Iberian Peninsula the boundaries of the Spanish-speaking domain do not coincide exactly with those of the political division called Spain, since within the latter are contained Galicia, whose inhabitants speak a Portuguese dialect, a Basque-speaking district in the north, and a Catalan-speaking region in the east. The inhabitants of the Balearic Islands speak a Catalan dialect. Probably not far from 50,000,000 persons at present use Spanish as their native tongue, the majority being in the New World. Five principal dialects are distinguishable in the language as spoken in the mother country: Asturian, Leonese, Aragonese, Andalusian, and Castilian. Castilian has become the standard literary speech.

Castilian has the five simple vowels, *a, e, i, o, u*, a variety of diphthongs, and a few triphthongs produced by the union of a strong vowel (*e, o, a*) with two weak vowels (*i, u*). Examples of the diphthongs and triphthongs are *iu* in *viuda*, 'widow;' *ui* in *ruido*, 'noise;' *ai* in *baile*, 'dance;' *eu* in *deuda*, 'debt;' *io* in *Dios*, 'God;' *iai* in *estudiáis*, 'you study.' The diphthongs *ie* and *ue* are especially common as representatives of a Latin short *e* or *o;* compare Latin *bĕne* and *fŏrum* with Spanish *bien* and *fuero*. Qualitative distinctions in vowels (open and close *e* and *o*) exist, but are not so marked as in certain other Romance languages (e.g. Italian and French). In assonance (rhyme of vowels without that of the consonants) these qualitative distinctions are not regarded; open and close *e* may therefore rhyme together, as may also open and close *o*, and, furthermore, final unaccented *i* and *u* may rhyme respectively with *e* and *o* similarly situated. Although *liaison*, strictly speaking, is not a feature of Spanish pronunciation, yet in rapid speech the vowel ending one word may be merged into the same vowel of the immediately following word, provided this latter be syntactically allied to it (e.g. *mi querida amiga* may become *mi queridamiga*, with a possible compensatory lengthening of the *a*). The consonant sounds are *p;* a bilabial spirant written both *b* and *v* (the more frequent sound of these letters); a labial stop written both *b* and *v* (the value of these characters where they follow an *m* of the same word or an *n* at the end of the preceding word, as in *también* and *en vida;* the sound is that of the usual English *b*, the sound of the English *v* not existing in Spanish); *f; w* (written *u* in hiatus); *m; t; d* (both *t* and *d* are articulated farther forward in the mouth than the corresponding English sounds, and *d* has a decided tendency to become everywhere the interdental spirant); a voiceless spirant that is interdental or nearly so (written *c* before *e* or *i*, and *z* before a consonant, at the end of a word, or before any vowel, though rarely now before *e* or *i;* e.g., *celo*, 'zeal;' *cielo*, 'heaven;' *zapato*, 'shoe;' *raiz*, 'root;' the value is about that of *th* in the English *breath*); a voiced spirant, interdental or nearly so (written *d*, which has this sound especially between vowels, as in *lado*, 'side;' or when preceded by a vowel and followed by *r*, as in *padre*, 'father,' or at the end of a word, as in *abad*, abbot; the value is about that of *th* in the English *breathe*); *l;* a palatalized *l* (written *ll* and pronounced nearly like the *li* of *filial*); *n;* a palatalized *n* (written *ñ*, and pronounced like the *ni* of *pinion*); a simple tongue-trilled *r* (never slurred); a reënforced form of the same sound (written *rr* between vowels and *r* at the beginning of a word, or after *s, l,* or *n* within a word, e.g. *perro*, 'dog;' *reo*, 'criminal;' *israelita*, 'Israelite;' *honra*, 'honor'); a voiceless *s* (with the value of the English *ss*); *y* (written both *i* in hiatus and *y*); *k* (written *c* before *a, o,* and *u*, or before a consonant and in the final position, and *qu* before *e* and *i*—*carro*, 'car;' *frac*, 'frock coat;' *acto*, 'act;' *querer*, 'to like;' *quién*, 'who'); *g* (the so-called hard sound of English *g* in *game, get;* written *g* before *a, o, u,* and *gu* befor *e, i*—*gato*, 'cat;' *guerra*, 'war'); a velar or guttural spirant (with approximately the value of *ch* in Scotch *loch* and German *nach;* written *j* in all positions and *g* frequently before *e, i*—*jamás*, 'never;' *gente*, 'people;' some observers find also a voiced form of this spirant, but it is usually voiceless); a velar *n* (with the value of English *ng* in *sing;* written *n* before a guttural or palatal, as in *banco*). It is the general rule that the Spanish written characters represent actual sounds; but *u* is frequently used before *e* or *i* as a sign that a preceding palatal consonant has the 'hard' or stop value, as in *que* or *guerra; j* is silent in the singular noun *reloj;* and in a few words like *usted* a final *d* may not be pronounced. The simple *h* is generally not pronounced, though before the diphthong *ue* it may have a slight aspiration. In the conjunction *y* (= 'and') the sound is that of the vowel *i*. An aversion to the doubling of consonants is a distinguishing feature of Spanish spelling; *c* and *n* alone may be doubled, as in *acción*, 'action,' and *innoble*, 'ignoble,' and these combinations must be pronounced as double sounds wherever they occur; *ll* and *rr* are properly not doubled consonants, and they figure as individual signs in the alphabet. Among the combinations of consonants may be mentioned *ch*, like *ch* in the English word *church;* e.g. *chico*, 'little.' According to the Academy the written *x* is a double

consonant equivalent to *ks;* but before a consonant there is a rather widespread tendency to pronounce it like a simple *s*. In older Spanish *x* was a much more common character than now and had the value of our *sh*. By a decree of the Spanish Academy issued in 1815, *x* with the value of *sh* has been displaced in favor of *j*, pronounced as described above. The matter of accentuation is governed by strict rules of the Academy. Words ending in a consonant not *n* or *s* regularly stress the last syllable; e.g. *verdad*, 'truth;' *amar*, 'to love.' Words ending in *n* or *s* or in a vowel regularly stress the syllable before the last; e.g. *aman*, 'they love;' *hijos*, 'sons.' Words infringing these rules and all words stressed on a syllable not the last or second last must bear a written acute accent on the stressed syllable, as *nación*, 'nation;' *cortés*, 'courteous;' *médico*, 'physician.' If a diphthong or a triphthong occur in the stressed syllable the stress will fall upon its strong element (*a*, *e*, or *o*), and where the diphthong consists of two weak elements (*i*, *u*) the second of the two will have the stress.

In its chief grammatical usages Spanish accords with French, Portuguese, Italian, and the other Romance languages. A decided peculiarity is the use of the preposition *á*, 'to,' before the direct object of a verb, when that object represents a person, e.g. *veo á mi amigo*, 'I see my friend.' Like Portuguese, Spanish has two verbs 'to have' (*tener* and *haber*, the latter used as an auxiliary in conjugation) and two verbs 'to be' (*estar* and *ser*), and in each case the functions of the verbs are distinct. With *estar* and the gerund of a principal verb there may be formed a very useful periphrastic conjugation corresponding to the English progressive form, thus, *Juan está estudiando*, 'John is studying.' Instead of the four conjugations of Latin there are but three in Spanish; furthermore, regular verbs of the Spanish second conjugation and the Spanish third conjugation differ in only four forms, viz. the present infinitive, the first and second persons plural of the present indicative, and the second plural of the imperative. There are certain radical-changing verbs which, though perfectly regular as to their endings, change their root vowels *e* and *o* under the accent, and, in some cases where they are not accented, to the diphthongs *ie* and *ue* respectively, or, going a stage farther, to the simple vowels *i* and *u*. The subjunctive mood persists with much more vigor than in most modern languages; besides the usual present and imperfect tenses, it has a second imperfect form (called also the conditional subjunctive), which is properly a descendant of the Latin pluperfect indicative, and upon occasion may still be used as an indicative pluperfect or aorist in Spanish, and also a future tense. Auxiliaries are used to form the compound tenses, as in the sister Romance tongues, but, contrary to the custom in French and Italian, it is 'to have' (*haber*) and not 'to be' that forms the perfect tenses of reflexive verbs, thus, *se ha lisonjeado*, 'he has flattered himself.' The neuter gender survives in the case of the singular of the definite article *lo*, of the demonstrative words, *esto*, *eso*, *aquello*, and of the objective pronoun of the third person *lo*. These neuter forms occur only in indefinite and general constructions, and then the neuter article, always accompanied by an adjective (or an adverb), forms abstract expressions, thus, *lo bueno*, 'the good' = 'goodness.'

Latin, of course, forms the basis of the Spanish vocabulary, but there is an admixture of words from other sources. There are doubtful traces of words from pre-Romance languages, such as Iberian and Celtic and the speech of the Punic invaders and colonists. Despite trading relations, no permanent acquisitions seem to have been made from Greek until after the Roman conquest. The Visigothic invasion brought a few Germanic words, and that of the Arabs brought in a host of Oriental words, many of which are easily detected by the prefixed Arabic article *al*. In the eleventh century many lexical elements came from beyond the Pyrenees with the entrance of French soldiers, ecclesiastics, and colonists, and an infusion of Italian elements was occasioned by Aragonese domination in Italy and by the great vogue of Italian poetry in the Spanish Peninsula during the fifteenth and sixteenth centuries. Colonial relations have led to the introduction of a few terms from Indian and other sources; and learned influences have constantly increased the stock of borrowings from Latin, Greek, and French.

Traces of written Spanish are found in Latin deeds and grants as early as the eighth century, but the first really important Spanish document is one of the eleventh century, containing a series of glosses, and literature in Spanish does not begin until the twelfth century, in so far as the extant documents are concerned.

BIBLIOGRAPHY. The second decade of the eighteenth century saw the founding of the Spanish Academy, and the results of its activity were a *Diccionario de la lengua castellana* (Madrid, 1726-39), an *Ortografía* (1742), and a *Gramática* (ib., 1771; new ed. 1895). An abridged edition of the *Diccionario* was produced in 1780, and has been repeatedly revised (13th ed., ib., 1899). Among the many dictionaries, grammatical treatises, etc., may be mentioned: Salvá, *Nuevo diccionario de la lengua castellana* (7th ed., Paris, 1865); Domínguez, *Diccionario nacional, ó gran diccionario clásico de la lengua española* (15th ed., Madrid, 1882); Barcia, *Primer diccionario general etimológico* (ib., 1881-83); De Eguilaz y Yanguas, *Glosario etimológico de las palabras españoles de origen oriental* (Granada, 1886); Dozy and Engelmann, *Glossaire des mots espagnols et portugais dérivés de l'arabe* (2d ed., Leyden, 1869); Cuervo, *Diccionario de construcción y régimen de la lengua castellana* (Paris, 1886 et seq.); Lopes and Bensley, *Nuevo diccionario inglés-español y español-inglés* (ib., 1900); Velazquez de la Cardena, *New Pronouncing Dictionary of the Spanish and English Languages* (rev. ed., New York, 1900); Bustamante, *Dictionary of the Spanish and English Languages* (Paris, 1897); Bello and Cuervo, *Gramática de la lengua castellana* (6th ed., ib., 1898); Knapp, *Grammar of the Modern Spanish Language* (New York, 1882); Ramsey, *Text-Book of Modern Spanish* (new ed., ib., 1902); Garner, *Spanish Grammar* (ib., 1901); Edgren, *Elementary Spanish Grammar* (ib., 1899); Baist, "Die spanische Sprache," in Grolber, *Grundriss der romanischen Philologie*, vol. i. (Strassburg, 1888).

SPANISH LAW. The most widely extended branch of the civil law (q.v.). Even if Portuguese law, which is an offshoot of mediæval Spanish law, be left out of the reckoning, Spanish law prevails to-day over a wider area and governs a larger population than any other system except the English. Spanish law, in its Castilian form, was introduced into all the Spanish colonies. In Mexico, in Central America, and in all of the South American States, except Brazil (which is governed by Portuguese law), the law of Castile still forms the historical basis of the legal order. Modern Spanish law, as codified in the later decades of the nineteenth century, obtains in Cuba, in Porto Rico, and in the Philippines.

HISTORY. (1) *Pre-Roman and Roman Periods.*—in mediæval Spanish law, some legal historians find traces of Iberian, Celtic, and Phœnician customs; but for all practical purposes the history of Spanish law begins with the conquest and civilization of the peninsula by the Romans. Until the fifth century of the Christian Era the rule of the Roman law was as complete in Spain as in any other province of the Roman Empire. The laws of Malaga and Salpensa, preserved in inscriptions dating from A.D. 82 or 83, are among the most valuable sources of our knowledge of Roman municipal law.

(2) *Visigothic Period.*—A new and important element was introduced in the fifth century by the German conquest of the peninsula. In the Visigothic kingdom, which existed until 711, the conquered Roman population retained, for nearly two centuries, their own law in matters that concerned themselves only. A special compilation of Roman law, the so-called Breviary of Alaric (q.v.), was drawn up for their use, A.D. 506. From the name of the royal official who attested the copies of this compilation, it is generally described in Spanish legal literature as the Breviary of Anianus. The Visigothic conquerors, however, lived by their own customs and laws; and to these, in case of conflict, the Roman law gave way. Their law also was put in written form. The so-called Lex Antiqua Visigothorum (palimpsest in the Bibliothèque Nationale, Paris) is ascribed by some authorities to King Euric (A.D. 466-c. 485), by others to King Leovigild or to King Reccared, a century later. The written law of the Visigoths was developed from reign to reign, with an increasing infusion of Roman law, civil and ecclesiastical. The assemblies which approved these laws were practically Church councils; they consisted wholly or chiefly of prelates. About the middle of the seventh century the Breviary of Alaric was deprived of legal authority, and the Romanized Lex Visigothorum became the general law of the peninsula. The form in which this code has come down to us is practically that which it received in the reign of King Reccessuinth (649-672). In the eighth and following centuries the Visigothic code was frequently described as the Liber Judicum, or Forum Judicum, or (in the vernacular) Fuero Juzgo. To the Visigothic period belongs a Spanish collection of council decrees and Papal decretals, the so-called Hispana, which was much used in Western Europe and became one of the most important sources of the canon law (q.v.).

(3) *Mediæval Period.*—The Moorish conquest and occupation of the peninsula (A.D. 711-1492) left few permanent traces upon Spanish law. The Christians who lived under Mohammedan rule retained not only their religion, but, in matters concerning themselves alone, their laws also. This was the case even with the so-called 'Mozarabs' who accepted the speech of the conquerors, as is shown by the existence of an Arabic translation of the Hispana and by Arabic notes on the Visigothic code. As the peninsula was gradually reconquered and the Christian States of Northern Spain, the Moors who remained enjoyed similar privileges; but the general expulsion of the 'Moriscos' (A.D. 1609-14) left Catholic Christianity and Gothic-Roman law in complete dominion. In Christian Spain, however, as in other parts of Europe, the development of the law during the Middle Ages was particularistic. The Visigothic code remained, in theory, applicable, but its rules were superseded by local, provincial, and class customs and laws (fueros, q.v.). The Spanish cities obtained charters of self-government (cartas pueblas) and developed independent city laws earlier than in the cities in the rest of Europe. The earliest town law that has come down to us is that of Leon (1020). At the close of the fourteenth century there was scarcely a town of any consequence that had not its own fuero. In the open country, the tenants and serfs of the Crown, of the Church, and of the nobles lived by different manorial customs. The earliest fueros of provinces or kingdoms represented the legal customs of the nobles; one of the most interesting of these is the Fuero Viejo of Castile (1212). In the thirteenth century attempts were first made to combine the general rules of provincial and town law in 'general fueros' of the various kingdoms, issued by the kings with the approval of the estates. Such were the Fuero Real (1255) and the Ordenamiento de Alcalá (1348) in Castile; the Fuero de Huesca (1247) and the Observancias (1437) in Aragon; and the Fueros Generales of Navarre (1237) and of Valencia (1239). The revival of the study of the law-books of Justinian in the twelfth and following centuries resulted in Spain, as elsewhere, in more or less 'reception' of Roman Imperial law. (See CIVIL LAW.) In Catalonia, in Valencia, and in Navarre the law-books of Justinian, as interpreted by the Italian commentators and taught in the Italian and Spanish universities, were received as subsidiary 'common law.' In Aragon and in Castile they were not so received, in bulk; but in Aragon the new jurisprudence influenced legislation, and in Castile it produced an essentially Roman code, the celebrated Siete Partidas. In its first form (so-called Spéculo or Setenario) this code dates from c.1260, but it did not obtain legal force until 1348. It was to be applied only when the general laws of Castile and the special fueros still in force furnished no rule; but in practice, through the influence exercised upon the courts by the doctrines of the universities, the Partidas to some extent supplanted the purely Spanish sources.

(4) *Modern Period.*—The union of Castile and Aragon (1479), the conquest of Granada (1492), and the annexation of Navarre (1512) established the modern Kingdom of Spain. In the new Spain, however, the provinces that had been

separate kingdoms retained a considerable degree of autonomy. Each of them kept its separate parliament (Cortes) and in each of them the law was developed by provincial legislation. In each of them compilations of the laws were made from time to time. In Castile the most important legislative products were the Ordinanzas Reales (1485), the Leyes de Toro (1505), the Nueva Recopilación (1567), and the Novísima Recopilación (1805-7). After the parliaments had ceased to play an important part some of the new laws promulgated by the kings were made applicable to all Spain, but no serious efforts to establish a common national law of marriage, it does not derogate from the penal code was adopted in 1822; another in 1848; another, which is still in force, in 1870. The existing code of criminal procedure dates from 1882. A code of civil procedure was promulgated in 1855 and revised in 1881. In 1885 a commercial code was adopted. The attempts to unify the civil law encountered obstinate resistance, because of the attachment of the provinces to their ancient fueros. The law of real property was transformed, early in the century, by the abolition of feudal tenures and of entails, and an important law requiring the registration of conveyances, mortgages, etc., was adopted in 1861 (revised in 1871). Civil marriage was introduced in 1870. In 1888 a general civil code was adopted (revised in 1889), but this code has not given Spain a common law, for, except as regards the law of marriage, it does not derogate from the laws previously in force in Navarre, Aragon, Catalonia and the Balearic Isles; i.e. it has, in these provinces, only subsidiary force. In Catalonia the Roman law, civil and canon, is still subsidiary law. In the rest of the peninsula, however, the code of 1888-89 has replaced the older laws.

SPANISH COLONIES. From the early part of the sixteenth century many laws were issued concerning the colonies. The earliest compilation of these laws was made in Mexico, in 1563, by Vasco de Puga. In 1570 was published, in Spain, a collection of Orders in Council affecting the colonies, and a fuller collection was made early in the seventeenth century. In 1680 a code of colonial laws was published—Recopilación de las leyes de las Indias. (This was repeatedly revised, the last edition dating from 1841.) This code dealt chiefly with administrative matters, to some extent with crimes and penalties, hardly at all with private law. In matters not covered by special colonial legislation the laws of Castile had been applied from the beginning, and this practice was expressly sanctioned in the Laws of the Indes, II., i., 2 and II., xv., 66.. In the early part of the nineteenth century (1810-26) all the Spanish colonies of Central and South America achieved their independence. These republics have adopted codes of their own. The earliest Spanish American civil code was that of Bolivia (1831). The most important is that of Chile, which has served as a model for several other Central and South American codes. All these codes, like the Spanish code of 1888-89, show the influence of the Code Napoléon. (See CODE.) In Cuba, Porto Rico, and the Philippines the Spanish codes of the nineteenth century are still in force.

BIBLIOGRAPHY. SPANISH: *Histories of Spanish Law*, by Sempere (1847), Marichalar y Manrique (1863), Falcón (1880), Moret (1893), Antequera (1895). That by Hinojosa (1887) deals with the earlier periods only, till A.D. 711. Systematic works on the older Spanish law by Sala (1803, and many subsequent editions) and De la Serna y Montalbán (1841, 13th ed. 1881). *Commentaries* on the civil code of 1888-89 by Manresa y Navarro, Falcón, Sanchez Román, and Scævola. The last is the most voluminous. *Dictionaries* (i.e. encyclopædic works in alphabetical order) by Escriche (1876), Sanchez de las Matas (1883), and Alcubilla (1895). The last is in 9 vols. with annual appendices. In English there are no works of value except translations of texts, as selections from *Las siete partidas* (New Orleans, 1820). The Spanish codes and the more important Spanish laws in force in our insular dependencies are published by the United States War Department. In German: a history of Spanish law by Brauchitsch (1852). In French: translations of the codes; also Lehr, *Eléments de droit civil espagnol* (Paris, 1880, 1890).

SPANISH LITERATURE (called also Castilian literature, since the dialect of Castile is the dominant and literary speech of Spain). Literature in the Spanish tongue began only when the process of reconquest restored to the Christian Spaniards a considerable portion of their ancestral domain. This first literature was epic song reflecting the warlike spirit of an heroic age. Very little of the Old Spanish epic poetry has been preserved to us in anything like its original form. The only considerable remains are some poems on the Cid, of which one, the *Poema del Cid*, is the oldest extant monument of Spanish literature, some fragments of a poem or of poems on the Infantes of Lara, and a learned poem on Fernán González. But allusions and records in the Chronicles and elsewhere lead us to believe that there once existed epics now lost. It was the *juglares* or minstrels who popularized and developed Spanish epic tradition, according to the theory of Gaston Paris, at first singing only the heroes celebrated by the French *jongleurs*. It was quite natural that the French tales dealing with Charlemagne's wars against the Spanish Arabs should most impress the Spaniards; and it was equally natural that the Spanish *juglares* should seek to make native heroism play some part in the conflicts with the Moors. This they did by inventing the figure of Bernardo del Carpio to supplant the French hero Roland. The traditions concerning Bernardo are preserved for us only in the prose accounts of the Chronicles, especially the *Crónica general* of Alfonso the Wise; but the Chronicles drew upon the poems of the *juglares* for the matter that they contain.

We come to a thoroughly domestic tradition in the story of Fernán González, Count of Castile (932-970), with whom began the actual though not the nominal independence of that region. An extended poetic account of his active life we owe to a monk of the monastery of San Pedro de Arlanza. This work was written in the second half of the thirteenth century, but we now possess it only in a late manuscript of the fifteenth century, which is incomplete. The *Crónica general*, however, affords us the substance of what must have been the second part of the poem. A purely Spanish tradition is found again in the tragic story of the seven Infantes of Lara (or

Salas), done to death through the perfidy of their uncle and aunt, and later avenged by their Moorish half brother, Mudarra. Here, also, the legend is preserved by the *Crónica general*, which has, in this case, absorbed many verses of the Old Spanish poems on the subject without wholly obliterating their rhyme and metre. By good fortune we still possess two of the Old Spanish poems dealing with the story of the doughtiest of all the native heroes, the Cid (q.v.), an historical personage of the eleventh century. The *Poema del Cid* has survived in but a single and incomplete manuscript of the fourteenth century, and, besides, its versification is in an exceedingly corrupt state. There are two main divisions (or *cantares*); the first begins with Rodrigo's exile from Castile, and ends with the conquest of Valencia and the marriage of his two daughters to the unhistorical Infantes of Carrión; in the second, the necessity of punishing the Infantes for their abuse and desertion of their spouses brings the Cid to the Court of Castile and affords an opportunity for completely reconciling him and his liege lord. The poem ends with a second marriage of the Cid's daughters, who, now wedding the princes of Barcelona and Navarre, make the Cid an ancestor of the later royal house of Spain. An imaginative account of the Cid's youth is found in the poem termed the *Crónica rimada*, a document of the thirteenth century relating particularly Rodrigo's slaying of Count Gormaz and the marriage of the youthful slayer to the Count's daughter, Ximena.

Much greater than the bulk of the heroic poetry preserved is that of Old Spanish religious, didactic, and narrative verse. The greater part of this verse is in the form of quatrains of alexandrines, with a single rhyme in the stanza (the so-called *cuaderna vía*). There is no knowledge of the existence of this learned poetry before the thirteenth century, but in the first half of that period it is found fully developed in a mystery play, in translations from the French or Provençal, and in poems. The mystery play, which is incomplete, is *El misterio de los reyes magos*. It is an outgrowth of the liturgical dramas or offices of the Church. No other important remains of the early Spanish drama have been discovered. Of the matter composed in *cuaderna vía* a large proportion is due to the cleric Gonzalo de Berceo, who is the first Spanish poet that we know by name. He flourished in the first half of the thirteenth century. Most of his productions deal with religious subjects. There is now attributed to him furthermore a long poem dealing with profane matter, the *Libro de Alexandre*, which relates in some 2500 stanzas the life of Alexander the Great.

With the end of the thirteenth and the beginning of the the fourteenth century the use of the *cuaderna vía* began to yield to prose in didactic composition. Contemporary with this change appeared the first true poet in Spanish literature, Juan Ruiz, who is known as the Archpriest of Hita. He belonged to the reign of Alfonso XI. (1312-50), and he was imprisoned by his superiors because of his evil life; but, like the French poet Villon, he sang with the true note of passion. In his *Cantares* (called by him *El libro de buen amor*) he recounts his erotic adventures, interspersing here and there many fables, descriptions of his disputes with Love (Don Amor), an account of a lesson which Venus, wife of Don Amor, gave him, etc.

Spanish prose, at first clumsy and labored, earliest appeared in law codes and official documents. The first use of Spanish prose for chronicle purposes is seen in the two *Anales Toledanos* put together before 1250. Between 1217 and 1223 were written certain genealogies and translations from Latin chroniclers were made in following years. Under the direction of Saint Ferdinand was begun the encyclopædic *Septenario*, which his son, Alfonso, completed, and there was planned a codification of Castilian laws. The prose thus formed, employed largely for didactic and historical works, was applied to fiction in the framework tales of Juan Manuel. Alfonso X., the Wise, wrote, or had written under his direction, many works dealing with the science of the time. Great value attaches to the so-called *Crónica general*, in which, availing himself of earlier Latin chronicles, he dealt with the history of his land from the earliest times down to the period of his own accession.

Moralizing works and collections of sententious sayings drawn from Arabic sources or written in imitation of them became rife both in Alfonso's time and in the ensuing period. One of the Arabic moral anthologies thus introduced into Spanish was the very popular *Bocados de oro*, which lived on in the poetical aphorisms of Sem Tob and Santillana.

Sancho IV. (1284-95), the successor of Alfonso X., inherited his father's love for letters, and by his direction there were prepared translations from Latin, French, and Provencal. The interesting translation, the *Gran conquista de Ultramar*, dealing with the Crusades, preserves the substance of French literary monuments now lost. This and other translations show a broadening interest in foreign literature, further exemplified in an early fourteenth-century version of the prose *Tristan*. To the first half of the same century may be ascribed the first independent example of Spanish prose fiction, the *Caballero Cifar*, and possibly also the *Amadis*, for the chivalrous romance seems already to be beginning its long period of popular favor.

Literature was not especially favored by Sancho's immediate successor, but a monarch of intellectual force appeared again in Alfonso XI. The most important of the works which were prepared under his direction was a series of chronicles that should close the gap between his own time and the period with which the *Crónica general* of Alfonso X. ended, a work which formed the basis of the *Poema de Alfonso XI.* Don Juan Manuel (1282-1345), a nephew of Alfonso X., played a more direct part in the development of letters at this time, being, like his uncle, one of the greatest prose writers in early Spanish literature. The most interesting and important of his many treatises is the famous framework of tales called the *Conde Lucanor* or *Libro de Patronio*, in which Count Lucanor, seeking advice from his tutor, Patronio, is answered by the latter with moralizing tales conveying the necessary counsel. The contents of the fifty-one tales comprise historical or pseudo-historical elements relating to Spain, matters of personal experience, Arabic traditions, besides elements drawn from Phædrus, the *Calila et Dimna*, the Barlaam story, and above all the general European stock

of stories; and all are told in an original and unpretentious style.

With the middle of the fourteenth century, an artificial form of the lyric continuing the tradition of the Troubadour poetry of Galicia, and called Court poetry—because it was mainly cultivated by versifiers attached to the royal Court—began to take the place of importance formerly occupied by epic, religious, and didactic verse. There was a transition period of some duration, however, so that the greatest development of the Provençalized lyric did not come until the reign of John II. (1407-54), and then there flourished by its side a humanistic literature bearing the impress of the Renaissance movement and an allegorical poetry that derived from the works of Dante and other Italian poets. As time went on, the Provençal Galician Court poetry passed out of vogue and the lyric measures of Italy became predominant everywhere throughout Spain. Spanish prose, already given considerable flexibility by Alfonso the Wise and Juan Manuel, becomes in the second half of the fourteenth century the medium of translation from the classics of antiquity, and, even more than the verse of this time, teems with Latinisms. Much more attractive than the verse already mentioned is the epic ballad, which was much cultivated during the period preceding the Golden Age (1550-1700) of Spanish literature; here and there may be found examples of a charming popular lyric.

Pedro Lopez de Ayala (1332-1407), who held important offices at the courts of King Pedro the Cruel and of Henry of Trastamare, was one of the last writers of his time to make any large use of the *cuaderna vía*. This form prevails in his satirical and didactic *Rimado de palacio*, in which he assails the social, political, and other abuses of his time. In the second part of the poem, he inserts, here and there, plaints, laments, and songs to the Virgin, which are lyric in their nature and are composed in various measures. These mark Ayala as one of the earliest of the Court poets who imported into Castilian that form of the lyric which, following Provençal rules, had long been cultivated in Galician. During the reign of Pedro the Cruel the Rabbi Santo of Carrión (Sem Tob) prepared his *Proverbios morales*. This collection constitutes one of the most important Hebrew contributions to Spanish literature, and it introduces a *genre* which is later to be attempted by such writers as Santillana and Pérez de Guzmán. Seriousness of purpose, lacking in the Court poetry, is present in the Dantesque allegory and vision introduced into Spain, soon after 1400, by Imperial, a native of Seville, but of Genoese origin. The serious moralizing tendency is also visible in the *Doctrina* of Pedro de Veragua and especially in the noted *Danza de la muerte* (Dance of Death), which seems to be the work of the middle of the fifteenth century. The highest point reached by culture in the reign of John II. is seen in the literary works of Santillana, of Fernán Pérez de Guzmán, of Mena, and of Rodríguez del Padrón. To Fernán Pérez we owe the *Claros varones de España* (a panegyric in verse), versified *Proverbios*, and allegorical and lyrical poems, besides historical works in prose; Rodríguez has left us ballads and a little verse in the conventional Court manner, besides a prose tale. Iñigo López de Mendoza, Marquis of Santillana (1398-1458), is probably the most impressive literary figure of the fifteenth century. He was one of the first to imitate Horace in Spain, he imported the sonnet from Italy, and he furthered the influence of Dante by copying the latter's allegorical methods in his *Comedieta de Ponza*, his *Coronación de Mossén Jordi*, and his *Infierno de enamorados*. In certain other poems he displays a didactic and a satirical bent, as in his *Proverbios*, his *Diálogo de Bias contra Fortuna*, and his *Doctrinal de privados*. The most interesting and certainly the most entertaining element of his poetical work is that represented by his love songs, such as the *serranillas*. In prose he himself prepared a *Carta al Condestable de Portugal*, in which he appears as the first true historian of Spanish literature. The influence of Dante, as well as that of Lucan, is obvious in the allegorical *Laberinto* (also called the *Trecientas*, from the original number of its stanzas) of Juan de Mena (1411-56), and to him are due likewise a poetical eulogy of Santillana, entitled *La coronación*, and the moralizing *Coplas de los siete pecados mortales*. Of other noteworthy poets of this time there can be mentioned here only Gómez Manrique (died 1491) and Jorge Manrique (died 1479); the latter is remembered for his noble *Coplas* on the death of his father.

During the reign of Henry IV. (1454-74) there appeared no slight amount of political satire, the chief instance being among the *Coplas de Mingo Revulgo*. Of ballads (*romances*) Spain has been exceedingly productive; in broadsheets or in collections (*romanceros*), there were published during the final years of the fifteenth century, and during the sixteenth century, a very large number dealing with subjects drawn from the real or legendary history of Spain and of France, etc., as well as with subjects chivalrous and erotic.

In Spanish prose of the fifteenth century, the humanistic work already begun in Italy was zealously carried on. There was much translation of the classics of antiquity and of the modern Latin writings of Boccaccio and others. Ecclesiastical Latin authors also received some share of attention, and works were introduced from the French, Catalan, and Italian, those of Boccaccio being particularly popular for translation purposes. The influence of all these translations—and especially those from Plutarch, Livy, and Valerius Maximus—manifested itself in the development given to the writing of history. López de Ayala continued the official chronicle of the realm (*Crónicas de los reyes de Castilla*); García de Santa María, Fernán Pérez de Guzmán, and Diego de Valera (1412-86) worked upon the *Crónica del rey Juan II.*; the last named writer and Enríquez del Castillo dealt with the reign of Henry IV. in the *Memorial de diversas hazañas;* and Fernando del Pulgar and Andrés Bernáldez prepared the account of the reign of Isabel I. There also appeared a multitude of chronicles dealing with the lives of individual personages. No little interest attaches to the *Crónica Sarracena* of Pedro de Corral, which gives the whole legendary history of Roderick the Goth.

In French stories of a pseudo-historical nature the Spaniards had very early begun to take a serious interest; and these stories, particularly those treating the *matière de Bretagne*, were to play an important part in connection with the development of prose fiction in Spain. The Court poetry of the reign of John II. (first half of the

fifteenth century) is full of references to Arthur and his knights of the Round Table, to Merlin, and to the Quest of the Holy Grail. Charlemagne and Roland are still named along with the heroes of the Round Table, but they obviously have no longer the same living interest.

With the *Caballero Cifar*, of the first half of the fourteenth century, we have the first independent work of fiction in Spain, and this was followed perhaps a generation later by one of the most famous of all modern romances, the *Amadis de Gaula*. (See AMADIS OF GAUL.) This important Spanish work may lay claim to no small amount of originality; it accepts the elements at the basis of the French courtly romance, but it develops them in its own way, for, though retaining the traditional service of woman and quest of adventure, it stresses the virtuous qualities of the hero no less than his courtliness, something that the French romances had not done. In the form in which we possess it, the *Amadis* is due to García Ordoñez de Montalvo, who completed his redaction of it between 1492 and 1504. By him we are told that he had simply rid its first three books of the errors and imperfections introduced into it by earlier redactors and by scribes, that he borrowed and improved the fourth book, and that he himself added the whole fifth book, the *Sergas de Esplandian* (or Exploits of Esplanadian), in which he deals with the history of the son of the hero, Amadis. The *Amadis* was the forerunner of many similar romances which enjoyed enormous vogue in the sixteenth century.

In imitation of Boccaccio's *Fiammetta*, which had been translated about the middle of the fifteenth century, the tale was now attempted in Spain; noteworthy instances are Rodriguez del Padrón's *Siervo libre de amor* and *El cárcel de amor* of Diego de San Pedro. Novelistic and didactic in its manner is the *Trabajos de Hércules* of Enrique de Villena (1384-1434). One of the most original and entertaining works of the whole period appeared in 1438; this is a satire on womankind by Alfonso Martínez de Toledo, chaplain to John II. and archpriest of Talavera, entitled *De los vicios de las malas mujeres*, but also called the *Corbacho*. Of decided interest for the study of folk-lore are the Hebrew-Spanish and the *aljama* documents, in which the Jews and the Moors, writing in Spanish, but using their Hebrew and Arabic characters, created a rather considerable literature of their own. Many of the documents in question belong to the fifteenth century, and especially the most important of them all, the *Poema de José*, which gives a Mohammedan version of the story of Joseph.

The sixteenth century ushers in the classic age of Spanish letters, that period which extends into the second half of the seventeenth century and is generally known as the Golden Age. The influence of Italy and the Renaissance, which had been so strong during the preceding century, persists, but, contrary to what happened in other European lands, it does not tend to bring about any dissolution of continuity as between the old and the new. The ancient Church remains unaffected and the humanistic paganism of the Renaissance gets no foothold in Spain. In lyric verse Italian forms prevail, but the subject matter is only partially affected by influences from without. A realistic movement, marked by a strict application of keen powers of observation, guides the development of the novel, which is perfected by Cervantes in the reign of Philip II. The ballad continues to be a favorite form and it contributes to the rise of the drama. The drama, giving fullest expression to the national and religious ideals of the Spaniard, constitutes the greatest glory of the Golden Age.

Already, in the fifteenth century, Santillana had imitated the structure of the Italian sonnet, but in this innovation he had had no followers; it remained for the Catalonian Boscán (c.1493-c.1542) to establish Italian verse methods in Castilian. A better poet than Boscán is his friend and companion in the work of innovation, Garcilaso de la Vega (1503-36). Petrarch is the chief model of the lyric poet, but so far as content is concerned, the love lyric of Petrarch did not differ very materially from that already cultivated by the Spaniard; the real innovation was a formal one. Moreover, the older Castilian measures were not cast aside; even those who favored most warmly the use of the imported forms continued to employ the domestic forms. A third leading representative of the movement was Diego Hurtado de Mendoza (1503-75); elements of refinement still lacking in the art of the three poets mentioned were added by writers such as Fernando de Acuña (c.1500-80), Gutierre de Cetina (c.1520-60), and the Portuguese Gregoria Silvestre (1520-70). In the second half of the sixteenth century the followers of Garcilaso formed two main groups, the school of Seville and the coterie at Salamanca; minor groups were those at Granada and in Valencia and Aragon. The head of the school at Seville was Fernando de Herrera (1534-97), who is noted both for the purity of his style and the richness of his diction, best exhibited, perhaps, in his hymns on the battle of Lepanto and on the tragic fate of the Portuguese King, Dom Sebastian. The most important member of the Salamancan group was the charming poet Luis de León (1527-91), whose religious and mystic strains have never ceased to please. Allied to him in spirit are the other mystic poets San Juan de la Cruz (1542-91) and Malón de Chaide. The religious lyric may be seen at its best in the *Romancero espiritual* of Valdivielso (died 1636) and in the *Rimas sacras* of Lope de Vega; its vogue began to decrease when that of the conceptism of Ledesma and his fellows began to grow. An overstressing of the importance of the formal side of things and an undue straining of the means necessary to the attainment of perfection of style led, in the early years of the seventeenth century, to the adoption of the kind of lyric mannerism which is known in Spain as *culteranismo*, and which is paralleled by the Marinism of Italy, by the Euphuism of England, and by the préciosité of France. Luis de Góngora (1561-1627) was the founder of this artificial style, which is therefore often called Gongorism. Its characteristics of bombast, obscurity, and general extravagance are fully exhibited in the so-called *Soledades* of Góngora. Even contemporaries of so high an order of talent as Lope de Vega and Francisco Gómez de Quevedo (1580-1645), who at first opposed the Gongoristic movement, later adopted many of its methods. As a poet, Quevedo was most successful in his satires, which are full of the spirit of Juvenal. The lyric

poets of the seventeenth century were legion: Mira de Amescua, Estéban Manuel de Villegas (1596-1669), Jacinto Polo de Medina, Francisco de Borja, Príncipe de Esquilache (1581-1658), and the dramatist Calderon were but a few of them. With the facilities now provided by the printing press, it became possible to make extensive collections of the ballads (*romances*), which, previous to the end of the fifteenth century, seem to have survived only through oral tradition.

There appeared during the *siglo de oro* more than two hundred poems belonging to the category of the artificial epic. Of these the most important deal with subjects appertaining to the national history; many treat religious matters, and many others are of the class of the chivalrous epic. They are mainly written in octaves, only occasionally in blank verse (*versos sueltos*). Chief among the epics of an historical character is the *Araucana* of Alfonso de Ercilla (1533-94), written by a soldier who here gives the results of his experience in the wars of the Spaniards with the Araucanian Indians. The historical value is still of a high degree in the *Elegías de varones ilustres de las Indias* (first part printed 1589) of Juan de Castellanos, and the *Argentina* of Centenera. The imagination plays a larger part than the historical fact in the *Austríada* of Juan Rufo (1547-c.1600). In the period of greatest dramatic productivity the historical epic gradually wanes in importance; the *Nápoles recuperada* of Francisco de Borja (1651) is one of the last. A place apart is occupied by the *Amantes de Teruel* (1616) of Salas, which the author pretended to be an historical account of the tragic fate of the famous lovers. The Vergilian epic was made known to many by the *Eneida* of Hernández de Velasco (1557); after the appearance of Boscán's *Fábula de Leandro y Hero*, mythological episodes from classic antiquity were made the theme of poems by Hurtado de Mendoza, Lope de Vega, Montemayor, Góngora, etc. The Italian epic of the *Cinquecento* was transplanted to Spain, and was made the subject, not only of verse translations, but also of amplifications and continuations, some of these latter dealing with Spanish history or legend. A religious epic deserving of note is Azevedo's *Creación del mundo* (1615), being remarkable in that, imitating the *Semaine* of Dubartas, it shows a resumption of literary relations with France. The mock heroic of Greece and Italy finds an echo in Juan de la Cueva's *Batalla de ranas y ratones*, Villaviciosa's *Mosquea* (1615), and Lope de Vega's *Gatomaquía*.

The tendency to fill Spanish prose with Latinisms, so strong in the preceding period, now yields to a feeling which finds a native dignity in the mother tongue. Juan de Valdés, in his *Diálogo de la lengua* (c.1535), initiated the scientific study of the grammatical and stylistic peculiarities of Castilian. Comparative perfection of form is attained in Mariana's *Historia de España* (1601, etc.), the first thoroughly good account of Castilian history based on the study of documents. In his *Agudeza y arte de ingenio*, Baltasar Gracián (c.1601-58) gave the lawbook of that system of literary mannerisms termed conceptism: he also got the attention of contemporaries and posterity by his aphoristic and sententious sayings of various kinds. Religious literature of a mystic and ascetic nature must occupy an important place in the annals of the time; it is best represented by the writings of Luis de León, San Juan de la Cruz (Saint John of the Cross), Malón de Chaide, Luis de Granada, and Santa Teresa de Jesús (Saint Theresa, 1505-82).

Preceding the period of activity of Cervantes, we have the continuation of the chivalric novel; the pastoral novel; the narrative form as exhibited in the *Celestina;* and the earliest of the picaresque novels. Of the posterity of the *Amadís*, the unsurpassable type of the romance of chivalry, are a number of continuations dealing with the adventures of Florisando, Lisuarte of Greece, Perión of Wales, Amadis of Greece, and similar heroes. Hardly less a favorite than the *Amadís* was an imitation of it entitled *Palmerín de Oliva* (1511), which in its turn was made the subject of other continuations and imitations. The books of chivalry prepared the way for the pastoral romance, introduced into Spanish by Jorge de Montemayor (c.1515-61), who founded his *Diana* on the *Arcadia* of the Italian Sannazaro. For contemporaries a good deal of the interest in the *Diana* and its kindred depended upon the personal allusions conveyed by the characters and in the dialogue. The *Tragicomedia de Calisto y Melibea* (later termed the *Celestina*) was published at Burgos in 1499, and appeared in an amplified form at Salamanca in 1500. Although it is called a tragicomedy, it cannot in its present form have ever been capable of scenic representation, and it is certainly more a novel than a play. On account of its spirited action and of the development which the *Celestina* gave to the handling of dialogue and the delineation of character, it exerted an influence upon later dramatists and novelists both. It soon provoked continuations and imitations, and a connection may even be traced out between it and the *Dorotea* of Lope de Vega. The realistic tendencies evinced in the *Celestina* are equally pronounced in the first of the picaresque novels, the anonymous *Lazarillo de Tormes* (1554), long ascribed to Diego Hurtado de Mendoza. In this novel we follow the career of a rogue (*pícaro*), who, beginning as the guide (*lazarillo*) of a blind beggar, deceives him, and, passing into the service of other personages representing various ranks of life, shows himself no less ready to beguile them. There is no attempt at palliation of the truth; it is a picture of the bald and iniquitous fact that is presented to us in the *Lazarillo* and its successors.

Realistic fiction of the *siglo de oro* culminates in the magnificent *Don Quijote* of Miguel Cervantes de Saavedra (1547-1616), a novel in which the matter-of-fact philosophy of Sancho Panza stands in sharp contrast with the grotesque idealism of his master. It is not improbable that Cervantes wrote the book in order to destroy the vogue of the chivalrous romances, although it may be urged that their popularity was already on the wane and that at the most he simply gave them the *coup de grâce*. *Don Quijote* (usually *Don Quixote* in English) has become one of the world's imperishable books. The first part of it was published in 1605; the second part was hurriedly prepared for the press in 1615, in order to baffle the designs of a certain Avellaneda, who had published a spurious sequel to the novel in 1614. Cervantes had much less success in an-

other novel, the *Persiles y Sigismunda* (published posthumously), but that he could handle the shorter tale with skill is proved by his *Novelas ejemplares*. Among those who cultivated the tale after the time of Cervantes were Lope de Vega, Tirso de Molina (in his *Cigarrales de Toledo*, 1621), Montalbán (*Para todos*, 1632), María de Zayas, Solórzano, Salas Barbadillo, and Luis Velez de Guevara (with his famous *Diablo cojuelo*, 1641, the source of Lesage's *Diable boiteux*). Quevedo (1580-1645) was the foremost of the prose satirists of the age; in his witty and sarcastic *Sueños, cartas del caballero de la tenaza*, etc., he cries out against abuses with which bitter personal experience had made him acquainted.

As a literary form the drama had been practically unrepresented since the end of the twelfth century; but now, at the end of the fifteenth century, it was to revive and receive an unsurpassed development. Juan del Encina (c.1468-1534) begins the new order. Encina spent some years in Italy; hence an Italian influence on his work is not improbable. The comic elements in some of the pieces may show an influence of the French *farce*. Disciples of Encina were Lucas Fernández, who employs the terms *'farsa'* and *'comedia'*; the Portuguese Gil Vicente; and Torres Naharro, whose art shows considerable progress over that of the master. In his plays we meet for the first time with a division into acts. The pieces of the foregoing authors were intended for the refined audiences of the Court; those of Diego Sánchez (c.1530-47) seem to have been meant for performance amid more popular surroundings. Italian influence is unmistakable in the *comedias* of Lope de Rueda, an actor (c.1540-66), famed for his short and witty *pasos* or *entremeses*. The Latin tragedy is obviously imitated in the first really important Spanish tragedy, the *Numancia* of Cervantes. Avendaño in 1533 first adopts the division into three acts instead of five. Juan de la Cueva (1550-1607), the first Spanish dramatist to deal with incidents taken from the national history, adopted a division into four acts.

But by common consent there is awarded to Lope de Vega (1562-1635) and to his younger compeer Pedro Calderon de la Barca (1600-81) supremacy among the many gifted dramatic authors. Inventive beyond conception and amazingly prolific in production, Lope is known to have composed over 1500 plays, irrespective of a number of *autos* (one-act plays of a religious and allegorical nature), *loas* (preludes), and *entremeses* (interludes); of these pieces about 500 are still extant. The number of enduring masterpieces among his pieces is remarkably large, especially in the case of his historical dramas, such as *El mejor alcalde el rey* and *Los Tellos de Meneses*; and we even still find hardly less interesting and powerful than they such a play as the *Estrella de Sevilla* and not a few of his *comedias de capa y espada* or plays dealing with every-day life. Lope's disciples included Mira de Amescua (c.1578-1641), Luis Vélez de Guevara (1570-1644), Montalbán, and Ruiz de Alarcón (died 1639). Alarcón wrote the comedy *La verdad sospechosa*, the model of Corneille's *Menteur*. In talent, Lope was most nearly approached by the cleric Gabriel Téllez (1570-1648; known also by the pseudonym Tirso de Molina).

After Lope's death Calderon reigned on the stage. Though less inventive, Calderon paid more attention to details of form, simplifying somewhat the multitudinous metrical forms in use in the drama. In philosophic insight he was inferior to Lope, yet in *La vida es sueño* ("Life is a Dream") he cannot really be deemed unsuccessful in his endeavor to give dramatic reality to one of the most transcendental of ideas. He first gave great importance on the boards to the *pundonor* (the point of honor) as an actuating impulse of the Spaniard's life, and he gave its greatest development to the stock figure of the *gracioso* or clown. He devoted no little attention to the type of religious play called the *auto sacramental*. Of his followers, two were men of distinguished talents: Francisco de Rojas Zorrilla (1607-c.1660), who produced the excellent play, *Del rey abajo ninguno*, and Agustín Moreto (c.1618-1669), to whom we owe *El desdén con el desdén*.

Swift and deep was the decline in Spanish letters that followed the *siglo de oro*, and it went hand in hand with a decay in things national and political, which the advent to the throne of the French Bourbon house could do little to check. By the opening years of the eighteenth century Gongorism had thoroughly vitiated lyric verse, the novel had become unimportant, and the stage was controlled by dull or absurdly fantastic imitators of the older national drama. Not a single Spanish writer of the first order made his appearance during the first three decades of the eighteenth century, and during that period the only event of importance was the establishment in 1714 of the Spanish Academy (La Real Academia Española), whose Dictionary appeared in 1726-39. With the fourth decade came a new movement, the chief object of which was to chasten popular taste by the introduction of foreign æsthetic canons, particularly those of France. The impulse to the new movement was given by Ignacio de Luzán (1702-54), a man of great talent and greater culture, who set forth in his *Poética* (1737) the principles that ought to govern poetic production. Luzán preached that the various literary genres should not be intermingled and that the Spanish drama should be subjected to the French system of unities. The doctrines which he thus laid down were taken up and applied by his disciples Nassare (1689-1751), Montiano (1697-1765), the author of two tragedies, and by Luis José Velázquez (1722-72), in his *Orígenes de la poesía castellana* (1749). In his *Teatro crítico* (1726-29) and in his *Cartas eruditas y curiosas* (1742-60), Benito Feijóo (1676?-1764) first made known to a large part of the Spanish nation many of the scientific developments and discoveries of the age. José Francisco de Isla (1703-81), in his amusing though rather long-winded novel, *Historia del famoso predicador, Fray Gerundio de Campazas* (1758), ridiculed unmercifully the extravagance, ignorance, and pedantry that characterized most of the pulpit eloquence of his time. Isla is also famous for his attempt to appropriate to Spanish literature the *Gil Blas* of Lesage.

A party headed by García de la Huerta (1734-87) strove, but ineffectually, to curb the growing tendency to imitate French models. On the other hand, the followers of Luzán formed a strong school, known as the Salamancan school. The foremost member of this new school was Juan

Meléndez Valdés (1754-1817). His little volume of lyrics shows more true poetic sentiment than anything that had preceded them since the days of the masters of the sixteenth and seventeenth centuries. Of considerable merit were Iglesias (1748-91), best known for his *letrillas;* Cienfuegos (1764-1809), whose lyrics come nearest to those of Meléndez in the expression of genuine feeling; and Diego González (1733-94). It was in the drama that the imported French classicism was to have its real triumph. To be sure, one writer of more than average ability, Ramón de la Cruz (1731-c.95), still kept alive the traditions of the Spanish stage of the Golden Age in his humorous little plays called *sainetes*, but, on his side, Ramón de la Cruz stood alone. It was only natural that men of taste, like Nicolás Fernández Moratín (Moratín the Elder, 1737-80) and the dramatist statesman Jovellanos (1744-1811), should, in their love for moderation and order, seek to elevate the fallen stage by adopting for their own compositions the rigid principles of the French theatre. But neither of these became a favorite with the masses, and it remained for Leandro Fernández de Moratín (1760-1828), the son of Nicolás, to compose dramas governed by the French rules, that could captivate Spanish audiences. Moratín the Younger brings us over the threshold of the nineteenth century; still he belongs properly to the eighteenth century. An enthusiastic admirer of Molière, he both imitated and translated plays of that great dramatist. But Moratín was more than a mere imitator or translator; for his mastery of dialogue, his pure style and his faithful description of the manners of his time show in him a talent of the highest order. Although he carefully applied the French system of unities, he did not disdain certain elements of the home stage. Thus, he divided his plays into three acts instead of five, as the French and classic Latin rules would have exacted, he employed the popular *romance* verse in a number of pieces, and, above all, he made a skillful use of the element of intrigue that had been so prominent in the dramas of the Golden Age and has ever remained dear to the Spanish heart. It was this happy blending of the spirit of romantic intrigue with the cold precision of French rules that made his masterpiece, the *Sí de las niñas* (1806), obtain at once the popularity that it has never since lost, and constitute it the only masterpiece produced for the Spanish stage since the days of Lope and Calderon.

Spanish literature of the nineteenth century begins with the patriotic poets, Manuel José Quintana (1772-1857) and Juan Nicasio Gallego (1777-1853), whose lyrics voice the sentiments of a party sprung up to combat the French invader. Quintana was the Tyrtæus of the struggle against the Napoleonic arms, and he attained his greatest success in the heroic ode (*Al armamento de las provincias contra los Franceses* and *A España después de la revolución de Marzo, 1808*). His friend Gallego is also seen at his best in the burning patriotic lyric, and although the bulk of his verse is slight, he was a good literary artist. The classic influence still dominated Quintana and Gallego, and is no less clearly marked in the members of a poetical coterie which from its centre may conveniently be termed the School of Seville. The members of this school, of whom the chief were Manuel María de Arjona (1771-1820), José María Blanco (1775-1841, known in the history of English literature as Blanco White), Alberto Lista (1775-1848), and Félix José Reinoso (1772-1841), sought to reform the prevailing bad taste by setting up the authority of a respectable classic tradition. They contributed efficaciously to the restoration of a proper æsthetic sense in Spanish literary aims, and they also helped to improve the purely formal side of Spanish verse by developing rhyme and metre.

In the thirties of the nineteenth century the romantic movement began to appear in the Spanish Peninsula, somewhat belated, indeed, but none the less sweeping in its effects. Two elements contributed to the establishment of romanticism in Spain: (1) the influence of foreign literatures; and (2) the influence of the older national literature, and in particular of the drama of Lope and Calderon and of the *romances*. Even this latter influence did not make itself felt until foreigners had aroused Spain to a realization of the worth of her dramatists of the Golden Age and of her ballads. Many of the young writers of the early part of the nineteenth century had opposed the despotic administration of Ferdinand VII., had been obliged to flee the land, and, going to France and England, they had had some contact with the romantic movements of those countries. The romantic writers whom political considerations did not force to abandon their native region founded, about 1830, a club called the *Parnasillo*, which, as the Cénacle had done in France, was to herald the new ideas.

In the lyrics of Manuel de Cabanyes (1808-33; *Preludios de mi lira*, 1833) there is no tinge of romanticism; but a transition stage is visible in the writings of Martínez de la Rosa (1789-1862), in the main a man of classic tastes, yet who in two plays, the *Aben-Humeya* and the *Conjuración de Venecia* (1834), entered into the domain of romanticism. José de Lazza (1809-37) in his novel *El doncel de Don Enrique el Doliente*, and in his play *Macías*, showed similar romantic tendencies. The triumph of romanticism was insured by the performance in 1835 of the drama *Don Alvaro* of Angel de Saavedra (1791-1865), one of the writers whom Ferdinand's tyranny had compelled to seek a refuge in England and France. The romantic principles to which he gave effect in this work governed also the composition of his lyric *El faro de Malta*, and of his epic poem *El Moro expósito*, in the latter of which he revived the Old Spanish legend of the Infantes of Lara. In the person of José de Espronceda (1810-42), the author of the magnificent though fragmentary poem *El diablo mundo*, and of the *Estudiante de Salamanca*, there are represented both the romantic element of revolt against social and literary conventions, which in England is strongly marked in the person of Byron, and that element of Bohemianism which characterizes so many of the French romanticists. Lyric supremacy is disputed with Espronceda by José Zorrilla (1817-93), who is, however, more justly celebrated for his treatment of legendary material from the Spanish Middle Ages than for his purely lyric endeavors. In the *Don Juan Tenorio* he gives a modern version of the story at bottom of the *Burlador de Sevilla*,

a drama of the Golden Age. The Cuban poetess Gértrudis Gómez de Avellaneda (1816-73), who spent most of her life in Spain and there became famous, had affiliations with the romantic school. Her lyrics owe no small amount of their inspiration to Chateaubriand, Lamartine, and Hugo; her novels reflect the methods of Dumas the Elder and George Sand. Sentimentalism appears in two well-known dramas, the *Trovador* of Antonio García Gutiérrez (1813-84), on which Verdi's opera is founded, and the *Amantes de Teruel* of Juan Eugenio Hartzenbusch (1806-80), a play which gave new life to an old Spanish story of true love that did not run smoothly.

The passing of the romantic movement becomes evident after the beginning of the fifth decade of the century. The fertile playwright Manuel Bretón de los Herreros (1796-1873) had temporary connections with it, but he gained his repute mainly as a writer of lively dramas of manners, although in his masterpiece, the comedy entitled *Escuela del matrimonio* (1852), he paved the way for the coming psychological drama of Ayala and Tamayo y Baus. Adelardo López de Ayala (1828-79) gives us, in his mercilessly sociological play *El tanto por ciento* (1861), a detailed analysis of the modern greed for wealth that has stifled the nobler instincts of man and made him capable of the basest treachery; and in his *Consuelo* (1878) he makes another powerful attack upon the positivism and the lack of idealism in our modern life. The psychological development is also obvious in the work of Manuel Tamayo y Baus (1829-98). In *Lo positivo* (1862) he treats the positivism of the modern world with no less severity than does Ayala, and in his chief play, *Un drama nuevo* (1867), he portrays the slowly growing and finally all-pervading power of marital jealousy.

The particular glory of the second half of the nineteenth century in Spain has been the rise and growth of a new novelistic literature. To the development of this a considerable impetus was given by the essay on manners, which had already been handled with skill by Larra in the first half of the century, and was now taken up by Estébanez (1799-1867), and by Ramón de Mesonero Romanos (1803-82), who has left us excellent descriptions of life in older Madrid. These essayists on manners prepared the way for the tale of manners and the novel of manners (*novela de costumbres*). The former was cultivated, though with no brilliancy, by Antonio de Trueba (1821-89); the latter was written, in a way to attract attention and applause, by Cecilia Böhl von Faber de Arrom (1797-1877), familiar still by her *nom de guerre* Fernán Caballero. A thoroughly delightful figure appeared in the person of the short-lived story-teller and poet Gustavo Adolfo Bécquer (1836-70). All his work is permeated by the highly subjective qualities that are more common in Northern Europe. His tales are all of a legendary cast and are everywhere actuated by the instinct of mystery.

Pedro Antonio de Alarcón (1833-91) is most felicitous in the composition of the short tale of manners or adventure of the type; he is less successful in the more ambitious novel, although the less lengthy among the novels, particularly the *Sombrero de tres picos* and the *Capitán Veneno*, continue to delight and amuse their readers. An incomparably greater artist is Juan Valera y Alcalá Galiano (born in 1824), whom a protracted career in the diplomatic service of his country has made one of the most cosmopolitan and cultured of moderns. In his novels Valera differs from the majority of his contemporaries in that he consciously tends toward idealism, whereas they seek rather to render the living fact. The novel of manners has been raised to a higher level than ever before by José María de Pereda (born 1834), who, in his chief works, has portrayed life on the mountains and at the seaside in a way hardly to be excelled for detail and charm of description. The *Don Gonzalo González de la Gonzalera* and the *Sotileza* show Pereda in the fullness of his power; where he leaves the scenes of rustic life and ventures into the city and the fashionable whirl, as in the *Pedro Sánchez*, he is still a master novelist, but he treads on uncertain ground. The work of Benito Pérez Galdós (born 1845) from first to last has been marked by tendencies frankly revolutionary. One of the most admirable and important divisions of his labors has been the composition of the collection of novels forming the *Episodios nacionales*, but it is by his psychological novels that Galdós has attracted most attention abroad. At least two other novelists of the first rank must be mentioned here, Armando Palacio Valdés (born 1853) and the remarkable woman Emilia Pardo Bazán (born 1851). Both have had tendencies toward a naturalism not unlike that which has so profoundly affected the French novel of the second half of the nineteenth century.

In the recent period we meet with only two poets of importance, Ramón de Campoamor y Campoosorio (1817-1901), who will continue to be pleasantly remembered for his philosophical and humoristic *Doloras* and a few descriptive poems; and Núñez de Arce, the virile author of the *Gritos del combate*. The latter has had disciples both at home and in Spanish America, but none of them have displayed superior talent. Criticism has flourished, principally through efforts of Marcelino Menéndez y Pelayo (born in 1856), who in his *Historia de las ideas estéticas en España* (1884-91) has raised a noble monument to the glory of his country.

BIBLIOGRAPHY. The best collection of the Spanish classics is Rivadeneyra's *Biblioteca de autores espanoles* (71 vols., Madrid, 1846-80), embracing texts of Spanish masterpieces from the earliest times down to the opening of the nineteenth century; note also *Colección de escritores castellanos* (106 vols., ib., 1882-96); Ochoa, *Colección de los mejores autores españoles* (60 vols., Paris, 1837-60); and *Colección de autores españoles* (48 vols., Leipzig, 1860-86). For the history, consult: Baist, "Die spanische Litteratur," in Gröber's *Grundriss der romanischen Philologie* (Strassburg, 1894-97); Ticknor, *History of Spanish Literature* (4th ed., Boston, 1871); Fitzmaurice-Kelly, *A History of Spanish Literature* (New York, 1898); Bouterwek, *Geschichte der spanischen Poesie und Beredsamkeit* (Göttingen, 1804), continued by Brinckmeier, *Die Nationallitteratur der Spanier seit Anfang des 19. Jahrhunderts* (ib., 1850); Lemcke, *Handbuch der spanischen Litteratur* (Leipzig, 1856); Klein, *Geschichte des spanischen Dramas* (ib., 1871-75); Schack, *Geschichte der dramatischen Litteratur und Kunst in Spanien* (Berlin, 1846;

supplement, Frankfort, 1855); id., *Poesie und Kunst der Araber in Spanien und Sizilien* (Stuttgart, 1877); Schäffer, *Geschichte des spanischen Nationaldramas* (Leipzig, 1890); Balaguer, *Historia de los trovadores* (Madrid, 1888); Menéndez y Pelayo, *Calderon y su teatro* (ib., 1881), *La ciencia española* (ib., 1889), *Estudios de crítica literaria* (ib., 1895), *Antología de poetas líricos castellanos* (ib., 1890 et seq.); De Puymaigre, *Les vieux auteurs castillans* (Paris, 1888-90); Menéndez Pidal, *La leyenda de los Infantes de Lara* (Madrid, 1896); Cotarelo y Mori, *Iriarte y su época* (ib., 1897).

SPANISH MACKEREL, or SIERRA. Any of several mackerels of southern waters, especially *Scomberomorus maculatus*, a slender, compressed, fusiform fish, bluish green above, a beautiful satiny white below, with yellowish spots on the back and sides, weighing usually from two to four pounds, although sometimes much larger. They are natives of tropical seas, but they range along the Atlantic coast from Brazil to Cape Cod. They are among the very finest of fish for the table. A California species of high quality for the table is the Monterey Spanish mackerel (*Scomberomorus concolor*), the male of which is steel blue, without spots on its silvery sides, while the female has dusky cloudings and two series of dark spots along the sides. The 'Spanish mackerel' of England is a typical mackerel, known in the United States as 'chub mackerel' (q.v.). Compare MACKEREL; and see Plate of SPANISH MACKERELS.

SPANISH MOSS. See BROMELIA.

SPANISH MUSIC. Spanish music has always been imitative. At first the influence of the great school of the Netherlands predominated. This period was followed by a prevalence of Roman influence, especially that of Palestrina. The sixteenth century may be regarded as the time when music in Spain was at its height, for then it boasted Morales, whose compositions are still sung at Rome, and the great Vittoria, the master who most closely resembles Palestrina. With the appearance of Italian opera, Spanish composers not only imitated the Italians, but actually wrote Italian operas. With Wagner's innovations Spain was again ready to adopt the new tendencies. At this juncture the name of Pedrell deserves special mention. Stimulated by the attempts of Russian, Scandinavian, and Bohemian composers to establish a national school of music, Pedrell chose for his operas national subjects. His most ambitious undertaking is a trilogy, *Los Pireneos*, somewhat after Wagner's *Nibelungen*. The rise of the Spanish drama in the seventeenth century exerted a beneficial influence upon lighter music. The earlier musical dramas of the Florentine school had no overture. Instead, a *madrigal* was sung before the curtain rose. The Spaniards adopted this custom for their purely dramatic representations, so that before very long even the most serious tragedies were preceded by such 'curtain-raisers.' These were called *cuatros de empezar*, and were always performed by the women of the company to a harp accompaniment. At first the *cuatros* were choruses for four voices; but with the rise of the monodic style polyphonic writing was abandoned and an action was introduced. When the 'curtain-raisers' had been developed so far, they were called *tonadillas*. This custom of beginning all dramatic representations with a *tonadilla* was adopted by the Italians, who called the tonadilla *intermezzo*, and soon developed this latter into the *opera buffa*. (See INTERMEZZO.) Then the Spaniards again imitated the Italians; and the result was the development of the *tonadilla* into the *zarzuela*. This was a kind of comic opera, operetta, or vaudeville, generally in two acts and with spoken dialogue. The name is derived from the castle of Zarzuela, where, in the seventeenth century, the first representations of this kind took place. This form has always been very popular in Spain, and about 1850 Hernando gave it a new impetus. Among the numerous composers who devoted their talents to this form, four deserve mention: Oudrid, Gaztambide, Barbieri, and Arrieta.

But for originality and characteristic traits we must turn to Spanish folk-music. Here we notice that the real folk-songs are almost exclusively used as accompaniments to dances. The limitations of the national instrument, the guitar, influenced the melodies and rhythms to a great extent, rendering the latter more attractive than the former. Of the old folk-songs composed in the time of the Troubadours a great number have been preserved in literary collections called *cancioneros*, but the music has been lost. The music of the folk-songs of the fifteenth and sixteenth centuries, however, has been transcribed from the actual performances of blind singers, who even now, as formerly, wander from town to town. The melodies of Andalusia, which are in all respects superior to those of the northern provinces, show undoubted traces of Moorish influences, as shown by the elaborate embellishments of the notes of the melody, peculiar intervals foreign to European scales, and a strange combination of distinct rhythms in the several parts. This foreign element has always attracted composers, who by this means have succeeded in creating a local atmosphere in their works. In this connection it is only necessary to mention the names of Bizet (*Carmen*), Massenet (*Le Cid, La Navarraise*), Weber (*Oberon*), and Moszkowski (*Boabdil*). The best known Spanish dance-forms are the bolero, cachucha, fandango, jota, malagueña, rondeña, and seguidilla, which are accompanied by the guitar and castanets. Consult: Soriano-Fuertes, *Musica española hasta el año 1850* (Madrid, 1857); Juan F. Riaño, *Critical and Biographical Notes on Early Spanish Music* (London, 1887); A. Soubies, *Histoire de la musique. Espagne* (Paris, 1900).

SPANISH NEEDLES. See BUR-MARIGOLD.

SPANISH POLITICAL PARTIES. See SPAIN; POLITICAL PARTIES, section on *Spain*.

SPANISH SUCCESSION, WAR OF THE. See SUCCESSION WARS.

SPANISH TOWN. A town in Jamaica, British West Indies, on the Cobre River, about 10 miles west of Kingston (Map: West Indies, J 6). It was founded by Diego Columbus in 1525 and was the capital of Jamaica until 1871. Population, over 5000.

SPANISH WAR VETERANS. A patriotic society incorporated in Washington, D. C., on November 2, 1899. It admits to membership any soldier or sailor of the regular and volunteer army and navy and marine corps of the United

States who honorably served during the war with Spain or the war in the Philippines. The National Auxiliary of this order admits to membership mothers, wives, sisters, and daughters of members, and other women, as nurses, who rendered species service during the war.

SPANKER. A fore-and-aft quadrilateral sail set on the mizzenmast of ships and barks (qq.v.). It was formerly called the driver.

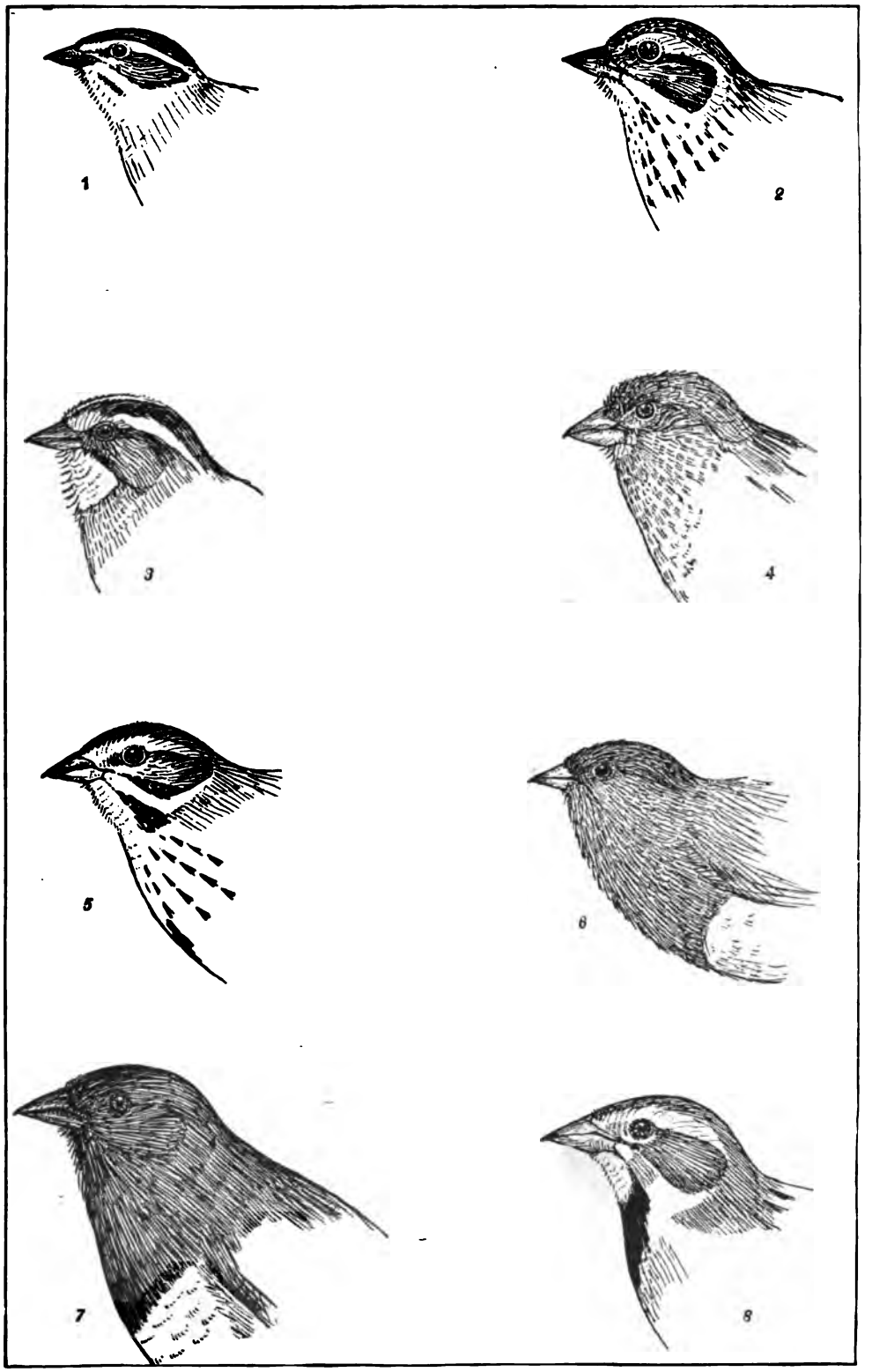
SPAR (AS. *spær*, Ger. *Spar*, gypsum). A term which is used by miners to denote any bright crystalline mineral, and which has been adopted by mineralogists in the names of a number of minerals, as calcareous spar, fluor spar, etc., in which, however, it has no proper generic significance.

SPARIDÆ (Neo-Lat. nom. pl., from Lat. *sparus*, from Gk. *σπάρος*, gilt-head, sort of fish). An important family of spiny-rayed fishes, to which belong the porgies, sheepshead, scup, etc. (qq.v.). The body is elongate, with the dorsal side more or less elevated. The scales are rather large. There is a single dorsal fin, the anterior portion being spinous. The family contains about 100 species. They are shore fishes, carnivorous in habit, most common in the tropical seas.

SPARKS, JARED (1789-1866). An American historian, editor, and educator, born at Willington, Conn. He graduated at Harvard College in 1815. Here, after teaching school, he was (1817-19) tutor in mathematics and natural philosophy. During this time he studied theology and (1817-18) edited the *North American Review*. From 1819 to 1823 he was pastor of a Unitarian church in Baltimore; in 1821-23 he edited there the *Unitarian Miscellany and Christian Monitor* (monthly); and from 1824 to 1831 again edited the *North American Review*, of which he was chief proprietor. In 1830 he founded and was the first editor of the *American Almanac and Repository of Useful Knowledge*, published annually until 1861. In 1839 he became professor of history at Harvard, of which institution he was president from 1849 to 1853. During this time he reformed administrative methods, insisted upon the recognition by the Massachusetts Legislature of Harvard's chartered rights, and vigorously opposed the elective system. He is best known, however, as a biographer, and as an editor and collector of documents relating to American history. In this field he was a pioneer and rendered services of great value. As an editor he was severely criticised for taking liberties with his materials, such as failing to reproduce letters and documents accurately, making many verbal and other changes, and omitting numerous passages; but the extent to which he took such liberties has been greatly exaggerated. Perhaps his best known work is his edition of the *Writings of George Washington* (12 vols., 1834-37), the first volume of which is an excellent biography of Washington, frequently published separately. This edition met with much criticism, involving Sparks particularly in a controversy with Lord Mahon, and it has since been superseded in many respects by that of W. C. Ford. Sparks also edited: *The Library of American Biography* (first series, 10 vols., 1834-38; second series, 15 vols., 1844-47), to which he himself contributed several biographies; *The Diplomatic Correspondence of the American Revolution* (12 vols., 1829-30), since superseded in most respects by Wharton's *Revolutionary Diplomatic Correspondence of the United States* (6 vols., 1889); *The Works of Benjamin Franklin with a Life of the Author* (10 vols., 1836-40), since superseded by Bigelow's *Complete Works of Benjamin Franklin* (10 vols., 1887-89); and *Correspondence of the American Revolution; Letters of Eminent Men to George Washington* (4 vols., 1853). He also published a *Life of Gouverneur Morris, with Selections from His Correspondence and Miscellaneous Papers* (3 vols., 1832). He left voluminous manuscript journals, and a mass of valuable documentary material relating chiefly to the diplomatic history of the American Revolution, which was collected by him during several trips to Europe, and which he bequeathed to the Harvard Library. Consult: H. B. Adams, *Life and Writings of Jared Sparks* (2 vols., Boston, 1893).

SPARROW (AS. *spearwa*, *spearewa*, Goth. *sparwa*, OHG. *sparo*, *sparwe*, sparling; connected with OPruss. *sperglas*, *spurglas*, sparrow, and probably ultimately with Eng. *spur*, *spurn*). A small bird of the finch family (Fringillidæ), generally with dull plumage and slight powers of song, feeding on the ground or among underbrush or weeds, and nesting in bushes or low trees or on the ground. Originally the name belonged specifically to the common European sparrow (see HOUSE SPARROW), but now has been inaccurately extended to include certain warblers, weaver-birds, and others. Of American sparrows probably the most familiar is the common chipping sparrow (see CHIPPY), a small grayish bird. The field-sparrow (*Spizella pusilla*) is a very similar species, which occurs throughout the Eastern United States in summer, distinguished by its brighter rufous color and flesh-colored bill. A third species of this genus, the tree-sparrow (*Spizella monticola*), occurs in the United States only in winter, breeding in Labrador and the Hudson Bay region. It is considerably larger than the chippy and has a conspicuous black spot on the grayish-white breast. Next to the chippy the best known American sparrow is probably the song-sparrow (*Melospiza melodia* or *cinerea*), which in some one of its varieties ranges throughout practically the whole of North America. It is between six and seven inches in length, the general shade of the upper surface brown, of the under surface dirty white, but everywhere more or less streaked with black or rufous brown, the streaks on the centre of the breast tending to form one large characteristic blotch. This is one of the earliest spring songsters in the Northern States, and its refrain, although not extended, is remarkably clear and sweet. Its nest is composed of grasses, rootlets, and the like, lined with fine grasses and long hairs, and is frequently placed on the ground. The eggs are very variable in color and form, the ground shade ranging from nearly white to deep blue thickly marked with reddish brown. Two broods are often raised in a season. Two other species of Melospiza range through Eastern North America, the swamp-sparrow (*Melospiza Georgiana*) and Lincoln's sparrow (*Melospiza Lincolni*). They resemble the song-sparrow in appearance, but are much more shy and retiring in their habits. Some twenty or thirty other birds are called sparrows in the United States, among

FAMILIAR SPARROWS



1. CHIPPY (Spizella socialis).
2. VESPER SPARROW (Poöcætes gramineus).
3. WHITE-THROAT (Zonotrichia albicollis).
4. PURPLE FINCH (Carpodacus purpureus).
5. SONG SPARROW (Melospiza melodia).
6. BLUE SNOWBIRD (Junco hyemalis).
7. CHEWINK (Pipilo erythrophthalmus).
8. BLACK-THROATED SPARROW (Euspiza Americana).

which the vesper-sparrow (*Pooœtes gramineus*), the savannah sparrows of the genus Ammodramus (which also includes the sharp-tailed and seaside sparrows), the crowned sparrows of the genus Zonotrichia, the wood-sparrows or summer finches of the genus Peucæa, and the large fox-sparrow (q.v.) are especially worthy of mention, while the sage-sparrows (Amphispiza) and the lark-sparrows (*Chondestes grammacus*) are characteristic Western forms. A familiar species of the West is the black-throated dickcissel (*Euspiza Americana*), a fine singer. The vesper-sparrow is often called grass-finch or bay-winged bunting, but its more common name has reference to its fondness for singing late in the afternoon. It is essentially a ground-loving species, feeding and nesting only on the ground. The outer tail-feathers of each side are white and are exposed by the bird when it flies. Ammodramus includes upward of a dozen species, widely distributed, but popularly little known, on account of their retiring habits. They are chiefly shy, elusive little birds of fresh and salt marshes. The crown-sparrows are large, handsome birds, of which the common white-throated Peabody-bird (*Zonotrichia albicollis*) is the best known. The conspicuous black and white and sometimes golden-yellow markings on the head make the crown-sparrows conspicuous among their more plainly colored relatives. The wood-sparrows are a group of Southwestern and Mexican species of medium or rather small size, with short rounded wings, one species of which, known as Bachman's finch or the pine-woods sparrow (*Peucea æstivalis*), occurs in the South Atlantic States, especially Florida, and is noted as a very superior songster; a variety of this species, the oak-woods or Bachman's sparrow, is found in the Mississippi Valley as far north as Illinois. The lark-sparrow is notable for the fact that, unlike other sparrows, the sexes are very unlike in color; while the female is streaked grayish brown, the male is black with a large white patch on the wings. This is a prairie species abundant on the central plains, ranging eastward to Illinois, and occasionally, as a straggler, to the Atlantic Coast. Consult Ridgway, *Birds of North and Middle America*, part i. (Washington, 1901), and authorities there cited. See Plate of FAMILIAR SPARROWS; and Colored Plate of EGGS OF SONG-BIRDS.

SPARROW-HAWK. Any of several distinct species of small hawks, whose prey consists chiefly of sparrows and other small birds, insects, and mice. In America the name is universally given to *Falco sparverius*, a handsome little falcon less than a foot long. It is very courageous and very active, and lives largely on mice and insects. It is rufous above, barred with black; most of the head is slaty blue, and underneath it is buffy. It breeds from Florida to Hudson Bay, and winters from New Jersey southward, and is everywhere one of the commonest species of hawk. It nests in a hole in a tree and lays from three to seven creamy or reddish eggs, finely marked with darker tints.

The Old World sparrow-hawk (*Accipiter nisus*) is very similar, and has often been trained for the purposes of falconry, to take land-rails, partridges, and similar game. See FALCON; FALCONRY; and Plate of EAGLES AND HAWKS.

SPARTA (Lat., from Gk. Σπάρτη, *Spartē*, Doric Σπάρτα, *Sparta*), also LACEDÆMON. The capital of Laconia, and the most famous city of the Peloponnesus. It occupied partly a group of low hills on the right bank of the Eurotas, and partly the intervening plain. Its appearance in its palmiest days was by no means equal to its renown, for it was little better than a group of five villages, with plain and even mean private houses, though there were a few notable public buildings, such as the shrine of Athena or the Bronze House, whose walls seem to have been lined with bronze, probably decorated with reliefs. The passes which lead into the valley of the Eurotas are so easily defensible, and the distance from the sea is so great, that Sparta continued without walls down to the end of the fourth century B.C., and, indeed, was not regularly fortified till the time of the tyrant Nabis (B.C. 195). The five districts or villages, Cynosura, Limnæ, Mesoa, Pitane, and Dyme, were united in the worship of Artemis Orthia and Athena, and had a common agora, or market-place, on which stood the public buildings—the senate-house, and the offices of the ephors and other magistrates. Famous public places were the *Choros*, where the youths danced in honor of Apollo; the *Dromos*, or race-course, where the gymnastic exercises took place, and where were also temples of the Dioscuri and other gods; and the *Platanistas*, a broad level space, shaded by plane-trees, and reached by two bridges where the Spartan youth, divided into two bands, met in strenuous personal conflict. Probably the so-called Acropolis, which was crowded with temples, was situated on the hill to the northwest, on whose southern side the theatre can still be traced. Not far from here excavations conducted by the American School at Athens in 1892 and 1893 brought to light the foundations of a circular building, which had contained a colossal statue, and may have been identical with one mentioned by Pausanias as containing statues of Zeus and Aphrodite, said to be a foundation of Epimenides of Crete.

After the Dorian conquest of Laconia the supreme power always remained in the hands of the pure-blooded Dorian families of Sparta. The farmer population and the lesser Dorian towns seem to have been reduced to Perioeci (q.v.), or to Helots (q.v.). Their situation, amid a subject population largely in excess of their own numbers, practically forced upon the Spartans a strict military discipline, and this formed the basis of their whole system. Sparta was little else than a permanent camp. At the birth of a child, the elders decided whether it was strong enough to be reared. A weakling was exposed on Mount Taygetus. After the seventh year the boys entered on a course of severe training, designed to develop physical strength and courage, as well as the uncomplaining endurance of hardship and cunning such as might serve the soldier. Music and the dance were added, and perhaps the elements of letters. Girls, too, passed through a training in gymnastics and the dance, that they might be fit consorts and bearers of strong children. Sentiment played but little part in the Spartan system, and the function of marriage was only the perpetuation of the State. At the age of twenty the young Spartan was liable to active service, was admitted to the public meals,

and was now allowed to marry, though he could only obtain stolen interviews with his bride, since he was still obliged to live with his companions. At thirty he became a full citizen. Discipline, however, was not relaxed. He must still eat regularly at his *Phiditia*, or mess, and contribute regularly to its support from the produce of his farm, which was cultivated by Helots. The government was a development from the old Homeric form of the king and council of elders. In Sparta there was a double kingship. The two lines claimed descent from the twin sons of Aristodemus, Eurysthenes and Procles, but were named from the second generation, Agis and Eurypon, Agidæ and Eurypontidæ. These two kings were the religious representatives of the State, on whose behalf they offered stated sacrifices, and also exercised limited legal functions. Their chief duty was, however, the command of the army, over which in early times they exercised unlimited power, though in the fifth century B.C. they were subject to the ephors and the Assembly. In the field their power was absolute. Associated with the kings was a council (the Gerousia) of 28 elders, men over 60 years of age, chosen for life from certain noble families by acclamation in the popular assembly. They discussed and prepared the orders to be submitted to the assembly, and also sat as a court of criminal jurisdiction in crimes against the State, especially where the kings were involved. Once a month the assembly of the citizens (Apella) met at the call of the kings, though in the fifth century B.C. the ephors presided. The body seems ordinarily to have simply voted on the business presented to it. Speeches were in general delivered only by the officials, and there was certainly no general discussion. Into this government were introduced, at an early date, the ephors, who, during the period of Spartan greatness, were the real rulers. (See EPHORI.) They exercised a general oversight over the community and maintained the authority of the established order. Elected for one year, they had the power to call any magistrate to account and even to suspend him from office. They presided over the Gerousia, and could impeach any citizen before that court. Their short term of office and accountability to their successors were really almost the sole limits to their power. Under the iron discipline of this constitution, which was attributed to the mythical Lycurgus (q.v.), the Spartan State gradually extended its power until it had gained complete control over Laconia and Messenia, and the recognized leadership of a somewhat loosely joined confederacy, which included most of the Peloponnesus outside of Argos. At the time of the Persian wars Sparta was the leading State in Greece, but the constitution was not adapted for military operations requiring prolonged absence from home, and with the transfer of the war to Asia the Spartans soon withdrew from the scene. (The leading events other than domestic in the history of Sparta have been given under GREECE.) The creation of the fleet which decided the Peloponnesian War put a severe strain upon the ancient customs, and long absences in foreign lands, often with free opportunity for luxury, rendered men unwilling to submit to stern discipline on their return. The hegemony of Greece, which had fallen to Sparta on the overthrow of Athens, was used solely as a means of aggrandizement and profit, and in a short time led to renewed wars. In B.C. 371 the defeat at Leuctra at the hands of the Thebans broke forever the power of Sparta, and the disintegration, which had begun with naval empire and the accumulation of the gold and silver, forbidden by the ancient laws, went rapidly forward. The attempt of Agis IV. (c.244-240 B.C.) to reform the State was defeated and Agis put to death, but Cleomenes III. (c.235-219 B.C.) carried through a serious of sweeping changes, which increased largely the number of citizens, and reëstablished the Lycurgean order. After his death Sparta was ruled by the tyrants Machanidas and Nabis, was then forced into the Achæan League, and finally with the rest of Greece passed under the rule of Rome. Treated with favor by the Romans, the city prospered; the old laws of Lycurgus were once more placed in force, and the old training practiced at least nominally, though the forms of government seem to have been much altered. In the thirteenth century the Acropolis was fortified by a wall, which may still be traced. The Frankish lords of the Peloponnesus built a strong fortress at Mistra (1248-49) on a spur of Taygetus, west of Sparta, and its superior security led to the abandonment of the ancient city. After the Greek Revolution a new town of Sparta was laid out as the capital of the Nomarchy of Laconia.

Consult, on the topography: Curtius, *Peloponnesus II.* (Gotha, 1852); Leake, *Travels in the Morea* (London, 1830); N. E. Crosby, "Topography of Sparta," in *American Journal of Archæology*, vol. viii. (Princeton, 1893); Frazer, *Pausanias*, vol. iii. (London, 1898). On the ancient constitution, consult: Hermann, *Lehrbuch der griechischen Antiquitäten*, vol. i., 6th ed., by V. Thumser (Freiburg, 1889); Busolt, "Griechische Staats- und Rechtsaltertümer," in Müller's *Handbuch der klassischen Altertumswissenschaft* (Munich, 1892), both of which contain full bibliographies.

SPARTA. A city and the county-seat of Monroe County, Wis., 26 miles east by north of La Crosse; on the La Crosse River, and on the Chicago, Milwaukee and Saint Paul and the Chicago and Northwestern railroads (Map: Wisconsin, C 5). It has an attractive situation and artesian mineral wells, and is a much frequented summer resort. There are in Sparta a public library, the State Public School for Dependent and Neglected Children, and Saint Mary's Convent. The city is the shipping centre for a rich farming and stock-raising section, and manufactures flour, paper, and iron products. The water-works are owned by the municipality. Population, in 1890, 2795; in 1900, 3555.

SPARTACUS. The leader in the great insurrection of Roman slaves in Southern Italy which took place B.C. 73. He was a native of Thrace, originally a shepherd, but afterwards a robber chief. He was taken prisoner and placed in a gladiatorial school at Capua. Seventy gladiators, including Spartacus, escaped and forced their way through the streets of Capua, defeated a detachment of Roman soldiers sent to bring them back, and established themselves on Mount Vesuvius, where they received considerable accessions, chiefly runaway slaves. Spartacus was chosen leader, and proclaimed freedom to all slaves. Thousands rushed to his standard.

After defeating Claudius Pulcher, Spartacus routed and slew Cossinius, legate of P. Varinius Glaber, the prætor; then he worsted Varinius himself in several engagements, capturing his lictors and the very horse on which he rode. All the southern part of the peninsula now fell into his hands; the country was devastated, the cities either pillaged or garrisoned. After the defeat and death of his lieutenants, who had separated from him, B.C. 72, he marched northward through Picenum toward the Po, overthrew first one consular army under Cn. Cornelius Lentulus and then another under Gellius Poplicola, and at the head of a large force meditated a march upon Rome. Servile indecision saved the city. Spartacus was forced by his followers to retreat south, and took up his winter headquarters at Thurii. In B.C. 71 the proconsul, C. Cassius Longinus, and the proprætor, Cn. Manlius, were defeated; in Picenum, Mummius, a legate of Crassus, was utterly routed; at last, however, Crassus succeeded in forcing Spartacus into the narrow peninsula of Rhegium. Crassus now built lines of circumvallation to hem him in and force him to surrender; but one stormy winter night Spartacus broke out of the toils prepared for him, and resumed the offensive. Near Petelia, Spartacus once more defeated his adversaries; but seeing clearly that with such wretched materials as he had he could not hold out much longer, he made a dash for Brundusium, hoping to seize the shipping in the harbors, and get safely across the Adriatic to his native shore, but was baffled by the presence of Lucullus (q.v.). There was nothing left for Spartacus but to die gallantly as he had lived. Drawing up his army in battle array, and solemnly slaying his war-horse, he began his last fight in a spirit of heroic desperation, and after performing prodigies of valor he fell unrecognized among the heaps of his slain foes. After his death the slave insurrection was at an end.

SPARTANBURG. A city and the county-seat of Spartanburg County, S. C., 93 miles northwest of Columbia; on several branches of the Southern and the Atlantic Coast Line railroads (Map: South Carolina, C 2). It has the Kennedy Public Library, and is the seat of Converse College, a non-sectarian institution for women, opened in 1890, Wofford College (Methodist Episcopal, South), opened in 1854, and the State Deaf, Dumb, and Blind Institute. Spartanburg is situated in a rich cotton-growing and farming section, which also has deposits of gold, limestone, and granite, and other mineral wealth. It is the centre of a large cotton-manufacturing district, containing some 30 mills with more than 400,000 spindles. There are several large cotton mills in the city and suburbs; also iron works, lumber mills, and manufactories of brooms and soap. The government, under the charter of 1901, is vested in a mayor, chosen every two years, and a unicameral council. Population, in 1890, 5544; in 1900, 11,395.

SPARTEINE (from Neo-Lat. *Spartium*, from Lat. *spartum*, *sparton*, from Gk. *σπάρτον*, Spanish broom, cable). A volatile, oily liquid alkaloid obtained from the tops of the broom-plant (*Cytisus Scoparius*), a European shrub of the order Leguminosæ. Sparteine is odorless, very bitter, soluble in alcohol, ether, and chloroform, but insoluble in water. Its sulphate, which is used in medicine, is a colorless, crystalline powder, soluble in water and in alcohol. It is a cardiac stimulant, acting at times when others fail, and used under these circumstances or when it is necessary to obtain a substitute for other drugs of its class. It increases the amount of urine excreted.

SPARTIUM, spär'shĭ-ŭm. A genus of plants. See BROOM.

SPASM (Lat. *spasmus*, from Gk. *σπασμός*, *spasmos*, *σπάσμα*, *spasma*, spasm, from *σπᾶν*, *span*, to draw, rend). Involuntary and sudden muscular contraction, due to central nerve disturbance, to peripheral irritation, or to reflex conditions from irritation of other parts. There are two kinds of spasm: tonic and clonic. Tonic spasm is a prolonged involuntary rigidity of a muscle or a group of muscles. Such spasm occurs at the beginning of an epileptic attack, during hysteria major, tetanus, angina pectoris, and meningitis. It also occurs in the muscles of the calves of the legs in swimmers, attended with pain, when it is called cramp (q.v.). Clonic spasm is an involuntary contracting and relaxing of groups of muscles, causing twitching, jerking, and rolling movements and contortions. It is the common convulsion, or fit. Such a spasm occurs in epilepsy, hysteria major, uræmia, chorea, hydrophobia, and in some cases of indigestion and worms. In asthma (q.v.) there is spasm of the muscles controlling the bronchial tubes, as also in whooping cough (q.v.), together with hyperæsthesia. Spasm occurs also in colic.

The treatment of spasm consists of the use of antispasmodics such as asafœtida, galbanum, musk, sumbul, valerian, belladonna, cannabis indica, opium, the bromides, and stramonium, and the administration by inhalation of choloroform or amyl nitrite, or by outward application of heat in a prolonged hot bath.

SPAVIN, BOG (OF. *esparvain*, *esparvent*, Fr. *éparvin*, spavin; possibly from Goth. *sparwa*, OHG. *sparo*, *sparwe*, AS. *spearwa*, *spearewa*, Eng. *sparrow*; in allusion to the hopping gait of a spavined animal). A lesion of the true hock-joint of the horse, consisting in distention of the capsule inclosing the joint. It usually arises suddenly from a sprain in action, from overwork, or wounds.

SPAVIN, BONE. An inflammation of and bony deposit on the flat bones of the lower and inner part of the hock-joint of the horse. At first there is tenderness, local heat, swelling, and lameness, but as the inflammatory stage passes the lameness is less perceptible, although the horse still continues to go stiffly. If the lameness is only slight it usually disappears after a little exercise. The animal should be given rest.

SPAWN-EATER. The spotted-tailed minnow (*Notropis Hudsonius*). See MINNOW.

SPEAKER. The name given to the presiding officer in various legislative bodies. In the English House of Commons the office of Speaker seems to have existed as early as the reign of Henry III., but the title Speaker was first given to Sir T. Hungerford in the reign of Edward III. (1377). The Speaker of the House of Commons presides over the deliberations of the House, and enforces the rules for preserving order. He puts

the question and declares the determination of the House. As the representative of the House, he communicates its resolutions to others, and conveys its thanks or its censures. He issues warrants in execution of the orders of the House for the commitment of offenders, for the issue of writs, the attendance of witnesses, the bringing up prisoners in custody, etc. He cannot speak or vote on any question, but on an equality of voices he has a casting vote. The office is non-political; and hence a Speaker may hold during several successive and opposing administrations. A retiring Speaker is usually rewarded with a peerage. See PARLIAMENT.

Unlike the English prototype, the Speakership of the United States House of Representatives is a political office of the highest importance. The first Speaker, chosen in 1789, was a moderator on the British pattern. But beginning with the right to appoint the standing committees in 1790, the powers of the office have gradually expanded until the Speaker has become the acknowledged leader of the House and the chief of his party. Henry Clay (1811-25) developed the political resources of the office, especially through the constitution of committees. The modern Speaker has been well called the American Premier. So far has the office departed from its original character that the Speaker now has the right to dispense the privileges of the floor in the interest of his party. He may even refuse to 'recognize' on the ground of personal dislike. Moreover, since 1860, as chairman of the Committee on Rules, he may in effect control the whole course of legislation. He "practically decides what shall be considered, how long debates shall last, and when the votes shall be taken." Through this function a kind of substitute for the right of the English Ministry to introduce and promote so-called 'Government bills' has been found. The Speaker is a member of the House chosen by the members; and he freely exercises his privilege of voting on any measure. Since 1874 his salary has been $8000 a year. He signs all bills, resolutions, and acts of authority; certifies to the mileage, etc., of members; and appoints three of the regents of the Smithsonian Institution. He may be removed from his office by an act of the House.

For the early history of the Speakership, consult Stubbs, *Constitutional History*, and in general, Todd, *Parliamentary Government* (London, 1869). The most important work on the American office is Follett, *The Speaker of the House of Representatives* (New York, 1896). This was preceded by Hart, "The Speaker as Premier," in *Atlantic Monthly*, March, 1891; reprinted in his *Practical Essays* (New York, 1893).

SPEAKING TRUMPET. An instrument for concentrating the waves of sound originated by the articulation of the human voice, and thereby enabling the sound to be conveyed to a greater distance. It was used on shipboard in enabling the officers to convey orders during windy weather from one part of the deck to another, or to the rigging, and in its more modern form, the megaphone (q.v.) is extensively employed. The invention is ascribed to Sir Samuel Morland (1625-1695) in 1670, though Athanasius Kircher laid claim to it. Morland's trumpet was shaped like a truncated cone, with an outward curve or lip at the opening.

SPEARFISH, or SPIKEFISH. The great 'billfish' or 'aguja blanca' (*Tetrapturus albidus*) of West Indian waters, which is dark blue above, whitish beneath, and may be seven feet long, including the spear-like jaws, and weigh 100 pounds. It is probably identical with the Mediterranean species, and others occur in the Eastern tropics. Their habits are similar to those of their relatives the sailfishes and swordfishes. See Plate of SPEARFISH AND SWORDFISH.

SPEARMINT. See MINT.

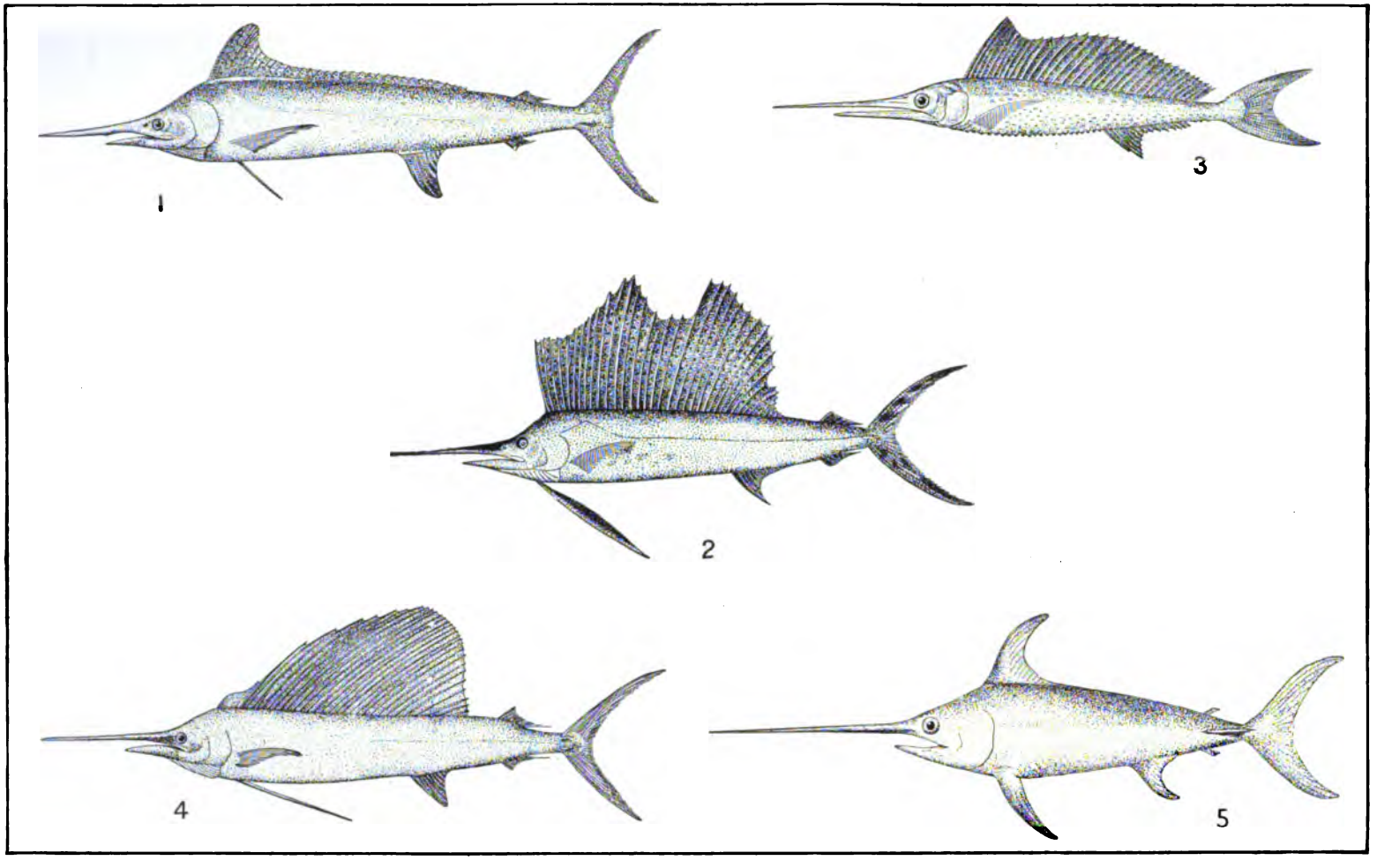
SPEARS, JOHN RANDOLPH (1850—). An American author and journalist, born at Van Wirt, Ohio. In 1875 he became editor of the East Aurora *Advertiser*, and the next year he founded the Silver Creek *Local*. He was a reporter on the Buffalo *Express* from 1880 until 1882, when he joined the staff of the New York *Sun*. His publications include: *The Gold Diggings of Cape Horn* (1895); *The Port of Missing Ships and Other Stories of the Sea* (1896); *The History of Our Navy* (1897); *Our Navy in the War with Spain* (1898); *The Fugitive* (1899); and *History of the American Slave Trade* (1900).

SPECIAL ASSESSMENT. A compulsory contribution levied in proportion to the special benefits derived from a public improvement, and designed to cover, entirely or in part, the cost of that improvement. A special assessment is levied most frequently in connection with the opening or improvement of streets or highways. It differs from a tax in that it is levied in proportion to the benefit directly derived from the uses to which the contribution is put. (See TAX.) Charges of the nature of special assessments were imposed in France as early as 1672. In 1807 a general law was passed authorizing such levies, but it has rarely been invoked. In Prussia, since 1875, the expenses of certain street improvements have been partially defrayed in this manner. In England contributions of the nature of special assessments were imposed in 1427 and in 1667. The Public Health Act of 1875 permits urban authorities, under certain contingencies, to recover the cost of improvements from property-owners, in proportion to the frontage of their premises. In England, however, no general policy of covering the costs of improvements by special assessments exists.

The principle of special assessments first appeared in America in a law of the Province of New York of 1691. By that law, however, all houses in the city of New York might be assessed in proportion to benefits derived from public improvements. By a law of 1787, assessments were limited to the owners of property which was intended to be benefited. In other States this form of revenue appeared about 1830. After the Civil War the principle became far more extended, and is now throughout the United States a recognized principle of local finance. In a typical case, when a street is graded or paved, after the improvement has been made a board of assessors is appointed, who apportion the cost in proportion to benefits received. Such assessments are usually subject to legal limitation as to amount. Consult Rosewater, *Special Assessments* (New York, 1893).

SPECIAL JURY. In the English law, a jury consisting of men who are entitled to be

SPEARFISH AND SWORDFISH



1. SPEARFISH (Tetrapturus albidus). 2. WEST INDIAN SAILFISH (Histiophorus nigricans). 3. YOUNG OF SWORDFISH (No. 5).
4. SAILFISH (Histiophorus gladius). 5. SWORDFISH (Xiphias gladius).

called esquires, or persons of higher rank, bankers, merchants, and persons who occupy private dwelling houses, or possess certain other property qualifications. Under the 'Juries Act' of 1870, either the plaintiff or the defendant in an action is entitled to demand a special jury, but the one making such demand must bear the additional expense, unless at the end of the trial he can obtain a certificate from the trial judge to the effect that the case was a proper one to be tried by a special jury. In some of the United States no provision is made for special juries; but in a few States *struck* or special juries may be ordered, in the discretion of the court, in important cases. See JURY.

SPECIAL PROCEEDING. Under modern codes of procedure, any civil proceeding which is not an action (q.v.). Under the New York Code of Civil Procedure, the following have been held to be special proceedings: an application for admission to the bar; supplementary proceedings; a proceeding to vacate an assessment; proceedings for contempt; proceedings for condemnation of land; habeas corpus. See ACTION, and consult Fiero, *Special Proceedings* (2d ed., New York, 1899).

SPECIAL SESSIONS. Under the English judicial system, where two or more justices of the peace sit together for the trial of some important cause, or to transact other urgent judicial business, the sitting is known as Special Sessions. In New York a criminal court for the trial of misdemeanors and petty criminal cases is called the Court of Special Sessions. See COURT; PETTY SESSIONS.

SPECIALTY. In law, in its broadest sense, any formal, as distinguished from a simple, contract, including judgments, recognizances, statutes staple, statutes merchant, and deeds of grant; but the term is more frequently used as synonymous with contract under seal. Contracts under seal were the earliest form of contract known to the law, having been used from the earliest time both under the common and the Roman law system. Unlike simple contracts, no consideration is required to give them validity at law, their validity, as in the case of all other specialties, depending on their form and the method of their execution. They must be written or printed on paper or parchment and they must be sealed and delivered by the grantor or obligor. It is said that signing a deed by the obligor is not essential to the validity, although it is now the universal practice to execute the instrument by signing as well as by sealing and delivering it. Delivery is effected by an actual delivery of the instrument by the person executing it to the obligor or to another for the obligor with the intent that it should become operative as a deed or contract under seal. After sealing and delivery the instrument remains in full force even if the person executing it take it back into his possession. One executing a specialty may, however, make a qualified delivery of it called a delivery in escrow (q.v.). Formerly specialties were classified as deeds poll and indentures (see DEED), but now the most satisfactory classification of specialties (using that term as applicable only to instruments under seal) is into grants, bonds, and covenants (qq.v.). All statements contained in a specialty are absolutely conclusive against the party making them and executing the instrument, that is, he is conclusively estopped to deny them. Whenever a specialty contract is given on account of or in place of a simple contract, the simple contract is merged in the specialty contract and thereby becomes extinguished. (See MERGER.) The statute of limitations provides a much longer period of limitation for specialties than other forms of obligations, the usual period being twenty years. (See LIMITATION OF ACTIONS.) In case of the death of the obligor the holder of specialty obligations executed by the deceased had at common law much higher rights against his estate than the holder of simple contract obligations. (See ADMINISTRATION.) Although consideration is not necessary to give legal validity to a specialty, courts of equity will not grant their peculiar form of relief by way of specific performance to one who has not given consideration for the specialty obligation which he holds. See SPECIFIC PERFORMANCE; TRUST; USES.

It was formerly held that a corporation could contract only by specialty under its corporate seal. This, however, is no longer the rule in the United States, where it is held that a corporation may enter into contracts by its proper officers without the use of its seal, wherever a private individual might so contract. For further information consult such titles as CONTRACT; BOND; DEED; COVENANT; SEAL; EQUITY; CONSIDERATION, etc., and consult the authorities referred to under CONTRACT and SEAL.

SPECIAL VERDICT. A verdict in which the jury find merely the facts as proved by the evidence and do not apply the law to the facts, but leave it to the discretion of the court as to whether in its opinion the plaintiff or defendant shall succeed. The matter is now regulated by statute in most jurisdictions. In some States such a verdict is said to be 'subject to opinion.' See JURY; VERDICT.

SPECIE PAYMENTS (abbreviation of ML. *in specie*, in coin, Lat. in kind, from *in*, in, and *specie*, abl. sg. of *species*, kind), SUSPENSION AND RESUMPTION OF. The circulating medium of modern States consists both of metallic money and of credit money, issued either by banks or by the Government, which in normal times is convertible into metallic money on demand. (See MONEY.) But there are few States which have not passed through crises when the metallic covering of its paper money has become too scanty, and the convertibility of the paper has been suspended. Such a general suspension of specie payments is legalized either directly or tacitly by the Government. The issues of credit money are usually in such close relation with the Government that such an action must receive governmental sanction. The effect of suspension is to relax the restrictions upon the issue of paper money, and the general result is a redundancy of such money and its depreciation. This does not happen immediately, as the action generally leads to the hoarding or export of such metallic money as remains in the country, thus causing a void in the monetary circulation which the issues of paper money do not at once fill. The extent of the depreciation of the paper money usually depends upon the facility with which it is issued. On the suspension of specie payments by the Bank

of England in 1797, the effect of increased note issues was only gradually felt, for the bank followed in the main a conservative policy. This was true also of the suspension by the Bank of France in 1870. On the other hand, during the suspension of specie payments in the United States in 1813, the banks issued notes recklessly and the depreciation was considerable. When the banks of the United States, on December 30, 1861, again suspended specie payments and the Government followed their example, the large issues of legal-tender notes caused a like result.

The resumption of specie payments is usually a slow and tedious process. The first step toward resumption is the gradual restriction of the paper issues; in the case of Government notes redemption is accomplished by the aid of taxation, while in the case of bank notes resumption occurs through pressure of the Government by taxation of excessive issues or by other means. The second step is to procure a fund of metallic money sufficient to meet probable demands for redemption. To effect this end the Government credit is usually called into requisition. The resumption of specie payments restores the convertibility of credit money, but does not destroy the money itself. It provides for the redemption in metallic money of such sums as may be presented, but not the compulsory redemption of the whole.

The financial history of the United States in the years succeeding the Civil War illustrates the process of resumption. The close of that war found the monetary circulation of the United States exclusively paper, Government issues, State bank notes, and national bank notes. Specie payments had been suspended since 1861, and a return to them seemed the first duty of financial policy. The fear of a contraction of the currency, however, made the first steps in this direction hesitating and uncertain. The gradual redemption of the United States notes, which in January, 1864, had stood at $449,000,000, undertaken under the law of April 12, 1866, had been arrested in February, 1868, when the amount stood at $356,000,000. In the financial troubles of 1873, the Secretary of the Treasury, upon somewhat dubious authority, had increased the volume, but by act of June 20, 1874, Congress stopped this increase when the issue had reached $382,000,000. The task of resumption was earnestly taken in hand early in 1875, when an act was passed providing for resumption on January 1, 1879. In its several provisions and as a whole the act was in the following years the object of repeated attack, but all efforts to repeal it failed. This law removed the limitation which had heretofore rested upon the aggregate issue of national bank notes. It provided, moreover, that as new notes were issued, United States notes to the extent of 80 per cent. of the new bank issues should be retired and canceled. Under this provision the volume of the legal-tender notes diminished by May 31, 1878, when this provision was repealed, to $345,000,000. The resumption act further authorized the Secretary of the Treasury, by the accumulation of surplus revenues and by the sale of bonds, to collect a supply of gold wherewith to resume. The amount to be collected and the amount to be maintained after resumption became a fact were left to his discretion. By the sale of bonds at favorable opportunities the Secretary had on hand on the day of resumption $140,000,000 in gold. The growing strength of the Treasury produced a diminishing premium on gold, and the first of January, 1879, passed off without the dreaded shock. Only a small amount of paper money was actually presented for payment. See MONEY.

SPECIES. See CLASSIFICATION OF ANIMALS; EVOLUTION.

SPECIFICATION. In the law of patents, a technical description of the invention mentioned in an application for a patent, and when used without the word 'claim' it includes the claims or arguments of the inventor as to the novelty, usefulness, etc., of his invention. See PATENT, and the authorities there referred to.

SPECIFIC GRAVITY (ML. *specificus*, specific, particular, from Lat. *species*, kind). The ratio between the weights of equal volumes of any substance and of some other, chosen as a standard. For solids and liquids the standard substance is water, for gases, air, or sometimes hydrogen. Since the volume of a given weight of a substance changes with temperature, it is necessary for exact determinations that the standard selected should be at a certain fixed temperature. Thus specific gravity is not the ratio of an equal volume of a given substance to water at any temperature, but only at the standard temperature which is selected, as described below. Likewise for a specific gravity determination to be of value the temperature of the substance at the time of making the measurement should be given. For gases not only the temperature, but the pressure must be mentioned. For many purposes the term density has replaced specific gravity, but the two are not synonymous. The density of a substance (at a given pressure and temperature) is the mass of that substance in a unit volume, provided it is homogeneous; otherwise it is the mass of a volume so small as to be homogeneous, divided by the volume. Thus density is an absolute term, expressing the quantity of a certain kind of matter in a given space, while specific gravity is merely relative, being in fact the ratio of the density of the substance to the density of the standard. The specific gravity of a gas or vapor is usually referred to air at the same pressure and temperature as that of the gas, but also frequently to hydrogen under like conditions. In terms of the latter it is equal to half the molecular weight of the gas. See MOLECULES—MOLECULAR WEIGHTS.

The specific gravity of solids and liquids is variously referred to water at 4° C., 15° C., or 62° F., and sometimes still other temperatures. Specific gravities on these scales are respectively as 1.000045, 1.000913, 1.001180—the density of water at these temperatures being inversely as these numbers. The difference is obviously not of importance except for purposes of extreme accuracy. Density in the metric system is measured in grams per cubic centimeter (kilograms per liter). If a liter of water at 4° C. weighed exactly a kilogram, as was intended, the density of water at this temperature would be one and metric density and specific gravity referred to water at 4° C. would be identical. The density of water at this temperature is actually .999955, so that specific gravity referred to water at 4° is equal to density × 1.000045. Specific gravity referred to air at 0° C. and 76 centimeters pres-

sure is equal to metric density divided by the density of air = .001293.

On the English system density is variously expressed in pounds per cubic foot, pounds per cubic inch, grains per cubic inch. To reduce specific gravity referred to water at 62° F. to density on these scales multiply by 62.3546, .0360848, 252.593, respectively.

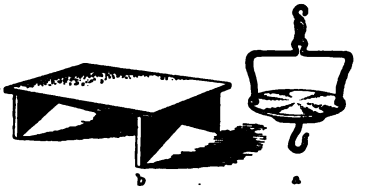
METHODS OF MEASUREMENT. I. DENSITY. Two courses may be pursued to determine the density of a substance: (1) Weigh a portion of it and measure its volume; (2) determine its specific gravity referred to a substance of known density. For approximate purposes the former is best, particularly in the case of solids of regular shape. To attain a high degree of accuracy, however, is difficult, since the direct determination of volume is subject to many errors. Hence the density of most substances is found by determining, by one of the methods below, its specific gravity referred to water or hydrogen, the density of each of these having been carefully investigated. The density of water is found by observing the loss in weight of a solid of regular shape when immersed in water, some of the best results being obtained with a glass cube whose exact dimensions were found by a method based on the interference of light.

II. SPECIFIC GRAVITY OF SOLIDS AND LIQUIDS. Most of the methods given below are based on Archimedes's principle, which states that a solid floating or immersed in a liquid loses weight equal to that of the liquid it displaces. Hence if it is totally immersed the loss of weight is the weight of a volume of liquid equal to the volume of the solid. Hence:

$$\frac{\textit{Weight of solid}}{\textit{Loss of weight}} = \frac{\textit{specific gravity of solid.}}{\textit{specific gravity of liquid.}}$$

Thus if either is known the other may be found. For exact purposes the temperature of the liquid must be known, weighings in air must be corrected for the buoyancy of the latter, and the solid must be supported in the liquid so that only a single fine wire cuts the surface. Air bubbles are also a serious source of error, and for this reason water when used should be freely distilled or boiled.

(A) HYDROSTATIC BALANCE. A chemical balance (see BALANCE) so arranged that a vessel of liquid may be placed under one end of the beam without resting on the pan. This is done by replacing the ordinary pan by a shorter (Fig. *a*) or else by resting the vessel on a bridge (Fig. *b*) over the pan.

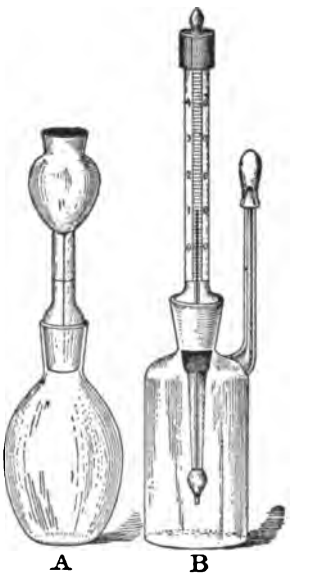


BRIDGE AND PAN FOR USE WITH BALANCE.

The solid is weighed in air, then suspended from a hook on the pan or pan support by a wire of known weight, so that it hangs totally submerged in the vessel of liquid, and again weighed.

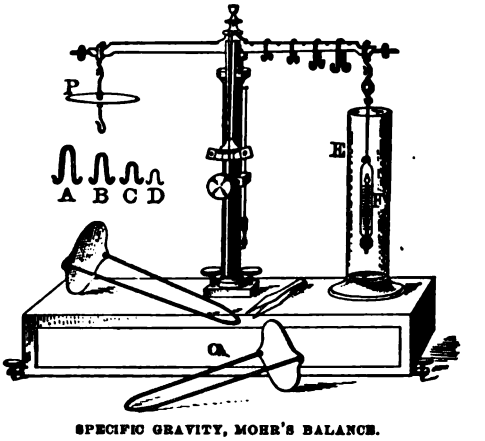
(B) JOLLY BALANCE. A large delicate spiral spring supported by a vertical rod of adjustable length and carrying at the bottom two pans, one below the other. For description see JOLLY BALANCE.

(C) SPECIFIC GRAVITY BOTTLE. A light glass flask with a ground stopper generally pierced with a fine hole so that it may be completely filled. The flask is weighed empty, then full of water. Knowing the density of water, the internal volume is calculated. The bottle may now be filled with a liquid of unknown density and weighed and the density calculated. Or a weighed amount of solid in small pieces may be put in the bottle, which is then filled up with water and weighed. The difference between the weight of the solid plus that of the bottle entirely filled with water and the weight observed is the weight of water displaced by the solid. This is the most accurate method for liquids and solids in small bits.



SPECIFIC GRAVITY BOTTLE OR PYKNOMETER.
A, simple form; B, with thermometer.

(D) MOHR'S BALANCE. A balance beam divided into tenths carries suspended from one end by a platinum wire a glass cylinder, F, almost solid. On the other end is a counterpoise, P, balancing the cylinder in air. Riders, A, B, C, D, are provided of weight equal to the loss of weight of the cylinder in water at 15° C. and of 1-10, 1-100,



SPECIFIC GRAVITY, MOHR'S BALANCE.

1-1000 this weight. When the cylinder hangs in a jar, E, filled with a liquid whose density is desired, these riders are adjusted on the beam so that balance is restored, and the position of the riders then gives directly the specific gravity referred to water at 15°. Thus with the riders

as in the figure the specific gravity would be .8642. The glass cylinder carries a small thermometer, and the temperature should be adjusted to about 15°. The method is extremely convenient to three places of decimals. The fourth requires many corrections.

(E) HYDROMETER. A long hollow glass cylinder or 'stem' weighted at one end by a bulb containing shot or mercury so that it will float upright in a liquid. The stem is graduated and the specific gravity is given by the mark to which it sinks, read *through* the liquid. The graduations are sometimes in specific gravity or density, but often according to established arbitrary scales, those of Beaumé and Twaddell being best known. Instruments are made of different styles for milk, spirits, oil, acids, etc. See HYDROMETER.



HYDROMETER.



APPARATUS FOR METHOD OF BALANCING COLUMNS.

(F) BALANCING COLUMNS. A tube such as that shown is supported vertically in two jars containing two liquids. These are drawn up into the tubes by suction on the tube at the top, which is then closed. The height of the liquids in the tubes above their surfaces in the tumbler are inversely as their densities. If the liquids do not mix a simple inverted U tube may be used, one liquid being poured into each arm. If tubes less than half an inch in diameter are used the liquids should be drawn up only a little, heights measured, then as far as possible, and the ratio of the *increase* in lengths of the columns taken.

(G) The specific gravity of a solid lighter than water is found by either the hydrostatic or Jolly's balance, a weight being attached sufficient to sink it. This weight should hang under water throughout.

III. SPECIFIC GRAVITY OF GASES. BUNSEN'S METHOD. The rate of effusion of a gas, i.e. the volume which escapes per second through a very small opening, is for a given opening and difference of pressure inside and out, inversely as the square root of its density.

Near the top of a long vertical glass tube is a partition consisting of a disk of platinum pierced by a hole about .0005 inch in diameter. Above this the tube is closed by a ground stopper. The tube is filled with gas and plunged into a deep bath containing mercury and adjusted until a glass float carried by the mercury stands at a fixed level. The stopper is removed and the time required for the float to rise to another fixed level as the mercury drives out the gas is measured. The experiment is then repeated in exactly the same manner with the standard gas. The ratio of the times observed is the square of the ratio of the densities, i.e. the specific gravity of the unknown gas referred to the standard gas. See MOLECULES—MOLECULAR WEIGHTS.

For tables of density and specific gravity, consult *Smithsonian Physical Tables* (Washington, 1896). Methods of determining the specific gravity of a substance will be found in any standard text-book on physics.

SPECIFIC HEAT. See HEAT.

SPECIFIC LEGACY. See LEGACY.

SPECIFIC PERFORMANCE. A technical legal term employed to denote the equitable doctrine and rules under which a court may compel a party who has refused to perform his part of an agreement to carry it out according to its terms. In an action at law for the breach of a contract the only relief possible is damages, but as money is not always an adequate compensation for the loss which may be suffered, the courts of equity will in certain cases decree a specific or actual performance of the terms of the contract. It lies in the discretion of the court whether or not to grant this relief, but precedents must be followed as a guide. In general, to obtain a decree of specific performance the plaintiff must satisfy the court that the remedy at law is entirely inadequate; that there was a valid, fair, and reasonable contract between the parties; and that he has done nothing inequitable on his part. It is a general rule to grant specific performance of contracts for the conveyance of real estate. It is only in exceptional cases that the relief will be granted in cases of contracts to convey personal property, and then only when the article is unique in its character and practically unobtainable elsewhere, such as a rare picture which could not be duplicated. In a few cases specific performance of a contract to do some act, such as build a structure, will be decreed. For example, where a railroad agreed to build an ornamental bridge over a private roadway in consideration of the right of way through a man's premises, the court decreed that the company should construct the bridge according to the terms of their contract. Consult Fry, *On Specific Performance*. See also CONTRACT, and authorities there referred to.

SPECTACLED BEAR (so called from the marking on the face). The small bear of the northern Andes. See BEAR.

SPECTACLES (Lat. *spectaculum*, show, from *spectare*, to behold, from *specere*, to see; connected with Gk. *σκέπτεσθαι*, *skeptesthai*, to look, Skt. *spaś*, to see, OHG. *spehôn*, Ger. *spähen*, to

spy). A device for the purpose of aiding the sight when impaired by age or otherwise. (See SIGHT, DEFECTS OF.) They were invented during the thirteenth century. The credit is attributed by some to Alessandro di Spina, a Florentine monk, and by others to Roger Bacon. The lenses are nearly always made of the best optical glass, and by the best makers are ground with extreme care. Lenses may be mounted in either eye-glass or spectacle frames, care being taken that the centre of the lens is opposite the pupil and that the glasses are tilted at a proper angle for reading or distance as desired. When separate lenses are required for these purposes the so-called bifocal glasses may be used. They are made by cementing a small strong lens upon the lower part of the other, so that when the eyes are lowered, as in reading, the line of vision passes through that portion. Lenses are now numbered, with one of a focus of one meter as a unit, known as one diopter. One with four times that strength has a focal distance of one-quarter of a meter and is known as 4 D. (diopters). Convex spherical lenses are used in hypermetropia, presbyopia, and after removal of the crystalline lens for cataract. Concave spherical lenses are employed in myopia. If astigmatism exists a cylindrical lens, either concave or convex as required, is used. As the astigmatism may be in only one meridian, while that at right angles to it is normal, or as there may be either hyperopic or myopic astigmatism in both, or hyperopic in one and myopic in the other, it is sometimes necessary to employ cross-cylinder lenses, a combination of two cylinders with their axes at right angles to each other. Prismatic glasses are used in cases with weakness of ocular muscles, one being chosen which will make the images seen by the two eyes coincide. Combinations of cylindrical and spherical lenses and prisms are needed when errors of refraction or accommodation are combined with astigmatism and muscular weakness, which cause double vision.

SPECTATOR, THE. (1) A famous periodical published daily in London from March 1, 1711, to December 6, 1712, to which Addison and Steele were the principal contributors. Addison wrote 274 papers, Steele 236. Addison's essays, almost perfect in form, fixed a new standard in manners, morals, and taste, whose influence lasted for years. The *Spectator* was revived in 1714, when 80 numbers were issued, of which Addison contributed 24.

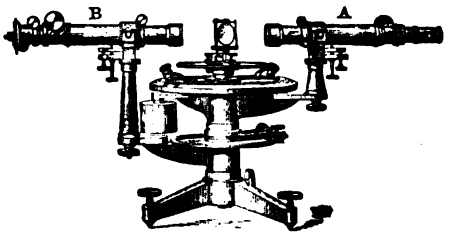
(2) A London weekly periodical, founded in 1828, devoted at first solely to literature and social questions; politics were, however, introduced and it became a strong advocate of the Reform Bill. The first editor was Robert S. Rintoul, who continued in office till his death in 1858. John Stuart Mill was a member of the staff. From 1861 to 1897 it was edited by Richard Holt Hutton, who wielded great influence in literature and theology, while his partner, Meredith Townsend, managed politics, which were liberal until 1886. He was succeeded as editor and owner by John St. Loe Strachey, the political attitude of the paper being Liberal-Unionist.

SPECTRAL BAT. See BAT and Colored Plate of MAMMALIA.

SPECTRE (from Lat. *spectrum*, appearance, image, apparition). A fanciful book-name for one of the small lemurine animals of the Malayan region, the tarsier, on account of its gaunt form, enormous eyes and nocturnal appearance. Many superstitious notions attach to these and related animals (see LORIS) among the natives of the East Indies, causing them to be regarded with more dread than curiosity. Their nocturnal and irregular appearance have caused certain bats and small owls also to be called 'spectral.'

SPECTROGRAPH (from Lat. *spectrum*, appearance, image, apparition, from *specere*, to see + Gk. *γράφειν*, *graphein*, to write). A particular form of spectroscope (q.v.) in which the apparatus to record the radiations is a photographic plate. The apparatus, then, consists of a collimator, a prism or a grating, and a telescope in which the eyepiece is replaced by a photographic camera.

SPECTROMETER (from Lat. *spectrum*, appearance, image, apparition + Gk. *μέτρον*, *metron*, measure). An instrument especially designed to determine the index of refraction of transparent bodies. The ordinary type of instrument is illustrated in the cut, and, as shown, consists essentially of two arms which are movable around an axis carrying a platform on which rests a prism of the substance to be investigated. One of the arms carries a telescope, A, while the other supports what is known as the 'collimator,' B. This consists of a tube at one end of which is a slit made by two movable parallel edges, and at its other end is a lens so placed that the slit is in its principal focus. If a source of light, for instance a sodium flame, is placed in front of the slit, a beam of parallel light will proceed from the collimator lens, fall upon the prism, suffer deviation, enter the telescope and be focused by the objective on the cross-hairs of the eyepiece. The angles made between the telescope and collimator may be read on a scale attached to the platform of the instrument.



SPECTROMETER.

To determine the index of refraction of a substance in the form of a prism, for radiations of a given wave length, it is necessary to know: First, the angle of the prism, that is, the angle made between the two plane faces of the prism; second, the angle of minimum deviation for the given radiations. Both these quantities can be measured with the spectrometer, care being taken to have the axes of the telescope and collimator perpendicular to the axis of the instrument, and the edge of the prism parallel to it. The following formula then gives the index of refraction, in which A represents the angle of the prism and D the angle of minimum deviation:

$$\text{Index of refraction } n = \frac{\sin \frac{A+D}{2}}{\sin \frac{A}{2}}$$

SPECTRO-PHOTOMETRY (from Lat. *spectrum*, appearance, image, apparition, + Gk. *φῶς, phōs*, light + *-μετρία, -metria*, measurement, from *μέτρον, metron*, measure), or SPECTRAL PHOTOMETRY (see also SPECTROSCOPY and PHOTOMETRY). The study of the relative intensities of light of various colors from the same source or from different sources. Not only, as an ordinary photometry, may the relative intensities of two sources of white light or of monochromatic light be compared, but spectro-photometers are provided with dispersing prisms so arranged that the various colors of one beam of white light may be compared with the corresponding colors of another. The general method is to bring some of the light from one source and some from the other

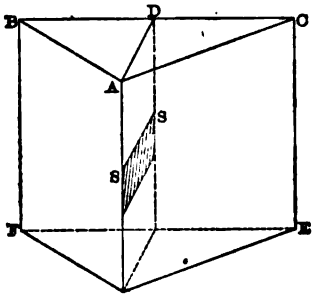


FIG. 1. DOUBLE PRISM, BRACE'S SPECTRO-PHOTOMETER.

source side by side in the same field of view, and by suitable means to alter the intensity of either beam (or of both) in a known degree until a 'match' or photometric equality is secured; this condition of equality being determined by the vanishing of the line of separation between the two portions of the field of view, illuminated respectively by the two sources to be compared. There is also a so-called 'method of contrast' devised by Lummer and Brodhun.

The most recent and efficient form of spectro-photometer is that devised by Professor Brace of

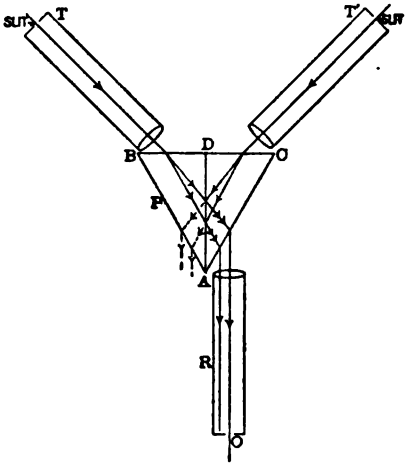


FIG. 2. OPTICAL SYSTEM, BRACE'S SPECTRO-PHOTOMETER.

the University of Nebraska. It consists essentially (see Fig. 1) of a double prism P with a narrow silvered strip SS on the face AD of the right half. T and T′ are two similar collimators symmetrically situated with respect to the prism and provided with adjustable slits through which the light from the two sources enters the optical system of the photometer. The amount of light entering the system through either collimator depends upon the width of its slits. The width of one slit, say T, is, after the initial adjustments of the instrument, kept fixed throughout any one series of observations, while the width of the other collimator-slit (T′) may be altered at will to secure a match in intensity of the two beams. Light of the same wave-length (i.e. of the same color) is thus brought by direct transmission from the collimator T, and after reflection at the silver strip from T′, to the same focus in the observing telescope R. When the eyepiece is removed and the prism viewed through a slit in the focal plane of R, the eye sees three fields (as in Fig. 3), the central one, ABCD illuminated by light from the right collimator, T′, and the upper and lower ones, ACF and BDG, by light from the left collimator, T. The fields meet in the sharp edges of the silver strip. A match in intensity is secured by altering the width of the slit T′, which is controlled by an accurately turned screw carrying a graduated drum so that the width of T′ can be altered at will by a known amount and thus the total amount of light passing through this collimator can be changed as desired. The intensities of two beams will be inversely proportional to the slit-widths required for a match between them and the light coming through the fixed slit T. (This simple relation is not quite true; the deviations from it are treated in the articles cited below.) The amount of light coming through the collimator with the fixed slit may be altered without changing the width of the slit by means of a rotating disk mounted directly in front of the fixed slit, so as to cut off the light during a certain fraction of each revolution. This device greatly increases the range of the instrument.

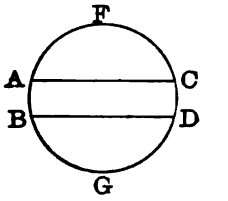


FIG. 3. FIELD VIEW OF SPECTRO-PHOTOMETER.

By turning the telescope R through a small angle the various colors of the spectrum may be brought into the field of view in succession, and the relative intensities of the two sources for each color determined.

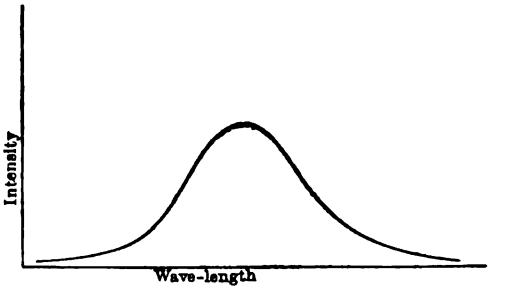


FIG. 4. INTENSITY CURVE, INCANDESCENT BODY GENERALIZED.

According to the measurements of Fraunhofer, Koenig, Brodhun, and others, the distribution of intensity in the spectrum of the sun and other incandescent bodies corresponds roughly to the

curve in the accompanying diagram, Fig. 4. A comparison of the intensity-distribution in the spectra of the electric incandescent and arc lights with that of the sun gives the following results, calling unity the relative intensity of each with respect to the sun for sodium light (D line):

WAVE-LENGTH	Inc. / sun	Arc / sun
800 μμ	11.86	1.67
Line A	4.88	1.37
" B	2.68	1.28
" C	1.25	0.97
" D	1.00	1.00
" E	0.38	0.77
" F	0.17	0.56
" G	0.10	0.83
" H	0.05	1.21

The reflecting power of a polished plane surface or the absorbing power of a thin film or plate of an absorbing medium can be determined for various colors by means of a spectro-photometer, by placing the mirror or the thin film in front of the adjustable slit T′, and comparing the intensity of the light after reflection or transmission with the intensity of the light coming directly to the other collimator of the photometer. For example, a polished silver surface reflects 95 per cent. of the red light falling on it normally, while for the blue only 60 per cent. is reflected. A mirror of solid cyanine reflects 15 per cent. of the orange, 2 per cent. of the green, and 6 per cent. of the violet.

BIBLIOGRAPHY. The methods of observation and of calibration, and the sources of error are fully treated in the following articles: Lummer und Brodhun, *Zeitschrift für Instrumentenkunde*, 1889, p. 42, and 1892, p. 137 (Berlin); Murphy, *Astro-Physical Journal*, 1897, p. 1 (Chicago); Brace, *Philosophical Magazine*, 1899, p. 420 (London), and *Astro-Physical Journal*, 1900, p. 6 (Chicago); Capps, *Astro-Physical Journal*, 1900, p. 25 (Chicago); Tuckermann, *Astro-Physical Journal*, 1902, p. 145 (Chicago).

SPECTROSCOPE (from Lat. *spectrum*, appearance, image, apparition + Gk. *σκοπεῖν*, *skopein*, to view). An instrument designed to investigate the nature of the radiations emitted by various sources of 'light,' it being understood that this term includes *all* waves in the ether, although only those within certain narrow limits of wave-length affect the sense of sight. It is shown in the article on SPECTROSCOPY that radiations are being sent off in the ether from all natural bodies, and that these are in the form of waves of different wave-length. When these waves pass through a spectroscope they are dispersed in such a way that the waves of certain wave-length are brought to focus at a point different from that to which waves of a different wave-length are brought. In this way the radiations from any source are analyzed and spread out in what is called a 'spectrum.' The essential features of a spectroscope are then: first, a slit, or extremely small source of radiation; second, some means of producing dispersion: third, a lens or other means of focusing the radiations at the eyepiece of a telescope, upon a screen, or upon some suitable recording instrument. If the radiations are of such a nature as to affect a photographic plate, that is, if they are in the ultra-violet or in the visible portion of the spectrum, methods of photography may be used in connection with the spectroscope. (See SPECTROGRAPH.) If the radiations are in the infra-red, that is, if the wave-lengths are so long that they do not affect the sense of sight, instruments must be used which are sensitive to such radiations; for instance, a thermometer, bolometer, radio-micrometer, radiometer, or other heat-registering device. It has been found that if a plate of glass covered with some phosphorescent substance, such as Balmain's paint, is exposed to light and then carried into a darkened room, it will continue to be luminous for some time; but, if exposed in a spectroscope to infra-red radiations, the phosphorescence at those points reached by the radiations is destroyed. This furnishes a method, therefore, for the study of these long waves.

As ordinarily constructed, a spectroscope has the same general appearance as a spectrometer (q.v.). There is, however, in addition, in case prisms are used to produce dispersion, some auxiliary apparatus for the purpose of enabling the observer to record numerically the positions occupied by the waves which he is observing, in comparison with other waves. One method which is in common use is to attach to the instrument a tube containing at one end a transparent scale, and at its other end a lens, the tube itself being so placed that when the scale is illuminated by a lamp the waves proceeding from it fall upon the last face of the last prism and are *reflected* in such a manner as to be brought to focus in the same plane as are the radiations under investigation. By this means there is produced across the spectrum a series of lines regularly spaced and numbered, and the position of any radiation can be recorded.

Various means are used to produce dispersion, but the two methods most generally adopted are (1) to interpose a prism or train of prisms between the collimator and telescope, or (2) to allow the light from the collimator to fall upon a diffraction grating (q.v.). The dispersing action of a prism and of a grating has been explained before (see DIFFRACTION AND DIFFRACTION GRATINGS); but there are several important differences between the spectra obtained by these two instruments. Prismatic spectra are said to be 'irrational' because there is no simple relation between the material and shape of the prism and the dispersion produced by it; and, further, because prisms of the same shape and size produce quite different spectra, in the sense that the relative deviations of the same waves differ widely when different prisms are used. See DISPERSION.

The spectra produced by plane gratings, on the other hand, obey a definite law, there being an extremely simple relation between the constants of the grating and the deviation of a given train of waves, which is independent of the material of the grating, and which enables one by simple means to measure the wave-length of the radiations being studied. If a concave grating is used in place of a plane one, as was first done by Rowland in 1882, it is not necessary to have lenses in the spectroscope, the essential parts of the instrument then being simply a slit, a grating, and some receiving apparatus, such as a photographic plate. There is a further advantage in the use of a concave grating (which may also be obtained with a plane grating if suitably ad-

justed) if this instrument is used in the standard manner, in the fact that the spectra produced are of such a kind that the distances along the photographic plate are proportional to differences in wave-length of the waves which are thus recorded. A spectrum of this kind is said to be 'normal.'

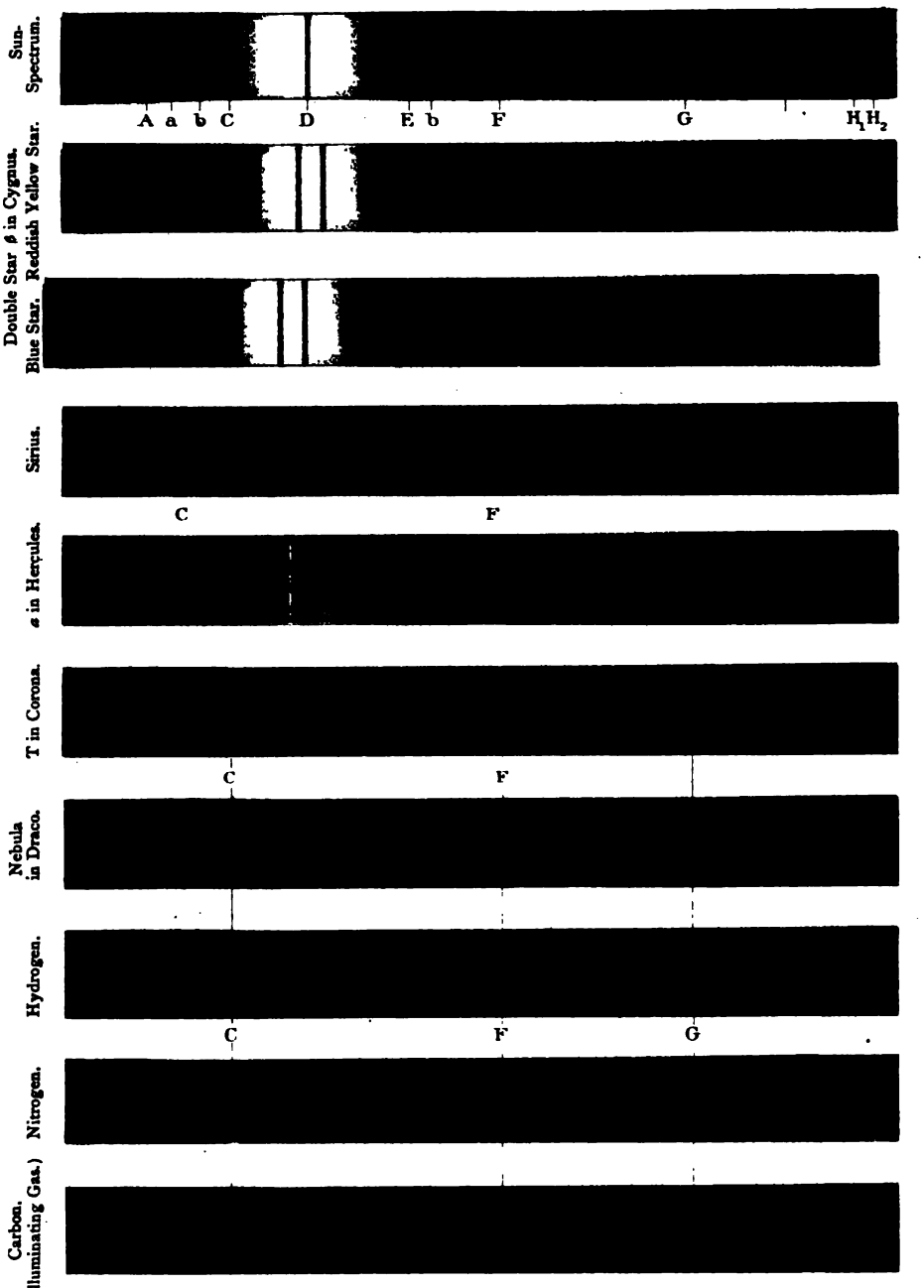
SPECTROSCOPY. The science which deals with the methods of production of the spectra by various sources of light (or of waves in the ether) and with their study and interpretation. Newton, in 1672, was the first to observe that if sunlight entering a darkened room through a small opening were allowed to fall upon a prism a spectrum was produced, owing to the fact that waves characteristic of different colors suffer different deviations by the prism, and that, therefore, the components of white light were separated. (See DISPERSION.) Newton made no observations except upon the visible portions of the spectrum; but in the year 1800 F. W. Herschel observed that the spectrum continued beyond the red, as was shown by holding a thermometer in that position; and in 1801 J. W. Ritter proved the existence of the ultra-violet light by showing that silver chloride was affected not alone by the violet portion of the spectrum, but beyond. In 1802 Wollaston made the discovery that the solar spectrum was not continuous, but was interrupted by certain dark lines, using in his experiments a slit and a prism with its edge parallel to the slit. It is remarkable that Newton did not make this same discovery in his investigation on the spectrum of the sun, because he also at times used a slit in the same manner as did Wollaston. The most important investigation, however, on the solar spectrum, one which in fact serves as the foundation of the science of spectroscopy, was that of Fraunhofer beginning in the year 1814. Fraunhofer (q.v.) was the inventor of the diffraction grating (q.v.), and was the first to measure accurately the wave-lengths of light waves. By using both grating and prism spectroscopes he showed that there were numerous dark lines in the solar spectrum, to the strongest of which he gave certain names in the form of letters, A, B, C, etc. He studied, further, the radiations from certain of the stars and from certain sources of light such as flames, etc. He made the important observation that the position occupied in the solar spectrum by the dark D lines is identical with that occupied by the bright yellow line observed in the spectra of all flames. His whole work was epoch-making.

Herschel was the first to investigate the absorption spectra produced by various bodies, that is, to study the effect of interposing between the source of light and the spectroscope a substance which absorbs certain radiations. The next great step was made by Kirchhoff, who showed from theoretical considerations that the emission spectrum and absorption spectrum of a substance should be the same at a definite temperature, and that as the temperature changed the intensity of the spectra would vary. In this way Kirchhoff was able to explain the dark lines in the solar spectrum as due to an absorbing layer of metallic vapors forming an atmosphere around the white-hot central portion of the sun, which was supposed to emit a continuous spectrum. In collaboration with Bunsen he then undertook a careful study of the spectra of various substances and founded the science of spectrum analysis. The explanation of the fact that absorption spectra and emission spectra are identical was first given by Stokes many years before Kirchhoff's statement, and Balfour Stewart had also arrived at the same idea. From the day of Kirchhoff up to the present time all branches of spectroscopy have been pursued most vigorously, the most important discovery being the principle of the concave grating, made by Rowland in the year 1882, which is discussed under SPECTROSCOPE, and under DIFFRACTION AND DIFFRACTION GRATINGS.

There are many methods of making vapors luminous, among which it may be sufficient to name the flame, the electric arc, the electric spark. The spectra produced in these various ways have received the names of flame spectra, arc spectra, etc. The standard method of producing flame spectra is to hold a portion of the substance to be investigated or a salt of the substance in the Bunsen flame until it is vaporized, and thus the vapor is raised to the temperature of the flame, and in general becomes luminous. Other flames than that of the Bunsen burner may be used. Extremely minute amounts of the substance may be recognized in this way, as has been shown by Kirchhoff and Bunsen. They state that one fourteen-millionth of a milligram of sodium can be recognized in the Bunsen flame; one sixty-thousandth of lithium; one fifty-thousandth of a milligram of calcium, etc. To produce arc spectra it is customary to bore out a small opening in a carbon rod, fill this with some salt of the substance to be investigated, and then use it as the positive pole in the ordinary electric arc. By this means a high temperature is produced, namely about 4000° Centigrade, and the vapor of the substance is made luminous. To produce the spark spectrum numberless methods are in use. Among these it may be sufficient to mention two. If the electric spark produced by an induction coil or transformer is made to pass between solid electrodes made up of the substance to be studied, they will be vaporized and the vapor will be luminous. If a gas, for instance nitrogen or hydrogen, be inclosed in a glass bulb into which enter two metal wires to serve as electrodes, and if the pressure be made sufficiently low, a spark can be made to pass through the remaining gas. Changes in the pressure, in the electrical constants of the circuit, etc., produce alterations in the spectra. The main distinction between the flame spectra and arc spectra is one of temperature, but so little is known in regard to the mechanism of a spark that no conclusions can be drawn with certainty. Beyond a doubt the spectra produced in the arc are due in the main to the high temperature of the arc, whereas the cause of the production of spectra in the spark is probably not a temperature effect at all, but something concerned with the transformation of electric energy.

The means of producing spectra are discussed under the head of SPECTROSCOPE (q.v.). Prisms or gratings are used for this purpose. The accepted method at present for measuring wave-lengths in the spectrum of any substance is to photograph on the same plate with these lines the spectrum of some substance whose lines are known and then to obtain the desired quantities by a method of interpolation. The spectrum of iron is as a rule used to give the comparison lines.

SPECTRUM



SPECTRA OF THE FIXED STARS AND NEBULAE COMPARED WITH THE SUN-SPECTRUM AND OTHER SPECTRA

It has been found as a result of careful observation that, with one or two doubtful exceptions, the spectrum of a solid or liquid is always continuous; and within recent years attempts have been made successfully to express in mathematical form the connection between the temperature of the solid and the distribution of energy in its spectrum as a function of its wave-length. These laws have been deduced theoretically and verified by experiment. It has been found further that the spectrum of a gas when rendered luminous is in all cases discontinuous, although occasionally there is a faint continuous background. This fact in regard to gaseous spectra is what would be expected from the kinetic theory. The exact origin of the spectrum is in general inside the atom; but the connection between the parts of the atom and the ether in which waves are produced is not known. The spectra of compounds when rendered luminous at a temperature not sufficient to decompose definitely the substance have been studied with care, and many interesting facts have been discovered. It has been shown that all gases will produce under varying conditions different spectra, but the reason for this is by no means clear. There are at least three different spectra of hydrogen, many of oxygen, many of argon, etc. The influence of pressure, of temperature, and of the electrical conditions is marked; and these subjects form at present one of the most important fields of research in spectroscopy.

The spectrum of a gas is modified if the source of light is either approaching or receding from the spectroscope, as, for instance, in the case of a star with a motion toward or away from the earth. It is owing to this fact that one is able, by a comparison of the spectra of certain stars with spectra produced here on the earth, to calculate the motion of the stars in the line of sight. See DOPPLER'S PRINCIPLE.

A careful comparison of the lines in the spectrum of any one gas or vapor, and of the spectra of different vapors, has led to the discovery of several simple mathematical laws connecting them. Thus the lines in the ordinary hydrogen spectrum have such wave-lengths that they can be expressed in a mathematical formula which is known as Balmer's law. This can be expressed as follows: $\lambda = h \frac{m^2}{m^2 - 4}$, where λ represents the wave-lengths, m has in succession the values 3, 4, 5, etc., and h is a constant whose value is approximately 3647.20.

A relation similar to this of Balmer's has been shown by Kayser and Runge to apply to most of the lines in the spectra of the alkalies and the alkaline earths. Another law has been found to express most accurately the distribution of the lines in the well-known bands which are produced by carbon, nitrogen, and other substances. Laws have been found also connecting the spectra produced by different substances, in those cases where these substances are related chemically.

In the year 1896 Zeeman discovered that a source of light if placed in a magnetic field and viewed either along the lines of force or at right angles to them had its spectrum changed by the resolution of its lines into several components. This fact has a most important bearing upon theories of matter and serves to prove that the vibrations in the ether are produced by the vibrations inside the atom of minute electrical charges which have been called electrons. A recent investigation of the Zeeman effect by Runge has shown that the components of these spectrum lines produced by the magnetic field also obey certain mathematical laws.

A most important branch of spectroscopy is the study of the solar spectrum as we observe it on the earth. A few of the absorption lines are due to the fact that the waves coming from the sun pass through the atmosphere of the earth, and, therefore, suffer absorption owing to the water vapor and oxygen in it. The 'rain band' is due to the presence of the former. The other lines are, as explained above, caused by the absorption in the atmosphere of the sun itself. The interior portion of the sun, which is at a high temperature, emits a continuous spectrum, but, owing to the presence in the atmosphere of the sun of metallic vapors at a temperature less than that of the interior, there is absorption, and thus the solar spectrum is a continuous one crossed by dark lines. There are radiations also coming to us from the outer portions of the sun, the so-called chromosphere and corona; but these are not easily observed, except at times of solar eclipses. Most of the solar lines can be identified with the spectra of known substances on the earth; for instance, sodium, iron, carbon, etc., are known to be in the sun. It may be stated in general that if the earth were raised to a temperature as high as that of the sun its spectrum as seen at a distance would be practically identical with that of the sun as we see it.

A careful study has been made of the spectra of the various stars, and attempts have been made with more or less success to group the stars in certain classes according to their spectra, the idea being that some knowledge might be obtained in regard to the evolution of the stars and their present stage in this progress. Consult Schuster, "The Evolution of Solar Stars," *Astrophysical Journal*, April, 1893.

The wave-lengths of a few of the important Fraunhofer lines in the solar spectrum, as measured by Professor Rowland, are as follows:

B	6870.186	$\times 10^{-8}$ Cm.	F	4861.527	$\times 10^{-8}$ Cm.
C	6563.054	"	G	4308.061	"
D_1	5896.357	"		4307.907	"
D_2	5890.186	"	H	3968.625	"
E_1	5270.495	"	K	3933.825	"
E_2	5269.723	"			

BIBLIOGRAPHY. There is a complete discussion of the methods, results, and theories of spectroscopy in Kayser, *Lehrbuch der Spektroskopie* (Leipzig, 1900). A briefer account is given in Landauer, *Spectrum Analysis* (New York, 1897). Fraunhofer's original papers are reprinted in *Prismatic and Diffraction Spectra, Scientific Memoir Series*, vol. ii. (New York, 1898); and those of Stewart and Kirchhoff in *Radiation and Absorption*, same series, vol. xv. (New York, 1901). Rowland papers *On Concave Gratings for Optical Purposes* (1883); *On the Relative Wave Lengths at the Lines of the Solar Spectrum* (1886); together with other papers contained in his collected physical papers (Baltimore, 1902), should be consulted by the student. More popular books dealing with spectroscopy are: Lockyer, *Contributions to Solar Physics* (London, 1874); id., *Chemistry of the Sun* (Lon-

don, 1877); Roscoe, *Spectrum Analysis* (London, 1866); Schellen, *Spectrum Analysis* (New York, 1872). See LIGHT.

SPECTRUM. See LIGHT; DISPERSION; SPECTROSCOPE; SPECTROSCOPY.

SPECTRUM ANALYSIS. As is explained in the article on SPECTROSCOPY, the spectrum of a definite substance under definite conditions is always the same. The spectrum of the radiations emitted by iron vapor, for instance, when rendered luminous, is characterized by certain definite trains of waves, or, as ordinarily expressed, by certain 'lines.' If the conditions under which the spectra are produced are varied, for instance, if for one case the spark was used, and in another the arc, there are differences in the spectra, consisting mainly in variations in the intensity of the lines. Further, if other substances are mixed with the iron, or if the iron exists as an impurity in some other substance, or if the pressure of the surrounding atmosphere is varied, there are corresponding alterations in the iron spectrum. But under definite conditions there are definite lines which are characteristic of iron. Extremely small traces of a substance may be thus made evident by the presence of its spectrum; and in a mixture of many substances the presence of the various parts may often be ascertained by a study of the spectrum emitted. This constitutes the science of spectrum analysis and has proved useful to the chemist in many cases. In fact the discovery of several elements, viz. cæsium, rubidium, and gallium, was due to the detection in certain spectra of lines which could not be ascribed to any known substances. The application of spectrum analysis to the study of the spectra of the sun, stars, and other heavenly bodies has proved most important, and some of the results of various observations and investigations are given in the article on SPECTROSCOPY (q.v.).

SPECULAR IRON ORE. See HEMATITE.

SPECULATION (Lat. *speculatio*, exploration, contemplation, from *speculari*, to view, watch, spy out, from *specula*, watch-tower, from *specere*, to see). Buying and selling of property chiefly with a view to securing a profit through changes in the price of that property. There is a speculative element in a great variety of business transactions; but the term is usually confined to those in which the element of risk is relatively important. In former times speculative activity was largely engaged in seeking to take advantage of differences in price in distant markets. Foreign trade 100 years ago was highly speculative. Improvements in transportation and in means of communication have reduced such differences to a matter of exact calculation. Speculative business has, therefore, come to be confined almost exclusively to transactions involving the time element.

In its simplest form time speculation involved the buying of property outright, and the holding of it in anticipation of a rise in price. This practice is as old as civilization, and until late times has usually been regarded as socially injurious. Toward the end of the seventeenth century the practice developed in Holland of buying and selling the products of fishing voyages before the results of the voyage were actually known. In the early part of the eighteenth century speculation in grain, coffee, etc., was very active in Amsterdam, developing many of the practices of modern exchanges. In all of these early forms of speculation, however, what was bought and sold was the right to a particular lot of goods.

With the development of warrants and the grading of goods speculation received a new impetus. It thus became possible for a man to sell goods which he did not possess, since he could at any time secure identical goods upon the market if he could pay the price. It is largely to this principle that the phenomenal development of speculation in recent years is due. For the extent of speculative dealings and the practices of modern exchanges, see STOCK EXCHANGE.

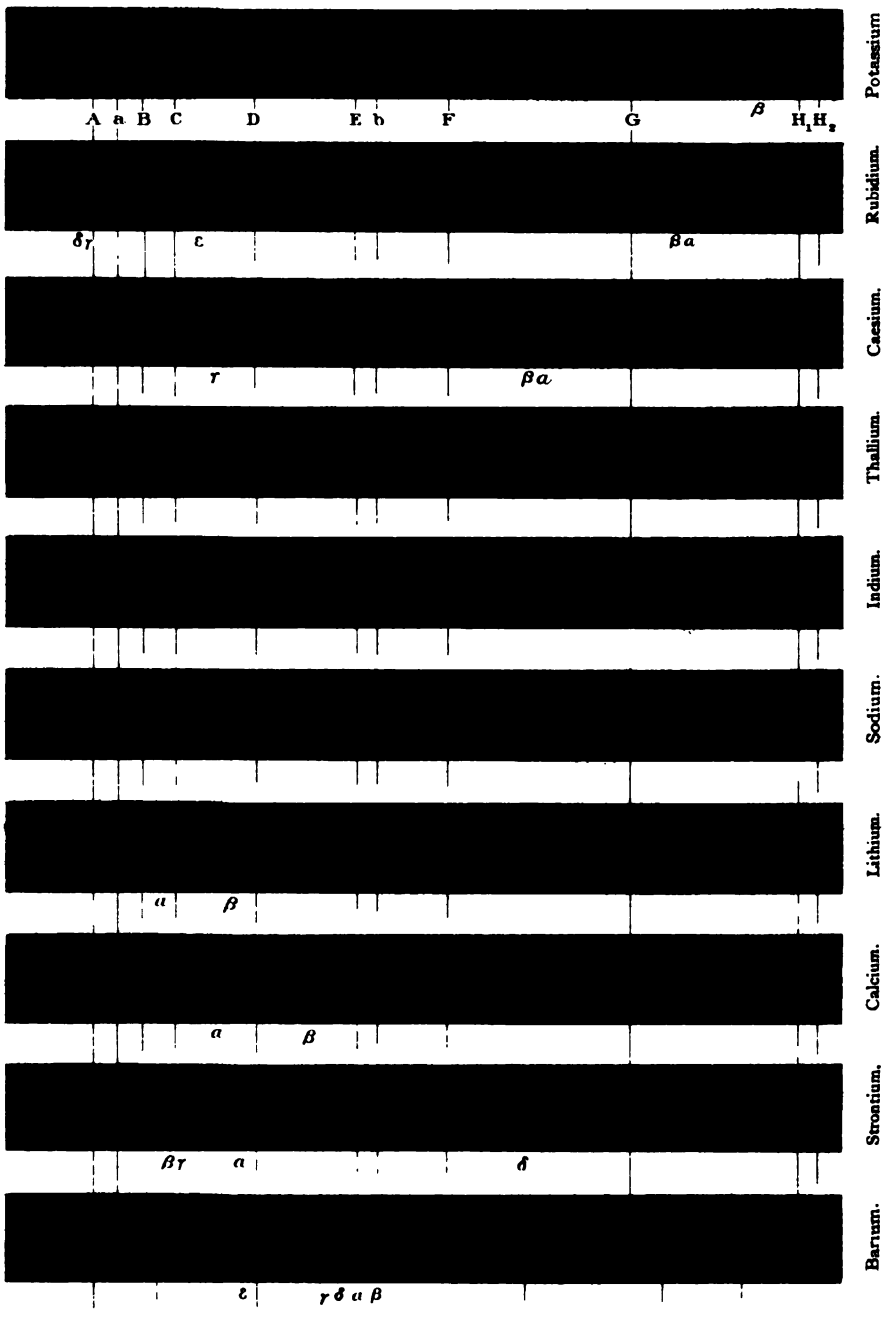
ECONOMIC FUNCTION OF SPECULATION. When the supply of any commodity is subject to great uncertainty, as, for example, the products of agriculture, it is manifestly to the advantage of society that it should be properly distributed through a period of considerable length. A class of individuals who study the conditions of demand and supply endeavoring to buy such commodities when they are abundant and cheap, in order to sell them when they are dear, serve to bring about such a distribution of consumption and thus render an important social service. Again, some commodities, such as iron, are subject to great fluctuations in demand, and hence in price, thus introducing a large element of uncertainty into all of those forms of industry which make extensive use of them. The speculator, by making contracts to deliver the article at a future date at a fixed price, frees the consumer from that uncertainty. Legitimate speculation thus serves as a means of insurance against certain classes of risks.

It may be, however, that the speculator is mistaken in his estimates of future supply and demand. In that case he exaggerates the evil which it is his function to minimize. Thus speculation may keep prices abnormally high for a period, only to render prices abnormally low for a succeeding period. Speculation may thus bring about a crisis (q.v.) with its attendant industrial stagnation.

A more serious evil results from the fact that speculation is carried on not only by those who are conversant with market conditions, but by a large class of individuals who engage in it without the proper equipment of technical knowledge. Unscrupulous operators, through false reports, or through their own apparent eagerness to buy or sell, often lead such unsophisticated speculators to their financial ruin. Such influences tend to increase business uncertainty, and hence diminish considerably the net social gain from speculation.

Popular sentiment in England and America has generally been hostile to speculation, and laws have frequently been passed to prevent it. An act of Parliament was passed in 1733, "To prevent the infamous practice of stock-jobbing." The act had no effect and was repealed in 1860. In America an act was passed in 1864 to prevent speculation in gold, but its operation was so unsatisfactory that it was repealed in two weeks. In several of the States laws have been enacted aiming to prohibit speculation in one form or another. These have proved quite ineffective. Bills were introduced in the Fifty-first, Fifty-second, and Fifty-third Congresses

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which were designed to prevent certain forms of speculation in grain, but did not become law.

Consult: Emery, *Speculation on the Stock and Produce Exchanges of the United States* (New York, 1896); Hadley, *Economics*, chapter "Speculation" (ib., 1898). See also general treatises on political economy (q.v. for references).

SPEDDING, James (1808-81). An editor of Bacon's works. He was born in Cumberland, England. From the grammar school at Bury Saint Edmunds he passed to Trinity College, Cambridge, where he graduated in 1831. Leaving Cambridge in 1835, he entered the Colonial Office. This position he gave up in 1841 that he might devote himself to the study of Bacon. For 30 years he continued his researches with slight interruptions. He died from an accident in London. Spedding's most delightful book is *Evenings with a Reviewer* (written in 1845, and privately printed; published 1881), in which with quiet humor Macaulay's essay on Bacon is torn into shreds. His *magnum opus* is an edition of Bacon's entire works with an exhaustive life (14 vols., 1857-74), in the preparation of which he was in some degree aided by Leslie Ellis and D. D. Heath. The biographical and historical parts of this work, much cut, were published under the title, *Account of the Life and Times of Bacon* (2 vols., 1878). Spedding also contributed articles to J. Gairdner's *Studies in English History* (1881) and wrote several other admirable historical papers. Consult the memoir of G. S. Venables prefixed to *Evenings with a Reviewer* (London, 1881); Edward Fitzgerald's *Letters* (ib., 1889); and Hallam Lord Tennyson's *Memoir of his father* (London and New York, 1897).

SPEECH (*AS. spæc, spēc, spræc, sprēc*, OHG. *sprâhha*, Ger. *Sprache*, speech, from AS. *specan, sprecan*, OHG, *sprehhan*, Ger. *sprechen*, to speak; possibly connected with Skt. *sphūrj*, to murmur). The act of producing vocal sound for the communication of ideas. Speech differs from voice in that the latter is rather the physiological potentiality and mechanical process, and from vocal language, which is the result produced by speech. Speech is, so far as known, like vocal language, peculiar to man, although attempts have been made to assign it also to monkeys and apes, while gesture language (q.v.) is shared by man with other animals. In a looser sense speech is synonymous with language. See Language; Voice.

SPEECH, Defects of. See Aphasia; Deaf Mute.

SPEED, James (1812-87). An American politician, born near Louisville, in Jefferson County, Ky. He graduated at Saint Joseph's College (Bardstown), was in the office of the clerk of the Circuit and County Courts, and after further legal study at Transylvania University began practice at Louisville in 1833. In 1847 he was elected to the State Legislature, where he served one term. He was the most effective opponent of the disunion cause in Kentucky, was elected to the State Senate in 1861, and in 1861-64 was in charge of the Kentucky recruiting stations. In 1864 he was appointed Attorney-General of the United States by President Lincoln, but he resigned from the post in 1866 because of his opposition to the reconstruction policy of President Johnson. In 1856-58 and 1875-79 he held a chair in the law department of the University of Louisville. His reputation as a jurist was considerable.

SPEED, John (c.1552-1629). An historical antiquary, the son of a London tailor. Through the generosity of Lord Brooke, he was able to give up manual labor and devote himself to study. Between 1600 and 1610 he published 54 maps of England and Wales, which were collected and described under the title of *Theatre of the Empire of Great Britaine* (1611). He next published the great work on which he had been engaged for many years: *The History of Great Britaine*, from the invasion of Julius Cæsar to King James I. (1611). This is regarded as the best history up to that time written by an Englishman. He also published *Genealogies Recorded in Sacred Scripture* (about 1611), of which 33 editions appeared in the course of 30 years, some of them being attached to issues of the Bible, and *A Cloud of Witnesses Confirming the Holie Word* (1616).

SPEEDWELL (*Veronica*). A genus of about 200 annual and perennial herbs and shrubs of the natural order Scrophulariaceæ, natives of temperate and cold climates. Some species grow in ditches and marshes, some only on the driest soils. They have generally very beautiful blue, white, or pink flowers, for which several species are cultivated. The bitter and astringent leaves of the common speedwell (*Veronica officinalis*), widely distributed in the Northern Hemisphere, are in some countries used medicinally and as a substitute for tea, as are those of the germander speedwell. *Veronica Virginica* is called Culver's physic in North America. Brooklime (q.v.) belongs to this genus.

SPEISS (Ger. *Speise*, amalgam, food, OHG. *spisa*, food, from OIt., ML. *spesa*, expense, cost, from OIt. *spendere*, from Lat. *expendere*, to expend, from *ex*, out + *pendere*, to weigh). A mixture of the antimonides, arsenides, and sulphides of copper, iron, and nickel, that collects at the bottom of a crucible when ores of arsenic, antimony, cobalt, or lead, containing sulphur, are smelted with fluxes. The speiss containing nickel, which is obtained largely in the preparation of smalt, is an important source of that metal.

SPEKE, spēk, John Hanning (1827-64). An English African explorer. He was born at Jordans, Somersetshire, entered the Indian army in 1844, served in the Punjab campaigns, and distinguished himself as a soldier, naturalist, and sportsman. While in the Indian service he made several trips into the Himalayas and even entered Tibet, bringing back valuable collections. He began his brilliant though brief career as an African explorer in 1854, when he accompanied Captain Burton into Somaliland. He was also Burton's companion on the expedition of 1857-59 from Zanzibar into the interior of Africa. In 1858 they discovered Lake Tanganyika, and in the same year, while Burton was ill at Kaze, Speke reached the Victoria Nyanza. He believed that he had found one of the sources of the Nile, but Burton discredited the information he brought back and Speke could not verify his discovery until 1862, when he returned to the lake with Capt. J. A. Grant, and, proceeding northward, came to the Nile, which he found to be the

outlet of the lake. Speke was killed by the accidental discharge of his gun. His books were *What Led to the Discovery of the Source of the Nile* (1864), and *Journal of the Discovery of the Source of the Nile* (2 vols., 1863). His companion, Grant, also described their journey in *A Walk Across Africa* (London, 1864).

SPELLING (from *spell*, ME. *spellen*, OF. *espeler*, to spell, OHG. *spellōn*, to declare, narrate, discourse, from OHG. *spel*, AS. *spel*, *spell*, Goth. *spill*, tale, narrative, history, tidings). The representation of words by combinations of alphabetic symbols; the practical application or use of an alphabet. In an alphabet that is accurately constructed and used there is one, and but one, symbol for each significant speech-sound, and but one speech-sound is represented by any given symbol. Under these conditions spelling is determined solely by the pronunciation ('sound') of the word to be spelled, that is, it is at once obvious when the pronunciation is known, and is accordingly marked by no irregularity or ambiguity. Such phonetically correct and simple orthography requires no special consideration apart from the alphabet employed. (See ALPHABET; PHONETICS; and SPELLING REFORM.) Outside of the writings of phoneticians, however, spelling of this degree of precision does not exist, though in certain languages there is a fairly close approximation to it. In customary spelling, in brief, each of the above-stated principles is, to a greater or less extent, violated, viz. there is alphabetic inadequacy, or the lack of symbols to represent certain important speech-sounds; redundancy, or the use of two or more symbols or combinations of symbols to represent the same sound; and the use of the same symbol or combination to represent two or more sounds. In other words, alphabetic writing as actually practiced is more or less ambiguous, irregular, and arbitrary. This divergence of customary spelling from the true alphabetic method has resulted, historically, in part, from defects inherent in the alphabets themselves (inadequacy and redundancy); but principally from continuous change in the sounds of the languages to which they have been applied. Since in every language pronunciation varies from age to age and from locality to locality, the phonetic character which every alphabet has originally possessed —or, more precisely, its phonetic use in spelling— could be maintained only by continuous adaptation to these alterations of the uttered words.

As a matter of fact changes of this sort in spelling have taken place in all alphabetically written languages, and in living European languages in particular (which alone are considered here) they have occurred abundantly, especially prior to the invention of printing; but except in some modern instances they have been effected under conditions unfavorable to phonetic precision, and so, in many cases, instead of producing greater accuracy, have often resulted in increased confusion. At best they have been inadequate to prevent spelling from becoming more and more faulty, from the phonetic point of view, as the alteration of pronunciation has advanced. Ambiguities and irregularities multiplied, new and complex associations between sounds and symbols were formed, and it became increasingly difficult to infer the pronunciation of a word from its written form. Moreover, this natural tendency toward phonetic corruption was intensified by a cause to which most of the defects of modern spelling may be attributed, namely, the establishment of a 'standard,' relatively unchangeable orthography, due principally to the introduction of the printing press. The beginnings of such an inflexible system existed earlier, wherever certain spellings were recognized as customary and then as 'correct' from the literary point of view (regardless of their phonetic value), and the feeling that the unity of the written and spoken words should be preserved was, accordingly, weakened; but its chief sources were the practical need of uniformity in spelling, which was quickly felt and (with much blundering) supplied in the printing office, and the influence of printed books. From this fixation of orthography it resulted not only that practically all the existing faults of the spelling found by the printer (together with those which he himself added) were rendered permanent, but also that even the imperfect earlier tendency to respond to phonetic change was almost wholly suppressed. Pronunciation has continued to change, often radically, but spelling has lagged behind. In certain languages notable divergence of the written from the spoken language has thus been effected, while others, like Italian, have been more fortunate in having had a relatively rational system of spelling to start with, or having undergone less extraneous disturbance, or having been able to adhere more closely or revert more frequently to the phonetic method.

These facts are well illustrated by English spelling, which in its existing standard form presents an extreme case of phonetic corruption or dealphabetization. The earliest English (Anglo-Saxon) spelling was almost purely phonetic, that is, the scribes sought to indicate the actual sounds of the words they wrote, using— with a high degree of precision—for this purpose the Roman alphabet (with certain modifications) and giving to its letters the values assigned to them in the pronunciation of Latin, with which they were familiar. But as the sounds gradually changed, confusion, due largely to imperfect adaptation (see above), slowly set in; certain symbols were not accurately distinguished, or were employed with different values in different combinations; the significance of some was irregularly altered and new ones were introduced; others were lost; and the accentual marks over the long vowels used in Anglo-Saxon disappeared, increasing the difficulty in distinguishing the long from the short vowels—a defect which has never been remedied except (in part) by non-alphabetic devices. But the most important irregularities were due to the influence of Norman, and later of literary (Parisian) French, under which, in the thirteenth and fourteenth centuries, English was practically respelled in accordance with Anglo-French methods. Notwithstanding this and other sources of confusion, however, English spelling remained for a considerable period in a notable degree phonetic. The change effected by the invention of printing has been indicated above; but it should be added that the printer's choice of spellings not only was not guided by any principles, but was often determined by ignorance, English having suffered, in this particular, more than any other language. Alteration in response

to phonetic change was not, indeed, wholly stopped—for it has continued in some measure until the present day—but it was made more and more difficult, and from the sixteenth century the power of effecting any substantial phonetic improvement of English spelling has been lost. Notwithstanding many later modifications of details (there are still over 3000 words whose orthography is unsettled), the development of English orthography ends with that period, the subsequent life of the spoken language being practically unrepresented in it. In this direction—that of sound—the alteration has been great, but we still retain what is essentially the Elizabethan spelling, in total disregard of the fact that the pronunciation which it embodies has very largely disappeared.

Another important source of confusion in English spelling, closely associated with this process of fixation, must also be mentioned. Under the influence of the revival of learning, which brought words of classical origin into special prominence, the idea was developed that (regardless of their pronunciation) such words should be made to conform in spelling as exactly as possible to the Latin and Greek terms from which they were ultimately derived. This etymological theory of spelling gained strength, both from the weakness of the contemporary feeling for phonetic accuracy and from the practical difficulty found by the printer, in his quest of uniformity, in making a selection among existing forms, which offered a wide opportunity for the activity of pedants; and from the sixteenth century until the present time it has kept its hold upon our orthography. There was much tinkering, not only with words directly borrowed from the classical tongues, but also with words of Romance origin, while the native English and Scandinavian elements of the language were but little interfered with. A result was the introduction of many forms erroneous from both the phonetic and the true philological points of view; for apart from the indefensibility of this use of spelling as a means of rendering derivation obvious to the eye the method was dangerous in the hands of men whose knowledge of the history of the language was necessarily inadequate. A familiar example is the present English *debt* (from Early Modern English and Middle English *det, dette*, from Old French *dette*), in which the *b* was etymologically inserted both in French (though later abandoned) and in English to make the spelling more directly suggest the original Latin *debita*, though it has never been pronounced. On the other hand, this process in some cases actually corrupted pronunciation. For example, the *l* in *fault* (Middle English and Old French *faute*), which was inserted in the same way, to suggest the Latin *fallere*, has actually come to be pronounced, though the correct pronunciation (in this particular) survived as late as the time of Pope, who makes the word rhyme with *ought, thought*, and *taught*. Of pure etymological blunders, again, an instance is the *s* in *island*, which was inserted to indicate derivation from the Latin *insula* and connection with English *isle* (also corrupted from *ile*), to neither of which it is at all related. The corruptions of this kind form a long and instructive list.

The results of the above-indicated history, embodied in modern English orthography, are briefly as follows:

(1) While all of the other principal European alphabets have retained with comparatively small variations the Roman or 'Continental' values of the letters, that of English has to a very large extent abandoned them. This is especially true of the 'long' vowels—at least of their common or name-giving values: Thus, approximately, 'long *a*' (say) = Cont. *é;* 'long *e*' (mete) = Cont. *i;* 'long *i*' (isle) = Cont. diphthong *ai;* 'long *o*' = Cont. *ó;* 'long *u*' (duty) = Cont. diphthong *iu*. Great confusion thus exists in the vowel-nomenclature, as well as an unfortunate divergence from the common usage of those languages which are most closely connected with English, both historically and practically. The quantity of vowels, also, as was noted above, is not (as in oldest English) distinguished by any alphabetic means, while the various orthographic devices employed for the purpose (doubling of consonants, etc.) are clumsy and are not used with uniformity.

(2) The letters of the alphabet are used with a great diversity of sound-values: Thus, of the vowels, accented and unaccented, *a* has 9 (as in *name*, *bare*, *man*, *father*, *water*, *want*, *ask*, *village*, *data*), *e* 9 (*be*, *here*, *there*, *acme*, *met*, *alert*, *English*, *sergeant*, *prudent*); *i*, 8; *o*, 10; *u*, 9; *y*, 3—48 in all; of the consonants, *b*, 2 (counting the silent ones); *c*, 6; *d*, 4; *f*, 3; *g*, 4; *h*, 3; *j*, 5; *k*, 2; *l*, 3; *m*, 3; *n*, 3; *p*, 2; *q*, 3; *r*, 2; *s*, 5; *t*, 5; *v*, 2; *w*, 2; *x*, 5; *y*, 2; *z*, 4—70 in all. To a certain extent this multiplication of values is due to the inadequacy of the alphabet, which has but 26 symbols to represent the 40 elementary sounds of cultivated English speech (44 with the diphthongs), but it is far in excess of what is necessary and results in manifold ambiguities.

(3) The various English speech-sounds are written with an even greater variety of symbols and combinations of symbols. These sounds, which comprise 16 vowels and 24 consonants (with 4 diphthongs), are represented in the standard phonetic alphabet, adopted by the American Philological Association, as follows (the sound being that of the corresponding letter in the word placed within the parenthesis): i (*it*), e (*met*), a (*at*), ɑ (*ask*), e (*not*), o (*obey*), ʊ (*but*), u (*full*), I (*pique*), ē (*they*), ā (*air*), ä (*arm*), ē (*nor*), ō (*no*), ū (*burn*), ū (*rule*), p (*pet*), t (*tip*), ch (*chest*), c or k (*come*), f (*fat*), th (*thin*), s (*sown*), sh (*she*), h (*he*), b (*bet*). d (*dip*), j (*jest*), g (*gum*), v (*vat*), dh (*thee*), z (*zone*), zh (*azure*), w (*wit*), l (*lo, ell*), r (*rat, are*), y (*ye, year*), m (*me*), n (*no*), ng (*sing*): diphthongs, ɑi (*aisle*, isle), ɑu (*out*, hour), ei (*oil*, boy), iu (*feud*, jew). The ways in which these sounds are represented in the customary spelling are too numerous to be here given and illustrated in full, but the orthographic situation will be understood from the following examples: i (*it*), accented or unaccented, is represented by i, y, e, o, u, ie, ee, ui, ai, hi, ive, eo, a, ia, ei, ey, ea, eig ('), ehea, ewi, ois, uy, oi, igh, ay, ieu, as in the following words: fit, hymn, pretty, women, busy, sieve, breeches, build, Saint John (sin'jun), exhibit, fivepence (fip'ens), Theobald (tib'ald), carriage, forfeit, donkey, guinea, sovereign, James's forehead, housewife (hus'if), chamois, plaguy, Jervois (jer'vis), Denbigh, Rothesay (roth'si), Beaulieu (bew'li). E (met) = e, ea,

a, u, ai, ei, ie, eo, ue, ay, œ, ave, as in *get, head, many, bury, said, heifer, friend, leopard, guess, says, fœtid*, Aber*gavenny* (abergen'i). O (*no*) = o, o-e, oa, ow, ou, owe, oe, oo, ew, ewe, ough, oh, eau, eo, au, os, aut, ock, as in holy, *vote, road, boul, soul, rowed, woe, brooch* (brōch), *sew, sewed, though, oh, beau, yeoman, hauteur*, apro*pos*, *hautboy*, Co*ck*burn (kō'bn). C (*come*) = c, k, q, ck, ch, cc, cq, qu, que, lk, gh, sc, x, ke, lke, quh, cch, as in *call, kill, quell, back, ache*, account, acquaint, liquor, bar*que, walk*, hou*gh*, viscount, except, Bur*ke*, Fol*kes*tone, Ur*quh*art, Bac*ch*anal. T (*tip*) = t, tt, ed, th, tw, bt, ct, pt, cht, phth, te, tte, as in *ten, better, stopped, thyme, two, debt, indict, receipt, yacht, phthisis, caste, gazette*. In brief, the 44 (with the diphthongs) English sounds are represented by upward of 500 symbols and combinations. From this it results that an English word can, theoretically, be written in a great variety of forms.

The confusion of English spelling, however, while great, is not so complete as might be expected from its above-stated theoretical defects; it exhibits a certain amount of system and it is possible also to demonstrate in it a very considerable phonetic element. Apart from the inadequacy of the alphabet, its chief practical defects are the ambiguities in the use of *c* and *k* (*cat, kill*), *c* and *s* (*cinder, seat*), *f* and *ph* (*fool, philosopher*), *t* and *d* or *ed* (*dropped*, kept), *ch* and *k* (*cholera, keep*), and the employment of silent letters, that is, letters which if omitted would leave the symbol (see above) a simpler and, generally a more common (though not necessarily more phonetically correct) one for the same sound (as in *feather, jeopardy, parliament, pedagogue, guard, add, feign, ghost, though, thorough*, scythe, etc.).

SPELLING REFORM. The modification of customary spelling in such a way as to remove, or at least lessen, the divergence of orthography from pronunciation. (For the origin, character, and practical results of this divergence, particularly in English, see SPELLING.) Complete reform of this sort involves: (1) The elimination of superfluous letters (e.g. in English, of two of the equivalent letters *c* (hard), *k*, and *q*); (2) the enlargement of the alphabet by the addition of enough symbols (letters or digraphs) to represent all the significant speech-sounds of the language (in English there are 40 elementary sounds and but 26 letters); (3) the use of each letter or symbol to represent but one sound; and (4), in English the use of the letters of the alphabet with their Roman values. Among such (proposed) remodelings of the English alphabet the most practical is that adopted by the American Philological Association and given above in the article on SPELLING. If the above-stated conditions were fulfilled, orthography and pronunciation would be in harmony—that is, spelling would be essentially phonetic. While, however, such completeness is the aim of the modern spelling reformer, it has hitherto remained—and is likely long to remain—merely an ideal. The customary spelling is so firmly connected with the habits, the practical interests, and the æsthetic (literary) sentiments of its users that such thoroughgoing reform of it is impracticable, changes in the alphabet especially being very hard to introduce. The practical efforts of the reformers are accordingly now directed almost exclusively toward the simplification of spelling by the removal of irregularities which can be eliminated without radically changing the forms of words, and by the omission of silent letters which are phonetically useless (that is, do not determine the value of another letter, as does the silent *e* of English hat*e*). Changes of this sort have occurred sporadically at every period in every European language; the spelling reformer attempts merely to make this familiar process more general and systematic. Rules for such simplification were adopted in 1883 by the American Philological Association and the British Philological Society, and in 1886 a list of amended spellings, based upon them, was adopted by the Philological Association and published in its *Transactions*. It has since been republished in (and approved by) the leading American dictionaries. While simplification of this sort would not, alone, produce phonetic accuracy, it would greatly enhance the phonetic character, uniformity, and simplicity of English spelling. Up to the present time, however, spelling reform, even in this restricted sense, though persistently urged by special associations and by persons of high scientific and literary authority, has made but little headway. Certain of the recommendations of the philological societies have been put into practice by a few individuals and journals, and by some scientific societies, but no general tendency to adopt them has been evident. Perhaps the most important step in this direction was the adoption by the American National Education Association in 1898 of the twelve simplified spellings: Program, tho, altho, thoro, thorofare, thru, thruout, catalog, prolog, decalog, demagog, pedagog.

In France, where the peculiarities of orthography give spelling reform a practical importance second only to that which it has in English-speaking countries, much interest in this subject has long existed, but little has been accomplished, the French being in matters of orthography almost as conservative as the English. The reform has also been active in Germany, and something has been done there, particularly in the omission of silent letters (*tat* for *that*, etc.). Spanish and Italian spelling are so simple and so largely phonetic that the practical reasons for reform have relatively little application to them.

SPEL'MAN, Sir HENRY (c.1564-1641). An English antiquary and philologist. He was born at Congham, Norfolk, and was educated at Cambridge and in law at Lincoln's Inn. He became High Sheriff of Norfolk, and was employed on various public missions by King James. In 1612 he removed to London, where he began to devote himself to the investigation of ancient law and custom with a view to establishing their relation to the English Constitution. In prosecuting this work he encountered so many strange and obsolete words that he turned aside to compile a glossary of law terms the first part of which, to the end of the letter L, he published in 1626, at his own expense. The second volume appeared in 1664 edited by Sir William Dugdale. He also compiled a collection of decrees of English Church councils from 1066 to 1531. He is best known in modern times by this and his curious *History and Fate of Sacrilege* (1693; new ed., London, 1846, 1853).

SPELT (AS. *spelt*, from Lat. *spelta*, spelt). A species of wheat (*Triticum Spelta*), characterized by grains held tightly within the chaff and not hulled out in threshing. It is grown chiefly where wheat fails on the poorer soils of the mountainous regions of Germany, Italy, Spain, and France, and is mainly employed as a stock food. It is little grown in America. The grain commonly called spelt in the United States and Russia is emmer (*Triticum dicoccum*), which has a much shorter and more compact head than spelt, and is much hardier as regards cold, drought, and rust resistance. Both spelt and emmer are grown and harvested like wheat.

SPENCE, HENRY DONALD MAURICE (1836—). An English clergyman and theological writer, born in London. He was educated at Westminster School and Cambridge University; took orders in the Church of England; held various important charges; and in 1886 became Dean of Gloucester. Among his numerous published works are: *Cloister Life in the Days of Cœur de Lion* (1892); *The Church of England; a History for the People* (4 vols., 1897-99); *The White Robe of Churches of the XI. Century* (1900); and *Early Christianity and Paganism* (1902).

SPENCE, JOSEPH (1699-1768). An English anecdotist, born at Kingsclere, in Hampshire. He was sent to Eton and Winchester, whence he passed to Oxford. Elected fellow of New College in 1720, he took orders in 1724. *An Essay on Pope's Odyssey* (1726) led to an intimate friendship with the poet, and to Spence's appointment as professor of poetry at Oxford (1727). He afterwards held the professorship of modern history and several ecclesiastical appointments. In 1749 he was presented by a former pupil with a small estate at Byfleet, in Surrey, where he amused himself with gardening. He was found dead in a canal in his garden. While associated with Pope he noted down the conversations of the poet and his friends. These most valuable anecdotes, after circulating in manuscript for the benefit of Warburton, Joseph Warton, Dr. Johnson, Malone, and other critics, were published in 1820. Among Spence's other works is the pleasant *Polymetis* (1747), dialogues on the Roman poets and artists. Consult the *Anecdotes*, edited from Spence's own manuscript, by S. W. Singer (London, 1820; reprint, 1859); *Selections*, edited by Underhill (Camelot Series, London, 1890); Dobson's essay on Spence in *Eighteenth Century Vignettes* (first series, New York, 1892).

SPEN'CER. The county-seat of Clay County, Iowa, 152 miles northwest of Des Moines; on the Little Sioux River, and on the Chicago, Milwaukee and Saint Paul and the Minneapolis and Saint Louis railroads (Map: Iowa, B 1). It has a public library and a fine court house. Spencer is known for its large hay interests. There are also some manufactures. The water-works and the electric light plant are owned by the municipality. Population, in 1890, 1813; in 1900, 3095.

SPENCER. A town, including several villages, in Worcester County, Mass., 12 miles west by south of Worcester; on the Boston and Albany Railroad (Map: Massachusetts, D 3). It has the Richard Sugden Library, with more than 11,000 volumes, and Spencer Public Park. Boots and shoes, wire, and woolen goods are manufactured. The government is administered by town meetings. The water works are owned and operated by the town. Population, in 1890, 8747; in 1900, 7627. Settled in 1720, Spencer formed a part of Leicester until 1753, when it was separately incorporated. Consult: Draper, *History of Spencer* (Worcester, 1860); Tower, *Historical Sketches Relating to Spencer, Massachusetts* (Spencer, 1901-02).

SPENCER, AMBROSE (1765-1848). An American jurist, born in Salisbury, Conn. He was educated at Yale and Harvard; was admitted to the bar in New York; in 1794 entered the State Assembly, and the next year became a member of the State Senate, to which he was reëlected in 1798. From 1802 to 1804 he was Attorney-General of the State, and in the latter year he became one of the judges of the Supreme Court, and was its Chief Justice from 1819 to 1823, when he resumed his private practice. From 1824 to 1826 he was Mayor of Albany, and from 1829 to 1831 a member of Congress. Eight years later he retired to a farm near Albany, but continued to take an interest in politics, and in 1844 he presided over the National Whig Convention at Baltimore. He secured the abolition in New York of the death sentence in all cases except those of murder and treason; took an important part in the State Constitutional Convention of 1821; and later opposed an amendment making the judiciary elective. Consult *Memorial of Ambrose Spencer* (Albany, 1849).

SPENCER, CHARLES, third Earl of Sunderland. An English statesman. See SUNDERLAND, CHARLES SPENCER, third Earl of.

SPENCER, HERBERT (1820-1903). A distinguished English philosopher. He was born at Derby, April 27, 1820. His father was a teacher by profession, with views in advance of his time. He believed in training the student's mind in observation and in reflection on objective facts instead of mere ideas. Herbert's health was delicate in childhood, and he was largely educated at home with as much outdoor life as possible. A little later he was put in charge of his uncle, a clergyman of the Church of England. He early showed a fondness for studies in nature, and for a good many years his favorite occupation was the catching and preserving of insects and the rearing of moths and butterflies; he also studied botany with some passion, and in these ways laid the foundation for the scientific character and interest of his later work. His parents were both originally Methodists, but his father became a Quaker. The boy's mind, however, being an independent one, and having early been brought into contact with the intellectual influences centring about John Stuart Mill and with the scientific spirit, he imbibed the tendencies of the age toward extreme liberalism in theological matters.

An uncle planned to send him to Cambridge, but the boy 'perseveringly objected,' and continued to study privately. He had no aptitude for languages, and made little progress in the classics, but showed original constructive power in mathematics and mechanics. His father wanted him to take up teaching, but an accidental opportunity decided in favor of another vocation more suitable to his tastes. In the autumn of 1837 work was offered to him under the chief engineer of the London and Birmingham Railway,

with whom he spent nearly a year. For some ten years he engaged in engineering pursuits. When the railway mania finally subsided, Spencer, now twenty-six, was left, like many other young men, without occupation. But the time spent at home while he was looking for something to do was not wasted. He had leisure for a good deal of miscellaneous reading. He studied Lyell's *Principles of Geology*, in which the doctrine of evolution as defended by Lamarck was attacked, but came away from the reading with a favorable impression of Lamarck's doctrine as against creationism.

While he was in the railway service, still a mere boy, he wrote some articles for *The Nonconformist* on "the proper sphere of government," in which he outlined the principles of non-interference which regulated all his thinking in later life. When no more work offered as an engineer, he went to London and soon obtained employment on *The Economist*, becoming its sub-editor in 1848. This position, which he held till 1852, gave him time for his studies, and made him acquainted with that brilliant coterie which centred about George Henry Lewes, George Eliot, and John Stuart Mill. During his leisure hours he wrote his first considerable work, *Social Statics* (1851). It is of a decidedly *a priori* character, and not written in the inductive spirit of his later thinking. It shows, however, his tendency to reconcile opposing influences and to discover closeness of relations where others did not suspect them. Subsequently he became dissatisfied with both its views and its methods, and wished to recall it from circulation. This being found impossible, in later years he revised it by omitting what he had outgrown.

In the eight years after his leaving *The Economist*, he pursued his studies with eagerness, and published a work on *Psychology* (1855), which he afterwards revised and expanded into a part of his *Synthetic Philosophy*. Over-application brought on a serious attack of nervous prostration, which obliged him for the rest of his life to abridge his hours of study. He became a chronic sufferer from dyspepsia and insomnia, so that all his later work had to be done under these disadvantages. Meanwhile he had conceived a system of philosophy which should embrace the general principles of all existing knowledge. In 1860 he published a prospectus or outline of it, indicating his intention to give twenty years to its development. The first instalments of the system did not meet with the reception he expected, and he feared he would have to abandon his undertaking. But the timely aid of American friends, at the head of whom was Mr. Youmans, editor of the *Popular Science Monthly*, enabled him to continue his work. His health, however, was so precarious that at one time he feared he would not live to complete the system. With this view he suspended his labors on the main part of his work to write *The Data of Ethics*, which had been the object of the whole system, and in which it was intended to culminate. Fortunately, his life was prolonged sufficiently to enable him to complete the system, and to revise a part of it in order to bring it up to date. It consists of *First Principles* (1862); *Principles of Biology* (1864); *Principles of Psychology* (1871-72); *Principles of Sociology* (1876-80); *Principles of Ethics* (1879). He also wrote three volumes of *Essays Scientific, Political, and Speculative* (1858-63), and some fugitive articles including two essays on Weissmannism (1894, 1895). He died December 8, 1903.

It was his intention in the *Synthetic Philosophy* to develop a complete and articulated conception of all cosmic phenomena, including those of mental and social principles. His qualifications for attempting so comprehensive a task were wide powers of generalization, profound acquaintance with the facts of the various sciences, and a veritable genius for detecting the relations and connections of phenomena that escape the specialist. No philosopher has employed such a wealth of illustration and facts to explain his meaning or to prove his thesis. It is the clearness of his thought, the force of his illustrations, and the dependence of his views upon the facts and methods of the inductive sciences that have given him his power over all thinkers, except the technical and traditional philosophers. His attempt to systematize all knowledge in terms of modern science must always receive high credit among intelligent men.

The *First Principles* endeavors to define the fields of 'the unknowable and the knowable,' and the postulates with which the study of the knowable must be pursued. The whole weakness of Spencer's system is shown in his discussion of the unknowable. The Absolute, Space, Time, Matter, Force, and Motion were all taken as unknowable. After telling us that all these are unknowable, he asserts that the most certain things in our conviction are the 'Absolute' and all the other fundamental data for the knowable. Besides, after telling us that all explanation consists in reference to the known, he says that all phenomena are explained as manifestations of the unknowable. Then, in the discussion of the knowable, Space, Time, Matter, Force, etc., appear as known. Both the strength and weakness of his system are due to this equivocal import of the term knowledge. If Spencer had omitted all reference to the dogma of the unknowable and confined himself to a discussion of the knowable, he would have avoided the controversy which has invited the distrust of his system. The postulates with which he conducted his speculations were, besides the existence of Space, Time, Matter, Motion, and Force, the assumption of the indestructibility of Matter, the continuity of Motion, and the persistence of Force, which he regarded as an *a priori* truth, though also determinable inductively.

The whole system is an application of the idea of evolution to the universe, and more particularly to organic life and its forms, and to political and social institutions. Spencer's conception of this process did not go beyond Darwin's in its details, but it was apparently quite as original and certainly more comprehensive, besides involving philosophic conceptions of which Darwin was incapable. Spencer applied the materialistic formula to the explanation of all things, but protested that he was not a materialist. Even if he had expressed his doctrine, as he said he could as well have done, in terms of consciousness, it would not have modified the accusation against his materialism, as the expression of philosophy in terms of mental states does not insure one against all that materialism stood for. In order to adapt the conception to all forms of phenomena, he variously expressed

the process as the passage from the simple to the complex, from the homogeneous to the heterogeneous, from indefinite homogeneity to definite heterogeneity, and so on. This description of the process brought him into controversy with all those who like metaphysics, and gave him no credit with those who do not. It was at best a vague formula, which might be true or false according to the definition of the terms and the statement of the facts; the phrase at least meant nothing more than the facts, and was not explanatory. In his facts and illustrations, however, Spencer gives a clearer idea of his doctrine than in his abstract formulas intended to cover every type of phenomena in the organic and inorganic kingdoms. These facts, he thinks, show a continuous order of things with historical connections and relations which suggest a common origin from some ultimate indefinite form of force which he calls matter and motion. Darwin did not pretend to go beyond the extension of a few types in the organic world or to develop their genesis. He was content to demonstrate the origin of species in the organic world and left unsolved and undiscussed the general origin of things—a much larger task. Spencer sought to make intelligible the process of evolution throughout the whole field of nature, and hence the importance of his formula about the 'continuous redistribution of matter and motion,' as embodying the whole system of changes and growths in the cosmos.

It was Spencer's antagonism to the doctrine of creationism that caused a complete misunderstanding of what evolution really undertakes to accomplish. The theory of creation was equivocal. It assigned a cause for the origin of phenomena, and it was associated with the conception of the miraculous and supernatural. Spencer denied the creational theory and adopted the gradual development of all things in its stead. But what he failed to recognize sufficiently, though he sees it at times, is the fact that evolution is the history of origin, not the explanation of it. It determines the law, not the cause of genesis. All that Spencer and his coadjutors established is the fact that the origin of things was *gradual* instead of *catastrophal*. Creationism was so closely associated with the latter conception that the disproof of great breaks in nature carried with it the principle by which every change has to be explained. The transition from species to species may be gradual instead of catastrophal, but this fact does not eliminate the agency of causes, and it was cause that the creationistic theory sought and unfortunately made catastrophal. It was natural, therefore, when the evolutionists showed that the process was gradual, that creationism should suffer to the same extent, but after all the real conquest was in favor of law instead of caprice in the order of nature, so that if Spencer and the evolutionists had refused to conceive their problem in opposition to creationism, and had limited themselves to the conception of the history of genesis, they would have escaped controversy with the metaphysicians on the one hand and with the theologians on the other.

Conceiving evolution, however, as the history rather of events than of causes that originate change, we shall find that Spencer's services to human knowledge can hardly be overestimated. It was a stroke of genius to combine the ideas of the persistence of force, adjustment to environment, and natural selection for the purpose of explaining the relations of all phenomena. It offered a mode of unifying the cosmos which showed identities and relations throughout the whole not before observed. The persistence of force guaranteed the fundamental identity of all reality, in spite of the differences of form which it assumed, while the varieties of composition explained the differences. The conception supplies an initial presumption of the variation of a single species to account for the varieties; this once done, the whole problem of evolution is at least historically conceived as intelligible. In the inorganic world it is merely a question of the collocations of matter. In the organic world it is a question both of collocation and of the adjustment of structure and function. In the ethical world the growth is in the form of the substitution of altruism for egoism or selfishness. In the political and social worlds the process is but a repetition of that in the others, except that we deal with collective as distinct from organic wholes. One law prevails throughout the whole process—the redistribution of matter and motion according to the conditions of the persistence of force. Originally Spencer reduced life to a function of matter and motion. But in the last edition of his *Biology* he admitted that life was an 'unknown force,' a position which involves a complete revolution in his system as recognizing something more in the world as ultimate than matter and motion. The hypothesis of a universal ether and the modification of older views regarding the nature of electrical and magnetic phenomena, with the discovery of a number of forms of energy not suspected a generation ago, threaten to modify greatly the bases of Spencer's system. But they do not disturb the general conception which he formed of the process of evolution, since this is independent of the forces involved and is simply a process of composition and decomposition throughout the cosmos and in all specific forms of reality. It is Spencer's manner of tracing the relations and affinities between the various phenomena of existence that gives his work its interest and has so generally influenced the intelligent public. He knew little of Greek philosophy and less of the modern Kanto-Hegelian movement. The consequence was that he began his speculations with science, eschewed the transcendentalism of German epistemology, and wrote in terms that every intelligent man can understand. The public has not cared whether his abstract formulas were clear or not, or whether they really expressed an explanation. They were impressed with his power of illustration and reference to facts which they were willing to use as interpreting his formulas, and as his illustrations and analogies depicted such an interesting unity in the course of nature, they were ready to take him as a prophet of the new gospel and leave subtleties to the transcendentalists. Spencer will not be forgotten for a method that supplies a clear conception of the unity of all things in terms of facts instead of abstract conceptions, though he was at times too much of a philosopher to avoid the sins which his scientific temperament sought to correct in others.

Consult: Hudson, *Introduction to the Phi-*

losophy of Herbert Spencer (New York, 1894); Collier, *An Epitome of the Synthetic Philosophy* (ib., 1889); Guthrie, *On Spencer's Unification of Knowledge* (London, 1882); Painter, *Herbert Spencers Evolutionstheorie* (Jena, 1896); Gaupp, *Herbert Spencer* (Stuttgart, 1897).

SPENCER, JESSE AMES (1816-98). A Protestant Episcopal scholar. He was born at Hyde Park, N. Y.; graduated at Columbia College (1837), and the General Theological Seminary; was ordained 1840, and became rector of Saint James's Church, Goshen, N. Y.; professor of Latin and Oriental languages at Burlington College, N. J., 1849-50; editor and secretary of the Episcopal Sunday School Union and Church Book Society (1851-57); rector of Saint Paul's, Flatbush, L. I. (1863-65); and professor of Greek in the College of the City of New York (1869-81). He edited the American reprint of T. K. Arnold's series of Greek and Latin text-books (1846-56) and other classics, including the Greek New Testament (1847). His independent works include a *History of the English Reformation* (1846), *Egypt and the Holy Land* (1850), *History of the United States* (1856-69), *Eschatology* (1887), *Memorabilia, 1820-86* (1890).

SPENCER, JOHN CANFIELD (1788-1855). An American jurist and politician, born at Hudson, N. Y. He graduated at Union College in 1806, studied law, and was admitted to the bar at Canandaigua in 1809. In 1813 he was brigade judge-advocate-general in the army on the northern frontier. From 1817 to 1819 he was a Democratic member of the United States House of Representatives and wrote the report condemning the United States Bank, which was afterwards used by President Jackson at a time when the author's views had changed. In 1820-21 he was a member of the Lower House of the State Legislature, serving as Speaker the first year. He was in the State Senate from 1824 to 1828, and in 1827 was appointed by Governor Clinton one of the committee to revise the statutes of New York. This work was finished in 1830; a second edition was published in 1835-36, and a third in 1846-48. For a time he was affiliated with the Anti-Masonic Party, and he was appointed by Governor Van Buren to prosecute the alleged abductors of William Morgan (q.v.), but resigned in 1830. He again sat in the Legislature in 1832, and in 1834-40 was Secretary of State for New York and Superintendent of Schools. On October 12, 1841, he became Secretary of War in the Cabinet of President Tyler. He was transferred to the Treasury Department, March 3, 1843, but opposed measures looking to the annexation of Texas and resigned May 2, 1844. He then resumed the practice of law at Albany, and was influential in establishing the State Asylum for Idiots. He edited a translation of De Tocqueville's *Democracy in America* (2 vols., 1838). Consult Proctor, *Review of John C. Spencer's Legal and Political Career* (New York, 1886).

SPENCER, JOHN CHARLES, Earl (1782-1845). An English statesman, best known as Lord Althorp. He was the son of the second Earl Spencer, and was born in London. After being educated at Harrow and Cambridge, he entered Parliament in 1804 and became a junior lord of the treasury in 1806. From that year till 1834 he continuously represented Northamptonshire in the Whig interest. In 1830 he became Chancellor of the Exchequer and leader in the House of Commons under the Grey Ministry, and was active in carrying the Reform Bill of 1832. He held office under the Melbourne Ministry which succeeded the Grey Ministry in July, 1834, but in November of the same year the death of his father gave him a seat in the House of Lords. He died October 1, 1845. He was a man without ambition or especial ability, fond only of agriculture and country sports; but honesty and industry raised him to positions of responsibility, all of which he filled with great credit. Consult Myers, *Lord Althorp* (London, 1890).

SPENCER, JOHN POYNTZ, fifth Earl Spencer (1835—). An English statesman. The only son of the fourth Earl, he was born at Spencer House, was educated at Harrow and at Cambridge, and in 1857, the year of his graduation, was elected member of Parliament, and by his father's death succeeded to the peerage. He was Lord Lieutenant of Ireland 1869-74, and again in 1882-85; and lord president of the council, with a seat in Mr. Gladstone's Cabinet, 1880-83 and 1886. He was First Lord of the Admiralty 1892-95.

SPENCER, JOSEPH (1714-89). An American soldier, born in East Haddam, Conn. He was a probate judge in 1753, and rose to the rank of colonel in the French and Indian War. He was one of the eight brigadier-generals appointed by Congress on June 22, 1775, served at Boston and New York, became a major-general in August, 1776, and commanded in Rhode Island in 1777. He resigned in January, 1778, and was a member of Congress in 1779.

SPENCER, JOSEPH WILLIAM WINTHROP (1851—). An American geologist, born at Dundas, in Ontario, Canada. He graduated at McGill University in 1874, and received the degree of Ph.D. from the University of Göttingen three years later. He was professor of geology in King's College, Nova Scotia, in 1880-82, and in Missouri State University, 1882-87; and was State geologist of Georgia, 1888-93. He is especially distinguished for researches in lacustrine geology. Among his published works are: *Niagara Fossils* (1884); *Glacial Erosion in Norway* (1887); *Geological Survey of Southwestern Georgia* (1891); *Geological Survey of the Paleozoic Belt of Georgia* (1893); and *Duration of Niagara Falls and History of the Great Lakes* (1895).

SPENCER, PLATT ROGERS (1800-64). The originator of the Spencerian system of penmanship. He was born at East Fishkill, New York, and at the age of ten years removed to Ashtabula County, Ohio. He gave many lectures upon penmanship in various parts of the country, and his work was influential in causing the establishment of business colleges. Spencer published *Spencer and Rice's System of Business and Ladies' Penmanship* (1848), later republished as *Spencerian or Semi-Angular Penmanship.*

SPENCER, ROBERT, second Earl of Sunderland. An English statesman. See SUNDERLAND, ROBERT SPENCER, second Earl of.

SPENCER, SARA ANDREWS (1837—). An American author and woman-suffragist, president and proprietor of the Spencerian Business College, Washington, D. C. She was born in

Savona, Steuben County, N. Y., and in 1864 married Henry C. Spencer, and afterwards removed to Washington, D. C. In 1871, with other women, she made an unsuccessful attempt to register and vote, and afterwards brought suit on which the Supreme Court of the United States decided (1874) that women have not the right to vote without local legislation. She represented the National Woman's Suffrage Association at the Republican National Convention in Cincinnati, in 1876; and engrossed, signed, and presented the *Woman's Declaration of Rights* at the Centennial Celebration at Philadelphia. Her publications include *Problems on the Woman Question* (1871).

SPENCER, WILLIAM ROBERT (1769-1834). An English poet and wit. He was a grandson of the third Duke of Marlborough. He was educated at Harrow and at Christ Church, Oxford, but left the university without a degree. Among his friends were Pitt, Fox, Sheridan, and Sydney Smith. His last years were passed in Paris, where he died in poverty. In 1796 Spencer published a version of Bürger's *Leonore*, which was praised by Scott; and in 1802 burlesqued German romance in *Urania*, a play performed at Drury Lane. In 1811 he collected his poems in a volume, which contained his best known pieces, like "Beth Gêlert" and "Too Late I Stayed." As a poet, Byron ranked him with Moore, Campbell, and Rogers. Consult the reprint of Spencer's *Poems* with biography (London, 1835).

SPENER, spā'nĕr, PHILIPP JAKOB (1635-1705). A German clergyman, the founder of the German Pietists. He was born at Rappoltsweiler, in Upper Alsace, and was educated at Strassburg, Basel, Tübingen, Geneva, and Lyons. At Geneva he was influenced by Labadie (q.v.), and his natural disposition led him strongly toward a religion of spiritual and untheological type. He preached at Strassburg, was transferred to Frankfort, and in 1666 became first pastor there. He strove to awaken a deeper faith and more active Christian life, emphasized the necessity of conversion and regeneration, and the study of the Scriptures, in opposition to the prevalent teaching which laid stress on orthodoxy and connection with the Church, and cared more for the symbolical books than for their source. His views were set forth in his *Pia Desideria, oder herzliches Verlangen nach gottgefälliger Besserung der wahren evangelischen Kirche* (1673). In 1670 he began meetings at his house for the cultivation of evangelical morality, the so-called *collegia pietatis*, with the aim, as he expressed it, of forming within the Church (*ecclesia*) a smaller church (*ecclesiola*) which should have a deeper spirituality. At the same time he reorganized the method of catechising and improved the religious instruction given to children. In 1679 a preface which he wrote for a new edition of the *Postille* of Arndt, in which he censured the morals of the upper classes, brought him into difficulties; and in 1686 he accepted an invitation to become Court preacher at Dresden and member of the upper consistory. In this capacity he effected changes in the theological teaching of the University of Leipzig and in the system of religious catechising practiced throughout Saxony; but because of attacks from the orthodox theologians, and having fallen into disgrace with the Elector Johann Georg III., in 1691 he went to Berlin as provost of the Church of Saint Nicholas and consistorial inspector, offices which he retained till his death. The Elector of Brandenburg encouraged his efforts for religious reform and intrusted theological instruction in the new University of Halle to Francke, Breithaupt, and others of his disciples. In 1695 the theological faculty of Wittenberg formally censured as heretical 264 propositions drawn from Spener's writings. There is no collected edition of his works; the full list (180 in number) is given in his biography by Von Canstein (Halle, 1740), and his chief works have been edited by Grünberg (Gotha, 1889). Consult also the lives by Hossbach (Berlin, 1828; 3d ed. by Schweder, 1861), by Wildenhahn (Leipzig, 1842; Eng. trans., Philadelphia, 1881), and by Grünberg (Göttingen, 1892-97). See PIETISM; GERMAN THEOLOGY.

SPENGEL, spĕng'l, LEONHARD (1803-80). A German classical scholar, born at Munich. He became known through his edition (1826) of Varro's *De Lingua Latina*, and was appointed in 1826 lector, in 1830 professor in the present Wilhelmsgymnasium of Munich. In 1842 he accepted a chair at Heidelberg which he held until his return, as professor, to Munich in 1847. Among his publications were his edition of the *Ars Rhetorica ad Alexandrum*, which, following Petrus Victorinus, he attributed to Anaximenes of Lampsacus (*Anaximenes Ars Rhetorica quæ Vulgo Fertur Aristotelis ad Alexandrum*, 1844), his edition of the *Rhetoric* of Aristotle (*Aristotelis Ars Rhetorica cum Adnotatione*, 1867), and his text edition of the *Rhetores Græci* (3 vols., 1853). His address *Ueber das Studium der Rhetorik bei den Alten* (1842) is a valuable outline sketch of the art of eloquence in classical times.

SPEN'NYMOOR. A town in Durham, England, 4 miles northeast of Bishop Auckland (Map: England, E 2). It has coal-mining and iron industries. Population, in 1901, 16,660.

SPEN'SER, EDMUND (c.1552-99). An English poet, born in London. He claimed relationship to the noble family of Spencers at Althorp, but he seems to have been more closely connected with the Spensers of Lancashire. His father, certainly in reduced circumstances, has been identified with John Spenser, a London clothmaker. The boy was apparently sent to the Merchant Taylors' School, London, whence he passed, as sizar or poor scholar, to Pembroke Hall, Cambridge. At the university he read widely and eagerly in Latin, Greek, Italian, and French literature. He was especially fond of Petrarch and Chaucer, of Marot and Du Bellay. He formed lifelong friendships with Gabriel Harvey and Edward Kirke. After graduating M. A. in 1576, he seems to have spent nearly two years with his kinsfolk in Lancashire, where he fell in love with a young woman whom he celebrated in verse under the name of Rosalind. In 1578 he went to London and found a place in the household of the Earl of Leicester. There he probably met Sir Philip Sidney, to whom he dedicated *The Shepheardes Calender* (1579). In 1580 he was appointed secretary to Lord Grey, the new Lord Deputy of Ireland. Thenceforth Spenser lived mostly in Ireland. There he completed *The Faerie Queene*, already begun at Leicester House.

By 1588 or 1589 he was living at Kilcolman Castle, in the County of Cork, which with its extensive lands was legally transferred to him in 1591. In the meantime he had written *Astrophel*, a noble pastoral elegy on Sidney, and had received a visit from Sir Walter Ralegh (1589), made memorable by *Colin Clouts Come Home Againe*. In 1590 he accompanied Ralegh to London, was welcomed by the Court, and published the first three books of *The Faerie Queene*, a moral and historical allegory. In 1591 followed a volume of miscellanies called *Complaints*, including "The Ruines of Time," "The Teares of the Muses," "Mother Hubberd's Tale," "The Tale of the Butterflie," and four other poems. Evidently disappointed of expected Court preferment, Spenser returned to Ireland, where he married a certain Elizabeth, probably Elizabeth Boyle, related to the first Earl of Cork. The courtship is described in the *Amoretti* (published in 1595), a series of mellifluous sonnets; and the marriage is celebrated in the *Epithalamion* (published in 1595), the richest nuptial hymn in the English language. In 1596 he brought to London for publication three more books of *The Faerie Queene*. Spenser intended to continue the work to twelve books, but he never got further than two cantos on *Mutabilitie* (printed 1609). While in England he seems to have completed a prose treatise on the *Present State of Ireland* (not published till 1633); he prepared for the press the beautiful *Foure Hymnes* (1596), in honor of love, beauty, heavenly love, and heavenly beauty; and wrote for a double marriage at Essex House the *Prothalamion* (1596), one of his choicest poems. Once more disappointed of preferment, he returned to Ireland. In October, 1598, his castle was sacked and burned by the Irish rebels. Spenser fled to England, where he died at a London inn, January 16, 1599. He was buried near Chaucer in Westminster Abbey.

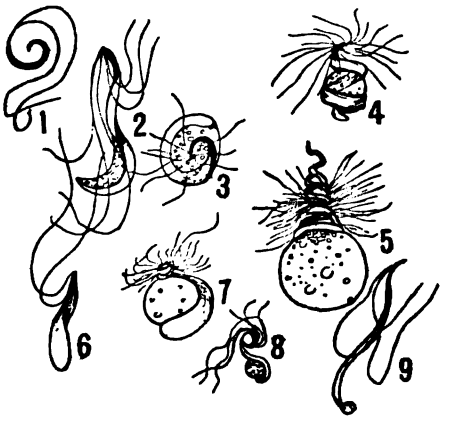
The Shepheardes Calender marks an epoch in English poetry. Conventional in theme, it yet shows a command over rhythm greater even than Chaucer's. It sounded the note of the Elizabethan outburst. As Spenser grew older he became more weighty in substance and discovered new melodies. In *The Faerie Queene* he invented a nine-line stanza known as 'Spenserian.' It is the Italian *ottava rima* with an added Alexandrine (twelve syllables). The rhymes run ababbcbcc. But there is more in Spenser than sweet verse. His imagination dwelt in a realm of beauty and the noblest ideals. His greatest fault is an insistence on the allegory until it becomes monotonous and obscure. With the poets themselves, for whom this weakness counts less than for the general public, Spenser has been a favorite. The generation following him were Spenserians, and to him Milton owed much. In the romantic revival at the end of the eighteenth century Spenser was potent, and Keats's *Eve of Saint Agnes* and Byron's *Childe Harold* were written in the Spenserian stanza.

Consult the *Life* by R. W. Church (English Men of Letters, London, 1879); *Works*, ed. H. J. Todd (8 vols., ib., 1805, new ed. 1877), by J. P. Collier (5 vols. new ed., ib., 1891), by R Morris, with memoir by J. W. Hales (Globe edition, ib., 1869, often reprinted), and by A. B. Grosart (Huth Library, 10 vols. ib., 1882-84). Consult also G. L. Craik, *Spenser and his Poetry* (ib., 1845), and the essays by Lowell, *Among My Books*, second series (Boston, 1876), and by Aubrey de Vere (London and New York, 1894). The Spenser Society, founded at Manchester in 1867, published a facsimile of the first edition of *The Shepheardes Calender*.

SPENSERIAN STANZA. See SPENSER, EDMUND; VERSIFICATION.

SPERANSKI, spâ-răn'skê, MIKHAIL, Count (1772-1839). A Russian statesman. Educated at the Saint Petersburg Ecclesiastical Academy, he was appointed professor of mathematics there in 1797, and State Secretary in 1801. He became Assistant Minister of Justice in 1808, and Privy Councilor in 1809. During his administration he remodeled the system of taxation and the system of national education, and instituted many other reforms. His influence brought him many enemies, and he was banished in 1812, but recalled in 1816 and made Governor of Pensa. As Governor-General of Siberia (1819-21) he displayed great energy in fighting official corruption and bettering the condition of the exiles. In 1821 he was made a member of the Imperial Council. Nicholas I. intrusted him with the codification of the Russian laws, which task he performed with singular success.

SPERM, IN PLANTS (Lat. *sperma*, from Gk. *σπέρμα*, seed, from *σπείρειν*, *speirein*, to sow), ANTHEROZOIDS, SPERMATOZOIDS. The male sexual cell, whose union with the egg is the process of fertilization, and results in the formation of an embryo. Sperms are produced by all plants except the lower algæ and many of the fungi, and are often characteristic of great groups of plants. An ordinary sperm is an actively moving, naked cell, consisting essentially of a relatively large nucleus with a thin sheath of cytoplasm, forming the body, and delicate, hair-like swimming



TYPES OF SPERMS.

1, Chara; 2-4, fern; 5, Marsilia; 6, club moss; 7, fern; 8, quillwort; 9, liverwort.

appendages (cilia). The male organ which produces sperms is uniformly called an antheridium (q.v.). See FERTILIZATION; REPRODUCTION; SEX.

SPERMACETI (Neo-Lat., whale's seed, from Lat. *sperma*, from Gk. *σπέρμα*, seed + *oeti*, gen. sg. of *cetus*, from Gk. *κῆτος*, *kētos*, whale; so called because at first supposed to be the spawn of the whale). A waxy substance obtained from cavities in the head of the sperm whale (*Physeter*

macrocephalus), which lives in the Pacific and Indian Oceans. In the living whale it is dissolved in an oil, but on cooling separates as a solid. As much as twelve barrels of crude spermaceti is obtained from an ordinary whale. It is purified by pressure, melting, and crystallization. It is white or translucent, crystallizable from alcohol and ether, not soluble in water, smooth to the touch, and without taste or odor. It becomes rancid and grows yellowish on exposure to light. It burns with a bright flame. Its specific gravity is .945, and its melting-point is about 38° C. (about 100° F.). It does not, like fats and oils, give glycerin after saponification, but cetyl alcohol. It consists chiefly of cetin, or cetyl palmitate, $\left.\begin{matrix} C_{16}H_{31}O \\ C_{16}H_{33} \end{matrix}\right\}O$. Spermaceti is used as an ingredient of many ointments and cerates. It is made into sperm candles of definite weight for photometric purposes.

SPERMATISTS. A school of physiologists of the seventeenth century, who held that the whole of the material transmitted from the parents to the offspring as the foundation of the embryo was contained in the spermatozoön of the male, opposing those (the ovulists) who asserted that all the material was supplied by the mother in the egg. See PREFORMATION.

SPERMATOPHYTES (from Gk. *σπέρμα, sperma*, seed + *φυτόν, phyton*, plant), SEED-PLANTS. The highest of the four primary divisions of the plant kingdom, distinguished from the other groups by the production of seeds. The much used name phanerogams, meaning evident sexual reproduction, is unfortunate because in this group sexual reproduction is least evident. The once used name anthophytes, meaning flowering plants, which last is probably the most commonly used popular name, is also inappropriate, since the production of flowers is not coextensive with the group. The most recently proposed name siphonogams, meaning sexual reproduction by means of a tube, referring to the passage of the male cells to the eggs through pollen-tubes, has not been extensively adopted. Since the seed-production seems to distinguish the group more than any other character, the name spermatophytes, which is in common use, seems likely to prevail.

This group, which includes practically all the conspicuous vegetation (herbs, shrubs, and trees), is by far the most useful group to man, so useful, indeed, that until the closing years of the nineteenth century elementary botanical training dealt with no other group and botanists were thought of chiefly as students of flowers. More than 100,000 species of seed-plants have been described, and grouped in two distinct but very unequal divisions—gymnosperms (q.v.) and angiosperms (q.v.). They are distinguished by the position of their seeds, which are naked or freely exposed in the former, but inclosed in a seed-case in the latter.

In all seed-plants the alternation of generations (q.v.) is very much obscured by the great reduction of the sexual plants, which are not popularly recognized, and are undiscoverable except by laboratory manipulation, the whole visible body of these plants, contrary to the popular notion, being the sexless phase or sporophyte. All the members of the group are also heterosporous. (See HETEROSPORY.) The pollen-grain is a sexless microspore that in germination gives rise to a small plant consisting of only a few cells, among them two male cells, which are formed within the pollen-grain and are to function as sperms. The pollen-grain is transferred to the immediate neighborhood of the female plant, usually by the wind or by insects. See POLLINATION; FERTILIZATION.

The megaspore, a large sexless spore, that produces the female plant, is developed within the

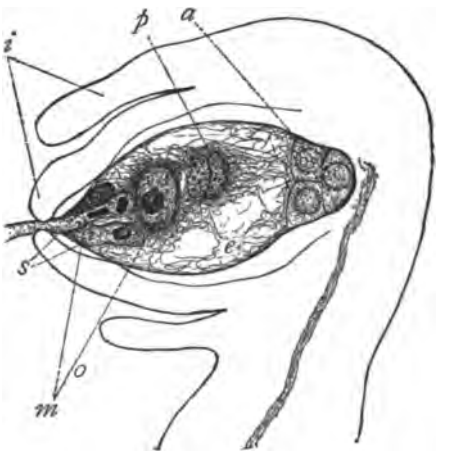


FIG. 1. OVULE.

Showing *i*, integument; *e*, embryo-sac; *a*, antipodal cells; *p*, polar nuclei fusing; *s*, syneryids; *o*, eggs; and *m*, pollen tube containing male cells.

ovule, which is, therefore, a sporangium. The fact that in this sporangium there is but a single megaspore, and that is not discharged, but retained,

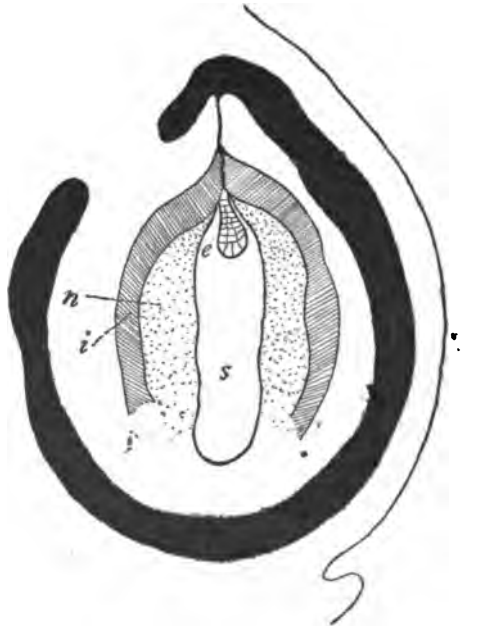


FIG. 2. OVULE IN OVARY CAVITY.

Showing *i*, integument; *n*, nucellus; *s*, embryo-sac; and *e*, embryo.

is what makes a seed possible; for the retained megaspore germinates within its sporangium

(ovule) and produces the female plant there. This megaspore within the ovule was once thought to be merely a sac-like cavity, within which the embryo appeared, and hence was called the 'embryo-sac' (*e*, Fig. 1; *s*, Fig. 2). In germination the megaspore produces a female plant, with several or many cells, which has long been called 'endosperm,' and recognized as a prominent nutritive tissue within the seed. The female plant, therefore, is entirely inclosed within the ovule, and produces an egg (*o*, Fig. 1) which is reached by a pollen-tube (*m*, fig. 1) and fertilized. This act of fertilization is followed by two conspicuous results, namely (1) the development of the embryo (*e*, Fig. 2), and (2) the development of a hard superficial tissue (testa) in the outer part of the ovule, which hermetically seals the female plant and embryo within, the whole complex structure constituting the seed.

In the seed condition the plant passes into a resting period of greater or less duration, and then, under favorable conditions, the seed is said to germinate. This simply means the renewed growth of the young plantlet, whose embryo, which had begun to develop, was checked by the hard investment of the seed. A seed, therefore, is a complex of three generations: (1) the old sexless generation (sporophyte), represented at least by the seed coats; (2) the following female sexual generation (gametophyte), represented by the endosperm; and (3) the new sexless generation (sporophyte), represented by the embryo.

SPERMATOZOÖN (Neo-Lat., from Gk. *σπέρμα, sperma*, seed + *ζῷον, zōon*, animal). The male germ cell. The phenomenon of sexuality consists of the union of two cells. In the lowest forms these may be alike, but in the higher plants and animals there is a difference in size of the two uniting cells. The larger is called the female cell or 'egg,' the smaller the spermatozoön. This difference in size is advantageous, for it means a division of labor. The large cell is passive and accumulates a large amount of food-material by virtue of which the future embryo is better provided for. The spermatozoön, on the other hand, retains the capacity for locomotion; it seeks the passive egg. Consequently, the spermatozoön becomes as small as possible and is provided with a large locomotive organ—the tail, flagellum, or lash. The spermatozoön is thus a highly specialized, actively locomotor cell. A typical flagellate spermatozoön consists of three parts: head, middle piece, and tail. The head contains the nucleus, made up of an extremely dense mass of chromatin; also often an apical body or acrosome, lying in a spur of the head. The middle piece is larger than the tail and usually contains the centrosome. The tail is a cytoplasmic thread, containing a central delicate thread and having a lateral membrane or fin which makes the stroke of the tail more effective. Spermatozoa exhibit a great variety of forms. Thus, the head may be nearly globular or spear-shaped, or even of the shape of a corkscrew. The membrane may be absent or it may twist spirally around the axial thread. Finally the spermatozoön may, as in certain Crustacea, be not thread-like, but star-shaped or spindle-shaped, with the head at the centre. In plants, also, the spermatozoön (spermatozoid) exhibits a great diversity of form from a sphere to a screw-like thread.

The spermatozoa develop in a special organ of the body called *testis*, typically a mass of germ cells, young and old. In the young male this gland is made up of epithelial cells known as primordial germ cells; from these by cell-division arise 'spermatogonia,' still undifferentiated cells. The spermatogonia grow until they become very big, and are then called 'spermatocytes.' Each large spermatocyte divides and the daughter cells promptly divide again into 'spermatids,' four of which thus arise from each spermatocyte. But each spermatocyte has only half the number of chromosomes that the original spermatocyte had. Each spermatid now undergoes a change of form by which it becomes a spermatozoön, and not until then is it ready to fertilize the egg. See FERTILIZATION.

SPERMOPHILE (from Gk. *σπέρμα, sperma*, seed + *φιλεῖν, philein*, to love). A ground-squirrel of the genus Spermophilus, of which more than a dozen species occur in the United States, but only one or two in Europe. They are all terrestrial, live in burrows under ground, feed chiefly on herbage and seeds, are very prolific, and are commonly called 'gophers' (q.v.), thus confusing them with an entirely different group of mammals. Three of the species, at least, are sufficiently abundant to do much damage to lawns and cultivated fields. A very effective means of destroying them is by soaking some absorbent substance in carbon bisulphide and placing it in the burrows. In size, form, color, and length and shape of tail, the spermophiles show great variety. They are usually some shade of brown, mottled, spotted, or striped with other shades. With the tail, they will average about a foot in length. All are western, and denizens of open regions, only two species occurring as far east as Illinois. The flesh is edible. Consult Bailey, "Prairie Ground Squirrels," in *Bulletin 4* (Department of Agriculture, Division of Ornithology and Mammalogy, Washington, 1893). Compare CHIPMUNK.

SPERM WHALE. See WHALE.

SPES (Lat., hope). The Roman goddess of hope, represented as a youthful divinity clad in a long robe and bearing a bud in one hand. Spes personified particularly hope for good harvests and for children, and gradually came to be looked upon as a goddess of the future, to be invoked at births, marriages, and other important times.

SPEUSIP'PUS (Lat., from Gk. *Σπεύσιππος*) (c.395-c.339 B.C.). An Athenian philosopher, nephew and pupil of Plato, with whom he is supposed to have visited Syracuse. For the last eight years of his life Speusippus was head of the Old Academy. He went even further than Plato in his mystical interest in the Pythagorean numbers, but in general agreed with his master, save that he denied the perfect goodness of the primordial unity, inasmuch as bad must be held to proceed from it as well as good. Consult Fischer, *De Speusippi Atheniensis Vita* (Rastatt, 1845).

SPEY, spā. A river of Scotland, rising in Inverness-shire, and, after a northeast course of about 110 miles, falling into the Moray Firth, 3 miles west of Portgordon (Map: Scotland, E 2). The Spey is the second longest river in Scotland. It has salmon fisheries.

SPEYER, spī'ẽr, or **SPEIER** (in Eng. often *Spire*). The capital of the Palatinate, Bavaria, situated at the confluence of the Speyerbach and the Rhine, 23 miles north of Karlsruhe (Map: Prussia, C 4). The chief feature is the magnificent cathedral, a vast Romanesque edifice. Its construction was begun in 1030 by Conrad II., the founder of the Franconian dynasty of German emperors, and in its original form it was completed in the reign of his grandson, Henry IV. It was long the burial place of the German emperors. It suffered in 1689 and 1794 from the vandalism of the French invaders, who spared nothing. The work of restoration was completed in 1858. The interior is embellished with magnificent frescoes, statues, and reliefs by Schraudolph and other masters. Among the other architectural monuments of the city is a splendid gate of the thirteenth century. Speyer has a fine museum of antiquities. The manufactures include woolens, machinery, shoes, tobacco, vinegar, and sugar. Speyer, the Roman Augusta Nemetum (later Noviomagus), was created an episcopal see in 348. It was a favorite residence of the German emperors, and became a free Imperial city in 1294. At the Diet of Speyer in 1529 the followers of Luther presented their protest, which gave them the appellation of Protestants. The city belonged to France from 1801 to 1814, when it passed to Bavaria. Population, in 1900, 20,911.

SPEZIA, spĕt'sê-ȧ. A city in the Province of Genoa, Italy, on the Gulf of Spezia, 56 miles by rail southeast of Genoa (Map: Italy, D 3). The beautiful scenery and mild climate have made it a favorite winter resort. The advantages of the Gulf as a naval station were pointed out by Napoleon I., and in 1861 the Italian Government made it the chief naval harbor of Italy. On the hills around the harbor there are strong fortifications. The ship-building yards are important, some of the largest Italian warships having been constructed here. The city has a technical institute, a school of navigation, and a marine hospital. Considerable trade is carried on, chiefly in olive oil, wine, fruits, and marble. There are manufactures of furniture, hemp-linen, and leather. Spezia is near the site of the ancient Luna, of which some remains exist. Population (commune), in 1881, 30,732; in 1901, 65,612.

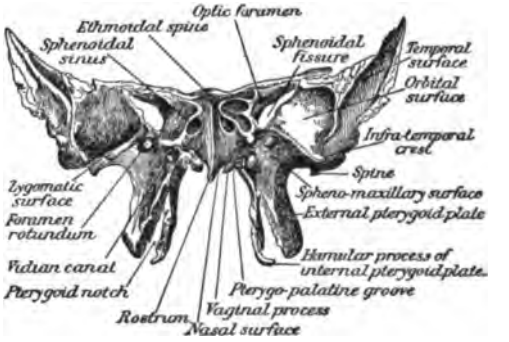
SPHACTE'RIA, or SPHAGIA. An island off the southwestern coast of Messenia, Greece, commanding the entrance to the Bay of Navarino.

SPHAGNUM (Neo-Lat., from Gk. *σφάγνος, sphagnos, σφάκος, sphakos, φάσκος, phaskos, φάσκον, phaskon*, sort of moss), or BOG MOSS. A genus of mosses intermediate between the liverworts and true mosses (see MUSCI) remarkable for their whitish or pale color. They often grow in considerable masses, absorbing water like sponge, but becoming friable when dry. They contribute much to the formation of peat, although peat from sphagnum alone is of poor quality. Gardeners employ them for covering and moistening the roots of plants because they readily absorb moisture from the air. The cells of the leaves are remarkable for their spiral structure, and for large pores in their sides. See Plate of BRYOPHYTES and Colored Plate under MUSCI.

SPHENE (from Gk. *σφήν, sphēn*, wedge; so called from the shape of the crystals). One of the light-colored (yellow or green) varieties of titanite (q.v.).

SPHENISCI (Neo-Lat. nom. pl., from Gk. *σφηνίσκος, sphēniskos*, diminutive of *σφήν, sphēn*, wedge). A group of birds, the penguins (q.v.).

SPHENOID BONE (Gk. *σφηνοειδής, sphēnoeidēs*, wedge-shaped, from *σφήν, sphēn*, wedge + *εἶδος, eidos*, form). A bone situated at the anterior part of the base of the skull, and articulated with all the other cranial bones, which it wedges firmly together. It somewhat resembles a bat with its wings extended, and hence was termed the *os vespertilionis*. It is divisible into a body, the greater and lesser wings, and various processes. The greater wings present three surfaces: a superior or cerebral surface, forming part of the floor on which the brain rests; an anterior surface, which assists to form the outer part of the orbit of the eye; and an external surface with a rough ridge, giving attachment to the external pterygoid muscle, one of the most powerful muscles of mastication. The second, third, fourth, fifth, and sixth cranial nerves emerge from the cranial cavity through foramina in this bone.

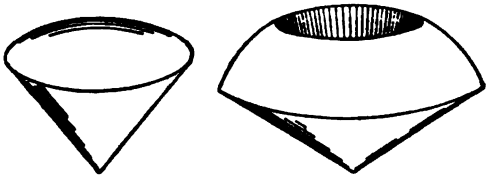


SPHENOID BONE AS SEEN FROM THE FRONT.

SPHERE (Lat. *sphæra*, from Gk. *σφαῖρα, sphaira*, ball, globe; connected with Lith. *spirà*, ball of dung, and perhaps with Skt. *sphar*, to hasten, stretch out). A solid bounded by a surface every point of which is at a given distance from a fixed point. The given distance is called the *radius* and the fixed point the *centre* of the sphere. A spherical surface may be generated by revolving a semi-circumference about its diameter. Sections of a sphere made by planes are circles. If the plane passes through the centre of the sphere, the circle is a *great* circle, otherwise a *small* circle of the sphere. If the segments into which a plane divides a sphere are unequal, the smaller is called the *minor* and the larger the *major* segment. That portion of the spherical surface which is included between two parallel planes which cut or touch the surface is called a *zone*. The portion of a sphere generated by the revolution of a circular sector about any diameter of its circle as an axis is called a *spherical sector*.

The surface of a sphere is equal to four times the area of a great circle of the sphere, or $4\pi r^2$, r being the radius of the sphere. Its volume is $\frac{4}{3}\pi r^3$. The rectangular equation of a sphere, the origin being at the centre, is $x^2 + y^2 + z^2 = r^2$. (See COÖRDINATES.) (For the formulas for areas and volumes relating

to zones, segments, and sectors, see MENSURATION.) A remarkable property of the sphere is that its surface is equal to the curved surface of the circumscribed cylinder and its volume is two-thirds of that of the cylinder, a property said to



SPHERICAL SECTORS. THE LEFT ONE A SPHERICAL CONE.

have been discovered by Archimedes (q.v.). If a sphere and a double cone be inscribed in an equilateral cylinder, the sphere and the volume between the cone and the cylinder are Cavalieri bodies. See CAVALIERI.

SPHERICAL TRIGONOMETRY. See TRIGONOMETRY.

SPHEROGRAPH. See SAILINGS.

SPHEROID. See ELLIPSOID.

SPHEROIDAL STATE (from *spheroid*, from Gk. *σφαιροειδής*, *sphairoeidēs*, like a ball or sphere, from *σφαῖρα*, *sphaira*, ball, globe + *εἶδος*, *eidos*, form). The phenomenon observed when a drop of water placed on a highly heated surface remains in its spherical shape and moves about over the surface, evaporating gradually, instead of vaporizing instantaneously. The experiment to show this condition of a liquid is generally performed by using a metallic disk heated by a lamp or Bunsen burner, on which one or more drops of water are carefully let fall. If the disk is sufficiently heated a layer of vapor will be formed between its surface and the drop, which is known as the 'Crookes's layer.' The liquid remains suspended on this vapor and the drop takes the form of an oblate spheroid, the temperature, however, never rising above the boiling point, being in the case of water about 206° F. or 96.6° C., while the disk itself must have a temperature of at least 340° F. or 171° C. The explanation of this fact is that the latent heat carried off in the course of vaporization is sufficient to keep the temperature below the boiling point. The drop does not actually touch the disk, but is supported on a cushion of vapor, which is evaporating toward the hot plate so rapidly as by its reaction to keep the water from falling. This may be seen by looking at a flame through the intervening space, or by attempting to pass an electric current from the drop of water to the metal disk, using a galvanometer to detect its passage, there being no deflection of the needle unless the two substances are in actual contact. The liquid takes a spherical shape owing to capillary action. Other liquids and bodies that are solid at ordinary temperatures also show this phenomenon, and instead of a metallic surface, that of a hot liquid can also be used. A striking illustration of this same principle is the immersion of a hand in molten metal, or in liquid air, the thin layer of aqueous vapor preventing the passage of the heat or cold to the hand. Consult: Stewart, *Elementary Treatise on Heat* (6th ed., Oxford, 1895); Barker, *Physics* (New York, 1893); Daniel, *Text-Book of the Principles of Physics* (3d ed., New York, 1894).

SPHINCTER MUSCLE (Lat. *sphincter*, from Gk. *σφιγκτήρ*, *sphinktēr*, that which binds tight, sphincter, from *σφίγγειν*, *sphingein*, to strangle; possibly connected with Arm. *pirk*, tight). A circular band of muscular fibres, whose function is to antagonize the expellent action of certain viscera, especially the bladder and the lower part of the intestinal canal. It is to the presence of these muscles that the higher animals owe the power of retaining for a considerable period the excrementitious matters collected in the bladder and rectum, and of discharging them at intervals, the sphincter muscles being, like those engaged in the process of respiration, mainly, but not entirely, under the control of the will.

SPHINX (Lat., from Gk. *σφίγξ*, *sphinx*, from *σφίγγειν*, *sphingein*, to strangle). A composite monster, famous in Greek mythology, having the head of a woman, the body of a lion, the wings of a bird, and the tail of a serpent. According to the legend, she proposed a riddle to the Thebans, slaying all who were unable to guess it, and when Œdipus finally solved her riddle, she threw herself over a cliff and perished. She is said to have been the daughter of Echidna and her son Orthrus, or of Chimæra and her brother Orthrus. The name sphinx was applied by the Greeks to a class of composite figures, familiar in Egyptian art, having the body of a lion and the head of a man or of some animal. A figure of this sort with a human head was called an androsphinx; one having a ram's head, a criosphinx; and one with a hawk's head, a hieracosphinx. Like the winged bulls and lions found in Assyria, the Egyptian sphinx was the guardian genius of the temple before which it stood. The avenues leading to many Egyptian temples were guarded by long rows of sphinxes placed at intervals on either side. Primarily the sphinx represented an imaginary human-headed animal, living in the desert, and believed to be a favorite incarnation assumed by the Sun-god Re. As a rule, the face was modeled after that of the reigning Pharaoh, the son of Re and his representative upon earth, and therefore Egyptian sphinxes were almost invariably male, though they might also present the features of a reigning queen. Where the sphinx has the head of an animal, the head is that of the animal sacred to the god before whose temple the figure is placed.

The most remarkable of all Egyptian sphinxes is the Great Sphinx of Ghizeh, lying about 300 feet east of the second pyramid. It is sculptured out of the native rock, to which masonry has been added in certain places to complete the form. The body is roughly hewn out, but the head was originally executed with great care. The entire height of the monument, from the crown of the head to the pavement on which the fore legs rest, is about 66 feet. In length the figure measures 172.5 feet; the fore legs are 50 feet long; and the head is 30 feet long by nearly 14 feet in breadth. The face was originally colored red, but the coloring has almost entirely disappeared. In 1816 the front of the Sphinx was cleared of sand by Caviglia, who found close to the breast a shrine, or small temple, containing an inscription of Thothmes IV. and one of Rameses II. Both monarchs had cleared away the sand that had accumulated about the monument. From the inscription of Thothmes IV. it is clear that the

Sphinx was considered to represent Harmachis (q.v.), a special form of the sun-god, and its office was to serve as a guardian of the necropolis near the pyramids. It has been supposed to be the work of King Chephren of the Fourth Dynasty, and some archæologists have even assigned it to an earlier period, but the existing evidence is insufficient to fix its date with any degree of accuracy. Consult: Vyse, *The Pyramids of Gizeh* (London, 1840); Lepsius, *Denkmäler* (Berlin, 1849-58); Perrot and Chipiez, *History of Art in Ancient Egypt* (London, 1883); Baedeker, *Aegypten* (4th ed., Berlin, 1897); Petrie, *A History of Egypt* (New York, 1899); Budge, *A History of Egypt* (ib., 1902). See Plate of PYRAMIDS.

SPHINX MOTHS. Moths of the family Sphingidæ, described under HAWK-MOTH. Prominent American examples are depicted on the Colored Plates of MOTHS, and of INSECTS.

SPHYGMOGRAPH (from Gk. *σφυγμός, sphygmos*, pulse + *γράφειν, graphein*, to write). An instrument invented by Vierovdt and perfected by Marey, by which are ascertained and permanently recorded the force and frequency of the pulse-beat and the changes which it undergoes. It consists of two essential parts: (1) Of two levers, one of which is so delicately adjusted on the vessel the pulsation of which it is desired to examine, that on each expansion of the vessel the lever undergoes a corresponding slight elevation; this lever communicates by a perpendicular arm with a second, to which it transmits the impulse received from the vessel; the extremity of this second lever is armed with a pen-point, which records the movement thus indicated on a movable plate, controlled by the second part of the instrument. (2) The second portion consists of a plate, moved by clockwork, and bearing a strip of paper on which the sphygmogram is written. The instrument may be combined with a microphone, constituting a sphygmophone. The pulsations may be seen by an appliance termed a sphygmoscope.

SPICCATO, spē-kä'tō (It., separated). A term in music indicating a distinct and detached mode of performance. Its usual application is to music for bowed instruments, where it implies that each note is to be played with a springing bow. The bow is allowed to fall by its own weight upon the string; it rebounds and falls again, thus producing the next tone.

SPICE BUSH. See FEVER BUSH.

SPICE ISLANDS. A group of islands in the Dutch East Indies. See MOLUCCAS.

SPICES. See FLAVORING PLANTS.

SPIDER (ME. *spither*, from AS., Goth., OHG. *spinnan*, Ger. *spinnen*, to spin; cf. OHG. *spinna*, Ger. *Spinne*, spinner, spider). Any member of the Araneida, an order in the class Arachnida. The arachnids are distinguished from insects by the possession of four pairs of legs; while spiders are separated from other Arachnida by the presence of spinning-organs near the tip of the body. The body of a spider is divided into two portions connected by a small slender pedicel. The anterior part is called 'cephalothorax,' and is supposed to represent the combined head and thorax of insects. The posterior part is the 'abdomen.' On the anterior part of the cephalothorax are the eyes, commonly eight in number, and frequently arranged in two transverse rows of four each. In the lower front margin of the cephalothorax are the mouth-parts. These consist of a pair of jaws, sometimes called mandibles or 'falces;' a pair of palpi, whose basal joints are enlarged into maxillæ; and a median unpaired lower lip. The mandibles are two-jointed; the basal joint is very large and stout, the apical one is small, claw-like, and called the 'fang.' The palpi are filiform, and six-jointed. In the female they are simple and often terminate in a claw; in the male, however, the apical joint is curiously modified into a complicated accessory sexual organ, suited to carry and apply the seminal fluid. The four pairs of legs are similar in structure, but variable in length. Each consists of seven joints, and ends in two or three toothed claws. The spiders that live on webs usually have three claws, the median more curved than the others; while other spiders commonly have but two. In place of the median claw is sometimes a dense fascicle of hairs. The abdomen of spiders is generally soft, tumid, and has no apparent joints. The genital organ opens near the base of the abdomen beneath. The male aperture is inconspicuous, but the female vulva or epigynum is often very prominent, and sometimes quite complicated. At the apex of the abdomen are four to six short, often two-jointed pieces, the spinnerets or spinning-organs. Each spinneret has on its surface many minute orifices, from each of which may issue a thread, and the many threads joined together make the spider's line. The substance which exudes from the spinnerets is glutinous, but dries on contact with the air. Some spiders possess an accessory spinning-organ, a transverse surface in front of the base of the spinnerets known as the 'cribellum.' Correlated with this is a row of curved hairs on the hind metatarsus, called the 'calamistrum.' The spider draws the row of hairs over the cribellum and combs out a curled or tangled thread of silk.

The mouth of the spider opens into a short œsophagus, which leads to a sucking-stomach which draws up the liquid food. From the posterior part of this organ arise two branches which extend upward and forward and meet over the mouth; each branch gives off on the outer side four smaller branches, one in front of each leg, and these unite below the sucking-stomach. From the stomach arises the intestine, which passes into the abdomen and opens just behind the spinnerets. In the abdomen just above the intestine is a long tubular heart or pulsating vessel, with openings in front, behind, and along the sides. The nervous system is represented by a large, long ganglionic mass lying on the floor of the cephalothorax. In front is a smaller mass which gives rise to nerves to the eyes and jaws. At the base of the abdomen below there is a cavity on each side, nearly filled by a series of thin plates through which the air reaches the blood. These are the 'lungs.' Spiders also have a pair of branching tracheæ, which open just in front of the spinnerets. The silk-glands lie above the spinnerets and along the floor of the abdomen. They are of two kinds, most of them short, but two are larger and very long. Each silk-gland has a separate opening or duct in the spinnerets.

The eggs are deposited (10 to 2000 in number) within silken cases or cocoons made by the mother spider for this purpose. The young spider on hatching is in general appearance much like the parent, but with larger hairs, and less distinctly marked. As the young spider grows, it is obliged to molt the skin. The number of molts varies from six to nine. The spider's silk is not used solely in the construction of webs, but serves a variety of purposes. With many spiders the web is a loose, irregular maze of crossed threads, which are the true 'cobwebs.' In other cases it is a flat sheet of threads with a tubular retreat at one corner. The geometric or orb webs consist of a varying number of radiating lines, crossed by many parallel or spiral threads. The whole is supported by several guy-lines or stouter threads. At one corner or in the near vicinity is a silken nest or retreat, where the spider remains concealed during the day or when not using the web. This retreat is connected by a line to the centre of the web. When waiting for prey the spider rests upon the centre of the web, head downward and legs extended. See ORB-WEAVER.

The male spider is usually smaller than the female, with longer legs, and often is more highly colored; sometimes he has additional spines on the legs, or spurs on the coxæ. In many of the minute species the male has the front of the cephalothorax greatly swollen and elevated, often molded into grotesque shapes. The courtship of spiders is frequently attended with grave peril to the male. The female, if not in the suitable temper, may attack and devour her devoted admirer. In some cases, however, the male is larger than his mate.

As a rule spiders can see clearly only for a few inches. They have an acute sense of hearing, as well as of touch. A number of spiders are so shaped or colored as to deceptively resemble ants, an appearance heightened by their erratic movements. Others resemble the surfaces upon which they usually occur, as the bark of trees, dead leaves or twigs, and the petals of flowers. A few are able to produce sounds; some by rubbing the base of the abdomen over the base of the cephalothorax, others by rubbing the palpi against the sides of the mandibles. A considerable number, known as trap-door spiders, dig holes in the ground, line them with silk, and cover the entrance by a close-fitting door, the upper surface of which is made to resemble its surrounding. Some species make similar nests in trees. A few spiders are social and produce webs in common, or closely connected to each other. Some of the large spiders are very powerful and can kill small birds, rats, fish, and other animals. All spiders have poison-glands and use them in capturing prey, but with most spiders the mandibles are so small and weak as to be incapable of piercing the human skin, and if they did so the small amount of poison injected could have no deleterious effect. With the large tarantulas it is different, although cases of death from their bites are few and doubtful. There is one group of spiders, however (genus Latrodectus), which appear to merit the name of 'poisonous spiders.' The New Zealand species, locally known as 'katipo' (q.v.), certainly appears to be dangerous. A species of Latrodectus occurs in the Southern United States, where it is called 'malmignatte,' but its bite (as far as known) has not proved fatal.

The classification of spiders, formerly quite simple and based on their habits and webs, has undergone a complete revolution. Thirty-five or forty families are now known; several, however, contain but few species. The more prominent families may be grouped in two classes for convenience. Of the non-web-building kinds are the Theraphosidæ, or tarantulas, and trap-door spiders. They have vertically moving fangs, four lung-slits, and are of large size. The Dysderidæ possess but six eyes and live in dark places. The Drassidæ are flat, with prominent spinnerets, and live on the ground or under stones. The Clubionidæ are convex and occur on bushes or among dead leaves. The Sparassidæ are very flat and broad and are abundant in the tropics. The Thomisidæ, or crab-spiders, are flat, broad, can walk sidewise, and catch prey by the fore legs. The Lycosidæ, or wolf-spiders, have the eyes in three rows, those of the lowest very small; they wander in woods and fields. The Attidæ, or jumping spiders, have eyes in three rows, those of the lowest row the largest; they jump, and stalk their prey.

Among web-building forms are the Agalenidæ, which make flat sheets of web with a tubular retreat at one side; the Dictynidæ, which possess a cribellum, and make irregular webs, with curled threads; the Theridiidæ, which make the familiar cobweb; and the Epeiridæ, which make geometric or orb webs.

Consult: Emerton, *The Common Spiders of the United States* (Boston, 1902); McCook, *American Spiders and Their Spinning Work* (Philadelphia, 1889); Cambridge, *The Spiders of Dorset* (Sherbourne, 1879-81).

SPIDER-CRAB. Any crab in which the legs are of unusual length in comparison with the body. The famous giant crab of Japan (*Macrochira Kempferi*) is the largest known spider-crab, and has legs from four to six feet in length. On the eastern coast of the United States the name is usually given to species of Libinia, especially *Libinia canaliculata*, which is very common on muddy shores or flats.

SPIDER-MONKEY, or COAITA. Any American monkey of the genus Ateles, characterized by slenderness and agility (see MONKEY). They frequent in small bands the tallest forest trees, moving swiftly by astonishing leaps, sprawling out like spiders, and catching by their perfectly prehensile tails. Most are black or nearly so, with the face shaded by projecting hair, which is either light or dark in color. They are mild, intelligent, and make interesting pets. Ten species occur between Southern Brazil and Central Mexico, of which the Amazonian red-faced (see Plate of MONKEYS) and the Mexican one are best known. Their food is mainly fruits and insects, and their flesh is eaten.

SPIEGEL, spē'gel, FRIEDRICH VON (1820—). A German Orientalist, one of the pioneers in the field of Iranian philology. He was born in Kitzingen, studied at Erlangen, Leipzig, and Bonn, then spent five years in the libraries of Copenhagen, Paris, London, and Oxford, and from 1849 to 1890 was professor of Oriental languages in the University of Erlangen. His early studies on Pali and the publication of the *Kammavâkya*

(1841) and the *Ancedota Palica* (1845) did much for the knowledge of southern Buddhism. They were quickly followed by his researches on Zoroastrianism and the Avesta. The edition of the greater part of the extant Avesta, together with the Pahlavi translation (1853-58), was followed by a German version (1852-63), and supplemented by a commentary (1865-69). He published a number of Persian works, as well as grammars of the Old Persian and Old Bactrian languages. Then came the valuable linguistic and archæological works, *Die altpersischen Keilinschriften* (1862), *Erân* (1863), *Erânische Altertumskunde* (1871-78), *Vergleichende Grammatik der alterânischen Sprachen* (1882), and *Die arische Periode und ihre Zustände* (1887). Mention should be made of a *Chrestomathia Persica* (1845), of the *Grammatik der Parsisprache* (1851), and of the *Einleitung in die traditionellen Schriften der Parsen* (1856-60).

SPIELHAGEN, spēl'hä-gen, FRIEDRICH (1829—). A German novelist, born at Magdeburg, and educated at Berlin, Bonn, and Greifswald. He taught for a while at Leipzig, and in 1859 became editor of the *Zeitung für Norddeutschland*, in Hanover. Thence he moved in 1862 to Berlin, and edited (1878-84) Westermann's *Illustrirte Monatschefte*. Spielhagen began novel-writing with *Problematische Naturen* (1860), and then for a while dealt with social problems, arising from the irrepressible conflict between the stolid landed nobility and the intelligence of the nation. In several books (*Durch Nacht zum Licht*, 1861; *Die von Hohenstein*, 1863; *In Reih und Glied*, 1866; *Hammer und Amboss*, 1869) he treated the subject with an aggressive optimism that won him a popularity which he afterwards maintained by sensational novels of a lower type. Of these *Sturmflut* (1877), *Der neue Pharao* (1899), and *Freigeboren* (1900) are sufficient exemplars. Excellent are his critical *Beiträge zur Theorie und Technik des Romans* (1883). His own ideal for the novel is to present an artistically composed picture of the times, and for this he makes constant hardly veiled allusions to persons of contemporary prominence, so that his novels lose with time something of their significance and actuality. As a translator Spielhagen rendered into German Curtis's *Howadji*, Emerson's *English Traits*, a selection of American poems (1859; 2d ed. 1865), and Roscoe's *Lorenzo de' Medici*. He also translated from the French minor works of Michelet, *L'amour*, *La femme*, *La mer*. His collected novels appeared in 22 vols. in 1895. Consult his autobiographical *Finder und Erfinder* (1890), and Karpeles, *Friedrich Spielhagen* (Leipzig, 1889).

SPIELMANN, spēl'man, MARION H. (1858—). An English art critic and author. He was born in London and studied at University College, London, with a view to becoming an engineer. He soon turned to literature, beginning with articles on art for the *Pall Mall Gazette* (1883). Afterwards he became art critic of the *Daily Graphic*, art editor of *Black and White*, and (1887) editor of the *Magazine of Art*. Among his publications are the *History of Punch* (1895), exceedingly well done; *Millais and His Works* (1898); *The Unidentified Contributions of Thackeray to Punch* (1899); *John Ruskin* (1900); *Notes on the Wallace Collection in Hertford House* (1900); and *British Soulpture and Soulptors of To-Day* (1902).

SPIGELIA (Neo-Lat., named in honor of Adrian van der *Spiegel*, a Belgian physician and professor of anatomy at Padua in the seventeenth century). A genus of plants of the natural order Loganiaceæ. *Spigelia marilandica*, often called worm grass and Carolina pinkroot, a native of the Southern United States, occurring from New Jersey to Wisconsin, and west to Texas, is a perennial plant with a simple quadrangular stem. The root has been employed in the United States as a vermifuge, as has also *Spigelia anthelmia*, a tropical American annual with spike-like racemes of purplish flowers.

SPIKE. A kind of inflorescence (q.v.).

SPIKENARD (OF. *spiquenard*, from Lat. *spica nardi*, spike of nard, from *spica*, spike, point, head or tuft of a plant, and *nardi*, gen. sg. of *nardus*, Gk. *νάρδος*, nard, from Pers. *nard*, from Skt. *nalada*, Indian spikenard), or NARD. A costly perfume of India highly prized by the ancients and used both in baths and at feasts. The 'ointment of spikenard' (John xii. 3) was probably an oil or fat impregnated with the perfume. The plant which produces it has been ascertained to be the Nardostachys jatamansi, a native of the mountains of Northern India. The root, which is from three to twelve inches long, sends up many stems, with little spikes of purple flowers, which have four stamens. Andropogon nardus yields an oil which is sometimes called oil of spikenard; and in the United States Aralia racemosa, a tall herb with large perennial spicy aromatic roots, is known as spikenard. See ARALIA.

SPINA BIFIDA (Lat., cleft spine). A congenital hernia of the membranes of the spinal cord through a fissure in the wall of the bony canal. A tumor is thus formed, which is nearly round, varying in size from that of an egg to that of an adult head, lying in the middle line of the back, fluctuating, and adhering to the adjacent vertebræ either directly or by a pedicle. The sac may contain only the spinal membranes (meningocele) or a part of the cord with the membranes (meningo-myelocele), or lastly the spinal cord so distended by the expansion of the central canal as to form a neural lining to the sac. The usual termination of the condition is death. As the size of the tumor increases, fatal convulsions ensue; or the skin investing the tumor may ulcerate, and suffocation follow. Occasional cases are, however, recorded in which patients with this affection have survived till middle life. Active surgical treatment usually hastens death, and should only be used in the most urgent circumstances. Moderate support by means of a hollow truss, or a well-padded concave shield, may tend to keep the disease stationary; and any interference beyond this is, in the great majority of cases, unadvisable.

SPINACH, or **SPINAGE** (OF. *spinache*, *espinache*, *espinage*, *espinace*, from ML. *spinacia*, *spinacium*, spinach, from Lat. *spina*, thorn, spine, so called because of the prickly fruit), *Spinacia*. A genus of herbs of the natural order Chenopodiaceæ; probably natives of Asia. Common spinach, or garden spinach (*Spinacia oleracea*),

is an annual widely cultivated for its young leaves, which are used as greens. Two very distinct botanical varieties are cultivated: prickly spinach, with somewhat triangular and arrow-headed leaves and rough knobby fruit; smooth spinach, or round spinach (*Spinacia glabra* of some botanists), with round and blunt leaves and smooth fruit. Upon poor soil and after the appearance of the stem, which reaches a height of two feet, the leaves become bitter, hence the more luxuriantly spinach grows, the better it is. It may be sown in spring in rows about one foot apart, but it is generally sown in autumn for early spring use. The smooth spinach is very generally preferred for the former purpose, and the prickly kind for the latter. Several unrelated plants are also called spinach, of which the best known is New Zealand spinach (*Tetragonia expansa*), a plant of the natural order Mesembryaceæ, a trailing, succulent annual that withstands the heat of summer and is a valuable successor to true spinach. See Plate of YAM, SWEET POTATOES, etc.

SPINAL CARIES. See SPINE, CURVATURE OF THE.

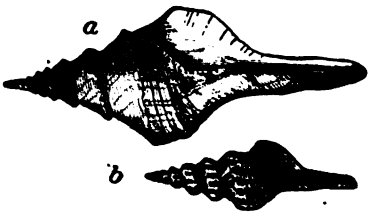
SPINAL COLUMN (Lat. *spinalis*, relating to a thorn or to the spine, from *spina*, thorn, spine), or SPINE. The most important and characteristic part of the skeleton of the highest animal sub-kingdom, which includes mammals, birds, reptiles, amphibians, and fishes. In each of these classes it is composed of a series of bones placed one above or in front of another, and called the vertebræ; and hence, these animals, having this distinguishing characteristic in common, are all included in the term *vertebrates*. The vertebræ vary greatly in number in different animals, and in shape they differ extremely, even in different parts of the same spine, in accordance with their special functions. In man the number of vertebræ which collectively form the spinal column is 7 in the neck (cervical vertebræ), 12 in the back (dorsal vertebræ), 5 in the loins (lumbar vertebræ), 5 ossified together, forming the sacrum, and 4 similarly united forming the termination of the column or coccyx. However long or short the neck may be, every mammal has 7 cervical vertebræ, excepting the three-toed sloth, which has 9, and the sea-cow, which has 6. In the other regions of the spine no such law exists. Each vertebra is attached to the two between which it lies by numerous strong and more or less elastic ligaments, and between each pair of vertebræ there is interposed a lenticular disk of fibro-cartilage, which acts as a buffer. By these arrangements the spinal column is rendered highly elastic, the communication of jars or shocks is prevented, and a very considerable general range of movement permitted, although the motion between any two adjacent vertebræ is slight. The elasticity of the column is further increased by the component vertebræ being arranged in curves, instead of being placed perpendicularly. These curves enable the spine to bear a greater vertical weight than it could otherwise maintain; they facilitate the movements of the body, especially in the act of running; and they are so disposed as to protect the cord in movements of the spine.

The vertebral canal formed by the apposition of the spinal foramina, or neural arches, and containing and protecting the spinal cord, varies in its size at different parts of the column. The intervertebral foramina through which the nerves emerge vary in shape and position in different parts, but are always of sufficient size to prevent injurious pressure on the nerves during movements of the spine; and in the dorsal region, which is the ordinary seat of angular curvature, the nerves are so protected by bony arches that they may escape injury, even when the bodies of several dorsal vertebræ have been destroyed by ulceration.

SPINAL CORD. See NERVOUS SYSTEM AND BRAIN.

SPINDLER, KARL (1796-1855). A German novelist, born at Breslau. He studied law at Strassburg, fled thence to escape being drafted into the military service of France, and became an actor. In 1825 he turned to literature, and became one of the group, including Hauff and Häring ('Wilibald Alexis'), which imitated in historical fiction the *Waverley* methods of Scott. Most of his work, which fills 101 volumes in the Stuttgart collective edition of 1854-56, while fascinating as to plot, is careless in execution. In a few cases, however, as *Der Jesuit* (1820), *Der Jude* (1827), *Der Invalide* (1831), and *Der Vogelhändler von Imst* (1842), he skillfully depicted the historical background, and merited, though he did not gain, a more than temporary success.

SPINDLESHELL. A genus (Fusus) of gastropodous mollusks nearly allied to Murex (q.v.), having a spindle-shaped shell, with a very elevated spire, the first whorl often much



SPINDLE-SHELLS

a, A living species (*Fusus proboscidalis*); *b*, A fossil (Miocene) species (*Fusus longirostris*).

dilated, and with a straight elongated canal. About 100 existing species have been described, and more than three times that number of fossil ones.

SPINDLE TREE (*Euonymus*). A genus of about 60 species of shrubs or small trees of the natural order Celastraceæ. The common spindle tree (*Euonymus Europæus*), a European shrub with an orange-colored aril, is often planted for ornament. The hard, fine-grained wood is used for fine turnery and for skewers. It was formerly used for making musical instruments and for spindles, whence the name. Charcoal made of it is much valued for crayons. In the United States wahoo, or burning bush (*Euonymus atropurpureus*), is a small crimson-fruited tree or shrub, which occurs from New York to Nebraska and southward. Strawberry bush (*Euonymus Americanus*) is a low shrub often found along wooded river banks from Illinois southward.



SPINDLE TREE (*Euonymus Europæus*).

SPINE, CURVATURE OF THE. There are two distinct forms of curvature, *lateral curvature*, arising from weakness of the bones, ligaments, and muscles, and *angular curvature*, which results from carious disease of the vertebræ.

Lateral curvature of the spine, or scoliosis, is not simply a bending of the spine laterally. In addition there is also considerable rotation or twisting of the vertebral bodies which normally are held in their proper relation and position by the ligaments and muscles. Muscular action is necessary for the maintenance of the erect pose; and if, through fatigue and exhaustion or through muscular weakness, from disease, such as rickets (q.v.), the muscles fail to act, a temporary deformity is brought about. If this is not remedied the ligaments become relaxed, the bones which are not yet fully developed adopt their growth to conform to the new relations, and the deformity persists. Postural habits, such as standing on one leg or sitting incorrectly at a desk, tend to distort the spine and to stretch certain ligaments, and often result in permanent deformity.

Lateral curvature is more frequent among girls than among boys, for their muscles are less developed by physical exercise and their general strength is often unequal to the strain put upon them in their school life. In lateral curvature the bodies of the vertebræ rotate toward the convexity and the spines toward the concavity of the curve. In the dorsal region the ribs are carried with the vertebræ in their rotation, and therefore the chest becomes deformed and the functions of heart and lungs are seriously interfered with. In order to maintain the erect position a compensatory curve develops. In the dorsal region the tendency is to the right, while in the lumbar region it is to the left.

The subjects of this affection do not usually complain of pain and often nothing wrong is noticed except an awkwardness in gait or a tendency to carry one shoulder higher than the spinal processes and the abnormal curve of the spine. Spinal supports and plaster jackets are not to be used. The whole treatment should be directed to strengthening the muscles by exercise and massage. Exercise, however, must not be carried to excess, for this will only aggravate the existing conditions.

Angular curvature of the spine, commonly known as *Pott's disease*, is the result of caries of the vertebræ, a disease essentially tubercular in character. It occurs most frequently in children between the ages of three and twelve years, but is also met with in babes and in adults. An injury such as a blow or a fall often acts as an important factor, but at times we can trace no existing cause whatever. The most common seat of disease is in the dorsal vertebræ. The inflammation begins in the bodies of the vertebræ, and as they become softened or destroyed the spinal column above settles down upon the healthy portion below and the spines of the diseased vertebræ are pushed backward, producing a deformity more or less marked.

The symptoms are rigidity of the spine with tenderness and a deformity of varying degree. Sometimes abscesses form and pus and bony debris are evacuated (especially lumbar and psoas abscesses). The pain is frequently marked and in some cases pressure upon the spinal cord or nerves gives symptoms of an aggravated type. The disease is slow, with a poor prognosis, although the chances are vastly improved if treatment is begun early. The best we can hope for is an arrest of the disease and an ankylosis at the site of the trouble. Rest of the spine is the essential factor in treatment, and is obtained by a plaster-of-Paris jacket or some one of the surgical appliances especially adapted to special regions. General treatment and hygiene are of course necessary.

SPINEL (OF. *spinelle*, *espinelle*, Fr. *spinelle*, spinel, from Lat. *spina*, thorn, spine). A mineral magnesium aluminate crystallized in the orthorhombic system. It has a vitreous lustre and is found in various shades of red, passing into blue, green, yellow, brown, black, and occasionally nearly white. It is highly prized as a gem, and the transparent red colored crystals are called *spinel rubies;* while the violet and purple ones are known as *almandine;* the rose-red to pink colored varieties as *balas rubies;* the black varieties as *pleonaste;* the yellow or orange spinels are called *rubicelle*, and the pale to sapphire-blue kinds are known as *sapphirine.* The gem varieties are found for the most part in Ceylon, Siam, and other Eastern countries, and near Franklin, N. J., crystals occur that occasionally afford small gems.

SPINELLO ARETINO, spē-nĕl'lō ä'rā-tē'no, properly LUCA SPINELLO (c.1333-1410). A Florentine painter, a prominent representative of the declining school of Giotto. He was born in Florence, of a family of Aretine goldsmiths settled there, and probably was a pupil of Jacopo di Casentino. He was employed upon the chief decorative tasks of Middle Italy, in the churches of Florence, in the Campo Santo of Pisa, where he painted scenes from the lives of Saints Ephesus and Hippolytus, and in the Palazzo Pubblico of Siena, decorating the Sala di Badia with subjects from the life of

Pope Alexander III. His best preserved works are the frescoes of the "Life of Saint Benedict," in San Miniato, Florence. He also executed extensive frescoes at Casentino and Arezzo, where, in Santa Maria degli Angeli, was his celebrated "Fall of Lucifer," which gave rise to Vasari's well-known fable that the painter died of fright in consequence of an apparition of Lucifer calling him to account for the painting. Spinello's work is facile in composition and vivacious in presentation, but superficial in form and execution.

SPINET (OF. *espinette*, Fr. *épinette*, from It. *spinetta*, spinet, point, diminutive of *spina*, from Lat. *spina*, thorn, spine). A stringed musical instrument with a keyboard, smaller and



SPINET.

weaker than the harpsichord, and, like it, one of the precursors of the pianoforte. The general outline of the instrument nearly resembled that of a harp laid in a horizontal position, with the keys occupying the position of the sounding-board. The oldest extant specimen is dated 1490.

SPINNAKER. A triangular racing sail carried by yachts. It hoists to the foremast or foretopmast head and is spread by a boom which is, at other times, carried up and down the foremast. The spinnaker is only set when the wind is free or behind the yacht. See YACHT.

SPIN'NER, FRANCIS ELIAS (1802-90). An American political leader, born at German Flats, now Mohawk, N. Y. From 1845 to 1849 he was auditor of the naval office in New York City. In 1854 he was elected to Congress as a Free-Soil Democrat, but soon identified himself with the newly organized Republican Party, and was twice reëlected to Congress, serving from 1855 until 1861, when he was appointed Treasurer of the United States. This position he filled with great credit until 1875, when he resigned on account of failing health and went to Florida, where he passed the remainder of his life. During his administration women were first employed as clerks in the Treasury Department to take the places of the men who enlisted in the Federal armies.

SPINNING (from *spin*, from AS., Goth., OHG. *spinnan*, Ger. *spinnen*, to spin; probably connected with AS., OHG. *spannan*, Ger. *spannen*, Eng. *span*, to stretch out, extend, and ultimately with Lat. *spatium*, extent, Gk. *σπᾶν*, *span*, to draw out). The art of drawing, twisting, and combining either animal or vegetable fibres, so that they are formed into continuous threads ready for the further operations of weaving, knitting, or sewing. The principal textile fibres are silk, wool, flax, jute, and cotton (qq.v.), and the method of spinning each of these substances differs slightly from the rest.

The most ancient instruments for spinning were the *spindle* and *distaff*, representations of which are to be seen on the earliest Egyptian monuments. The distaff was a stick or staff upon which a bundle of the prepared material was loosely bound, and which was held in the left hand or stuck in the belt; the spindle was a smaller tapering piece to which the thread was attached. By a dexterous twirl of the hand the spindle was made to spin round and at the same time recede from the spinster, who drew out between the forefinger and thumb of the right hand a regular stream of fibres so long as the twisting of the spindle lasted. It was then drawn in, the new length of thread wound upon it, and the operation renewed. An obvious improvement in this device was to set the spindle in a frame and make it revolve by a band passing over a wheel, driven by occasional impetus from the hand.

The *Saxon wheel* is said to have been invented in Nuremberg in 1530. This wheel, used only for flax-spinning, contained the germ of Arkwright's invention, described later on. A bobbin or 'pirn' with a separate motion was placed on the spindle, which had a bent arm—a flyer or flight—for winding the yarn on the bobbin. The spindle and bobbin revolved at different speeds, the revolutions of the spindle giving the twist, and the difference of the speed causing the winding on. The two-handed wheel had two spindles and pirns a little apart, with the distaff stuck into the frame between them, and the spinster produced a thread with each hand.

During the last half of the eighteenth century three inventions were made which completely revolutionized the art of spinning. These three inventions were Hargreaves's *spinning jenny*, Arkwright's *throstle machine* or *roll-drawing spinning machine*, and Crompton's *mule spinner*.

In the spinning jenny a number of large reels of fibre formed into a thickish coil, called a *roving*, were set on upright fixed spindles, and the ends of the rovings were passed between two small movable bars of wood placed horizontally and under the control of the spinner, who could thus make them press more or less on the roving, and consequently increase or decrease the draw upon it from the spinning spindles, which were set in a row at the other end of the frame, and all capable of being set in motion simultaneously by the wheel. The spinner drew out the rovings by moving the bars back and forth and at the same time turned the crank with his right hand to rotate the spindles.

The *throstle machine*, patented by Arkwright in 1769, had for its object the drawing of the rovings through a succession of pairs of rollers, each pair in advance of the others, and moving at different rates of speed. The first pair receive the sliver, compress it, and pass it on to the second pair, which revolve at a greater speed, and thus pull it out to exactly the number of times

greater length that their revolutions exceed those of the other pair, and as the first roving is passed though a second, third, and sometimes fourth machine, the finished roving is 32 times longer than the sliver. As the roving issues through the last rollers of each machine it is received on *spools* or *reels*, calculated to hold a given quantity; and these are transferred to the *spinning frames*, which resemble the *roving frames*. Here the roving takes the place of the sliver, and, as it unwinds from the spool, is drawn through successive pairs of rollers, moving as before at different rates, each succeeding pair faster than the backward ones, so that the roving gets thinner and thinner, until the tenuity is carried as far as

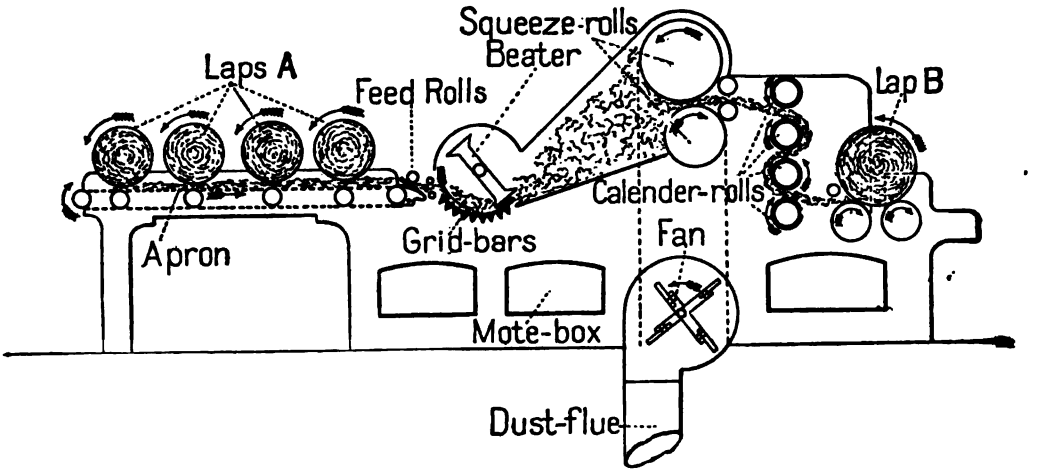


FIG. 1. SECTION OF INTERMEDIATE OR FINISHER-LAPPER.

desirable. It is then carried on to a spindle which revolves with great rapidity, and, by means of a simple arrangement, is made both to twist the thread and wind it on the spindle ready for the weaver.

It was found that the process of spinning by rollers produced too great a strain upon the thread in its progress to admit of its being drawn as fine as is wanted for many purposes, and this led to the invention of the mule jenny by Crompton in 1779, which has a traveling frame upon which the spindles are set, and which in its modern form is described below.

During the nineteenth century many important improvements were made in the details of the construction of spinning machinery, but the general principles are those worked out a hundred years ago. The greatest improvements have been changes in the construction of spindles, allowing them to revolve more rapidly and freely. In the modern factory spinning is the final process in a series of operations necessary to convert the raw fibre into thread. Each of these processes has for its object the removal of smaller and smaller impurities and the production of a finer and stronger thread. These are: (1) opening and picking; (2) carding and combing; (3) drawing; (4) roving; (5) spinning. Other intermediate operations may be introduced.

The *opener* or *breaker lapper* is a similar machine to the *intermediate* or *finisher lappers*, as shown in Fig. 1, and described below. In the breaker lapper the cotton as taken from the bale is fed to it in a hopper or by some kind of automatic feed, and delivered in laps which are then placed on the intermediate lapper, either 3 or 4 laps being 'doubled' on the same and the cotton after being loosened and further cleaned is delivered in laps to be placed on the finisher lapper, 3 or 4 laps from the intermediate being again 'doubled' and delivered in a single lap ready for the card. The function of the lappers is to thoroughly loosen the lumps of cotton as taken from the bale, to remove dirt and dust and as much leaf, trash, and motes as possible. There are usually three of these, the breaker, intermediate, and finisher lapper. Fig. 1 is a section of an *intermediate* or *finisher lapper*. The cotton enters these machines in a sheet made up from the laps, A, delivered onto the slowly moving apron, from which it is taken by the feed-rolls and delivered to the rapidly revolving *beater*, which forces it against the *grid-bars*, loosening the dirt and motes which fall through the *grids* into the *mote-box*. The cotton is left in a light and feathery mass which is drawn between the *squeeze-rolls* by the suction of the fan, which also draws the dust and fine dirt from the beaten mass and discharges them through the *dust-flue*. The sheet of cotton from the squeeze-rolls is taken by the *calender-rolls*, and compressed and finally rolled into the lap B. The lap is about one inch in thickness, 40 inches to 48 inches wide, and usually from 48 to 52 yards long.

After the cotton has passed through the series of lappers the laps from the finisher lapper go to the *card* (Fig. 2). (See CARDING.) The cotton in the lap A is delivered to the *feed-roll* of the card and is grasped by the teeth of the *licker-in* or *taker-in*, from which it is taken in a thin sheet by the fine wire teeth of the *card-clothing* on the *cylinder* B, and carried upward to come in contact with the teeth on the clothing of the *top-flats*, and the fibres are combed into a degree of parallelism—the *cylinder* revolving rapidly, while the *flats*, which are in a chain, move slowly forward so that new *flats* are continually coming in contact with the cylinder—and much of the short and broken fibres is removed; the *comb*, C, removes the short fibres

from the *flats* and they are rolled upon the *rod*, and the flats are further cleaned by the brush. The carded cotton is taken from the *cylinder* by the *doffer cylinder*, the latter having a surface velocity somewhat less than that of the main cylinder, and is removed from the *doffer* by the *comb*, D, in a thin evenly carded film; this film is drawn through the *trumpet* by the *calender-rolls*, in a round strand about one inch thick called a *sliver*, which is automatically coiled in the *sliver-can* by the *coiler*.

As all the processes are arranged to 'double' the mass of cotton and then to reduce the mass in size by 'drawing' it out to several times its original length until the yarn is finally produced, an examination of Fig. 3 will help the reader to understand how the 'drawing' acts on the fibres. On the left is shown the *sliver* from the card, the cotton being in a more or less tangled condition, but after passing between the successive pairs of *drawing-rolls*, 4.4', the last or right hand pair, revolving faster than the others, 'draws' the fibres past each other and straightens them, bringing them into a nearly parallel position.

The card-sliver goes first to the *drawing frame*, Fig. 4, and four or six slivers, A, are combined by passing them through the drawing rolls as above described. The *drawing sliver* is carried through the trumpet and deposited in the can by the coiler the same as from the card. This drawing process is repeated two or three times as the work may demand, always 'doubling' and 'drawing,' but without putting in any twist. After the drawing frames, the drawn sliver is placed in cans, behind the first of the *roving frames* which have rolls similar to the drawing frames, but have spindles by which the stock, then called *roving*, is twisted and wound on bobbins. The first of the roving frames is called the *slubber*, and is heavier than the *intermediates* and *fine frames*, as the other roving frames are designated. The full bobbins, A, from the slubber are placed in the creel of the *intermediate* frame, as shown in Fig. 5, and two strands combined are delivered to the rolls and drawn, the new strand of roving is carried to the top of the *flyer*, on the spindle B, is passed through one arm of the flyer, which is hollow, and

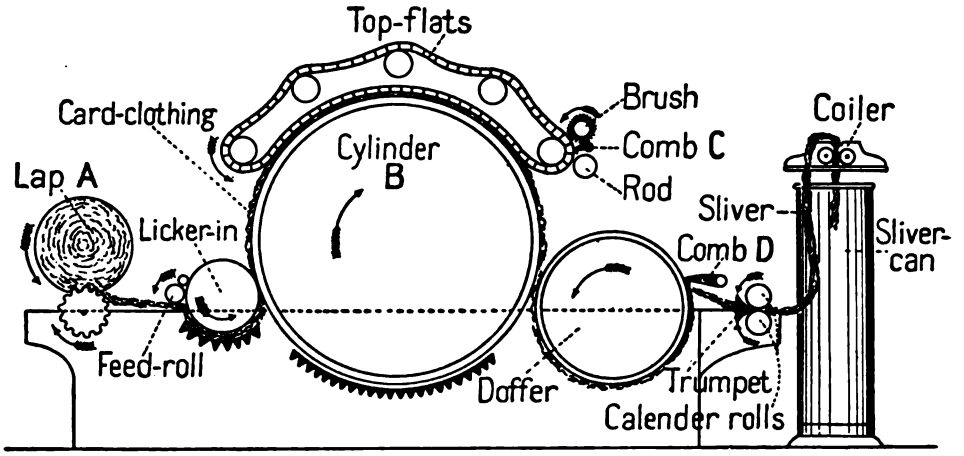


FIG. 2. SECTION OF REVOLVING TOP-FLAT CARD.

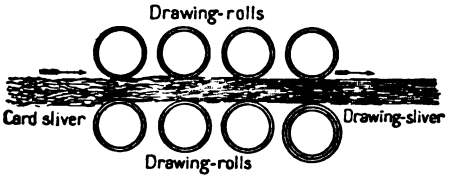


FIG. 3. DETAIL OF DRAWING PRINCIPLE.

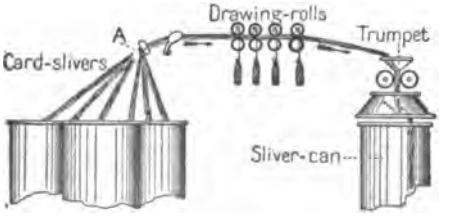


FIG 4. SECTION OF DRAWING FRAME.

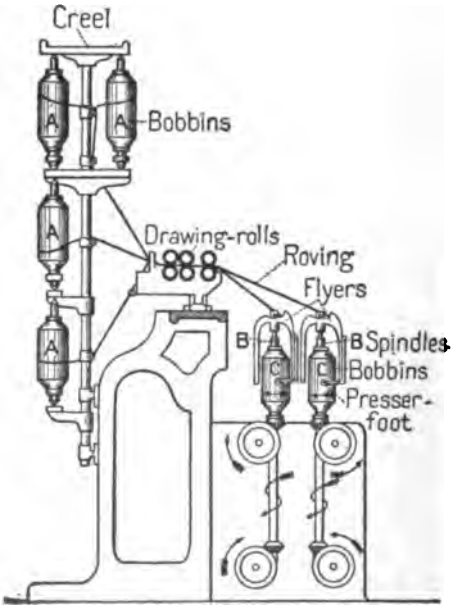


FIG. 5. SECTION OF ROVING FRAME.

strand of roving, while the difference in speed between the flyer and the surface of the bobbin winds the roving on the latter.

The *fine frame* is a similar frame to the above, and delivers the roving finer and more even than any of the preceding machines and ready for the *spinning frame* (Fig. 6). The roving may be doubled or run singly on the spinning frame, the rolls produce the drawing effect as on the preceding machines, and the revolution of bobbin and spindle puts in the twist. The *bobbin* A is fast on the *spindle* B, and draws the yarn through the *traveler*, a small wire loop attached

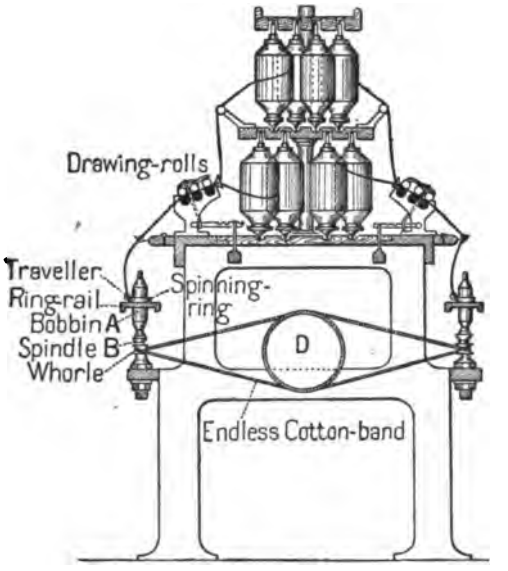


FIG. 6. SECTION OF SPINNING FRAME.

to and movable on the *spinning ring*, which surrounds each spindle. The spindles are made to revolve by an endless cotton *band*, which passes around the *whorl* of the spindle and is driven by the *cylinder* D. The production of the spinning frame is technically 'frame-spun yarn,' either

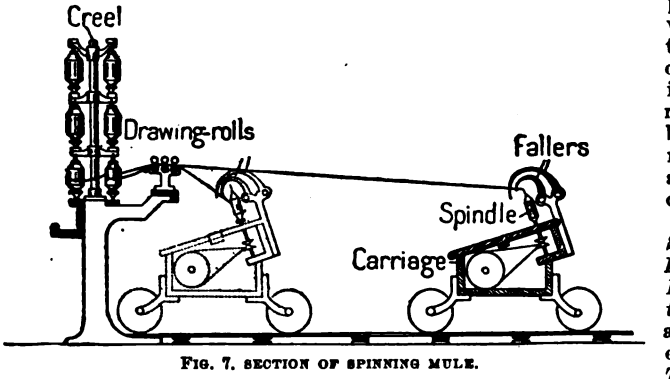


FIG. 7. SECTION OF SPINNING MULE.

warp or filling. This is wound on the bobbins by the moving up and down of the *ring rail*, which holds the *spinning rings* with the *travelers*, the pull or drag of the travelers winding the yarn on the bobbin.

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SPINNING-GLAND. One of a class of glands (q.v.) possessed by the larvæ of many kinds of insects and by the majority of spiders. See SPIDER.

SPINOLA, spē'nō-lȧ, AMBROSIO, Marquis de (1569-1630). A Spanish general, born in Genoa, Italy. In 1602 he led a force of 9000 veterans to the Netherlands against Maurice of Nassau. Made chief commander of the Spanish army there, he forced Ostend to surrender in 1604, after a siege of more than two years. He continued his operations against Maurice till the twelve years' truce of 1609, when he took command of the Spanish troops in Germany. He took the field against the Elector Palatine Frederick V. and the Protestant Union in 1620, and forced the Union to disband in 1621. He captured Jülich in 1622, and Breda in 1625. Disease forced him to give up his command, but he afterwards commanded the Spanish army in Italy.

SPINOZA, spē-nō'zȧ, BARUCH, or BENEDICT (1632-77). A famous Dutch-Jewish philosopher, born in Amsterdam, November 24, 1632. His father, a Portuguese merchant, had fled from Catholic persecution to the Netherlands. Spinoza was carefully educated in Jewish theology and speculation. He was, however, alienated from the orthodox belief by studies of physical science and of the writings of Descartes and probably those of Giordano Bruno. His heresies resulted in threats of severe punishment from his instructors in the Talmud and the Cabala, and the relation soon became so unpleasant that Spinoza withdrew from the synagogue. The rabbis, in 1656, excommunicated him and secured his banishment from Amsterdam. However, he remained in the neighborhood of the city for five years, supporting himself, as in later years, as a lens-maker.

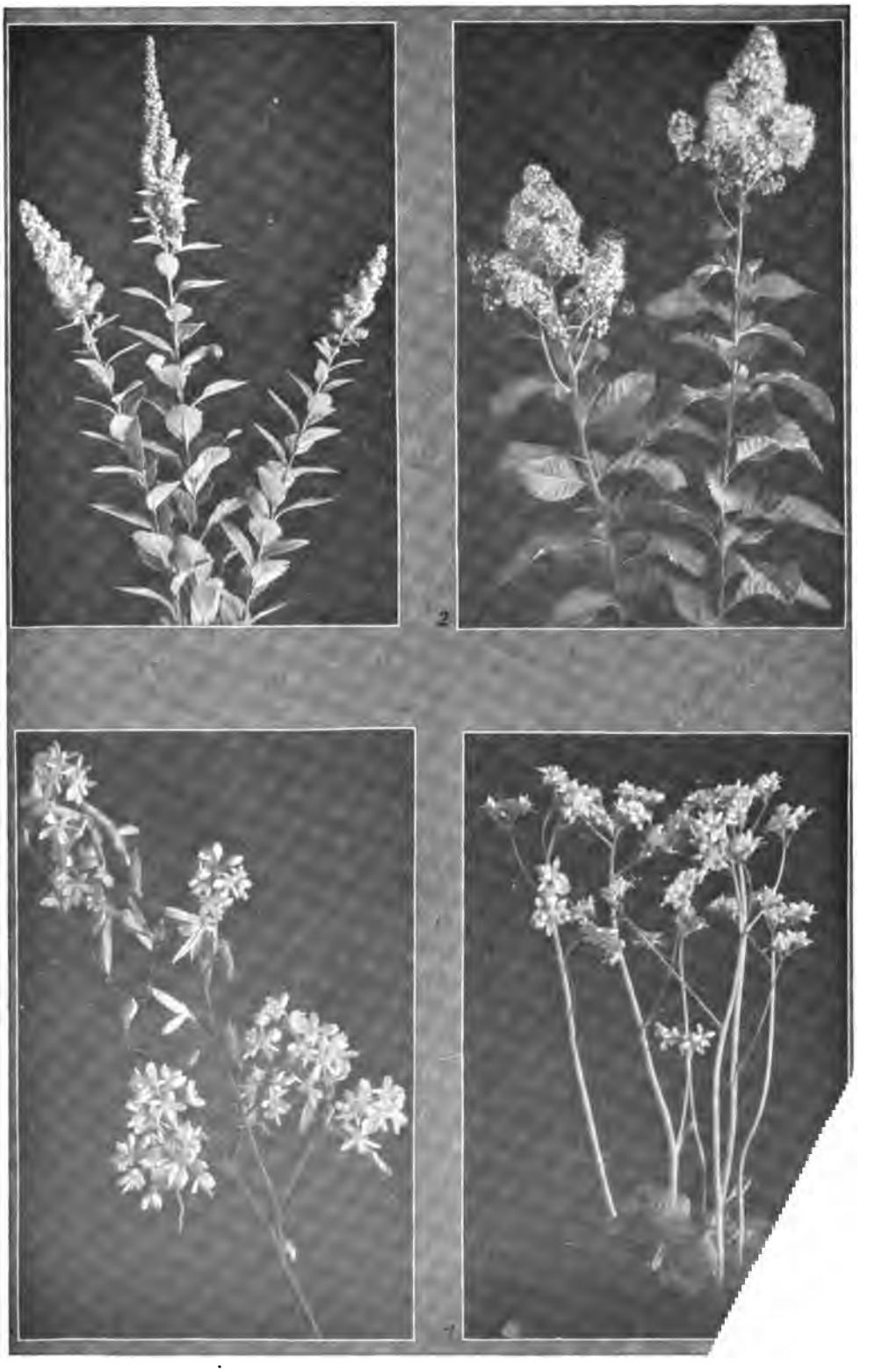
Previous to his expulsion from the Jewish community Spinoza is said to have fallen in love with the daughter of Van den Ende, his master in Greek and Latin, and to have been rejected by her. Possibly even before his expulsion he composed his first work, *Tractatus de Deo et Homine ejusque Felicitate* (discovered in a Dutch translation in 1852, the Latin original not being extant), in which the form of his developed system is foreshadowed. And the *De Intellectus Emendatione* and *Tractatus Theologico-politicus* are also probably referable to the period of his Amsterdam residence, although the latter was not published until 1670 and the former until 1677.

In 1661 Spinoza went to Rhynsburg, near Leyden, and two or three years later to Voorburg, near The Hague. Shortly after, yielding to the solicitations of friends, he removed to The Hague itself. The Elector Palatine, Charles Louis, offered him a chair at the University of Heidelberg, but Spinoza declined the position in order to be free from any restrictions upon his thinking. An offer of a pension, on the condition of his dedicating a work to Louis XIV., he rejected with scorn. His domestic accounts, after his death, show that he preferred to live on a few pence a day rather than be indebted to another's bounty. He died February 21, 1677. His constitution was no less undermined by consumption and overwork than his sensitive mind was wrought upon by persecution and the violent severance of natural ties. But no word of complaint ever passed his lips; simplicity and heroic forbearance, coupled with an antique stoicism and a child-like, warm, sympathizing heart, were the salient features of his character. His life, in its nobility and suffering, is perhaps the most convincing plea for the vitality of the philosophy for which it served as the human context.

Spinoza's philosophy finds its most adequate expression in his great work, *Ethica Ordine Geometrico Demonstrata* (posthumously published in 1677). The basis from which it was developed was mainly Cartesianism. Certainly from Descartes he derived his empirical rationalism and his conception of exact demonstration. This latter, on the analogy of geometrical demonstrations, consisted of a series of axioms with corollaries, propositions, and elucidations, designed to render bias or extraneous inference impossible, and there can be no doubt that Spinoza was one of the most conscientious of thinkers in his effort to eliminate the personal equation. Nevertheless, there are few philosophers in whom the personal element is more distinctive. The very fact of Spinoza's severance from his own race and religion, together with his failure to adopt Christian thought, made the individuality of his system the more inevitable; he was bound by no tradition and so followed to the fullest the instincts of his reason. He was influenced by Descartes in method and probably by Bruno in his pantheism, but his system is still his own to a degree seldom true in the history of philosophy.

This system is a thorough-going and complicated pantheism. The universe is identical with God, who is the substance of all things. The conception of substance (which Spinoza inherited from the Scholastics) is not that of a material reality, but of a logical subject—the self-sufficient and comprehensive basis for all reality, capable of sustaining as its attributes all temporal existences. Spinoza recognized the possible existence of an infinite number of such attributes, but held that only two kinds are known to us—extension, or the world of material things, and thought. These two comprehend existence and they include all that exists in a real and palpable way, at least so far as human knowledge is concerned.

The idea of extension as the gist of physical reality, and of thought as a non-extended reality, Spinoza derived from Descartes. But Descartes made each of these independent substances and conceded to them the power of causal interaction —mind acting upon body and *vice versa*. Spinoza, as we have seen, makes both forms of reality dependent upon an ultimate substance—God—in which is their existence. Furthermore, he denies their power of causal interaction. Cause and effect in his conception are always similar; extension and thought are wholly dissimilar: therefore their causal interrelation is impossible. Causation may subsist between individual objects in the attribute extension, that is, between physical bodies, or between individual ideas in the attribute thought, but not between ideas and things. To explain the apparent causal interactions of the latter Spinoza resorted to an elaborate theory of parallelism. Every idea has a physical counterpart in the attribute extension; every physical object has its idea. This



1. HARDHACK (Spiræa tomentosa).
2. WILLOW-LEAVED SPIRÆA (Spiræa salicifolia).
3. SHADBUSH (Amela
4. SAXIFRAGE (Saxif

is not only true for the individuals in each attribute, but necessarily for their relations also. Hence parallel with every physical causal series there is an ideational causal series reduplicating it; neither is dependent upon the other, but both depend upon the divine substance made manifest through them.

The individuality of things, whether ideas or physical objects, Spinoza explained as particular modes or 'affections' of substance. All particular things in space are the modes of God in the attribute extension; all particular thoughts and feelings are modes of God in the attribute thought. The modes are *natura naturata;* substance or God is *natura naturans.* The modes are ephemeral and their existence assumes temporal form; God is eternal, outlasting all attributive changes. Particular things, accordingly, whether of body or mind, are evanescent and finite. All existence is mortal.

Nevertheless there is an indestructible world. It is not to be found in the realm of existences, but in a realm of essences—something wholly different. The Spinozistic conception of essence is most nearly related to the Scholastic conception of Realism and to Plato's conception of a world of ideas. It is an hypostatization of the universal aspect of things, that is, of their essential nature in a logical or definitive sense, and in many respects is a striking forecast of Hegel's logic of the Absolute. The most distinctive difference between Spinoza's world of existences and his world of essences is that the former exists in time, while the latter has no temporal being. But mortality can pertain only to temporal being; therefore the world of essences, being timeless, must be immortal. Furthermore, the world of essences is a world of immanent being. Every existence has a universal or essential character, though to realize this character it must transcend its own intrinsic form, that is, free itself from whatever gives it particularity. The world of essences thus has a kind of being within the world of existences—as the immanent cause of the latter—though it does not share its temporal limitation. Now this is precisely true of the divine substance; and so it is that the world of essences represents the essential nature of God.

Immanent causation means self-causation, and that which is self-determined is free. From this reasoning Spinoza derived his doctrine of freedom to be won in the world of essences. Existence in the attribute is bondage, for each existent thing is determined by its own causal series; every particular object or idea is subject to other objects or ideas, and the form of its being is determined by them. Only in non-temporal, self-caused being, that is, in the universal and immanent, is freedom possible; only by identification with the eternal verities, with substance or God, is immortality—and with it peace—to be obtained.

From this conception springs Spinoza's ethical doctrine, developed in the third, fourth, and fifth parts of the *Ethica.* In its practical form his teaching assumes that everything, so far as in it lies, strives to remain in its own being. The effort by which this striving is manifest is nothing but the actual essence of the thing. This effort, when it is in the mind alone, is will; when in mind and body, it is appetite. If desire is satisfied, we have pleasure; if not, we have sorrow. All affections and emotions resolve into desire, joy, and sorrow, accompanied by ideas. The good is that which we know to be useful, that is, that which we know to be a means for the nearer attainment of the standard of human nature which is our ideal. Knowledge of good and bad can be a cause in the moral world, counteracting passion and raising us from the world of appetite and mortality to the world of eternal truths.

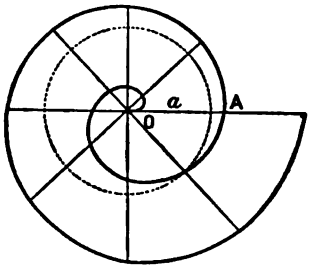
The passage from mortality to immortality, from bondage to freedom, is made plausible to Spinoza's mind by the fact that every reality has its immanent cause, its universal aspect, or what may be called its cosmological truth. By cultivating steadily this immanent and universal nature man is enabled to realize his immortal destiny. As to the nature of the initiative by which a soul in bondage is to alter its course, Spinoza has no clear teaching. The problem seems not to have presented itself to him, and indeed this is hardly to be wondered at, since his own mind turned so instinctively to what he conceived to be the divine and the good.

Spinoza's position in the development of philosophical thought is in many respects unique. He belonged to no school and he founded none. While in a measure his work was based upon that of his predecessors, it is too strikingly individual to be conceived a mere continuation, even of Cartesian thought. In the vigor and comprehensiveness of his conception, in synthetic daring, he must be ranked with the greatest philosophical thinkers; and though his system gave rise to no sequential development, he has had perhaps the most pervasive influence of any modern philosopher except Kant. Not only metaphysicians, but poets such as Goethe, Wordsworth, and Shelley, have gone to him for inspiration, and the essence of his thought has been in large part appropriated in the poetic pantheism of modern interpretations of nature.

Complete editions of Spinoza's works have been published by Paulus (1802-03), by Bonden (1843-46), and by Van Volten and Land (1882-82). English translations have been made for the Bohn Library (1883), by White and Stanlay, the *Ethics* (London, 1883), by Fullerton, *The Philosophy of Spinoza,* selections with introduction (New York, 2d ed. 1894). Of the extensive literature especially to be mentioned are: Caird, *Spinoza* (Edinburgh, 1888); Martineau, *A Study of Spinoza* (London, 1882); Pollock, *Spinoza* (2d ed., ib., 1899); Fullerton, *On Spinozistic Immortality* (Philadelphia, 1899); Camerer, *Die Lehre Spinozas* (Stuttgart, 1877); Baltzer, *Spinozas Entwickelungsgang* (Kiel, 1888); Berendt and Friedländer, *Spinozas Erkenntnislehre* (Berlin, 1891); Hoff, *Die Staatslehre Spinozas* (ib., 1895); Kuno Fischer, *Geschichte der neueren Philosophie,* I. (Heidelberg, 1897).

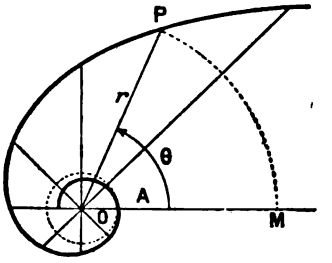
SPIRÆA (Lat., from Gk. *σπειραία, speiraia,* meadow-sweet, from *σπεῖρα, speira,* coil, twist, spire; so called from the shape of the follicles). A large genus of herbs and low deciduous shrubs of the natural order Rosaceæ, natives of the Northern Hemisphere. Dropwort (*Spiræa filipendula*) and meadow-sweet or queen of the meadow (*Spiræa ulmaria*) are European species. Two other species are shown on the accompanying plate. Many species are cultivated in shrubberies for their flowers.

SPIRAL (ML. *spiralis*, from Lat. *spira*, coil, spire, from Gk. σπεῖρα, *speira*, coil, spire, twist). A curve which during its gradual regression from a point winds repeatedly around it. A *plane* spiral is generated by a point moving along a line according to a fixed law, while the line revolves uniformly about a fixed point in the plane. A spiral which is not plane is generated by a point moving on a given surface other than a plane, about a fixed point according to a given law, e.g. the loxodrome (q.v.). A great many spirals have been studied. Of these the most common are the spiral of *Archimedes*, the *hyperbolic*, *parabolic*, *Cotes's*, *logarithmic* or *equiangular* spirals, and the *lituus*.



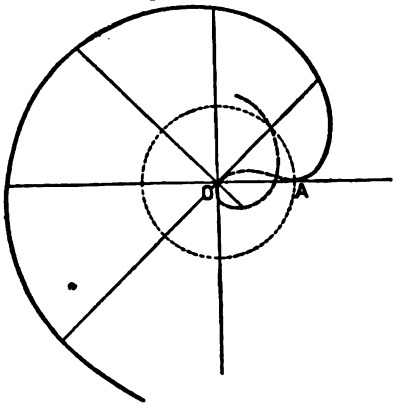
ARCHIMEDES SPIRAL.

The spiral of Archimedes, probably discovered by Conon, has the equation $r = a\theta$. In this curve the point moves with a constant velocity along the radius vector, and the length of the radius is proportional to the angle described. The curve may be constructed by points as follows: Draw a circle of radius a about O as a centre; draw radii dividing the circumference into n equal parts, and lay off from O on these radii the distances $\frac{a}{n}, \frac{2a}{n}, \frac{3a}{n}, \frac{4a}{n}$, etc. The circle used in this construction is called the measuring circle of the spiral. If the point so moves that the radius vector varies inversely as the angle described, the curve is called a *hyperbolic* or *reciprocal* spiral. Its equation is $r = \frac{k}{\theta}$, k being the circumference of the measuring circle. It follows from the equation that an infinite number of spires are necessary for the curve to reach the origin. The curve received its name from the fact that it can also be constructed by means of an auxiliary equilateral hyperbola. If r varies directly as the square root of θ the equation becomes $r^2 = a\theta$, and we have the *parabolic* spiral. The figure represents the curve for both positive and negative values of r.



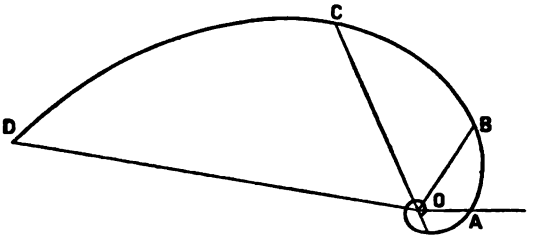
HYPERBOLIC SPIRAL.

If p denotes the perpendicular distance from the pole to the tangent at any point P of the curve, and if $p = \frac{br}{\sqrt{a^2 + r^2}}$, various spirals may be formed representing this equation. These are known as Cotes's spirals, and are of scientific



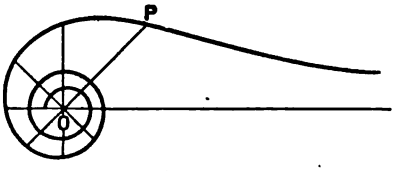
PARABOLIC SPIRAL.

interest, especially in their relation to trajectories (q.v.). If $b = a$ the equation is that of the *logarithmic* or *equiangular* spiral. The characteristic property of this spiral is that the angle between any radius vector and the corresponding tangent is constant. The equation of the logarithmic spiral is $\log r = a\theta$. It is evident from the equation that the curve has an infinite number of spires. The evolute (q.v.) of the logarithmic spiral is a similar logarithmic spiral.



LOGARITHMIC SPIRAL.

A spiral in which the square of the radius vector varies inversely as the angle described is called the *lituus* or *trumpet*, a curve described by Cotes (1682-1716). Its equation is $r^2 = \frac{a}{\theta}$. The curve begins at infinity and winds round the origin, but cannot reach it by a finite number of spires.



LITUUS.

One of the best, although not recent, monographs on the general subject is to be found in the *Mémoires de l'Académie des Sciences* (1704, pp. 47, 69). For the general and special bibliographies and for a list of various spirals studied,

partie complémentaire, 1899, p. 166). On the spiral of Archimedes, consult Pfaff, *Betrachtungen über die Spirale* (Munich, 1830). On the parabolic spiral and that of Cotes, consult Sacchi in the *Nouvelles Annales de Mathématiques* (1860). On the logarithmic spiral, Turquan in the same journal (1846) and Whitworth (1869). On the hyperbolic spiral, Fouret and Lebon in the same journal (1880).

SPIRE (AS. *spir*, stalk, Ger. *Spier*, needle, pointer). A very acute pyramidal roof in common use over the towers of churches or secular buildings. The history of spires is somewhat obscure, but there is no doubt that the earliest examples of anything of the kind are the pyramidal roofs of towers in the Romanesque buildings of the eleventh century. In the twelfth century, especially in France, these stone roofs were often made octagonal and pointed and took the form we call spire. They were less used in England and Italy, where square and flat tops remained common; they were most developed in France and Germany. The point where the square tower merged into the octagonal base of the spire was marked by angle turrets and pinnacles, to which tabernacles and windows often corresponded in the alternate faces of the spire. This masking afterwards was carried still farther up by galleries, flying buttresses, and pinnacles, enhanced by every variety of tracing and surface ornament, breaking up the outlines of the spire. At first the surface of the spire was of solid masonry merely varied by angle moldings and scaled surfaces, but before the close of the thirteenth century the masonry was often more or less pierced and the outlines infinitely varied, first with windows and galleries and then by a network of tracery which made of the entire spire a series of lacework patterns or grouped arcades and pinnacles.

SPIRE. A town of Germany. See SPEYER.

SPIRIFER (Neo-Lat., from Lat. *spira*, coil, spire + *ferre*, to bear). A genus of long hinged fossil brachiopods of Paleozoic age. The shells are biconvex with the greatest width on the hinge line, the hinge areas are well marked and usually large, the ventral beak prominent and overreaching that of the dorsal valve, the surface marked by strong radial folds or striations, and with a pair of calcified spirally coiled brachidia within the interior of the shell. These brachidia served as supports for the breathing organs and are coiled in the form of cones with the apices of the cones directed toward the outer angles of the shell. The genus has many species, ranging from the Silurian system upward into the Carboniferous and distributed all over the world. Consult Schuchert, "Synopsis of American Fossil Brachiopoda, etc.," *Bulletin of the United States Geological Survey, No. 87* (Washington, 1897).

SPIRILLUM. See BACTERIA.

SPIRIT (Fr. *esprit*, from Lat. *spiritus*, spirit, breath, air, from *spirare*, to breathe). A term sometimes used in connection with a variety of volatile substances, and more especially with solutions of volatile substances in alcohol. *Spirits of wine* is ordinary alcohol; *spirits of wood* or *pyroxylic spirit*, is wood alcohol, or methyl alcohol; *spirit of hartshorn* is aqueous ammonia; phurous acid, etc. Among the 'spirits,' i.e. alcoholic solutions, used in medicine may be mentioned those of lemon, peppermint, ether, chloroform, phosphorous, camphor, lavender, bitter almonds, etc. *Aromatic spirits of ammonia* is made up of 34 parts of ammonium carbonate, 90 parts of ammonia water, 1 part of nutmeg oil, 10 parts of oil of lemon, 700 parts of alcohol, and 1 part of oil of lavender flowers, enough water being added to make 1000 parts. In the British pharmacopœia alcoholic solutions of 20 per cent. strength are called 'essences.'

SPIRITUALISM (from *spiritual*, Lat. *spiritualis*, relating to spirit or breath, from *spiritus*, spirit, breath, air, from *spirare*, to breathe). A term which, as most commonly used, describes the belief of those who think that communications are occasionally established between the living and the dead who survive in some other mode of existence. This conception, in so far as any general acceptance of the doctrine is concerned, is probably not more than half a century old, although sporadic instances of the belief are possibly as old as human nature.

In modern times the first definite movement in the direction of a general interest in spiritualism took place in 1848 in America, and was associated with the Fox sisters, at Hydesville, New York. The 'phenomena' associated with these sisters were the traditional 'raps' and 'knockings,' the meaning of which required that the experimenter agree upon some certain number of 'raps' as an indication of an affirmative or negative answer to questions. In more complicated matters the answers were spelled out by pointing to letters, etc. The *modus operandi* of the 'communications' is not important, as it was only the familiar production of physical phenomena supposed to be evidence of some transcendental origin. The Fox sisters performed their wonders for all classes of men and women and numbered among their followers many intelligent people. But opinion was divided as to the value and significance of their 'phenomena.' The more intelligent investigators discovered fraud in them, and finally the sisters confessed to the manner in which they had consciously produced the 'raps' and 'knocks.' In the meantime the excitement and interest in spiritualism had spread to England and the Continent. It was probably much less the actual facts in the alleged phenomena that created the widespread interest in the subject than it was two facts in the mental condition of the age wholly independent of the inciting cause. The first was the immense strides which skepticism and criticism had made in discrediting the older theology; the second was the growing faith in scientific experiment and methods.

It was about the same time that hypnotism (q.v.) began to arouse a scientific interest and to contribute to the spiritualist's cause. It had arisen about 1770 or 1780 under Mesmer and was called mesmerism (q.v.) after him. But the quackery and incautiousness associated with it, encouraged by the inertia of scientific academies, brought it into neglect, and it was not heard of more until Dr. Braid, of Manchester, England, reopened the question by showing that there were genuine phenomena in it worthy of scientific attention. This was about 1840. He changed the



name of mesmerism to hypnotism and employed 'suggestion' as the explanatory principle as against 'magnetic fluids' of Mesmer. But the peculiar methods of producing hypnosis and the strange psychological susceptibilities exhibited by hypnotic patients were well calculated to impress the popular mind with the belief in occult forces, and in spite of the scientific treatment to which it has been exposed, it still suggests to the public the possibility of supernormal phenomena. Its facts were more easily demonstrable, and could be put to more dignified uses, than the ordinary absurdities of the séance room.

Another type of phenomena occurred about the same time to encourage the spiritualist in his general theory. It was the production of Andrew Jackson Davis, who discovered in 1844 that he could go into a 'trance,' and that he had a strange power of performing intellectual feats in this condition, which were not natural to him in his normal state. He made a bargain with two friends to 'mesmerize' him and to take down in notes what he said during the 'trance.' A volume was published as a result representing the work of fifteen months. His utterances, which were very slow and deliberate, were taken down verbatim, and the volume was called *The Principles of Nature, Her Divine Revelations, and a Voice to Mankind*. The work dealt with the physical, chemical, and vital phenomena of the cosmos on a large scale, and treated of astronomical matters in a manner to excite curiosity, especially when the prediction of a new planet was verified soon afterwards by the discovery of Neptune by Leverrier and Adams. At the same time the man was practicing 'clairvoyance,' and the book asserted the existence of spirit 'communication.' But it was not the philosophic nature of the work that gave it its influence. It was the apparent illiteracy of the man who produced it, and its association with 'clairvoyance' and alleged spirit 'communications.' Davis himself said that, up to the time of his work, he had read but one book in his life and this was a romance called *Three Spaniards*. This claim, however, seems to be fairly well controverted, and it is probable that the man had read scientific matter in a casual way. But no amount of casual reading will easily explain in a normal way the systematic character of this work. There are indications in the man's history, and the fact that he was 'clairvoyant' or subject to the 'trance' state is evidence, that his was a remarkable case of secondary personality. See DOUBLE CONSCIOUSNESS.

In 1853 a work was published by Judge Edmonds and Dr. George Dexter that was second in interest only to that of Davis. Mr. Edmonds was a Judge of the Supreme Court of New York State and Dr. Dexter was an eminently respectable citizen of New York City. Their attention had been called to the subject of spiritualism by the excitement about the Fox sisters, and they set about investigation for themselves, and soon developed personal phenomena of a peculiar interest. They entered upon a system of experiments in coöperation upon themselves and various 'mediums,' with the result that they published a work which soon became classic, owing to the reputation of the authors. The phenomena recorded and described purported to represent more or less direct communications with discarnate spirits. At first they investigated with a view to ascertain whether the phenomena were genuine in any sense of the term, and having convinced themselves that they were dealing with spiritistic influences, they published, as the bulk of their work, the alleged messages from Swedenborg and Bacon, and the respectability of the men availed to carry their work through many editions. But the subject of secondary personality was not understood in their time, and was not worked out until a generation later, when the result was to discredit the spiritistic claims of Edmonds's and Dexter's work.

The most remarkable personality, however, in this movement was William Stainton Moses. He was born in 1839 and was educated at Oxford in England, becoming a clergyman in the Established Church. In 1872 he became interested in spiritualism through his friend, Mrs. Speer, and soon developed 'mediumistic' powers in himself. He fought against their influence on his mind for a long time, but his skepticism was finally overcome, and he became a spiritualist and abandoned the Church and at last became the editor of the chief spiritualist paper, *Light*. No one ever questioned his sincerity and honesty. The phenomena which he records were of a type and variety which tend to excite astonishment. They included the physical and the trance phenomena of the usual kind, such as the alleged movements of physical objects without contact, and even through other matters, and automatic writing evincing the personal identity of deceased persons and the spiritual and hortatory counsel of discarnate spirits long since deceased. His two works, *Spirit Identity* and *Spirit Teachings*, were widely read. But he resented scientific investigation because he thought it a reflection on his honesty, and hence, though there is some independent testimony to the nature of his phenomena, they depend mostly upon his own asseverations; and though there is no reason to impeach the probity of these, neither he nor his contemporaries reckoned sufficiently with the problems of abnormal psychology and secondary personality to assure the elimination of influence in the production of the phenomena that were quite compatible with honesty and yet were inconsistent with their supernormal character.

After the excitement produced by the Fox sisters, there appeared a perfect inundation of similar and more questionable performances in the person of all sorts of traveling 'mediums.' The popular conception of spiritualism was soon determined by the methods of this class of impostors. Their 'demonstrations' took the form of cabinet séances, 'materializations,' slate writing performances, and tricks that are easily imitable by the prestidigitator. To this day the general public has no other conception of spiritualism than that which is furnished by the most absurd and most trivial legerdemain. Finally the indifference of the public after discovering the futility of such methods and the influence of the Report by the Seybert Commission (see below) caused the interest in such phenomena to decline. The Society for Psychical Research (see PSYCHICAL RESEARCH, SOCIETY FOR) also had its share of the credit in this depreciation of the movement.

To this period, contemporaneous with Moses and apparently combining the phenomena described by him and the performances of the

average trickster, belonged David D. Home, who created an enormous sensation throughout America and Europe. He received the attention of Sir William Crookes, and a system of experiments involving all sorts of physical 'miracles,' which still mystify students who have confidence in Crookes.

What the Society for Psychical Research has accomplished tends to show that the methods of physical science which had captivated the last generation are not adequate to cope with the problem. It has been shown to be a psychological problem that must comprehend the whole field of normal and abnormal psychology, including in the latter all the phenomena of automatism, sensory and motor, illusion, hallucination, secondary personality, hysteria, insanity of the functional sort, and the various hyperæsthesias. The consequence of all this has been to suggest that neither fraud nor spirits are always necessary to account for seemingly supernormal phenomena. We are being made acquainted with a vast fund of facts in connection with subliminal consciousness which are well calculated to strike the unwary as having a spiritistic significance, but which are only the strange productions of irresponsible secondary personalities. These personalities, like the dream life of normal people, are apparently quite as liable to deception as are the states of consciousness of every-day life. However, the range and capacity of the powers of subliminal states have not yet been exactly determined.

About the same time that the Society for Psychical Research was founded a Mr. Seybert gave a fund to the University of Pennsylvania for the investigation of spiritualism, and the Seybert Commission was appointed for the purpose. The commission exposed many of the ordinary frauds of professional mediums, and its conclusions were adverse to the usual spiritistic claims. After publishing a *Report*, the commission was allowed to lapse.

In Germany and France the movement has had a similar history and outcome. In Germany Reichenbach was the most important investigator, and in France Cahagnet and Du Potet are the principal men of interest. This was in the earlier period. Later we have Karl du Prel, A. N. Aksakoff, a Russian, and Schrenck-Notzing, who manifested interest in the subject and wrote freely upon it.

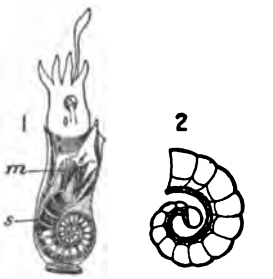
In recent years the *Proceedings* of the Society for Psychical Research have recorded data, especially in the phenomena of coincidental apparitions and experiments with a Mrs. Piper, a Boston 'medium,' which some of the members have thought favorably confirm the possibility of the spiritistic theory. She has been the subject of experiment for nearly eighteen years. This, with two recent volumes of Mr. F. W. H. Myers, has had the effect of reviving an interest in the general problem. But the subject must still run the gauntlet of scientific skepticism and investigation. The early history of the movement has been so infected with charlatanism, fraud, half-baked science, and various forms of radicalism in religious and social matters as to put it under abeyance by the intelligent part of the community.

It is not possible to determine with any accuracy the number of adherents to the spiritualistic belief. They are certainly very numerous, and have many thriving organizations. These take the form of the ordinary church. It is claimed that they have nearly 350 churches and over 200,000 members. It is probable that the number of believers far exceeds this figure. There is nothing in the belief to suggest the necessity of organization as in the orthodox Christian Church. Their periodicals are quite numerous. There are few, however, of first class character. *Light*, a weekly, published in London, England, is, perhaps, the best. The *Banner of Light* is published in Boston, Mass.

The literature on the subject is a very large one, but most of it is not of much importance. Even the best of it has to be read with more than the usual caution. The following, in addition to those mentioned in the body of the article, is a brief list of the most important works connected with the claims of spiritualism and dealing with various phases of it: Edmonds and Dexter, *Spiritualism* (New York, 1854-55); Allan Kardec, *Livre des esprits* (Paris, 1853); Mrs. De Morgan, *From Matter to Spirit* (London, 1863); Alfred Russel Wallace, *Miracles and Modern Spiritualism* (ib., 1876); Karl Du Prel, *Philosophy of Mysticism* (Eng. trans., ib., 1889); Frank Podmore, *Aspects of Psychical Research* (ib., 1897); id., *Modern Spiritualism* (ib., 1902); Frederick W. H. Myers, *Human Personality and Its Survival of Bodily Death* (ib., 1902); Flammarion, *L'inconnu* (Paris, 1899); Flournoy, *Des Indes à la planète Mars* (Geneva, 1900); Parish, *Hallucinations and Illusions* (London, 1897).

SPIROPHYTON (Neo-Lat., from Gk. *σπεῖρα*, *speira*, coil, twist, spire + *φυτόν*, *phyton*, plant). A fossil alga found in rocks of Devonian age. It presents a flabellate expansion with a central pit from which radiate curved ribs as from the centre of a vortex. The surfaces of the Esopus grit of Lower Devonian age in eastern New York and Pennsylvania are covered with these algal fronds. The genus is known also in the Carboniferous rocks, and it has been described from European localities under the name of Taonurus.

SPIRULA (Lat., diminutive of *spira*, coil, spire). A genus of small decapod, dibranchiate cephalopods, comprising two or three species, and constituting the family Spirulidæ, in which the internal skeleton is in the form of a nacreous, discoidal shell, the whorls of which are not in contact with one another, and which are divided into a series of chambers by partitions pierced by a ventral tube or siphuncle. The animal has minute lateral fins, and there are six rows of small suckers on the arms. The three species constituting the family dwell in the deep waters of the tropical seas. In internal anatomy Spirula is a true dibranchiate, having two branchiæ and an ink-bag. It has the peculiar feature that the hinder end of the body acts as a suctorial disk for fastening itself to foreign bodies.



SPIRULA.

1, Animal, showing position of shell; *s*, shell; *m*, siphon muscles; 2, shell enlarged.

The genus Spirula is not known in a fossil state, but it has ancestors, Spirulirostra and Spirulirostrina, in the Tertiary deposits of Italy. These latter have remnants of the 'guard' at the apical portion of the shell, which feature seems to indicate the descent of Spirula from some form of shell like Belemnites. See CEPHALOPODA.

SPIT'ALFIELDS. An eastern district of London, England, in Whitechapel, adjoining Bethnal Green. It is a manufacturing district inhabited chiefly by the poorer class of population, and by silk-weavers, descendants of French Huguenots. It is the seat of the Spitalfields market. Spitalfields derives its name from the Hospital of Saint Mary, founded in 1197. Population, in 1891, 26,594; in 1901, 27,965.

SPIT'HEAD. A roadstead off Portsmouth, England, between Portsea Island and the Isle of Wight (Map: England, E 6). It is 14 miles long by 4 miles in average breadth, and receives its name from the 'Spit,' a sand-bank stretching south from the English shore for three miles. Fortified by circular towers, and, except on the southeast, protected from all winds, it is a favorite anchorage of the British navy, styled by sailors 'the King's bedchamber,' on account of its security.

SPIT'TA, KARL JOHANN PHILIPP (1801-59). A German religious poet, born in Hanover. He was educated at Göttingen, and from 1824 to 1828 he was a tutor at Lüne, and there wrote the best of his hymns. Afterwards he was vicar or pastor in several churches, and in 1859, shortly before his death, was made superintendent at Burgdorf. His hymns, contained in *Psalter und Harfe* (1833; revised with biographical note by his son, Ludwig, 1890; 'Jubilee' ed., 1901), and in the *Nachgelassene geistliche Lieder* (1861 and often), rank high in the German spiritual song of the century, and attained great popularity by their freshness of thought, purity of style, and depth of sentiment.

SPITZBERGEN. A group of islands in the Arctic Ocean, situated about 430 miles north of the northern extremity of Norway, between 76° 30′ and 80° 48′ north latitude, and between 10° and 30° east longitude (Map: Arctic Regions, H 3). The group consists of three large islands, West Spitzbergen, North East Land, and Edge Island, whose areas are, respectively, about 15,000, 4000, and 2500 square miles, and a number of smaller islands. All of them are of a rocky and mountainous character and very irregularly indented. West Spitzbergen has an ice-covered plateau running along its eastern coast and eroded toward the west into deep and narrow valleys terminating in fiords, and carrying the overflow of ice in the form of glaciers to the sea. These valleys and fiords are separated by rugged and rocky mountain spurs, here and there forming a network of craggy peaks and ridges interspersed with glaciers. The highest point is the Horn Sund Tind with an altitude of 4560 feet. North East Land is almost wholly covered with an ice sheet, while the other islands are free from permanent ice, or carry only isolated glaciers on their eastern slopes. The mean monthly temperatures range from 10° below zero in February to 37° above in August. Snow falls at all seasons, but in summer a considerable herbaceous growth covers the lower western slopes. This consists largely of mosses, though there are 130 species of flowering plants and ferns, with sedges predominating along the shores. The fauna includes the reindeer, which, however, is fast disappearing, the polar bear, and the fox. The walrus is still found along the coast, but the birds are becoming fewer.

Spitzbergen has no permanent inhabitants, and no country claims possession of it. The islands were discovered by the Dutch in 1596. The interior was first explored in 1892 by Rabot, and in 1896 by Sir Martin Conway, who was the first to cross the large island. Spitzbergen has been an important base for polar expeditions, and in 1897 Andrée made it the starting point in his ill-fated attempt to reach the Pole by balloon. In recent years the west coast has been visited by a number of tourists, and in 1896 a weekly steamship service during summer was established from Norway, and a small hotel was built on the coast.

BIBLIOGRAPHY. Nordenskjöld, *Die schwedischen Expeditionen nach Spitzbergen und Bären Eiland* (Jena, 1869); Zeppelin, *Reisebilder aus Spitzbergen, Bäreneiland und Norwegen* (Stuttgart, 1892); Conway, *The First Crossing of Spitzbergen* (London, 1897); Hafter, *Briefe aus dem hohen Norden* (Frauenfeld, 1900).

SPITZ DOG, or POMERANIAN DOG. See SHEEP DOG.

SPITZ'KA, EDWARD CHARLES (1852—). An American psychiatrist, born in New York City. He was educated at New York University, in Germany, and in Vienna. He served as interne in the New York City Asylum for the Insane, was professor of medical jurisprudence and diseases of the nervous system in the New York Post Graduate Medical School and Hospital from 1881, consulting surgeon to the Northeastern Dispensary, physician to the department of nerve diseases in the New York Polyclinic, and physician to the Metropolitan Throat Hospital. His writings include *A Treatise on Insanity* (New York, 1883), besides many monographs.

SPITZWEG, spĭts'vāk, KARL (1808-85). A German genre and landscape painter, one of the most original figures in the art world of Munich, the most genial exponent of the humorous genre. Born and educated in Munich, he dispensed drugs for several years, then studied at the university, and in 1833 was won to art by his accidental surroundings in a watering place. Under the introductory guidance of the historical painter Hansonn (1791-1863), he took to brush and palette, but, practically self-taught, developed his rare talent for the depiction of those inimitable types of German philistinism amusingly associated with his name. On the establishment of the *Fliegende Blätter* in 1844, he became one of its most diligent contributors, whose incomparable humorous drawings were for years the delight of the entire reading world. Among his finely colored pictures of old bachelors, bookworms, hermits, etc., and his poetic landscapes with fanciful accessories, may be mentioned: "The Poor Poet" (1837), "Two Hermits" and a "Scholar in the Attic" (1882), all in the Pinakothek, Munich; "Spanish Serenade," "The Hypochrondriac," "Herd-Girls on an Alp," and "Turkish Coffee-House," all in the Schack Gallery, Munich; "Going to Church Near Dachau" (1862), in Dresden; "His Reverence" and

"Village Street," both in the National Gallery, Berlin. Reproductions of his works appeared in the collections *Spitzweg Mappe* (Munich, 1887) and *Spitzweg Album* (ib., 1888). Consult: Regnet, in *Zeitschrift für bildende Kunst* (Leipzig, 1886), and Holland, in *Allgemeine deutsche Biographie*, xxxv. (ib., 1893).

SPLAY. The sloping or bevelled opening in window recesses and other such openings. Also the corner taken off the outer angle of such openings.

SPLEEN (Lat. *splen*, from Gk. *σπλήν*, spleen; connected with Lat. *lien*, Skt. *plihan*, spleen). The largest and most important of the so-called ductless glands. It is generally oval in form, somewhat concavo-convex, soft, of very brittle consistence, highly vascular, of a dark bluish-red color, and situated in the left hypochondriac region, with its interior slightly concave surface embracing the cardiac end of the stomach and the tail of the pancreas. In the adult it is usually about 5 inches in length, 3 or 4 in breadth, and an inch or an inch and a half in thickness, and weighs about 7 ounces. At birth its weight in proportion to that of the entire body is as 1 to 350, which is nearly the same ratio as in the adult; while in old age the organ decreases in weight, the ratio being as 1 to 700. The size of the spleen is increased after gastric digestion, and is large in highly fed and small in starved animals. In intermittent fevers and leucocythæmia it is much enlarged, weighing occasionally from 18 to 20 pounds, and constituting what is popularly known as the ague-cake.

The spleen is invested externally by the peritoneum and inside this by a fibrous capsule giving off from its inner surface numerous small fibrous bands termed *trabeculæ*, which unite at numerous points with one another, and run in all directions. The parenchyma or proper substance of the spleen occupies the interspaces of the above-described areolar framework, and is a soft pulpy mass of a dark reddish-brown color, consisting of colorless and colored elements. The *colorless elements* consist of granular matter, of nuclei about the size of the red blood-disks, and a few nucleated vesicles, and constitute one-half or two-thirds of the whole substance of the pulp in well-nourished animals, while they diminish in number, and sometimes altogether disappear, in starved animals. The *colored elements* consist of red blood-disks and of colored corpuscles either free or included in cells; sometimes enlarged blood-disks are seen included in a cell, but more frequently the inclosed disks are altered in form and color, as if undergoing retrograde metamorphoses. Besides these, numerous deep-red, or reddish-yellow, or black corpuscles and crystals, closely allied to the hæmatin of the blood, are seen diffused through the pulp substance.

The venous blood of the spleen is carried away by the splenic vein, which contributes to form the great portal venous system, distributed through the liver; while arterial blood is supplied by the splenic artery, the largest branch of the cœliac axis. The branches of this artery subdivide and ramify like the branches of a tree, with the *Malpighian* or *splenic corpuscles* attached to them like fruit. These splenic corpuscles, originally discovered by Malpighi, are whitish spherical bodies, which are either connected with the smaller arterial branches by short pedicles, or are sessile upon their sheaths. They vary considerably in size and number, their diameter usually ranging from 1-30 to 1-60 of an inch. Each consists of a membranous capsule, homogeneous in structure, and formed by a prolongation from the sheath of the artery. The blood capillaries form a delicate plexus within these corpuscles.

With regard to its uses the spleen may be regarded as a storehouse of nutritive material, which may be drawn upon according to the requirements of the system, and the constant presence in large amounts of certain nitrogenous substances seems to indicate that some special nitrogenous metabolism takes place in it. The formation of both white and red blood cells probably also occurs in the spleen as well as the disintegration of exhausted blood corpuscles.

SPLEENWORT. See ASPLENIUM, and Colored Plate of FERNS.

SPLICING. See KNOTTING AND SPLICING.

SPLINT (Swed. *splint*, spike, forelock, flat iron peg, Dan. *splint*, splinter; connected with Eng. *split*). In surgery, a certain mechanical contrivance for keeping a fractured limb in its proper position, and for preventing any motion of the fractured ends; it may also be employed for securing perfect immobility of the parts to which it is applied in other cases, as in diseased joints, after resection of joints, etc. Many different kinds of splints are used, but wood and plaster of Paris are most common. In using wooden splints we take light strips slightly wider than the limb and long enough to reach beyond the joints that lie to either side of the injury. The fractured ends are brought as nearly as possible into their normal relation, thoroughly padded with absorbent cotton to prevent pressure or friction, and then the splints are applied and firmly bandaged to the limb, so as to prevent all motion. Wire netting, gutta percha, leather, and other materials are also frequently employed, as they can be molded to the shape of the limb. In the same way plaster of Paris can be applied to one side of a limb, carefully molded to it, and held in place by bandages. All movable splints, however, have the disadvantage that they must be readjusted from time to time, and thus the fractured limb is subjected to handling.

The plaster of Paris splint is desirable, therefore, in many cases. The limb is carefully protected with a light layer of non-absorbent cotton, especial care being used to guard bony prominences and to avoid any unevenness. Coarse, wide-meshed bandages well rubbed with dry plaster of Paris are immersed for a moment in water and then applied like ordinary bandages, each layer being rubbed into the one beneath so as to make a firm cohesive splint. The plaster should include the joints to either side of the injury. This splint may be both strengthened and lightened by the introduction of wooden or metal strips between the layers of plaster. Drying takes place rapidly and gives a firm resisting splint. In compound fractures or in operative cases a fenestrum may be left over the wound proper and an opportunity thus given to attend to the required dressings without disturbing the splint.

SPLINT. A bony enlargement on the horse's leg between the knee and the fetlock, usually appearing on the inside of the fore leg, frequently situated between the large and small canon bones.

It is usually caused by concussion, and is most common in young horses that have been driven rapidly along hard roads before their bones have become firm.

SPLÜGEN, splü'gen. An Alpine pass leading between the Tambohorn and the Surettahorn from the Swiss Canton of Grisons into Italy at an altitude of 6946 feet (Map: Italy, D 1). The southern or Italian descent has three great galleries built to protect the road from avalanches, and completed by the Austrian Government in 1834.

SPODUMENE (from Gk. *σποδούμενος, spodoumenos*, pres. part. mid. of *σποδοῦν, spodoun*, to burn to ashes, from *σποδός, spodos*, ashes). A mineral lithium and aluminum silicate crystallized in the monoclinic system. It has a vitreous lustre and is light green, gray, yellow, or purple in color. It occurs commonly in the coarse granitic veins, and is found in Sweden, the Tyrol, Scotland, Brazil, and in Massachusetts, Maine, Connecticut, North Carolina, and South Dakota. The yellow green to emerald green crystalline variety found in Alexander County, N. C., is highly valued as a gem, and is known as *hiddenite*, from its discoverer, W. E. Hidden, of New York.

SPOF'FORD, AINSWORTH RAND (1825—). An American librarian, born at Gilmanton, N. H. He was privately educated, became a bookseller, then associate editor of the Cincinnati *Daily Commercial* (1859), and in 1861 assistant librarian of Congress. From 1864 to 1899 he was librarian in chief of the Congressional Library, and became widely known for exceptional knowledge of books. He wrote much for periodicals on literature, economics, and history, and edited with others a *Library of Choice Literature* (10 vols., 1881-88), a *Library of Wit and Humor* (5 vols., 1884), and a *Practical Manual of Parliamentary Rules* (1884). He published annually *The American Almanack and Treasury of Facts, Statistical, Financial, and Political* (1878-91), and *A Book for All Readers* (1900), on the collection and preservation of books and the founding of libraries.

SPOFFORD, HARRIET ELIZABETH (PRESCOTT) (1835—). An American novelist, born at Calais, Me. Educated at Newburyport, Mass., and Derry, N. H., she adopted literature as a profession and first attracted attention in 1859 by a story of Parisian life, *In a Cellar*, printed in the *Atlantic Monthly*. In the same year she published *Sir Rohan's Ghost*, followed by *The Amber Gods and Other Stories* (1863), and *Azarian, an Episode* (1864). In 1865 she married Richard S. Spofford, a Boston lawyer. The more noteworthy of her later books were: *New England Legends* (1871), *The Thief in the Night* (1872), *Art Decoration Applied to Furniture* (1881), *Marquis of Carabas* (1882), *Poems* (1882), *Hester Stanley at Saint Marks* (1883), *The Servant Girl Question* (1884), *Ballads About Authors* (1888), *Scarlet Poppy and Other Stories* (1894), *A Master Spirit* (1896), and *In Titian's Garden and Other Poems* (1897).

SPOHR, spōr, LOUIS (1784-1859). A German composer and violinist, born at Brunswick. He studied there under Kunisch and Maucourt and in 1802 became a pupil of the celebrated Franz Eck. In 1805 he accepted the appointment of concertmeister at Gotha and in 1812 went to Vienna as leader at the Theater an der Wien, where he remained until 1815. From 1817 to 1819 he filled a similar position at Frankfort and in 1821 received a life appointment as Court conductor at Cassel. It was in connection with this last position that he won his greatest successes as a violinist, composer, and conductor; besides which he succeeded in bringing his orchestra to a pitch of perfection that earned it a world-wide reputation. In 1831 he completed his work, *The Violin School*, which has remained one of the standard works of instruction for that instrument. His oratorio *Calvary* received its first presentation on Good Friday, 1835. He was a prolific composer and wrote in all nearly 200 works. Most of his operas were little known outside of Germany, but his oratorios have been very popular in England and America, particularly *Die letzten Dinge* (The Last Judgment). As a composer of distinct individuality he ranks but little below the greatest representatives of German music. He died at Cassel. Consult: *Autobiography* (Cassel, 1860; Eng. trans., London, 1865); Schletterer, *Louis Spohr*, in Waldersee's *Sammlung* (Leipzig, 1881).

SPOILS SYSTEM. See CIVIL SERVICE REFORM.

SPOKAN, spō-kān'. An Indian tribe of Salishan stock (q.v.) formerly occupying the whole basin of Spokane River in Washington and Idaho, and now chiefly gathered upon reservations in the same States. They were visited in 1806 by Lewis and Clark, who call them *Liartielo*. In language, customs, and alliance they were closely connected with the Sanpoil (q.v.). All are now civilized and Christianized, about equally divided between Catholic and Protestant. The majority are reported to be thrifty and industrious, promising soon to become self-supporting and good citizens. They numbered about 700 in 1903.

SPOKANE, spō-kān'. The county-seat of Spokane County, Wash., 450 miles east of Puget Sound, on the Spokane River and on the Northern Pacific Railway, the Great Northern Railway, the Oregon Railroad and Navigation Company, and several local branch lines (Map: Washington, H 2). The city was formerly known as Spokane Falls. Elevation, 1900 feet above sea level. The Spokane River flows through the heart of the city from east to west in a series of waterfalls, having a total descent of 142 feet, from which, at the lowest stage of water, 30,000 horse-power is available. Electrical power generated here is transmitted to the famous Cœur d'Alêne silver and lead mines of Idaho, 100 miles away. Spokane has the Gonzaga College (Roman Catholic), opened in 1887, Brunot Hall, an Episcopal school for girls, and Saint Stephen's School for Boys. The city is well provided with hospitals and charitable institutions, and expends about $8000 annually for a public library (Carnegie). The notable buildings are the court house, city hall, post office, and Auditorium Theatre. Twenty-three bridges span the river within the city limits. Fort Wright, a large United States army post, is situated on the river just outside the city. Spokane is the mining centre of the Pacific Northwest, the tributary mines producing over $21,000,000 annually in gold, silver, copper, and lead. The city is surrounded on the north, east, and south by large

pine timber forests. It is also the metropolis of a highly productive cereal belt. In the census year 1900 there was $2,678,823 capital invested in the various industries, whose output was valued at $15,427,540. Lumber, foundry and machine shop products, cars, flour, malt liquors, brick, brooms, furniture, pottery, marble and granite, and ornamental iron constitute the principal manufactures. The government is vested in a mayor, chosen every two years, and a unicameral council, and in administrative officials, the majority of whom are appointed by the mayor with the consent of the council. The city spends annually for maintenance and operation about $547,000, the principal items of expense being: Schools, $157,000; interest on debt, $145,000; the fire department, $67,000; police department, $36,000; and streets, $21,000. The water-works, which represent an expenditure of $1,326,761, are owned and operated by the municipality. Population, in 1890, 19,922; in 1900, 36,848. In the early part of the nineteenth century an Indian trading post was established at Spokane, but there was a population of only 350 in 1880. The growth of the present city dates from 1884, when the Northern Pacific Railway was completed to this point. The city soon became an important distributing centre, and by 1892 was entered by eight railways. In 1889 it was almost completely destroyed by fire, but was quickly rebuilt. Consult a chapter by Harold Bolce, in Powell, *Historic Towns of the Western States* (New York, 1901); Edwards, *An Illustrated History of Spokane County* (n. p., 1900).

SPOLETO, spō-lā'tō. A city in the Province of Perugia, Italy, situated on a hill, 61 miles north-northeast of Rome (Map: Italy, G 5). It is dominated by a citadel, now a prison, in which in 1499 Lucretia Borgia was incarcerated. The town is united with the neighboring height of Monte Luco by a Roman bridge and aqueduct. Beneath the Piazza Vittorio Emanuele are the ruins of a Roman theatre. Several of the churches occupy the sites of Roman temples. The eleventh-century cathedral has a fine Renaissance portico. The gathering of truffles, together with the preservation of meats, fruits, and vegetables, the manufacture of olive oil and silk, and the mining of lignite are the chief industries. Population (commune), in 1881, 21,507; in 1901, 24,642. The ancient Umbrian town of *Spoletium* was colonized by the Romans in B.C. 241. It was destroyed by the Goths, but rebuilt by Narses. In 574 it became the capital of the Lombard Duchy of Spoleto, which rose to great power in the ninth century, when two of the dukes, Guido (q.v.), and Lambert, his son, successively received the Imperial crown from the Pope. From 1220 to 1860 it was a Papal possession.

SPOLIATION (Fr. *spoliation*, from Lat. *spoliatio*, a plundering, from *spoliare*, to plunder, spoil). The destruction of a thing by a person not an owner or interested therein, particularly the erasure of a signature on or alteration of the body of an instrument in writing. The wrongdoer is liable in damages for his act. Such an alteration or destruction of an instrument will not destroy its legal effect if the original contents can be clearly proved. Spoliation differs from *alteration* in that the former is committed by a stranger and the latter by a person interested in the thing destroyed or altered.

In admiralty law, the hasty spoliation or destruction of ship's papers or other documents connected with the voyage by the officers of a vessel suspected of smuggling or blockade running is held to create a presumption of guilt, which, however, may be rebutted.

In ecclesiastical law the term denotes the destruction or waste of church property.

SPONGE (Lat. *spongia*, from Gk. *σπογγία*, sponge; connected with Lat. *fungus*, mushroom). A group of animals representing a distinct branch or phylum, Porifera. The sponges are many-celled animals, with three cell-layers, without a true digestive cavity, supported usually by calcareous or siliceous spicules, the body-mass permeated by ciliated passages or containing minute chambers lined by flagellate, collared, monad-like cells. There is no true mouth-opening, but usually an irregular system of inhalent pores opening into the cell-lined chambers or passages through which the food is introduced in currents of sea water, the waste particles passing out of the body by a single but more usually by many cloacal openings (oscula). Sponges are hermaphroditic, multiplying by fertilized eggs, the germ passing through a morula and a gastrula stage.

Sponges are divided, according to the nature of the skeleton or supporting fibres or spicules, into two orders: (1) *Calcispongiæ*, in which the spicules are calcareous, and (2) *Silicispongiæ*, or glass sponges, in which the spicules are siliceous, or horny and fibrous, as in the bath sponges, when spongin instead of silica forms the supporting framework. Examples of the siliceous sponges are the Venus's flower-basket (Euplectella) and allied deep-sea forms, such as Hyalonema, Holtenia, etc. To the second order also belongs the fresh-water sponge (Spongilla), which grows in lakes or sluggish streams. These differ from other sponges in producing statoblasts or winter buds, formed by the protoplasm dividing into round bodies as large as a pin's head and enveloped by a dense membrane, thus enabling the species to survive freezing cold or droughts.

Certain sponges bore into shells, causing them to disintegrate. For example, *Cliona sulphurea* has been found boring into various shells, such as the oyster, mussel, and scallop; it also spreads out on all sides, enveloping and dissolving the entire shell. It has even been found to penetrate one or two inches into hard statuary marble. Cliona also disintegrates coral.



A FOSSIL SPONGE.
One of the Brachiospongia (*Tholiasterella gracilis*).

Of the marketable sponges there are six species, with numerous varieties. They are available for our use from being simply fibrous, having no siliceous spicules. The Mediterranean sponges are the best, being the softest; those of the Red Sea are next in quality, while our West Indian species are coarser and less durable. Our glove-sponge (*Spongia tubulifera*) corresponds to *Spongia Adriatica*, which is the Turkey cup-sponge and Levant toilet sponge of the Mediter-

ranean. *Spongia gossypina*, the wool sponge of Florida and the Bahamas, corresponds to *Spongia equina*, the horse or bath sponge of the Mediterranean. This wool sponge of Florida attains under favorable circumstances a weight of one-tenth pound, in six months, and reaches a size of commercial value in a year.

Fossil sponges are known in rocks of all ages. They appear first in the Cambrian as Protospongia and Archæoscyphia, representing the hexactinellids and lithistids. They are represented in the Ordovician by the curious Brachiospongia, and a number of irregular forms; in the Silurian by Astræospongia, Astylospongia; in the Devonian by Hindia and the Dictyospongidæ, which latter enjoyed such great expansion in the shallow seas of western New York during Chemung time. Receptaculites is a peculiar sponge that is common in the Ordovician. During the Mesozoic sponges attained a great development, became especially abundant during the Cretaceous period, and declined during the succeeding Tertiary. Noteworthy Cretaceous genera are Ventriculites and Cœloptychium.

BIBLIOGRAPHY. Hyatt, "Revision of North American Poriferæ," in *Memoirs Boston Society of Natural History* (vol. ii., Boston, 1875); Rauff, "Palæospongiologia," in *Palæontographica*, vol. xl. (Berlin, 1893); Hinde, *Catalogue of Fossil Sponges of the British Museum* (London, 1883); Hall and Clarke, "A Memoir on the Palæozoic Reticulate Sponges Constituting the Family Dictyospongidæ," in *Memoirs of the New York State Museum*, vol. ii. (Albany, 1898).

SPONGIOZOA (Neo-Lat. nom. pl., from Gk. *σπογγία, spongia*, sponge + *ζῷον, zōon*, animal). One of the branches or phyla of Invertebrates, intermediate between the Protozoan and the Cœlenterati, and represented by a single class, Parifera, which comprises the sponges.

SPONSORS (Lat. *sponsor*, surety, from *spondere*, to promise; connected with Gk. *σπένδειν, spendein*, to pour a libation). The persons, also called godfathers and godmothers, who present a candidate for baptism, and in the Roman Catholic Church for confirmation also, to the minister of those sacraments. In the case of infants they are representatives who make the vows the child is incapable of making; with adults they act rather as witnesses, and among their duties is a subsequent general oversight in spiritual matters, with a view to preserving religious life in their godchildren. The spiritual bond resulting from this relation is supposed by Roman Catholic theologians to constitute a species of affinity, and hence an impediment of marriage, extending to the parents of the baptized, and even at one time operating between the sponsors themselves.

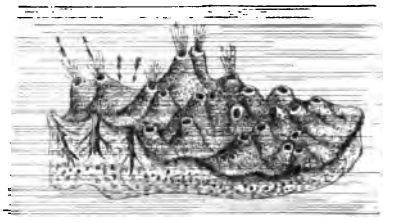
SPONTANEOUS COMBUSTION (Lat. *spontaneus*, willing, of one's own accord, from *sponte*, abl. sg. of **spons*, will). The ignition of substances at a given moment apparently without the intervention of any causative agency. The spontaneous combustion of organic materials is a frequent cause of fires. When large quantities of soot, linen, paper, cotton or woolen stuffs, ship's cables, etc., are soaked with relatively small amounts of oils (especially drying oils) and exposed to a limited access of air, they may be expected to take fire sooner or later. Similarly, trimmings of lamp-wicks have been known to take fire if kept in open boxes. The presence of moisture frequently aids spontaneous combustion, and piles of damp hay, freshly mown grass, sometimes take fire spontaneously. The phenomenon is not, however, without a clearly defined cause. Fats and oils can be shown to undergo a slow process of combustion at but slightly elevated, if not at the ordinary, temperatures. This fact may be demonstrated by placing a little oil on a hot (but not red-hot) metallic surface, when the combustion of the oil will cause a peculiar odor and will render the oil faintly luminous in the dark. The combustion of a small amount of oil causes the evolution of a corresponding amount of heat; the consequent rise of temperature accelerates the combustion, and hence produces a further elevation of temperature, and so forth, until at a given moment the temperature may become so high as to cause the inflammation of the oil, and with it of the entire mass of organic material containing it. The more porous the material, the greater the surface of oil exposed to the air, provided the amount of oil is not large enough to fill the pores completely. Free access of air might prevent spontaneous combustion by effecting a lowering of the temperature; nor could combustion take place if too little or no air at all were admitted. As to the spontaneous combustion of human bodies, it is an impossibility, and all reports of such cases can be clearly shown either to be due to erroneous observation or to be intentionally fraudulent. See PYROPHORUS.

SPONTANEOUS GENERATION and PROTOGENESIS. The doctrine that different forms of life, especially the lower, have arisen by phy-

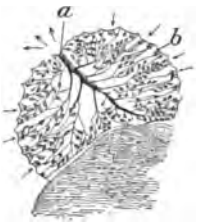
SPONGE STRUCTURE.

1. Exterior of a living bath-sponge: the arrows show how the water is sucked into the small pores and expelled from the elevated canal-mouths (oscules).
2. Diagram of canal system, represented by a young sponge with a single excurrent orifice; such a system is represented in a large sponge by each oscule: *a*, oscule; *b*, inhalent pores.
3. Vertical section of a part of a bath-sponge: *b*, inhalent pores; *c*, canals; *d, d*, flagellated chambers; *e, f*, skeleton fibres; *g*, maturing eggs.
4. Enlarged view of a part of the canal system: *a*, inhalent pores and passages by which water is drawn into the spherical flagellated chambers and their connecting passages (apopyles) conducting it into larger spaces (*b*) whence it flows out through an oscule (*c*). Cf. Fig. 2.
5. Enlarged view of flagellated cells lining the chambers and canals; and a single cell: *n*, nucleus; *c*, contractile vesicle; *m*, collar; *f*, flagellum.
6. Various forms of siliceous spicules.
7. One form of siliceous fibrous skeleton.
8. Fresh-water sponge; vertical section of Spongilla; the water enters through the dermal pores (*a*) into the sub-dermal cavities (*b*), then enters the incurrent pores and passages (*c*, colored black), and passes into flagellated chambers (*d*), thence out through the excurrent canals (*e*), into the main central canal or perigastric cavity (*f*), in which the openings (*g*) of these canals from all sides are indicated by the black dots; and the water is finally discharged through the apical oscule (*h*).
9. A bath-sponge (Spongia).
10. A branching sponge (*Chalinopsilla oculata*), a 'finger' sponge, common on the Atlantic coast of the United States.

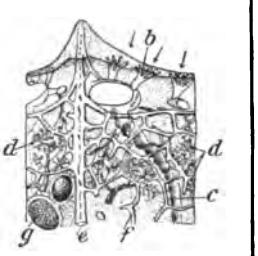
SPONGE STRUCTURE



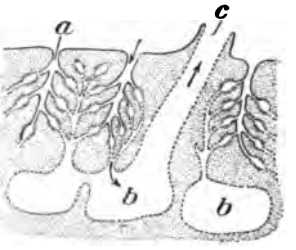
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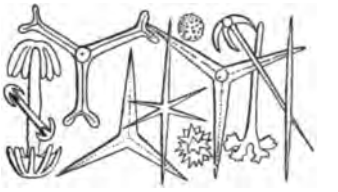
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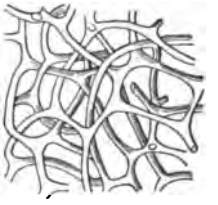
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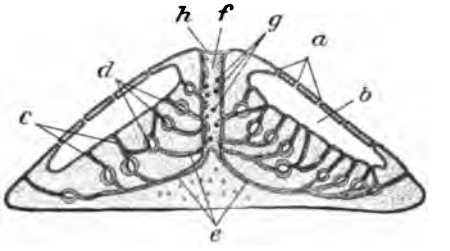
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For Names and Descriptions, see Text

sico-chemical agencies from inorganic substances. This view prevailed from ancient times until after the middle of the seventeenth century, and as late as 1842 Weeks maintained that mites (Acarus) were spontaneously generated in "several solutions under electrical influence." In 1859 Pouchet, in his *Hétérogénie*, revived the subject, and in 1871 Bastian maintained that bacteria and torulæ were developed at the present day in certain fluids containing organic matter by laws similar to those by which crystals arise, or by what he calls 'archebiosis.'

In 1660 Redi disproved the prevailing notion that the maggots of flies were generated in putrefying meat, by covering similar pieces of meat with fine gauze, and keeping away the blow-flies. He thus demonstrated that the maggots grew from eggs, and that there was "no life without antecedent life." About a century and a half ago Needham experimented by boiling and corking flasks of water containing infusoria, but in every case animalcules appeared after a longer or shorter period. This led Spallanzani (1768) to make more careful experiments. He boiled infusions longer, and instead of simply corking, fused the necks of his flasks. The result was that the infusions remained entirely free from living organisms. Schulze and Schwann in 1836 made further experiments. They carefully boiled their infusions, and then supplied air; but they made it first pass through red-hot tubes, so that any germs present in it would be burned. Under these conditions no infusoria appeared. Then the discovery was made by Cagniard de la Tour that fermentation, like putrefaction, is always accompanied by the presence of microscopic organisms. In 1854-59 Schroeder and Dusch invented the screen of cotton-wool now used for plugging the openings of tubes, which kept out the germs, and it was thus found that the cause of putrefaction and fermentation, and the origin of the living forms accompanying these processes, must be microscopic particles existing in the air. The next step was taken by Pasteur (*On the Organized Particles Existing in the Air*, 1862). On sowing these particles in suitable sterilized infusions he raised from them microscopic organisms. Germs like these were afterwards shown by Cohn to be low plants to which he gave the name 'bacterium.' Finally Tyndall, in 1869, by passing a beam of light through the air in a box, showed that whenever dust was present the putrefaction occurred sooner or later; when it was absent it did not. The result of these experiments and conclusions is that the view that spontaneous generation takes place at the present day has been entirely discarded.

SPONTANEOUS GENERATION (PROTOGENESIS) NECESSARY TO ACCOUNT FOR THE BEGINNINGS OF LIFE. Some of those who, like Wyman, made observations disproving its occurrence at the present day, yet supposed that in the beginning the first living organisms probably arose from inorganic matter, through the action of unknown physico-chemical processes. In 1868 Herbert Spencer, while rejecting the ancient doctrine of spontaneous generation, stated his belief that the formation of organic matter and the evolution of life in its lowest forms "took place at a time when the heat of the earth's surface was falling through ranges of temperature at which the higher organic compounds are unstable." He conceived that the molding of such organic matter must have begun with portions of protoplasm, moré minute, more indefinite, and more inconstant in their characters than the lowest rhizopods, or even the Protogenes of Haeckel. With this view biologists are now in agreement.

It is evident that the earliest living organism appeared when the temperature of the earth's crust and of the air and sea approached that which it is now; the earth's climate probably exceeded in temperature that of the present torrid zone; the sea may have been less saline; but we know that at present exceedingly few plants and animals can live in hot springs; that there is no life in our geysers, and, judging from analogy, the earth's surface must have been nearly as it is now when the first bit of animated protoplasm came into being.

When the earth had assumed its present shape, with its incipient continents, and the oceans lying in their basins, the period arrived when the conditions for the appearance of life became favorable, and at this critical moment the protoplasmic substance probably came into being. The chemical compounds giving origin to it were far more abundant, and the physical and chemical conditions more favorable.

The origin of protoplasm was probably the result of a combination of circumstances which certainly never occurred before in the history of our planet, and which has never happened since. The phenomenon of protogenesis, after taking place once for all, could never have again occurred. Such is the nature of cell-division, of sexual reproduction, of growth, and of heredity, that it would be contrary to the course of nature to suppose that it was ever afterwards necessary for it to again occur. After protoplasm appeared, the earth and ocean probably became too cool to supply a sufficiently high temperature, or chemical compounds of the right degree of stability to form protoplasm.

FIRST BEGINNINGS OF LIFE. To account for the beginnings of life we have been compelled to imagine the creation of a primordial microscopic bit of protoplasm. In shape it was drop-like, spherical or oval, its form being due to gravity, as the primary form of all living beings tends by the action of gravity to be round or ovate.

This primordial being had the power of absorbing and digesting food, or the protoplasmic materials round it, and hence of growing; it was contractile and could move automatically, and thus it was adapted for moving through the water, sending out from its body rootlike extensions or pseudopodia to aid in seizing its food and in locomotion. A single 'chance' germ (though in nature there is no such thing as chance) would have been sufficient. Such a primordial cell or sphere of protoplasm, by the simple process of self-division, even if not far enough advanced in organization to have a nucleus, may have multiplied itself, and in a few hours even become the parent of thousands of young, while the lapse of a few days would enable it to give birth to millions.

These primordial beings were plastic. Already the earth's surface varied, if not in relative distribution of land and sea, in depth, specific gravity, density, light, and shade, in the nature of the bottom of the primeval sea, and in chemical constitution and other physical features.

There would follow migrations and the foundation of new colonies in scattered areas. Adaptation to each new environment would take place, and in the course of time variation would set in and the evolution of higher organisms take place. See EVOLUTION. Consult: Chambers's *Encyclopædia*, art. "Spontaneous Generation"; Spencer, *Principles of Biology* (New York, 1898-1901); Haeckel, *The History of Creation* (ib., 1876); Verworn, *General Philosophy* (ib., 1899).

SPONTINI, spôn-tē'nê, GASPARO LUIGI PACIFICO (1774-1851). An Italian dramatic composer, born at Majolati, Ancona. In 1791 he became a pupil at the Conservatory della Pietà de' Turchini at Naples, where he studied under Sala and Tritto. As early as 1803 he had produced sixteen operas in the light Italian style used at that time. His opera *La finta filosofa* and two imitations of French opéra comique, *Julie* and *La petite maison*, met with little success. He then gave himself up to the study of Mozart and showed a marked change in the one-act opera *Milton* produced in 1804. The Empress Josephine, to whom he had dedicated the score of *Milton*, had him appointed chamber-composer, and she secured the production of *La vestale* in 1807. It proved a great success. His grand opera *Ferdinand Cortez* (1809) was equally successful. In 1810, as director of the Italian Opera, he staged Mozart's *Don Giovanni* in the original form for the first time in Paris. In 1820 he was appointed general musical director at Berlin. He wrote for the Berlin festival play *Lalla Rukh* (1821), remodeled as the opera *Nurmahal, oder das Rosenfest von Kaschmir* (1822); *Alcidor* (1825); and *Agnes von Hohenstaufen* (1829). In 1842 he resigned his position and returned to Paris. He died in his birthplace.

SPOONBILL. An ibis-like bird of the family Plataleidæ, distinguished by the flat, dilated, spoon-like form of the bill. The species are five or six, in two genera widely distributed. The spoonbills of the Old World belong to the genus Platalea, and have the windpipe curiously convoluted. The spoonbills of the New World lack these convolutions, and are therefore placed in a distinct genus Ajaja. The roseate spoonbill (*Ajaja ajaja*), the only American species, is very abundant within the tropics. It is nearly three feet in length, and is a beautiful bird, with plumage of a fine rose color, of which the tint is deepest on the wings; the tail-coverts are carmine. It was formerly abundant in Florida, but is now rare there, and most commonly seen along the coast of Texas. It nests in colonies, and builds a coarse platform of sticks, in trees, on which it lays three eggs, white spotted with brown. The only European species is the white spoonbill (*Platalea leucorodia*), common in marshy districts throughout Northern Europe and Asia in summer, and in the salt marshes of the Mediterranean in winter. See Colored Plate of WADERS.

SPOON-BILLED SANDPIPER. A rare reddish, stint-like sandpiper (*Eurynorhynchus pygmæus*) of Eastern Asia, remarkable only for its spoon-shaped bill. (See Colored Plate of SHORE-BIRDS.) It breeds in Siberia, occasionally crossing to the Alaskan coast, and migrates southward in winter to China and India.

SPOON'ER, JOHN COIT (1843—). An American lawyer and legislator, born in Lawrenceburg, Ind. In 1859 he removed with his parents to Wisconsin. He graduated at the University of Wisconsin in 1864. He served during the Civil War first as a private in the Fortieth Wisconsin Volunteers and subsequently as a captain in the Fiftieth Wisconsin, and was brevetted major at the close of hostilities. In 1867 he was admitted to the bar, and from 1868 to 1870 he was Assistant Attorney-General of the State. He was a member of the State Assembly in 1872-74, and in 1885 he was elected to the United States Senate. In 1892 he was defeated for Governor by George W. Peck, and in 1893 resumed legal practice in Madison. In January, 1897, he was again elected to the United States Senate to succeed Senator Vilas. He took a prominent part in legislation and debates, and became recognized as the spokesman of the McKinley and Roosevelt administrations. He was reëlected for a third time in January, 1903, despite the opposition of Governor La Follette's faction in the Wisconsin Legislature.

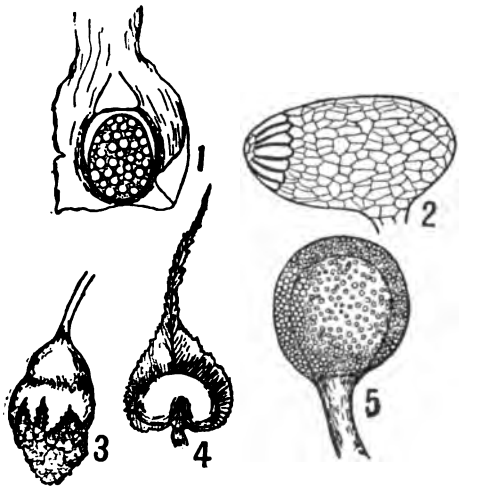
SPOONER, SHEARJASHUB (1809-59). An American dentist and author, born at Brandon, Vt. He graduated in 1830 at Middlebury (Vt.) College, at the College of Physicians and Surgeons, New York City, in 1835, and practiced dentistry in New York with much success until 1858. He contributed extensively to periodicals, professional and other, and published, in addition to dental works, two compilations once valuable: *Anecdotes of Painters, Engravers, Sculptors, and Architects, and Curiosities of Art* (1853), and a *Biographical and Critical Dictionary of Painters, Engravers, Sculptors, and Architects from Ancient to Modern Times* (1853; new ed. 1865). He also bought and restored the plates of Boydell's *Shakespeare Gallery*, which he republished.

SPORADES, spôr'â-dēz (Gk., scattered). The collective name for the islands lying in the southeastern portion of the Ægean Sea between Samos and Rhodes, and east of the Cyclades (q.v.) (Map: Greece, J 5). The ancients included under the Sporades a number of islands which lie south of the Cyclades proper and whose principal members are Melos, Ios, Santorin, and Amorgos; but these are now classed with the Cyclades, belonging to the Greek nomarchy of that name. The Sporades proper belong to Turkey. Their principal members are Astropalia, Leros, Patmos, Nicaria, Calimno, Cos, Nisyros, and Scarpanto. Some also include Rhodes, Samos, Chios, and Lesbos with the neighboring islands. In a wider sense the name Sporades is applied to all the islands of the Ægean Sea except the Cyclades proper. The group lying in the western part of the sea, north and east of Eubœa or Negropont, the principal member of which is Scyros, are known as the Northern Sporades, and belong to the Greek Nomarchy of Eubœa. For details, see articles on the principal individual islands.

SPORAD'IC (Lat. *sporadicus*, from Gk. σποραδικός, *sporadikos*, from σπείρειν, *speirein*, to sow). Isolated. In medicine, a disease is sporadic when but few cases, widely separated, appear. If many cases are found in the same region, the disease is called epidemic (q.v.). In botany, sporadic growths are those which are scattered or widely dispersed.

SPORANGIUM (Neo-Lat., from Gk. *σπόρος*, *sporos*, seed + *ἀγγεῖον*, *angeion*, vessel). The plant organ within which asexual spores are produced. Among algæ and fungi the sporangium is usually a single cell (mother-cell), which produces few to numerous spores. Among bryophytes there are no distinct sporangia, the spores being produced by a more or less complex capsule which is the essential feature of the characteristic leafless sporophyte (sporogonium) of the group. Among pteridophytes the sporangia are very prominent, and their origin is the basis of a fundamental distinction in the group. They are complex, many-celled organs, usually borne on leaves, and if they are developed from a single superficial (epidermal) cell the plant is *lepotosporangiate*, if they involve several epidermal and deeper cells the plant is *eusporangiate*. The ancient ferns, represented by a few tropical forms to-day, were eusporangiate; while the great host of modern ferns, including the water ferns, are leptosporangiate. It is natural, therefore, to regard the eusporangiate condition as primitive, and the leptosporangiate as derived. The two other divisions of pteridophytes (horsetails and club mosses) and all the spermatophytes (seed-plants) are eusporangiate.

The structure of the ordinary fern sporangium indicates its highly specialized character. It consists of a long slender stalk that bears a spore-containing capsule. The walls of the capsule are thin, except for a single row of thick-walled cells (annulus) which girdles the capsule like a



TYPES OF SPORANGIA.
1, Quillwort; 2, fern; 3, liverwort; 4, club moss; 5, fungus.

meridian, from the stalk nearly around to the stalk again. At maturity the annulus acts like a bent spring, and when the thin wall of the capsule begins to yield straightens violently, hurling out a spray of spores. In the eusporangiate plants such a contrivance is absent.

In most ordinary ferns the sporangia are developed in very great numbers upon the under surface of foliage leaves, usually occurring in definite groups (sori), popularly called 'fruit dots,' which are generally protected by a flap-like outgrowth (indusium, q.v.) from the epidermis. In some ferns (e.g. 'sensitive fern'), however, foliage-work and spore-production are separated, and distinct ('spore-leaves') in the other g and club mosse sporophyll bei the horsetails club mosses (L phylls are or (strobilus), w cones of pines, of the flowers exhibit heteros ferentiated, so sporangia) an rangia). This pteridophytes, (Selaginella, plants. Since seed-plants, lo are really mic spectively, sta sporophylls, a supposed.

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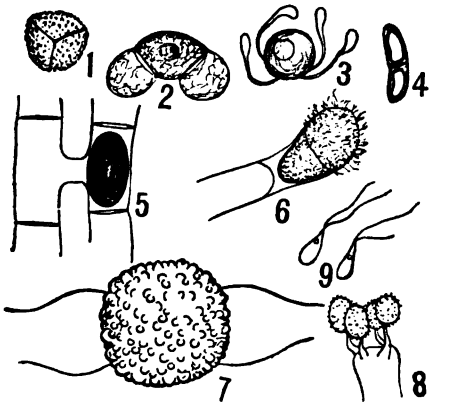
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ASEXUAL SP asexual spores character of t which produce rophyceæ, q.v.) ospore or swa naked mass of means of one Among the br zoöspores are t concave side.

ceæ, q.v.) the spores have no cilia and hence cannot swim, and as each sporangium produces four such spores they are called tetraspores.

Among the fungi, asexual spores, which are produced in great profusion and variety, have received many names. Among the alga-like fungi (Phycomycetes, q.v.) they are developed in one-celled sporangia, and are mostly light, dry cells, easily scattered by wind. Such are called simply spores, with no designating prefix. Among the sac-fungi (Ascomycetes, q.v.), however, two conspicuous forms of asexual spores occur: the one, conidia, which are successively cut off from the tip of a filament, often forming chains; the other, ascospores (fig. 4), developed within a delicate sac (ascus). Among the rusts (Uredinales, q.v.) the greatest variety of asexual spores for one plant is reached; e.g. in wheat rust there are four. Among toadstools (Basidiomycetes, q.v.) the characteristic spores are basidiospores, borne two or four together on the tips of pointed branches from a swollen filament, the basidium (fig. 8). There are several other spores of minor significance among the fungi, each with its distinctive name. Among the bryophytes (liverworts and mosses) and most of the pteridophytes the asexual spores are called simply spores. In heterosporous plants (some pteridophytes and all spermatophytes), however, there are two kinds of asexual spores, megaspores or macrospores and microspores (qq.v.). Before their character in seed plants was appreciated these two kinds were called respectively embryo-sacs and pollen-grains. In all of these wind-dispersed asexual spores, the spore-wall consists of two layers, a delicate inner one (intine or endospore) and a tough outer one (exine or exospore), often variously sculptured, especially in the pollen-grains of flowering plants, and sometimes even winged, as in the pollen-grains of pines (fig. 2).

SEXUAL SPORES. Only two names, zygospores and zygotes, are used to designate sexual spores which result from the union of similar gametes (fig. 5, 7). (See ISOGAMY.) Oöspores, produced by all but the lowest plants, are formed



TYPES OF SPORES.

1, Megaspore of Selaginella; 2, microspore (pollen) of pine; 3, spore of Equisetum with elaters, 4, ascospore of lichen; 5, zygospore of Spirogyra; 6, zoöspore of Vaucheria; 7, zygospore of Mucor; 8, basidiospores; 9, zoöspores of green alga.

by the union of dissimilar gametes (see HETEROGAMY) known as sperms and eggs (oöspheres). See SEX in plants.

Under suitable conditions any spore begins to form a new plant, the process being called germination. In some cases the germination is immediate; in others it is delayed for a longer or shorter period by unfavorable conditions, as in winter. Spores adapted to delayed germination are called resting spores, and may be recognized by their unusually heavy protecting wall. See REPRODUCTION.

The methods of spore dispersal are as diverse as the various means of seed dispersal. In many of the lower forms, as in the algæ and some fungi, zoöspores may distribute the species over wide areas. Most aerial spores are light and usually small, and are thus readily scattered great distances by wind, a fact evidenced by the usually early appearance of ferns on new tropical islands. Mechanical expulsion and special devices for separating or entangling spores, as the elaters of Equisetum (fig. 3), are common.

SPÖRER, spĕ'rĕr, GUSTAV FRIEDRICH WILHELM (1822-95). A German astronomer, born in Berlin and educated there. He taught at Bromberg, at Prenzlau, and at Anklam (since 1849). Here he began in 1860 to observe sun spots with the view of determining the law of solar rotation. Through a Government endowment a solar observatory was erected by him at Anklam. Spörer arrived independently at a conclusion similar to that of Carrington concerning the equatorial quickening of the sun's movement on its axis. In 1868 he took part in an expedition to East India for observing a total eclipse of the sun. The structure of the chromosphere was also investigated by Spörer. This showed the chromosphere to be of the same nature as the vast protrusions from it. From 1874 to 1894 Spörer was observer at the astrophysical observatory at Potsdam.

SPOROPHYLL (from Gk. *σπόρος, sporos,* seed + *φύλλον, phyllon,* leaf). A leaf-like organ that occurs only in spermatophytes and in certain pteridophytes and bears sporangia (sporecases). Though generally unlike ordinary foliage leaves in appearance, they are regarded as foliar organs. See SPORANGIUM.

SPOROPHYTE (from Gk. *σπόρος, sporos,* seed + *φυτόν, phyton,* plant). The sexless phase in alternation of generations (q.v.).

SPOROZOA (Neo-Lat. nom. pl., from Gk. *σπόρος, sporos,* seed + *ζῷον, zōon,* animal). A class of parasitic protozoa comprising the malaria germs, Texas cattle-fever germs, etc. While the sporozoa differ much in structure, they are similar in parasitic habits and development. As a rule they are more or less oval or elongated, with no organs of locomotion except in the early stages. They are very minute, though *Gregarina gigantea,* which lives in the intestine of the European lobster, is of comparatively colossal size, being a little over half an inch in length. They are nourished by the absorption of the fluid in which they live. The young arise as 'sporoblasts,' which when enveloped with a membrane are called spores, the contents of which break up into several small bodies or 'sporozoites'; the latter to complete their development must leave the first host and enter a second one.

Some of the sporozoa are parasites in the interior of cells, such as those lining the intestine of higher animals. Malaria in man has been proved to be due to the presence of a sporozoan

(*Hæmamœba* or *Plasmodium Laverani*) which invades and destroys at a certain stage in its life history the red corpuscles of the blood. The sporozoites are developed in a mosquito (Anopheles) and are transferred from the salivary glands to man by the sting or proboscis. The bird-malaria germ is communicated by the ordinary mosquito (Culex). Another form (*Apiosoma bigeminum*) causes the Texas fever in cattle, the infection being carried by ticks (q.v.). A parasite of the tsetse fly (q.v.), which is a flagellate hæmatozoan, is the cause of the tsetse disease in Southern Africa. See *Insects and Disease*, in article INSECT.

The Myxosporida are generally rather large sporozoa, their hosts being fish and insects. The silkworm disease called pebrine is due to one of the Myxosporida (*Glugea bombycis*), which inhabits all the tissues of the caterpillar.

The Sarcosporida, also called Rainey's or Mieschers's corpuscles, take up their abode in the voluntary muscles of mammals. They form oval cysts, which when ripe inclose spores, each of which contains numerous kidney-shaped sporozoites. Thus *Sarcocystis Miescheriana* occurs in the muscles of the pig; *Sarcocystis muris* in the mouse; *Sarcocystic Lindemanni* rarely in human muscle.

SPORT (by aphæresis for *disport*, from OF. *desporter, deporter, depporter*, to support, banish, amuse, divert, from Lat. *deportare*, to carry away, from *de*, down, away + *portare*, to carry). In biology, the appearance at birth of an individual having one or more marked or extraordinary physical or mental characteristics; a sudden aberration from the type. See EVOLUTION; NATURAL SELECTION.

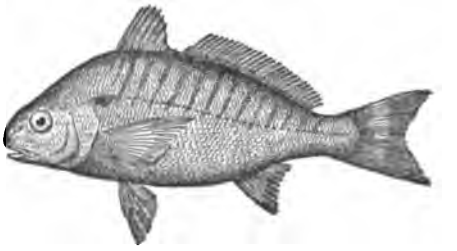
SPORTS, BOOK OF. A name popularly given to an edict issued by James I. of England in 1618 dictating the games which should or should not be played on Sundays after divine service. According to this declaration "no lawful recreation shall be barred to my good people which does not tend to the breech of the laws of my kingdom and the canons of the established Church." The sports allowed were dancing, archery, leaping, vaulting, May games, Whitsun ales, Morris dances, and the setting up of May poles. The occasion of this proclamation was the conduct of some Puritan authorities in the County of Lancashire, who, by their arbitrary repression of the customary recreations of the people, had created considerable discontent and (in the estimation of the King and his advisers) "had given much comfort to the Roman Catholics" by giving a repulsive aspect to the reformed religion. The unlawful sports were bear-baiting, bull-baiting, and bowling. In 1644 the Long Parliament ordered all copies of the Book of Sports to be called in and publicly burned.

SPOT, or LAFAYETTE. A small food-fish (*Leiostamus xanthurus*) of the South Atlantic and Gulf Coast, locally called 'Lafayette' (q.v.), 'goody,' and 'oldwife.' The color is bluish above and silvery below, with about fifteen dark, wavy bands slanting down the sides, and a black spot behind the eye. It appears numerously on the northern coast in September, when it is preparing to spawn in the inlets.

SPOTS'WOOD, or **SPOT'TISWOOD,** ALEXANDER (1676-1740). A British soldier and American colonial governor. He was born at Tangier, Africa; entered the British Army; served with Marlborough and was wounded at Blenheim. He was appointed Lieutenant-Governor of Virginia in 1710, became active in promoting the interests of William and Mary College, and was also interested in the improvement of the condition of the Indians. It is to his efforts that the improvement in the production of tobacco is attributable, and he favored the act for making tobacco-notes a circulating medium. He introduced the manufacture of iron into Virginia. Owing to a lack of support, disputes, and other difficulties, he was superseded in 1722, but he remained in America, and in 1730 was appointed Deputy Postmaster-General.

SPOTTED FEVER. See MENINGITIS.

SPOT'TISWOODE, SPOT'TISWOOD, SPOTTISWOOD, or **SPOTS'WOOD,** JOHN (1565-1639). Archbishop of Saint Andrews. He was educated at the University of Glasgow, and on his father's death in 1583 succeeded him as parson of Calder. He was for many years an uncompromising Presbyterian, but he afterwards adopted English episcopal ideas. He became the chief instrument of James I. and Charles I. in their attempts to reconstruct the Scottish Church after the English model. He was made Archbishop of Glasgow in 1603 and member of the Scottish privy council in 1605. In 1610 he was moderator of the Assembly which gave its consent to the introduction of episcopacy into Scotland. In 1615 Spottiswoode was translated to the see of Saint Andrews, which held the primacy in Scotland. In 1618 he persuaded the General Assembly to accept the Five Articles of Perth, ordaining certain ceremonial innovations, and he subsequently inforced the articles as far as he could. He took part in the revision of the Scottish Prayer-Book, but was opposed to the introduction of the Laudian system into Scotland. In 1633 he crowned Charles I. at Holyrood, and in 1635 he was made Chancellor of Scotland, a dignity which no churchman had held since the Reformation. Finding that the King was determined to introduce the Prayer-Book, he, as usual, stifled his own scruples and acted energetically, according to the King's wishes, but in the resulting disorders he found it necessary to flee from Scotland. He was excommunicated and deposed by the General Assembly, December 4, 1638, and Charles asked him to resign the Chancellorship. Spottiswoode was the author of the *History of the Church and State of Scotland from the Year of Our Lord 203 to the End of the Reign of King James the VI., 1625*, an official compilation written at the request of King James, first printed in London in 1655.



THE SPOT.

SPOTTISWOODE, WILLIAM (1825-83). An English mathematician and physicist, born in

London. He was educated at Balliol College, Oxford. His memoirs on the contact of curves and surfaces in the *Philosophical Transactions* and various other scientific journals are important and original. Among his works are: *Meditationes Analyticæ* (1847); *Elementary Theorems Relating to Determinants* (1851; a second edition appeared in *Crelle's Journal*, 1856); *A Tarantasse Journey Through Eastern Russia* (1857); *Polarization of Light* (1874); *A Lecture on the Electrical Discharge, Its Form and Functions* (1881).

SPOTTSYLVANIA COURT HOUSE, BATTLES OF. A series of battles during the Civil War, fought between May 7 and May 21, 1864, at and near Spottsylvania Court House in Virginia, 49 miles north by west of Richmond, between the Federal Army of the Potomac, under General Meade, and the Confederate Army of Northern Virginia, under General Lee. As in the battle of the Wilderness (q.v.), the movements of the Federal army were directed by General Grant. Both armies paused for breath after the battle of the Wilderness (May 5th, 6th), and prepared to renew the struggle. The Federal wagon trains were early in the afternoon of the 7th drawn to the eastward to clear the direct road to Spottsylvania Court House, upon which a night march had been ordered. This was, however, anticipated by General Lee, and Longstreet's corps (under R. H. Anderson) moved toward the same point, which (having a shorter line) they reached early on the morning of the 8th in time to oppose the advance of Warren's corps. Anderson had been ordered to begin his march at about the hour when (forced to move earlier by the burning forest in which he could not bivouac) he actually arrived at his destination. Notwithstanding the celerity with which Anderson moved, Watson's division of the Federal cavalry reached the Court House some hours earlier, and had not, as alleged, Sheridan's dispositions been countermanded by Meade, the result might have been different. Anderson immediately intrenched, and, although attacked by Warren with vigor, was enabled to maintain his position until heavily reinforced.

By noon of the 9th the relative positions of the opposing forces were as follows: The Confederate line formed a semicircle in front of the Court House, facing north, northwest, and northeast, with Anderson, Ewell, and Early from left to right. Confronting them were Warren, Sedgwick, and Burnside from right to left in order named; Hancock had not yet arrived, but had been ordered to threaten Lee's left. In the course of these movements the distinguished commander of the Sixth Corps—General Sedgwick—was killed by a sharpshooter, and was succeeded by General Wright. It was discovered that Hancock's movement had caused Lee to draw troops from his right, and Grant thereupon (on the 10th) delivered a severe blow upon that part of his enemy's line. Combining for the purpose the Fifth, Sixth, and part of the Second Corps, all under Hancock, while Burnside was to coöperate (a storming party of 12 regiments under Colonel Upton being a feature of the attacking column), he scaled the enemy's intrenchments and took several guns and some hundreds of prisoners. The general attack failed, and was repulsed with loss; it was renewed with success and Upton's men (their commander severely wounded) were finally withdrawn, bringing their prisoners with them, but leaving the guns behind. On the 11th there was no fighting.

A reconnaissance made on the 11th from Hancock's corps discovered a salient, at the right centre of the Confederate intrenchments. At 4 o'clock the next morning a combined attack of Hancock and Burnside was made, resulting in the capture of 4000, prisoners, 30 guns, several thousand stand of arms, and many colors. This success was only achieved after the most severe hand-to-hand fighting that occurred during the war. The captured artillery was turned upon the defenders of the position, who, heavily reinforced, resisted most strenuously. Five times Lee's men made desperate attempts to dislodge Hancock, each time losing heavily. It was 3 o'clock next morning before the fighting ceased, after the troops had been for nearly twenty hours under fire. Lee retired to a fresh position in rear of the one previously occupied and strongly intrenched. Until the 18th the two armies lay facing each other, engaging in several minor conflicts, and Grant then, on May 19th-21st, transferred his army to the North Anna River. On the 8th Sheridan had been detached with his command and sent on a raid in the direction of Richmond and against Lee's communications. He was promptly followed by the Confederate cavalry, but, notwithstanding their efforts, succeeded in passing entirely around Lee's army. He had four severe engagements with Stuart's cavalry, in one of which that distinguished leader was mortally wounded, recaptured 400 Federal prisoners, captured large quantities of supplies and war material, destroyed miles of railroad and telegraph, passed within the outer defenses of the enemy's capital, and after a fortnight's absence reached Grant's headquarters. The Federal losses at Spottsylvania are estimated at 6820; those of the Confederates at 9000, in killed, wounded, and missing. Consult: *Official Records;* Johnson and Buel (eds.), *Battles and Leaders of the Civil War* (New York, 1887); Humphreys, *The Virginia Campaign of 1864 and 1865* (New York, 1883); Grant, *Personal Memoirs* (last ed., New York, 1895); Badeau, *Military History of Ulysses S. Grant* (New York, 1868-81); and Swinton, *Campaigns of the Army of the Potomac* (new ed., New York, 1882).

S. P. Q. R. The abbreviation of *Senatus populusque Romanus* (the senate and the Roman people), the motto surmounting the Roman standards.

SPRAGUE, sprāg, CHARLES (1791-1875). An American poet, born in Boston, Mass. Leaving school at an early age, he became a merchant's clerk, and in 1820 teller in a bank. From 1825 to 1865 he was cashier in the Globe Bank of Boston. His literary skill was chiefly shown in occasional poems, which were first collected in 1841. In 1850, 1855, and 1876 editions of his *Poetical and Prose Writings* were published. Much of his verse is in the familiar rhymed couplet of the eighteenth century, to which period its literary feeling chiefly belongs.

SPRAGUE, WILLIAM (1830—). An American manufacturer and politician, born at Cranston, R. I. After studying at the Irving Institute, Tarrytown, N. Y., he entered his fa-

ther's calico factory, and afterwards became interested in linen weaving and locomotive building. He was elected Governor of Rhode Island, but at the outbreak of the Civil War he offered his services to the United States Government, and served with the Rhode Island troops, participating in the first battle of Bull Run and in the Peninsular campaign. From 1863, when his term as Governor expired, until 1875, he was a member of the United States Senate and served as chairman of the committees on public lands and on manufactures and as a member of the committees on commerce and on military affairs.

SPRAGUE, WILLIAM BUELL (1795-1876). An American clergyman and compiler of *Annals of the American Pulpit* (10 vols., 1857-1869), a comprehensive biographical dictionary of the leading American ministers of all denominations. He graduated at Yale (1815), studied theology at Princeton (1819), had pastoral charges at West Springfield, Mass. (1819-29), and Albany, N. Y. (1829-69), and afterwards devoted himself to literary work at Flushing, L. I. Besides the *Annals* mentioned above, he wrote numerous books, of which the chief are: *Life of Rev. Edward Dorr Griffin, D.D.* (1838); *Life of Rev. Jedidiah Morse* (1874); and *Women of the Bible* (1850).

SPRAIN (from OF. *espreindre*, from Lat. *exprimere*, to press out, from Lat. *ex*, out + *premere*, to press), or STRAIN. A term employed in surgery to designate a violent stretching of tendinous or ligamentous parts with or without rupture of some of their fibres. Sprains are very frequent in all the joints of the upper limbs, especially in the wrist and the articulations of the thumb. In the lower extremity the ankle is the joint by far the most frequently affected; and this is accounted for anatomically by the small size of the articular surfaces, the great weight the astragalus (the bone presenting the lower articular surface) has to support, and the unyielding nature of the lateral ligaments. In slight sprains of this joint the ligaments are only stretched or slightly lacerated, but in more severe cases they may be completely torn through. Sprains are sometimes mistaken for fractures, and *vice versa;* and the two injuries may coexist. The pain and swelling sometimes make an accurate diagnosis difficult, especially if the patient is not seen for some time after the accident; and if any doubt exists, the case should be treated as for the more severe injury. Sprains of the knee are not uncommon, and are characterized by great swelling from effusion of fluid within the joint. Sprains of the back are not unfrequent accidents, and are the most serious of any. The treatment of sprains generally must be regulated by their severity. In most cases, elevation of the joint, the application of cold, and complete rest in a splint will be sufficient, and as soon as the inflammation subsides massage and movement are necessary to prevent adhesions. Sometimes pain and impaired function persist for a long time, and frequently after a severe sprain a joint is permanently weaker.

Sprains, or strains, are very common among horses, owing to the severe exertions required of them, often while they are young and unprepared for such work. Various muscles, ligaments, and tendons are liable to strain, but none more frequently than the large tendons passing down the back of the fore limbs. In slight cases cold water continuously applied for several hours gives relief; but in all serious cases diligent fomentation with water about the temperature of 100° is preferable; or the injured part may be swathed in a thick woolen rag, kept constantly moist and warm by frequent wetting with the hot water. Perfect rest is essential, and in order to insure the relaxation of the large tendons of the horse's limbs, he may in bad cases be kept slung for several days. Blisters, hot oils, firing, and all such irritants are on no account to be used until the inflammation abates, and the part becomes cool and free from tenderness. Such remedies are then useful for causing the reabsorption of swelling, and perhaps also for invigorating the weakened part.

SPRAT (dialectic variant of *sprot*, from AS. *sprota*, OHG. *sprozo, sprozzo*, Ger. *Spross*, sprout, from AS. *sprēotan*, Ger. *spriessen*, to sprout). A small European herring (*Harengula sprattus*), very abundant in the northern Atlantic. It is six inches in length when fully grown. Sprats are cured in great quantities both dry-salted and in brine, and form a cheap and excellent food. Certain small and unimportant species have taken the name in America, where the true sprat is not found.

SPREADING ADDER. See HOGNOSE; and the photographic Plate of SNAKES.

SPRECK'ELS, CLAUS (1828—). An American business man, born at Lamstedt, in Hanover, Germany. He emigrated to Charleston in 1846; worked for a time in New York City; and went to San Francisco in 1856. In 1857 he started the Albany Brewery in San Francisco, and in 1863 organized the Bay Sugar Refining Company. Two years afterwards he sold his interests and went to Europe, where he studied the manufacture of sugar in all its aspects. Returning to California, he engaged more extensively than ever in business, having large interests in manufactures and shipping both in California and in the Hawaiian Islands. He acquired large sugar interests in Hawaii; built large refineries with improved processes; engaged in beet-sugar farming in California; and by the control he exercised over the sugar industry gained for himself the name of the 'sugar king.'

SPREE, sprā. A river of Prussia, which rises in the eastern part of the Kingdom of Saxony, on the borders of Bohemia (Map: Prussia, E 2), and after a winding northwest course of 226 miles, mainly through Brandenburg, falls into the Havel at Spandau. It flows through a low and marshy region, frequently expanding into lakes. It becomes navigable for small vessels at Liebsch, and has recently been deepened below Berlin so as to admit large ships to that city. It is connected with the Oder by two canals.

SPREMBERG, sprĕm'bĕrk. A town of Prussia, on the Spree, 77 miles southeast of Berlin (Map: Germany, F 3). Its chief industry is cloth manufacture. There are oil mills and mines of lignite. Population, in 1900, 10,925.

SPRENGEL, sprĕng'el, KURT (1766-1833). A German physician and botanist, born at Boldekow, near Anklam, and educated at Halle. In 1789 he was made professor of medicine there, and in 1797 he was appointed professor of botany as well. He published: *Versuch einer pragmatischen Geschichte der Arzneikunde* (1792-

1803; 4th ed. 1846), *Handbuch der Pathologie* (1795-97; 4th ed. 1815), *Historia Rei Herbariæ* (1807-08), *Geschichte der Botanik* (1817-18), and *Neue Entdeckungen im ganzen Umfange der Pflanzenkunde* (1819-22).

SPRENGER, sprĕng'ĕr, ALOYS (1813-93). A German-English Orientalist, born at Nassereit, Tyrol. He was educated at Innsbruck and at the University of Vienna. In 1836 he settled in London and became a naturalized British subject. In 1843 he proceeded to Calcutta under an appointment to the medical service of the East India Company. In 1844-48 he was principal of the Mohammedan College at Delhi. In December, 1847, he became an assistant resident at Lucknow, where he was employed for some time in cataloguing the manuscripts in the royal library of the King of Oudh. From 1851 to 1854 he was official Persian translator at Calcutta, and principal of the Mohammedan College at Hoogli. During these years he traveled extensively through the Orient, gathering materials for his projected *Life of Mohammed*, the first portion of which was published at Allahabad in 1851. In 1857 he returned to Europe, and settled at Heidelberg. In 1858-81 he was professor of Oriental languages at the University of Bern. The remainder of his life he spent in retirement at Heidelberg. His published works include: *Technical Terms of the Suffees* (1844); *An English-Hindustani Grammar* (1845); *Selections from Arabic Authors* (1845); *The History of Mahmud Ghaznih* (1847); *The Gulistan of Saadi* (1851), a translation from the Persian; *Leben und Lehre des Mohammed* (3 vols., 1861-63); and *Die alte Geographie Arabiens* (1875).

SPRING (AS. *spring*, *spryng*, OHG. *spring*, *sprung*, Ger. *Spring*, spring, from AS. *springan*, *sprincan*, OHG. *springan*, Ger. *springen*, to spring, leap; probably connected with Gk. *σπέρχεσθαι*, *sperchesthai*, Lith. *sprugti*, to spring away, escape). A subterranean stream which discharges at the earth's surface. Most springs are fed by meteoric waters in the form of rain and snow that percolate into the soil and accumulate at some depth in the strata. This accumulation is known as ground water, and its upper surface, which is called the water-level, coincides more



ARRANGEMENT OF STRATA CAUSING A SPRING.

The water collects in the depression A, and percolating through the porous stratum D, issues at B as a spring. C and E are impervious layers which prevent the escape of the water above or below D.

or less closely with the surface of the ground, receding from it, however, under the hill crests and approaching it closely under the valleys. When the side of a valley is steep or its floor is much depressed the ground water may come to the surface and escape as a spring. Springs may also be formed by the percolating waters encountering an impervious layer of clay or cemented sand which retards their further descent, causing them to follow this dense stratum until they emerge on some hill slope. Springs of this character are more or less dependent on rainfall. All water in penetrating the soil and rocks, even if at no great depth, becomes more or less charged with dissolved mineral and organic matter, as by reason of its carbonic acid it possesses marked solvent powers. Spring waters therefore commonly contain various solid substances in solution, such as the carbonate, sulphate, or muriate of lime, salts of soda, potash, magnesia, and iron, or more rarely silica. When the quantity of dissolved solids is unusually large the spring is termed a mineral spring, and is often utilized for medicinal purposes. See MINERAL WATERS.

Underground waters may collect above an impervious stratum which does not appear at the surface, and they escape by slow percolation through the overlying strata, forming a marsh or swale. To such marshy tracts occurring in the arid regions of California, Arizona, and Mexico, the name cienega has been given.

Thermal springs, whose temperatures are notably higher than that of ordinary springs, usually have a deep-seated origin. In regions where the rocks have been greatly disturbed and fractured the surface waters penetrate to great depths, and thus become warmed by the interior heat of the earth, or they may be heated from contact with uncooled masses of lava. It is also known that igneous rocks of all kinds give off a great quantity of vapor during the process of cooling, and some springs thus may be fed by waters whose source lies deep within the earth, and which for the first time appear at the surface. Thermal springs are mostly limited to mountainous regions; in the United States they occur in great numbers along the Appalachians and the Rocky Mountains. In company with geysers they are found in the Yellowstone National Park, Iceland, and New Zealand. Consult Schlichter, *The Motion of Underground Water*, *Water Supply and Irrigation Papers*, No. 67, United States Geological Survey (Washington, 1902). See ARTESIAN WELLS; GEYSERS; GEOLOGY.

SPRING. A term used in mechanics to designate variously constructed devices of metal or other elastic material adapted to resist concussion, to supply motive power, or to register stress through their property of tending to return to their original form. A spiral spring is one which is wound around a fixed point or centre in constantly receding coils, like the mainspring of a watch or clock. Spiral springs are usually made of flat strips or ribbons of steel, but may be made of round or other shaped wire. A helical spring is one which is wound around a cylindrical arbor in advancing spirals like the thread of a screw. Helical springs are usually made from round bars or from square rods of steel, and are perhaps more extensively used than any other form. An elliptical or laminated spring is made of flat bars, plates, or 'leaves' of regularly varying lengths superposed one upon the other. For formulas for calculating the strength and energy of springs of various forms and sizes, consult Kent, *Mechanical Engineers' Pocket Book* (New York, 1900).

SPRING, GARDINER (1785-1873). An American Presbyterian clergyman, son of Samuel Spring (q.v.). He was born at Newburyport, Mass., and was graduated at Yale College in

1805. He began the study of law at New Haven, taught for two years in Bermuda, at the same time continuing his legal studies, and was admitted to the bar at New Haven in 1808. The next year he entered Andover Theological Seminary to study for the ministry. In 1810 he was ordained, and settled as pastor of the Brick Presbyterian Church, New York City, where he remained for over fifty years. He was one of the founders of the American Bible Society in 1816, the American Tract Society in 1825, and the American Home Missionary Society in 1826. He published many books of a religious character besides his *Personal Reminscences of the Life and Times of Gardiner Spring* (1866.)

SPRING, SAMUEL (1746-1819). An American Congregational clergyman. He was born at Northbridge, Mass., graduated at the College of New Jersey in 1771, and later studied theology. In 1775 he joined the Continental Army, and accompanied Benedict Arnold as chaplain of the invading army into Canada. In 1776 he left the army, and the next year was installed pastor of the church at Newburyport, Mass., where he continued until his death. He was one of the founders of Andover Theological Seminary, and also of the Massachusetts Missionary Society, and to him is attributed the idea of forming the American Board of Commissioners for Foreign Missions. Many of his occasional sermons have been printed, the most notable of them being *A Sermon on the Death of Washington* (1799), and *A Discourse in Consequence of the Late Duel* (1804)—that between Burr and Hamilton. Consult the *Life and Times of Gardiner Spring*, vol. i. (New York, 1866).

SPRING BALANCE. An instrument used to determine the weight of a body by the extension or compression of a spring. In the usual form of spring balance a spring of coiled wire is contained in a metal case and incloses a central rod to which is attached at one end a hook, and at the other a projection which extends through a slit in the case and moves over a graduated scale. The central rod can also be connected by means of a rack and toothed wheel with an axle on which is fastened a pointer moving over a circular scale or dial. The spring balance measures the amount of attraction of the earth at any particular place; consequently, readings at the equator would be different from those at the poles or other places on the earth's surface. The ordinary balance, on the other hand, would give the weight for a body irrespective of its position. The force of the spring varies with temperature, which alters the length and elasticity of the wire and renders impossible precise measurements.

SPRINGBOK (Dutch, springing goat). A South African gazelle (*Gazella euchore*). It is larger than the common deer, and its neck and limbs much longer and more delicate. The general color is fulvous brown on the upper parts, pure white beneath, the colors separated on the flanks by a broad band of deep vinous red. The whole head is white, except a broad brown band on each side from the eye to the mouth, and a brown spot in the centre of the face. The springbok derives its name from the prodigious leaps which it takes either when alarmed or in play, often to the height of seven feet, and sometimes of twelve or thirteen feet. It is one of the most sought-after game animals of South Africa, yet remains numerous. Consult authorities cited under ANTELOPE; and see Plate of GAZELLES.

SPRING EEL. A fish of the small order Opisthomi and family Mastacembelidæ, several species of which occur in the fresh waters of the East Indies; they are eel-like in form, with the dorsal fin very long, and the fore part of it composed of low free spines. Allied to this is a small, curious eel (*Derichthys serpentinus*) dredged from the depths of the North Pacific. See Plate of EELS.

SPRINGER, ALFRED (1854—). An American chemist, born in Cincinnati, Ohio. He studied chemistry at the University of Heidelberg, and then settled in the practice of his profession in Cincinnati. He published studies on *Glycocholic Ether* (1879), *Pentachloramyl Formate* (1881), and *Reduction of Nitrates by Ferments* (1883), in which he announced his discovery of denitrifying ferments among the microörganisms of the soil, and forming a sort of link between the plants and their nitrogenous constituents; also, *A Latent Characteristic of Aluminum* (1891) and *Increase of Segmental Vibrations* (1897).

SPRINGER, ANTON (1825-91). A German art critic and historian. He was born at Prague, and studied at the university of his native city and at Tübingen. He taught successively at Prague, Bonn, Strassburg, and Leipzig. His historical works include: *Geschichte des Revolutionszeitalters* (1849); *Oesterreich, Preussen und Deutschland* (1851); and *Geschichte Oesterreichs seit dem Wiener Frieden* (1863-65). His principal works on art are: *Die Baukunst des christlichen Mittelalters* (1854); *Geschichte der bildenden Künste im 19. Jahrhundert* (1858); *Bilder aus der neueren Kunstgeschichte* (1867); *Raffael und Michelangelo* (1877); *Grundzüge der Kunstgeschichte* (1888; 4th ed., as *Handbuch der Kunstgeschichte*, 1895); and *Albrecht Dürer* (1892). Consult the posthumous *Aus meinem Leben* (Berlin, 1892).

SPRINGER, WILLIAM MCKENDREE (1836—). An American jurist and political leader, born at New Lebanon, Ind. He graduated at the Indiana State University in 1858, and for the next four years was a newspaper correspondent and editor. He was admitted to the bar in 1859, and in 1872 became a member of the Illinois Legislature. From 1875 to 1895 he was a member of Congress, where he introduced a resolution which was carried by a large majority, declaring that it would be "unwise, unpatriotic, and fraught with peril to our free institutions" for one man to serve more than two terms in the Presidency. From 1895 to 1899 he was United States Judge of the Northern District of Indian Territory and Chief Justice of the United States Court of Appeals there.

SPRINGFIELD. The capital of Illinois, and the county-seat of Sangamon County, 185 miles southwest of Chicago; on the Illinois Central, the Chicago and Alton, the Chicago, Peoria and Saint Louis, the Baltimore and Ohio Southwestern, the Saint Louis, Chicago and Saint Paul, the Cincinnati, Hamilton and Dayton, and the Wabash railroads (Map: Illinois, C 4). It is regularly laid out with wide streets. The most prominent edifice is the State Capitol, a handsome building begun in

1867, and completed twenty years later. It is 399 feet long and 286 feet wide, and has a massive dome 364 feet high. Other interesting structures are the old Capitol, now used as the county court-house, and the Lincoln residence, now under State supervision. The Lincoln Monument and Mausoleum of gray granite, the cost of which was borne by several States, is situated a little more than a mile from the heart of the city. There are the Bettie Stuart Institute (female), Concordia Seminary, Saint Agatha's School, and the Academy of Our Lady of the Sacred Heart. The State Library has 50,000 volumes, and the Public more than 42,000 volumes. There are also the State Historical Library, that of the Illinois State Museum of Natural History, and the Supreme Court Library. Other noteworthy features are the City Hall, Post-Office, Governor's Mansion, the High School, and the Odd Fellows' Buildings, the Orphanage of the Holy Child, the Springfield and Saint John's Hospitals, and the David Prince Sanitarium.

Springfield is the centre of a rich farming and coal-mining region, which also has important horse-breeding interests. Its industries in the census year 1900 had an invested capital of $5,030,438, and an output of $6,612,286. The Illinois Watch Company maintains a very large establishment here, and there are also engine works, boiler works, car shops, foundries and machine shops, lumber mills, woolen mills, breweries, and manufactories of soap, saddlery, flour, mattresses, brick, clothing, etc. The government is vested in a mayor, elected biennially, and a unicameral council. The subordinate officials, with the exception of the school board, which is chosen by the council, are appointed by the mayor. For maintenance and operation, the city spends annually about $375,000, the principal items being: Schools, $106,000; interest on debt, $52,000; fire department, $45,000; police department, $32,000; municipal lighting, $23,000; and streets, $21,000. The water-works are owned by the municipality. Population, in 1890, 24,963; in 1900, 34,159. First settled in 1819, and laid out in 1823, Springfield was incorporated as a town in 1832, and was chartered as a city in 1840. In 1837 it was chosen as the State capital, and the State Legislature assembled here for the first time in 1839. Consult Power, *History of Springfield* (Springfield, 1871).

SPRINGFIELD. The county-seat of Hampden County, Mass., 98 miles west-southwest of Boston; on the Connecticut River, and on the Boston and Albany, the Boston and Maine, and the New York, New Haven and Hartford railroads (Map: Massachusetts, B 3). Several bridges here span the river. There are 498 acres in the public park system. Forest Park, the largest of the pleasure grounds, contains 464 acres. In Court Square are the Soldiers' and Sailors' Monument and a statue of Miles Morgan. "The Puritan," by Saint Gaudens, near the library, is a work of great merit. Among the prominent buildings of Springfield are some designed by H. H. Richardson, the most notable of which, perhaps, are the County Court-House and the Church of the Unity. The United States Arsenal is conspicuously situated within the extensive armory grounds. Some 1200 men are employed here in making rifles for the United States Government. (See SMALL ARMS.) Other prominent structures are the railroad station, the Springfield Science Museum, Art Museum (containing the George Walter Vincent Smith collection, one of the best in the country), the City Hall, the Federal Government Building, the High School, and the Public Library. Springfield is the seat of the French-American College, opened in 1885, and of the International Y. M. C. A. Training School. The Public Library has more than 115,000 volumes. There are several other collections of books, among which is the Hampden County Law Library, dating from 1813. The most important charitable institutions include the State Almshouse, Springfield Hospital, Mercy Hospital, and the Hampden Homœpathic Hospital.

Springfield is a port of entry, its foreign trade in 1901 consisting of imports valued at $88,846. In the census year 1900 the various manufacturing industries had capital to the amount of $17,106,000, and an output valued at $21,207,000. The leading manufactures are foundry and machine-shop products, paper and envelopes, tobacco, cigars and cigarettes, brass castings, lumber and lumber products, buttons, electrical apparatus and supplies, confectionery, bicycles, automobiles, rubber and elastic goods, cotton and woolen goods, tools, etc. The government is vested in a mayor, annually elected, and a bicameral council. Springfield spends annually for maintenance and operation about $1,165,000, the principal items being: Schools, $360,000; interest on debt, $140,000; streets, $135,000; fire department, $97,000; police department, $68,000; municipal lighting, $67,000; and charitable institutions, $58,000. The water-works are owned and operated by the municipality. The system has cost $2,141,263. The net debt of the city in 1902 was $2,196,888; the assessed valuation of real and personal property, $74,338,927. The population in 1800 was 2312; in 1850, 11,766; in 1870, 26,703; in 1880, 33,340; in 1890, 44,179; in 1900, 62,059.

Springfield was first settled in 1636 by a party from Roxbury headed by William Pynchon. Until 1640, when it received its present name, it was known as Agawam. On October 4, 1675, during King Philip's War, it was attacked by Indians and burned. During Shays's Rebellion it was the scene (September, 1786) of a riot headed by Shays. Later (January 25, 1787) occurred a sharp skirmish between a small body of State militia and about 2000 insurgents led by Shays, the latter being easily defeated. In 1852 Springfield was chartered as a city. Consult: Green, *Springfield, 1636-1886* (Springfield, 1888); Burt, *The First Century of the History of Springfield, The Official Records from 1636-1736* (Springfield, 1898-99).

SPRINGFIELD. The county-seat of Greene County, Mo., 200 miles southeast of Kansas City; on the Saint Louis and San Francisco and the Kansas City and Memphis railroads (Map: Missouri, C 4). The city is in the vicinity of the Ozark Mountains, and is surrounded by beautiful forest and prairie scenery. It is the seat of Drury College (non-sectarian), opened in 1873, and of Loretto Academy. Other features include the United States Government building, the high school building, Saint John's Hospital, and the Zoölogical Gardens. The national cemetery here has 1703 graves, of which 737 are of unknown dead. Situated in the mineral belt of southwest

Missouri, Springfield has also important agricultural, lumbering, and stock-raising interests. In manufacturing, it ranked fourth in the State in the census year 1900, its industries having an invested capital of $2,111,048, and an output valued at $4,126,871. The leading establishments are carriage and wagon factories, lumber mills, flouring mills, foundries, and shops of the Saint Louis and San Francisco and the Kansas City and Memphis railroads. Springfield is also the centre of an extensive wholesale trade. The government is vested in a mayor, chosen biennially, and a unicameral council. The school board is elected by popular vote. Population, in 1890, 21,850; in 1900, 23,267. Springfield was settled as an Indian trading post about 1819, and in 1838 was incorporated, having been laid out three years earlier.

SPRINGFIELD. The county-seat of Clark County, O., 45 miles west of Columbus; at the confluence of Lagonda Creek and the Mad River, and on the Erie, the Cleveland, Cincinnati, Chicago and Saint Louis, the Pittsburg, Cincinnati, Chicago and Saint Louis, and the Ohio Southern railroads (Map: Ohio, C 6). It is the seat of Wittenberg College (Lutheran), opened in 1845, and has a female seminary, and the Warder Public Library, with more than 18,000 volumes. Noteworthy are the city hall, the United States Government building, the homes of the fraternal organizations, and Snyder Park. The Soldiers' Monument here was erected at a cost of $400,000. Springfield is surrounded by a highly productive farming section. Excellent water power has aided in making an important industrial centre. In the census year 1900 there was invested in the various industries capital to the amount of $14,091,175. Their output was valued at $12,777,173. More than five-sevenths of the capital, and nearly two-thirds of the output were represented by the manufactures of agricultural implements, and foundry and machine shop products. The government is vested in a mayor, elected biennially, and a unicameral council. For maintenance and operation the city spends annually about $395,000, the principal items being: Schools, $132,000; streets, $152,000; municipal lighting, $48,000; fire department, $40,000; interest on debt, $37,200; police department, $34,000. The water works, which represent an expenditure of $707,577, are owned by the municipality. Population, in 1890, 31,895; in 1900, 38,253.

SPRING HILL COLLEGE. A Roman Catholic institution near Mobile, Ala., founded in 1830, under the direction of the Society of Jesus. Its courses are preparatory (one year), commercial (four years), and classical (six years). The students in 1902 numbered 166, and the faculty 26. The buildings and ground were valued in that year at $250,000. The income was about $42,000 and the library contained 18,500 volumes.

SPRINGING USE. A use which is limited to take effect on the happening of a future event and not depending upon any preceding use or estate. This is a peculiar form of future estate and differs from a shifting use, which operates in derogation of some other estate, and from a remainder which must be limited upon some particular or preceding estate. It may be limited to rise either upon a certain or uncertain and contingent event. Consult Gilbert *On Uses*, Sudgen's edition.

SPRINGTAIL. Any one of the very minute insects of the families Poduridæ, Smynthuridæ, Entomobryidæ, and Papiriidæ, of the thysanuran suborder Collembola. These little insects leap by the tail-like organ arising from the under side of the penultimate or antepenultimate segment of the abdomen, reaching forward horizontally when at rest, nearly to the head. This organ when suddenly drawn toward the perpendicular throws the insect high into the air and sometimes to a distance of several feet. The springtails are found in great numbers on the surface of the ground or just beneath the surface in boreal and even arctic regions. They occur in the spring in the Northern United States on bright sunny days when the snow is melting, frequently in great numbers on the surface of the snow. One species (*Achoreutes nivicola*) is commonly known as the 'snow-flea.' Springtails are also found on the surface of stagnant water, and commonly in deep soil which contains more or less soil humus.

SPRING VALLEY. A city in Bureau County, Ill., 17 miles southeast of Princeton; on the Chicago, Rock Island and Pacific and the Chicago, Burlington and Quincy railroads (Map: Illinois, C 2). It is important as the shipping centre of a coal-mining and farming region. There is a public library. The water-works are owned by the municipality. Population, in 1890, 3837; in 1900, 6214.

SPRING WHEAT. See FLOUR and WHEAT.

SPRIT (AS. *sprēot*, pole, sprout, from *sprēotan*, Ger. *sprieseen*, to sprout). A light spar extending from the peak (see SAIL) to a sliding becket on the mast. In the early days of square-rigged ships, square sails set on yards under the head booms were called the sprit-sail, sprit-sail topsail, and sprit-sail topgallant sail. When the square sprit-sails of the head booms were replaced by fore-and-aft jibs and staysails, the various sprit-sail yards were no longer used, but as a spreader was needed for the jib guys, whisker booms (see SHIP) were devised, and these are occasionally called sprit-sail yards, though they are in two parts, one on each side of the bowsprit cap.

SPRUCE (ME. *Spruce*, *Pruce*, from OF. *Pruce*, from ML. *Prussia*, Prussia), *Picea*. A genus of about twenty species of coniferous trees, indigenous to the Northern Hemisphere, nearly half being natives of North America. The genus was formerly combined with Abies (see FIR), from which it differs in having pendulous cones, leaves jointed on the twigs, keeled on both sides and not arranged in ranks, but scattered and pointing in every direction. The spruces occur as trees farther north than most others, forming forests within the Arctic Circle, and extending south, especially in the mountains as far as the Pyrenees in Europe, and North Carolina and Arizona in the United States. Some of the species occur in pure forests over immense tracts, the white spruce and also the black spruce covering extensive areas in Canada to the almost total exclusion of other trees. In Europe the Norway spruce is similarly distributed. The species are pyramidal in habit of growth, the lower branches drooping when old. The Norway spruce (*Picea*

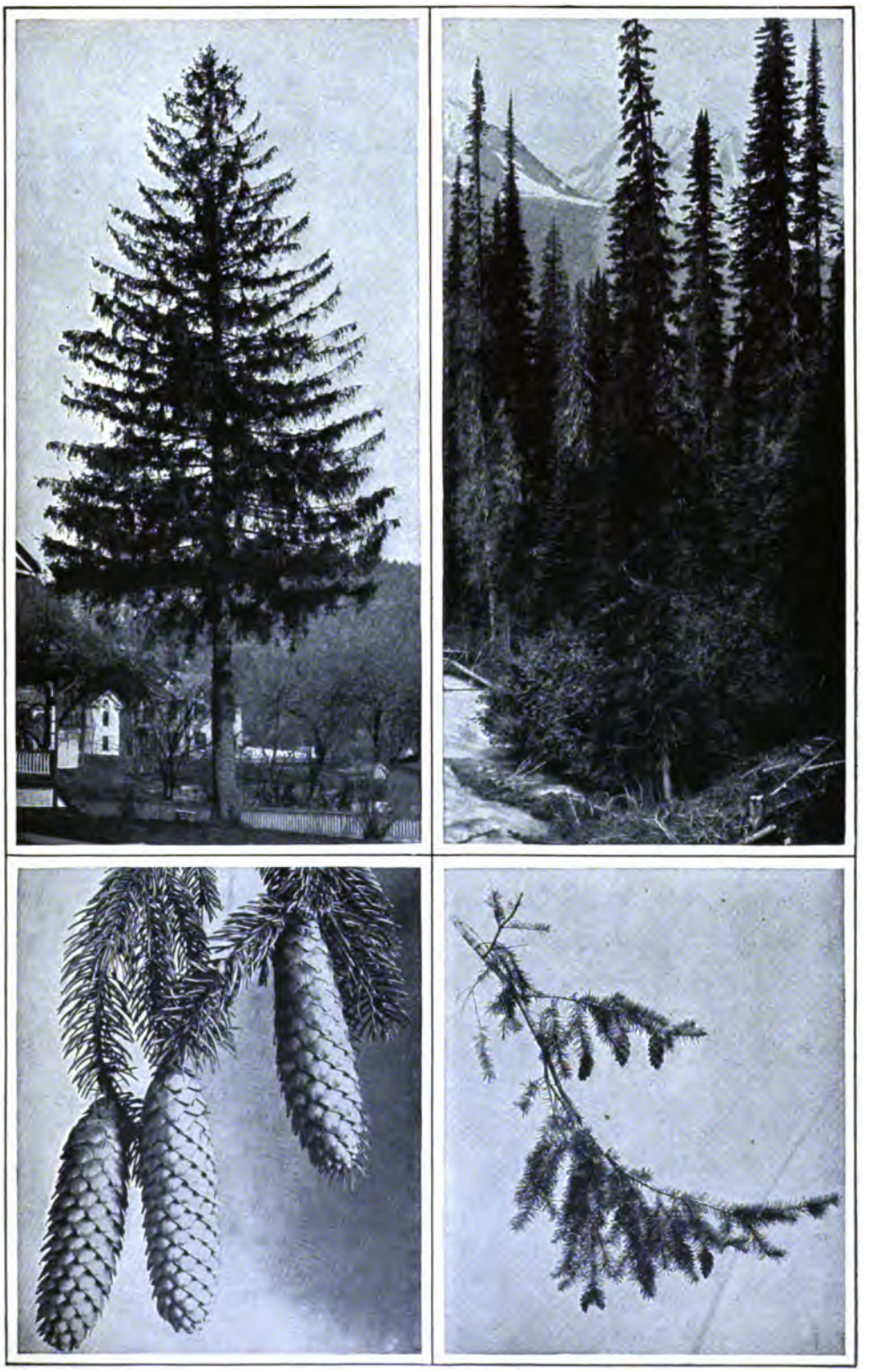
excelsa), the principal European species, is of rapid growth, attains a height of 150 feet or more, and is extensively planted both as a forest tree and as an ornamental. The timber is valuable for fuel and for house building, and is largely exported from Norway and Sweden for masts and spars of sailing vessels. The tree yields resin and turpentine; its bark is used in tanning and for basket-making, etc. The wood is used for wood pulp and paper manufacture. In North America the prevailing species over the greatest extent of territory are the white and the black spruce (*Picea alba* and *Picea nigra*), although in lumbering the two species are seldom recognized. The former is found from New York to British Columbia and northward to Newfoundland, Hudson Bay, and Alaska. It is a handsome tree 50 to 150 feet high. The wood is light, soft, compact, nearly odorless, light yellow, and with scarcely distinguishable sap wood. It is largely used for general building, spars, flooring, etc. It also yields some of the spruce gum of commerce. The latter has a distribution somewhat similar to the white spruce, except that it descends along the mountains to North Carolina and Tennessee and probably does not reach Alaska. It is a somewhat smaller tree, but is otherwise very similar to the white spruce. It forms immense forests in Maine, New York, Canada, and elsewhere, and is largely used for wood pulp and paper. These two species are the chief and best source for wood paper-making. The gum of the black spruce is used for chewing. The branches are used in the preparation of essence of spruce, and by adding sugar or molasses and slightly fermenting, spruce beer is obtained. The bark contains tannin and is used to some extent in tanning leather. The roots are often split into narrow strips and made into baskets, coarse mats, ropes, etc. The Sitka or tideland spruce (*Picea sitchensis*) is a large tree occurring abundantly from northern California to Alaska, following the coast as far as the island of Kadiak. It is one of the largest trees of North America, attaining in its lower regions a height of more than 300 feet and a diameter of 7 or 8 feet at 100 feet from the base. Specimens upon the islands in southeastern Alaska measured more than 200 feet in height and 25 feet in circumference 4 feet from the ground. The timber of this tree is very valuable, entering into all kinds of building operations. In the tree-planting operations in the West the spruces, especially the white and the Norway, have proved among the most adaptable of evergreen species. The black, being of slower growth, less ornamental, and not so well adapted to dry soils, is less frequently planted. For ornamental planting none excels the blue spruce, which is of rather slow growth. All are hardy and all have been extensively planted in Europe. Each of the American species has developed several well-known varieties, which vary principally in the character of their foliage, branching habits, etc. A tree known as Douglas spruce or Douglas fir (*Pseudotsuga Douglassi*) is one of the important timber trees from the Rocky Mountain region to the Pacific and north to British Columbia. Upon the Pacific Coast it attains a height of more than 300 feet and a diameter of 10 to 12 feet. The timber is fine, straight-grained, heavy, and very strong, and is useful for all kinds of building, masts, etc. It has been very successfully planted in Minnesota, where it is believed it will supersede the other species for general planting.

SPRUNER VON MERZ, KARL (1803-92). A German chartographer, historian, and poet, born at Stuttgart. He entered the Corps of Cadets at Munich in 1814, became lieutenant in 1825 and had attained tne rank of lieutenant-colonel in 1855, when King Maximilian II. appointed him his aid-de-camp. Favored with that monarch's special confidence, he was a steadfast advocate of Pan-German and liberal principles at the Bavarian court. In 1864 King Ludwig II. appointed him his adjutant-general and in 1883 general of infantry. He retired from service in 1886 and died in Munich. His principal work is the great *Historisch-geographischer Handatlas* (118 maps, 1837-52; 4th ed. by Sieglin, 1893 et seq.); besides which he published a model *Atlas zur Geschichte von Bayern* (1838); Handatlas für die *Geschichte des Mittelalters und der neueren Zeit* (90 maps, new ed. by Menke, 1879); *Historisch-geographischer Schulatlas* (10th ed., 1880); and others. He wrote a *Leitfaden zur Geschichte von Bayern* (1853); *Pfalzgraf Rupert der Kavalier* (1854); *Charakterbilder aus der bayrischen Geschichte* (1878); several historical dramas and, anonymously, *Jamben eines greisen Ghibellinen* (1876), and *Aus der Mappe des greisen Ghibellinen* (1882), both strictly Christian, but anti-papal.

SPULLER, spụ'lâr', EUGÈNE (1835-96). A French publicist and political leader, born at Seurre (Côte d'Or). He was educated at the college at Dijon and studied law at the University of Paris, but in 1863 became identified with journalism. After the proclamation of the Republic in 1870 he became Gambetta's secretary and one of his most trusted supporters, and with him escaped from Paris in a balloon on October 7, 1870, in order to assist him in reorganizing the provincial governments. He was elected by a Paris constituency to the Chamber in 1876, and became one of the most influential leaders of the Union Republic group. Upon the formation of Gambetta's short-lived Cabinet, in November, 1881, Spuller was made Under-Secretary of State for Foreign Affairs. He returned to the Chamber in the following year, and in 1884 was chosen one of the vice-presidents of the body. He was Minister of Public Instruction in the Rouvier Cabinet in 1887, and Minister of Foreign Affairs in the Tirard Cabinet in 1889-90. In 1892 he was elected Senator, and in 1893-94 held the portfolio of Public Instruction in the Cabinet of Casimir-Périer. He published: *Petite histoire du second empire* (1870); *Ignace de Loyola et la compagnie de Jésus* (1876); *Michelet, sa vie et ses œuvres* (1876).

SPUNGING-HOUSES. In the law of England, the private houses of the bailiffs, who may detain there a debtor who has been arrested for debt for 24 hours, to admit him or his friends to arrange to settle the debt. The name is derived from the extortion often practiced on the debtor. The name is not used in the United States.

SPUR (AS. *spora*, OHG. *sporo*, Ger. *Sporn*, spur, from AS. *spcornan*, OHG. *spurnan*, to kick, spurn; connected with Lat. *spernere*, to despise, Gk. σκαλρειν, *spairein*, to flounder, Lith. *spirti*, to tread, Skt. *sphur*, to thrust with the foot).



NORWAY SPRUCE AND CONES

DOUGLAS SPRUCE AND CONES

Originally spurs were made with a single point or prick and were known as the 'prick-spur' or goad-spur, but they soon developed into the rowel. In some instances the spur proper consisted of a ball from which projected a sharp point. Although the rowel is first met with in the thirteenth century, it was not common until the middle of the fifteenth century. In the Middle Ages the use of the spur was limited entirely to knights, who were granted their spurs as a symbol that they had won their right to knighthood. Similarly, the hacking off of his spurs denoted the public disgrace and degradation of the knight. During the age of chivalry, to serve a pair of spurs on a dish before a knight was a pointed declaration on the part of the host that he desired his guest to leave as speedily as possible. In the United States Army the spurs of mounted officers are of yellow metal or gilt, with ornamentation, while the rank and file wear the same pattern spur made of steel with a plain surface. Throughout Europe generally, the gilt spur denotes an officer of field rank, and the steel spur a mounted officer of regimental rank. The use of the spur is not nearly so common in these days of lightly equipped horsemen and intelligently bred horses.

SPURGE (OF. *spurge, espurge*, from *espurger*, from Lat. *expurgare*, to purge, cleanse, from *ex*, out + *purgare*, to cleanse, from *purus*, pure + *agere*, to drive, to do), *Euphorbia*. A genus of about 600 species, mostly tropical shrubs or trees or temperate climate herbaceous species of the natural order Euphorbiaceæ, characterized by a resinous, milky, usually acrid juice. Some of the green-stemmed, fleshy, and spiny African species so resemble certain cacti in their habit of growth as to render their identification more or less uncertain when not in flower. The leaves are either wanting or fall off early, and the functions of assimilation are performed by the stems. The flowers of many species, especially of Poinsettia, have bright-colored bracts that make them very ornamental. About forty species are indigenous or introduced in the Eastern United States.



CYPRESS SPURGE (*Euphorbia cyparissias*).

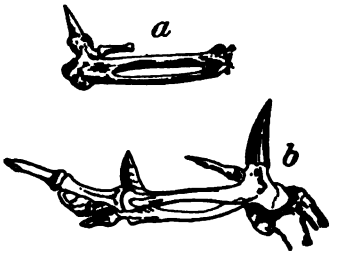
SPUR'GEON, CHARLES HADDON (1834-92). A celebrated English preacher. He was born at Kelvedon, Essex, attended school at Colchester, and spent a few months at an agricultural college at Maidstone. His family intended him for an Independent minister, but his own sympathies drew him toward the Baptists, whose connection he joined in 1850. The same year he became a school-teacher, and, removing to Cambridge, began to deliver cottage sermons in the neighborhood. The popularity of the 'boy preacher' was almost immediately established, and at the age of eighteen he had charge of a small Baptist congregation in the village of Waterbeach, Cambridgeshire. In 1854 he entered upon the pastorate of the New Park Street Chapel, London, where his preaching proved so attractive that in two years' time the building had to be greatly enlarged. The Surrey Music Hall was for some time engaged for his use, and finally his followers built for him the well-known 'Metropolitan Tabernacle' in Newington Butts, opened in 1861. Many evangelistic and philanthropic agencies grew up in connection with this immense chapel, such as the Stockwell Orphanage; a pastor's college, where hundreds of young men were trained for the ministry under Spurgeon's care; the Golden Lane Mission, etc. He was compelled in his later years to stop his work frequently because of ill health, and died at Mentone, France. His sermons were published weekly from 1854, and yearly volumes were issued since 1856. They had an enormous circulation, and many of them were translated into various languages. He also published many volumes, including: *The Saint and His Saviour* (1857); *Morning by Morning, and Evening by Evening* (1866-68); *John Ploughman's Talks* (1869); *The Treasury of David* (a commentary on the Psalms, largely from Puritan writers, 1870-85); *Lectures to My Students* (1875-77); *Commenting and Commentaries* (1876); *John Ploughman's Pictures* (1880); and after 1865 he edited a monthly magazine, *Sword and Trowel*.

In theology he was a pronounced Calvinist, in biblical science an extreme conservative, in policy an open communion Baptist, in politics a Liberal Unionist, in all things independent. He attacked the Low Church Party in the Church of England because it countenanced, he asserted, the teaching of baptismal regeneration in the Prayer Book, and in 1864 withdrew from the Evangelical Alliance because it was supported by it. He attacked his own co-religionists for their alleged rationalistic views and withdrew in 1887 from the Baptist Union. As a preacher he knew how to enchain the attention of his hearers through sermons of great length, by a flow of vigorous English and a mingling of tenderness and sternness, humor and soberness. A biography by his wife and private secretary was published in London in 1897-98.

SPURRY (OF., Dutch *spurrie*, MDutch *sporie, spurie, speurie, spurrie*, spurrey; of uncertain etymology). Plants belonging to the genera Spergula and Buda of the order Caryophyllaceæ. The species of Spergula are natives of Europe, those of Buda of America. Spurry is a weed sometimes cultivated as a forage crop. Corn spurry or common spurry (*Spergula arvensis*) is an annual from 6 to 12 inches high, producing a tangled mass of succulent stems with numerous whorled linear leaves. It prefers sandy or stony soil, upon which it is often planted as a green manure and as a soiling crop for sheep and cattle. The plant readily re-seeds the ground, but need not become a pest on well-tilled farms, where it is often welcomed as a catch crop. Giant spurry (*Spergula maxima*), by many botanists not regarded as a species distinct from the above, is similar to, but larger than, common spurry.

SPURS, Battle of the. See Battle of the Spurs.

SPUR-WINGED GOOSE, PLOVER, etc. Many terrestrial birds have the bend of the wing armed with one or more spurs or bony knobs, which they use for attack and defense. This armament is conspicuous in the geese of the African family Plectropteridæ, of which there are four species, and here it is based upon one of the wrist-bones, instead of on the metacarpus, as is usual elsewhere. The 'spur-winged plover' (*Hoplopterus spinosus*), one of the commonest birds of the Nile Valley, is only one of many tropical plovers so armed, the largest and finest spurs being those of a Chilean plover (*Belonopterus Chilensis*); its spur is situated just



Anatomy of wing-spurs.

a, spur of the spur-winged plover; *b*, relative positions of the two wing-spurs of the screamer (q. v.).

at the base of the thumb, and, as in other cases, is sheathed with horn, and sharp at the end. Some of the jaçanas have wing-spurs, and others a peculiar blade-like enlargement of the forearm. Lastly, the large, turkey-like South American screamers (q.v.) have two wing-spurs, the larger of which is an inch and a quarter long. Consult Lucas, "Weapons of Birds," in *Bird Lore*, vol. iv. (New York, 1902).

SPURZHEIM, spōōrts'hīm, Johann Kaspar (1776-1832). A German physician and phrenologist, born near Treves. While studying medicine at Vienna he was introduced to Gall (q.v.), and became his pupil and later his colleague in investigating the structure and functions of the brain. He lived in France and England alternately, and was widely known as a lecturer. In 1832 he came to the United States on a lecturing tour, but fell ill and died suddenly in Boston. Among his works are: *The Physiognomical Works of Drs. Gall and Spurzheim* (1815); *Elementary Principles of Education* (1821); *Phrenology* (1825); *Anatomy of the Brain* (1826); and *Sketch of the Natural Laws of Man* (1828). Consult Carmichael's *Memoir of Spurzheim* (Dublin, 1833). See Phrenology.

SPUTUM. See Expectoration.

SPUYTEN DUYVIL (spī'ten dī'vil) **CREEK.** A channel connecting the Hudson with the Harlem River, at the northern end of Manhattan Island (q.v.).

SPY (OF. *espie*, from *espier*, Fr. *épier*, to spy, from OHG. *spehōn*, Ger. *spähen*, to watch; connected with Lat. *specere*, Gk. *σκέπτεσθαι*, *skeptesthai*, Skt. *spaś*, *paś*, to look). A person employed to obtain information regarding an enemy by entering the latter's camp, and employing any possible means or methods by which to attain his ends. He differs from the scout in that the latter never surrenders his military character, is invariably a soldier, and secures his information without employing false pretenses. While the employment of spies is recognized by the law of nations, the spy himself is regarded as an outlaw and generally meets with an ignominious death whenever discovered. Military law (q.v.), although distinct in ordering the death of a spy, is not clear in defining what constitutes a spy.

SPY, spē. One of the most important archæological sites in Europe. In 1886 while exploring a grotto in the commune of Spy, near Namur, Belgium, MM. de Puyot and Lohest recovered two human skeletons from a bed rich in Paleolithic implements and remains of ancient animals, among which those of elephants abound. These ancient men were below the Belgians in stature and were dolichocephalic. Consult Mortillet, *Le préhistorique* (Paris, 1900).

SPY, The. A novel by James Fenimore Cooper (1821) giving the story of Harvey Birch, a spy employed by Washington in 1780 in Westchester County, New York, 'the neutral ground.' His services could not be acknowledged and he was suspected by patriots and Tories alike.

SQUADRON (OF. *esquadron*, Fr. *escadron*, from It. *squadrone*, squadron, augmentative of *squadra*, squad, square). Ordinarily two troops of cavalry. It occupies the same position to cavalry that battalion does to infantry. The actual strength of a squadron varies with that of the component troops and ranges from 120 to 200 swords. See Army Organization. For the use of the term in naval affairs, see Tactics, Naval.

SQUALODON (Neo-Lat., from Lat. *squalus*, sort of sea-fish + Gk. *ὀδούς*, *odous*, tooth). An extinct genus of whale based on fossil skulls and teeth found in Miocene and Pliocene deposits. See Cetacea; Mammalia, Fossil.

SQUALORAJA (Neo-Lat., from Lat. *squalus*, sort of sea-fish + *raja*, ray, skate). A fossil shark of the Lower Lias of England, ancestral to the modern chimæra (q.v.).

SQUARCIONE, skwär-chō'nā, Francesco (1394-1474). An Italian painter of the Early Renaissance, founder of the school of Padua. He was a teacher rather than a painter. From the large number of his pupils he has been styled the 'Father of Painting,' and the influence of his school was dominant throughout Northern Italy. His method of teaching differed from that of other masters in that he had his pupils copy antique statues rather than his own works. The chief characteristics of their art are the statuesque character of the figures and the wealth of antique ornamentation, combined, however, with a trenchant realism. It is impossible to distinguish the works ascribed to him at Padua and elsewhere from those of his pupils, only one, a "Madonna," in possession of the Lazzari family, Padua, being signed.

SQUARE (in geometry). See Parallelogram.

SQUARE ROOT. See Involution and Evolution.

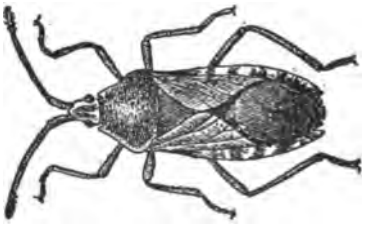
SQUARING THE CIRCLE. See Circle; Quadrature.

SQUARES, Method of Least. See Least Squares, Method of.

SQUASH (abbreviation of *squanter-squash, squonter-squash*, from North American Indian *askutasquash, asquash*, plural of *asq*, green, unripe). The common name for the fruits and plants of various varieties of *Cucurbita Maxima, Cucurbita Pepo*, and *Cucurbita Moschata*. The term is frequently applied in America to what are known in Europe as pumpkins. Squashes are cooked as a vegetable and also used for making pies. They are of divers forms, with early, late, and mid-season varieties of each. Squashes like a warm fertile soil. They are planted about the same time as corn in hills eight feet apart each way. From four to six seeds are put in each hill, which should be made rich with a few shovels of well-rotted manure placed in the bottom. The winter varieties are gathered upon the approach of frosty weather and left in the sun to cure for a while, being covered at night with hay or like material. Before cold weather sets in the fruits should be stored on shelves one deep in a dry, cool, not cold, room. See Plate of CUCUMBER ALLIES.

SQUASH. A ball game belonging to the family of tennis, which it is considered to have preceded in origin. It is played with a racquet the ball in an inclosed court of varying size without any affixed standard, but generally less than 40 feet by 20 feet, divided by a central line on the floor and a cross line into four spaces. The underlying principle of squash is that two players try alternately to hit the ball up against the front wall above a 'tell-tale' line. Whichever first fails to do so before the ball's second bounce from the floor loses the point. There are various rules governing the placing of the ball and of scoring, which will best be studied in *The Game of Squash*, by Eustace Miles (New York, 1901).

SQUASH INSECTS. The insect fauna of the squash and the pumpkin are practically identical, and several insects which feed upon these plants also attack melons, cucumbers, etc. (See MELON INSECTS.) The most important in the United States are the squash-bug (*Anasa tristis*) and its closely similar relative, the horned squash-



COMMON SQUASH-BUG (*Anasa tristis*).

bug (*Anasa armigera*), the squash-vine borer (*Melittia satyriniformis*), and the squash ladybird (*Epilachna borealis*). The squash-bug is a dull grayish brown musky-smelling bug of the family Coreidæ, a little over half an inch long, which hibernates in the adult stage. Its large golden brown eggs are laid in the spring upon the foliage. The young bugs, which grow rapidly and molt five times, suck the juices of the plant. Hand-picking the bugs before eggs are laid, kerosene sprayed upon vines started very early to act as decoys, and destruction of the bugs on the vines and fruits after the crop has been gathered, are the only feasible remedies. The squash-vine borer, a clear-winged moth of the family Sesiidæ, has an orange or red and black and bronze abdomen and hairy hind legs, red or orange on the outer surface, and black inside. The young caterpillars hatched from eggs laid on the stems in late spring bore into the stem, which wilts and dies. In midsummer they pupate in a tough cocoon beneath the surface of the ground, whence the adult emrges in spring. In the South a second generation appears in August. The best preventive measures consist in late fall harrowing and deep spring plowing. The squash ladybird, belonging to the genus Epilachna, which contains the only plant-feeding species of the family Coccinellidæ (see LADY-BIRD), is a black-spotted, yellow, hemispherical species of wide geographical distribution. The adult beetles hibernate and lay their eggs upon the leaves in May or June. The yellow, spiny larvæ chew circular holes in the leaves, reach full growth in from two to four weeks, and transform to pupæ, attaching themselves by the tip of the body to a leaf or stem. There are two or more generations each year, and the insect is readily controlled by an arsenical spray.

The pickle-worm, melon caterpillar, certain plant-bugs, and flea-beetles (qq.v.) are also troublesome. Consult: Smith, *Manual of Economic Entomology* (Philadelphia, 1896); Chittenden, *Bulletin 19, Division of Entomology, Department of Agriculture* (Washington, 1899).

SQUATTER SOVEREIGNTY. See POPULAR SOVEREIGNTY.

SQUAWFISH. A fresh-water fish (*Ptyochelus Oregonensis*) of California, where it is locally known as 'Sacramento pike.' It is the largest American species of the carp family (see CYPRINIDÆ), and reaches a length of from three to five feet. See Plate of DACE AND MINNOWS.

SQUEERS, WACKFORD. In Dickens's *Nicholas Nickelby*, the heartless, ignorant Yorkshire schoolmaster of Dotheboys Hall.

SQUETEAGUE, or DEEP-WATER TROUT. A fish (*Cynoscion regalis*) latterly far more widely known as weakfish (q.v.).

SQUID (of uncertain etymology). A cephalopod mollusk, differing from the nautilus in having no outer shell, the body being supported by an inner pen-shaped horny structure, or, in the cuttle of the Mediterranean, by a calcareous 'bone,' flattened oval in shape. The body of the squid is somewhat fish-like, pointed behind, with two fins, while the head is rather large and armed with ten long arms, bearing cup-shaped suckers, two of the arms being longer than the others. The eyes are large and perfect. The mouth is armed with two powerful black teeth, shaped like the jaws of a parrot. At the base of the smaller jaw is the lingual ribbon (radula). With this they divide their food. The squid is provided with an ink-sac, and when attacked it will discharge the water in its mantle through its siphon, the ink passing out with the water as if from a syringe; in this way the water is colored, and under cover of the inky cloud the squid darts backward. Squids are very active and powerful in their movements; they will enter a school of fish, dart to the right or left, and seize a fish, biting it in the nape of the neck and killing it instantly. The body is beautifully tinted and spotted with all the colors of the rainbow, and the animal rapidly changes

(See METACHROSIS.) Flying squids (q.v.) are oceanic decapods of the genus Ommastrephes.

Ordinary squids are from 1 to 2 feet in length. The largest squid known is *Architeuthis princeps*, nearly 19 feet long in body; the longer arms measure about 29 feet, the entire animal, with extended arms, reaching a length of 40 feet. Another species (*Architeuthis monachus*) has a body about 7 feet long, with the two longer arms 24 feet in length. (For fossil squids, see BELEMITES.) Consult Verrill, "The Cephalopods of the Northeastern Coast of America," in *Transactions of the Connecticut Academy*, vol. v. (New Haven, 1879-80). Compare CEPHALOPODA and DECAPODA.

SQUIER, skwīr, EPHRAIM GEORGE (1821-88). An American archæologist and traveler, born at Bethlehem, N. Y. After varied experience he became known to science through his study of the antiquities of the Mississippi Valley. In 1849 he went on a diplomatic mission to Central America, which he revisited in 1853 in the interest of an interoceanic railway and of archæology. In 1863 he was appointed United States commissioner to Peru, where he investigated Inca remains. He was first president of the Anthropological Institute (1871). He made extensive contributions to the *Encyclopædia Britannica* and published: *Serpent Symbols* (1852); *Nicaragua, Its People, Scenery, and Monuments* (1852; *The States of Central America* (1857 and 1870); *Tropical Fibres and Their Economic Extraction* (1861); and *Peru, Incidents and Explorations in the Land of the Incas* (1877).

SQUILL (from Lat. *squilla, scilla*, from Gk. *σκίλλα, skilla*, squill), *Scilla*. A genus of bulbous-rooted plants of the natural order Liliaceæ, with a spreading perianth, stamens shorter than the perianth, smooth filaments, a three-parted ovary, and a three-cornered capsule with three many-seeded cells. Many of the species are plants of humble growth, with scapes like those of hyacinths and beautiful flowers.

SQUILLA. A mantis shrimp (q.v.).

SQUINTING. See STRABISMUS.

SQUIRREL (OF. *esquirel, escureuil*, Fr. *écureuil*, squirrel, from ML. *sciuriolus, sciurellus*, diminutive of Lat. *sciurus*, from Gk. *σκίουρος, skiouros*, squirrel, shadow-tail, from *σκιά, skia*, shadow + *οὐρά, oura*, tail). A rodent mammal of the family Sciuridæ, subfamily Sciurinæ. The Sciurinæ are a group of seven genera with compressed incisors, rather slender bodies, and long, hairy tails. The number of species is still a matter of doubt, owing to the remarkable range of color-variation among the individuals. Squirrels are found in all parts of the world except Australia, and are most abundant in India and Southern Asia. They range from the size of a mouse to that of a cat. In color squirrels tend toward gray, reddish brown, or black, though many species are white underneath, and the Oriental species are often handsomely variegated. The pelages differ locally in texture, being affected apparently by the climate. Some of the northern species have a fine, dense fur, and their skins have considerable commercial value, while some of the tropical species have the hair scanty and rather stiff, and in one three-fourths of all known squirrels, and all but five of the American species.

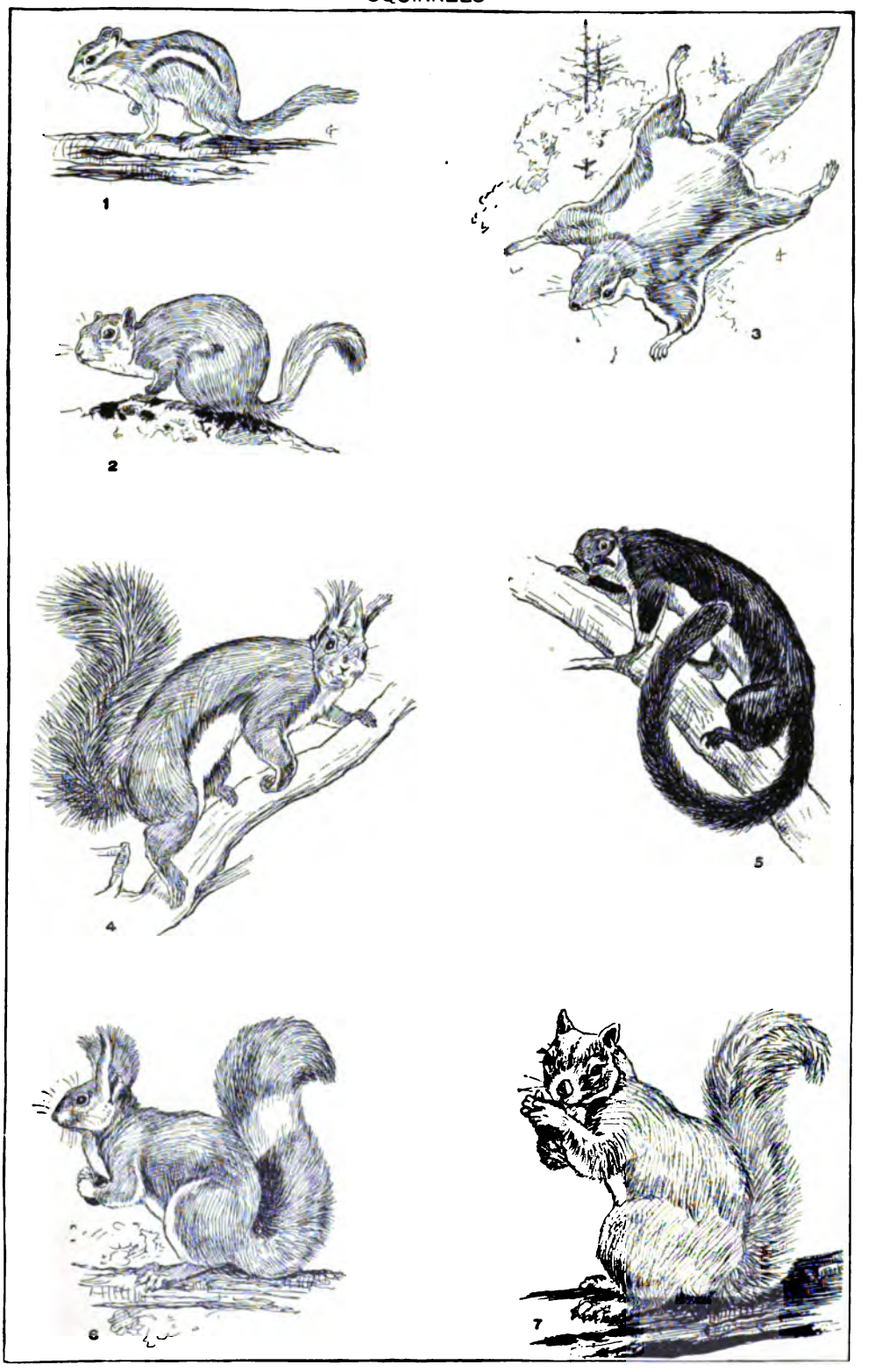
The commonest and most widely distributed of these is the red squirrel or chickaree (*Sciurus Hudsonius*), which ranges from the northern and the mountainous parts of the United States to the limit of trees in British America. It is a small species only eight inches long, not including the tail. Its upper surface is bright ferruginous or chestnut red; the lower surface is pure white, and there is a black stripe along the sides. The ears are commonly tipped with a little tuft of hairs. In its habits the chickaree is a typical squirrel, very active, almost exclusively arboreal, and very fond of nuts, which are one of the most important items in its bill of fare. The diet is, however, diversified, as is true of most squirrels, for while nuts and grains are doubtless the staple articles, birds and their eggs and young, insects, young twigs, and fruit are often eaten. Many ornithologists, indeed, consider this squirrel one of the most deadly enemies of the common song birds, and this enmity is frequently expressed by the birds themselves. The home of the chickaree is usually in some hollow tree, though frequently a special nest is constructed out of branches, twigs, and leaves. The young are born in the spring, three or four in a litter. The chickaree is a rather noisy little animal, and though not gregarious, several are usually found within calling distance of each other. The sounds uttered are rapidly repeated notes, making a shrill, scolding chatter.

East of the great plains and south of the chickaree's range occur the fox squirrels, the largest and handsomest of the American Sciuridæ. They are a foot or more in length, besides the beautiful bushy tail, which is somewhat longer than the head and body. The color ranges from gray with a reddish tinge to jet black. The largest form is the black squirrel (*Sciurus niger*) of the South Atlantic and Gulf States, which is usually very dark colored, but always has the nose and ears white. The fox squirrel of the Middle States (*Sciurus cinereus*) is usually reddish, with the tips of the hairs whitish, giving it a grizzled appearance, but black specimens are common. The fox squirrel of the Mississippi Valley (*Sciurus Ludovicianus*) is more strongly and constantly reddish and is rarely, if ever, black. These large squirrels all agree in their habits, which are not essentially different from those of the chickaree, except that fox squirrels seem to do less harm to the birds. They are intelligent and in captivity make interesting pets. They have a considerable antipathy to the chickaree.

The 'gray' squirrels are a third group of common American species, somewhat smaller than the fox squirrels and more widely distributed, ranging as far west as California. They have a considerable tendency toward melanism in certain regions. They are white or whitish underneath. The common Eastern species (*Sciurus Carolinensis*) is about ten inches long, besides the somewhat longer tail. It is one of the popular game animals of New England, where the fox squirrel is very rare, and not only is it prized for food, but the skin has some commercial value. It is also often kept as a pet, and, like the fox squirrel, can be taught simple tricks. Two or



SQUIRRELS



1. GROUND SQUIRREL: CHIPMUNK (Tamias striatus).
2. RED SQUIRREL (Sciurus Hudsonius).
3. FLYING SQUIRREL (Sciuropterus volans).
4. NEW MEXICAN SQUIRREL (Otoxiurus Aberti).
5. BLACK-MUSTACHED EAST INDIAN SQUIRREL.
6. COMMON EUROPEAN SQUIRREL (Sciurus vulgaris).
7. AMERICAN GRAY SQUIRREL (Sciurus Carolinensis).

three other species of gray squirrel occur in the Southwestern United States and California, of which the chestnut-backed gray squirrel (*Sciurus Aberti*) is notable for having the ears tufted as in the chickaree. This is a very handsome species, with a broad band of chestnut on the back and a black stripe on each side; melanistic specimens are common. The California gray squirrel (*Sciurus fossor*) is remarkable for its large size and black tail.

Of the remaining sixty or seventy members of the genus Sciurus the most important is the common squirrel of Europe (*Sciurus vulgaris*), which ranges from Ireland to Japan and from Northern Italy to Lapland. It is a little larger than the chickaree, and, like that species, it is brownish red above and white beneath. In winter it undergoes some change of pelage, becoming gray or even almost white. The ears are tufted with little pencils of hair. A handsome Oriental squirrel (*Sciurus caniceps*) is remarkable as the only known instance among mammals of the temporary assumption during the breeding season of a distinctly ornamental pelage. During most of the year this squirrel is gray, but in December the back becomes a beautiful orange yellow, which becomes gray again late in March, after the breeding season is over. Of the other five genera one contains only a single species, a large and very handsome Bornean species (*Phithrosciurus macrotis*), which is very remarkable for certain peculiarities of the skull and particularly for the vertical grooves on the front surface of the incisors. The tail is also unusually long, the ears have long tufts, and the coloration is peculiar, the sides being banded with black and white. The genus Xerus includes four species known as 'spiny squirrels,' on account of the pelage, which is coarse and prickly, the hairs being intermingled with spines. They are ground-loving species, and live in burrows which they themselves dig. They are somewhat larger than the chickaree and are all natives of Africa. The genus Tamias includes the small ground squirrels, chiefly American, which connect the tree squirrels with the spermophiles. They are all similar in size and habits to the common chipmunk (q.v.). The remaining genera, mainly Old World species, are remarkable for their powers of sailing from one tree to another. They are described in the article FLYING SQUIRREL.

Consult: Coues and Allen, *Monograph of North American Rodentia* (Washington, 1877); Stone and Cram, *American Animals* (New York, 1902).

SQUIRREL-FISH (so called from the sound made by the fish when taken from the water, which resembles the bark of a squirrel). Any of several brilliantly colored tropical fishes. One group is the family Holocentridæ, allied to the mullets, many species of which abound about coral reefs and are numerous in American tropical waters. The best-known species (*Holocentrus Ascensionis*) is about two feet long and bright red, with shining streaks along the rows of scales. Another group is the genus Diplectrum of the sea-bass family, among which one very handsome species (*Diplectrum formosum*) is common from Charleston to Montevideo, and is also called 'sewano' and 'sandfish.' It is about a foot long and brownish, with many blue markings.

SQUIRREL-MONKEY. One of the names applied to certain small, active, bushy-tailed tropical American monkeys of the marmoset group, and especially of the golden-haired genus Chrysothrix, because of their squirrel-like size, manners, and appearance. A well-known species is one of the titis (*Chrysothrix sciureus*), whose crown, muzzle, and rings about the eyes are black, giving a comical likeness to a human skull, so that it is known as the death's-head squirrel-monkey.

ŚRADDHA, shrăd'hȧ (Skt. *śrāddhā*, faith, connected with Lat. *credere*, to believe). The funeral ceremony of the Hindus, in which balls of rice are offered to the deceased ancestors of the sacrificer, or to the pitris (q.v.) collectively. It is especially performed for a parent recently deceased, or for three paternal ancestors, represented by three Brahmans, and secures the residence of the souls of the dead in the heaven of the pitris at the end of a year. The term śraddha is also applied to the daily offerings to the manes in general, and to offerings performed on various domestic occurrences, as on the birth of a son. There are likewise voluntary śraddhas performed for a special object, such as the hope of religious merit. The presentation of the ball of food to the deceased, and to his progenitors in both lines, is the office of the nearest male relative. If, however, sons have divided their patrimony contrary to their father's wishes, they may be excluded from the śraddha. The widow can inherit only on condition that she has the ceremony duly performed. The śraddha is still offered in certain parts of India, as at Gaya in Behar. The entire ceremony is based on the fear of malignant ghosts, since if the śraddha is not performed, the dead man will return to seek revenge for the neglect shown him. See GHOSTS. Consult: Caland, *Ueber Todtenverehrung bei einigen der indogermanischen Völker* (Amsterdam, 1888); id., *Altindischer Ahnenkult* (Leyden, 1893); Jolly, *Recht und Sitte* (Strassburg, 1896); Hillebrandt, *Ritual-Litteratur* (ib., 1897).

ŚRAVAKA, shrä'vȧ-kȧ (Skt. *śrāvaka*, Pali *sāvaka*, disciple, from *śru*, to hear). Originally any true disciple of Buddha. The term was later applied to those who were on the four-fold road to Nirvana (q.v.). The four classes of śravakas are the *śrōtāpannas* (Pali *sōtāpanna*), neophytes or converts; the *sakarāgāminas* (Pali *sakadāgāmin*), who are so far purified that they need be reborn on earth only once; the *anāgāminas* (Pali also *anāgāmin*), who will be reborn in a Brahmaloka, not in an inferior heaven or on earth; and the *arhats* (Pali *arahā*), who have attained such sanctity that they are freed from reincarnation. The general name among the Northern Buddhists for the Southern sect is śravakas.

SRINAGAR, srē'nȧ-gŭr', or **SERINAGUR,** se-rē'nȧ-gŭr'. The capital of the native State of Kashmir, India, on the Jhelam River, 195 miles by rail northeast of Rawal Pindi (Map: India, C 2). It is in the 'Vale of Kashmir,' a region noted for its picturesque lakes, lofty mountain peaks, and interesting ruins. The Jhelam River flows through the city, and the numerous canals extend in all directions. Within the wall-girt citadel are the city fort and a summer residence of the Maharaja. Dal Lake, a beautiful sheet of water on the eastern border of the city, was

formerly a favorite resort of the Mogul rulers. Srinagar is surrounded by a rich agricultural section, and manufactures shawls, papier maché, and leather. The city was founded in the sixth century, and came under British protection in 1846. Population, in 1901, 122,618.

SRIRANGAM, srē-rŭng'ăm, or **SERINGHAM**, sē-rĭng'hăm. A town in the Province of Madras, India, two miles north of Trichinopoli, on an island of the same name in the Kaveri River (Map: India, C 6). It is connected with the mainland by a bridge of 32 arches and is noted for its great temple to Vishnu. (See INDIAN ART.) The temple of Jambukeshwar, about a mile distant, and the neighboring anikuts or dams of the Kaveri River are also noteworthy. Population, in 1891, 21,632; in 1901, 23,039.

SRIRANGAPATAM, srē-rŭng'ă-pă-tăm'. A town of Mysore, India. See SERINGAPATAM.

ŚRUTI, shrōō'tē (Skt., hearing, revelation). In Sanskrit literature, the technical term for those works which are regarded as divine revelation. It originally applied only to the texts of the Vedas (q.v.) and to the Brahamanas (see BRAHMANA), but at a later period it included also the Upanishads (q.v.). The term *śruti* is therefore contrasted with *smṛti*, or tradition. See SMRITI.

SS, COLLAR OF. A collar composed of a series of the letter S, either linked together or set in close order, on a blue and white ribbon, with the ends connected by two buckles and a trefoil-shaped link, from which hangs a jewel. Such collars have been much worn in England by persons holding great offices in the State, as well as by gentlemen of various ranks, from esquires upward. The origin of the device has not been satisfactorily explained. Among the numerous conjectures regarding its meaning, one is, that the letter S stands for "Souveraigne," the favorite motto of Henry IV.; others have suggested "seneschal"; and it may, with equal probability, owe its origin to the swan of the De Bohuns, that badge being found in one of the earlier examples of this collar (1402), pendent around the neck of the poet Gower, in St. Saviour's Church, Southwark. The collar had, without doubt, originally a Lancastrian character. Collars of SS are still worn, with certain recognized distinctions, by the Lords Chief Justices, the Lord Chief Baron of the Exchequer, the Lord Mayor of London, the heralds, and the sergeant-at-arms.

STAAL, stäl, MARGUERITE JEANNE [CORDIER] DELAUNAY, Baronne de (1684-1750). A French writer of memoirs and letters of much historic value. She was born in Paris. Her father was an artist. Having studied in a convent at Rouen, she became maid to the Duchess of Maine (1711), took part in Cellamare's plot to deprive the Duke of Orleans of the Regency, and was imprisoned (1718-20) in the Bastile. Through her verses and dramatic plots she attained prominence in court circles and finally a leading rôle in Paris society. She afterwards married (1735) Baron de Staal, captain in the guard of the Duke of Maine. She spent the rest of her life at the ducal Court at Sceaux and died in Paris. Her *Mémoires* (Paris, 1755, best edited by Lescure, 2 vols., 1878) are remarkable for keen observation, sincerity, and irony, as well as for their style. Her letters and two comedies are in her *Œuvres* (Paris, 1821). Consult: Sainte-Beuve, *Portraits littéraires*, vol. iii. (2nd ed., Paris, 1864), and a monograph by Frary (ib., 1863).

STA'BAT MA'TER. One of the most famous of the great mediæval hymns, describing the sufferings of the Virgin Mary as she stood by the cross of Jesus. It is generally spoken of by the above name, from the words with which it begins:

> Stabat mater dolorosa
> Juxta crucem lacrymosa,
> Dum pendebat Filius.

It was formerly attributed to various authors, including Pope Innocent III., Saint Bonaventura, and Saint Bernard; but it is now generally ascribed to Jacopone da Todi (q.v.). It was adopted as the sequence for the feast of the Seven Sorrows of Mary in many places, and came into the Roman missal, as one of the few sequences retained in it, in 1727, when the feast was extended to the entire Church. It is a magnificent example of the rhyming Latin poetry of the Middle Ages, deservedly famous for the beauty both of its language and of its thought. Well-known musical compositions on this text are those of Palestrina, Astorga, and Pergolese. Rossini's version, although popular, is of too secular a character to rank with those of his predecessors. Monographs on the hymn have been written by Lisso (Berlin, 1843) and Ritter (Leipzig, 1883), the latter covering the music also.

STABILITY (Fr. *stabilité*, from Lat. *stabilitas*, steadfastness, from *stare*, to stand). The property of a body by virtue of which it tends to return to a position of equilibrium if it receives an impulse acting to displace it from this position, or, in other words, where work must be done to alter the position of its centre of gravity. Thus a pendulum would be said to be in stable equilibrium, as also would be a well-ballasted ship. To satisfy this condition the centre of gravity must occupy such a position that when it is displaced it is raised with respect to its original position. If under the action of a force the centre of gravity is moved to a lower position the body is said to be in unstable equilibrium. Stability of floating bodies is an important consideration in shipbuilding (q.v.). See BUOYANCY; EQUILIBRIUM; HYDROSTATICS; MECHANICS; METACENTRE.

STABLE FLY. A biting fly (*Stomoxys calcitrans*) of the family Muscidæ, probably introduced into the United States from Europe long ago. It closely resembles the common house fly, so closely, in fact, as to deceive most untrained observers. It does not frequent dwellings except late in the autumn and on the approach of a rainstorm, a circumstance which gives rise to the common expression that flies begin to bite before a rain. The larvæ feed in fresh horse manure, and the flies live chiefly on the blood of vertebrate animals, frequently causing much an-



STABLE FLY.

noyance to horses and cattle, and biting human beings. Another cosmopolitan muscid fly (*Muscina stabulans*) is sometimes known as 'stable fly.'

STACCATO, stȧ-kä'tō (It., detached). In music, a term implying a detached, abrupt mode of performance. A certain amount of time is subtracted from the proper value of any note played staccato, and a rest substituted. A dot placed over a note indicates that it is to be played staccato. A dash implies a greater degree of staccato; and a very light degree of staccato is expressed by uniting the dot with the slur.

STACHYS, stā'kis (Lat., from Gk. *στάχυς*, woundwort, ear of corn, spike). A genus of plants of the natural order Labiatæ, containing numerous species widely distributed in temperate and tropical climates except Australia and New Zealand. *Stachys sylvatica*, hedge nettle, common in shady places, is a coarse herb from 2 to 3 feet tall with ovate, heart-shaped leaves on long stalks and whorls of purple unpleasant smelling flowers. *Stachys elatior*, common in moist places, sometimes proves a troublesome weed in meadows. It was formerly used as a vulnerary, hence the name woundwort. Several species are cultivated in flower gardens. To this genus some botanists refer the common betony or wood betony (*Stachys Betonica*), plentiful in woods and thickets in Europe. It is a hairy-stemmed plant one or two feet high, has oblong heart-shaped leaves, whorls of purple or white flowers, and a fetid smell. A Japanese species (*Stachys Sieboldi*, often called *Stachys tuberifera*) has small edible tubers an inch or two long used as a vegetable in China and Japan; in the latter country they are known as chorogi, under which name they have been introduced into America.

STADE, stä'de. A town in the Province of Hanover, Prussia, on the Schwinge, an affluent of the Elbe, about 4 miles from its mouth (Map: Prussia, C 2). It manufactures machinery, ships, trimmed lumber, salt, bricks, wine, and cigars. Stade was designated a city as early as the tenth century. Population, in 1900, 10,575.

STADE, BERNHARD (1848—). A German theologian, born at Arnstadt and educated at Leipzig and Berlin. In 1875 he was appointed professor of theology at Giessen. He wrote *De Isaiæ Vaticiniis Æthiopicis Diatribe* (1873), *Ueber die alttestamentlichen Vorstellungen vom Zustand nach dem Tode* (1877), *Lehrbuch der hebräischen Grammatik* (1879), and *Geschichte des Volkes Israel* (vol. i. 1881-84; vol. ii., with O. Holtzmann, 1888). In collaboration with Karl Siegfried (q.v.) he published (1893) a *Hebräisches Wörterbuch zum alten Testament*. In 1871 he became the editor of the *Zeitschrift für alttestamentliche Wissenschaft*.

STADIA (ML. *stadia*, station, from Lat. *stadium*, from Gk. *στάδιον*, standard of length, furlong). An attachment fitted to the telescope of a transit and used in surveying to measure distances. Stadia surveying is a modification of transit surveying, and is effected by the use of the stadia or gradienter attachment. The telescope of the ordinary transit (see ENGINEERING INSTRUMENTS) contains a vertical and a horizontal wire dividing the field of vision into four quadrants; but the stadia telescope contains extra horizontal wires mounted on an independent diaphragm, so that the distances between the respective wires are adjustable. The principle of its operation is simple. If the space between two auxiliary wires, one on each side of the horizontal wire of the telescope, is so adjusted as to subtend a foot on a rod at a distance of 100, the space will subtend two feet on a rod at two hundred feet, and so on. Thus by proper adjustment the approximate distances to various near-by points can be calculated at once by reading the rod. If from any convenient point in a field the corners are all visible, and the stadia instrument be set at this point, the distance to each corner can at once be read and also the angles between these lines. Thus with two sides and the included angle of each triangle, the areas of the different parts and that of the whole field can be calculated. This plan is known as the method of *radiation*. The gradienter attachment is a micrometer screw which takes the place of the tangent screw to the axis of the telescope. A mounted scale registers the number of turns of a micrometer screw. The value of the thread is usually such that one revolution of the screw moves the horizontal wire of the telescope over a space of one foot on a rod at the distance of a hundred feet. If the micrometer screw is divided into one hundred spaces, it is clear that when the screw is turned through 25, 50, or 75 spaces, or $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of a space on the scale, the wire of the telescope will pass over $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of a foot on the rod, and so on. See SURVEYING.

STADIMETER (from Gk. *στάδιον*, *stadion*, standard of length, furlong + *μέτρον*, *metron*, measure). A nautical instrument invented by Commander B. A. Fiske, United States Navy, and designed for measuring the distance of objects when their height is known. It is somewhat similar in principle to the sextant, but its readings are in yards instead of angular measure. See RANGE-FINDER.

STADIUM (Lat., from Gk. *στάδιον*, standard of length, furlong, race-course, from *ἱστάναι*, *histanai*, Skt. *sthā*, Lat. *stare*, to stand; ultimately connected with Eng. *stand*). The name for the Greek race-course, within which also other athletic contests took place. It was used only for contests, not apparently as a place for exercise. The spectators stood or sat on the high banks of earth at the sides and across the ends. In some cases one end was curved like a horseshoe, and at times one end was open. At Olympia there seems to have been no permanent seats at the sides, but we hear that at Athens Herodes Atticus (see ATTICUS) fitted the stadium with Pentelic marble seats. The floor of the stadium was sand or loose earth. The course was straight away, and at each end was usually a long strip of marble which served to mark the start and finish. The length of the course was always 600 Greek feet, but, as the foot varied in different localities, the stadium was not of uniform length. At Athens the standard foot seems to have been 0.2957 meter, like the Roman foot, and the stadium was 177.42 meters. This seems to be the length of the stadium used commonly as a measure of distance, of which 8⅓ made a Roman mile, and a little more than 9 an English mile. Consult: Hultsch, *Griechishe und römische Me-*

trologie (2d ed., Berlin, 1882); Dörpfeld, in *Mittheilungen des deutschen archäologischen Instituts Athens* (Athens, 1882).

STADTHOLDER (Dutch *stadthouder*, Ger. *Stadthalter*, stead-holder, lieutenant, viceroy, governor of a province). The title bestowed on William of Orange (q.v.) by the Dutch provinces which rose in revolt against the tyranny of Alva in the sixteenth century. (See NETHERLANDS.) On the assassination of William in 1584 his son Maurice of Nassau was appointed to the office. The stadtholderate was considered to be at an end on the death of William III. in 1702, but in 1747 William IV., descended from a collateral branch of the House of Nassau, was proclaimed stadtholder, captain-general, and admiral-in-chief of the United Provinces. His son, William V., the seventh stadtholder, was driven from the country by the French in 1795 and resigned his office in 1802.

STAËL-HOLSTEIN, stä'ĕl hōl'stīn, *Fr. pron.* stäl ôl'stĂN', ANNE LOUISE GERMAINE, Baronne de, commonly called MADAME DE STAËL (1766-1817). A famous French authoress, born in Paris, April 22, 1766. She was the daughter of the Genevese banker and distinguished French Minister of Finance, Jacques Necker (q.v.), and of his wife, Suzanne Churchod, Gibbon's youthful beloved. She passed her childhood in one of the most brilliant literary salons of Paris, where her naturally active mind was stimulated by association with the keenest wits and critics of the pre-Revolutionary decade, chief among them F. M. Grimm, Thomas, Marmontel, and Raynal. In this vortex of disintegrating ideas she assimilated more than any other of her generation the intellectual spirit of that age. She married in 1786, in obedience to her mother's wish, the Swedish Minister, Baron de Staël-Holstein, by whom she had three children. But she kept the tenor of her independent way, always positive and self-assertive, a little boisterous and rather vain, writing much, but publishing nothing until the appearance of her *Lettres sur Jean Jacques Rousseau* (1788), whose social ideas she warmly admired. She had fallen also under the spell of Goethe's *Werther*, and thus she sympathized with the Revolution till the imprisonment of the King caused a revulsion to an equally indiscreet 'incivism.' She abused her ambassadorial right of asylum, and, in fear of the consequences, left Paris before the massacres of September, 1792, going to Coppet, near Geneva, where she gathered some political sympathizers. In 1793 she tried to make herself the centre of a more important group in England, not without some personal scandal. For nine years (1794-1803) she played at politics in Paris, with brief visits to Coppet. She was amicably separated from Baron de Staël in 1788, and irritated Napoleon by biting epigrams till the consular police banished her from Paris (1803). She went to Germany, which then 'ruled the kingdom of the air' (Richter), and in her unwearying search for noted people to talk to she came in the winter of 1803-04 to Weimar. Goethe, after at first excusing himself on the score of ill health, saw much of her and later on in his *Annalen* spoke of "her brilliant way of showing her readiness of thought and repartee." On the whole, in spite of her 'passionate demands' for ready information on the most important subjects, he admitted that "one could get on with her easily and pleasantly if she was taken in her own way." Schiller found her "with little ideality or poetry and no feminine reserve." The Romanticists were more attracted, and A. W. Schlegel (q.v.), an eccentric prophet of the new school, became her devoted companion and counselor. Thus the German ideas that she introduced into France were seen through Schlegel's eyes, far from impartially, as is constantly obvious in her *De l'Allemagne*, written in 1809-10 and printed in England in 1813. Before her exile Madame de Staël had written two essays, *De l'influence des passions* (1796) and *De la littérature considérée dans ses rapports avec les institutions sociales* (1800), the latter curious for its marks of the close association with Benjamin Constant (q.v.), who gave his impression of their relation in *Adolphe*. Her literary power was first revealed in the novel *Delphine* (1802), a half-autobiography of the 'misunderstood woman,' to be exploited later by George Sand. Much finer is a second story, *Corinne* (1807), wherewith she made the novel carry artistic discussion, as Goethe and Richter had done in Germany.

In 1810 she published her *De l'Allemagne* in Paris, but Napoleon condemned the entire edition and expelled her from France. She retired to Coppet, and there, in 1811, she married secretly a young officer, De Rocca, more than twenty years her junior. In the same year she set out on her travels in Russia, Sweden, and England, and after Napoleon's fall returned to France, though she still spent much time abroad, for her health was gradually failing, as her last book, *Considérations sur la révolution française* (1818), witnesses. She died in Paris, July 14, 1817. Of her three children by her first husband, Auguste (1790-1827) became known as the author of *Lettres sur l'Angleterre;* Albertine (died 1838) married the Duke Achille de Broglie, and Albert became a Swedish officer and fell in a duel. By her second husband (Rocca) she had one child.

In her person, excepting her fine eyes and well-formed figure, Madame de Staël was not attractive. In conversation she often repelled even those who appreciated her talents. If one considers only language and style she was not a great writer, but she had great enthusiasms, faith in human progress, and in democracy. Thus she did much to free French literature from the self-imposed fetters of the classical criticism. Studiously cosmopolitan, she compelled France to contrast and compare her ideals of letters and art with those of Germany and England. The French spirit, she said, needed to be regenerated by some more vigorous sap. It was artistic, rationalistic. They were idealistic, individually subjective. To establish in France Ossian, Byron, Goethe, Richter, was to complete the work begun by Rousseau. Thus the French romantic movement, one of the greatest literary regenerations in history, is in large measure the work of Madame de Staël.

BIBLIOGRAPHY. Madame de Staël's complete works, edited by her son, Baron Auguste de Staël-Holstein, and with a biography by her cousin Madame Necker de Saussure, 17 vols. (Paris, 1820-21). There are *Lives* by Norris (London, 1853); Stevens (ib., 1880); Lady Blennerhasset, trans. (ib., 1889); Sorel (Paris, 1891; trans. London, 1892). Consult also Count d'Haussonville, *Le salon de Madame Necker* (Paris, 1882;

trans., 1882); Sainte-Beuve, *Causeries du lundi*, vol. iv.; Brunetière, *Evolution de la critique* (Paris, 1890); Dejob, *Madame de Saussure et l'Italie* (ib., 1890); Faguet, *Politiques et moralistes*, vol. i. (ib., 1898).

STAFF (AS. *stæf*, staff, Goth. *stafs*, rudiment, letter, OHG. *stap*, Ger. *Stab*, staff; connected with OChurch Slav. *stabŭ*, staff, Lith. *stúbas*, *stóbras*, pillar, Skt. *sthāpay*, to make stand, from *sthā*, to stand, and ultimately with Eng. *stand*). In military and naval usage, the aides or assistants of a commanding officer. The staff of an army comprises the assistants of the general-in-chief and of his generals, and their duties are to relieve the chief of the details to which he cannot personally attend.

In the *United States* this body is divided into the *military* staff and the *administrative* staff. The former is charged with the more purely military duties, and comprises the chiefs of staff (the assistants and executive officers of the generals in the office and in the field), the adjutants-general (who attend to the correspondence, orders, etc.), the inspectors-general (who are charged with the inspection of the troops), the chief of artillery (the assistant and adviser in all matters relating to the artillery, and responsible for the artillery materiel and personnel), the chief of cavalry, the chief of engineers, the chief signal officer (responsible for the military telegraph, signal stations, and balloons), the provost-marshal-general (who has charge of the police, prisoners, deserters, secret service, and post-office), and the aides-de-camp (attached more directly to the person of a general, assisting him by carrying orders, studying and reporting on portions of the field, and attending to a part of the correspondence). The administrative staff is charged with the service of administration and supply, and comprises the judge advocate (who supervises the proceedings of military courts and boards), the commissary of musters (who supervises the muster and pay rolls, and makes musters into and out of the service), the chief ordnance officers (who are charged with the supply of ordnance material), the chief quartermasters (providing transportation, forage, clothing, and camp and garrison equipage), the chief commissaries (providing commissary stores), the chief paymasters, and the medical directors and their respective assistants.

GENERAL STAFF CORPS. Since the passing of the General Staff Bill, which was approved on February 14, 1903, and which entered into legal effect August 15 of the same year, a general staff organization has been instituted as follows: The General Staff Corps establishment consists of officers detailed from the army at large under such rules as may be prescribed by the President. The duties of the General Staff Corps are to prepare plans for national defense and mobilization of troops in time of war; to investigate and report on questions relating to the efficiency of the army and its preparation for war; to aid and assist the Secretary of War or other general officers and commanders, and to act as their agents in informing and coördinating other officers, who are subject to the supervision of the chief of the staff; and to perform such other military duties as may be prescribed by the President.

The General Staff Corps consists of one chief of staff, and two general officers chosen from the army, not below the grade of brigadier-general, four colonels, six lieutenant-colonels, and twelve majors from corresponding grades, twenty captains from grades of captain and first lieutenant, to have rank, pay, and allowances of captains mounted. Time of detail, four years, unless otherwise relieved. When relieved these officers return to their former branch of the army, and are not eligible for service in the General Staff Corps until they have served two years in that branch of the army in which they hold their commission, except in case of war or emergency.

The chief of staff supervises all troops of the line, and the adjutant-general's, inspector-general's, judge-advocate's, quartermaster's, subsistence, medical, pay, and ordnance departments, corps of engineers and signal corps, and performs such other military duties as may be assigned by the President. All duties previously prescribed by statute for the commanding general, as member of the Board of Ordnance and Fortification and of the Board of Commissioners or of the Soldiers' Home, are performed by the chief of staff or other officers designated by the President. Acts or sections of acts authorizing aides-de-camp and military secretaries do not apply to officers of the General Staff Corps.

The chief of artillery serves as an additional member of the general staff and enjoys the rank, pay, and allowances of a brigadier-general.

In *England* the regular army officers, non-commissioned officers, and men doing duty with a militia, volunteer, or yeomanry corps correspond very nearly to the French *cadres complémentaires*. The English up to 1902 had no regular staff institution, answering to that of the French or Germans, but strong efforts were being made to secure the organization of such a system. The staff college prepares officers for staff duty, but officers are frequently thus employed who have not passed the staff college. Officers of the British army desirous of serving with the native army in India join what is called the *Indian Staff Corps*, from which they are appointed to any regiment to which they may be assigned.

In *Germany* the Prussian general staff organization is known as the general staff of the army, Bavaria, Württemberg, and Saxony maintaining their own establishments, but subordinate to the Prussian corps. It consists of the chief of the general staff, usually a high ranking officer, subject only to the Kaiser; the *Haupt-Etat*, or principal establishment of the general staff; and the *Neben Etat*, or auxiliary establishment of the general staff. The duties and functions of the general staff are as follows: Collecting, adding to, and arranging military information necessary for the knowledge of the German Empire and all foreign States, and the further training of officers of the general staff and of the officers attached to it for duty. The great general staff consists of a central and six other sections. The central section is under a major-general, who is the principal assistant of the chief of the general staff. The first section keeps informed about everything that would be useful in case of war with Russia, Austria, Sweden, Norway, Denmark, the Balkan Peninsula, and Asiatic Russia. The second section deals with corresponding details regarding Germany itself.

The third section deals with England, France, Italy, Belgium, Holland, Switzerland, Spain, Portugal, America, and Asia exclusive of Russian Asia. The fourth section covers the subject of fortifications and fortresses and technical engineering affairs. The fifth class is a military historical section, and the sixth has charge of all railway questions. Each section is in charge of the chief of section, whose staff varies according to the work in hand. All general officers must have served on the general staff, an important essential being that they must have held regimental command. In order that officers of other corps or arms of service may be eligible for the rank of general officer, every major in the general staff, independent of the arm of the service to which he belongs, is assigned for a period to the command of a battalion of infantry.

In *France* the general staff is not a permanent organization, but is composed of officers temporarily assigned from the line. It is directly under the Minister of War as chief, and comprises the military household of the President, the special staff of the military governments of Paris and Lyons, the staff of the army corps, divisions, and brigades, the staffs of the fortification commands, the staffs of the marshals of France, the military attachés abroad, and the staffs of the artillery and engineer commands. The general staff of the army is under the chief, who has three brigadier-generals as assistants, and comprises four military bureaus (one for organization and mobilization, one for studying foreign armies, one for military operations and education, and one for railroads), and five sections (one for personal matters relating to the general staff, one for matériel, one for Algiers and Tunis, one for history, and one for land survey). The general staff together with the Ministry of War administers the affairs of the army. The War Ministry is subdivided into bureaus corresponding to the sections of the German greater general staff. The *army staff* itself is under a general of division, called the chief of staff, who is himself assisted by three other superior officers with their subordinates. The staff has its own sections, bureaus, and special services, and is occupied with the organization and mobilization details of the army, the procuration of information regarding that of foreign armies, instruction, railways.

In the *Italian* army system the general staff constitutes the second division of the war university and has in charge the preparations for war. It is subdivided into divisions and sections which are known as the 'office in charge of the Eastern or the Austro-Italian frontiers,' the 'office in charge of the Western or Swiss and French frontiers,' etc. The staff has charge of the archives, geography department, information, intendance, transport, and the Turin War Academy. The chief of staff in time of war is also chief of the intelligence department.

In *Russia* the higher general staff is not practically an independent organization, as is the German Grosser Generalstab, but instead acts entirely under the Ministry of War, which latter consists of various branches. The general staff has to do principally with army organization, manœuvres, camps, fortifications, promotions, rewards, equipment, remounts, geography, and topography, home and foreign, transport, literature, etc. When it happens that the Czar is not an active military leader the War Ministry is dominated by the Minister or some conspicuous and concededly able general officer, who is also a member of the council of war.

REGIMENTAL STAFF. The commissioned staff of a regimental commanding officer would consist of such officers as are not duty officers in the battalion squadron or regiment, as the regimental adjutant, quartermaster, commissary, etc.

The aides-de-camp of a general officer constitute his staff, together with such departmental and technical officers as may be temporarily detailed to assist the general in some specific undertaking.

THE NON-COMMISSIONED STAFF consists of non-commissioned officers not forming part of the company establishment proper and who have relationship only to the battalion, squadron, or regiment, as sergeant major (battalion or regimental), quartermaster-sergeant (regimental), commissary sergeant (regimental), chief musician, chief trumpeters, and principal musician. In the United States army non-commissioned officers doing duty as part of the permanent establishment of an army post or fort are termed the *post non-commissioned staff*, which ordinarily consists of an ordnance sergeant, post quartermaster-sergeant, electrician-sergeant, hospital steward, etc. Throughout the armies of Europe battalion, regimental, and post (depot or fortress) staffs, commissioned or non-commissioned, include practically the same descriptions of officers. See STAFF COLLEGES AND SCHOOLS; ARMY ORGANIZATION.

In the navy the staff does not play as important a part as in the army, nevertheless what is essentially a general staff is required to control the *personnel* and direct the movement of fleets, etc. In the United States Navy the term staff officer is applied to those officers who do not belong to the executive or line branch, as surgeons, paymasters, chaplains, etc.

STAFF (in music). See MUSICAL NOTATION; NEUMES.

STAFFA, stăf'fâ. A celebrated but uninhabited Scottish islet, one of the Inner Hebrides (q.v.), seven miles west of Mull (Map: Scotland, B 3). It rises to a height of 144 feet, is 1½ miles in circumference, and oval in shape. Except on the northeast its cliffs hollowed by caverns rise from the water 84 to 112 feet high. There are seven caves, of which the most remarkable is Fingal's or Great Cave. The entrance, formed by regular basaltic columnar ranges on each side, supporting a lofty arch, is 33 feet wide and 65 feet high. The length of the cave is 230 feet. As one of the most perfect and beautiful specimens of natural architectural phenomena it is much frequented by tourists.

STAFF COLLEGES AND SCHOOLS. Military training schools for officers candidates for staff appointments. To prepare officers for duty on the staff of an army special colleges or schools have been instituted by all the leading military nations of the world. (See MILITARY EDUCATION.) In the United States there is the General Service and Staff College at Fort Leavenworth, Kan., to which officers are ordered for their technical and professional instruction, and students showing marked proficiency in their studies are considered to be eligible for staff or other duties for which they are best fitted. In



FINGAL'S CAVE, ISLAND OF STAFFA

England officers desirous of qualifying for staff appointment must have had five years' service in the army, undergo the two years' course at the Staff College at Sandhurst, and serve at least four months at Aldershot in some arm of the service other than the one to which they belong. The rule in Germany is to select officers for the general staff from among the graduates of the military colleges having the best qualifications and the highest percentages in examination. The training is received at Berlin and Munich. In France staff officers are educated at the Higher War School at Paris, which was first organized as a staff college at the beginning of the nineteenth century, and reorganized in 1875 as the permanent college for general staff candidates. Austria-Hungary sets apart the Kriegsschule at Vienna for instruction in staff work. The Italian general staff school is at Milan, where about 24 officers graduate each year. The Saint Nicholas Academy at Saint Petersburg is the staff school of Russia, entrance to which is competitive to all officers of three years' service and upward. See STAFF.

STAFFORD. The county town of Staffordshire, England, on the Sow, 29 miles northwest of Birmingham (Map: England, D 4). Tanning and the manufacture of cutlery and of shoes are the chief branches of industry. Population, in 1891, 20,270; in 1901, 20,900. Stafford was of importance before the Conquest, is mentioned in Domesday, and King John confirmed and enlarged the privileges of an old charter.

STAFFORD. A town, including the borough of Stafford Springs, in Tolland County, Conn., 20 miles north by west of Willimantic, on the Willimantic River, and on the Central Vermont Railroad (Map: Connecticut, F 2). It is a summer resort, with mineral springs. It manufactures woolens. There is a public library. Population, in 1890, 4535; in 1900, 4297.

STAFFORD, HENRY, second Duke of Buckingham (c.1454-83). An English nobleman and political intriguer. He was the grandson of the first Duke and succeeded to the title in 1460. He was a prominent adherent of the Duke of Gloucester, afterwards Richard III., while the latter, then Protector, was conspiring to seize the throne, and assisted him in his efforts against Earl Rivers and Lord Grey. After the downfall of those noblemen he received as a reward for his services the office of Chief Justice and constable of the royal castles in Wales, and later that of Lord High Constable of England. A few months later, however, he joined the Lancastrians in an effort to overthrow Richard, but his projects were frustrated, and he was summarily tried and beheaded at Salisbury in 1483. He is "the deep revolving wily Buckingham" mentioned in Shakespeare's *Richard III.*

STAFFORD, WILLIAM HOWARD, Viscount (1614-80). An English statesman. He was the fifth son of Thomas, Earl of Arundel and Surrey, and was educated as a Roman Catholic. In 1634 he married a sister of the thirteenth Baron Stafford, and on the latter's death assumed the title. This marital claim was afterwards disputed, but finally decided in his favor, and a new creation was made by the King, declaring him Baron and afterwards Viscount Stafford. During the Civil War he was a firm adherent of the King, but after the Restoration (q.v.) frequently opposed the royal will from his place in the House of Peers. In 1678 Stafford was one of those denounced by the infamous Titus Oates (q.v.) as a conspirator in the pretended popish plot. He was impeached on a charge of high treason, and, despite a spirited defense against suborned testimony, was found guilty and publicly executed on Tower Hill. In 1824 the act of attainder was reversed by Parliament.

STAFFORDSHIRE. An inland county of England, bounded on the west and northwest by Shropshire and Cheshire (Map: England, D 4). Area, 1128 square miles; population, in 1891, 1,083,408; in 1901, 1,234,382. In the north wild moorlands in long ridges, separated by deeply cut valleys, extend from northwest to southeast. The surface is low and undulating in the midland regions, but becomes hilly again in the south. The Pottery coal field occupies the north, and the Dudley coal field, remarkable also for its abundant and rich iron ores, occupies the south. The Trent, flowing first southeast through the county, then northeast along its eastern border, is the chief river. The climate is humid, much of the soil is clayey, and agriculture is in a backward condition. The manufactures, however, are extensive and varied, including cutlery and ironware, pottery, shoes, and glass, and cotton, silk, and leather goods. Stoke-upon-Trent and Burslem are the chief seats of the pottery industry. Capital, Stafford.

STAG, or RED DEER. See DEER; ANTLERS.

STAG-BEETLE. Any member of the Lucanidæ, a family of beetles including 500 to 600 species. The common name is derived from the shape of the mandibles of the males, which are developed in some species so as to equal in length nearly that of the entire body, and are armed with spines or teeth. The males are of varying size and exhibit remarkable differences in the development of the head and mandibles. In each species in which these extraordinary variations occur there are no subtle intergradations, so that distinct 'forms' or 'states' occur, the largest being termed 'teleodont,' the smallest 'priodont,' and two intermediate forms 'mesodont' and 'amphiodont.' *Lucanus cervus* is the common English species. *Lucanus dama* is the commonest North American species. In the Southern States *Lucanus elaphus,* the giant stag-beetle, occurs. See Colored Plate of BEETLES.

STAGE, THE (OF. *estage,* Fr. *étage,* stage, floor, loft, from Lat. *stare,* to stand; ultimately connected with Eng. *stand*). A term frequently employed to designate the profession of the actor. This will accordingly be discussed in the present article, with reference especially to the life and training of actors, past and present; while in the article THEATRE will be found details of the construction and management of theatres as they affect the audience. Until the beginning of the nineteenth century the actor was classified by English law with vagabonds. In the Middle Ages actors, like poets and musicians, were more or less upon a footing with the household servants of the great; in fact, often were the servants of the nobility. Until 1875 in great English houses it was not uncommon to see a silken cord placed somewhere in one of the drawing rooms to separate the artists or performers at a formal soirée from the invited guests. If this

was the feeling toward acknowledged artists, it can be readily believed that the strolling player from Shakespeare's time down to the beginning of the last century was looked upon as but one step above the tramp. Within the last fifty years the social status of the actor has vastly improved, because of the more universal interest taken in stage performances, the higher salaries paid to actors, and the better organization of the theatrical business as a whole. For the first time in the history of England an actor, Sir Henry Irving, has been knighted for his services to the stage. With the growth of importance of the theatrical business, the character of its management has changed, with a decided loss in some directions and a gain in others. The old-time manager from Shakespeare's day to that of Sir Henry Irving in England, and of Lester Wallack in this country, was always an actor and not a business man. Within the last twenty-five years the management of most American theatres has fallen into the hands of business men, with a consequent loss in artistic quality and a gain in financial stability. The permanency of theatrical enterprises, and the fair certainty that contracts will be carried out, have made the profession less of a hazardous undertaking than it formerly was. At the same time, the fact that theatrical contracts are seldom made but for one season, commonly of forty weeks, that few plays please the public for more than a year, and that there are always several thousand unemployed actors and actresses in the United States alone, renders the actor's life, for the rank and file at least, a more or less uncertain one. Among the other disadvantages of the stage as a profession may be mentioned the absence of home life, nine-tenths of the profession having to travel from town to town, and the loss of earning capacity after a certain age. The advantages of the profession are that it requires no capital, and that there is always a possibility of earning a much larger salary than the average man or woman can expect in other businesses or professions.

Within the last thirty years the number of theatres in this country has increased from hundreds to thousands, and according to trustworthy statistics there are now about 10,000 stage performers in the United States, to which number must be added about as many more persons employed as musicians, scenic artists, stage hands, costumers, and theatrical employees, making an army of about 20,000 persons who look to the stage for support. The people on the stage are employed by 400 theatrical companies, with an average of twenty persons to each company. The Actors' Fund of America, the charitable organization of the dramatic profession in the United States, has a record of 17,000 persons employed in capacities entitling them to its recognition. Few plays are given in Germany and France for more than a few weeks at a time. In England and the United States the same play is performed as long as it attracts a playing audience, and most American companies are organized for one particular play, which is given throughout the season. This system entails constant traveling, which is one of the hardships of the actor's life. Scores of companies play the 'one-night stands,' as they are called, for month after month right through the season, traveling by day and acting at night. Miss Clara Morris, in her reminiscences, speaks of traveling all day without food to get to a town where she had to play the light-hearted daughter of a millionaire in the evening; she had to wear a low-necked dress upon a stage in Winnipeg, with Arctic blasts sweeping the stage; while a month later in Texas, with the thermometer at 100°, the part called for furs.

The number of women stage performers now exceeds that of men. Until 1660 they were forbidden upon the English stage, the female parts in Shakespeare's day being taken by boys or young men, which was also the custom in France and Germany. Women so soon became popular as actors that one of Dryden's comedies was produced in 1668 in London with all the parts, both male and female, played by women. With the employment of women greater attention was paid to costuming. A Parisian dancer, Mlle. Sallé, raised a storm in 1740 by appearing in the ballet of Pygmalion in Greek costume. Paris audiences objected to the innovation, but London accepted it. It was not, however, until Talma insisted in 1800 upon playing Brutus at the Théâtre Français in Roman costume and without a powdered wig that classical plays were costumed according to the epoch represented. It may also be supposed that the appearance of women as actors led to a more natural style of acting. So far as may be inferred from the books of the seventeenth and eighteenth centuries, acting in England and France was then as stilted and artificial as the manners of the time. Talma, Rachel, and Lemaître in France, Garrick, Kean, and Macready in England, instituted more natural methods. In more recent years what is known as 'realism' has made itself felt in acting as well as in literature. The old-time actor underwent a long training in the traditions and technicalities of the art; he was expected to play many parts. The actor of to-day has usually a narrower range.

Whether to trust to study and calculation or to inspiration when on the stage is a question on which experts differ. The noted French comedian Coquelin teaches that all acting is a distortion of nature so regulated by study and experience that it will seem to be nature when seen by an audience. The actor, says Bronson Howard, the American playwright, must make the people in the audience, some of them a hundred feet away, think that he is moving, appearing, and speaking like the character he assumes, and to do so he must do something that he would never think of doing in real life in the same circumstances. His talk and gesture must be as false as his complexion in order that they may seem real. Such exaggeration is an art that must be learned like any other. The foremost dramatic school of Europe has been that of the Paris Conservatoire, whose prize winners are engaged by the Paris Théâtre Français and the Odéon. In the United States the stage is now partly recruited from schools in New York, Boston, and Chicago, which graduate yearly several hundred pupils who have studied elocution, acting, make-up, costuming, etc., and have taken part in constant rehearsals of standard plays. Of these schols the oldest is the American Academy of Dramatic Arts (q.v.), founded in New York in 1884 by Franklin H. Sargent. Many actors who have retired from the stage also make a business of teaching.

A prosperous theatre in the city of New York may in a favorable season do a business of about $400,000 and keep in employment 150 persons. Only a few theatres, and those in large cities, now maintain stock companies of their own; local managers accept the performance given by an American or English company which comes for a shorter or longer period, taking as its pay a certain share of the receipts. As a rule the dramatic author receives from five to ten per cent. of the gross receipts in return for the use of his play. There is also an arrangement called the 'sliding scale,' by which the author's royalties are in a changing ratio to the gross receipts. The employees of the theatre consist of actors, stage hands, or men who move the scenery, manage the lights, etc., musicians, door-keepers, ticket-sellers, and ushers. Where stock companies are maintained there are also a number of scene-painters and costumers employed. Costumes are sometimes provided by the manager and sometimes by the actor. In costume plays—those in which scenery and elaborate costumes of another age are used—the manager provides them; where modern plays are the rule, the male members of the company generally provide their own clothes.

The salaries paid vary according to the standing of the company. In a first-class New York theatre the leading four or five people in the company may receive from $100 to $250 a week. From these figures, which are five times what actors were paid half a century ago, there is a gradual drop to $20 or $25 a week for the people who have but a line or two to say. In companies playing burlesque or light opera, the chorus girls receive from $12 to $20 a week, while the male chorus singers average $20. The star, as the leading actor of the company, male or female, is called, usually makes a special arrangement to take a share of the receipts in lieu of salary. All companies include a stage manager, who often plays one of the parts; for elaborate productions a special stage manager at a salary of from $75 to $100 a week is engaged to arrange the stage pictures. The cost of mounting a new play may vary from $2000 to $20,000, according to the number of people employed upon the stage, their costumes, the scenery, and properties. It is not unusual for the three or four costumes used by a chorus singer in one play to cost $100; the costumes for the dozen or more important characters may cost $500 for each player. The expense of putting on a big London Christmas pantomime, which sometimes employs 250 people on the stage, seldom falls short of $40,000. If a play proves to be a great success a second, third, and even fourth company may be organized to give it on 'the road,' one company going south, another north, thus covering the country before the fame of the original performance has died out.

The arrangement between the owner of the theatre and the manager of the company is a sharing plan. The latter furnishes the play, the actors, such special scenery and properties as have to be carried, the costumes, the street bills, and window advertisements; he also employs a man known as the advance agent to go ahead of the company to awaken interest in the performance by the insertion of newspaper articles and by any other devices that may serve. The manager of the theatre furnishes everything else, including as many extra stage hands as may be necessary to handle especially heavy scenery. The average division of receipts is 60 per cent. to the manager of the company and 40 per cent. to the theatre. A very popular actor may insist upon better terms.

The business of carrying a company through the country is so complicated that it has now largely fallen into the hands of a few large firms, who undertake to lay out the route, to make the engagements with local managers, and the contracts with the railroads for transportation. To lay out a route for a traveling company it is necessary to know (1) the seating capacity of every theatre in order that the company may not be sent to a house which it might pack and still lose money; (2) the number, character, and taste of the population, in order that a play wholly unsuited to it may not be offered; (3) the cost of railroad transportation. The company has to be kept going. In some places it can play a week, in others three nights, in others only one. The manager of the company has to pay all railroad fares, so that the nearer the towns in which he plays the better. Furthermore, he must as far as possible know what other attractions will be offered against him; a circus in a country town will 'kill' any play. The dramatic agencies do all this work for the companies, receiving a certain share of the profits in return and also payment from the managers of theatres to whom they furnish attractions. The most important agencies some years ago organized themselves into a syndicate, which made it almost impossible for any outside manager to engage 'time' in any of the best houses of the larger cities. The syndicate refused to send companies to any theatre which received an outsider. It not only controlled theatres, but it produced plays, recognizing only such playwrights and actors as consented to its terms. As the members of this powerful syndicate are business men rather than artists, art has suffered. A few prominent actors and managers, tired of the syndicate rule, have within the last year or two cut loose from it and have encouraged the building of independent houses in the largest cities of the country. There are now such independent theatres in New York, Philadelphia, Boston, and a few other cities.

The ordinary dramatic company is divided somewhat as follows: (1) leading man and woman, to whom are allotted the most important parts of the play; (2) juvenile man and woman, who play the two parts next in importance; (3) character actors, men or women, who play parts requiring eccentric acting or appearance; (4) old man and woman; (5) heavy man, who is mostly the villain of the piece; (6) utility people, minor actors who can be trusted with small parts; (7) walking gentlemen and ladies, people who simply appear but have nothing to say beyond a few unimportant words; (8) supernumeraries, commonly known as 'supes,' people who fill up stage pictures, but have no lines to speak and are usually under the direction of a 'captain;' (9) the stage manager. Other necessary employees in every theatre are the wardrobe woman, who cares for all the costumes, the property man, who looks out for the furniture and any articles needed upon the stage, the stage carpenters, the electricians, who attend to the lights,

and the scene-shifters. The stage manager is responsible for the smooth working of the performance. He sees that the stage is properly prepared for each act, he 'rings' the curtain up and down, and makes sure that each actor is ready for his cue to come on. The stage manager usually plays a small part that will give him time to attend to his other duties. In large companies there is also a stage director, who rehearses the play, calls extra rehearsals when he thinks they are necessary, and is generally responsible for the artistic part of the performance. Each part is studied by two persons in the company, so that in case of sickness the understudy can step in. Rehearsals made necessary by the substitution of an understudy are conducted by the stage manager, who also has charge of the music, the behavior of the supernumeraries, stage hands, etc.

The 'greenroom,' where in the old days the actor could wait while not on the stage, has been sacrificed in most modern theatres to the need of room for the elaborate scenery now used. In Europe it is still an institution and in important theatres, such as the Théâtre Français of Paris, it is a reception room handsomely fitted up, to which the favored patrons of the house are admitted. All important European theatres maintain stock companies, the important members of which are State employees. The company as a whole seldom plays outside of the home theatre, but leading actors are allowed to appear elsewhere as 'guests,' when they receive double pay. This visiting system, which is much in vogue in Germany, enables the chief actors to see what is done in rival theatres and provides variety of entertainment.

BIBLIOGRAPHY. Pougin, *Dictionnaire historique et pittoresque du théâtre* (Paris, 1885), a good account of French theatres and actors; Malone, *History of the Stage* (London, 1821), an exhaustive account of the English stage to the beginning of the nineteenth century; Lewis, *On Actors and the Art of Acting* (New York, 1880); Dunlop, *History of the American Theatre and Anecdotes of the Principal Actors* (ib., 1832), the best account of the early American theatres; Hubert, *The Stage as a Career* (ib., 1900), an account of the actor's life, its requirements, rewards, and hardships; Blum, *Allgemeines Theater-Lexikon* (Leipzig, 1842).

STAGGER BUSH. See ANDROMEDA.

STAGGERS. Various affections of animals. In horses, mad or sleepy staggers is attributed to inflammation of the brain and is considered fatal. Grass or stomach staggers is said to result from indigestion. In sheep a tapeworm in the brain cavity is held accountable for the phenomenon.

STAGHOUND. See HOUND.

STAGING. Staging and scaffolding are interchangeable terms for the temporary frameworks of timber erected about a building under construction or repair, to furnish platforms for the workmen and for the materials and implements of construction required for immediate use. For exterior work the staging may be built up in one of three ways: by series of movable trestles or 'horses' supporting planks, in successive tiers or stages; by 'putlogs' projecting horizontally through temporary holes in the masonry, to support the platforms; or by rows of lofty poles or posts standing on or in the ground, to which are nailed, bolted, or lashed with ropes the necessary girts and cross-pieces, with braces to prevent the sidewise racking of the frame. In cities a very heavy staging is also built of heavy timbers over the sidewalk for the protection of passers-by. Materials are hoisted by derricks, or in France by means of scaffold-towers of poles, often of elaborate construction. For the erection of interior trusses, as in railway stations, stagings on wheels or rollers are often used, being moved from one truss to the next, as each is completed. Similar stagings are used in decorating and repairing the vaults, domes, or ceilings of lofty interiors. The construction of stagings often calls for a high degree of engineering skill. The stagings erected to support the trusses of bridges while building are called *falsework*.

STAGI'RA or STAGIRUS. An ancient town in southeastern Macedonia, on the Strymonic Gulf, celebrated as the birthplace of Aristotle. It was founded in the seventh century B.C. by a colony from Andros, but declined during the Peloponnesian War. The modern village of Stavro is on its site.

STAGIRITE, THE. A name frequently given to Aristotle from his birthplace, Stagira.

STAGNELIUS, stâg-nā'lê-ụs, ERIK JOHAN (1793-1823). A Swedish poet born on the island of Onland, and educated at Upsala and Lund. He was deeply interested in Gnosticism and treated all sides of this question in his books. He is considered a master of form. He published the epic poem *Wladimir den store* (1817), the philosophico-religious *Liljor i Saran* (1821), *Martyrene, his best drama* (1821), and the tragedy *Bacchanterna* (1822).

STAHL, stäl, ERNST (1848—). A German botanist, born near Strassburg, and educated there, at Halle, and at Würzburg. He became professor in Strassburg in 1880, and professor and director of the botanical gardens at Jena the following year. He visited Ceylon and Java in the winter of 1889-90. Among his books are *Entwickelung und Anatomie der Lenticellen* (1873), *Einfluss des Lichtes auf den Geotropismus einiger Pflanzenorgane* (1884), *Zur Biologie der Myxomyceten* (1884), and *Regenfall und Blattgestalt* (1893).

STAHL, FRIEDRICH JULIUS (1802-61). A German politician and political philosopher. He was born in Munich of Jewish parents, turned Protestant in 1819, studied at Würzburg, Heidelberg, and Erlangen, and in course of time became professor of law at Erlangen, Würzburg, and Berlin. In 1849 he was made a member of the Upper House of the Prussian Legislature, and in 1850 he was a member of the Erfurt Parliament. Stahl was a leader in the Lutheran Church, and became one of the most powerful influences for reaction in Germany. He stood for an absolute monarch and an absolute Church that should control the monarch. The basis of his political philosophy was the conception of the subserviency of all things lay and clerical to the will of God as expounded by the clergy. His most important work is the *Philosophie des Rechts nach geschichtlicher Ansicht* (1830). Some of his other works are *Ueber Kirchenzucht* (1845), *Das monarchische Prinzip* (1845), *Der*

christliche Staat (1847), *Die Revolution und die konstitutionelle Monarchie* (1848), *Die lutherische Kirche und die Union* (1859).

STAHL, GEORG ERNEST (1660-1734). A German physician and chemist, born at Ansbach. He was called in 1694 to the chair of medicine, anatomy, and chemistry in the newly founded university of Halle, whence he removed to Berlin in 1716, and was appointed physician to the King of Prussia. Stahl was one of the ablest chemists of his time, and destroyed numberless absurd opinions which had found their way into science, and propounded the first general theory of chemical transformations (see CHEMISTRY), which was universally accepted till the time of Lavoisier. His works, according to Haller, number 250, the most important being *Theoria Medica Vera* (1707, and 1831-33), which contains his medical theory, and *Experimenta, Observationes et Animadversiones Chymico-Physicæ* (1731), in which his chemical opinions are set forth. An account of his opinions is found in Lemoine, *Le vitalisme et l'animisme de Stahl* (Paris, 1864). Consult also Lasègue, *De Stahl et sa doctrine médicale* (ib., 1846).

STAHR, stär, ADOLF (1805-76). A German author, born in Prenzlau, Prussia. After study at the University of Halle he went to the gymnasium at Oldenberg, and in 1836 became professor there. While on a tour through Italy in 1845, which was afterwards described in *Ein Yahr in Italien* (1847-50), he met the author Fanny Lewald, whom he married in 1855, after separating from his first wife. Perhaps the most noteworthy of his writings are his classical studies, which include translations from Aristotle, Suetonius, and Tacitus, and *Bilder aus dem Altertum* (1863-66). His miscellaneous works, some of which have been translated into English, include: *Charakteristik Immermanns* (1842); *Die Republikaner in Neapel* (1849); *Die preussische Revolution* (1850); and *G. E. Lessing, sein Leben und seine Schriften* (1858).

STAIGG, RICHARD M. (1820-81). An American genre and portrait painter. He was born at Leeds, England, and studied drawing in an architect's office before coming to America in 1831. He began painting miniatures on ivory, and soon attained a high degree of excellence. He was elected member of the National Academy of Design in 1861. In 1867-69 he studied at Paris, and after his return he ceased miniature painting and devoted himself to portraiture and coast scenes. His work is pleasing in color and detailed in execution. His genre pictures, characterized by an unaffected simplicity and grace, include "Learning to Slide" and the "Sailor's Grave," Stuart collection, Lenox Library, New York City, and the "Cat's Cradle."

STAINED GLASS The process of coloring glass requires particular care. When it is to be of full color (as commonly for windows of rich decorative effect) it is called 'pot metal;' but, while colored glass of many hues and tints is used in which the whole mass of the glass is equally stained throughout, certain colors are prepared by covering one side of a piece of colorless glass with pot metal of the color required. Crimson and ruby glass for windows is made in this way, the process being called 'flashing.' Opaline glass, much used for windows in America since 1885, though known and used long before, when very much clouded or stained so as to be nearly opaque, for utilitarian purposes, has some of the opal's power of giving at once the general color and its complementary color; thus glass of smoky blue shows also a spark of orange or of pinkish light. It has been found practicable to give the opaline character to glass of the full color of pot metal; and upon this depends much of the splendor of recent American windows. Glass so colored is often not of the same degree of translucency throughout. Some pieces of opaline and other glass prepared for windows vary much in the same piece with regard to this matter of translucency. The designer, while directing the choice of glass for a rich mosaic window, will sometimes be in doubt just where to cut off the sheet, and will experiment with rays of sunlight falling upon the glass to see where it becomes too nearly opaque for his use. Some of these sheets of glass prepared for rich windows have much change of color in their mass, cloudings, and veinings of different hues, the contrasts being enhanced by the varying thickness of the parts of the same sheet. The composer of a rich window knows how to utilize these contrasts and gradations.

Iridescence, as found on the surface of ancient glass vessels and fragments which have been long buried in the earth, is the result of a curious process of decay, in the course of which the substance of the glass becomes disintegrated, forming thin laminæ, which are no longer brittle as a thin piece of undecayed glass would be, but have rather the crumbling texture of flakes of mica or the like; that is to say, this part of the glass has lost its vitreous qualities. Modern attempts to produce iridescence are, of course, not in that direction; the attempt has been to give the changing play of colored light to the surface of perfect glass. They are of different character, according to the greater or less degree of translucency desired. The ancient and partly decayed glass is of course mainly non-transparent, but still allows some light to pass through it. Thus in a phial or plate of that pale green transparent glass so common in the Greco-Roman period, parts will be brilliantly iridescent when the piece is found, and still other parts will have a whitish degeneracy which is incipient change of mass. These parts will be comparatively opaque, not allowing a small object to be clearly seen through their substances, while other parts of the same vessel will be entirely transparent as soon as the earthy deposits have been removed. The most common iridescent glass of modern manufacture is, however, entirely clear, and an iridescent effect of the surface, like that of the surface of a soap-bubble, is given by some process which is often kept secret. During the last two decades of the nineteenth century a very brilliant glass was made in America by a single establishment. In this glass, the uniting of successive layers of the material, one imposed upon another while hot, allows of giving to one or both surfaces a brilliant iridescence which, when fully developed, makes the whole mass entirely non-translucent. It is full of the play of brilliant color, nearly like a rich piece of mother-of-pearl. This process differs wholly from enameling

(q.v.). in that the glass to be made iridescent is not allowed to lose its high degree of heat. It is continually returned to the furnace at very brief intervals, and the layers of glass become a solid mass, although close examination will often reveal their once separate existence and their number. The idea may have been taken from the Greco-Roman pieces, which are often amber or violet in the natural state of the glass, like modern pot metal, and rendered opaque and iridescent by the gradual decay of the exterior surface.

In the course of experiments upon iridescent and lustrous surfaces, much was done in the way of depositing iron, tin, and other metals in a nearly pure state. By way of producing *tours de force* for exhibition pieces, these metallic deposits were sometimes carried to surprising extremes; thus about 1890 a vase was exhibited which was of glass within, but had its outside almost wholly non-vitreous and showing only an opaque and rough surface of warm brown; and this piece was described by the exhibitor as containing as much iron as glass could possibly receive and retain.

STAINED GLASS WINDOWS. By far the most important use of stained glass is its application to the artistic decoration of windows, usually termed glass painting, though properly speaking it is not painting at all. Originally, there was but one method of making ornamental glass windows, and that was to produce the pattern in outline with finely made leaden frames, into the grooves of which pieces of colored or stained glass were fitted. It appears to have been a branch of art unknown to antiquity and to have been used in a primitive fashion in churches of the fourth and following centuries, the different colors forming not figures, but ornamental patterns. These are described by early authors such as Prudentius, Sidonius, Apollinaris, and Gregory of Tours, but nothing of this period has been preserved. The majority of windows up to the eleventh century were closed by thin slabs of alabaster or other translucent material often pierced by holes arranged to form patterns, as at Santi Vincenzo ed Anastasio and other Roman churches.

One of the best known of the early examples of the use of figures in glass windows is of the eleventh century in the former monastery of Tegernsee (Bavaria); like all of the first attempts, they were only tasteful arrangements of colored glass in imitation of the stone mosaics used for floors, etc. Shortly afterwards in the twelfth century the monk Theophilus describes in his treatise the method of making such windows as the earliest ones at Chartres, Saint Denis, and Vendôme. The centre of the steady progress throughout the twelfth and thirteenth centuries was in Northern France, where the use of Gothic architecture, with its immense increase in the size of the windows, suddenly brought stained glass windows into prominence, not only as one of the most important accessories of architecture, but as the one prominent color factor in the great Gothic interiors. As the windows occupied the entire wall-space between the piers, both in the aisle-walls and clerestories of the churches, they afforded the same opportunity for composition that the solid walls had previously offered to fresco-painting. The French cathedrals of the thirteenth century at Le Mans, Chartres, Bourges, and to a less degree Rheims and Rouen, preserve whole series of contemporary windows, which gave the type to other countries and to the succeeding century. Those of the Sainte Chapelle in Paris are also of extreme beauty. The characteristics of the earliest Gothic windows are: multiplication of small figures in many separate compositions grouped in tiers or rows of framed medallions; rich and dark coloring; wide decorative borders; heavy leads bent so as to outline the figures or cut them in the deep shadows.

The development during the fourteenth century was toward lighter coloring, larger figures, narrow borders, more ornamentation in the body of the windows, more delicate gradations of color, and increase of modeling, loss of simplicity, and tendency to mannerisms, while in the fifteenth century much clear glass was introduced into the backgrounds, and inscribed ribbons and architectural accessories became conspicuous, whereas the earlier windows are composed of many small and distinct pictures set in a groundwork of grisaille or of color ornament, the later ones comprising a single figure or picture for each light or even a composition occupying the whole window. The designers of the Gothic age did not, to any great extent, give the details of their pictures on glass as their successors—Renaissance and modern—mistakenly attempted to do, but obtained their superb effects by a clear knowledge of the interaction of colors, by juxtaposition of complementary colors, and the effect of distances; the technique being that of glass colored not on the surface, but in the mass either by stain or incorporation. This branch of art was, therefore, governed by totally different artistic principles from those governing opaque painting (fresco, oil, tempera, tapestry, etc.), and these principles were thoroughly understood.

The practice of painting on glass, i.e. of applying color with the brush on fusible pigments fixed by heat, began in the use of grisaille, a browning pigment, for cross-hatching and outlining on clear glass the ornamental details of the backgrounds, in order to soften the glare of the clear glass without introducing disturbing color-elements. It was then applied, even in early French windows, to the faces and hands to indicate the features and fingers; and its use extended gradually to all the shaded details, the inscriptions and ornaments, of the later windows. The perfection of the French work of the thirteenth century has never been equaled. These series of cathedral windows were also one of the principal branches of Christian iconography (q.v.), joining with sculpture in expressing the subjects of religious thought in art.

During the latter part of the thirteenth century the art was carried to England, Germany, and Italy, where it did not really flourish before the following century. In Italy the imperfect understanding of Gothic methods did not allow of the use of such immense windows, and the art never became thoroughly acclimated. At Arezzo Cathedral are some windows by a French artist, Guillaume de Marcillati, proving the transmission from France. Other interesting examples are in San Francesco at Assisi, San Petronio in Bologna, and the Cathedral and Santa Croce in

Florence. Many of the best Italian examples belong rather to the early Renaissance than to the late Gothic. England would have possessed some very fine series, as is shown by the examples at York and Canterbury, had it not been for the vandalism of the Reformation. In Spain there are fine windows at Toledo and Leon, very close to French models. Germany, however, ranks next to France in the importance of its remaining windows, beginning in the fourteenth century, with those of the choir of Cologne Cathedral, those of the cathedrals of Freiburg, Strassburg, and Regensburg, and the churches at Oppenheim, Esslingen, and Nuremberg. German works, however, do not approach the French in quality either of technique or art.

As the fifteenth century approached the use of *grisaille* or light colorless monochrome windows increased. This process had always been in use for smaller windows or borders with geometric designs, as at Obasine and Auzerre in France, Heiligenkreuz in Austria, and Sainte Gudule at Brussels, but it became more popular and was used in larger windows as the Renaissance period approached; the brown enamel on the white or greenish ground became lighter, all the glass less opaque, and the leads more delicate. In colored glass windows a brilliant window became very popular, while green and violet went out of fashion. The donor's window at the Cathedral of Evreux shows how the fourteenth-century artist substituted realism for the older conventions, and introduced profusely architectural forms as framework and background of the figures. The increased use of the white line and background and the invention of the yellow stain, used profusely in place of the applied enamel, increased the light effect. With the approach of the fifteenth century the increased perfection in drawing and naturalism does not compensate for the loss of the special methods of glass painting, for which artists commenced to substitute effects taken from wall and other forms of opaque painting. In Germany a peculiar novelty popular during the Renaissance was the use of coats of arms as the exclusive or almost exclusive design. The extreme of possible realism was then reached in the architectural and landscape effects of the windows at Gouda in Holland. Jean Cousin in France; Holbein, Ghiberti, and Paolo Uccello in Italy; Dürer and Baldung Grün in Germany—were among the prominent artists of the Renaissance who designed windows. At the same time this very fall of the glass-painter to the rank of an artisan and the influence of painting on his art hastened its fall in the seventeenth century.

The attempts to revive it during the two following centuries, as exemplified by Sir Joshua Reynolds's remarks, were based upon the same mistaken principles. The glass windows produced to the middle of the nineteenth century were paintings on glass in imitation of oil or water-color pictures—of opaque effects in painting. The majority are, therefore, inadequate and commonplace, works of industry rather than art. The Munich School bettered the process somewhat; the revival of the study of Gothic art between 1850 and 1875, especially that initiated in France by Viollet-le-Duc, led to a better appreciation of and an attempt to revert to mediæval processes. The French first rediscovered them, and American artists, of whom the most prominent is John La Farge, have done perhaps more than any others during the last decade to replace glass painting again in the sphere of real art. Besides studying again the irradiation of colors, the special requirements of transparent painting, and the consequent grouping of complementary colors, artists like La Farge and Tiffany have produced wonderful effects in iridescence with an increase of richness in tones similar to glass mosaic-work. A questionable but extremely popular American innovation has been the introduction of what may be called modeled glass, to reproduce the effects of shading by its purposed or accidental variations of thickness. American artists also make large use of the accidental streakings of vari-colored glass ('pot metal') to produce pictorial effects without painting and without too minute subdivision and leading of the picture.

BIBLIOGRAPHY. Lévy, *Histoire de la peinture sur verre en Europe* (Brussels, 1854-60); Gerspach, *L'art de la verrerie* (Paris, 1885); Westlake, *History of Design in Painted Glass* (Oxford, 1879-94); Kolb, *Glasmalereien des Mittelalters und der Renaissance*, with 60 plates (Stuttgart, 1884-89); Didron, in *Annales archéologiques*, vols. xxiii., xxiv., xxvii. (Paris, 1878-81). The first historic study, really scientific and artistic, was Viollet-le-Duc's article "Vitraux" in his great *Dictionnaire raisonné de l'architecture française* (Paris, 1858-68). Consult also: Lasteyrie, *Histoire de la peinture sur verre d'après ses monuments en France*, with 110 plates (ib., 1853-57), and Geyling and Löw, *Meisterwerke der kirchlichen Glasmalerei* (Vienna, 1895 et seq.). A model publication of one of the great series of Gothic windows is Hucher, *Vitraux peints de la cathédrale du Mans* (Le Mans, 1864), with 100 immense plates. For American work consult Sturgis, "Decorative Windows in England and America," in *Architectural Record*, vol. vi. (New York, 1896-97); La Farge, *The American Art of Glass* (New York, 1893), and the same author's article "Window" in Sturgis, *Dictionary of Architecture* (New York, 1901).

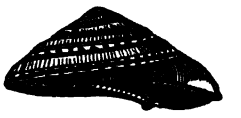
STAINER, stīn'ẽr, JAKOB (1621-83). A German violin-maker, born at Absam, Tyrol. He was the son of poor peasants, but at an early age began to make violins and subsequently studied at Cremona under the best makers of his time. His extravagances kept him in continual poverty and he died in an insane asylum in Absam. Stainer violins are rare and command high prices, though they do not rank with the instruments of Guarnerius, Stradivarius, or the Amati (qq.v.).

STAINER, Sir JOHN (1840-1901). An English composer and organist, born in London. In 1854 he became organist and choirmaster of Saint Benedict and Saint Peter's Church, and two years later was selected by Sir Frederick Ouseley as organist for the newly founded College and Church of Saint Michael, Tenbury. He held this appointment for three years, during which time he had matriculated at Christ Church, Oxford, and had taken his degree of bachelor of music. He next became organist of Magdalen College, Oxford, at the same time entering the university as an undergraduate. In 1863 he took his degree and was appointed

organist of the university and conductor of t
two musical societies. In 1865 he was m
doctor of music, and in 1866 became one of
examiners for musical degrees. He succe
Sir John Goss as organist of Saint Paul's,
don, from 1872 to 1888, when he was kni
by Queen Victoria, and the following yea
appointed to the chair of music at Oxfor
versity. He was also professor in the
College of Music. In 1878 he was
chevalier of the Legion of Honor. Hi
sitions are nearly all for the church an
the oratorio *Gideon*, and the cantatas *T*
ter of Jairus (1878), *Saint Mary*
(1883), and *The Crucifixion* (1887).
positions include numerous anthem
canticles, songs, and primers; and,
tion with W. A. Barret, a dictiona
terms (1876, 3d ed. 1880). His t
among the best in the English lan

STAIR, VISCOUNT and EA
DALRYMPLE.

STAIRCASE-SHELL. A
for the low, conical, handsomel
shells of the mollusks of the
and especially of the genus S



STAIRCASE

1, The common existing spe
2, A fossil form (*Solarium*
taceous of Belgium.

genus the umbilicus
sculptured edges of th
comparable to a sp
lusks are related to

STALACTITE
tos, oozing, from
στάω, *stalazein*, *σ*
STALAGMITE (fro
dripping, from
Elongated masse
mineral substan
rise from the fl
with carbonic
as all rain ar
less carbonic
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after the abduction of Prince Alexander in August, 1886, until the election of Prince Ferdinand, in July, 1887, then became Premier, and for nearly seven years ruled autocratically, establishing amicable relations with the Porte, but antagonizing Russia. In time his masterful course gained him bitter enemies and aroused the dissatisfaction of Prince Ferdinand. In May, 1894, the Minister resigned. On July 15, 1895, Stambuloff was set upon by three assassins in the streets of Sofia and was left for dead, expiring three days later. The murderers were sentenced to nominal terms of imprisonment. A confession made by one of them in 1902 implicated several men then in power, and tended to cast suspicion on Prince Ferdinand. Consult: Hulme-Beaman, *M. Stambuloff* (London, 1895); id., *Twenty Years in the Near East* (ib., 1898).

STAMEN (Lat., warp, thread, fibre, stamen). The organ in flowers which produces pollen (q.v.). It is usually differentiated into two regions: (1) A stalk-like portion, called the filament, and (2) the terminal anther which bears the pollen sacs. See FLOWER.

STAMFORD. A market town in Lincolnshire, England, on the Welland, 16 miles by rail northwest of Peterborough (Map: England, F 4). It is remarkable for its history and its antiquities, of which four fine churches, two old gateways, and the ruins of a priory remain. Its charter dates from 982. Population, in 1901, 8300. Consult Neirnson, *History of Stamford* (London, 1879).

STAMFORD. A city in Fairfield County, Conn., 33 miles northeast of New York City, on Long Island Sound, and on the New York, New Haven and Hartford Railroad (Map: Connecticut, A 5). It is attractively situated, and contains the homes of many New York business men. There are the Ferguson Library, with more than 10,000 volumes, and the Stamford Hospital. Stamford is especially known for its manufactures of hardware, including locks and keys. Dyestuffs, drugs, pianos, typewriters, and foundry and machine-shop products are also extensively manufactured. In the census year 1900 there was invested in all industries capital to the amount of $5,189,195. The output was valued at $4,743,704. The government, under the revised charter of 1899, is vested in a mayor, chosen annually, and a unicameral council. Population, in 1900, 15,997. Stamford was settled in 1641 by a company from Wethersfield, some of whom were natives of Stamford, England. Until 1662, when the Connecticut and New Haven colonies united, it was under the jurisdiction of the latter. Out of part of Stamford, Darien was created in 1820. Stamford was incorporated as a city in 1893. Consult: Huntington, *History of Stamford* (Stamford, 1868), and an article, "Stamford—1641-1900," in *Connecticut Magazine*, vol. vi. (Hartford, 1900).

STAMMERING (from *stammer*, OHG. *stammalōn*, *stamalōn*, Ger. *stammern*, *stammeln*, to stammer; connected with OHG. *stammal*, *stamal*, stammering, *stam*, Ger. *stumm*, mute, Goth. *stamms*, stammering). An imperfect enunciation of words due to irregular or spasmodic action of the muscles of articulation. The trouble is sometimes a form of chorea (q.v.), sometimes entirely an emotional incoördination. In many sufferers, difficulty lies in the enunciation of the initial syllables of certain words, especially if they begin with *b*, *p*, *t*, or *d*. In some cases, when once pronounced, the syllable is involuntarily repeated again and again. This variety of stammering is sometimes termed *stuttering*. The latter is physical, while stammering is mental. The trouble often begins merely as hesitancy with a disposition to avoid certain words, or a little imperfect articulation and stumbling over certain words. Many regard their condition as hereditary because there are other members of their family who stammer. This is probably an error. Mimicry is the cause in many cases. Some begin at the time of an illness, some are due to fright. The great majority of stammerers begin at the age of five years or earlier. Very rarely is the habit formed after twenty years of age. The proportion of males to females is as 4½ to 1. Malformation of organs of speech in stammerers is so rare that it may be denied. In the very rarest instances disease or defect in the hypoglossal nerve and its muscles exists. Emotion, fear, anger, argument, and embarrassment all increase stammering and are in some instances entirely accountable for it. If the bodily condition is improved, the stammerer acquires more self-control and prevents the occurrence. Out-of-door exercise, mental and moral hygiene, avoidance of all undermining influences, and great care result in conquest of the condition in most cases. Boldness and self-reliance will render it impossible. Measured tones, care in attacking each word, and thoughtful deliberation are almost always absolutely successful. Stammerers can always sing without difficulty. Some learn to enunciate distinctly while performing an associated movement, as tilting the head or lifting a finger with each word. It is stated that in the United States there are over 400,000 cases of this speech defect. Consult Lewis, *Practical Treatment of Stammering and Stuttering* (Detroit, 1902).

STAMP (from AS. *stempan*, OHG. *stamfōn*, Ger. *stampfen*, to stamp; connected with Gk. *στέμβειν*, *stembein*, to stamp, *στείβειν*, *steibein*, to tread, Skt. *stambh*, to make firm or steady). A piece of paper upon which a mark or device has been printed or impressed by authority of law, and which is adapted for the purpose of attaching it to some object chargeable with a duty or tax of some nature. The stamp is usually gummed on the back and attached to the instrument or article by adhesion. Such stamps are usually made to represent different values to suit the requirements of the tax law or revenue act under which they are imposed.

The British Government has long employed stamps for the above purposes, and the United States Government for the purpose of raising revenue during the Civil War imposed a stamp tax upon legal instruments and a great variety of other articles of property. The method is to require a stamp to be affixed to an article before it can be sold, which duty is usually performed by the manufacturer of the article. During the Spanish-American War the United States Government passed a war revenue act requiring stamps on legal instruments and certain articles of commerce. This law was repealed when the necessity for the increased revenue had ceased. However, internal revenue stamps are still required on tobacco, snuff, liquors, cigars, etc., under excise laws, and this is considered to be the

most satisfactory method of collecting revenue upon such articles. Where a stamp tax is imposed on legal instruments the revenue act usually provides that an instrument shall be void unless it has the proper stamp. However, the courts are liberal in their construction of such provisions, and will usually hold an instrument good if the parties inadvertently have omitted to affix the stamp. Consult: Cooley, *Constitutional Limitations;* Parsons, *Contract.* See POSTAGE STAMPS.

STAMP ACT. In American history, an act passed by the British Parliament and signed for George III. (then insane) March 22, 1765, "for granting and supplying certain stamp duties, and other duties, in the British colonies and plantations in America, towards further defraying the expenses of defending, protecting, and securing the same." This act, which was to go into effect on November 1st, prescribed (1) that stamped paper be used for legal and official documents, diplomas, and certificates; (2) that stamps be placed on playing cards, dice, books (excepting those used in the schools), newspapers, pamphlets, calendars, almanacs, and various other articles; and (3) that jury trial be denied to offenders at the discretion of the authorized prosecuting officers. Lord Grenville had given notice in March, 1764, of an intention to introduce such an act, and the various colonies had protested vigorously through their authorized agents, but had been unable to suggest any satisfactory substitute. News of its actual passage reached America early in May, 1765, and immediately a fierce opposition everywhere manifested itself on the ground that the colonists were not represented in Parliament and therefore could not legally be taxed without their formal consent. It was urged, moreover, that the duties would be exceedingly burdensome and would cause the withdrawal from circulation of what little specie there was in various colonies. The stamp agents were nearly everywhere compelled by the 'Sons of Liberty' (q.v.) to resign or to destroy their stamps, or both, while many of them were mobbed and much property was destroyed; so that by the time it was to go into effect the act had been virtually nullified. Resolutions, moreover, were passed by many of the colonial assemblies, notably by Virginia (May 30th) (see HENRY, PATRICK), insisting on the general rights of the colonists as British subjects, and denying the jurisdiction of Parliament over the colonial pocketbook. The famous Stamp Act Congress, composed of delegates from New York, Massachusetts, Connecticut, Rhode Island, New Jersey, Pennsylvania, Delaware, Maryland, and South Carolina, assembled at New York on October 7th, in pursuance of a circular letter sent out June 8th by Massachusetts, and issued a dignified "Declaration of Rights and Grievances," a formal address to the King, and petitions to each House of Parliament. In addition many able pamphlets were written to oppose the act, and on November 1st, when it was to go into effect, bells were tolled, flags were placed at half-mast, and newspapers were put in mourning. Finally, on March 18, 1766, after a long and bitter debate, Parliament repealed the objectionable measure, having previously, however, passed (March 7th) a "Declaratory Act" asserting a right to "bind the colonies and people of America . . . in all cases whatsoever." The repeal caused great rejoicing throughout America, though dissatisfaction was soon expressed with regard to the Declaratory Act. The whole affair has been regarded as one of the chief immediate causes of the Revolution. For the text of the act, consult Pickering's *Statutes at Large,* XXVI. Consult also Frothingham, *Rise of the Republic* (Boston, 1872), and Tyler, *Literary History of the American Revolution* (New York, 1896).

STAMPING OF METALS. See DIES AND DIE-SINKING; MINT.

STAMP MILL. See GRINDING AND CRUSHING MACHINERY.

STANBERY, HENRY (1803-81). An American lawyer and jurist, born in New York City. He was educated at Washington College, Pa., was admitted to the bar in 1824, and for several years was in circuit practice in Lancaster County, Ohio. In 1846 he became the first Attorney-General of the State, and in 1866 was appointed Attorney-General of the United States under Andrew Johnson. This office he held until 1868, when he resigned to act as counsel for the President during the impeachment proceedings. He was then nominated for the Supreme Court bench, but the appointment was not confirmed by the Senate, and he resumed his professional labors in Cincinnati.

STANDARD. A battle-flag; in a broader sense, the emblem of a ruler or a nation. On the Egyptian monuments are representations of standards, usually consisting of the image of some sacred animal, a fan or semicircular disk, an ostrich feather, the symbol of victory, the name of the king, or some other symbolic device. The standard-bearer was an officer of approved valor, and distinguished by a badge representing two lions symbolizing courage, and two other emblems of doubtful meaning. In an Egyptian representation of the siege of a town of the Khita, the enemy appear to have as a standard a shield pierced with arrows. The Bible also refers to the use of banners or standards to mark the divisions and subdivisions of the children of Israel on their march from Egypt to Palestine. The Assyrian monuments show standards attached to the chariots. These are circular disks mounted on a pole, and bear the image of two bulls galloping in opposite directions, a disk supported on two bulls' heads, or the god Asshur represented as an archer standing on the back of one or two bulls. According to Xenophon the Persian standard was a golden eagle. The Greeks do not seem to have used flags or standards of any kind, though we hear on some occasions that the signal was given by displaying a scarlet cloak on a spear or pole.

Legend claimed that the first Roman standard was a wisp of hay (*manipulus*) on a pole. In historic times, however, we find a thorough system of military standards or signa. One of these belonged to each maniple (consisting of two centuries), and their details naturally differed from the legion and the nature of the troops, for the auxiliaries and cavalry naturally bore ensigns not like those of Roman legionaries. As represented on the monuments, the *signum* of the maniple of the legion was a long pole, shod with metal, and near the top a

cross-bar, on which seems to have been a plate with the name of the company. From the ends of this bar hung ribbons tipped with silver oak-leaves. Below the bar along the pole are a number of metal disks, which seem to have been marks of distinction, and consequently vary with the legion and company. Above the bar is sometimes a disk, or a hand, the emblem of fidelity, or the figure of an animal, though these latter seem to appear on the standards of native troops in the Roman service. Another standard bore the image of the Emperor. The standard of the legion was a golden eagle, with spread wings, and usually holding a thunderbolt in its claws. It was placed near the commander in battle, and in the camp had a special shrine, for, like all the standards, it was sacred. Another form of standard was the vexillum, a piece of fringed cloth, hanging from a cross-bar on a pole. This was a very old form, as it was the banner hoisted when the Comitia Centuriata was in session. It gave the signal for battle when raised over the general's tent, and was used by any division on detached duty. It was carried by the cavalry of the legion, and seems sometimes to have been attached to the *signum*. The color of the cloth was red or white. For modern standards and national emblems, see FLAG, and HERALDRY, section on *National Coats of Arms*.

STANDARD, BATTLE OF THE. A name frequently given to the battle fought between the English and the Scotch, August 22, 1138, at Northallerton (q.v.).

STANDARD OF LIVING. In economics, the term used to designate the degree of comfort or enjoyment derived from the use of material goods which each social class regards as essential to tolerable existence. Those have a 'high standard of living' who demand control over a large and varied quantity of consumption goods; those whose wants are few and tastes inexpensive have a 'low standard of living.' The terms are usually used without moral connotations, injurious and degrading modes of consumption entering into a 'high' standard of living, as well as consumption of goods which exercise a refining influence. In some sociological studies, however, the test of a high standard of living is its moral influence. Students of the housing problem (q.v.) regard the development of a higher standard with respect to house room as an advance in the standard of life, although such a development may result in checking expenditure in other directions. In a developing society like that of the United States, the gradations of standards of living are as numerous as those of social classes. In a rough way it may be said that the professional and business classes have a higher standard of living than artisans; and the standard of the latter is higher than that of the laborer. Comparing societies as wholes, the American standard of living is higher than the European, which in turn is higher than the Asiatic. While preserving a certain fixity within relatively brief periods of time, the standard of living of classes or of nations tends to rise or fall as a result of general economic conditions. Throughout the Western world standards of living have been rising for the past hundred years, although the standards of isolated classes have fallen.

In recent discussion much emphasis has been laid upon the influence of the standard of living upon wages. If a social class has a high standard, each individual in it will exert himself to the utmost to maintain the same control over goods as his fellows. A rising standard thus acts as a spur to those whose individual wants would demand no great degree of exertion. To raise the standard of backward races or classes is therefore regarded as a prerequisite to industrial improvement. In the second place, a high standard, assuming that it consists in the consumption of goods which improve the physical and mental condition of the laborer—e.g. good food, clothing, housing, a thorough education and technical training for children—tends in the long run to increase industrial efficiency. Thus the native American workman, owing to his high standard of life, is capable of more effective work than underfed and ignorant immigrants. Thirdly, it is difficult for an employer to beat down wages of laborers whose standard is high. Thus a greater share in the social dividend may be diverted to labor. Fourthly, men whose standard is high refuse to marry until they have a fair prospect of bringing up their children in a way in keeping with class standards. Hence the supply of labor is kept from exceeding the demand for it and wages are kept from falling to a subsistence level. See WAGES; POLITICAL ECONOMY.

STANDARD TIME. See TIME, STANDARD.

STANDARD-WING. Either of two African nightjars of the genus Macrodipteryx, in which the second primary wing-quill of the male is enormously elongated, so as to look like a pennant floating from the wing as the bird flies. In one species it has no vane except near the tip; and when the bird sits upon the ground these feathers stand upright. See Plate of NIGHTJARS, ETC.

One of the birds of paradise (*Semioptera Wallacii*) is also known by this name.

STANDING STONES. See MEGALITHIC MONUMENTS.

STANDISH, MILES or MYLES (1584-1656). An American colonist, born in Lancashire, England. He served in the English army in the Netherlands, and emigrated to America in 1620, being one of the passengers on the *Mayflower*. He was active among the Plymouth colonists as an explorer and Indian fighter and became military leader of the colony. In the summer of 1625, the colony being in great straits, Standish was sent to England to secure the intervention of the Government against the merchant adventurers, but was unsuccessful. He returned to the colony in the following year with supplies and became one of the proprietors and settlers of Duxbury, Mass., where he held the office of magistrate for the remainder of his life. A granite monument to his memory has been erected in Duxbury. The second courtship of Standish has been made the subject of one of Longfellow's best known poems, *The Courtship of Miles Standish*. Consult Bradford, *Plymouth Plantation* (last ed., Boston, 1898).

STANDPIPE. See WATER-WORKS.

STANFIELD, CLARKSON (1793-1867). An English marine and landscape painter. He was born of Irish parents in Sunderland, Durham, and was a sailor and a scene-painter. In 1835 he became a member of the Royal

Academy, and in 1848 settled at Hampstead, where he executed some of his finest pictures. The "Battle of Trafalgar," painted for the United Service Club, is his best work. He painted in a broad style, but his coloring is cold, and he was seemingly untouched by the sentiment of the sea. His realism brought to him the approval of Ruskin, but more recent critics do not find the same pleasure in his works.

STAN'FORD, CHARLES VILLIERS (1852—). A British composer, born in Dublin. In 1872 he became organist of Trinity College. In 1883 he received the appointment of professor of composition and conductor of the orchestra at the Royal College of Music; in 1885 he became conductor of the Bach choir, and in 1887 succeeded Macfarren as professor of music at Cambridge. In 1897 he became conductor of the Leeds Philharmonic Society and in 1901 of the Leeds Festival. He received the degree of doctor of music from Oxford and Cambridge, and in 1902 was created a knight. His compositions include many operas, notably *Savonarola* (1884) and *Shamus O'Brien* (1896), but he appealed to a larger public in his oratorios and choral works.

STANFORD, LELAND (1824-93). An American capitalist, born at Watervliet, N. Y. In 1849 he removed to Wisconsin and for a time practiced law in Port Washington. In 1856 he established a commercial business in San Francisco. He was elected Governor of California on the Republican ticket in 1861. In the same year he became president of the new Central Pacific Railway Company, and, repairing to Washington, successfully lobbied for the passage by Congress of the bill granting Government aid to the project. In the construction of the road he personally undertook the responsibility and supervision of that part of the road crossing the ridge of the Sierra Nevada Mountains, and as a result 530 miles of mountain road were constructed in 293 days. The road was completed in 1866 to Ogden, Utah, where it was subsequently connected with the Union Pacific system. Stanford was elected United States Senator in 1884 and in 1890. He founded Leland Stanford, Junior, University (q.v.) at Palo Alto, California, as a memorial to his son.

STANG, stäng, EMIL (1838—). A Norwegian statesman, son of Frederik Stang. He studied law in Christiania and in 1884, two years after his election to the Storthing, was reckoned the leader of the Conservative Party. In 1891 he was forced to retire after two fairly successful years as Prime Minister and became an assessor of the Christiania Supreme Court. He was called upon again in 1893 to form a Ministry, and stayed in office through the confusion of the early part of 1895, when the task of forming a new Cabinet was declined by nearly every leader of the Radical Party. The dispute as to the division of the consular offices between the two parts of the kingdom caused his overthrow. Stang then returned to his former post in the Supreme Court.

STANG, FREDERIK (1808-84). A Norwegian statesman, leader of the Conservative Party and Norway's first Prime Minister. He represented Christiania in the Storthing in 1859-60; in 1861 formed a Ministry; and in 1873 became first Prime Minister under the new Cabinet regulations. He became popular owing to his part in the introduction of railroads and telegraphs and kept office in spite of a large radical majority in the Storthing until 1880, when he voluntarily resigned. Stang was a national authority on jurisprudence and constitutional law, his principal works being *Systematisk fremstilling of Kongeriget Norges konstitutionelle eller grundlovsbestimmte ret* (1833) and *Om den kongelige sanktionsret efter Norges grundlov* (1883).

STANHOPE, stän'op, CHARLES MAHON, third Earl Stanhope (1753-1816). An English statesman and scientist. He was born in London and was educated at Eton and at Geneva. Returning to London, he married the eldest daughter of Lord Chatham (1774), was elected to Parliament (1780), and succeeded to his father's peerage (1786). Sympathizing with the French Revolution, he introduced into the House of Lords a motion against English interference in the affairs of France. As his motion had no support, he was thereafter known as 'the minority of one.' He was caricatured as 'Citizen' Stanhope. He devised several mechanical inventions, of which the most important was an iron hand press, called the Stanhope printing press. He also perfected a process of stereotyping, and constructed two calculating machines. Consult Fletcher, *Earl Stanhope's Opinions* (London, 1819).

STANHOPE, EDWARD (1840-93). An English statesman, second son of the fifth Earl Stanhope, born in London, and educated at Oxford. He was appointed by Lord Salisbury (1886) Secretary of State for the Colonies. In the following December he was transferred to the War Office and introduced nearly all of the important measures for army reform in England and for the reorganization of the War Department. His administration was sustained in Parliament and the Ministry, but did not enjoy popular support.

STANHOPE, Lady HESTER LUCY (1776-1839). The eldest daughter of Charles, third Earl Stanhope. In 1803 she went to reside with her uncle, William Pitt, as superior of his establishment, and became his most trusted confidant and private secretary. Till his death she had full scope for the exercise of her imperious instincts. On the death of Pitt a pension of £1200 a year was assigned her by the King. Conceiving a disgust for society, she left England and wandered for a year or two in the Levant, finally settling among the semi-civilized Druses of Mount Lebanon in a convent, which she fortified, at the village of Djoun. Here she adopted Eastern manners and by the force and fearlessness of her character obtained a curious ascendency among the rude races around her. She was regarded with superstitious reverence as a sort of prophetess, and gradually came so to consider herself. Assuming the garb of a Mohammedan chieftain, she adopted a religion which seems to have been sincere and profound, and was compounded in about equal proportions from the Koran and the Bible. The main sources of information about her are the notes of the frequent travelers, including Lamartine and Kinglake, who visited her in her strange seclusion, and of Dr. Meryon, her occasional medical attendant. Consult: Meryon, *Memoirs of Lady Hester Stanhope* (3

vols., London, 1845); id., *The Seven Years' Travels of Lady Hester Stanhope* (ib., 1846).

STANHOPE, James, Earl (1673-1721). An English soldier born in Paris and educated at Oxford. He took a prominent part in the siege of Barcelona in 1705, and in 1706 was appointed Minister to Spain. In 1708, under Eugene's orders, he captured Port Mahon, and in 1710 saw the final success of his policy of offensive action in the victories of Almenara and Saragossa. But at the close of the year, separated from his allies and surprised by the swift approach of the Bourbon army under Vendôme, after a brief defense he surrendered at Brihuega. Upon his return to England (1712) he entered politics; became Secretary of State for the Southern Department in 1714; and, after being Chancellor of the Exchequer, was again Secretary of State. His foreign policy was vigorous and excellent, especially in the formation of the Quadruple Alliance in 1718.

STANHOPE, Philip Dormer. An English statesman and letter-writer, fourth Earl of Chesterfield (q.v.).

STANHOPE, Philip Henry, Earl (1805-75). An English historian, born at Walmer. To his efforts are largely due the National Portrait Gallery, the Historical Manuscript Commission, and the copyright law. Though not a great historian, as Macaulay said, he was clear, concise, and exhibited "great diligence in examining authorities, great judgment in weighing testimony, and great impartiality in estimating characters." His most important works are: *The War of the Succession in Spain; A History of England from the Peace of Utrecht to the Peace of Versailles, 1713-1783*, in 7 vols.; *The History of England, Comprising the Reign of Queen Anne, Until the Peace of Utrecht* (4th ed. 1872). The two works last named are the most elaborate of his writings, but are perhaps not so valuable as his *Life of the Right Hon. W. Pitt*.

STANIMAKA, stä'nē-mä'kȧ. A town of Eastern Rumelia, 12 miles southeast of Philippopolis (Map: Balkan Peninsula, E 3). It has a trade in wine. Population, in 1893, 13,089.

STAN'ISLAS I. LESZCZYNSKI, lyĕsh-chĭn'y'skē (1677-1766). King of Poland from 1704 to 1709, and again in 1733. He was born at Lemberg, Galicia, of one of the greatest among the old Polish noble families. He was Palatine of Posen at the time of the war between Augustus II. (q.v.) of Saxony and Poland and Charles XII. (q.v.) of Sweden, which cost Augustus the Polish throne, and conducted negotiations between them in such a manner as to win the regard of the Swedish King, who secured the election of Stanislas to the Polish throne in 1704. In 1709, when Charles XII. was crushed by Peter the Great in the battle of Poltava, Augustus recovered Poland. The property of King Stanislas was confiscated and he joined Charles at Bender, in Bessarabia. He was Governor of Zweibrücken, in the Palatinate, from 1714 until the death of Charles XII., when he took up his residence in Alsace. His daughter Maria became the wife of Louis XV. of France in 1725, and this alliance enabled Stanislas to obtain the election to the Polish throne on the death of Augustus II., in 1733. The latter's son, Augustus III., was, however, installed with the support of a Russian army. The War of the Polish Succession ensued, and by the preliminary treaty of Vienna, in 1735, Augustus III. was recognized as King of Poland. Stanislas retained his estates and received the duchies of Lorraine and Bar, which after his death were to fall to France, together with a pension of two million francs. He was also allowed to retain the title and dignity of King of Poland. He maintained a court at Lunéville and Nancy, encouraged letters, established institutions of learning, and earned the title *le bienfaisant*. He left four volumes, *Œuvres du philosophe bienfaisant* (1767).

STANISLAS II. AUGUSTUS (1732-98). The last King of independent Poland (1764-95). He was the son of Count Stanislas Poniatowski (q.v.) and was born at Wolczyn. In 1752 he was elected to the Diet and afterwards was sent as a representative to the Russian Court. There he gained the favor of the future Catharine II., who, after the death of Augustus III. of Poland (1763), successfully exerted her influence to bring about the election of Stanislas to the throne in September, 1764. He lacked the force of character to impose submission on the turbulent nobles, and the anarchic condition of the country during his reign rendered its spoliation by Russia, Austria, and Prussia easy. On the third and final partition of the kingdom, in 1795, he laid down his crown. See Poland.

STANISLAU, stän'ĭs-lou (Pol. *Stanisławów*). A town in the Crownland of Galicia, Austria, on the Bistritza, 75 miles southeast of Lemberg (Map: Austria, J 2). There are railway construction shops, flour mills, dye works, and tanneries. Population, in 1900, 29,628.

STAN'LEY, Arthur Penrhyn (1815-81). An English scholar and divine. He was born at Alderley, of which his father (afterwards Bishop of Norwich) was rector. From 1829 to 1834 he was at Rugby, where he was profoundly impressed by the extraordinary influence of Dr. Arnold, then head master, which molded his whole life. His own position in the school was one of marked power, the impression of which is reproduced in Hughes's *Tom Brown's School Days*, though Hughes and Stanley were not, as is frequently supposed, intimate friends at Rugby. He went up in 1834 to Balliol College, Oxford, where he achieved a brilliant reputation. In 1838 he was elected a fellow of University College, was ordained deacon in 1829, and priest in 1843, and soon acquired a great influence, taking a definite stand in favor of latitude and liberality in religious matters, defending both Ward and Hampden, as in later years he defended Jowett and Colenso. He was made Canon of Canterbury in 1851, regius professor of ecclesiastical history and Canon of Christ Church in 1856, and Dean of Westminster in 1864. Here he assumed a commanding position, and used it, as the recognized leader of the Broad Church party in England, for widening the bounds of the national Church. His preaching was more ethical than doctrinal, and his intercourse with those outside the Church of England, whom he welcomed to the Abbey and even to its pulpit, although it offended many strict churchmen, gained him a wide popularity. He accompanied the Prince of Wales (now King Edward VII.) on his tour through the East in 1862, and was closely

associated with Queen Victoria, whose chaplain he was for many years. In 1863 he married Lady Augusta Bruce, daughter of the Earl of Elgin; her death in 1876 gave him a shock from which he did not recover. He visited the United States in 1878, traveled widely, and made many memorable addresses which were published under the title of *Addresses and Sermons in America.* His most important literary work was his *Life and Correspondence of Dr. Arnold* (1844). Other noteworthy books were his *Sinai and Palestine* (1856); *Lectures on the History of the Eastern Church* (1861); *Lectures on the History of the Jewish Church* (1863-76); *Essays on Church and State* (1870); and *Christian Institutions* (1871). Consult: Prothero, *Life and Correspondence of Dean Stanley* (London, 1893); id., *Letters and Verses of Dean Stanley* (ib., 1895); Bradley, *Recollections of A. P. Stanley* (ib., 1883).

STANLEY, David Sloane (1828-1902). An American soldier, born in Cedar Valley, Ohio. He graduated at West Point in 1852. During 1861 he served in Kansas and Missouri, taking part in several engagements, including the battle of Wilson's Creek, and on September 28, 1861, was appointed brigadier-general of volunteers. In 1862 he commanded a division of the Army of the Mississippi in the operations against New Madrid and Island Number 10, and in the battles of Iuka and Corinth. On November 24, 1862, he became chief of cavalry of the Army of the Cumberland, and on November 29th was promoted major-general of volunteers. He took part in the battle of Stone River, in most of the battles of the Atlanta campaign, in the movement of concentration about Nashville, and in the battle of Franklin, November 30, 1864. A wound received at Franklin terminated his active campaigning in the war. For gallantry in this battle he received the brevet of major-general, U. S. A. After the war he became colonel of the Twenty-second Infantry and was actively engaged in campaigning against the Indians in the Northwest. In 1884 he became a brigadier-general, retiring in 1892.

STANLEY, Edward Henry Smith. An English statesman, fifteenth Earl of Derby (q.v.).

STANLEY, Frederick Arthur, Earl of Derby (1841—). An English statesman, second son of the fourteenth Earl of Derby. He was born in London and was educated at Eton. Elected to Parliament in 1865, he sat in that body as a member for various Conservative constituencies until 1886, and was nominated to several important offices, including Secretary of State for the Colonies (1885-86). In 1886 he was raised to the peerage as Baron Stanley of Preston, and from 1888 to 1893 was Governor-General of Canada. In 1893 he succeeded his brother as sixteenth Earl of Derby. Upon the accession of King Edward VII. Lord Derby was nominated supernumerary aide-de-camp to his Majesty and Lord Lieutenant of Lancashire.

STANLEY, Sir Henry Morton (1841-1904). An African explorer. He was born at Denbigh, Wales, the son of John Rowlands, who died when the boy was two years old. When sixteen years old he worked his way on a sailing vessel to New Orleans, where he found employment in the office of a merchant, named Stanley, who became his friend. For this reason the youth changed his name to that of his benefactor. He enlisted in the Confederate Army and in the battle of Shiloh (1862) was taken prisoner, but managed to escape and soon after returned to his Welsh home. In 1863 he went to New York, enlisted in the Federal Navy, was assigned to the flagship *Ticonderoga,* and soon became secretary to the admiral. For gallantry in swimming 500 yards under fire to fix a line to a Confederate steamer he was made an officer. After the war he left the navy and in 1867 acted as newspaper correspondent in one of the Indian campaigns in the West. In 1868 he was sent by the New York *Herald* to Abyssinia with the British expedition under Sir Robert Napier. In 1869 the *Herald* dispatched Stanley to find David Livingstone (q.v.) in Central Africa. After spending a year in traveling through various countries of the East, Stanley started from Zanzibar February 5, 1871, with about 200 men, and on November 10th met the feeble and almost helpless Livingstone at Ujiji, on Lake Tanganyika (q.v.), nursed him back to better health, and, as he declined to return to Europe, gave him the supplies needed to continue his explorations. After taking part with Livingstone in an exploration of the northern end of Lake Tanganyika, Stanley returned to Europe in 1872, and in 1873 was sent by the *Herald* to West Africa to report the British campaign against the Ashantis.

In 1874 Stanley determined to take up the exploration of Africa where Livingstone had left it. The New York *Herald* and the London *Daily Telegraph* shared the expense of fitting out this expedition. On November 12, 1874, Stanley left Bagamoyo, near Zanzibar, with 356 men in his caravan, including three young white men. Stanley's first great work was a boat survey of the coasts of the Victoria Nyanza (q.v.). He also spent some time with the Waganda on the shores of the Victoria Nyanza. To the west of the Victoria Nyanza Stanley discovered the Muta Nzige (Lake Albert Edward), one of the head reservoirs of the Nile. He found that the Kagera or Alexandra Nile, rising near Lake Tanganyika, was the most important feeder of the Victoria Nyanza. Arriving at Tanganyika (1876), he sought in vain for its outlet, the fact being that the level of the lake was then so low that no water was passing through the Lukuga into the Congo (q.v.). His expedition had been greatly enfeebled by fever and smallpox, but he pushed westward to Nyangwe, on the Lualaba, which Livingstone and Cameron had visited. Stanley determined to make his way down the great river, and in November, 1876, embarked on the perilous journey. He was frequently attacked by cannibals, thousands of whom sometimes pursued him in canoes, and if it had not been for his guns his expedition would undoubtedly have perished. After a voyage of over 1500 miles, in the course of which he twice crossed the equator, he emerged on the Atlantic coast, having lifted the veil that had hitherto hung over the Congo, which was thus shown to be the same river as the Lualaba. On August 9, 1877, the party marched into Boma, on the lower Congo, 999 days after leaving Zanzibar, having traveled over 7000 miles. Besides his three white companions Stanley lost 170 of his porters. In the spring of 1879 Stanley sailed again for Africa

under the auspices of the Africa International Association (q.v.), and began five years of incessant toil, founding his stations from Vivi, on the lower Congo, to Stanley Falls, about 1300 miles up the river, making treaties with 450 native chiefs, carrying all his supplies and steamboats in sections on the heads of men 235 miles around the rapids of the lower Congo, building station houses, and planting gardens. The years 1885 and 1886 were a period of comparative rest for the explorer, who had now been the recipient of honors from learned societies all over the world and was the most distinguished of living explorers.

In 1886 Stanley was placed at the head of an expedition for the relief of Emin Pasha (q.v.), Governor of the Equatorial Province of the Egyptian Sudan. In March, 1887, he reached the mouth of the Congo, ascended it to the Aruwimi, pushed on to the head of navigation on this tributary, and then struck out through the equatorial wilderness in the direction of the Albert Nyanza. The party marched for months through interminable tropical forests, where they had literally to hew their way, and did not reach the Albert Nyanza until December 13, 1887. Out of 389 men only 174 were left, and they were little more than skeletons. In April, 1888, the intrepid Emin Pasha made his appearance on the shores of the lake. Stanley now retraced his steps to the Aruwimi in order to bring up a detachment of men which he had left there. He found but a remnant of them. For the third time he crossed the vast forest, and in January, 1889, he rejoined Emin, with whom he proceeded to the coast. On this journey Stanley made his second crossing of Africa, emerging at Zanzibar after discovering the extent of the great forest, the water connection between Lake Albert Edward and the Albert Nyanza, the snow-capped Ruwenzori mountain chain between the two lakes, and the southwestern prolongation of the Victoria Nyanza. This expedition ended his active career in Africa, of which he had given to the world more information than any other man, excepting Livingstone. Stanley was patient and kind to the natives, and his success in founding the Congo Free State (q.v.) was largely due to the confidence he inspired and the friendships he won by his unfailing tact. At the same time he did not hesitate to fight the Africans with every resource at his command if their hostility threatened the destruction of his expeditions or imperiled his enterprises.

Stanley was married to Dorothy Tennant, the artist, in 1890. In 1892 he became a naturalized citizen of Great Britain, and in July, 1895, he entered the British Parliament for North Lambeth as a Liberal Unionist. In 1899 he received a Knighthood of the Bath. His books, which were published in London and New York, and most of which have been translated into several languages, are: *How I Found Livingstone* (1872); *My Kalulu* (1872); *Coomassie and Magdala* (1874); *Through the Dark Continent* (1878); *The Congo* (1885); *In Darkest Africa* (1890); *My Dark Companions* (1893); *Slavery and the Slave Trade in Africa* (1893); *My Early Travels and Adventures in America and Asia* (1895); and *Through South Africa* (1898).

STANLEY, Thomas (1625-78). An English translator, born at Cumberlow, Hertfordshire, and educated at Cambridge. During the Civil War he traveled on the Continent, returning near its close and taking rooms in the Middle Temple, where he devoted himself to literature. He wrote considerable verse, and translated many classical writers. Long famous were his edition of Æschylus with a Latin translation (1663) and his compilation under the title *History of Philosophy* (4 vols., 1655-62). Consult Stanley's *Poems and Translations,* edited with memoir by S. E. Brydges (London, 1814-15), and his translations of Anacreon, edited by A. H. Bullen (Bohn's Classical Library, ib., 1893).

STAN'NARD, Henrietta Eliza Vaughan (Palmer) (1856—). An English novelist, born at York. She became well known under the pseudonyms John Strange Winter and Violet Whyte. In 1884 she married Arthur Stannard, a civil engineer. Her first great successes were *Sketches of Cavalry Life* (1881), *Bootles' Baby* (1885), and *Houp-la* (1885). Till she threw off the mask of anonymity, these stories were supposed to have been written by an army officer. Among her later novels are: *On March* (1886); *Garrison Gossip* (1887); *A Siege Baby* (1887); *Beautiful Jim* (1888); *A Blameless Woman* (1895); *Heart and Sword* (1898); *The Married Miss Binks* (1900); *A Blaze of Glory* (1902); and *Marty* (1903).

STANOVOI (stä'nô-voi') **MOUNTAINS.** A mountain range of Eastern Siberia. It begins on the Mongolian frontier south of Lake Baikal, where it merges with the **Altai** Range and is known as the Yablonoi Mountains (Map: Asia, O 2). Thence it extends northeast in a large zigzag line 2400 miles, following for a part of its length the shores of the Sea of Okhotsk, and terminating in the East Cape on the Bering Strait. For a long time imperfectly explored, it is now known to be not a true mountain range, but a plateau or height of land forming the water-parting between the Pacific and Arctic Oceans. It reaches its highest altitude, over 8000 feet, in Mount Tehokhondo, or Sokhondo, in the extreme southern part, where it consists of rounded ridges covered with birch and larch forests. Farther north its mean elevation is only 3000 feet.

STAN'TON, Edwin McMasters (1814-69). An eminent American statesman, born at Steubenville, Ohio, December 19, 1814, of Quaker descent. He studied at Kenyon College from 1831 to 1833, later studied law, and was admitted to the bar in 1836. He first practiced in Cadiz, Ohio, and in 1837 became prosecuting attorney of the county. Later he practiced in Steubenville, Ohio, and in Pittsburg, Pa., where he became the leader of the bar, and gained a high reputation, in particular, for his conduct of the case of the State of Pennsylvania vs. the Wheeling Bridge Company. In 1856 he removed to Washington and practiced extensively before the United States Supreme Court. In 1858 he was in California acting as counsel of the United States in certain important land cases. After President Lincoln's election in 1860, on the reorganization of Buchanan's Cabinet, Stanton was appointed Attorney-General to succeed Jeremiah Black. In politics he was originally a Jacksonian Democrat, but later he became a stanch antislavery advocate, and while a member of Buchanan's Cabinet took a firm stand for the Union, declaring that the surrender of Fort Sumter would be a public

the other members of the Cabinet, but in January, 1862, was recalled by Lincoln, and was given the portfolio of Secretary of War, in which office he shared with the President the burden of the vast war operations of the Government. His administration was marked by a course of integrity, comprehensive judgment, determination, and force which won for him the admiration of his countrymen, although at the same time provoking criticism on the part of his opponents.

Shortly after the assassination of President Lincoln, Stanton tendered his resignation, but was induced by President Johnson to remain at the head of the War Department. After the breach between President Johnson and Congress over the various questions growing out of the reconstruction of the Southern States, Stanton took sides against the President and supported Congress. The President called for his resignation on August 5, 1867. Stanton refused to resign, on the ground that his withdrawal would seriously interfere with the execution of the reconstruction acts, to which the President was strongly opposed, and was encouraged by leading men of the Republican Party to hold to the office. On the 12th of August the President suspended him, but Stanton still refused to surrender the office, after which the President removed him in spite of the Tenure of Office Act (q.v.), and designated a Secretary *ad interim*. Again Stanton refused to give up the office and continued to hold it until after the impeachment and acquittal of the President, when he sent in his resignation and turned the office over to his successor. He then resumed the practice of his profession, but his health had been broken by his long and arduous labors. On December 20, 1869, President Grant nominated him an associate justice of the Supreme Court, and he was at once confirmed by the Senate. He died four days after this appointment. The most comprehensive *Life* is that by Gorham (2 vols., Boston, 1899).

STANTON, Elizabeth (Cady) (1815-1902). An American reformer and promoter of the woman's rights movement, born at Johnstown, N. Y. She was educated at Johnstown and at Troy, N. Y., and married Henry B. Stanton (q.v.), the anti-slavery reformer. She became interested in the anti-slavery and other reform movements at an early age, and through acquaintance with Lucretia Mott (q.v.) was led to sign the call for the first woman's rights convention, which was held in Seneca Falls, N. Y., in July, 1848. This convention made the first formal demand for the extension of the suffrage to women, and of the National Woman's Suffrage Association there formed Mrs. Stanton became the first president, retaining that office until 1893. From 1848 she devoted a greater part of her time to traveling from State to State, addressing political conventions, State Legislatures, and educational bodies in behalf of woman's rights. In 1868 she was a candidate for Congress. She was connected editorially with various reform periodicals, was a frequent contributor to magazines, and was joint author of *A History of Woman's Suffrage* (3 vols., 1880-86). *Eighty Years and More*, an autobiography, was published in 1895.

STANTON, Frank Lebby (1857—). An American poet and journalist, born at Charlestown, Stanton was connected editorially with newspapers in Atlanta, and finally became an editor of the Atlanta *Constitution*. He contributed to many magazines, and some of his poems were collected in volumes such as *Songs of the Soil* (1894) and *Comes One With a Song* (1898). Stanton's verse, appearing at random, and mostly in newspapers, has distinct literary merit, in that it presents faithfully the folk-lore and crude poetry of the Southern negro. In this field, though at present less conspicuously (especially in the North), his position is not unlike that of Joel Chandler Harris and Thomas Nelson Page.

STANTON, Henry Brewster (1805-87). An American reformer and journalist, born in Griswold, Conn. In the abolition movement he became prominent and allied himself with the political abolitionists in opposition to the followers of William Lloyd Garrison, who did not believe that anything could be accomplished by political action. In 1840 he married Elizabeth Cady, and proceeded to London, where he was secretary of the World's Anti-Slavery Convention. Later he studied law, and practiced first in Boston, and then in Seneca Falls, N. Y., being elected from the latter place to the State Senate in 1849 and 1851 as a Free-Soil Democrat. He took part in the organization of the Republican Party. In addition to his connection with various anti-slavery papers, he was a member of the staff of the New York *Tribune* for several years, and was an editor of the New York *Sun* from 1868 until his death. He published *Sketches of Reforms and Reformers in Great Britain and Ireland* (1849), and *Random Recollections* (1886).

STANTON, Oscar Fitzalan (1834—). An American naval officer, born at Sag Harbor, N. Y. He graduated at the U. S. Naval Academy in 1855, and after considerable service in Mediterranean and African waters, cruised with the Pacific Squadron from December, 1860, to March, 1862. Promoted to be lieutenant-commander in June, 1862, he commanded the steamer *Tioga* of a squadron operating on the James and Potomac rivers, and from December, 1863, to November, 1864, was with the West Gulf Blockading Squadron in command of the *Panola*. After ordnance duty at the Brooklyn Navy Yard, and some service with the East Gulf Blockading Squadron, he held the command of various vessels and served at the Norfolk Navy Yard, the United States Naval Station, the New London Naval Station, and at the Naval Academy. In 1891 he was made commodore and in 1893 was given the command of the North Atlantic Station with the rank of acting rear admiral. In 1894 he was retired.

STAN'WIX, John (1690-1766). An English soldier. He entered the army in 1706, and in 1756 he came to America as commander of the Sixtieth or Royal Americans, and was put in charge of the southern district with headquarters at Carlisle, Pa. He was sent to Albany in 1758 and erected Fort Stanwix at the Oneida portage. At the time of Wolfe's expedition against Quebec Stanwix commanded in Pennsylvania and restored Fort Duquesne, now Pittsburg. He returned to England in 1760, and was appointed Governor of the Isle of Wight. He was drowned while crossing the Irish Channel.



STAN'YHURST, RICHARD (1547-1618). A translator of Vergil, born in Dublin, Ireland. He was educated at Oxford. He contributed a "Description of Ireland" and a "History of Ireland" (during the reign of Henry VIII.) to Holinshed's *Chronicles* (1577). Two years later he passed over to the Continent never to return. At Leyden he published his translation of the first four books of the *Æneid* into English hexameter verse (1582). The work is curious as an attempt to base English verse on quantity rather than on stress or accent. He thereafter devoted himself to histories and theological treatises in Latin prose. Having become a Roman Catholic, probably not long after he had left England, Stanyhurst was appointed chaplain to Archduke Albert, the Spanish ruler of the Netherlands, and was involved in the intrigues against Elizabeth. He died at Brussels. Consult the reprint of the *Translation of Vergil*, edited, with introduction, by Arber (London, 1895).

STAPFER, stäp'fâr', PAUL (1840—). A French essayist, born in Paris, where he was educated at the Bonaparte Lyceum. He was tutor in the family of Guizot, and afterwards obtained a position in the faculty of Grenoble as a professor of foreign literature. In the same capacity he went to Bordeaux in 1883. Stapfer's essays are remarkable for their clearness of style, perfection of finish, and accuracy of detail. Among his works are: *Petite comédie de la critique littéraire de Molière selon les trois écoles philosophiques* (1866); *Causeries guernesiaises* (1881); *Shakespeare et l'antiquité* (1883); *Gothe et ses deux chefs-d'œuvre classiques* (1881); *Racine et Victor Hugo* (1886); *Rabelais, sa personne, son génie, son œuvre* (1889); *Montaigne* (1894); and *La grande prédication chrétienne en France: Bossuet, Adolphe Monod* (1898).

STAPH'YLOCOC'CUS. See BACTERIA.

STAPH'YLO'MA (Neo-Lat., from Gk. *σταφύλωμα*, defect of the eye within the cornea, from *σταφυλή*, *staphylē*, bunch of grapes, swollen uvula). A term employed to signify a protrusion of one of the coats of the eye, chiefly of the sclera or cornea. Staphyloma of the sclera may be anterior, equatorial, or posterior. *Posterior staphyloma* usually results from choroiditis or is associated with myopia. Ophthalmoscopic examination shows a crescentic white patch at the temporal side of the optic disk. *Anterior* and *equatorial staphyloma*, bulging of the sclera at its anterior or middle portion, are the result of increased intraocular tension, caused by inflammatory processes. If the entire cornea is involved the staphyloma is called *total;* if only a portion protrude, it is spoken of as *partial.*

STAPLE (AS. *stapel, stapol, stapul*, prop, post, OHG. *staffal, staphal*, Ger. *Staffel*, step, from AS. *stapan*, OHG. *stephan, staphōn*, to go, step; ultimately connected with Eng. *stand*). In England, a town officially designated by the Government as a market for sale and exportation. All towns were not staple towns. They were originally for the convenience of the tax collector, but their inhabitants appreciated the monopoly and jealously guarded their privileges.

STAPLES, stā'p'lz, WILLIAM READ (1798-1868). An American jurist and historian, born in Providence, R. I. He graduated at Brown University in 1817, studied law, and in 1819 was admitted to the bar. He rose rapidly in his profession, was an associate justice of the Supreme Court of Rhode Island from 1835 to 1854, and from 1854 to 1856 was Chief Justice. He was an authority on Rhode Island history and published *Annals of Providence to 1832* (1843); *Documentary History of the Destruction of the "Gaspé"* (1845); *Proceedings of the First General Assembly for the Incorporation of Providence Plantations in 1647* (1847); and *Rhode Island Form-Book* (1859). He edited vol. ii. of the Rhode Island Historical Society's *Collections*, and Samuel Gorton's *Simplicities' Defense Against Seven-Headed Policy* (1835).

STAPPEN, *Fr. pron.* stä'pän', CHARLES PIERRE VAN DER (1843—). A Belgian sculptor, born at Saint Josseten-Noode, near Brussels. He began his artistic training in 1860, under the painter Portaels, but afterwards formed an independent style in Paris under the influence of Rude, Mercié, and Carpeaux. His first successful production, the bluntly naturalistic "Faun's Toilet" (1869, gold medal, Brussels), brought him the election to the Brussels Academy. It was followed by "The Sorceress" (1872) and the "Man with the Sword" (1876, Brussels Museum). A sojourn of several years in Italy, during which he studied Donatello and Michelangelo, resulted in maturer works, of which a youthful "David" (Munich Academy) is the most remarkable. Upon his return to Brussels, in 1883, he was appointed professor at the Academy, and thereafter produced in rapid succession the allegorical group of "Instruction in Art" (Palais des Beaux-Arts), "Saint Michael Overcoming Satan" (Staircase, Hôtel de Ville), and the statue of "William the Silent" (Place du Petit Sablon). Gradually developing an individual style of his own, which combines severe and lofty conception with a wholly untrammeled naturalistic treatment, he aimed especially at a vigorous dramatic expression. His most noteworthy creations of this kind include "The Wrestlers," "The City Builders," and the "Chimera Fountain" (Parc du Cinquantenaire, Brussels). He also fashioned numerous portrait busts of great vivacity, genre figures, allegorical and realistic reliefs, designs for épergnes, candelabra, and various other objects of industrial art, and contributed actively to the revival of the chryselephantine statuary of Greek antiquity, recently inaugurated in Belgium. In 1898 he was appointed director of the Brussels Academy.

STAR (AS. *steorra*, OHG. *sterro, sterno*, Ger. *Stern*, Goth. *staírnō*, star, connected with Lat. *stella*, Gk. *ἀστήρ, astēr*, Corn., Bret. *steren*, Arm. *astł*, Skt. *tāra*, star, Av. *star∂*, star, and possibly with Skt. *star*, to strew). One of those heavenly bodies which remain *apparently* immovable with respect to one another. Hence they were early called *fixed* stars, a name which they still retain, although their perfect fixity has been completely disproved in numerous cases, and is no longer believed in regard to any. Twinkling or scintillation is another mark which distinguishes stars from planets. The first thing that strikes the observer is the apparent daily motions of the stars. The greater part appear to rise in the east, describe smaller or greater arcs in the heavens, and set in the west; while others describe complete circles around the pole of the heavens. These apparent motions arise

from the rotation of the earth on its axis. (See EARTH.) With few exceptions the distance of the fixed stars is still unknown, and must in all cases be enormously great. Since the time of Bradley many attempts have been made to measure what is called the annual parallax (q.v.) of the stars, and thus determine their distances. When we consider that the motion of the earth round the sun alters our position in space a whole diameter of its orbit (185,000,000 miles) in six months, we should expect a change in the relative positions of certain stars as seen from two opposite points of the orbit. But no such change is seen to take place, and this was one of the early objections to the theory of Copernicus (q.v.). The only answer that the Copernicans could give was that the distance of the stars from us is so great that the diameter of the earth's orbit shrinks into insignificance when compared with it. The detection of the parallax of the fixed stars depended upon the perfection of instruments. The parallax of a star is the minute angle contained by two lines drawn from it, the one to the sun, the other to the earth. If that angle amounted to a second the distance of the star would be at least 206,000 times that of the sun; and when the measurement of angles came to be reliable to a second and still no parallax was discernible astronomers could say that the distance of the nearest stars must be more than 206,000 times that of the sun, i.e. 206,000 times 93,000,000 miles.

The method now in use for measuring stellar parallaxes was first applied successfully by Bessel (q.v.) in 1838. He employed in his observations a remarkably fine heliometer (q.v.) and adopted what is called the differential method. Having selected a star which he suspected might be near us, and therefore have a parallax large enough to measure, he proceeded to determine every clear night its position in the sky relatively to two neighboring very small stars. Such relative (differential) determinations of positions can be made with far greater accuracy than measures with the meridian circle (q.v.); and Bessel judged rightly that the two minute comparison stars were really so immeasurably far away that they would themselves suffer no appreciable parallactic displacement. Sure enough, he found his 'parallax star,' 61 Cygni, slowly describing day after day a tiny oval curve in the sky, reproducing there the earth's orbit in space. But the comparison stars did not move. The proof was complete that 61 Cygni had an apparent motion due to the real motion of our earth, and that it was *measurable*. This observation of Bessel's is one of the most famous in the annals of astronomy.

When other astronomers had succeeded in repeating Bessel's observations, and quite a number of stars came to have known parallaxes, their distances were found to be too great to be expressed conveniently in miles, or any other linear unit. Therefore astronomers invented a new unit, the 'light-year,' being a distance equal to the space traversed by light in one year. As light moves about 180,000 miles per second, it will be seen that the light-year is a unit of stupendous magnitude, and will be fitted to measure the profound distances of stellar space. A few of the larger stellar parallaxes at present known are as follows:

STAR	Magnitude	Parallax	Distance in light-years
Centauri α	1	0″.75	4.4
Lalande 21,185	6.9	0 .50	6.5
61 Cygni	5.1	0 .40	8.1
Sirius	1	0 .39	8.4

In this table the second column gives the 'magnitude' of the stars. The third column gives the parallax, or angle subtended by the earth's orbit-radius at the star. The corresponding distance in light-years is in the last column. Thus we do not see the stars as they are to-day, but as they appeared so many years ago.

The principal constellations north of the Zodiac (q.v.) are:

Ursa Major.	Boötes.
Ursa Minor.	Corona Borealis.
Draco.	Hercules.
Cepheus.	Lyra.
Cassiopeia.	Cygnus.
Camelopardus.	Vulpecula.
Andromeda.	Aquila.
Perseus.	Antinoüs.
Auriga.	Delphinus.
Leo Minor.	Pegasus.
Canes Venatici.	Ophiuchus.
Coma Berenices.	

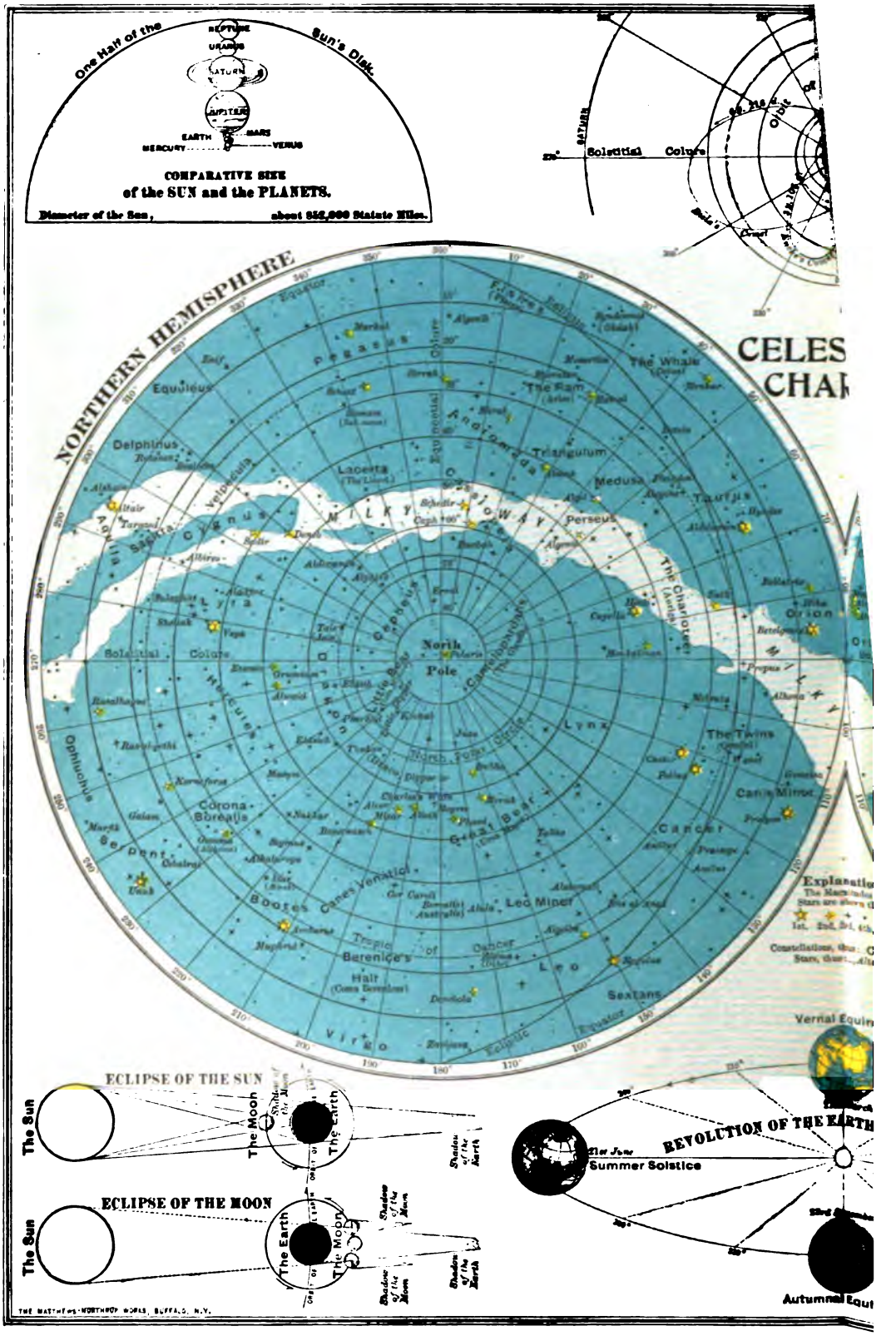
The principal constellations south of the Zodiac are:

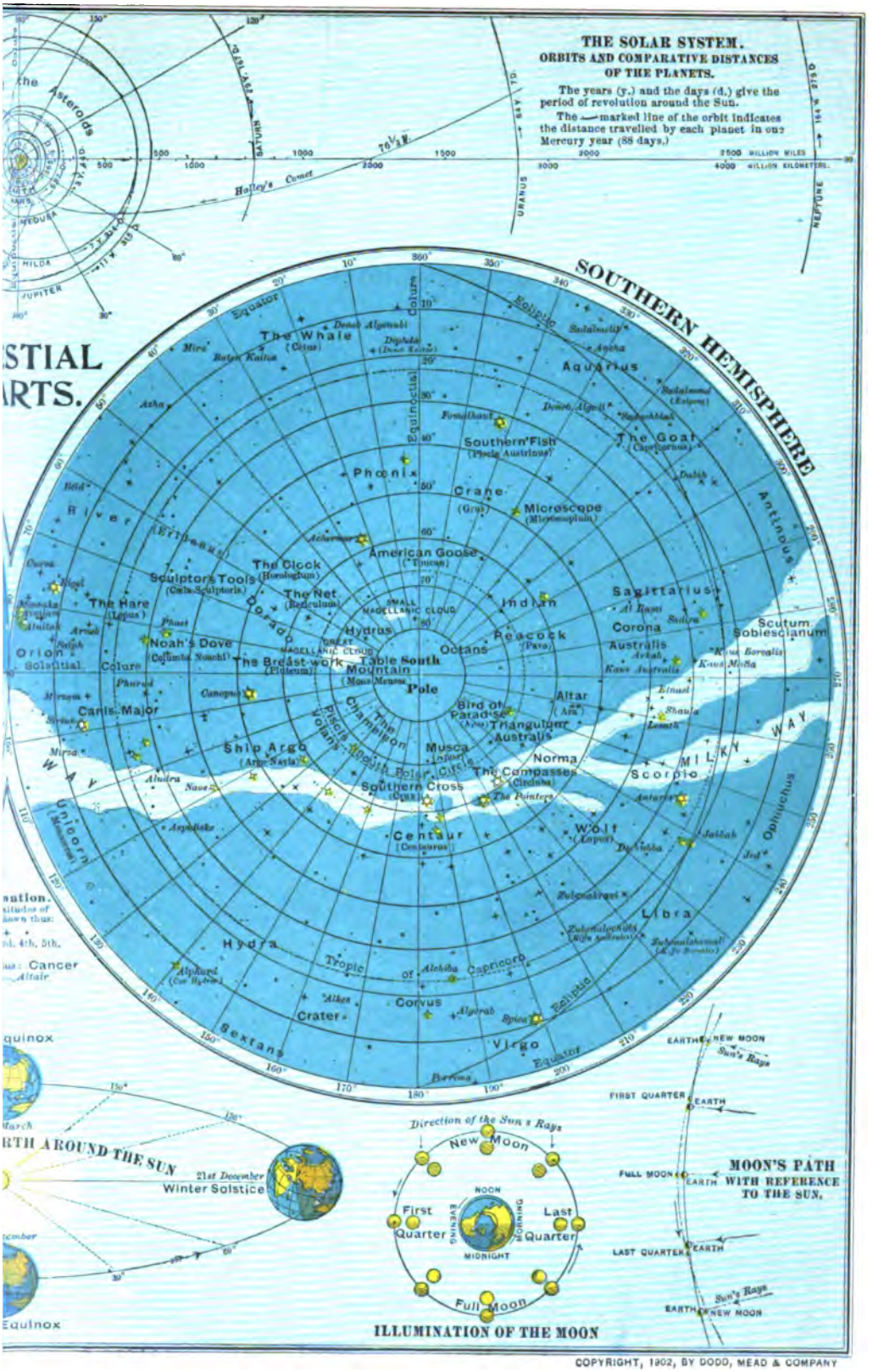
Cetus.	Canis Minor.
Orion.	Crux.
Lepus.	Argo-Navis.
Centaurus.	Hydra.
Lupus.	Crater.
Monoceros.	Corvus.
Canis Major.	Eridanus.

For the constellations of the Zodiac, see ZODIAC. The several stars belonging to the same constellation are usually distinguished from one another by Greek letters, beginning the alphabet with the brightest; and when these are not sufficient by Roman letters and by numbers. Many of the most brilliant stars have special names. They are also divided according to their brightness into stars of the first, second, third, etc. magnitudes, a division which is necessarily somewhat arbitrary. The smallest stars discernible by the unaided eye are usually called stars of the fifth magnitude; but an unusually sharp eye can discern those of the sixth and even seventh magnitude. All below are telescopic stars, which are divided down to the twentieth magnitude. The quantity of light given by a star of any magnitude is taken as 2.512 times as great as the quantity given by a star one magnitude fainter. This number is called the 'light-ratio,' and it is so chosen that a diminution of five magnitudes corresponds to a division of stellar light by just 100 ($2.512 = \sqrt[5]{100}$). In other words, 100 average stars of the sixth magnitude should give as much light as one of the first.

But the whole matter of stellar photometry is subject to some uncertainty. According to the *Harvard Photometry* the following are the brightest stars in the order of lucidity: Sirius, Canopus*, Arcturus, Capella, Vega, α Centauri*, Rigel, Procyon, Eridani*, β Centauri*, α Orionis, Altair, Aldebaran, α Crucis*, Antares, Pollux, Spica, α Piscis Austria*, Regulus. Those marked with an asterisk are not visible in our northern latitudes. No real magnitude in the proper sense of the word has yet been observed in any star. In the best and most powerfully magnifying telescopes, even the brightest stars of the first mag-




One Half of the Sun's Disk.
NEPTUNE
URANUS
SATURN
JUPITER
EARTH
MARS
MERCURY
VENUS
COMPARATIVE SIZE
of the SUN and the PLANETS.
Diameter of the Sun, about 852,000 Statute Miles.
NORTHERN HEMISPHERE
CELES
CHA
Equator
Ecliptic
Colure
Solstitial Colure
Equinoctial Colure
Pegasus
Equuleus
Delphinus
Aquila
Sagitta
Cygnus
Vega
Lyra
Hercules
Ophiuchus
Serpent
Corona Borealis
Bootes
Canes Venatici
Leo Minor
Leo
Sextans
Virgo
Tropic of Cancer
Arctic Circle
Lacerta
Andromeda
Triangulum
The Whale
The Ram
Medusa
Perseus
Taurus
Orion
The Charioteer
MILKY WAY
Cassiopeia
Cepheus
North Pole
Polaris
Little Bear
Great Bear
Charles's Wain
Lynx
The Twins
Cancer
Leo
Berenice's Hair
Explanation
Constellations, the
Stars, their
Vernal Equinox
ECLIPSE OF THE SUN
The Sun
The Moon
The Earth
Shadow of the Earth
ECLIPSE OF THE MOON
Shadow of the Moon
REVOLUTION OF THE EARTH
21st June
Summer Solstice
Autumnal Equi
THE MATTHEWS-NORTHRUP WORKS, BUFFALO, N.Y.



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nitude appear, not with small disks as all the planets do, but as luminous points without any visible diameter, and always the smaller the better the telescope. We are, therefore, totally ignorant of the real size of the fixed stars; nor could it be determined though we were sure of their distances, for the apparent diameter is an essential element in the calculation. We cannot, then, say whether the greater brilliancy of one star, when compared with another, arises from its greater nearness, its greater size, or the greater intensity of its light. But it is certain that the fixed stars are self-luminous. The number of the stars is beyond determination. Those visible to the unaided eye in the Northern Hemisphere amount only to about 3000. Stars of the first magnitude visible north of 35° south declination are reckoned by Heis at 14, of the second at 48, of the third at 152, of the fourth at 313, of the fifth at 854, and of the sixth at 2010. But in the following classes the numbers increase rapidly, so that it is impossible to say how many there are. Recent photographic observations seem to indicate that if the exposure of the sensitive plate in the telescope was continued long enough the entire plate would be light-struck. If this be so we must conclude that the entire heavens would be found covered with stars if we were able to see the faintest ones in existence.

That the fixed stars are not really immovable, as their name would imply, is seen in the phenomenon of *double* or *multiple* stars, which are systems of two or more stars that revolve about one another, or rather about their common centre of gravity. As they can be seen separate only by means of a telescope, and in most cases require a very powerful one, their discovery was possible only after the telescope was invented. Galileo himself discovered their existence and proposed to make use of them in determining the yearly parallax of the fixed stars. After a long lapse of time, Bradley, Maskelyne, and Mayer again directed attention to the phenomena of double stars, but nothing important was made out respecting them until the elder Herschel made them the subject of a protracted series of observations, which led to the most remarkable conclusions as to their nature. At present over 10,000 stars are known to be double; and in many cases more than one companion accompanies the principal star. The apparent angular distance between two stars must be less than about thirty seconds in order that they may be counted a double. The theory of probabilities renders it almost certain that this vast number of double stars could not exist unless there were some real physical connection between the component numbers of a double. Still, there is always a possibility of duplicity being merely apparent, the two stars lying nearly in the same direction in space, but at widely different distances from the earth. Such apparent doubles are called *optical* doubles, and those in which a real physical connection has been demonstrated by observed gravitational rotation of the component members are called *binary stars*. Of these only about 250 are known. In some cases one of the components of a double star is much larger than the other, as in the star Rigel, in Orion, and in the polar star; but very often the connected stars are nearly equal in luminous power. The two members of double stars are mostly of one color when the two components are nearly equal; but a difference of color is often observed when the components are widely different in size. In many of these cases the one color is the complement of the other. It was Sir W. Herschel who first advanced the view, which has been confirmed since, that double stars are connected systems of two or more stellar bodies revolving in regular orbits around one another, or rather round their common centre of gravity. Their motions are found to follow the same laws as prevail in the solar system, and the orbits are elliptical. These distant bodies are therefore subject to the Newtonian law of gravitation. The period of revolution has, in many cases, been computed; the shortest is estimated at 5½ years; others are set down at hundreds. In cases where the parallax is known the size of the orbits can be determined, and thus the astronomer is able to assert in regard to the double star α Centauri that the orbit described by the two components about each other is 24 times as large as that of our earth around the sun. Even the masses of these stars have been calculated as being together 2, that of our sun being 1. It is a consequence of these revolutions that some stars are now seen double that formerly seemed single, and vice versa. If the plane of revolution has its edge presented to the earth the stars will seem to move in a straight line, and at times to cover one another. In addition to these double stars that can be seen to revolve and change their relative positions there are others of which the components are so close together that even our most powerful telescopes fail to separate them. These doubles are known to exist from peculiarities in their spectra. They show a doubling of the spectral lines that must be caused by a duplicity in the source of light, and where this doubling is shown to occur periodically we must conclude that the two sources of light are revolving in some way or other.

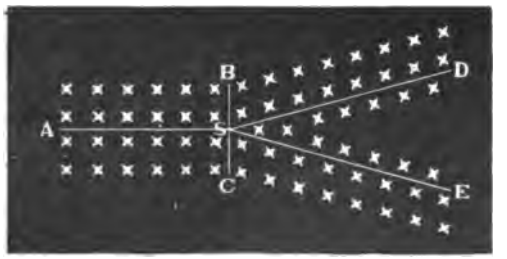
The proper motion of stars is of another kind. It consists in a displacement in various directions of the individual stars, so that the configuration of constellations is slowly changing. The annual proper motions yet observed vary from nothing to 8.7″. The proper motion of the binary star 61 Cygni amounts to 5.2″, so that in 360 years it would pass over a space equal to the moon's diameter. It must thus take thousands of years to alter sensibly the aspect of the heavens; although, taking into account the enormous distances, the actual velocities must be great. But the observed proper motions of the stars do not give us very accurate information as to their real motions and velocities. In the first place, it is only the *angular* change of the star's position that we observe; and we cannot tell the corresponding linear shift unless we know the distance of the star from the earth. And even where this distance (parallax) is known we can obtain only the transverse motion, as projected on the sky. There may be also a component of motion directly toward us or away from us. This *radial* component remained entirely unknown until recently, when it became possible to measure it with the spectroscope.

It was first observed by Sir W. Herschel that there is a perceptible tendency in the proper motions, as observed, to make the stars generally diverge or open up in one quarter of the heavens, and draw together in the opposite quarter; and

with his planets in the direction of the former point. The apparent motion thus caused is complicated with the real independent motions of individual stars. The point toward which the motion is directed, which is called the 'solar apex,' was fixed by Herschel in the constellation Hercules; and the result of subsequent and independent researches gives a nearly coincident point. The velocity has been calculated at about 11 miles per second, a figure still very uncertain.

Coming now from a consideration of stellar motions and velocities to their physical characteristics, we must again have recourse to information derived from a study of star spectra. Fraunhofer was the first to study them, and his researches have been followed by Rutherford, Huggins, Secchi, Vogel, Pickering, and others. It has thus been possible to identify in the stars many of the terrestrial chemical elements. Many stars exhibit well-marked periodic alterations of magnitude, and are hence called *variable* stars. A considerable number have been observed, of which perhaps the most remarkable are Mira (the wonderful) in Cetus, and Algol in Perseus. The first attains its greatest lustre every 334 days, and sometimes appears for 14 days as a star of the second magnitude; it then decreases for two or three months, till it becomes of the sixth and even tenth magnitude, so as to be for half a year invisible to the naked eye. After this it begins to increase, but more rapidly than it decreased. It is visible to the naked eye for three or four months of its period. Of all the variable stars yet observed Algol has the shortest period, being 2 days 20 hours 48 minutes 55.4 seconds. It appears for about 60 hours a star of the second magnitude, then decreases for four hours, and appears for a quarter of an hour of the fourth magnitude, after which it increases again for four hours. Various explanations have been offered of these mysterious appearances; that generally accepted postulates a large dark body revolving about the luminous one, so as to intercept more or less of its light in different positions and making of Algol-type variables simple eclipse phenomena.

Allied to the variable stars are the *new* or *temporary* stars that appear suddenly in great splendor, and then disappear without leaving a trace. Fourteen instances are on record. It is not improbable that these also may be periodic.



STAR SYSTEM.

STAR SYSTEMS. From the appearances connected with the Milky Way or Galaxy (q.v.), Sir W. Herschel came to the conclusion that the stars forming our firmament do not extend indefinitely into space, but are limited in all directions. conceived the shape to be something like that of a huge millstone, having one side cleft, and the two luminæ set apart at a small angle. Let the diagram represent a vertical section of such a broad flat stratum, suppose the solar system situated as at S to a spectator looking on either side, in the direction of the thickness, as SB, the stars would appear comparatively sparse, but all round in the direction of the breadth (as SA) there would appear a dense ring, which would separate into two branches (SE, SD) in the direction of the cleft side. This supposition accounts for the appearance of the Milky Way, and subsequent observations have tended to confirm the conjecture.

Consult: Young, *General Astronomy* (Boston, 1900); Clerke, *System of Stars* (London, 1890); id., *History of Astronomy* (ib., 1893); Chambers, *Handbook of Astronomy*, vol. iii. (Oxford, 1890); Newcomb, *The Stars* (New York, 1901); on the constellations, consult Walentiner, *Sternbilder* (Breslau, 1901).

STAR. A frequent charge in heraldry (q.v.). See ESTOILE.

STAR AND GARTER. A former London Tavern on Pall Mall, the meeting place of the Literary Club.

STAR ANISE. See ILLICIUM.

STAR APPLE (*Chrysophyllum Cainito*). A West Indian tree about 20 or 30 feet high, introduced in other warm countries, beyond which it is not hardy. It is named from the star-like cross-section of its large white or rose-colored, green, and yellow fruits, with an agreeably flavored soft, sweet pulp. The tree is very beautiful in foliage.

STARAYA LADOGA, stä'rȧ-yȧ lä'dô-gȧ. A small village in the Government of Saint Petersburg, Russia, on the Volkzhov, a few miles south of Lake Ladoga. It is one of the oldest Russian settlements and has considerable historic interest.

STARAYA RUSSA, rụs'sȧ. An ancient town and noted health resort in the Government of Novgorod, Russia, 181 miles south-southeast of Saint Petersburg (Map: Russia, D 3). It is well built, and has a number of fine parks. The saline springs are used both for drinking and bathing. Population, in 1897, 15,234.

STARBOARD. A naval term to denote the right side of a vessel to an observer looking forward. See HELM.

STARCH (assibilated form of *stark*, stiff, strong, AS. *stearc*, OHG. *starc*, Ger. *stark*, strong, stiff, Goth. *ga-staúrknan*, to dry up; connected with Lith. *stregti*, to become rigid, Pers. *suturg*, strong). A form of carbohydrate (see CARBOHYDRATES), occurring as stored food in many plants. Its composition corresponds to the empirical formula $C_6H_{10}O_5$, but its molecular formula, and, of course, its constitution, are as yet unknown. The number of atoms in its molecule is probably very large. Starch is formed as a condensation product from sugar by the action of certain specialized portions of the protoplasm of plant cells. The typical starch-formers are leucoplasts (q.v.), which occur in all cells where starch is permanently stored. But the chloroplasts of the leaves may form starch when the green cells become overloaded with sugar. Thus

leaves are often found to contain large quantities of starch, especially at the end of a long period of bright illumination. The sugar formed by the process of photosynthesis (q.v.) is constantly diffusing away into other parts of the plant, but during periods of bright light it is formed more rapidly than it can diffuse, and it is then condensed by the chloroplasts to form starch. During periods of darkness or of weak illumination, when the photosynthetic process ceases or lags, the starch of leaves is reconverted into sugar by the enzyme diastase (q.v.), and then diffuses to other regions of the plant. Thus leaves seldom contain starch in the morning or on cloudy days. But by far the greater part of the starch found in any plant is organized into grains by leucoplasts. By the action of these bodies, sugar which comes from the green leaves is condensed or polymerized into starch. Starch is thus formed in all parts of plants, being especially plentiful in tubers, in thickened roots, and in the endosperm and embryo of seeds.

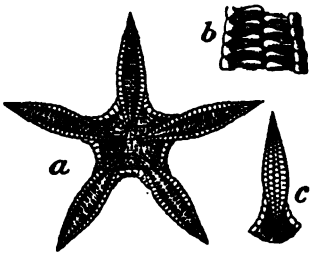
STAR CHAMBER. A celebrated English tribunal, which met in the council-chamber of the old palace of Westminster. The origin of the name is unknown. According to Sir Thomas Smith it was derived from a decoration of gilded stars on the ceiling. This theory is unsupported by evidence, but it is now well established that since the middle of Edward III.'s reign the star chamber (Camera Stellata) was the usual meeting place of the King's Council, or Privy Council, as it was afterwards known. The history of the Star Chamber Court is particularly associated with the act of 3 Henry VII., c. 1. By this statute the "chancellor and treasurer of England for the time being and keeper of the King's privy seal, or two of them, calling to them a bishop and a temporal lord of the King's most honorable Council and the two chief justices of the King's Bench and Common Pleas for the time being, or other two justices in their absence," are given jurisdiction in seven offenses: Unlawful maintenance; giving of liveries, signs, or tokens; retainers by indentures, oaths, writings, or otherwise; embraceries of the King's subjects; untrue demeanings of sheriffs in the making of panels, and other untrue returns; taking of money by juries; and great riots and unlawful assemblies. Since the days of Elizabeth it has been very commonly held that the historical Star Chamber was created by this act; and that its proper jurisdiction was restricted to the offenses just enumerated. Recent research has shown that such was not the case. The Star Chamber possessed the entire jurisdiction of the King's Council. During the reigns of Henry VII. and Henry VIII. neither the membership nor the jurisdiction of the court conformed to the statute of 3 Henry VII., c. 1, as usually interpreted. Moreover, the King's Council is seen performing the same functions as the court, whether sitting in the Camera Stellata or elsewhere; and, conversely, the powers of the Star Chamber appear to be equivalent, even in State matters, to those of the Council itself. The Star Chamber, in fact, claimed its vast jurisdiction on the ground that it was the King's Council. As a criminal court, it could inflict any punishment short of death, and had cognizance of all cases that might be brought under the head of contempt of the royal authority. Jurors were there punished for verdicts against the Crown. Offenders against the royal proclamations or the religious laws were there condemned. The form of proceeding was by written information and interrogatories, except when the accused person confessed, in which case the information and proceedings were oral; and out of this exception grew one of the most flagrant abuses of this tribunal in the later period of its history. Regardless of the existing rule, that the confession must be free and unconstrained, pressure of every kind, including torture, was used to procure acknowledgments of guilt; admissions of the most immaterial facts were construed into confessions; and fine, imprisonment, and mutilation were inflicted on a mere oral proceeding, without hearing the accused, by a court consisting of the immediate representatives of prerogative. The proceedings of the Star Chamber had always been viewed with distrust by the commons; but during the reign of Charles I. its excesses reached a height that made it absolutely odious to the country at large; and in the last Parliament of that sovereign a bill was carried in both Houses (16 Car. I., c. 10) which decreed its abolition. See especially Burn, *The Star Chamber* (London, 1870).

STARE DECISIS, stā'rē dē-sī'sĭs (from the Latin *Stare decisis, et non quieta movere*—"to stand by decisions and not to disturb matters once settled"). A phrase employed to describe a doctrine prevailing in most judicial systems of modern times, which, briefly expressed, is that the courts will follow the principles of law declared in former decisions where they are not contrary to the ordinary principles of justice. The theory on which this doctrine was established is that when a point of law is once decided it will be followed by the public as a guide. The doctrine of *stare decisis* does not apply to a decision until the time for appeal has elapsed; and a superior court may at any time overrule or repudiate the principles of a case previously decided in an inferior court and never appealed. Under such circumstances the original case erroneously decided would not be affected, and would remain *res judicata* between the parties thereto, but would no longer be cited as an authority. Courts of equal jurisdiction in the same State are not bound by each other's decisions, and one United States circuit court is not bound by the decisions of another. The United States courts will usually follow the decisions of the courts of the various States where an interpretation or application of their laws is involved. The courts of one State are not bound by the decisions of the courts of another, nor by those of a foreign country.

The courts are especially averse to disturbing the principles of law involving titles to and interests in real estate. The policy seems to be not to do so where it is only a question of expediency, and to do so with caution where the principles of a decision are erroneous and will tend to work injustice in the future. Consult: Wells, *The Doctrines of Res Adjudicata and Stare Decisis* (Des Moines).

STARFISH. Echinoderms with a star-like or pentagonal body, with two or four rows of ambulacral feet or tentacles on the oral side. The body is covered with small, short spines, often arranged in groups. The nervous system is pentagonal, with nerves extending into the

arms. Most of the species are bisexual; the young usually pass through a metamorphosis, the starfish budding out from the water-vascular system of the pluteus, bipinnaria, or brachiolaria form, which previously passes through a



A PALEOZOIC STARFISH.

a, Ventral aspect of *Aspidosoma petaloides* (Lower Devonian); *b*, ambulacral surface of an arm, in detail; *c*, dorsal plates of an arm.

morula, gastrula, and cephalula stage. Starfishes are covered with scattered pedicellariæ, pincer-like spines consisting of two prongs. Sense organs (sphæridia) are also present. Starfish have the sense of smell, which is supposed to be localized in the suckers at the back of the eye-plate.

Starfish crawl or glide by means of from two to four rows of slender tubular processes or 'feet,' with a sucker at the end. These ambulacral feet are thrust out, fastened to the bottom, and by means of them the body is warped or pulled along over mussel or oyster beds, rocks, or weeds, the arms being capable of slightly bending. At the end of each arm is the red eye, terminating the radial nerve. Starfish are very destructive to oysters, clams, mussels, barnacles, snails, worms, and small crustacea. To devour an oyster or clam the starfish grasps both valves of the shell, and by persistently exerting a constant steady strain, finally fatigues the adductor muscles closing the valves so that they slightly gap open. Then the stomach is protruded between the shells or valves and the soft body of the mollusk is digested. The injury to the oyster beds of Rhode Island caused by starfish in one year was estimated at $100,000. See ECHINODERMATA (and Plate); OYSTER.

Fossil starfish are found first in the Ordovician rocks, and they occur sparingly in later formations, with some increase in the Devonian and Carboniferous, but they are never of geological importance. Some Mesozoic sandstone formations of Middle Europe have furnished abundant casts, and they are found also in a few Tertiary localities. The Paleozoic species are grouped in the subclass Encrinasteriæ, in which the ambulacral ossicles alternate with each other along the middle line of the ambulacra; while the Mesozoic and Tertiary species, and also the recent, are included in the Euasteriæ, which have the ambulacral ossicles opposite each other.

Consult: Romanes, *Jellyfish, Starfish, and Sea Urchins* (New York, 1885); Mead, *29th Report Rhode Island Commissioners of Inland Fisheries* (Providence, 1899).

STARGARD, stär'gärt. A town in the Province of Pomerania, Prussia, situated on the navigable Ihna, 22 miles east-southeast of Stettin (Map: Prussia, F 2). It is the most important town in the eastern part of the province. The Marienkirche and town hall are noteworthy. The town manufactures railway supplies and other machinery, has foundries, and is a woolen and cotton market. It belonged to the Hanseatic League and was strongly fortified. Population, in 1900, 26,858.

STAR GRASS. A popular name for several grass-like plants whose flowers or other parts resemble stars in outline. Among them are species of Hypoxis, Chelone, Callitriche, Aletris, and Rhinchospora. See Colored Plate of AMARYLLIDACEÆ.

STARHEMBERG, stä'rem-bĕrk, ERNST RÜDIGER, Graf (1638-1701). An Austrian general, born at Gratz and educated for the army by Montecuccoli. He took part in the last campaigns of the Thirty Years' War, was present at Saint Gotthard in 1664, and gained especial glory by his brave defense of the city of Vienna for nine weeks in 1683, against the Turkish army. The Emperor Leopold made him a field-marshal and a Minister of State. Three years afterwards he was wounded at Bude and forced to retire from active service. He settled in Vienna and became president of the Council of War. Consult Thurheim, *Feldmarschall Ernst Rüdiger, Graf Starhemberg* (Weimar, 1882).

STARK, JOHN (1728-1822). An American soldier, born at Londonderry, N. H. In early life he worked on his father's farm. During the French and Indian War he served with Rogers' Rangers first as a lieutenant, and later as a captain. Reporting at Cambridge early in 1775, he was commissioned colonel, and, with a regiment raised in one day by himself, took part in the battle of Bunker Hill. Later he served in the Canada expedition and then under Washington in New Jersey, distinguishing himself at Trenton and Princeton; but, resenting the promotion over himself of a number of officers, he resigned in April, 1777, and returned to his home. On the approach of Burgoyne, he accepted an independent command from New Hampshire, and defeated a force of Hessians in the battle of Bennington (q.v.), August 16, 1777. For this he was made a brigadier-general, and was formally thanked by Congress. With a force of New Hampshire recruits he took an active part in the Saratoga campaign, and in 1778 and again in 1781 he commanded the Northern Department. Consult his biography by Edward Everett in Sparks's *American Biography*, and his *Life and Official Correspondence* by Caleb Stark, his grandson.

STARLING (diminutive of *stare*, AS. *stær*, OHG. *stara*, Ger. *Star*, *Staar*, *Stahr*, starling; connected with Lat. *sturnus*, starling). A European bird (*Sturnus vulgaris*) of the family Sturnidæ, famous for its song and powers of mimicry. It is rather smaller than the American meadowlark, its nearest analogue in the New World, and is brown finely glossed with black, with a pale tip to each feather. It has been introduced into America and seems to have become established in and around New York City.

The starling family is a large one, containing about 200 species, mostly living in the tropics of Africa and Asia. They fall between the Corvidæ and Icteridæ, and are divisible into two sections: one containing the more typical terrestrial starlings, the oxpeckers, the pastors, the mynas, pied

starlings (Sturnopastor), and wattled starlings (Dilophus). In the second group, often regarded as a separate family (Eulabetidæ), distinguished by the absence of rictal bristles and by the fact that they lay spotted eggs, whereas the 'true' starlings lay blue unspotted eggs, are the African glossy starlings (Lamprotornis), with richly colored plumage, and the grakles or hill-mynas. Consult writers upon African and East Indian ornithology, summarized in Lydekker, *Standard Natural History* (London, 1895). See Plate of LARKS AND STARLINGS.

STARNBERGER (stärn'bĕr-gĕr) **LAKE.** A lake south of Starnberg, in Southern Bavaria. Its length from south to north is about 18 miles; its altitude nearly 2000 feet. The Würm flows through the lake. The shores are picturesque and covered by lordly villas affording splendid views.

STARNINA, stär-nē'nȧ, GHERARDO (c.1354-c.1410). A Tuscan painter, born at Florence. After painting the histories of Saint Nicholas and Saint Anthony on the ceiling of the Castellani Chapel in Santa Croce, he was involved in the Ciompi intrigues and fled in 1384 to Spain. There he enjoyed royal favor, which enabled him to return to Florence in 1387. Frescoes in Santo Maria del Carmine have been attributed to this period—scenes from the life of Saint Jerome, of which only the "Death" remains. Starnina was commissioned to paint a Saint Denis on the façade of the Guelph palace at Pisa, the city having surrendered on the day of that saint. The last work of the artist is to be seen in the right choir chapel of the Duomo at Prato—the "Birth of the Virgin," the "Presentation of the Virgin," and the "Preaching of Saint Stephen." This series was finished by his pupil Antonio Vite, by whom and by his more famous pupils, Antonio da Pistoia, Masolino, and Masaccio, he is chiefly remembered.

STAR-NOSED MOLE. See MOLE.

STAR OF BETHLEHEM (so called from its star-shaped flowers, which are white within), *Ornithogalum*. A genus of about seventy species of bulbous-rooted plants of the natural order Liliaceæ. The species are natives almost exclusively of the Eastern Hemisphere. Only a few species are grown in flower gardens. The common star of Bethlehem (*Ornithogalum umbellatum*), a native of France, Switzerland, Germany, the Levant, etc., has racemes of six to nine large white fragrant flowers, which open about eleven o'clock in the morning and close again about three or four in the afternoon. The plant is very hardy and may be grown three or four years without being disturbed. *Ornithogalum arabicum* is a tender species often grown in glasses like hyacinths. It produces large creamy white flowers, with a fragrance not agreeable to all persons. The hardy species flourish in ordinary well-drained garden soil. Propagation is effected by offsets from the bulbs, which are planted in the fall about nine inches deep in sheltered places.

STAR OF INDIA, ORDER OF THE. A British order with three classes founded by Queen Victoria in 1861, consisting of the sovereign, the Viceroy of India, and 246 members, in addition to an unrestricted honorary membership. The decoration is an oval medallion bearing a bust of Victoria in onyx, surrounded by a blue band with the device *Heaven's Light our Guide*, and surmounted by a diamond-studded crown.

STAROKONSTANTINOV, stä'rô-kŏn'stȧn-tyĕ'nôf. A district town in the Government of Volhynia, Russia, 86 miles southwest of Zhitomir. The chief manufactures are tobacco and soap; mineral waters are marketed. Population, in 1897, 16,527.

STARR, ELIZA ALLEN (1824-1901). An American poet and lecturer on art. She was born of Puritan ancestry at Deerfield, Mass., and was educated at Deerfield Academy. In 1854 she left the Unitarian Church, in which she had been reared, and became a convert to Catholicism. In 1856 she settled in Chicago, where she became a teacher of drawing and painting. In 1877 she began the series of lectures on Christian art for which she is best known. She published *Poems* (1867); *Patron Saints* (1st series 1871, 2d series 1881); *Pilgrims and Shrines* (2 vols., 1883); *Isabella the Catholic* (1889); *Christian Art in Our Own Age* (1891); *Three Keys to the Camera della Signatura* (1895); and *The Seven Dolors of the Blessed Virgin Mary* (1898). Her works on Christian art are elaborately illustrated.

STARR, FREDERICK (1858—). An American anthropologist, born in Auburn, N. Y. He studied at the University of Rochester and at Lafayette, where he graduated in 1882. He was registrar of Chautauqua University in 1888-89, and after two years in charge of the American Museum of Natural History in New York City (1889-91) in 1893 became professor of anthropology in the University of Chicago. His publications include: a *Catalogue of Collections of Objects Illustrating Mexican Folklore* (1899); *Some First Steps in Human Progress* (1895); and *Indians of Southern Mexico* (1900).

STARR, MOSES ALLEN (1854—). An American neurologist, born in Brooklyn, N. Y. He graduated from Princeton College in 1876; from the College of Physicians and Surgeons, New York City, 1880; served as interne in Bellevue Hospital, 1880-82; was professor of nervous diseases, New York Polyclinic, 1886-88; clinical professor of nervous diseases, College of Physicians and Surgeons, New York City, 1888-89; and professor of the same since 1889. He is the author of many articles contributed to medical journals, as well as of *Familiar Forms of Nervous Disease* (1891); *Brain Surgery* (1893); *Atlas of Nerve Cells*, with Dr. Strong (1899); *Organic Nervous Diseases* (1903); and other works.

STAR ROUTE FRAUDS. Certain frauds connected with the management of the star route postal service during the administration of President Hayes. The term 'star routes' was applied to those routes over which, owing to the lack of railroads and steamboats, the mail was carried on horseback or in wagons, such routes being commonly marked, in the books of the Post Office Department, with an asterisk or 'star.' A 'ring,' including Brady, the Second Assistant Postmaster-General, and Senator S. W. Dorsey, of Arkansas, on the one hand, and certain mail contractors on the other, was alleged to have been

formed for the purpose of defrauding the Government by increasing unduly the remuneration of certain mail contractors. The sphere of operations of the combination included 135 mail routes on which the compensation for carrying the mail was increased from $143,169 to $622,808. This increase was accomplished by securing numerously signed petitions from the localities interested praying for an increase in the number of trips, after which the schedule time for each trip was shortened. Estimates from the contractors largely in excess of the actual cost were allowed, and the profits were alleged to have been divided between the contractors and the members of the ring at Washington. The frauds were brought to light early in Garfield's administration, and the chief participants were prosecuted. Dorsey was tried, but the jury failed to reach a decision. Upon a second trial in 1883 he was acquitted. Brady was also tried, but was not convicted. Of all those prosecuted only one was ever punished. The ring was eventually broken up, but not until a number of those interested had acquired fortunes.

STARS AND BARS. The popular name applied to the flag adopted by the Confederate States of America early in 1861. See FLAG.

STAR SPANGLED BANNER, THE. The national hymn of the United States, written by Francis Scott Key (q.v.) on board the frigate *Surprise* during the bombardment of Fort McHenry, Md., by the British, in 1814. He directed that the words should be sung to the tune of "Anacreon in Heaven," composed in England by John Stafford Smith between 1770 and 1775. "The Star Spangled Banner" was first sung in a tavern near the Holiday Street Theatre, Baltimore, by Ferdinand Durang. Consult Johnson, *Our Familiar Songs* (New York, 1881); Fitz-Gerald, *Stories of Famous Songs* (London, 1898).

STARVATION (from *starve*, AS. *steorfan*, OHG. *sterban*, Ger. *sterben*, to die, Icel. *starf*, trouble, toil, work), or INANITION. Emaciation, enfeeblement, lowered vitality, and finally death, resulting from insufficiency of or total deprivation of food. The fact is stated, as quoted from Chossat, that death from starvation occurs after the loss of four-tenths of the body weight. The same observer recounts the most prominent phenomena during or after the death of animals who were starved, as follows: (1) Dropsical effusion. (2) Softening and destruction of the mucous membrane. (3) Blackening of the viscera, especially of the liver. (4) Bluish, livid, yellow, and reddish stains during life in the transparent parts of the skin. (5) Hectic fever, and a continuous decrease in the power of the body to resist cold. (6) At first a scanty excretion of dry, bilious, grass-green fæces, and afterwards diarrhœa of liquid saline matter. (7) Convulsions similar to those in death by hemorrhage. (8) Death by starvation seems to be in reality death by cold; since the temperature of the body is not much diminished until the fat is nearly consumed, when it rapidly falls, unless it be kept up by heat applied externally. (9) Young animals succumbed far sooner than adults. (10) The results of insufficient food were in the end the same as those of total deprivation, the total amount of loss being almost the same, but the rate being less, so that a longer time was required to produce it.

Chossat did not find that much influence was exerted on the duration of life by permitting or withdrawing the supply of water; but there is no doubt that in man, and probably in mammals generally, death supervenes much earlier when liquids as well as solid food are withheld. During the famine of 1847 in Ireland, the following were the most striking symptoms observed in the starving: Pain in the stomach, relieved by pressure; pallor and emaciation; bright and wild eyes; hot breath; parched mouth, thick and scanty saliva; intolerable thirst; fœtor from the skin, which becomes covered with a dark-brown secretion; tottering gait, weak and whining voice, the tears starting easily; imbecility.

The time during which life can be supported under entire abstinence from food and drink varies much. In one case, reported by Sloan, a healthy man, aged 65 years, survived 23 days' imprisonment without food in a coal-mine, having impure water for the first ten days of this period. He died three days after rescue. The average healthy individual will survive a week or ten days of complete abstinence from food and water. Consult: Fernet, "Amaigrissement extrême et mort par inanition," in *Bulletin et mémoire, Société médicale de l'hôpital de Paris* (1901); Leeson, "Death from Starvation," in *Dublin Medical Press* (1847); Davies, "Starvation," in *Popular Science Monthly*, vol. xxvi. (New York, 1884-85).

STARWORT. See CHICKWEED.

STARY-OSKOL, stä'rĭ ŏs-kôl'. A district town in the Government of Kursk, Russia, on the river Oskol, 92 miles east-southeast of Kursk. It has tanneries and tobacco factories. Population, in 1897, 16,662.

STAS, stȧs, JEAN SERVAIS (1813-91). A Belgian chemist. He was born in Louvain, studied under and later assisted Dumas, and was for many years professor of the Military Academy in Brussels. He was one of the earliest investigators of the constitution of organic compounds, such as acetal. Subsequently he devoted a number of years to the determination of the atomic weights of the elements, and it is principally for these classic researches that he is celebrated in the history of science. The impulse to these researches was given by the discussion as to whether the atomic weights are or are not exact multiples of the atomic weight of hydrogen—a question connected with Prout's hypothesis, according to which the several chemical elements are derived from hydrogen and are not essentially different substances. But the results of Stas's work have been of much further-reaching importance, and its precision has hardly as yet been surpassed. His collected works appeared in three volumes (Brussels, 1894). Consult Spring, *Notice sur la vie et les traveaux de J. S. Stas* (Brussels, 1893).

STASSFURT, stäs'fo͝ort. A town in the Province of Saxony, Prussia, on the Bode River, 20 miles south of Magdeburg (Map: Prussia, D 3). There are iron mills, and the important royal salt works, which mine potash and rock salts. Extensive chemical works are also found here. Population, in 1900, 20,031. The town has been known since 806.

STATANT (heraldic Fr., standing). In heraldry, a term applied to an animal standing still, with all the feet touching the ground. If

the face be turned to the spectator, it is said to be *statant gardant*, or in the case of a stag, *at gaze*. See HERALDRY.

STATE (OF. *estat*, Fr. *état*, from Lat. *status*, state, condition, from *stare*, to stand; connected with Gk. *ἱστάναι*, *histanai*, Skt. *sthā*, OChurch Slav. *stati*, OHG. *stān*, *stēn*, *stantan*, Ger. *stehen*, Goth., AS. *standan*, Eng. *stand*), THE. The theory of the State in its broadest sense may be taken to cover the whole field of political philosophy, involving the comprehensive examination of the laws underlying political phenomena. (See POLITICAL SCIENCE.) In a narrower sense, the theory of the State is concerned primarily with the essential nature of the State, its origin and basis, its various forms, and proper function or purpose.

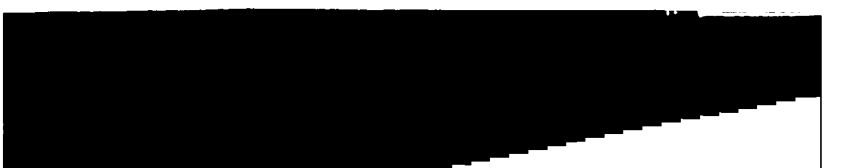
The essential elements of the State, together distinguishing it from other social groups, are generally considered to be the following: a territorial basis serving as the physical foundation of the State, a population constituting its citizenship, and a more or less complete form of political organization exercising the power of life and death. Finally, the State is a sovereign body, being supreme over all persons on its territory and independent internationally. It is also held by some authorities that the State is an organism or a person.

The origin and basis of the State have been explained in various ways for the purpose of justifying or condemning various political systems. It has been held that the State owes its genesis and continuance to the will or command of God, a doctrine that has been used in the defense of all forms of government, including democracy. The origin of the State has been traced by others to the family, and explained as a development of the power of the early patriarchs. Others have maintained that the State was created by and exists in virtue of a voluntary contract to which the parties were either (1) the government on the one hand and the people on the other; or (2) separate individuals who agreed to form a political society and a government by a contractual process. Again it is argued that the foundation and support of the State is superior force, which in its first and last analysis is the essential fact in a political system. The modern theory is that the State owes its being to an historical process in which many or all of the foregoing factors may have played a part as the varying conditions required. The explanation of the present existence of a coercive power over individuals is generally found in a variety of motives for obedience. Of these the principal ones are custom or habit, fear, utility or the calculation of accruing advantages and disadvantages, and the element of conscious and rational consent. The general tendency of political development is toward a State based on general perception of its utility, and consequent consent to its laws. It may be added that the anarchistic school denies the existence of any rational justification for the State, demanding its complete abolition, and the substitution of some such principle as that of 'justice' or 'humanity' for that of coercive power.

The forms of the State are three, monarchy, aristocracy, and democracy, according as political power rests with one, the few, or the many. All other forms of government may be resolved into the three
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speculation centred was the true and proper relation between Church and State. Thomas Aquinas (*Summa Theologica* and *De Regimine Principum*) was the most successful champion of the Church; Marsilius of Padua (*Defensor Pacis*) and Dante (*De Monarchia*) of the State. During the Renaissance and the Reformation political theory made important advances. By the work of Machiavelli (*Il principe, Discorsi*) politics was divorced from theology and ethics, and elevated to the position of an independent science. Jean Bodin, reviving the method and spirit of Aristotle, laid the foundations of modern systematic politics in his epoch-making treatise, *De Republica*. In the revolutionary period of the seventeenth and eighteenth centuries the so-called natural-law philosophy was dominant. The fundamental premise of this system was the universal prevalence of an immutable law of natural justice, under which and independently of any government all men hold certain natural rights, e.g. life, liberty, and property. From this premise followed the theory of a contract as the basis of all legitimate government, the administration of government for the good of the parties to the contract, and the right of revolution whenever government is perverted to selfish ends by the rulers. Of these doctrines John Locke (*Two Treatises of Civil Government*) and Jean Jacques Rousseau (*Le contrat social*) were the most influential expounders. During the same period the opposing doctrines of the divine right of kings and governmental absolutism were developed by Robert Filmer (*Patriarcha*) and Bossuet (*Politique tirée de l'écriture Sainte*), while Thomas Hobbes turned the natural-law theory to the defense of absolutism (*The Leviathan*). As opposed to the *a priori* conception of these writers, Montesquieu (*Esprit des lois*) placed the study of political science upon an historical basis.

The modern theory of politics, dating from the reaction against the excesses of the French Revolution, is based on the historical-scientific premise that all institutions are the product of an evolutionary movement in which the conscious will of individuals plays a comparatively unimportant part. The method followed is historical and comparative, in contrast to the deductive style of the preceding school. The numerous problems arising out of the development of modern democracy, those involved in Nationalism, Federalism, and Imperialism, and the determination of the proper function of government, are the questions upon which general attention is fixed.

BIBLIOGRAPHY. The most important works on the history of political theory are: Dunning, *A History of Political Theories* (New York, 1902); Janet, *Histoire de la science politique dans ses rapports avec la morale* (Paris, 1850, 1872); Bluntschli, *Geschichte der neueren Staatswissenschaft* (Munich, 1864); Mohl, *Geschichte und Litteratur der Staatswissenschaften* (Erlangen, 1855-58); Pollock, *Introduction to the Study of the Science of Politics* (London, 1890). Consult also: Lieber, *Manual of Political Ethics* (Boston, 1838-39); id., *Legal and Political Hermeneutics* (ib., 1839); Woolsey, *Political Science; or the State Theoretically and Practically Considered* (New York, 1877); Wilson, *The State* (Boston, 1889); Sidgwick, *Elements of Politics* (London, 1896); Willoughby, *The Nature of the State* (New York, 1896); Bosanquet, *The Philosophical Theory of the State* (London, 1899).

STATE, DEPARTMENT OF. One of the nine executive departments of the Government of the United States, presided over by a Secretary who is a member of the Cabinet and first in the line of succession to the Presidency after the Vice-President. In rank the Department of State stands first among the other departments and is also the oldest in point of origin. It was in fact the logical successor of the old Department of Foreign Affairs created in 1781 and presided over first by Robert R. Livingston and afterwards by John Jay. The Department of State is the organ of communication between the Government of the United States and all foreign governments, as well as with the Governors of the individual States. The Secretary of State conducts all such correspondence; has charge of the negotiation of all treaties and conventions; he preserves the originals of all treaties, public documents, and correspondence with foreign governments as well as of the laws of the United States; he publishes all statutes and resolutions of Congress and proclamations of the President; he is the custodian of the great seal which is affixed to all commissions of appointment requiring the consent of the Senate, proclamations, warrants for extradition, pardons, etc., emanating from the President; he issues and keeps a record of passports granted to American citizens traveling abroad; issues warrants for the extradition of criminals to be delivered to foreign governments; presents foreign ministers to the President; etc. He makes an annual report of the conduct of foreign affairs for the year, publishes the consular reports and the 'foreign relations' of the United States, and performs such other duties relative to the conduct of foreign affairs as the President may direct.

To aid the Secretary of State, an Assistant Secretary was provided for in 1853; in 1866 a second assistant was created, and in 1874 a third, each charged with the supervision of a particular branch of the department. The business of the department is distributed among seven bureaus, namely, a diplomatic bureau, a consular bureau, a bureau of indexes and archives, a bureau of accounts, a bureau of rolls and library, a bureau of foreign commerce, created in 1897 (formerly the bureau of statistics), and a bureau of appointments, created in 1898. The name of each bureau indicates broadly the nature of the business assigned to it. Besides the Secretary and the three assistant secretaries there is a solicitor, detailed from the Department of Justice, an assistant solicitor, created in 1900, seven chiefs of bureaus, two translators, sixty-three clerks, and a number of messengers, making a total force of about one hundred employees.

The following is a list of the Secretaries of State from the organization of the department in 1789 to the present, with the dates of their appointment: Thomas Jefferson, September, 1789; Edmund Randolph, January, 1794; Timothy Pickering, December, 1795; John Marshall, May, 1800; James Madison, March, 1801; Robert Smith, March, 1809; James Monroe, April, 1811; John Q. Adams, March, 1817; Henry Clay, March, 1825; Martin Van Buren, March, 1829; Edward Livingston, May, 1831; Louis McLane,

May, 1833; John Forsyth, June, 1834; Daniel Webster, March, 1841; Hugh S. Legaré, May, 1843; Abel P. Upshur, July, 1843; John Nelson, February, 1844; John C. Calhoun, March, 1844; James Buchanan, March, 1845; John M. Clayton, March, 1849; Daniel Webster, July, 1850; Edward Everett, November, 1852; William L. Marcy, March, 1853; Lewis Cass, March, 1857; Jeremiah S. Black, December, 1860; William H. Seward, March, 1861; Elihu B. Washburne, March, 1869; Hamilton Fish, March, 1869; William M. Evarts, March, 1877; James G. Blaine, March, 1881; Frederick T. Frelinghuysen, December, 1881; Thomas F. Bayard, March, 1885; James G. Blaine, March, 1889; John W. Foster, June, 1892; Walter Q. Gresham, March, 1893; Richard Olney, June, 1895; John Sherman, March, 1897; William R. Day, April 1898; John Hay, September, 1898. Consult: *History of the Department of State* (Washington, 1901); Schuyler, *American Diplomacy* (New York, 1886).

STATEN (stät'*en*) **ISLAND.** An island of New York constituting Richmond County, and since 1898 the Borough of Richmond, New York City (q.v.). It is distant a little more than five miles from the southern extremity of Manhattan Island, and is separated from Long Island on the east by the Narrows, which connect the Upper New York Bay with the Lower Bay.

STATE PUBLIC SCHOOL. A model institution at Coldwater, Mich., for the education and support of dependent and ill-treated children of the State. It was established by an act of the State Legislature in 1871, but was not formally opened until 1874. It is the object of this institution to receive, care for, educate, and place whenever possible in family homes all the dependent children of the State of sound mind and body between the ages of two and twelve. The board of control, however, has the discretionary power vested in it of admitting children under two, where circumstances warrant such an exception. Since its foundation it has received over 5000 children, and in 1902 there were in the school 155 inmates. The school is located on a farm of 160 acres, covered partly by orchards, ornamental trees, and gardens. The buildings consist of an administration building, schoolhouse proper, and nine cottages among which the inmates are distributed. This system of cottages, under the superintendence of matrons who are specially qualified for that work, has the tendency to foster a love for home life. The State of Michigan was first in establishing this type of school. Similar institutions have since been established in Iowa, Minnesota, Kansas, Montana, Colorado, Wisconsin, Texas, Nebraska, Alabama, Rhode Island, and Nevada.

STATES, Popular Names of.

Badger State. Wisconsin, from the animal.

Bay, or Old Bay, State. Massachusetts. The name Massachusetts Bay, though later used in a more extended sense, was originally restricted to Boston Harbor, and as early as 1622 persons from Plymouth spoke of 'the Bay.' Under the first charter, the government was called the Colony of the Massachusetts Bay; and under the second charter, the Province of the Massachusetts Bay. Hence the nicknames Bay Colony, Bay Province, and Bay, or Old Bay, State.

Bayou State. Mississippi, from the number of its bayous, a word derived from the Indian *bayouc(k)*, meaning a rivulet.

Bear State. Arkansas, from the animal.

Blackwater State. Nebraska, from the dark color of its rivers, owing to the black vegetable mold which covers large areas.

Blizzard State. South Dakota. The word 'blizzard,' of obscure origin, was used as early as 1829 in the sense of a blow or a discharge from a gun. In its present sense the word was recorded in 1876, and is said to have been current in Dakota for a decade previous.

Blue Grass State. Kentucky, from its celebrated blue grass.

Blue Hen State. Delaware. The term is said to have originated in the Revolutionary War, when an officer in a Delaware regiment raised famous gamecocks from a breed of blue hens; hence the members of his regiment were called 'Blue Hen's Chickens,' and so the name came to be applied to the State; but the story lacks proof.

Blue Law State. Connecticut. See Blue Laws.

Bread and Butter State. Minnesota, from its wheat and dairy products.

Buckeye State. Ohio, because of the horse-chestnut, which grows there in great profusion and which for more than a century has been popularly called *buckeye*.

Bullion State. Missouri, from the sobriquet 'Old Bullion,' applied to Senator Thomas Hart Benton of that State on account of his advocacy of gold and silver currency.

Centennial State. Colorado, because it was admitted into the Union in the Centennial year, 1876.

Central State. Kansas, from its location with reference to the other States of the Union.

Corn Cracker State. Kentucky, perhaps because the poor whites subsist chiefly on corn.

Cotton State. Alabama, because it is the central State of the cotton belt.

Cracker State. Georgia, from the poor whites, who for more than a century have been called Crackers.

Creole State. Louisiana, from its many inhabitants descended from the French and Spanish settlers.

Dark and Bloody Ground. Kentucky, because in its early days it was the scene of frequent Indian wars. The name has been known for more than a century.

Diamond State. Delaware, from its diminutive size.

Dominion, Ancient or Old. Virginia. In early documents we read of 'the Colony' or 'the Plantation' or 'the Colony and Plantation' of Virginia; while later, about 1674, there are allusions to 'the Colony and Dominion' of Virginia, about 1682 to 'the Dominion' of Virginia, and about 1697 to 'the Ancient Colony and Dominion' of Virginia. Hence, in time, came the nicknames Ancient Dominion and Old Dominion merely. According to some, the name is due to Virginia's loyalty to the Stuarts during the Civil War.

Egypt. Southern Illinois, either from its alleged intellectual darkness or from the fertility of its soil.

El Dorado. California. El Dorado (q.v.) was the name of a fictitious region or city, abounding in gold, supposed to exist in South America. Hence it was sometimes, after the discovery of gold in California in 1849, applied to that State.

Empire State. New York, from its size, wealth, and number of its inhabitants.

Empire State of the South. Georgia, from its enterprise.

Evergreen State. Washington.

Excelsior State. New York, from the motto on its seal (adopted 1778).

Freestone State. Connecticut, from its freestone quarries.

Golden State. California, from its gold-mines.

Gopher State. Minnesota, from the animal.

Granite State. New Hampshire, from its granite hills.

Green Mountain State. Vermont, from the Green Mountains.

Hawkeye State. Iowa. The name arose about 1839, apparently in allusion to J. G. Edwards, familiarly known as 'Old Hawkeye,' editor of the Burlington *Patriot*, the name of which paper was changed September 5, 1839, to the *Hawkeye and Patriot*.

Hoosier. Indiana. In use as early as 1833, but its origin is obscure.

Jayhawker State. Kansas. The word, of obscure derivation, appears to have originated with a party on its way to California in 1849, but no instance of its use is recorded prior to 1858, when it was used in Kansas, where it was derisively applied to James Montgomery and his men, who, in retaliation for the atrocities committed on Free-State settlers by the 'border ruffians,' raided the pro-slavery settlers and their abettors from Missouri. Later it was applied to marauders on both sides during the Civil War, and finally was applied to the people of Kansas.

Keystone State. Pennsylvania, probably because it was the central State of the Union at the time of the formation of the Constitution.

Lake State. Michigan.

Land of Steady Habits. Connecticut. See BLUE LAWS.

Little Rhody. Rhode Island, from its diminutive size.

Lone Star State. Texas, from the single star in the flag of the Texas Republic (1836-1845).

Lumber State. Maine.

Mormon State. Utah.

Mother of Presidents. Virginia, because the birthplace of seven Presidents.

Mother of States. Virginia, because the first settled of the States.

New England of the West. Minnesota.

Nutmeg State. Connecticut, in allusion to the alleged manufacture of wooden nutmegs in that State.

Old Colony. That part of Massachusetts which from 1620 to 1692 was the Plymouth Colony.

Old Line State. Maryland, probably from the 'Maryland Line' which won distinction in the Revolutionary War.

Old North State. North Carolina.

Palmetto State. South Carolina, from the device on its seal.

Panhandle State. West Virginia, from the irregular section of the State projecting northward between Pennsylvania and Ohio.

Pelican State. Louisiana, from the device on its seal.

Peninsula State. Florida, from its location.

Pine Tree State. Maine, from the device on its seal, adopted in 1820.

Prairie State. Illinois, from its prairies.

Sage-Brush State. Nevada, from the plant.

Silver State. Nevada, from its silver-mines.

Sucker State. Illinois, because in the early days the men went up the Illinois River to the mines and returned at the season when the sucker migrated. The term was first used about 1833.

Sunflower State. Kansas.

Turpentine State. North Carolina, from the turpentine produced in it.

Web-Foot State. Oregon, from the quantity of rain which falls there.

Wolverine State. Michigan, from the animal.

STATE'S EVIDENCE (or, in England, KING'S or QUEEN'S EVIDENCE). A popular phrase used to denote the testimony given by an accomplice in the commission of a crime against the other accomplices on their trial, under an agreement or understanding with the prosecuting officer that the witness shall not be brought to trial for his part in the crime, in consideration of his aid to the State. Such an agreement or understanding on the part of the prosecution is not valid and enforceable as a matter of law, but in practice such agreements are usually adhered to by the prosecutor as a matter of good faith and are countenanced by courts as a justifiable and proper means of securing convictions for crime. In several States there are statutes providing that there shall be no conviction for crime upon the uncorroborated testimony of an accomplice. In applying this statute, whether a witness is an accomplice whose testimony requires corroboration is a question for the jury, unless the facts are undisputed or the question rests upon some rule of law, where it must be passed upon by the court. See ACCOMPLICE; PRINCIPAL; ACCESSORY.

STATES-GENERAL (Fr. *états généraux*). The name given to the convocation of the representative body of the three orders of the French kingdom, representing the nobility, clergy, and bourgeoisie or *tiers état* (Third Estate). As far back as the time of Charlemagne, there were assemblies of clergy and nobles held twice a year to deliberate on matters of public importance, and in these assemblies the extensive body of laws bearing the name of the Capitularies of Charlemagne was enacted. These national convocations seem to have ceased to be held at the time of the final disruption of the Carlovingian realm, about seventy years after Charlemagne's death. From that time forward there is no trace of any national assembly in France till 1302, when the *états généraux*, including the three orders of clergy, nobles, and citizens, were convoked by Philip the Fair, with the view of giving greater weight to the course adopted by the King in his quarrel with Pope Boniface VIII. In 1308 Philip obtained from the states-general a condemnation of the Knights Templars. During the period of the Hundred Years' War (1337-1453) the states-general were frequently convoked, and the exigencies of the Court enabled them to play an important rôle in connection with the revenue and taxation. But they were not a law-making body, although they enabled the voice of the nation to assert itself against abuses of the royal power. As the royal authority became more and more absolute, and a standing army made the sovereign less dependent upon financial grants made by his subjects, the summoning of the states-general gradually ceased to

be regarded as indispensable. The advisers of Louis XIII. convoked the states-general, after a long interval, in 1614, but the body was soon dismissed for looking too closely into the finances; and from that time there was no convocation of the states-general till the memorable meeting in 1789, which initiated the French Revolution. The states-general voted by orders, but in 1789 the Third Estate refused to abide by a regulation which enabled the other two orders to combine against it and to thwart its purposes. They insisted that the vote should be by members in a single body (with the Third Estate as numerous as the other two orders combined), and they achieved their object by constituting themselves the National Assembly. See FRENCH REVOLUTION.

The name States-General is also applied to the existing legislative body of the Kingdom of the Netherlands (q.v.), as was formerly the case in the Republic of the Netherlands from 1593 to 1795.

STATES OF THE CHURCH. The territory in Central Italy formerly under the temporal sovereignty of the Holy See. For their history, see PAPAL STATES; and for the theory involved, TEMPORAL POWER.

STATES' RIGHTS. A political term having reference to the rights of the individual States as compared with the central Government in countries having a federal form of government. In the history of the United States, the term is used to denote the view prevailing in the South prior to the Civil War with regard to the nature of the Union. According to this view the Union was a compact of sovereign and independent States; the central or Federal Government was the mere agent of the States, which were regarded as the principals; and the primary allegiance of the individual was to his State rather than to the United States. In effect this view upheld the right of a State to interpose its authority when the central Government enacted oppressive or unconstitutional laws. (See NULLIFICATION.) Southern statesmen and political leaders contended for this view with particular insistence in connection with the long controversy over slavery. Prior to the Civil War, a large proportion of the people of the Southern States held to the States' rights view of the Constitution, although many of them were not nullifiers. In the early part of the nineteenth century, particularly at the time of the War of 1812, the States' rights view was also strong in the North and East, and was not abandoned until it became the view and support of the slavery interest. The Civil War settled the issue adversely to the States'-rights view, and it is no longer a constitutional question in the old sense of the term. In the German Empire, States' Rights, or Particularism, as the Germans call it, is very strong, and has been at the bottom of many great constitutional struggles in that country. The Imperial Constitution recognizes a large sphere of autonomy of the individual States, and some of those in South Germany enjoy rights which are survivals of the Confederation.

STATESVILLE. The county-seat of Iredell County, N. C., 156 miles west of Raleigh, on the Southern Railway (Map: North Carolina, B 2). It is in the centre of a rich grain and tobacco growing section, with some mineral deposits. One of the State experiment farms is just outside the city limits. There are furniture factories, flour mills, cotton mills, tanneries, foundries, and iron works. The water works and the electric light plant are owned by the municipality. Population, in 1900, 3141.

STATE TRIALS. In English law, a phrase employed to denote trials involving offenses against the State, or which determine questions concerning the duties and privileges, etc., of important officers of the Crown. The first collection of State Trials appeared in 1719; a second in 1730; a third in 1742; *Hargrave's* edition in ten volumes in 1776-81; and between 1809 and 1826, the fifth edition in thirty-three volumes was published. This edition is the one now used, and is known as "Howell's State Trials," after the real editor, Thomas Bayley Howell, who compiled the work, although the name of one Cobbett appears as editor on the title-page of volume i. These reports contain much learning in criminal and constitutional law. A new series is being prepared under the supervision of a Parliamentary Committee, and all important cases in constitutional and international law will be included.

STATIC ELECTRICITY. See ELECTRICITY.

STATICS (from Gk. *στατικός, statikos*, relating to standing, from *στατός, statos*, placed, standing, from *ἱστάναι, histanai*, to stand). That branch of dynamics which treats of the properties of material bodies when, under the action of forces, their motion is not changing. They are then said to be in equilibrium. See MECHANICS and EQUILIBRIUM.

STATIC SENSE. In close anatomical connection with the cochlea of the inner ear there are in man and most other vertebrates three bent tubes of bone inclosing three membranous tubes, filled with and floating in a fluid, the endolymph and perilymph. These tubes, known as the semicircular canals, lie approximately in the three planes of space. At the termination of each canal is a flask-like swelling (ampulla), within which are to be found certain specialized nervous end-organs. The ingoing fibres from the three ampullæ constitute the main portion of the vestibular branch of the eighth or auditory nerve. Arguing from these anatomical features, it was long supposed that the canals served some auditory function such as the sensation of noise or the perception of localization of sounds. But we now have abundant evidence for regarding them as the organ of the 'static sense'—by which is meant (1) that they constitute a *physiological* apparatus for the maintenance of equilibrium (and some would add, for the maintenance of muscular tonicity); (2) that any irregularity in their operation makes itself felt *mentally* as giddiness or dizziness; and more doubtfully (3) that an acceleration or a diminution of the rate of movement of the body as a whole so affects them as to set up sensations which are interpreted as what has very loosely been termed a 'sense of translation.'

STATIONERS' HALL. The guildhouse of the 'Master and Keepers or Wardens and Commonalty of the Mystery or Art of Stationers of the City of London,' now situated near Ludgate Hill in London. This company, which had been

preceded by a voluntary association as early as 1403, was incorporated in 1556. For nearly three hundred years it regulated the publication of all books in England. Since the passage of the copyright law (1842), registration is no longer compulsory, but it is necessary for securing copyright. For a history of the company, consult the first volume of E. A. Arber's valuable *Transcript of the Stationers' Registers, 1554-1640* (5 vols., London, 1875-94).

STATIONS (Lat. *statio*, from *stare*, to stand). A name applied in the Roman Catholic Church to certain places reputed of special sanctity, which are appointed to be visited as places of prayer. The name is particularly applied in this sense to certain churches in the city of Rome. The word is employed in reference to a popular devotional practice of the Roman Catholic Church, known as that of 'the stations of the cross.' Carved or painted representations, the subjects of which are supplied by scenes from the passion of Christ, are called stations of the cross, and are found in every church. The origin of this devotional exercise, like that of local pilgrimages, is traceable to the difficulty of access to the holy places of Palestine, consequent on the Turkish occupation of that country. The number of the stations is commonly fourteen; the subject of all is a sort of pictorial narrative of the passion. The devotional exercise is performed by kneeling at the several stations in succession, and reciting certain prayers at each, or joining in their recitation by the priest.

STATISTICAL CONGRESS, INTERNATIONAL. An organization of the most eminent statisticians of all countries, which convenes from time to time to define and systematize investigations. The first meeting was held at Brussels in 1853.

STATISTICS. Etymologically, the science of States. The word seems to have been introduced into England about the beginning of the nineteenth century. It came into use in Germany about half a century earlier, and was there applied to lectures or books upon descriptive political science, of which the *Statesman's Year Book* and the *Almanach de Gotha* are typical modern representatives. If either of these annual publications be imagined stripped of the numerical statements so frequent in them, a very fair notion is left of Achenwall's *Outlines of Modern Political Science* ("Abriss der neuesten Staatswissenschaft," etc., 1749), which opens with the statement: "The notion of statistics so called, that is, the political science of the several kingdoms, is very differently understood, and among the many books on the subject it is not easy to find any one that agrees with the rest in the number and the arrangement of its parts," a complaint which might be made to-day with almost equal correctness. The title Statistics thus adopted by Achenwall established itself as the prevailing name for a sort of descriptive political science, which had existed long before as the Elzevir *Republics* and the writings of Conring illustrate, and which maintained itself at the universities and before the public in Germany until into the nineteenth century.

Meantime in England a different line of work had begun about the middle of the seventeenth century, after the recurrent and disastrous visitations of the plague had roused interest enough in the mortality it did so much to swell to cause weekly reports of the burials and later of the christenings in London to be made and published. The keen interest in the methods of observation and measurement which culminated in and were reinforced by the Royal Society, chartered in 1662, induced Captain John Graunt to apply methods of observation, induction, and measurement to the births and deaths of London. He presented to the Royal Society in 1662 his "Observations on the Bills of Mortality," the foundation of statistics as that word is now understood. But at that time the new study was baptized by his friend and collaborator, Sir William Petty, 'Political Arithmetic.' Interest in this line of work grew and spread gradually to the Continent, where Achenwall's contemporary Süssmilch in 1741 hailed Graunt as a scientific Columbus who had discovered a new continent and confessed himself Graunt's disciple, but showed no knowledge of Achenwall's work and made no use of the name statistics. Gradually the word statistics spread to Great Britain, where, in 1798, Sir John Sinclair published his *Statistical Account of Scotland*. The word was taken up by Malthus in editions of his *Principle of Population* after the first, and in such connection as to indicate that he borrowed it from Sinclair. Malthus's subject-matter was in the line of previous writers on political arithmetic, and his adoption of the term statistics may have been instrumental in leading to its gradual displacement of the lengthier phrase in English writing. Meantime the study of political arithmetic, born in England, extended to the Continent, gradually displacing the older statistics of Achenwall, sometimes called 'university statistics,' from its prevalence as a subject of university lectures, and, to add insult to injury, usurped its name. Perhaps the most striking difference between the two notions of statistics, the older and the newer, is that the former is purely descriptive and takes no account of the underlying notion of modern science, the notion of causation, while the latter subordinates description to explanation, or an attempt at explanation. At the same time it would be inconsistent with present usage to limit the word statistics any further than to say that it refers to the results obtained in any field of reality by methods of counting and that these methods are mainly employed in the study of societies politically organized into States.

Methods of counting apply especially to the study of human societies, because in them the individual units are widely different, and it is with the differences almost as much as with the resemblances between individuals that science is concerned. In the inorganic sciences and to a less extent in the sciences of plant and animal life, the units taken for purposes of investigation resemble one another far more closely than human individuals do, or at least their resemblances are far more obvious and for man's purposes more important than their differences. In other than the social sciences, therefore, the observation of one or a few units may serve as a basis for general statements about the group, but in human societies it is frequently necessary to ascertain the existence, or non-existence, of a particular characteristic in every member of the group. This involves counting, and results in a

statement in some numerical form, as a percentage, an average, or a series of figures showing the distribution of the characteristic among the members of the group. This indicates a fundamental reason for the imperfect development of methods of measurement in the social sciences and a reason that statistics or the science of measuring aggregates of units, as distinct from individual units, is more necessary and has a wider range of applications in the study of social sciences than it has in the study of natural sciences. There is, therefore, much ground for the opinion of those who define statistics as the numerical study of social facts, or the numerical investigation of man's social life. But it seems more correct to hold that, for example, an enumeration through the century of the number of auroras observed each year and an observation through the same period of the extent of spots on the sun, and an arrangement of these two measurements in such a way as to show that they have fluctuated in close conformity, is to be included in statistics.

THEORY. The United States Census reported in 1890 22,329,990 persons in the country over 15 years of age and married; in 1900 this class of the population numbered 27,765,707. On computing the ratios it is found that among each 1000 adults 553 were married in 1890 and 557 in 1900. The same authority reported at the Eleventh Census 875,521 deaths during the preceding year, of which 6756 were caused by railroad accidents, and at the Twelfth Census 1,039,094 deaths, of which 6930 were due to the same cause, so that railroad accidents caused in 1890 657 deaths and in 1900 667 deaths out of each 100,000 reported. The foregoing will serve to illustrate a regularity or uniformity often, but not always, traceable in the distribution of conditions or the recurrence of events in society. Upon this uniformity in the characteristics of, and this regularity in the events occurring in, social groups, which has been not very felicitously called 'the law of large numbers,' the statistical method rests. These uniformities and regularities do not exist in the individual or even in the small group, and if they could not be traced in the large group the laborious and uninviting statistical method would add nothing to the information obtainable from examination of a few individuals or instances, and therefore, however important for political ends, would have no significance for science. It is this 'law of large numbers,' or the permanence of numerical relations in social life, that makes it possible to describe human societies with accuracy in quantitative terms, to frame inductions from their past, which are found to hold for their future, to forecast the influence of a given change upon their life and so in multitudinous ways to control that life. Perhaps the best illustration of the importance of the 'law of large numbers' is found in the business of insurance, which could not exist were it not for that law as a foundation. This principle stands in somewhat the same relation to the possibility of a science of society that the principle of the uniformity of nature does to the possibility of natural science. In social phenomena it is seldom if ever possible to carry the isolation of causes to the degree of perfection it has reached in the natural world. The presence of a few drops of hydrochloric acid is practically the only difference between a transparent solution of nitrate of silver and a turbid white fluid, so the acid is said to cause the precipitate. But the marriage of an individual man or woman is influenced by so many complex considerations that it is impossible to perceive in the vast majority of marriages taken separately any effect of so subsidiary a cause as the price of bread or the spread of business depression. What this subsidiary cause loses, however, in power over each individual instance it gains by the number of individuals it reaches and the fact that its effect is uniformly in the same direction, while the influence of age, of example, of personal affection, of gain or loss of property, etc., though in many individual cases far more powerful, is felt sometimes in one direction and sometimes in another. Such causes, therefore, are as powerless on the aggregate as they are potent on the individual, and, on the contrary, the society as a whole betrays the undeniable effects of slight causes, which perhaps few individuals therein would admit to have swayed their action. The 'law of large numbers' thus assumes that the causes of any social phenomenon may be divided into two groups, the individual, accidental, or disturbing causes, and the essential or primary causes, and that causes of the former sort have no constant tendency to act in one direction rather than another, and, accordingly, no tendency to move the group as a whole in any one direction. If a sufficiently large number of instances be taken, the disturbing or individual causes cancel and allow the influence of the essential or group causes to be traced. How large a number of instances must be enumerated to eliminate these individual causes with any specified degree of completeness is a mathematical problem dealt with by the calculus of probabilities.

BIBLIOGRAPHY. For the only survey of the history in English, see Falkner's translation of Meitzen's *Geschichte, Theorie und Technik der Statistik*, published by the American Academy of Political and Social Science in 1891. For the theory of the subject, see the latter part of the foregoing book; Bowley, *Elements of Statistics* (London, 1901), strong in English methods, in wage statistics, and in the mathematical basis of the subject; and Westergaard, *Theorie der Statistik* (Jena, 1890). See also Mayo-Smith, *Statistics and Sociology* and *Statistics and Economics*.

STATIUS, stā'shĭ-ŭs, PUBLIUS PAPINIUS (c.40-c.96 A.D.). A Roman poet, born at Naples. He became famous for his poetic gifts, especially for his skill in extemporaneous verse, and three times gained the prize in the Alban contests. But finally, having been vanquished in the quinquennial games, he retired with his wife, Claudia, to his birthplace, Naples, where he died about A.D. 96. He is polished and correct, but one often feels the note of artificiality in his verse. He wrote a very dull and laborious epic entitled *Thebais;* the *Silvæ*, five books of miscellaneous poems; and an epic of the Trojan cycle, *Achilleis*, of which only a portion has survived. The best modern editions are: of the *Silvæ*, by Bachrens (Leipzig, 1876), Vollmer (with extensive German commentary, Leipzig, 1898), and Klotz (Leipzig, 1900); of the *Achilleis* and *Thebais*, by Kohlmann (Leipzig, 1879). There are English translations, in whole or in part, by Pope, Howard, Stephens, and Lewis.

STATUTE (Lat. *statutum*, statute, neu. sg. of *statutus*, p.p. of *statuere*, to set up, establish, from *statum*, supine of *stare*, to stand). A law enacted or promulgated in writing by the supreme legislative body of a government, or by its authority. Statute law is sometimes spoken of as written law to distinguish it from the common or unwritten law, which is established exclusively by judicial decision. All statutes have their source in the official action of the legislative body, the form of which may vary according to the particular form of government under which it acts. The validity of a statute in any given case depends not only upon the legislative body's being lawfully constituted, but upon its constitutional authority to act. (See CONSTITUTIONAL LAW.) Statutes may be enacted by indirect legislation, that is, by some subordinate legislative body whose acts derive their validity from the sanction of the supreme legislative body. Thus, in England Orders in Council and the various rules of court adopted under the judicature acts, and in the United States the ordinances of Boards of Aldermen, and the ordinances of Boards of Health under the various public health acts, are examples of statutes enacted by indirect legislation.

The procedure by which statutes are created by legislative enactment has been fully discussed under the topics PARLIAMENT; CONGRESS; LEGISLATION; etc.; to which reference is here made. In England the acts of Parliament have the full force of statutory law without the approval of the sovereign, although it is the established custom for the sovereign to promulgate all statutes "by and with the advice and consent of the Lords Spiritual and Temporal in this present Parliament assembled." In the United States the acts of Congress require the assent of the President of the United States, and the acts of the various legislatures require the assent of the Governors of their respective States to give them validity as statutes. See VETO.

Statute laws may be classified with reference to the purpose for which they are enacted, with reference to the subject-matter of the statutes, and with reference to the compliance with the statute required. With reference to their purpose, statutes are said to be (a) Declaratory, when passed for the purpose of affirming a rule of the common law which is uncertain or indefinite, or a statute of doubtful meaning; (b) Remedial, when passed for the purpose of remedying defects or supplying omissions in the statute or common law; (c) Penal, when passed for the purpose of prohibiting acts specified in the statute and imposing a penalty for its violation. With reference to their subject matter, they are said to be (a) Public, when applicable to the entire community, and (b) Private (see the explanation of these terms under the titles LAW; LEGISLATION; PUBLIC LAW; etc.), as distinguished from public when applicable to a single individual or corporation, or to a limited number of individuals. The distinction between public and private statutes, first made as early as the reign of Richard II., now has considerable importance, owing to various statutory and constitutional provisions requiring the publication of public and private statutes separately. Statutes have also been classified with reference to the extent of territory in which they are applicable. Those statutes are said to be (a) General, when they apply to the entire territory subject to the legislative jurisdiction of the law-making body, and (b) Local, when they extend only to a single or limited political division of such territory, as statutes enacted by State legislatures which apply only to a single town, city, or county.

With reference to the subject matter also, statutes are classified as Enabling acts, which confer rights or privileges, as the Married Women's Enabling Acts; and Disabling acts, which take away rights or privileges hitherto enjoyed, as statutes requiring legal voters to have new or additional qualifications.

With reference to the compliance required statutes are said to be (a) Mandatory, when they direct an act to be done with the consequence that if it is not done all acts or proceedings taken under the statute are invalid. Thus statutes formulating the procedure for organizing corporations, or authorizing civil arrest, are mandatory, since they must be strictly complied with, or all acts done under them have no validity.

(b) Directory, when failure to comply with the statute does not affect the validity of acts done under it or entail the imposition of any penalty for failure to comply with the statute. Thus many statutes specifying the time and manner of filing official reports are directory only. There is no penalty for failure to comply with the statute, and compliance with it can be compelled only by mandamus (q.v.).

(c) Prohibitory, when they forbid the doing of any act either with or without penalty for failure to comply with the statute.

(d) Permissive, when they allow acts to be done not before permitted, or give to them some additional legal effect, although such acts are not required to be done, as the various statutes permitting the disposition of property by will.

A statute may contain four distinct parts—the title, the preamble, the enacting clause, and the purview. The title is a short form of description of the statute, as for example, 'An Act Prohibiting Sabbath-Breaking.' In some States the title is of great importance, because of constitutional provisions requiring statutes to have titles descriptive of the subject matter of the statute. In the absence of such provision, it is now the usual practice to omit the title.

The preamble is an introductory and explanatory statement setting forth the reason and purpose of the statute. It is of service only as an aid in interpreting the purview of the statute which follows. All the early English statutes included the preamble, but it is now seldom used.

The enacting clause is a brief direction that the statute be enacted by the legislative body; as, "Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled."

The purview is that portion of the statute following the enacting clause, and is the only part of the statute which has the effect of law. It may contain various subdivisions or clauses known as provisos, exceptions, the saving clause, the repealing clause, terms which are self-explanatory.

At common law a statute was deemed to take effect as upon the first day of the session in which it was enacted. This was modified by

Statute 33, Geo. III., c. 13, which provided that all statutes should become operative from the date of their receiving the royal assent. It is now generally the rule in the United States that statutes shall become operative from the date of their receiving the assent of the Executive, unless a different date is otherwise specified in the statute itself.

Courts will take judicial notice of all public statutes operative within their jurisdiction, and it is therefore not necessary generally to plead a public statute upon which a litigant founds an action or defense. Some rule of public policy may, however, require a public statute to be pleaded in special cases, as the Statute of Limitations (q.v.) and Statute of Frauds (q.v.). Private statutes, however, are required to be pleaded, and the statutes of foreign States and countries, being regarded as matters of fact, are required to be pleaded and proved like other matters of fact.

For discussion of the *amendment* and *repeal* of statutes, consult those topics respectively; and for a discussion of the interpretation of statutes, see INTERPRETATION; CONSTITUTIONAL LAW; LAW; etc.

Consult the authorities referred to under LEGISLATION; LAW.

STATUTE OF FRAUDS. See FRAUDS, STATUTE OF.

STATUTE OF LIMITATIONS. See LIMITATION OF ACTION.

STATUTE OF PARLIAMENT. See ACT OF PARLIAMENT.

STATUTES OF JEOFAILS. English statutes permitting amendments to pleadings or curing certain mistakes or omissions in the proceedings in an action. The name was derived from the old phrase *jeo faile* (I have failed), by which the pleader acknowledged an error in his pleadings or proceeding, after which he could take advantage of the provisions of these statutes. The procedure acts in practically all of the United States provide for the amendment of pleadings and the arbitrary waiver of defects and irregularities in certain cases, but the term *jeofails* is not commonly applied to such acts. Consult Chitty on *Pleading;* Stevens on *Pleading.*

STAUBBACH, stou'bäĸ. A celebrated waterfall in the southern part of the Canton of Bern, Switzerland, 8 miles south of Interlaken. It is one of the highest in Europe, having a descent of between 800 and 900 feet. Long before it reaches the bottom it is blown into a dust of spray, whence its name *Staubbach* (dust-stream).

STAUNTON, stạn'ton. The county-seat of Augusta County, Va., 135 miles northwest of Richmond, on the Baltimore and Ohio and the Chesapeake and Ohio railroads (Map: Virginia, E 3). It is the seat of the Western State Hospital for the Insane, and of the State Deaf, Dumb, and Blind Institution; and has the Mary Baldwin Seminary, Virginia Female Institute, and Kable's Military Academy. Other prominent features are the City Hall, Court House, Masonic Temple, Columbian Hall, and Gypsy Hill and Highland Parks. Staunton manufactures organs, flour, overalls, wagons, machine-shop products, and agricultural implements. The government, under the revised charter of 1879, is vested in a mayor, chosen biennially, and a unicameral council. The waterworks and the electric-light plant are owned and operated by the municipality. Population, in 1890, 6975; in 1900, 7289.

STAUNTON, Sir GEORGE THOMAS (1781-1859). An English traveler and Orientalist, born at Salisbury. In 1792 he went with his father, Sir George Leonard Staunton (1737-1801), to China, where he learned to speak and write the language. After two terms at Cambridge he was appointed writer in Canton for the East India Company's factory. He introduced vaccination into China in 1804, by translating George Pearson's treatise. He translated from Chinese: *La Tsing lew lee, being the Fundamental Laws of China* (1810), the first book translated from Chinese into English; the *Narrative of the Chinese Embassy to the Khan of the Tourgouth Tartars* (1821), and wrote *Miscellaneous Notices Relating to China* (1822), *Notes of Proceedings and Occurrences During the British Embassy to Peking* (1824), *Observations on Our Chinese Commerce* (1850), and *Memoir of Sir J. Barrow, Bart.* (1852).

STAUNTON, HOWARD (1810-74). An English chess master and Shakespearean scholar. In 1843 he defeated St. Amant, then the chess champion of Europe, and three years afterwards won from the German experts Harrwitz and Horwitz. His plans at all times displayed great originality in attack, fertility in defense, and untiring patience. He founded the *Chess Player's Chronicle* in 1840, which he edited until 1854, and from 1844 until his death conducted the chess column of the *Illustrated London News.* His Shakespearean researches resulted in an edition of the plays and poems (1857-60), edited and analyzed with shrewdness and good taste, a facsimile of the 1623 folio, and a series of articles contributed to the *Athenæum,* on "Unsuspected Corruptions of Shakespeare's Text" (1872). His other writings include: *Chess Player's Hand-Book* (1847); *Chess Player's Companion* (1849); *Chess Praxis* (1860); *Great Schools of England* (1865).

STAUPITZ, stou'pĭts, JOHANN VON. A friend and spiritual guide of Martin Luther (q.v.).

STAUROLITE (from Gk. *σταυρός, stauros,* cross + *λίθος, lithos,* stone), or FAIRY STONE. A mineral hydrated iron-aluminum silicate crystallized in the orthorhombic system. It has a sub-vitreous to resinous lustre and is dark brown to black in color. The crystalline varieties are frequently cruciform, owing to twinning. On account of their resemblance to a cross these forms are popularly believed to have fallen from heaven, and are used to some extent not only as ornaments, but also as charms. They occur in crystalline schists, and are usually associated with garnet, syenite, and tourmaline. Staurolite is found in Switzerland, the Tyrol, Moravia, Ireland, and in the United States at various localities in New England, New York, North Carolina, Georgia, and elsewhere along the Appalachian range of mountains.

STAUROSCOPE (from Gk. *σταυρός, stauros,* cross + *σκοπεῖν, skopein,* to view). A variety of polariscope (q.v.) adapted to the study of crystals, and consisting essentially of a mirror, two Nicol's prisms, and a revolving stage. By it sections cut from crystals along any desired

direction are examined by use of parallel rays of plane polarized light. See CONOSCOPE; CRYSTALLOGRAPHY.

STAVANGER, stä'vàng-ẽr. A seaport of Southwestern Norway, on the south shore of the wide entrance to the Stavanger or Bukken Fiord, 190 miles southwest of Christiania (Map: Norway, A 7). It has a Gothic cathedral, one of the finest in Norway. The town produces woolen, linen, and cotton goods, soap, preserves, oleomargarine, hardware, pottery, and bricks. There are iron foundries, and the harbor is provided with ship-yards. Fisheries and the curing of fish are important industries. The shipping at the harbor amounts to about 325,000 tons annually, and the trade in 1899 was valued at $3,867,100, the principal exports being fish, preserved foods, butter and margarine, marble, and manure. Population, in 1891, 23,899; in 1901, 30,541.

STAVROPOL, stäv'rô-pôl-y'. A government of Ciscaucasia, bounded by the Province of the Don Cossacks and the Government of Astrakhan on the north, the Territory of Terek on the east and south, and the Territory of Kuban on the west (Map: Russia, F 5). Area, 23,430 square miles. The surface is largely steppe-like in character, and only the southwestern part is mountainous, the highest point being about 2200 feet. The principal rivers are the Kuma and the Great Egorlyk. Agriculture and stock-raising are the principal occupations. The chief cereals are wheat, oats, and barley. In 1898 there were in the government over 3,800.000 head of live stock, including over 2,600,000 sheep. Population, in 1898, 912,639, of whom the Russians constituted 90 per cent.

STAVROPOL. The capital of the Russian government of the same name, situated about 700 miles south-southeast of Moscow (Map: Russia, F 5). Farming and gardening are the main occupations. Population, in 1897, 41,621, chiefly Russians.

STAWELL, stą'el. A town of Borung County, Victoria, Australia, 179 miles northwest of Melbourne, in the centre of the richest gold-mining region of the province (Map: Victoria, B 4). There are important freestone quarries. Population, in 1901, 5296.

STAY (OF. *estaie, estaye,* Fr. *étai,* from MDutch *staeye,* a stay). In law, a suspension of legal proceedings by order of a court. A stay is usually granted by the court in which an action or proceedings are pending, and is commonly ordered for the purpose of compelling a party to an action to comply with some condition or order of the court, as to pay costs on some interlocutory motion, or to give security for costs, etc. In a few instances the courts may grant absolute stays, as, for example, where an unfounded action is commenced merely to harass or annoy the defendant. It is customary for the United States courts to stay the proceedings in all actions pending against a bankrupt in State courts during the pendency of the bankruptcy proceedings. A temporary stay of execution may usually be obtained, especially where the defeated party desires to appeal. No rights are destroyed by a stay, as it only operates to suspend proceedings and does not involve their merits. See Chitty, *On Pleading; New York Code of Civil Procedure.*

STEAD, WILLIAM THOMAS (1849—). An English journalist, born at Embleton, Northumberland. After a brief schooling he went into business, but in 1871 was appointed editor of the *Northern Echo* (Darlington). Here he remained until 1880, when he was called to be assistant editor, under John Morley, of the *Pall Mall Gazette.* He was editor of this paper from 1883 to 1889 and in the next year founded the *Review of Reviews* (monthly). He established similar publications in the United States (1891) and Australia (1894). As editor of the *Pall Mall Gazette,* a daily, he introduced American journalism into England, in the way of the interview, illustrations, and 'extras.' Though regarded as thoroughly sincere and intensely earnest in his treatment of public affairs, he aroused criticism by these methods and by injudicious conclusions. He became known as a vigorous opponent of social evils, a steadfast advocate of international peace, and, though patriotic, an apologist of Russia. His *The Truth About the Navy* (1884) led to the laying down of more ships in the following year. In 1885 his *The Maiden Tribute of Modern Babylon,* an exposure of legally permissible outrages upon women and children, landed him for a three months' term in Holloway Gaol, but it was followed by the enactment of the Criminal Law Amendment Bill. In 1898 he started *War Against War,* a weekly devoted to the opposition of the Anglo-Boer War. His publications include: *The Truth About Russia* (1888); *The Pope and the New Era* (1889); *The Story that Transformed the World* (1890); *If Christ Came to Chicago* (1893); *The Labor War in the United States* (1894); *Satan's Invisible World: A Study of Despairing Democracy* (1897); *Mr. Carnegie's Conundrum* (1900); *The Americanization of the World* (1902); *The Last Will and Testament of Cecil John Rhodes* (1902).

STEALING. See LARCENY.

STEAM (AS. *stēam,* Fris. *stoame,* Dutch *stoom,* steam; of unknown etymology). Water in a gaseous condition. It is a dry, colorless gas with a specific gravity of 0.625 as compared with air at the same pressure. The white cloud of vapor which rises from boiling water and which is commonly called steam is a vapor composed of minute particles of water suspended in the air and formed by the condensation of the steam coming in contact with the cool air. When water is subjected to the action of heat, it is converted into steam. Though a change takes place in the physical condition of the substance, the chemical composition of the steam is in no way different from that of the water from which it was generated. If heat be applied to the bottom of a vessel containing water, the air contained in the water will first appear as little bubbles which rise to the surface. Then the water in immediate contact with the heated portion of the vessel will be converted into steam, which will form as bubbles on the bottom of the vessel, and these will rise through the liquid, but at the commencement of the operation they will be at once condensed by the cold upper layers of water. Finally, however, the water becomes heated through when the bubbles rise to the surface and the steam exudes upon the air, and we have the phenomenon known as boiling. As the steam

passes into the air, it is cooled and collects into small particles of water which are visible as a white cloud above the surface, and the phenomenon is called condensation. If all the particles of this white cloud were collected into one mass, there would be a volume of water equal to the volume of water in the original vessel which had been converted into the steam forming the cloud. Boiling occurs only when the water in the vessel has reached a certain temperature. This temperature varies with the pressure. At the atmospheric pressure of 14.7 pounds at mean sea level, it is 212° F., but it would be somewhat less on the top of a high mountain and somewhat greater at the bottom of a deep mine. See HYPSOMETER; HYPSOMETRY.

The boiling temperature or boiling point of water thus varies with the pressure upon it. At a pressure of 5 pounds per square inch, it is as low as 162.3° F., and at a pressure of 100 pounds per square inch, it is as high as 327.58° F. Condensation takes place at any temperature lower than the boiling temperature.

To explain more fully the action of heat in the formation of steam, reference will be made to the accompanying diagrams. In Fig. 1, let the cylinder contain one pound of water at 32° F., and let the pressure of the atmosphere be represented by the weighted piston. Then if heat be applied to the bottom of the cylinder, the temperature of the water will rise higher and higher until it reaches 212° F.; the piston will up to this point remain stationary except for the small expansion of the water. On continuing the heat, the water shows no further rise in temperature, but steam begins to form and to force the piston upward as shown by Fig. 2, and this continues until the last drop of water is converted into steam and we have the condition illustrated by Fig. 3.

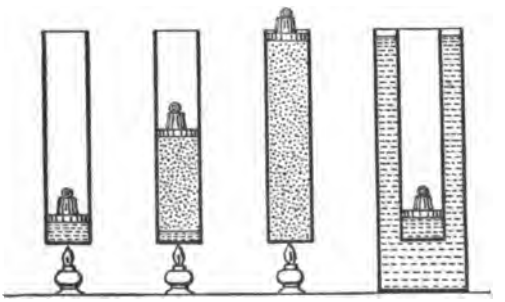


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

Before proceeding further, we must note first that no steam began to form until the water reached a temperature of 212° F., hence this is evidently the lowest temperature at which steam will form under normal atmospheric pressure. Second, we must note that in the condition illustrated by Fig. 3 we have one pound of steam occupying the least possible volume at atmospheric pressure. In actual figures this volume is 26.36 cubic feet. Steam in this condition is known as *saturated steam*. If now we continue to heat the steam in the cylinder Fig. 3, its temperature will rise above that of saturated steam, and the piston will move upward, and we will have *superheated steam*. If now we take the cylinder Fig. 3 and plunge it into a vessel of cold water, as shown by Fig. 4, the heat will be taken away from the steam and it will condense to water. When this water has cooled to 32° F., the whole heat taken away is exactly equal to the whole heat added during the operations illustrated by Figs. 1, 2, and 3.

The amount of this added and abstracted heat may now be considered. First, let us assume that the cylinder Fig. 1 has an area of 1 square foot and that it contains 1 pound of water. The height to which the water rises in the cylinder is 0.016 foot. The pressure on the piston from the air is 14.7 pounds × 144 square inches = 2116.8 pounds. Now on applying heat to the water it will at first gradually rise in temperature from 32° F. to 212° F. before evaporation commences. Then 212° — 32° = 180 are the number of heat units required to raise water from 32° F. to the boiling point at atmospheric pressure. Steam now begins to form and the piston to rise until all the water is converted into steam at a temperature of 212° F. This steam, as before stated, occupies a space of 26.36 cubic feet. The heat required to perform this operation is 966 units. Hence the total heat required first to raise the water from 32° F. to 212° F. and then to convert it into steam is 180 + 966 = 1146 units. It is quite clear how the heat required to raise the water from 32° F. to 212° F. has been expended, but it is not so clear how the 966° F. required to convert the water at 212° F. into steam at 212° F. has been expended. It will be observed that two things have happened in this last operation. First, the water has been converted into steam, which occupies 1644 times the space occupied by the water from which it was generated. Second, the piston has been raised from the surface of the water in Fig. 1 to the surface of the steam in Fig. 3. Therefore, the heat has been expended in two ways: First, in overcoming the internal molecular resistance of the water in changing its condition from water to steam, and, second, in overcoming the external resistance of the piston to the increasing volume of the steam during formation. The first task performed is called the internal work of the steam and the second task is called the external work. Now the share of the heat expended in each operation may be calculated as follows: The total heat expended is, as already stated, 1146 units. To raise the piston with a pressure on it of 2116.8 pounds through a height of 26.36 feet requires 55,799 foot-pounds of energy. As the energy of one heat unit is 772 foot-pounds, then 55,799 ÷ 772 = 72.3 heat units expended in raising the piston. Adding this to 180, the number of heat units required to raise water from 32° F. to 212° F., we have 252.3 units consumed in heating the water and raising the piston. This amount subtracted from the total heat expended gives 1146 — 252.3 = 893.7, which is the number of heat units expended in internal work. We can now summarize the distribution of the heat as follows:

In raising temperature of water	180 units
In doing internal work	893.7 units
In doing external work	72.3 units
Total	1146.0 units

Having gone through the phenomenon of steam generation in detail, we can summarize some of the general facts that have been brought out. The temperature of the water gradually rises until it reaches the temperature at which steam

the pressure or the load on the piston. If this pressure is the normal atmospheric pressure of 14.7 pounds per square inch, steam begins to form at a temperature of 212° F.

As soon as 212° F. is reached, steam will begin to form and the piston will steadily rise, but no matter how hot the fire may be, the temperature of both water and steam will remain at 212° F. until all the water is evaporated. We had one pound of water at 32° F. and at 14.7 pounds absolute pressure, and found that steam formed at a temperature of 212° F. and remained at that temperature. We added 180.9 B. T. U. (British Thermal Units), the heat of the liquid, to bring the water from 32° to the boiling point. To convert water at 212° into steam at 212°, we added 965.7 B. T. U. more. This quantity, known as the latent heat, or heat of vaporization, makes the total heat 1146.6 B. T. U. If we should measure the volume carefully after all the water was evaporated, we should find that there was just 26.36 cubic feet of dry saturated steam. We had one pound of water, and therefore must have one pound of steam, for none of it could escape; hence one cubic foot will weigh $\frac{1}{26.36} = 0.03794$ pound, which is known as the density of steam. Density is the weight of a unit volume of a substance, and the density of steam is the weight of one cubic foot of steam. Volume is the space occupied by a substance, and the volume of steam is the number of cubic feet occupied by one pound of steam.

Suppose now we place a weight of 85.3 pounds on the piston. The pressure is 85.3 pounds plus 14.7 pounds, or 100 pounds absolute. We shall now find that no steam will form until a temperature of 327.58° is reached. Starting with water at 32°, it will be necessary to add 297.9 B. T. U. before a temperature of 327.58° is reached, and also we must add 884 B. T. U. more to vaporize it, making a total heat of 1181.9 B. T. U. Under this greater pressure the steam occupies a volume of only 4.403 cubic feet, or one cubic foot of it weighs $\frac{1}{4.403} = 0.2271$ pound.

We have already seen that any change in the temperature of saturated steam produces a change of pressure, and that every change of pressure corresponds to a certain change in temperature. There are several properties of saturated steam that depend upon the temperature and pressure; and the values of all these different properties when arranged for all temperatures and pressures are called steam tables. The

TABLE OF PROPERTIES OF SATURATED STEAM

PRESSURE IN POUNDS PER SQUARE INCH ABOVE VACUUM	Temperature in degrees, Fahrenheit	Total heat in heat-units from water at 32°	Heat in liquid from 32° in units	Heat of vaporization, or latent heat in heat-units	Density or weight of cubic foot in pounds	Volume of 1 pound in cubic feet	Factor of equivalent evaporation at 212°	Total pressure above vacuum
1	101.99	1113.1	70.0	1043.0	0.00299	334.5	.9661	1
2	126.27	1120.5	94.4	1026.1	0.00576	173.6	.9738	2
3	141.62	1125.1	109.8	1015.3	0.00844	118.5	.9786	3
4	153.09	1128.6	121.4	1007.2	0.01107	90.33	.9822	4
5	162.34	1131.5	130.7	1000.8	0.01366	73.21	.9852	5
6	170.14	1133.8	138.6	995.2	0.01622	61.65	.9876	6
7	176.90	1135.9	145.4	990.5	0.01874	53.39	.9897	7
8	182.92	1137.7	151.5	986.2	0.02125	47.06	.9916	8
9	188.33	1139.4	156.9	982.5	0.02374	42.12	.9934	9
10	193.25	1140.9	161.9	979.0	0.02621	38.15	.9949	10
15	213.03	1146.9	181.8	965.1	0.03826	26.14	1.0003	15
20	227.95	1151.5	196.9	954.6	0.05023	19.91	1.0051	20
25	240.04	1155.1	209.1	946.0	0.06199	16.13	1.0099	25
30	250.27	1158.3	219.4	938.9	0.07360	13.59	1.0129	30
35	259.19	1161.0	228.4	932.6	0.08508	11.75	1.0157	35
40	267.13	1163.4	236.4	927.0	0.09644	10.37	1.0182	40
45	274.29	1165.6	243.6	922.0	0.1077	9.285	1.0205	45
50	280.85	1167.6	250.2	917.4	0.1188	8.418	1.0225	50
55	286.89	1169.4	256.3	913.1	0.1299	7.698	1.0245	55
60	292.51	1171.2	261.9	909.3	0.1409	7.097	1.0263	60
65	297.77	1172.7	267.2	905.5	0.1519	6.583	1.0280	65
70	302.71	1174.3	272.2	902.1	0.1628	6.143	1.0295	70
75	307.38	1175.7	276.9	898.8	0.1736	5.760	1.0309	75
80	311.80	1177.0	281.4	895.6	0.1843	5.426	1.0323	80
85	316.02	1178.3	285.8	892.5	0.1951	5.126	1.0337	85
90	320.04	1179.6	290.0	889.6	0.2058	4.859	1.0350	90
95	323.89	1180.7	294.0	886.7	0.2165	4.619	1.0362	95
100	327.58	1181.9	297.9	884.0	0.2271	4.403	1.0374	100
105	331.13	1182.9	301.6	881.3	0.2378	4.205	1.0385	105
110	334.56	1174.0	305.2	878.8	0.2484	4.026	1.0396	110
115	337.86	1185.0	308.7	876.3	0.2589	3.862	1.0406	115
120	341.05	1186.0	312.0	874.0	0.2695	3.711	1.0416	120
125	344.13	1186.9	315.2	871.7	0.2800	3.571	1.0426	125
130	347.12	1187.8	318.4	869.4	0.2904	3.444	1.0435	130
140	352.85	1189.5	324.4	865.1	0.3113	3.212	1.0453	140
150	358.26	1191.2	330.0	861.2	0.3321	3.011	1.0470	150
160	363.40	1192.8	335.4	857.4	0.3530	2.833	1.0486	160
170	368.29	1194.3	340.5	853.8	0.3737	2.676	1.0502	170
180	372.97	1195.7	345.4	850.3	0.3945	2.535	1.0517	180
190	377.44	1197.1	350.1	847.0	0.4153	2.408	1.0531	190
200	381.73	1198.4	354.6	843.8	0.4359	2.294	1.0545	200
225	391.79	1201.4	365.1	836.3	0.4876	2.051	1.0576	225
250	400.99	1204.2	374.7	829.5	0.5393	1.854	1.0605	250
275	409.50	1206.8	383.6	823.2	0.5913	1.691	1.0632	275
300	417.42	1209.3	391.9	817.4	0.644	1.553	1.0657	300
325	424.82	1211.5	399.6	811.9	0.696	1.437	1.0680	325
350	431.90	1213.7	406.9	806.8	0.748	1.337	1.0703	350
375	438.40	1215.7	414.2	801.5	0.800	1.250	1.0724	375
400	445.15	1217.7	421.4	796.3	0.853	1.172	1.0745	400
500	466.57	1224.2	444.3	779.9	1.065	.939	1.0812	500

following are the principal items that are found in the tables:

(1) The absolute pressure in pounds per square inch; it is equal to the gauge pressure plus the atmospheric pressure of 14.7 pounds.

(2) The temperature of the steam, or boiling water, at the corresponding pressure.

(3) The heat of the liquid; or the number of B. T. U. necessary to raise one pound of water from 32° F. to the boiling point corresponding to the given pressure.

(4) The heat of vaporization, or the latent heat; this is the number of B. T. U. necessary to change one pound of water, at the boiling point, into dry saturated steam at the same temperature and pressure.

(5) The total heat; or the number of B. T. U. necessary to change one pound of water from 32° F. into steam at the given temperature or pressure. The total heat is evidently equal to the sum of the heat of the liquid and the heat of vaporization.

(6) The density of the steam; that is, the weight in pounds of one cubic foot of steam at the given temperature or pressure.

(7) The specific volume; or volume in cubic feet of one pound of steam at the required temperature or pressure. Evidently the specific volume is equal to $\frac{1}{\text{density}}$.

All these properties have been calculated by means of various formulas which have been deduced from the results of actual experiment.

We have seen that a saturated vapor contains just enough heat to keep it in the form of a vapor; if it loses heat it will condense. A superheated vapor is one that has been heated after vaporization; it can lose this extra heat before any condensation will take place. A vapor in contact with its liquid is saturated; one heated after removal from the liquid is superheated.

For saturated steam there is a fixed temperature for every pressure. If we know either the pressure or the temperature, we can find the other in the steam tables. For instance, if the gauge pressure of a boiler is 60.3 pounds and we wish to know the temperature, we simply add atmospheric pressure and turn to our tables and find it to be 307° (approximately).

With superheated steam the case is entirely different, for there is no longer the same direct relation between the temperature and pressure. In fact, the relation between temperature and pressure of superheated steam depends upon the amount of superheating. Superheated steam at 60.3 pounds gauge pressure may have a temperature considerably above 307° F. At a given pressure the temperature and volume of a given weight of superheated steam are always greater than the temperature and volume of the same weight of saturated steam. The properties of superheated steam at given pressure are not constant as is the case with saturated steam.

If superheated steam were a perfect gas, we could determine the relation of p, v, and t by the equation $pv = ct$; but superheated steam is not a perfect gas, hence we must modify our equation. By experiment it has been determined that the following equation is nearly correct:

$$pv = 93.5\ t - 971\ p^{\frac{1}{4}},$$

in which p = absolute pressure in pounds per square inch,
t = absolute temperature, and
v = volume of 1 pound in cubic feet.

STEAM CARRIAGE. See AUTOMOBILE.

STEAM ENGINE. A motor in which the expansive force of steam is employed as the medium for transforming the energy of heat into useful work. Ordinarily the steam acts upon a piston inclosed within a cylinder in such a manner as to be capable only of *reciprocating* motion, but in certain rare forms of engines it acts upon an inclosed piston or vane, which *rotates* around an axis. The rotary engine has the advantages of compactness and of being capable of applying its power directly, while the reciprocating engine has to have the rectilinear motion of the piston transformed into the rotary motion of a fly wheel or shaft by a cumbersome intermediate mechanism. These advantages of the rotary engine are, however, more than counterbalanced by its decided lack of economy in steam consumption, which prevents it from successfully competing commercially with the reciprocating engine. Only the latter is here treated.

EARLY HISTORY. The first instance of the use of steam as a motive power is generally assumed to have been the æolipile of Hero of Alexandria (q.v.). As early as 1543 a Spanish captain, named Blasco de Garay, is reputed to have shown in the harbor of Barcelona a steamboat of his own invention. A French engineer, Salomon de Caus, describes in 1615 a steam machine, which was merely a contrivance for forcing the water contained in a copper ball through a tube by applying heat. An Italian engineer, Giovanni Branca, invented, in 1629, a sort of steam windmill; the steam, being generated in a boiler, was directed by a spout against the flat vanes of a wheel, which was thus set in motion. See STEAM TURBINE.

In England the first successful effort was that of the Marquis of Worcester, who, in 1663, describes a steam apparatus by which he raised a column of water to the height of 40 feet. The first patent for the application of steam power to various kinds of machines was taken out in 1698 by Thomas Savery. His engines were the first used and seem to have been employed for some years in the drainage of mines in Cornwall and Devonshire. The essential improvement in them over the older ones was the use of a boiler separate from the vessel in which the steam did its work.

To Denis Papin, a celebrated Frenchman, is due the idea of the *piston*.

The next great step in advance was made about 1705 in the 'atmospheric' engine, conjointly invented by Newcomen, Calley, and Savery. In this engine, which is shown in Fig. 1, the previous inventions of the separate boiler and of the cylinder with its movable steam-tight piston are utilized, although in a new form. The 'beam,' which has ever since been in use in pumping engines, was used for the first time, and for the first time also the condensation of the steam was made an instantaneous process, instead of a slow and gradual one. To one end of a beam moving on an axis, I, was attached the rod, N, of the pump to be worked; to the other, the rod, M, of a piston moving in a cylinder, C, below.

The cylinder was placed over a boiler, B_1 and was connected with it by a pipe provided with a stop-cock, V, to cut off or admit the steam. Suppose the pump-rod depressed, and the piston raised to the top of the cylinder—which was effected by weights suspended at the pump end of the beam—the steam cock was then turned to cut off the steam, and a dash of cold water was thrown into the cylinder by turning a cock, R,

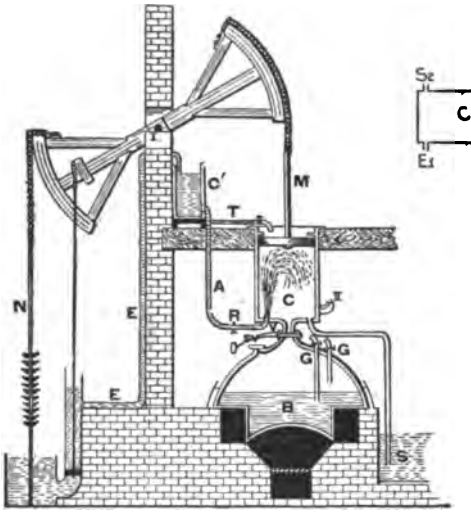


FIG. 1. NEWCOMEN'S ENGINE.

on a water pipe, A, connected with a cistern, C'. This condensed the steam in the cylinder, and caused a vacuum below the piston, which was then forced down by the pressure of the atmosphere, bringing with it the end of the beam to which it was attached, and raising the other along with the pump-rod. The cock was then turned to admit fresh steam below the piston, which was raised by the counterpoise; and thus the motion began anew. The opening and shutting of the cocks was at first performed by an attendant, but in 1713 a boy named Humphrey Potter devised a system of strings and levers by which the engine was made to work its own valves. In 1717 Henry Beighton invented a simpler and more scientific system of 'hand-gear,' which rendered the engine completely *self-acting*.

The next essential improvements on the steam engine were those of Watt. The first and most important improvement made by Watt was the separate condenser, patented in 1769. He had observed that the jet of cold water thrown into the cylinder to condense the steam necessarily reduced the temperature of the cylinder so much that a great deal of the steam flowing in at each upward stroke of the piston was condensed before the cylinder got back the heat abstracted from it by the spurt of cold water used for condensing the steam in the cylinder. The loss of steam arising from this was so great that only about one-fourth of what was admitted into the cylinder was actually available as motive power. Watt, therefore, provided a separate vessel in which to condense the steam, and which could be kept constantly in a state of vacuum, without the loss which arose when the cylinder itself was used as a condenser. The principal improvements since have been either in matters relating to the boiler or in details of construction consequent on increased facilities, improved machinery, and greater knowledge of the strength of materials.

ANALYSIS. The motor element of the engine is the cylinder and piston (Fig. 2). The cylinder, C, is a hollow cylinder of metal closed at

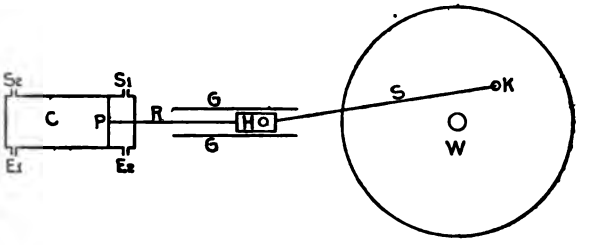


FIG. 2.

both ends, except for small openings for the entrance and escape of steam and for the passage of the piston rod. Inside the cylinder is the piston, P, a circular disk of metal fitting steam-tight and capable of movement lengthwise of the cylinder. The openings S_1 and S_2 provide for the admission of steam into the cylinder, and the openings E_1 and E_2 provide for the exhaust of steam from the cylinder. These passages are opened and closed by valves. These valves operate in pairs; when valves S_1 and E_1 are open valves S_2 and E_2 are closed and vice versa. If steam be admitted by opening valve S_1 its pressure forces the piston P to the opposite end of the cylinder. Valves S_1 and E_1 now close and valves S_2 and E_2 open, and steam entering at S_2 forces the piston to return and press, as it advances, the previous cylinderful of steam out of the exhaust port E_2. The repeated and alternate opening and closing of the two pairs of valves, as described, causes the piston to reciprocate back and forth in the cylinder. This motion is carried outside of the cylinder by means of the piston rod R. This is a cylindrical rod attached rigidly to the piston and passing out of the cylinder through a steam-tight orifice in the cylinder head. At its outer end the piston, rod is attached to a rectangular piece H, called the crosshead, which slides between two guides, GG. To the opposite end of the crosshead is hinged the rod S, called the connecting rod, the forward end of which is journaled to a crank K, which operates the fly-wheel W.

In the steam engine, as actually constructed, these different parts and their movements are variously modified, but the essential operating parts of all reciprocating steam engines are: The cylinder and piston; the valves and valve gear; the piston rod; the crosshead and guides; the connecting rod; the crank and crank-shaft or fly-wheel.

The ordinary unit of measure of the work done by a steam engine is the horse power, and it was originated by Watt. As defined by Watt a horse power is the work done in lifting 33,000 pounds one foot high in one minute. Now if the area of the piston P, Fig. 2, is w square inches and the pressure of the steam admitted to the cylinder is y pounds per square inch, then the pressure exerted by the steam against the pis-

ton is $w \times y$. If now the total travel or stroke of the piston is s feet, then the foot pounds of work for such stroke is represented by $w \times y \times s$, and if the piston makes n strokes per minute, the foot pounds of work of the piston per minute are represented by $w \times y \times s \times n$. This amount, divided by 33,000, gives the horse power of the engine. Assuming all of the other factors to remain the same or to be constant, the horse power of an engine may be varied by varying either the area of the piston, the length of the stroke, the pressure of the steam, or the number of strokes per minute. The whole of the theoretical horse power, however, is never available for useful work, owing to the friction of the moving parts and other causes.

CLASSIFICATION. Steam engines may be classified (I.) according to the nature of their mechanism, (II.) according to the manner in which the steam is used, and (III.) according to the use to which the engine is put.

I. Reciprocating engines may be grouped according to the position of the axis of the piston into horizontal engines, vertical engines, and inclined or diagonal engines. Fig. 2 shows the position of the parts of a *horizontal engine*, that is, an engine with the axis of the cylinder and piston horizontal. The advantages of such an engine are convenient access from the ground to all parts of the mechanism, distribution of the weight over a large area, and the location of the centre of gravity of the machine close to the foundation; its disadvantages are greater friction and wear of the cylinder owing to the fact that the piston is supported upon the bottom of the cylinder.

In the *vertical engine* the axis of the cylinder and piston is vertical; if the cylinder is carried by a frame above the crank shaft so that the piston rod extends downward, the engine is called an *inverted vertical engine;* and if the cylinder is below, with the piston rod extending upward to a crank shaft above, the engine is called a *direct vertical engine.* The advantages of the vertical engine are that the cylinder friction and consequent cylinder wear of the horizontal engine are largely avoided and that a comparatively small area of ground is occupied by the engine. Its disadvantages are that the weight of the piston, piston rod, crosshead, and connecting rod acts with the steam in one direction and against the steam in the other direction, thus producing unequal effort on the crank on alternate strokes, which has to be counteracted by special constructions; that the different parts of the mechanism are at different heights, requiring more attendants; that the centre of gravity of the machine is high, reducing its stability. The limited foundation area required for the vertical engine especially adapts it to places where room is scarce or expensive, as in steamships and city power houses. See STEAM NAVIGATION.

Inclined engines possess in a measure the advantages and disadvantages of both the horizontal and the vertical engine. In such engines the axis of the cylinder is at an inclination between the vertical and horizontal, and the cylinder is usually set below with the piston rod projecting diagonally upward to the crank shaft. They are used chiefly in side-wheel steamboats of shallow draught and in ferry-boats.

An engine in which the motion of the piston is transmitted by a connecting rod direct to the crank, as shown by Fig. 2, is called a *direct-acting engine.* As applied to pumps this term has a somewhat different meaning. (See PUMPS AND PUMPING MACHINERY.) In contradistinction to direct-acting engines we have *beam engines,* of which the engine shown by Fig. 1 is an early example. In the beam engine the connecting rod is journaled to one end of a beam rocking on a horizontal axis. To the other end of the beam is journaled a pitman rod which connects with the crank shaft. The engines for side-wheel steamboats are usually beam engines; and they are also used for pumping engines.

Besides the forms of engines mentioned there are various special forms, a few of which are sufficiently important to merit mention. The *oscillating engine* dispenses with the connecting rod, the piston rod connecting directly to the crank, and the cylinder is mounted upon suitable trunnions so that it can oscillate in conformation to the swaying of the piston rod in operating the crank. The *trunk engine* dispenses with the piston rod, the connecting rod being attached direct to the piston, which takes the form of a hollow cylinder closed at one end. The *back-acting engine* has the connecting rod extending back from the crosshead to a crank shaft back of the engine instead of extending forward as shown by Fig. 2.

II. The method in which the steam is used in the engine is also a basis for a scheme of classification. The fact that the same number of foot pounds of energy per minute may be secured by a small piston working at high speed or a larger piston working at a slower speed gives us our first classification, viz., *high-speed* and *low-speed* engines. The high-speed engine has the advantage of small dimensions and small weight for a given power, and, because the strokes are so frequent, of meeting variations in resistance more quickly than a slow-speed engine. Its disadvantages are its comparatively greater waste of steam, the greater wear of the moving parts, the greater danger of heating, and consequently the higher cost of construction and operation. Altogether, experience shows the slow or moderate speed engine to be superior to the high-speed engine where circumstances permit its use. Between 600 and 800 feet per minute is regarded as a moderate piston speed, and over 900 feet per minute as a high piston speed. Referring to Fig. 2, it will be observed that the steam acts first against one side of the piston and then against the other side. Such an engine is called a *double-acting engine.* When the pressure of the steam is exerted against one side of the piston only the engine is called a *single-acting engine.* The single-acting principle is utilized in the well-known Cornish engine for pumping and in certain high-speed rotative engines for electric light and power service. In the latter form of engine two cylinders are used which are coupled to separate cranks on the same shaft in order to secure continuous action. Two familiar forms are the Westinghouse and the Winans, and both are inverted vertical trunk engines. Owing to their single action and the omission of the connecting rod, these engines escape many of the disadvantages of the double-acting high-speed engine.

The Cornish single-acting pumping engine deserves particular notice because of its essentially

peculiar steam-cylinder mechanism. It appears in two forms, the beam form and the direct-acting form. The beam Cornish engine has a vertical cylinder from whose top the piston rod extends, and has the usual connecting-rod connection with one end of a beam pivoted at the centre, to whose other end are attached the pump rods. The direct-acting Cornish engine has the cylinder located directly over the mouth of the shaft and the piston rod passing out of its bottom connects directly with the pump rods. This form of Cornish engine is usually called the Bull Cornish, from the name of its first adopter. In both forms of Cornish engine the action of the steam is simply to raise the heavy pump rods, whose weight in falling displaces the water to be pumped. The cylinder of the Cornish engine has three valves, one for the admission of steam, one for the exhaust of the steam, and an equilibrium valve, these being shown in Fig. 3 at S, D, and E, respectively.

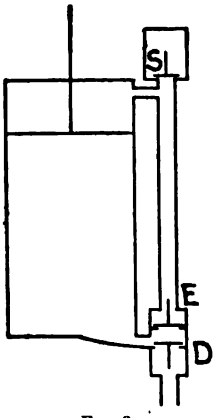


FIG. 3.

The cycle of operations is as follows: The pump rods being at the bottom of their stroke, the piston P of a beam Cornish engine will be at the top of the cylinder. The steam valve S and the exhaust valve D will be opened and the equilibrium valve E will be closed. The pressure of the steam drives the piston to the bottom of the cylinder, lifting the pump rods. When this operation has been completed, valves S and D are closed and valve E is opened. The opening of valve E permits the steam above the piston to flow freely beneath it, equalizing the pressure on the two sides of the piston and leaving it free to return to the top of the cylinder under the pull of the heavy pump rods. The valves of the Cornish engine are worked by a special device called a *cataract*. This consists of a weighted piston working in a cylinder, having a large intake valve and a small discharge valve, whose opening can be adjusted to various dimensions. During the working stroke of the pump this weighted plunger is lifted, drawing water into its cylinder through the large inlet valve. When the pump makes its return stroke the weighted plunger is released and gradually descends as its weight presses the water out of its cylinder through the small discharge valve. The return stroke of the weighted plunger actuates the valves of the steam cylinder of the pump so as to cause another working stroke.

The third subdivision of engines according to the method of using the steam comprises expansive and non-expansive working engines. To understand the nature of this subdivision it will be found convenient to refer to the diagram Fig. 4. In this diagram the full lines represent the cylinder, piston, and piston rod. Now if steam be admitted behind the piston it will force it forward to the position which it occupies in the diagram. The steam may be made to perform this operation in two ways, non-expansively and expansively. When used non-expansively the steam enters the steam port at boiler pressure, and as this port remains open until the piston has completed its stroke, boiler pressure is maintained behind the piston during the whole stroke. If we assume the broken line *ad* to represent the steam pressure and the broken line *dc* to represent the stroke, then the work done by the steam is represented by the dotted rectangle *abcd;* the pressure *bc* at the end of the stroke is the same

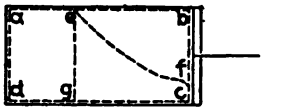


FIG. 4.

as the pressure *ad* at the beginning of the stroke, and a cylinderful of steam at full pressure has to be exhausted in order to make the return stroke. When using the steam expansively the steam valve is closed when the piston has reached some intermediate point, as *e*, called the point of cut-off, in its forward stroke, and no more steam is admitted into the cylinder. Full steam pressure is, therefore, maintained against the piston for the portion *ae* of its stroke, but afterwards this pressure gradually decreases as the steam expands until at the end of the stroke it is represented by the line *cf*. The work done by the steam is represented by the area *aefcd*, which, as will be readily seen, is less than the area *abcd*, representing the work done when using the steam non-expansively. In using the steam expansively, however, the amount at boiler pressure which is consumed at each stroke is represented by the rectangle whose base is *ae* and whose height is *ad*, as compared with the rectangle *abcd*, representing the amount of steam at boiler pressure consumed at each stroke in non-expansive working. Evidently, from the diagram, the amount of steam used in proportion to the work done is less in expansive working than in non-expansive working. This advantage has made the expansive working engine practically universal where circumstances will permit.

The fourth subdivision of steam engines according to the method of using the steam comprises condensing and non-condensing engines. In a non-condensing engine the waste steam from the cylinder is exhausted into the air at air pressure, or 14.7 pounds per square inch. In the condensing engine it exhausts into a vacuum and is condensed into water. Thus, in a non-condensing engine the steam has to force the piston against a back pressure of 14.7 pounds per square inch, while in a condensing engine this back pressure is obliterated, with a consequent gain of 14.7 pounds per square inch in the effective working pressure of the steam. The practical advantage of the condensing engine may, therefore, be expressed by saying that it will receive the same power with a smaller cylinder and greater power with the same cylinder, as compared with a non-condensing engine. (See CONDENSER.) A fifth subdivision of steam engines according to the method in which steam is used comprises simple engines, compound engines, and multiple expansion engines. In a simple engine the steam, after having done its work in forcing the piston through its stroke, is exhausted into the air or into a

condenser. In a compound or multiple-expansion engine the steam, after having done its work in one cylinder, is exhausted into a succeeding cylinder of larger size, where it continues to perform work. The operation may be explained by the diagram Fig. 5. Steam enters the cylinder HP, which is connected with cylinder LP by two passages *a* and *b* closed by valves, and here performs the work of driving piston P_1 to the front end of the cylinder. This steam, instead of being exhausted into the air or into a condenser to allow the return stroke of the piston P_1, is exhausted through the passage *a* into cylinder LP, where it acts to drive forward piston P_2. Were the size of the cylinder LP the same as that of the cylinder HP, it is evident that the propulsive effect of the steam on piston P_2 would be exactly counterbalanced by the back pressure on piston P_1, and, therefore, that there would be no increase, but rather a loss, in the work done. If, however, cylinder LP is made twice the diameter of cylinder HP, then the forward pressure on piston P_2 is greater than the back pressure on piston P, and a position or working effect is obtained by the second use of the steam. A two-cylinder engine like Fig. 5 using steam as described is called a *compound* engine. Were the exhaust steam from the second cylinder to enter a third and larger cylinder and continue working we should have a *triple expansion engine*. If a fourth cylinder were added to the set we should have a *quadruple expansion engine*. The expansive working of steam has not been successfully carried beyond four expansions. The cylinders of compound engines are generally arranged parallel to each other or side by side, or else one behind the other, or tandem. A tandem compound with the cylinders set vertical is called a *steeple engine*. When the cylinders are placed side by side, but some distance apart so as to allow space for a fly wheel between them, the engine is commonly called a *cross-compound engine*. Modern marine engines for screw vessels are nearly always inverted vertical compound or multiple expansion engines. (See Plates under STEAM NAVIGATION.) The arrangement of the cylinders of triple and quadruple expansion engines varies considerably. The great practical advantage of the compound or multiple expansion engine is the economy resulting from the expansive use of steam, as indicated in discussing expansive and non-expansive working engines. It is obviously possible to use the steam according to any of the methods discussed with any of the arrangements of mechanism previously discussed and thus make a great number of combinations.

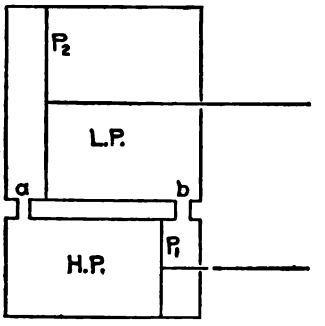


FIG. 5.

III. A very usual classification of steam engines is based upon the service or use to which the engine is to be put. It includes the following groups: *Stationary engines, locomotive engines,* and *portable engines*. The first group or stationary engines include mill engines, power-house engines, pumping engines, blowing engines, air compressors, hoisting engines, and others. Locomotive engines include locomotives, marine engines, traction engines, steam road rollers, self-propelled fire engines, and others. Portable engines include a wide variety of engines, such as agricultural engines, so designed that the engine and boiler are self-contained and do not require a foundation or permanent structure of any kind.

STRUCTURAL DETAILS. Structurally the steam engine consists of the working parts and the fixed structure or frame by which the working parts are supported and maintained in their relative positions. The supporting frame is usually a structure of cast or forged iron or steel varying in shape to suit the form of engine of which it is a part. The working parts of an engine comprise the cylinder and piston, the valves and valve gear, the governor, the piston rod, crosshead, and connecting rod, and the crank shaft and fly wheel. The function of the engine frame is to constitute a fixed link in a kinetic chain, and to perform this function it must be essentially rigid and strong. In a horizontal engine, as shown in Fig. 2, it will be evident that the duties of the frame are to support the cylinder C at one end, and the fly wheel W at the other end; and to steady and align the transforming mechanism connecting these two parts. The frame of a vertical engine performs an exactly similar duty, but of course differs in construction to suit the different arrangement of the moving parts. Thus in an inverted vertical engine there is a broad base plate, on which the crank shaft is directly supported. From this base plate rises a columnar structure supporting the cylinders and guiding the reciprocating parts. Cast iron and cast steel are particularly adapted to furnish the rigidity and massiveness desired, and are, therefore, the materials commonly employed for engine frames. In certain classes of engines, such as the locomotive and the marine engine, where lightness combined with great strength is an essential, forged steel frames are used.

Turning now to the working parts, the cylinder and piston as the motor elements naturally call first for consideration. The engine *cylinder* is a barrel-shaped or box-shaped casting, with its interior bored out into the form of a perfect cylinder. The ends of this cylinder are closed by cover-like castings fastened by studs or bolts to the body. The front head has a circular orifice at the centre to allow for the exit of the piston rod, and where a tail rod is used a similar orifice is necessary in the back head. The barrel or body of the cylinder has one or more orifices for the admission and exhaust of the steam, and these orifices are covered by a box-like chamber called the *steam chest*, inside of which work the *valves*, as will be described immediately. The body and often the ends of the cylinder casting are usually covered with a *lagging* or envelope of some material which is a poor conductor of heat and whose purpose is

inder by the loss of heat due to radiation from its outer walls. The *piston* is a circular disk of metal of sufficient strength to resist distortion by the steam pressure. In the edge of this disk are set rings of metal so arranged that they are constantly pressed outward against the walls of the cylinder, either by their own elasticity or by the elasticity of springs pressing against them from behind. These rings are called *packing rings*, and their function is to make the piston fit steam-tight in the cylinder and at the same time render its movement as free from friction as possible.

The function of the valves and valve gear is to control the admission and exhaust of the steam. The functions of the *valve* are both primary and secondary. The primary function is to admit the steam from the boiler to one side of the piston, while the exhaust steam filling the other end of the cylinder is permitted to escape with the least possible resistance. The secondary functions are to close the admission of steam at the point necessary to give the expansion desired and to close the exhaust orifice at such a point in the return stroke that a certain volume of steam shall be caught and compressed behind the piston to serve as an elastic cushion. It is necessary also that the opening of the inlets and outlets of the cylinder should be so timed with respect to the stroke of the piston that pressure may not be brought too soon against the piston head, nor the exhaust opened until the expanding steam has done its entire work for that stroke. The valves for admitting and distributing steam in an engine cylinder may open the ports which they control, either by lifting from their seats or by sliding upon their seats. When the engine is a double-acting one there must be provision to connect each end of the cylinder with the boiler and each end with the exhaust pipe. When the engine is single-acting it is only necessary to connect one end to the boiler and exhaust pipe alternately. Apparently the simplest arrangement would be to have four valves, as shown by Fig. 2, one at each end for steam, and one at each end for exhaust. This is the arrangement in the *Corliss engine*. An important type of engines makes use of a separate valve for admitting steam at each end, while the exhaust is controlled by a single valve for both ends. Such engines are called *three-valve engines*. Another arrangement is to have one valve for admitting steam to both ends and another controlling the exhaust for both ends. Such engines are called *two-valve engines*. A fourth class has one *single valve*, so designed as to perform the inlet and outlet functions for both ends. Such are the great majority of stationary engines and all locomotive and marine engines.

The simplest form and also the most common form of single valve is the D-shaped *slide valve*. In the diagram, Fig. 6, W represents a portion of the top wall of the cylinder, S and S_1 being the steam ports to the two ends of the cylinder. At the top these steam ports open into the inclosed space A, B, C, D, which represents the steam chest. The valve proper is represented by V, which is operated by the rod R passing out through a suitable orifice in the forward end of the steam chest. The steam from the boiler is admitted into the space above the valve. It valve exactly covers the ports S and S_1, and steam from the steam chest cannot enter the cylinder, nor can any steam contained in the

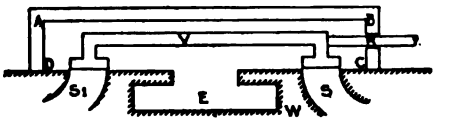


FIG. 6.

cylinder escape. If the valve is moved either to the right or left of the position shown, both ports are immediately uncovered. If the movement be toward the right, port S_1 is opened to the live steam space above valve V, and port S is opened to the exhaust space E, beneath the valve V. A reverse movement of the valve opens port S to the live steam space, and port S_1 to the exhaust space. The movement of the valve from 'centre' to the right and back again to 'centre' accomplishes the right-hand stroke of the piston; its movement from 'centre' to the left and back again to 'centre' accomplishes the left-hand stroke of the piston. These alternate right and left movements of the valve are accomplished by means of the rod R, and are eccentric. (See ECCENTRIC.) When the valve is at 'centre' the axis of the eccentric is at right angles to the fly-wheel crank, providing the valve is constructed, as shown, to cover exactly the steam ports, which is the construction for non-expansive working of the steam. This is the simplest form of slide valve. To provide for the expansive working of the steam, its use as a compression cushion and other desirable variations in admission and exhaust, the construction of the valve and the position of the eccentric have to be modified in various ways, an analysis of which is a matter of considerable mechanical intricacy.

The train of mechanism by which the opening and closing movements of the valves are effected is called the *valve gear*. This varies in construction and operation. The precise character of the gear adopted in any case is determined partly by the form of valve and partly by the nature of the general problem presented for solution. In some cases it is merely required that a fairly good steam distribution shall be se-

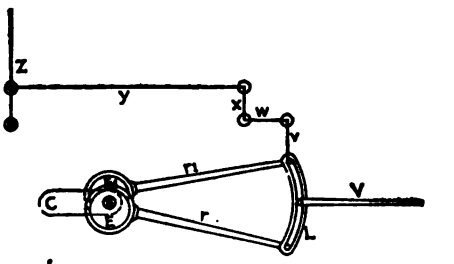


FIG. 7.

cured; in other instances a good method of expansion must be obtained; in still other cases the system must be capable of adjustment with a view to wise regulation of speed, and in all locomotive and marine engines easy and prompt reversal of the direction of motion is required. Different inventors have invented different forms

of valve gear designed particularly to meet one or the other of these conditions. Of these the link motion invented by Howe in 1843, and first used on Stephenson's engines, is perhaps the most familiar, it being the gear very generally used, either as originally designed or in some modified form, on locomotives and marine engines. Fig. 7 shows the Howe link, or, as it is more commonly called, the Stephenson reversing link valve gear. The two eccentrics E and E_1 are set on the crank shaft, S, at right angles to the crank, C. These eccentrics carry two rods r and r_1 diverging from each other at a slight angle and with their forward ends connected by the slotted, curved link, L. The valve stem, V, has a block or pin which connects it to the link by means of a sliding fit in the slot. If the link be lifted so that the rod r lies nearly in line with V, then the valve receives its motion merely as if driven directly by the single eccentric E; if the link be lowered so that rod r_1 lies nearly in line with V, then the valve acts practically as if driven by the single eccentric E_1. Now eccentric E_1 being set for forward motion of the engine and eccentric E being set for backward motion, it will be seen that the movement of the link gives a ready means for reversing the engine. It does more than this, however, since by putting the link in intermediate positions between full forward and full backward gear the cut-off of the valve can be adjusted for expansive working of the steam. The train of levers v, w, x, y, and z in Fig. 7 shows the means of operating this link in an ordinary locomotive engine.

The *governor* of a steam engine is a device whose function is to regulate the energy developed in accordance with the load propelled. If the admission and pressure of the steam be constant, the speed will vary as the load varies; with a light load the speed will be high and with a heavy load it will be slow. These fluctuations in speed are always undesirable and may easily become dangerous, as, for example, when the engine 'races' or 'runs away,' causing the fly wheel to burst from centrifugal force. Governors act to regulate the energy in two ways, first by cutting off steam from the boiler as the speed increases, which amounts to a reduction in boiler pressure, and second by reducing the quantity of steam admitted into the cylinder. The first are called *throttling governors* and the second are called *cut-off governors*. Governors are also classified according to their method of action and according to their form. The most common form of governor is the fly-ball or pendulum governor, which may operate either by throttling or by cut-off action. The diagram (Fig. 8) shows a form of pendulum governor. The stem or shaft, S, is given rotary motion by means of a belt embracing the pulley, P. Keyed to the top of the shaft is the plate a, carrying, by means of the arms b and b_1, the heavy balls c and c_1, and hung to the arms b and b_1 are the arms d and d_1 which connect with the plate e, which is free to slide up and down the shaft S. The balls and their connecting arms revolve with the shaft, and because of the familiar law of centrifugal force they tend to fly apart as the speed of rotation increases and to come closer together as this speed decreases. As the balls fly apart, due to increased speed, they lift the plate e, and this operates the train of levers x, y, and z in such a way as either to shut off steam from the boiler or from the cylinders. That is, as the speed increases the energy is decreased, and conversely as the speed decreases the energy is increased. In this way the energy is proportioned to the load at every instant, the exactness with which this proportion is maintained depending upon the sensitiveness of the governor.

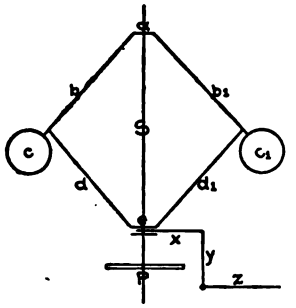
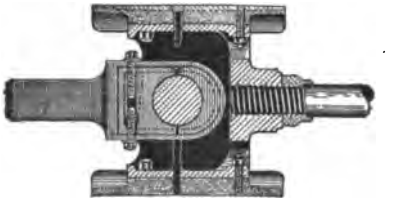


FIG. 8.

The *transmission mechanism* of a steam engine consists of the piston rod, the crosshead, and the connecting rod. The duty of the *piston rod* is to convey the energy developed by the piston outside of the cylinder so that it may be transmitted to the crank shaft or fly wheel. At its inner end the piston rod is attached rigidly to the piston at its centre and at its outer end it is rigidly attached to the crosshead. The rod passes out of the cylinder through an orifice in its front end, this orifice being so constructed that it is steam-tight. It is due largely to the fact that a circular orifice is more easily made steam-tight than any other form that the piston rod is universally cylindrical in form. The *crosshead* is the connecting link which permits the rectilinear motion of the piston rod to be transformed into the swaying motion of the connecting rod. The manner in which it accomplishes this is clearly shown by Fig. 9, which is a section through a familiar make of crosshead. The piston rod coming from the right is rigidly attached to the crosshead by a threaded connection, while the connecting rod is connected by means of a horizontal pin, so that it can swing up and down. The top and bottom of the crosshead are planed smooth and fit a groove or track in the upper and lower guides. These guides are a part of the engine frame, and serve to prevent any vibration of the outer end of the piston rod due to the swaying motion of the connecting rod. The connecting rod is commonly a rectangular or cylindrical bar having at each end a circular bearing, one to embrace the crosshead pin and the other to embrace the crank pin. Fig. 10 shows the construction described. The articles CRANK and FLY WHEEL describe the construction and functions of these parts of the engine's mechanism, and they will not be mentioned further. In concluding this section reference may be made to Fig. 11 as showing in a very plain manner the character and relation of the several structural details which have been described individually. In this


FIG. 9. SECTION OF CROSSHEAD.

engraving the different parts are designated by letters as follows: The engine frame, A; the cylinder, B; the piston rod, C; the crosshead, D; the connecting rod, E; the crank, F; the fly wheel, G; and the governor, H.

The first practical use of importance to which steam engines were put was the pumping of water, and the *pumping engine* still remains one of the principal forms of the steam engine. The various types of pumping engines are described in the article on PUMPS AND PUMPING MACHINERY. The next important use of the stationary steam engine was for driving the machinery of factories, mills, and workshops, and such establishments still consume an enormous aggregate of steam-engine power. The modern form of *mill engine* is the horizontal direct-acting fly wheel engine, in which the power is taken from the fly wheel and transmitted to shafting by means of belts. (See BELTS and POWER, TRANSMISSION OF.) For mill engines of large size present practice favors compound engines; simple engines are used when the unit of power which is required is small. Generally tandem compound and cross compound engines are preferred to engines using steam with three or four expansions, although multiple-expansion mill engines are not infrequent. A horizontal simple engine of comparatively small size which can be used for dynamo driving or other high-speed work, is shown by Fig. 11. A third type of stationary engine is the *hoisting engine*, which in its smaller sizes combines a vertical steam boiler and a duplex horizontal or vertical engine in one machine. Such engines do not have a fly wheel, but connect directly with a crank shaft which drives the drum upon which the hoisting rope is wound. Hoisting engines of larger size have separate boilers and often operate as many as eight separate drums. The largest sizes of hoisting engines are those used in raising ore from deep mine shafts. These mine hoists have capacities of from 2000 to 5000 horse power. Like the smaller sizes, they are either duplex vertical or duplex horizontal engines. A duplex engine consists of a right-hand and a left-hand engine, both of which couple to the same crank shaft. They are to be distinguished from cross-compound engines, which have a similar appearance structurally, by the important fact that each half of the machine is distinct from the other half so far as the use of the steam is concerned. In direct-acting mine hoists the drum or drums are mounted directly on the crank shaft; in general hoists the crank shaft drives a separate drum shaft by means of gearing. A fourth form of stationary engine is the *rolling-mill engine*, used for driving the trains of rolls in rolling mills. (See ROLLING MILL.) This is usually a horizontal simple engine of

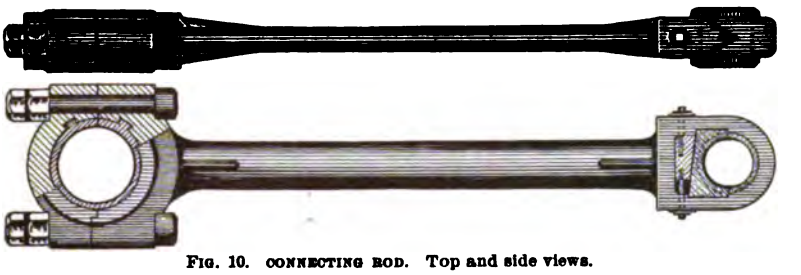


FIG. 10. CONNECTING ROD. Top and side views.

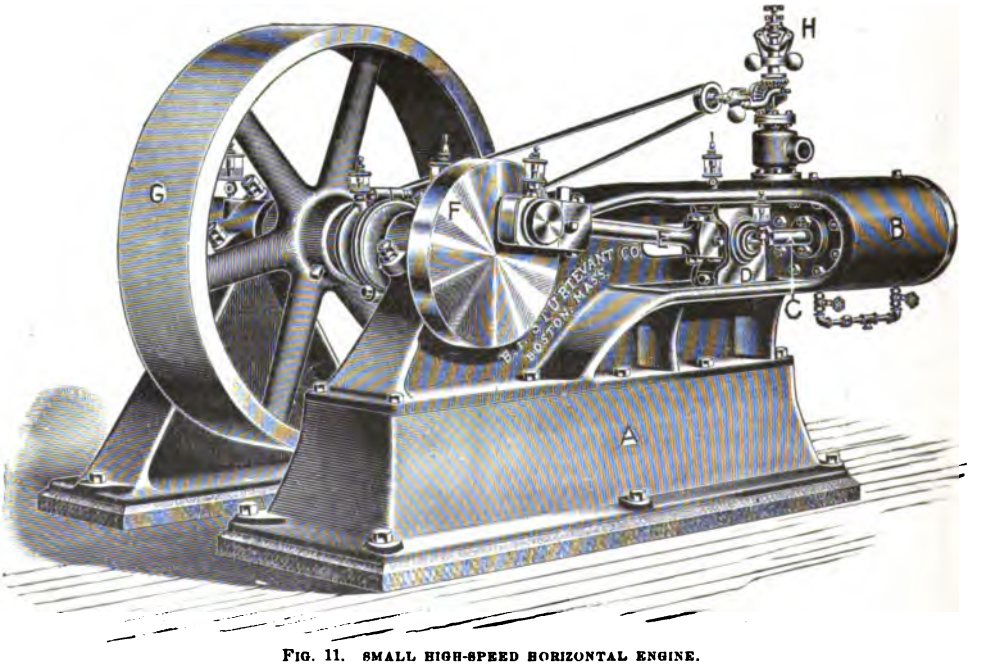
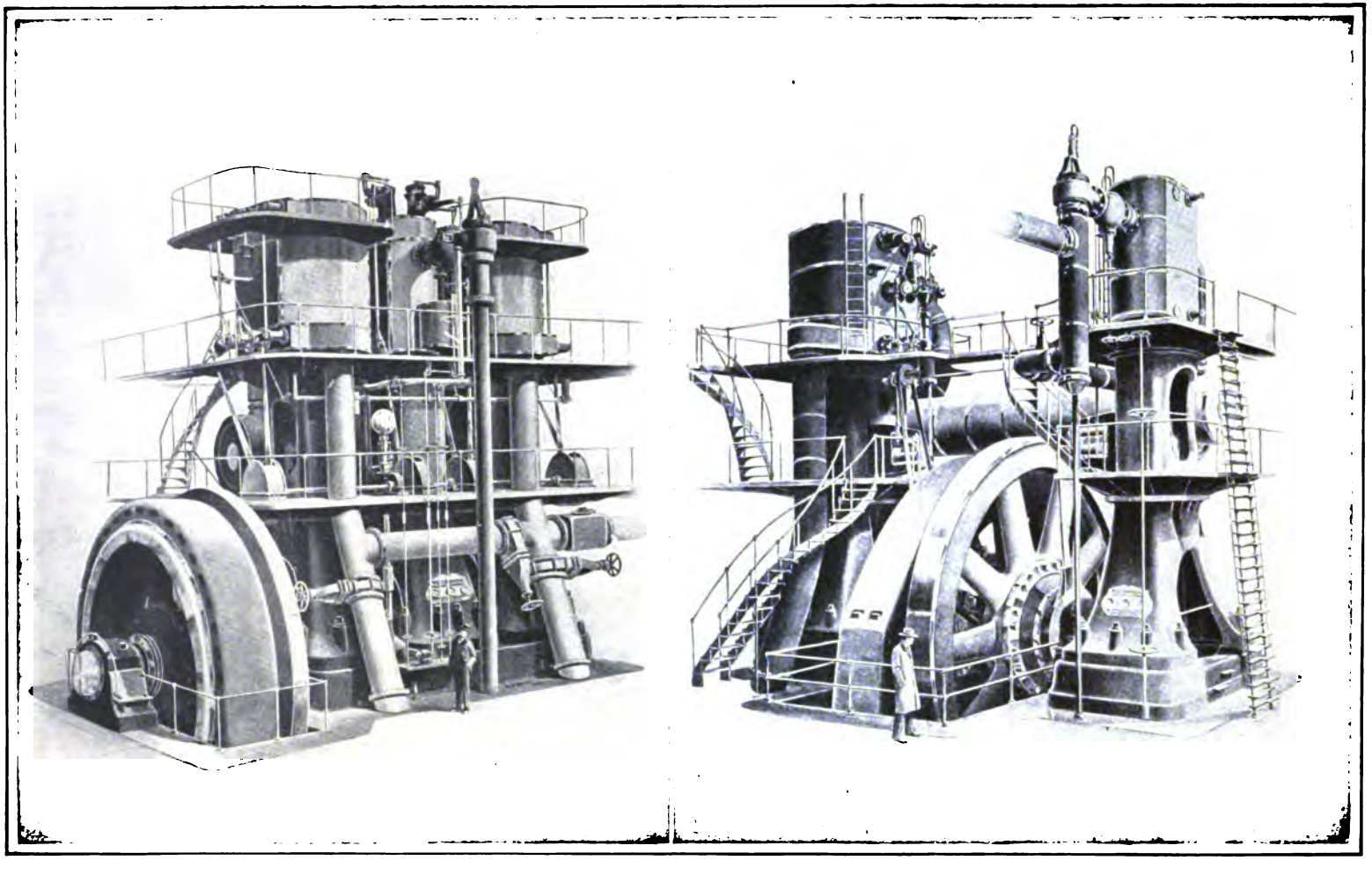


FIG. 11. SMALL HIGH-SPEED HORIZONTAL ENGINE.

STEAM ENGINE



VERTICAL STEAM ENGINES DIRECT CONNECTED TO ELECTRIC GENERATORS

1. 6,000 Horse-power Poppet Valve Westinghouse Cross-compound Engine.

2. 5,000 Horse-power Westinghouse-Corliss Cross-compound Engine.

large size and especially sturdy construction. The largest stationary steam engines now used in any form are those employed for driving the generators of electric power plants. These large machines are almost universally of the inverted vertical direct-acting type, illustrated in the accompanying plate. A sixth important form of steam engine is the steam-driven air compressor described in the article AIR COMPRESSORS.

Engines other than stationary fall into one of two great classes, viz., locomotive engines for railways and marine engines for ship propulsion. The *traction engine* is essentially a locomotive engine designed to run on common roads, and the *portable engine* is practically a stationary engine and boiler plant of small size mounted on wheels so that it may be hauled from place to place. The growth and construction of the *locomotive engine* are described in the article LOCOMOTIVE. *Marine engines* fall into two separate classes. For paddle-wheel boats the beam engine and the inclined engine are universally employed. For screw-propelled vessels the inverted vertical direct-acting engine is almost universal. (See STEAM NAVIGATION.) For a discussion of the theory of steam engines and heat engines in general, see STEAM and THERMODYNAMICS. For descriptions of special applications of steam engines, see AUTOMOBILE; FIRE-ENGINE; BLOWING-MACHINES.

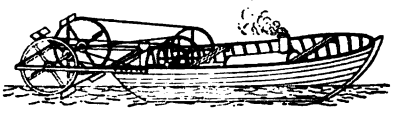
BIBLIOGRAPHY. For an account of the development of the steam engine, see Thurston, *Growth of the Steam Engine* (New York, 1879). Among the best theoretical and descriptive works are: Clark, *The Steam Engine* (London, 1890); Thurston, *Manual of the Steam Engine* (New York, 1892); Hutton, *The Mechanical Engineering of Power Plants* (ib., 1897); Seaton, *A Manual of Marine Engineering* (ib., 1895); Peabody, *Valve Gears for Steam Engines* (ib., 1892).

STEAMER DUCK, LOGGERHEAD, or RACEHORSE. A very large duck (*Tachyeres cinerus*), numerous about the southern extremity of South America, so called on account of its peculiarity of rowing itself along the surface of the water at great speed. This is said to be due to the remarkable fact that this bird loses its power of flight when it reaches maturity.

STEAM HAMMER. See HAMMER.

STEAM HEATING. See HEATING AND VENTILATION.

STEAM NAVIGATION. The Spaniards assert that as early as 1543 Blasco de Garay made an attempt to propel a vessel by steam in the harbor of Barcelona. In the absence of direct proof of the fact this may well be doubted. At the time mentioned the most advanced scientists in Europe had not yet begun seriously to consider steam as a source of power. The assertion is also made that Denis Papin (q.v.) in 1707 propelled a boat by steam on the River Fulda. Papin invented the safety valve and a single-acting steam cylinder pump, and made various improvements in steam pumps, but it does not appear that he ever built what might be called a steam engine. The boat which has been mentioned and which is frequently referred to had some sort of paddle wheels, but they were operated by the crew and not driven by steam power. In 1729 Dr. John Allen took out a patent in England for a method of propelling a boat by means of forcing water out of the stern with steam or other pressure. In 1736 the rather vague ideas of Allen were improved upon by Jonathan Hulls, a clockmaker of Campden, Eng-

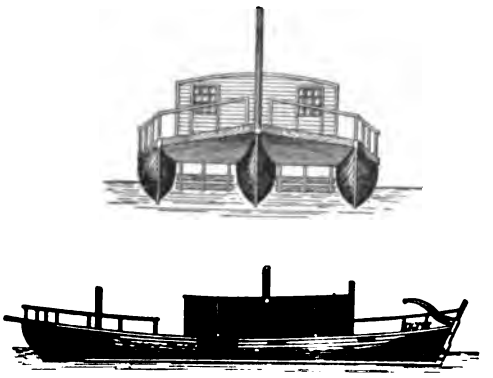


HULLS' BOAT.
(From an old drawing.)

land, and he was granted a patent for mechanism to propel a boat by steam power. Like Allen, he apparently made no serious attempts to put his ideas into practice. In 1752 the French Academy of Sciences awarded a prize to the distinguished physicist Daniel Bernoulli for an essay on the manner of propelling boats without wind. In addition to other suggestions he proposed the use of the screw propeller.

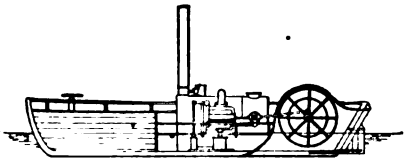
Up to this time successful steam navigation was impossible because a practical steam engine did not exist. This deficiency was supplied by Watt, who took out his first patent in 1769, but the engines contemplated were really single-acting pumps. In 1782, however, Watt brought out the double-acting engine, and developed the principle of expansive working by cutting off the steam at a suitable point instead of allowing it to follow full stroke. All the conditions for the propulsion of vessels by steam were now in existence and experimental boats rapidly appeared. In 1783 the Marquis de Jouffroy built one which was tried at Lyons, and it is said to have been successful; but before it could be developed into a form for practical use the Revolution overtook and ruined him. At the same time John Fitch, James Rumsey, and Oliver Evans were experimenting in America. Rumsey's boats, like the proposed vessel of Dr. Allen, were fitted with jet propellers, whereby a stream of water was discharged by a steam-driven pump. His first boat was tried in Virginia in 1784 and a second, which attained a speed of 4 knots, was completed in 1786. He died in London in 1792, just previous to the trial of a new boat built from his plans. Fitch's boats were fitted with various types of propelling machinery —with paddle wheels in 1785 and afterwards with long paddles which were given motion similar to that of the paddle of an Indian canoe. In 1790 one of Fitch's boats attained a speed of 7 knots, and afterwards was used on the Delaware to carry passengers. In 1793 Fitch went to France; in 1796, after returning to America, he built a small screw steamboat, but the exact measure of success that he attained is uncertain. Evans experimented with various peculiar types of steamboats, one of which was fitted with a rude screw and wheels with which to run on shore. In England Joseph Bramah obtained a patent in 1785 for propelling vessels by means of "a wheel with inclined Fans or Wings similar to the fly of a Smoke-jack or the vertical sails of a windmill." A patent for a similar invention was issued to William Lyttleton in 1784 and to Edward Shorter in 1800. In 1791 John Stevens of Hoboken, N. J., patented a multitubular steam boiler, and he soon after began experiments with steam propulsion of boats, in which he was assisted by the

celebrated engineer Mark Isambard Brunel, then an exile. Brunel left the United States in 1799, however, and it was not till three years later that Stevens completed a small screw-propelled boat which he used for his own pleasure. This little boat, only twenty-five feet in length, was the first successful screw-propelled craft built. Engines suitable for large screw steamboats were not yet invented, so that commercial success in this direction was not yet aimed at. Patrick Miller, a retired banker of Edinburgh, for several years experimented with boats of various types in a lake on his estate of Dalswinton in Dumfriesshire. These boats had two or three hulls con-



MILLER'S BOAT.

nected by a flying deck and driven by paddle wheels placed in the space between the hulls. In the earlier experiments men were employed to turn the wheels, but in 1788, partly at the instance of James Taylor, a tutor in his family, Miller engaged a Scotch engineer by the name of Symmington to fit the boats with steam power. A small boat was tried and gave such promises of success that a larger one was built in 1789. In October of that year this boat attained a speed of seven miles an hour on the Forth and Clyde Canal. Either because of lack of interest or of means, Miller ceased thereafter to interest himself in the matter and nothing further was attempted. But in 1801 Symmington was commissioned by Lord Dundas of Kerse to build a steamer for towing barges on the Forth and Clyde Canal. This was the celebrated *Charlotte Dundas*. She was a success in



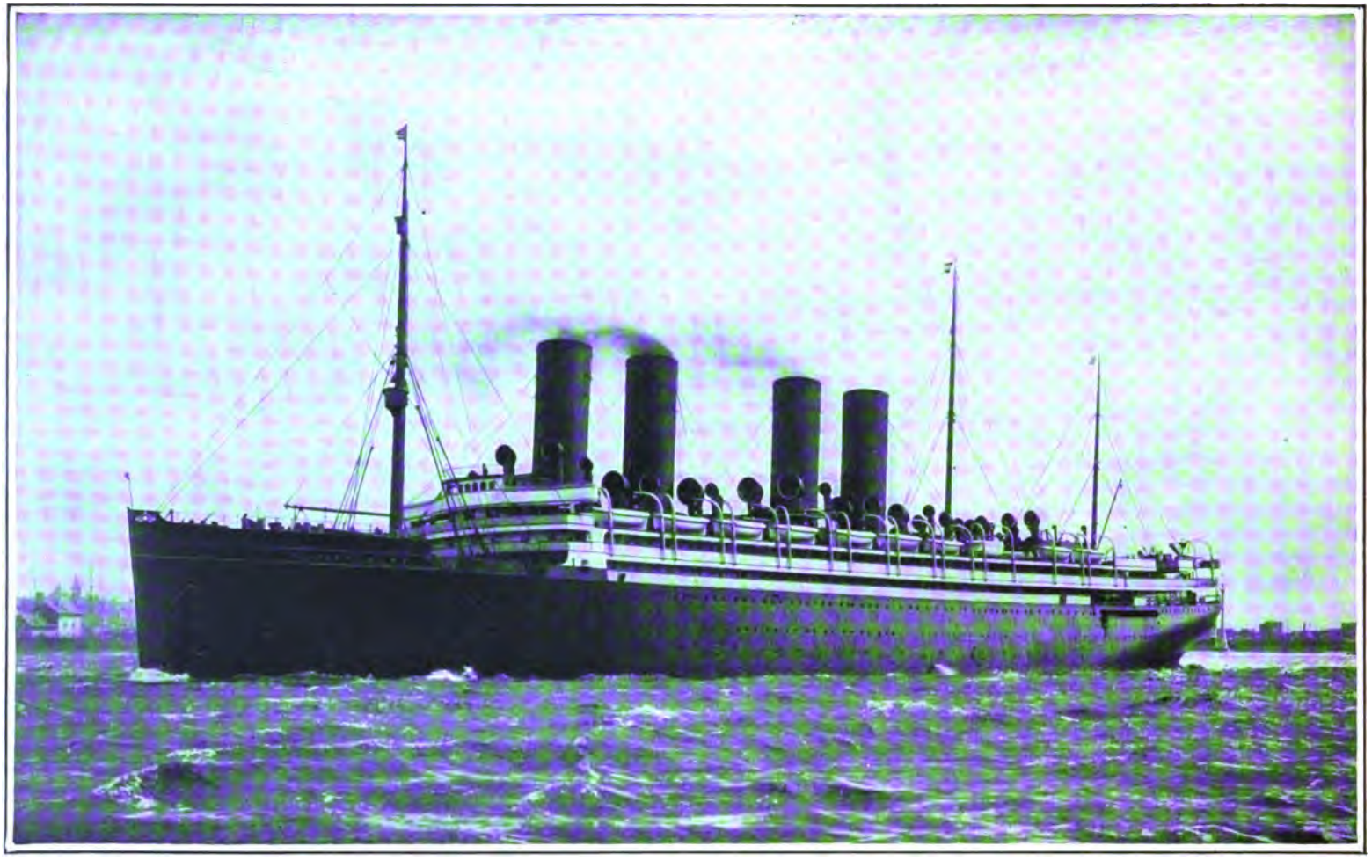
CHARLOTTE DUNDAS.

all essential respects, but the proprietors of the canal refused to use her because they feared the effect of the wash from her paddles on the banks of the canal. She was therefore broken up and her disappointed designer turned his attention to land machinery.

The next development was Robert Fulton's *Clermont*, and her advent marks the beginning of steam navigation as a commercial success. In 1797 Fulton (q.v.) went to Paris from England and soon afterwards began experiments with submarine torpedoes and torpedo boats. About the year 1801 he secured the assistance of Robert Livingston, then the United States Minister to France, and they built a small steamboat. Her engines proved to be too heavy for the poorly constructed hull, which collapsed and sank. The engines were recovered, however, and placed in a larger boat 66 feet long and 8 feet broad, and on August 9, 1803, this boat was tried on the Seine, but the speed obtained was unsatisfactory. In 1804, as the agent of Livingston, Fulton went to England, where he ordered of Boulton and Watt the machinery for a much larger vessel which was to be built in the United States. In the autumn of 1806 Fulton returned to America, and the new engine followed him almost immediately. A hull, built in New York, was launched early in 1807, the engines were placed on board, and on August 7, 1807, the *Clermont* started on her trial trip. She proceeded without stopping to Clermont, the home of Livingston, on the Hudson, 110 miles away, and twenty hours later went on to Albany. The next day she started to New York and made the trip in thirty hours at an average speed of 5 miles an hour. Within a month she began to run regularly between Albany and New York.

The success of paddle steamers for sheltered waters was now assured, and they multiplied rapidly, particularly in the United States, where the conditions were particularly suitable. In Great Britain the use of steamers was less immediate. The first commercially successful one to be completed there was the *Comet*, built by Henry Bell in 1811-12. She went into service on the Clyde and was soon followed by others. In the meantime the use of steamers for ocean navigation was being tried. In 1813 Fulton began the war steamer *Demologos* (see UNITED STATES, section on *Navy*), which was the first steam war vessel as well as the first ocean-going steamer. Several steamers began to make regular trips along the British coast in 1818-19, but the voyages were all short. In 1819 a vessel fitted with steam power crossed the Atlantic. This was the *Savannah*, of 350 tons, with a length of 100 feet, which crossed from Savannah to Liverpool in 25 days. In her, however, the engines were purely auxiliary; she was fitted with full sail power, and when the wind was fair or the seas too boisterous for steaming the paddle wheels were unrigged and taken in on deck. The beginning of real transatlantic voyages under steam was made by the *Sirius* and the *Great Western*. The latter was built for transatlantic service and was the larger and more powerful, while the former was taken from the London and Cork line. The *Sirius* started on April 4, 1838, and the *Great Western* four days later. They arrived in New York within twenty-four hours of each other, the *Sirius* at 10 P. M. on the evening of April 22d and the *Great Western* the next afternoon at three o'clock. The average speed of the *Sirius* was 161 miles per day—the highest 220 miles and the lowest 85 (half day only); the amount of coal consumed was 450 tons. The *Great Western* averaged 208 miles per day and her highest run was 247 miles. Neither vessel carried much sail.

For two or three years the transatlantic



A TRANSATLANTIC LINER—NORTH GERMAN LLOYD STEAMSHIP "KAISER WILHELM II."

steamer service was rather irregular. The *Sirius* was withdrawn after making a few trips, and though the *Great Western* continued running, she lost money for the company that owned her. Other steamers made a few trips, but they also, like the *Sirius*, were withdrawn. In 1839 Samuel Cunard, of Halifax, N. S., went to England and succeeded in forming the celebrated Cunard Company. Assisted by a liberal Government mail subsidy, it was commercially successful from the start. The first vessels put in service were the paddle steamers *Britannia*, *Acadia*, *Columbia*, and *Caledonia*. They were of 1154 tons burden and their machinery was of 740 horse power. The *Britannia*, the first to sail, left Liverpool on July 4, 1840, and made the passage to Halifax in 12 days 10 hours; on her return voyage she did better, the time being but little over ten days. The Cunard Company enjoyed a practical monopoly of the transatlantic service until 1850, when the Collins (American) and Inman lines were started. The Collins Line lost two of its four steamers and was discontinued in 1858. Two other American steamship lines were started in 1850, the New York and Havre Steamship Company and the Vanderbilt Line. Both ceased running at the beginning of the Civil War.

The Inman Line was more successful. It began its career with steamers built of iron and propelled by screws. Though no faster than the wooden paddle-wheel Cunarders, they were cheaper to operate. The screw propeller (q.v.) now began rapidly to displace the paddle wheel, though the Cunard Company launched the *Scotia*, their last and finest paddle steamer, in 1861. The rapid increase in size of ocean steamships led to the production of the *Great Eastern* (q.v.), but she was half a century ahead of the demands of ocean traffic and the adequate development of marine steam engineering. She was fitted with both screw and paddle engines, as it was thought impossible for either separately to deliver sufficient propulsive effect. The combination was not an economical one, and was a leading cause of her failure as a commercial venture. By 1860, in the fight for supremacy, the screw had become the unquestioned victor over the paddle wheel so far as ocean navigation was concerned, both in the merchant marine and in naval construction. Its advantages for war vessels were numerous, but the greatest of these was the possibility of placing all the propelling machinery of a screw steamer below the water line; and this alone was decisive. In merchant steamers the advantages of the screw were of a different kind. The efficiency of the paddle wheel depends upon the depth of immersion of the paddles; if too great or too little, the losses from slip, drag, and churning of the water are serious. The variation of draught consistent with economical propulsion was therefore very small—too small to admit of heavy loading. Very large wheels and feathering wheels reduced the losses somewhat, but introduced troubles of another type, while the rolling of paddle steamers in heavy seas greatly interfered with their speed and economy no matter what the character of the wheels. The draught and condition of lading of screw steamers was of much less importance and could be varied within much wider limits without perceptible loss of efficiency; rolling produced little effect, and though pitching might be serious in short vessels in which the screw was not deeply immersed, yet, owing to the small ordinary angle of pitch, the screw rarely rose high enough above the surface to give trouble.

Up to this time boilers were of the box type and the pressure of steam carried rarely exceeded 25 pounds per square inch—in many of the early steamers 10 pounds or less was the common practice. But the displacing of box boilers by cylindrical permitted a higher steam pressure, and this in turn demanded another form of engine to utilize it economically. The compound engine, which was built and patented by Hornblower in 1781 and revived by Woolf in 1804, had not been much used, because the conditions had not demanded it; but now it became a necessity. It consisted at first of two cylinders—and many compound engines are still so built—in which the steam was expanded in two stages, the first expansion taking place in the high-pressure cylinder, by which the pressure was reduced one-half, more or less, and the second expansion in the low-pressure cylinder, where the pressure was carried down to the atmospheric line or below it.

The demand for increased speed led to higher steam pressure and greater engine speed. The range of economical expansion in one cylinder being limited, the tri-compound or triple-expansion engine was designed to utilize the increased boiler pressures. The gain was twofold. The new engines, using a higher pressure of steam, were lighter than their predecessors of equal power and they were also more economical. The first large vessel to be fitted with them was probably the *Propontis*, which, in 1874, was supplied with engines designed by Mr. A. C. Kirk. By 1880 the use of triple-expansion engines became common, though compound engines were largely used for another decade and they are still fitted in certain steamers where the conditions favor their economical working.

The continued demand for increased power, particularly in small vessels (torpedo boats and the like), naturally pushed up the steam pressure again, and, although the locomotive boiler was used to some extent, the advantages of the water-tube boiler soon became apparent. (See section on *Boilers* below.) Its capability to furnish very high pressure steam reacted upon engine design and produced the quadruple-expansion engine. The water-tube boiler is not yet much used in the mercantile marine, but is rapidly displacing the cylindrical boiler in naval construction. It has not yet brought about the extended use of quadruple-expansion engines in large vessels, but this may follow in the course of time.

The length of the voyage and the vast amount of traffic has caused the transatlantic trade to be the principal field of steamship development. While the gain in size and speed of the vessels in this trade has been continuous from the start, a great impulse was given by the building of the *Britannic* and *Germanic* for the White Star Line in 1874. They at once reduced the average passage from Queenstown to New York to about eight days. They were followed in 1879 by the *Arizona* of the Guion Line, confessedly built to outstrip all competitors, and her success was the begin-

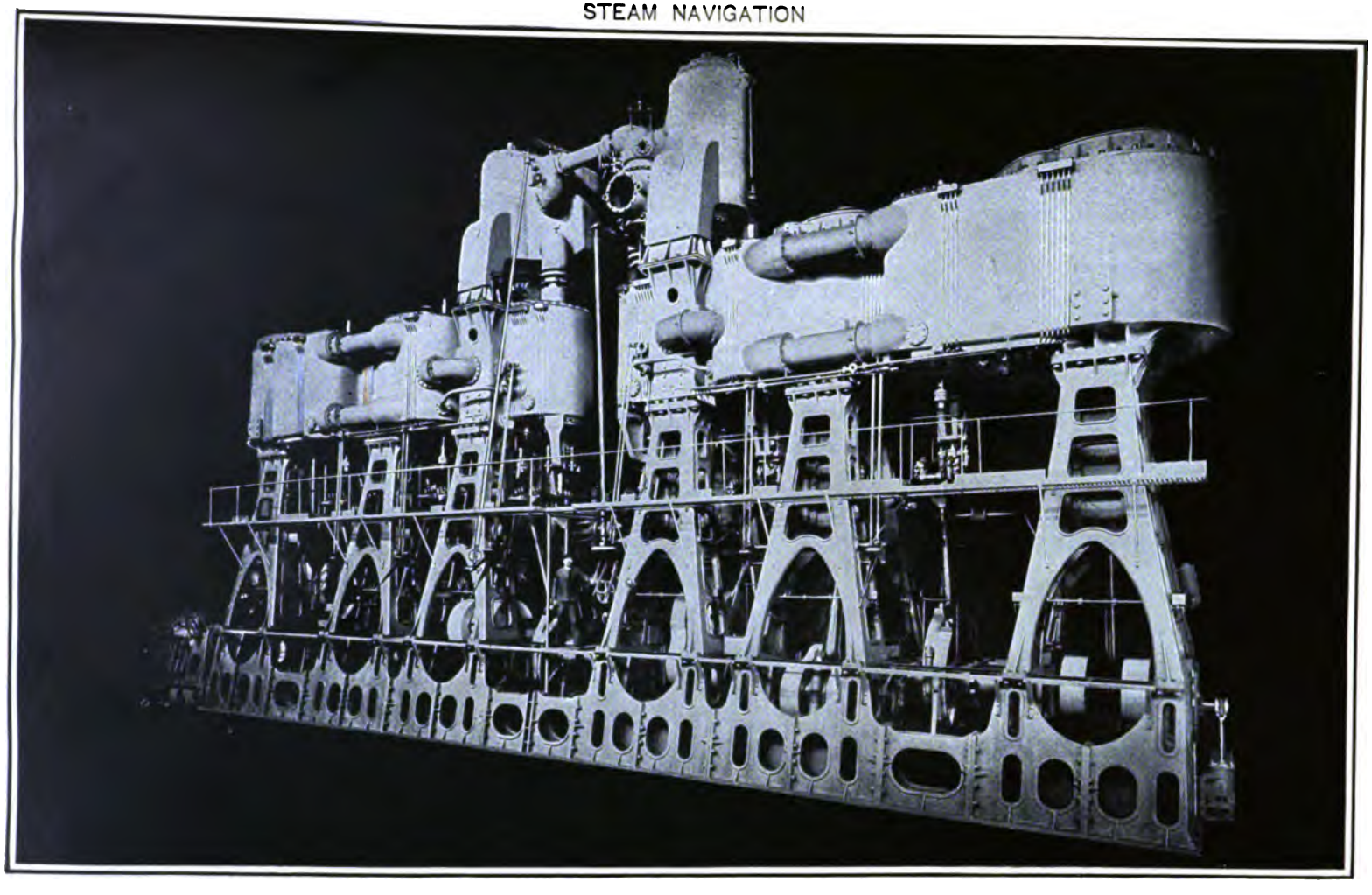
ning of a race for speed supremacy that has brought out a new 'record-breaker' almost every year since. As the vessels are increased in size it takes less horse power per ton to drive them at a given speed, and this has tended to augment the tonnage of the great liners so that the dimensions of the *Great Eastern* are now exceeded by nearly a dozen vessels, built and building. The accompanying table gives the principal features of the largest ships belonging to the great steamship companies, transatlantic and transpacific.

MARINE ENGINES. Marine engines have during recent years tended to one general type. For special services on inland waters a great num-

TABLE GIVING PARTICULARS OF THE LARGEST AND MOST IMPORTANT STEAMERS IN THE WORLD

NAMES OF VESSELS AND OF OWNERS	When completed	Net tonnage	Gross tonnage	Displacement tonnage at full load	Length between perpendiculars feet	Length over all, feet	Beam, feet	Depth of hold, feet	Draught at full load, feet	Indicated horse power of engines	Mean ocean speed, knots
AMERICAN LINE:											
St. Paul	1895	5,874	11,629	16,000	535.8	554.2	63.0	42.0	26.0	20,000	21
St. Louis	1895	5,894	11,629	16,600	535.8	554.2	63.0	42.0	26.0	20,000	21
New York	1888	6,318	10,675	.....	.....	560.0	63.3	42.0	.....	20,000	21
Philadelphia (Built 1888, rebuilt 1901)	1901	6,289	10,787	.....	.....	560.0	63.3	42.0	.....	20,000	21
ANCHOR LINE:											
Columbia	1901	.....	8,900	.....	.....	503.0	56.0	.....	.....	.....	.....
ATLANTIC TRANSPORT LINE:											
Minneapolis	1900	.....	13,401	.....	.....	600.7	65.5	39.7	.....	.....	14
Minnesota	1900	.....	13,403	.....	.....	600.7	65.5	39.5	.....	.....	14
Minnetonka	1902	.....	13,398	.....	.....	600.7	65.5	39.7	.....	.....	14
New ship	b'ld'g 1903	.....	13,400	.....	.....	615.0	65.0	51.0	.....	12,000	15
New ship	b'ld'g 1903	.....	13,400	.....	.....	615.0	65.0	51.0	.....	12,000	15
Missouri	b'ld'g 1903	.....	10,425	.....	.....	490.0	58.0	43.0	.....	.....	15
Maine	b'ld'g 1903	.....	10,425	.....	.....	490.0	58.0	43.0	.....	.....	15
CUNARD LINE:											
Campania	1892	5,000	12,950	.....	600	622.0	65.3	41.5	25.0	30,000	22
Lucania	1892	5,000	12,950	.....	600	622.0	65.3	41.5	25.0	30,000	22
New ship	b'ld'g 1903	.....	.....	.....	.....	760.0	78.0	.....	29.0	60,000	25
New ship	b'ld'g 1903	.....	.....	.....	.....	760.0	78.0	.....	29.0	60,000	25
COMPAGNIE GÉNÉRALE TRANSATLANTIQUE:											
Touraine	1890	.....	9,778	13,000	.....	536.0	55.0	38.0	.....	.....	.....
Aquitaine	1890	.....	10,000	13,000	.....	520.0	58.0	38.0	.....	.....	.....
Lorraine	1899	.....	11,869	15,400	557.7	582.3	60.5	39.4	25.5	22,000	21.5
Savoie	1900	.....	11,869	15,400	557.7	582.3	60.5	39.4	25.5	22,000	21.5
HAMBURG-AMERICAN LINE:											
Deutschland	1900	.....	16,502	23,620	662.8	686.6	67.0	44.0	29.0	36,000	23.5
Fürst Bismarck	1890	.....	8,430	.....	520.0	.....	58.0	40.0	.....	18,000	.....
Augusta Victoria	1889	.....	8,470	.....	520.0	.....	56.0	38.0	.....	15,000	.....
Columbia	1889	.....	7,241	.....	.....	465.0	56.0	38.0	.....	15,000	.....
NORTH GERMAN LLOYD LINE:											
Kaiser Wilhelm der Grosse	1898	5,521	14,349	20,880	625.0	648.6	66.0	43.0	28.0	30,000	23.0
Kaiserin Maria Theresa	1899	3,769	7,800	.....	.....	546.0	52.0	37.0	.....	17,000	21.0
Kronprinz Wilhelm	1901	.....	15,000	21,300	.....	663.0	66.0	43.0	28.5	36,000	23.5
Kaiser Wilhelm II	1902	.....	19,500	26,000	.....	706.5	72.0	52.5	29.0	39,000	23.5
Grosser Kurfürst	1900	.....	12,200	22,000	.....	581.5	62.0	39.0	.....	16,000	20.0
RED STAR LINE:											
Vaderland	1900	7,490	11,899	.....	560.0	580.0	60.0	42.0	27.9	12,000	17.5
Zeeland	1901	7,511	11,905	.....	560.0	580.0	60.0	42.0	27.9	12,000	17.5
Finland	1902	.....	12,300	.....	560.0	580.7	60.0	42.0	28.0	10,400	17.0
Kroonland	1902	.....	12,300	.....	560.0	580.7	60.0	42.0	28.0	10,400	17.0
WHITE STAR LINE:											
Teutonic	1889	4,269	9,984	.....	.....	585.0	57.0	42.0	.....	16,000	20.5
Majestic	1890	4,269	9,965	.....	.....	585.0	57.0	42.0	.....	16,000	20.5
Oceanic	1899	6,917	17,274	28,500	685.0	704.0	68.4	49.0	32.5	27,000	20.7
Celtic	1901	13,449	20,880	37,770	680.8	699.0	75.4	49.3	36.5	13,000	17.0
Cedric	1902	13,500	20,970	37,870	680.8	699.0	75.4	49.3	36.5	13,000	17.0
GREAT NORTHERN RAILWAY COMPANY (Transpacific):											
Dakota	1903	.....	21,000	33,000	.....	630.0	73.5	55.7	33.0	9,600	14.0
Minnesota	1903	.....	21,000	33,000	.....	630.0	73.5	55.7	33.0	9,600	14.0
PACIFIC MAIL COMPANY (Transpacific):											
Korea	1902	.....	11,300	18,400	550.0	572.4	63.0	40.7	29.0	17,900	18.0
Siberia	1902	.....	11,300	18,400	550.0	572.4	63.0	40.7	29.0	17,900	18.0

N.B.—The names of vessels which fly the American flag are printed in italics.



ONE OF THE TWO SETS OF MAIN ENGINES OF THE "KAISER WILHELM II."
Each set of engines develops 20,000 horse-power, and consists of two four-cylinder, three-crank, quadruple-expansion engines.

ber of various specialties are found, but in sea-going steamers the type in almost universal use is the vertical (i.e., the piston moves vertically), inverted (i.e. the cylinder is above the crank), direct-acting (i.e. the connecting rod joins the crosshead directly to the crank), triple (or quadruple) expansion engine. Engines differ as regards fittings and attachments, length of stroke and revolutions, weight, speed, etc., but a description of the general type will give the essential features of all.

Naval engines are built lighter, have a shorter stroke, and run at higher speeds than those in the merchant service. In a triple-expansion engine the steam works expansively in three successive stages, in a quadruple in four. The reason for the introduction of the multiple-expansion engine is the greater economy obtained when steam is used expansively over a greater range. This cannot be efficiently accomplished in a single cylinder owing to various causes chiefly due to liquefaction, hence compound (two stage) engines were introduced, then the triple and quadruple. The economy gained by the compound over the simple is about 50 per cent., by triple over compound about 25 per cent., and by quadruple over triple about 10 per cent. In the quadruple the gain in economy is obtained by considerable increase in weight, so that for most services the real gain of the quadruple is questionable. The type of engines will depend largely on the steam pressure employed. For a pressure of 40 to 90 pounds a compound; up to 190 pounds the triple; above 190, the quadruple may be used if space and weight are not very important. At present the pressure used is ordinarily between 140 and 250 pounds per square inch above the atmosphere. A great advantage of multiple-expansion engines, and a cause for their adoption, is the more even turning effect and better balancing obtained. The triple-expansion engine has either three or four cylinders, more often three, arranged in successive order, H.P. (high pressure), I.P. (intermediate pressure), L.P. (low pressure), each cylinder being attached by means of its piston and connecting rod to its own crank on the crank shaft, which is usually made in interchangeable sections, one for each crank. Cranks are usually set at 120° from each other to obtain even turning effect. Four cylinders are used when the L. P. cylinder would be too large to be conveniently fitted or built, or to obtain a better balancing of the engine and reduce vibrations. The sequence of the cylinders is then high pressure, intermediate pressure, low pressure, low pressure; or, on what is known as the Yarrow-Schlick-Tweedy system, low pressure, high pressure, intermediate pressure, low pressure, with cranks set at right angles. Here the crank shaft is generally in two sections.

The course of steam in a triple-expansion engine would be as follows: Leaves main steam pipe, passes through separator, then throttle, and into high-pressure valve chest. The movement of the valve opens and closes the steam ports at pressure cylinder for 0.6 to 0.75 of the stroke and then cuts off. The steam in the cylinder then expands, continuing to move the piston. Just before the end of the stroke the valve opens to exhaust and at about the same time begins to allow steam to enter on the other side of the piston; this results in cushioning at the end of the stroke. The steam having been reduced about 50 to 60 per cent. in pressure and correspondingly in temperature, leaves the high pressure cylinder, and passes to the intermediate pressure receiver, which is really the intermediate pressure valve chest. From here it enters through the intermediate pressure valve and does its work in the intermediate pressure cylinder, being again reduced in temperature and pressure. On leaving the intermediate pressure cylinder the steam is generally at about atmospheric pressure. Then it is conducted to the low pressure receiver and goes through its third stage of working and expansion. On leaving the low pressure it goes through the exhaust pipe to the main condenser where it is condensed, and then as water and vapor it is pumped by the air pump to the hot well or feed tank, and thence to the boiler, where it is re-evaporated.

A plate illustrating a four-cylinder triple-expansion engine of a modern second-class cruiser for the United States Navy is shown with various parts indicated. The engine framing is supported on a *bed plate* made in sections and bolted by *holding-down bolts* to structural parts of the vessel. The engine framing is made of *steel columns* braced by various *cross rods*. A more general practice is to have cast or wrought steel inverted Y frames on one side which support the guides, and in the merchant service the condenser is generally cast in one piece with lower portions of the Y frames. The *cylinders* are supported on top of framing and bolted to it by various fastenings. In large engines each cylinder is a separate casting; generally the valve chest is cast with the cylinder, making the whole a rather intricate casting. Cast iron is generally used for cylinders. Cylinders are fitted with liners, *a*, which form the bearing surface for the piston. The liners are bolted at the lower end to the bottom of the cylinder and the joint at the top is packed. Liners are of cast steel or cast iron; steel is stronger, but cast iron gives a better wearing surface. The space between the cylinder and liner is commonly used as a steam jacket. Lately the economy of steam jacketing, especially for fast-moving engines, has been questioned. All cylinders are fitted with covers, *c*, of cast iron or steel, and these are secured to the cylinders by bolts and nuts and the joints packed by gaskets. For large cylinders, smaller openings called bull's-eyes, *d*, are fitted for purposes of examination. The pistons are cone-shaped, made of forged or cast steel or cast iron, and fitted with cast iron spring packing rings, *e*. The piston rod is secured to the piston by its taper and the piston rod nut, *f*, on top. The opening in the bottom of the cylinder for the piston rod is fitted with a stuffing box, *g*, supplied with some form of metallic packing. The lower end of the piston is secured to the crosshead *h*, made of forged steel, which has a slipper, *i*, sliding on the crosshead guide, *j*. The crosshead also has journals, *k*, for the upper end of the connecting rod. The lower end of the connecting rod is attached to the crank pin, *l*, by means of the crank pin brasses, *m*. The crank shaft is supported by the main bearings, *n*, which are supported by a bed-plate. All large bearings are lined with anti-friction metal.

The valves *o* for the H. P. and I. P. cylinders are piston valves, either single or double ported, hollow or solid. For the L. P., the

double-ported flat slide valve, *p*, fitted with a relief ring is used. Piston valves are employed with high pressure because in them the pressure is on all sides and there is no force holding the valve against its seat. They are fitted with spring rings to make them tight. Valves are made of cast iron, cast steel, or forged steel. The valve seats are generally liners of cast iron. The valve stem is secured to the valve by its taper or shoulder and the nut *q* and the upper end *r* of the rod is fitted as a guide. The lower end of the valve rod is connected by means of a bearing to the link block *s*, which works in the link *t*. To the ends of the link are attached the eccentric rod *u*, and the lower ends of these rods are bolted to the eccentric straps *v*, which move around eccentrics *w*. The eccentrics are secured to the shaft and fitted so that the position can be slightly changed. There are two eccentrics, one to give go-ahead motion and the other backing. The link is moved by an arm attached to the reversing shaft *x*, which is operated by the reversing engine *y*, and this engine is controlled by the reversing lever. The link arm is attached to the adjustable cut-off block, by means of which the cut-off can be varied from .5 to .75 of stroke. This is the Stephenson gear, which is most generally used; others are Marshall's, Joy's, Morton's, etc.

In the cut shown, the air pump A is operated by a cross beam B attached to the L. P. crosshead. In many merchant vessels the circulating, bilge, and feed pumps are operated from such a beam. For large installments these pumps are as a rule independent and of the Blake, Worthington, Snow, or other patent type. The office of the air pump is to pump the condensed water and vapor from the condenser to the feed tank and produce a vacuum. Surface condensers are now always fitted, and the steam and condensed fresh water are kept separate from the circulating sea water. This keeps salt out of the system. The condenser consists of an approximately cylindrical vessel, having a water chamber and a tube sheet at each end. Brass tubes connect the two tube sheets and cold sea water is pumped through the tubes by means of the circulating pump, thus cooling and condensing the exhaust steam surrounding the tubes. Condensers are made of bronze or cast steel and the tubes of brass. Circulating pumps are centrifugal and operated by a vertical simple or compound engine.

The feed tank is generally fitted with a filter chamber for purifying the water. Feed heaters, using auxiliary exhaust steam to heat the water before reaching the boilers, are fitted for purposes of economy and make the service less hard on boilers. The feed pumps are vertical, single, or duplex plunger pumps. Cylinders are lagged (i.e. covered with non-heat-conducting material) to prevent loss of heat. All cylinders are fitted with relief valves set at appropriate pressures, drains for conducting off any water that may accumulate, and indicator pipes, cocks, and reducing motion for taking indicator cards. Pressure gauges are supplied to indicate the pressure in the steam pipe, the various receivers, and the vacuum in the condenser. Revolution counters are attached, which automatically record the number of revolutions of the engines. A water service is supplied, consisting of a system of piping by means of which sea water can be circulated through such parts as the thrust bearing and crosshead guides, or sprayed on various other bearings where heating is likely.

The oil services on a modern engine are very elaborate, as all working bearings must be supplied with a lubricant. The best practice is the manifold system, where each bearing has a small pipe leading up to one of the several manifolds where it is fed by means of a wick. The manifold can be filled from a reservoir placed above the level of the engine. Besides oil, graphite and various preparations of tallow and grease are used for lubrication.

The steam pressures now used are 150-300 pounds. It is not likely that much higher pressures than 250 will be soon used, on account of the great strength of parts necessary to withstand the pressure, the difficulty of keeping tight joints, and the high temperature of steam, which heats the working surfaces and prevents proper lubrication.

Steam is expanded in triple-expansion engines 6 to 9 times; in quadruple, 8 to 12 times. The ratio of the area of the H. P. to that of L. P. cylinder varies from 1 to 5 to 1 to 10, there being a greater ratio with increased pressures.

The revolutions vary from 80 or 100 per minute in very long stroke engines to 400 to 500 in high-speed torpedo boats. The piston speed is limited to about 1000 feet per minute. The length of stroke for large merchant vessels is four to six feet; for naval engines not over four feet; with smaller engines the stroke is less. A relatively long stroke results in greater economy.

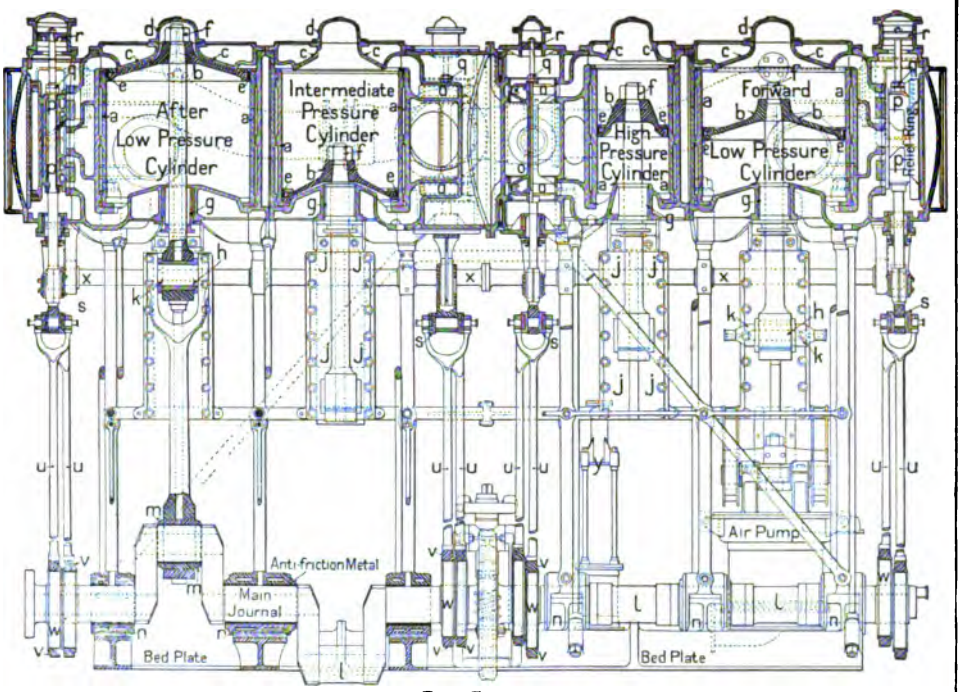
Of late the steam turbine is beginning to be introduced in place of the reciprocating engine for fast vessels. See STEAM TURBINE.

BOILERS. Modern marine practice is either to use the cylindrical fire-tube boiler carrying pressures of 150 to 200 pounds per square inch, or some form of water-tube boiler using pressures of 160 to 300 pounds. W.T. (water-tube) boilers are more largely used for naval purposes and fast passenger vessels and cargo vessels in fresh water, cylindrical boilers for general merchant service.

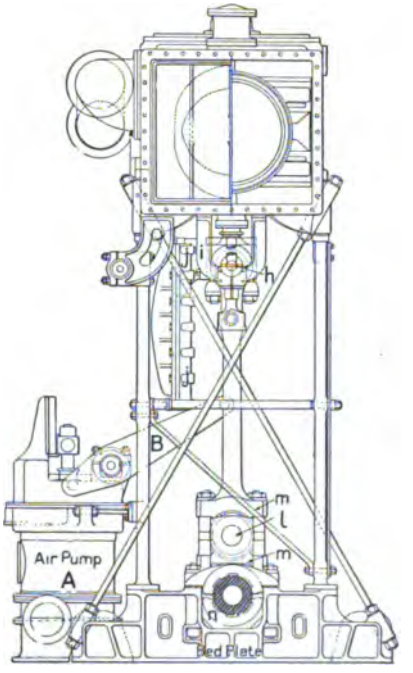
The substantial advantages of the cylindrical boiler are: reliability, simplicity; it is well made and generally understood; it can use salty or dirty water, and it will stand hard usage without serious loss or injury. The disadvantages are: great weight; steam cannot be gotten up or taken off quickly; it does not readily adjust itself to change of output; and heavy forced draught cannot be used.

The advantages of the water-tube boiler are: lightness; adaptability to high pressure; rapidity of raising steam or taking it off; it is readily adjusted to sudden change of output; forced draught can be used (in nearly all types); and repairs or removals are more easily made. Its disadvantages: it requires great care and attention; it cannot use salty or dirty water or experience hard usage; corrosion takes place very readily; it is complicated and many types require a large number of mechanical attachments; and being new, it is not well understood by men who handle it and best results are not obtained. The economy of fuel is about the same in the best of each type. For average running the cylindrical is probably the more economical.

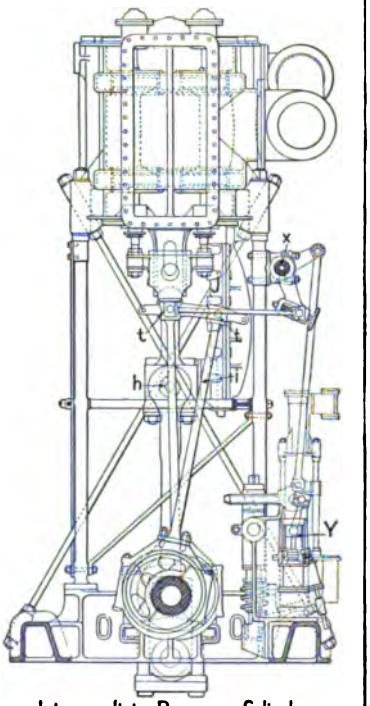
The general form of a cylindrical boiler is the



Port Engine
(Side Elevation)



After Low Pressure Cylinder
(Looking Forward)



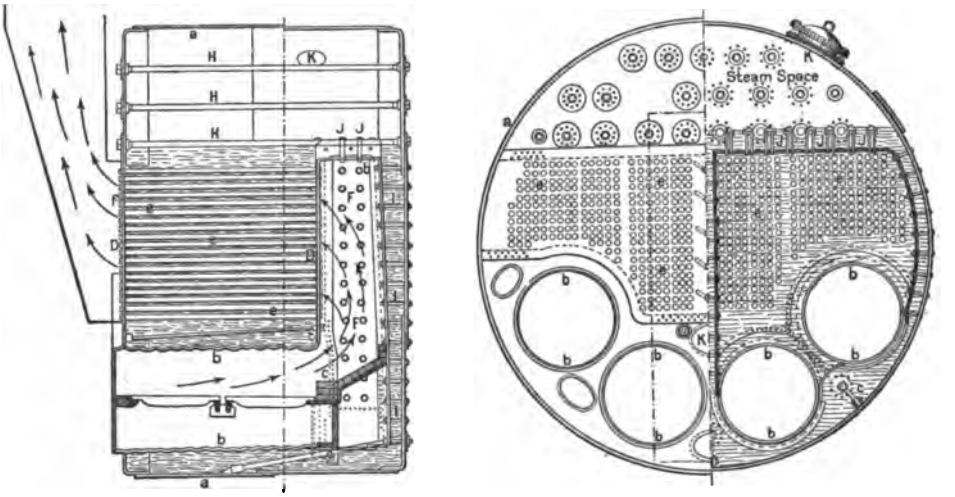
Intermediate Pressure Cylinder
(Looking Aft)

SECTIONS OF ENGINE OF UNITED STATES TWIN-SCREW PROTECTED CRUISER.

Displacement of Vessel, 3200 tons.
Indicated Horse-power, 4500.

Diameter of cylinders, 18, 29, and (2) 35 1-2 inches.
Stroke, 30 inches.

single or double ended return-tube boiler fitted with two, three, or four corrugated furnaces. Boilers vary from 9 to 20 feet in diameter, and 9 to 18 feet in length for single-ended, and 17 to 21 feet for double-ended. A cut of a single-ended boiler is shown; *aa* are the shell-plates, made in two courses of three sections each, with butt joints; *bb*, corrugated furnaces, either of Fox, Purves, or Morrison patent, into which the grate and bridge wall are fitted; *c*, stays supporting boiler front and combustion chamber;



SINGLE-ENDED CYLINDRICAL BOILER.

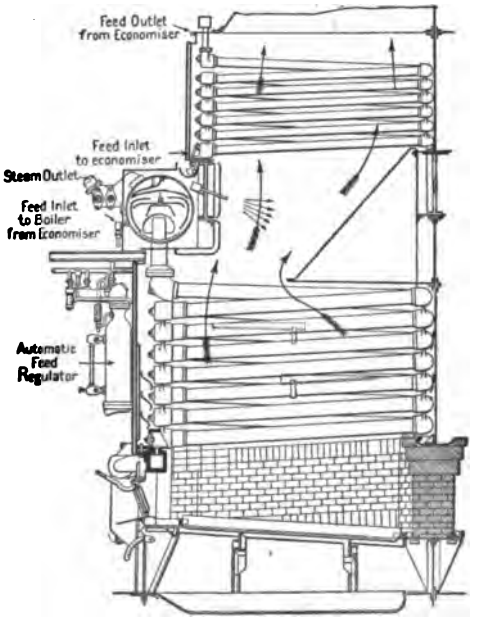
DD, tube sheets with tubes, *e*, expanded into them; some of these are stay tubes screwed into tube sheets which they help to support. F is the combustion chamber, where the gases of combustion are finally mixed and burned. The products of combustion pass through the tubes to the uptake and then to the smoke pipe. The heating surface is composed of the crown sheets (top of furnaces), top and sides of combustion chamber, and tube surface, the tube surface being by far the larger portion. H, H, H are steam space stays supporting the boiler ends. The back and sides of the combustion chamber are supported by short stay bolts, I, and the top by girder stays, J. The steam space is fitted with a dry pipe which collects the steam and discharges through the stop valve to the steam pipe.

The furnace front is fitted with furnace and ash-pit doors, the ash pit being the part of the furnace below the grate. Manholes, K, are fitted to obtain access to boiler for cleaning, etc. The coverings for manholes are called manhole plates. Practically all parts of a boiler, except the grate, furnace doors, and bridge wall, are built of mild steel.

The attachments of a boiler like the one shown are: main and auxiliary stop valves in the steam pipe; check valves through which feed water enters; surface and bottom blow valves, by means of which the boiler is blown down or pumped out; two water columns to show the height of the water; pressure gauge; spring safety valve; and circulating apparatus (generally a hydrokineter).

The grate surface of such a boiler develops 13 to 16 indicated horse power per square foot. Ratio of heating to grate surface, 30-35 to 1. Weight per I. H. P. including water, 90 to 120 pounds. Maximum coal burnt per square foot grate surface per hour about 40 pounds ordinarily 15 to 20 pounds. The efficiency of the boiler is about 70 to 75 per cent. in best condition.

In water-tube boilers the water is contained within the tubes, and as these are relatively small great pressures can be carried and the boiler may be considerably lighter. Most types of water-tube boilers have a number of steam and water chambers connected by a system of tubes either straight or bent. The feed water usually enters the upper or steam drum and is conducted by



BELLVILLE BOILER—ECONOMIZER TYPE.

down tubes to a lower or water drum; from here the water, becoming heated, rises and passes up through steam-collecting tubes to the steam

drum. Thus a circulation is set up. The efficiency of a water-tube boiler depends in a large measure on proper circulation. As the distance of grate to smoke stack is rather short, most types of water-tube boilers have a system of baffle plates for conducting the gases among the tubes to increase the distance of travel. The economy depends in large measure on efficient baffling.

The boilers are fitted with a casing made of fire brick, asbestos, or other non-conducting material held in place by thin sheet metal.

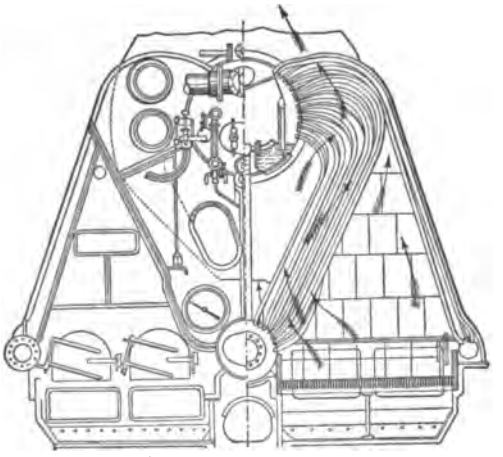
Water-tube boilers have all the attachments enumerated for the cylindrical fire-tube boiler. In addition nearly all except Babcock & Wilcox boilers have automatic feeding apparatus. Bellville boilers are fitted with reducing valves. Some types, especially Bellville, are fitted with feed heaters or economizers placed above the boiler proper, where the feed water is heated before entering the boiler. Others are fitted with superheaters. Most types have an arrangement of steam or air service for the removal of soot.

Down-tube boilers are those in which the steam-generating tubes discharge into a steam drum below the water line. Priming boilers are those where these tubes discharge at or above the water line. Such a boiler as the Schultz appears to be neither one nor the other.

Large-tube boilers use tubes varying from three to five inches in diameter. Small-tube boilers use tubes one to two inches in diameter.

Express boiler is a term applied to rapid steaming small-tube boilers, capable of large power on small weight and using heavy forced draught. This type is rather less economical and is chiefly used for very fast vessels such as torpedo boats.

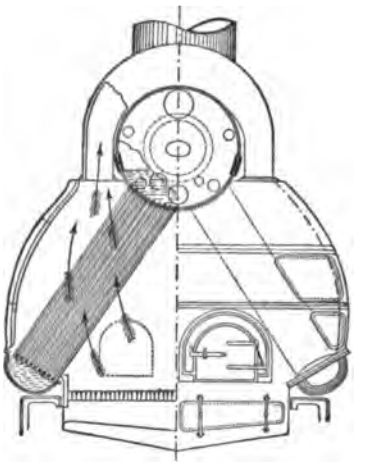
Up to the present time the Babcock & Wilcox and Dürr of large-tube type, and the Thornycroft, Yarrow, and Normand of express type, have given the greatest satisfaction in service.



THORNYCROFT BOILER—DARING TYPE.

The Niclausse and Bellville appear to give satisfaction in some services and dissatisfaction in others.

The Babcock & Wilcox and Bellville are straight-tube priming boilers. The former is shown in section on the plate accompanying the article on BOILER (q.v.). The Niclausse, Dürr, Yarrow, and D'Allest are straight-tube 'drowned' tube boilers. The Thornycroft and the Schultz are express bent-tube priming boilers. The Normand is an express bent-tube 'drowned' tube boiler. Of these the Yarrow, D'Allest, and Babcock & Wilcox are simplest and the Bellville most complicated.



YARROW BOILER.

The systems of forced draught in use are the closed ash pit and closed fire room. Of induced systems generally fitted with air heaters we have various patent forms. Superheating is somewhat used, but does not meet with great satisfaction, owing to increased cost and weight and the rapid deterioration of such attachments.

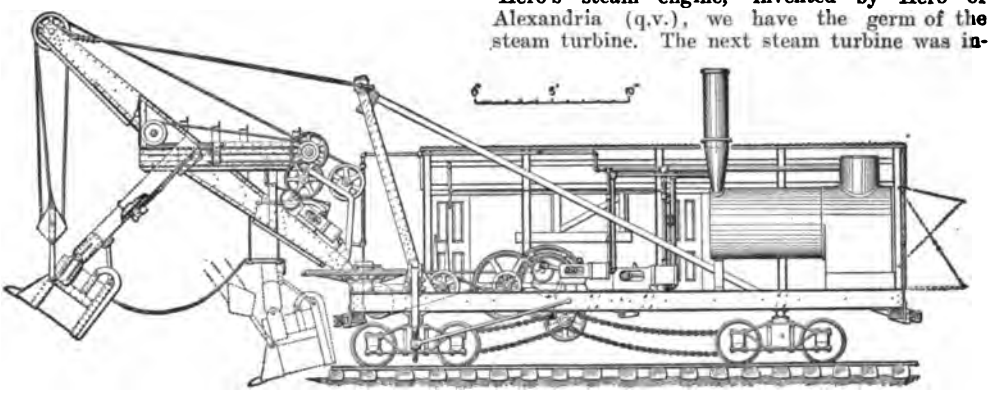
The economic results and other data of water-tube boilers varies so much with different types and conditions that no average results can fairly be taken. As a rule there is a larger ratio of heating surface than in Scotch and a decrease in weight, so that among some of the best types the weight per indicated horse power, including water, is 50 to 90 pounds. See SHIPBUILDING; STEAM; STEAM ENGINE; SHIP, ARMORED; NAVIES; TRANSPORTATION.

STEAM PUMP. See PUMPS AND PUMPING MACHINERY.

STEAMSHIP. See STEAM NAVIGATION.

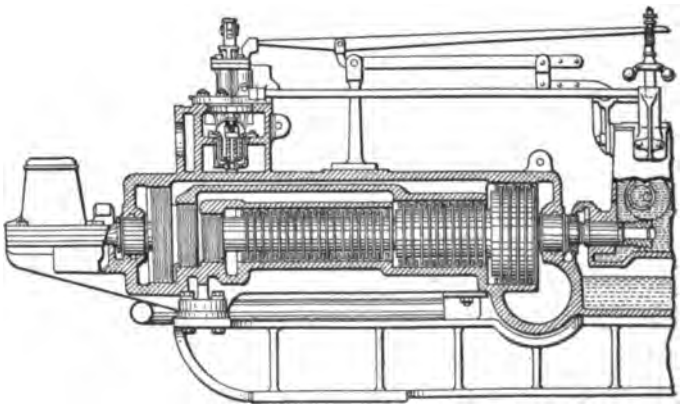
STEAM SHOVEL. A modified form of dredge adapted for excavating material on dry land. The steam shovel was invented in 1840 by an American named Otis, but it did not come into general use until about 1865. The large increase in railway construction in the United States created an active demand for a rapid excavating machine. As will be seen from the accompanying outline drawing, the steam shovel consists essentially of a strong frame mounted on wheels to form a base to which the working parts are attached. The digging mechanism consists of a crane hinged to a mast or support at the front end of the car, and a dipper handle and dipper carried by the crane. The operating machinery consists of a main engine, which hoists the dipper and swings the crane, and of a thrusting mechanism for forcing the dipper into the earth. The operation begins with the dipper at the position shown by the dotted lines in the illustration. The engine man begins to hoist and thus swing the dipper

upward along a curved path; at the same time the crane man by means of the thrusting mechanism forces the dipper into the earth so that a layer is scooped off the face of the bank and falls into the dipper. The depth of the cut is so regulated by the crane man that the dipper is just filled when at its topmost position. The dipper is then hauled back and the crane is swung so as to carry the dipper over the car set alongside the shovel, and the latch is pulled, setting free the swinging bottom of the dipper, which falls open and permits the contents of the dipper to fall into the car. In actual operation these several movements are combined to a greater or less extent, and are accomplished by various devices which will be found described in Hermann, *Steam Shovels and Steam Shovel Work* (New York, 1894). The various parts of the shovel, body, mast, crane, and dipper handles, are constructed either of wood or steel, the latter material being most generally used for the heavier types of shovels. The dipper is always made of steel or iron plates, and its size or capacity varies from one to five cubic yards, but capacities of 1, 1½, 2, and 2½ yards are the ones most common. For digging blasted rock the front edge or lip of the dipper has steel teeth. The excavating capacity of steam shovels varies from 2400 cubic yards of sand to 600 cubic yards of loose rock per ten hours, with a 2½ cubic yard dipper. For extensive records of actual operation in various kinds of material, consult Hill, *The Chicago Main Drainage Channel* (New York, 1896).

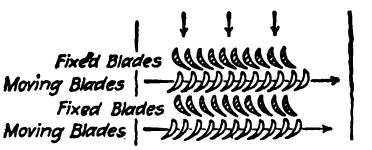


SECTION SHOWING MECHANISM OF STEAM SHOVEL.

STEAM TURBINE. A form of prime motor in which the kinetic energy of expanding steam acts upon a wheel provided with vanes so as to cause rotation. The ordinary method of using steam to obtain power is to admit it into a closed cylinder, where it acts upon a movable piston. (See STEAM and STEAM ENGINE.) In this case work is performed by the static expansive force of the steam pressing against the piston; in the case of the steam turbine the work is developed by the kinetic energy of particles of steam which are given a high velocity by reason of the steam expanding from one pressure to a lower pressure. In the æolipile (q.v.) or 'Hero's steam engine,' invented by Hero of Alexandria (q.v.), we have the germ of the steam turbine. The next steam turbine was invented by Branca in 1629 and consisted simply of a jet of steam impinging upon the vanes of a paddle wheel and blowing it around. Branca's device was the first impulse steam turbine. Practically no attention was given to the steam turbine from this time until the last quarter of the nineteenth century, when several inventors began experimenting, among whom C. A. Parsons of England and Dr. de Laval of Sweden deserve particularly to be noted. Mr. Parsons built his first turbine in 1884, and Dr. de Laval recorded his first patent in 1889. The first Parsons turbine developed 10 horse power at 18,000 revolutions per minute, and proved entirely practical. The Parsons turbine consists of several successive turbine wheels, or rows of blades, on



SECTION OF PARSONS'S STEAM TURBINE.

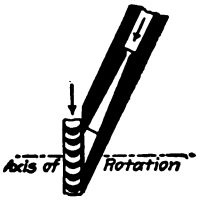


ACTION OF STEAM ON BLADES OF PARSONS'S TURBINE.

one drum or shaft within a concentric case having interior blades; the moving vanes or blades on the shaft are in circumferential rows projecting outwardly from the shaft and nearly touching the case, and the fixed blades on the casing are in similar rows, projecting inwardly from the case and nearly touching the spindle or shaft. This construction constitutes what practically amounts to a series of turbine wheels on one shaft, each one complete in itself, like a parallel flow or Jonval water turbine, through which the steam is forced to pass. Each successive turbine is also slightly larger in passageway than its predecessor, to allow for the increasing bulk of the elastic steam as it exerts its force on each turbine successively and expands with a consequent reduction of pressure. The steam in passing through the successive turbines transmits to each a rotative impulse partly by reaction and partly by impulse, and thus the Parsons turbine involves the germinal principles of both the Branca turbine and Hero's engine. The notable feature of the Parsons turbine is the 'compounding' of the steam, or its expansion in successive



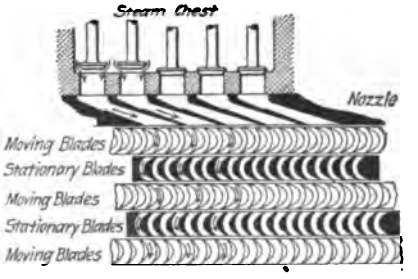
ACTION OF STEAM IN DE LAVAL'S TURBINE.



SECTION OF NOZZLE OF DE LAVAL'S STEAM TURBINE.

stages, losing a few pounds in pressure at each stage. This quality of the machine permits a slow enough speed of rotation without serious loss of efficiency to allow the turbine to be coupled direct to a dynamo or even a screw propeller without the necessity of reduction gearing. It has been successfully employed in both these capacities.

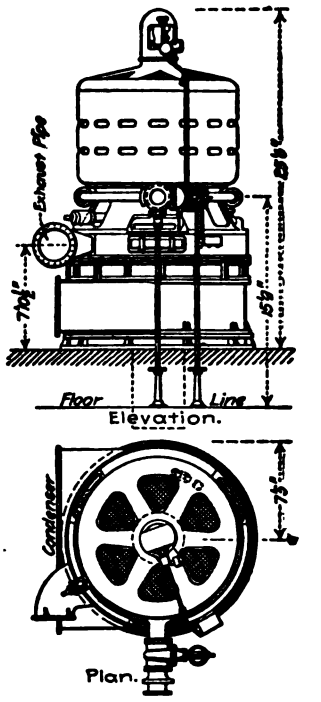
The De Laval turbine is simply a highly improved form of Branca's impulse turbine. It consists of a divergent nozzle which directs the jet of steam upon suitably formed buckets which are attached to the periphery of a revolving wheel. The outer edge of the buckets is shrouded by a steel ring which prevents the centrifugal



ACTION OF STEAM BLADES OF CURTIS'S TURBINE.

escape of the steam. These turbines, especially in the larger sizes, are equipped with several nozzles. They are essentially of very high speed, the smaller sizes running at 30,000 revolutions per minute and the larger sizes at 10,000 revolutions per minute. A train of gearing reduces the speed to reasonable working velocities.

Two other turbines which have gained some prominence are the Seger turbine, a Swedish invention, which is similar in principle to the De Laval, but which employs two revolving vane wheels, instead of one, upon which the steam acts successively, and the turbine invented by J. H. Dow of Cleveland, O., which is notable as having the same principle of 'compounding' the steam as does the Parsons turbine, but which differs materially in construction from the Parsons machine.



CURTIS TURBINE OPERATING DYNAMO.

STEARIC ACID (from Gk. *στέαρ*, *stear*, tallow), $C_{18}H_{36}O_2$. One of the solid fatty acids. It exists as a glyceride (stearin) in most fats, and is especially abundant in the more solid kinds, such as mutton-suet. The stearic acid of commerce is in reality a mixture of stearic and palmitic acids. Pure stearic acid may readily be separated from this mixture by dissolving in hot alcohol and precipitating with a hot alcoholic solution of magnesium acetate, the precipitate being composed of practically pure stearate of magnesium; in this reaction, one part, by weight, of magnesium acetate should be employed for every four parts of commercial stearic acid treated. The magnesium stearate thus obtained is decomposed by boiling with hydrochloric acid, and the stearic acid set free is further purified by recrystallization from alcohol. Pure stearic acid is a colorless crystalline substance having neither taste nor odor; it melts at 69.2° C. (157° F.). It is insoluble in water, on which it floats, but dissolves in alcohol and ether, its solution reddening litmus powerfully. It may be distilled under diminished pressure. The only stearates soluble in water are the stearates of the alkalies, whose solutions are frothy and form a lather, but on

the addition of an excess of water separate into an acid salt which is deposited in silky crystalline plates, and the free alkali, or more probably a basic salt, which remains in solution. (See SOAP.) The stearates of the alkalies are soluble also in alcohol. Chloride of sodium (common salt) has the property of separating the alkaline stearates from their aqueous solution.

Free stearic acid has been found in decomposing pus and in the caseous deposits of tuberculosis. In adipocere and in fæces stearic acid occurs in the form of its calcium salt; in blood, chyle, and in serous fluids, in the form of sodium salts. See CANDLE; FATS; OILS; SOAP.

STEARIN (from Gk. *στέαρ, stear*, tallow), or TRI-STEARIN, $C_3H_5(C_{17}H_{35}CO_2)_3$. One of the chief constituents of fats. It is considerably harder than palmitin (q.v.) and is less soluble than both palmitin and olein, the other characteristic constituents of natural fats. It may be obtained in a tolerably pure state from mutton-suet, by repeated crystallization from ether. The only way in which it may be obtained chemically pure is by synthesis: first, anhydrous glycerin is heated with an equal weight of stearic acid, the product being a compound called mono-stearin; the mono-stearin, freed from the excess of glycerin, is then heated with a further excess of stearic acid, and the product, tri-stearin, is carefully freed from the excess of stearic acid. Like palmitin and certain other tri-glycerides, it presents a remarkable peculiarity in melting: it melts first if heated to 55° C.; on further heating, however, it resolidifies and then melts again when the temperature of 72° C. is reached.

STEARNS, WILLIAM AUGUSTUS (1805-76). An American clergyman and educator, born at Bedford, Mass. He was educated at Harvard and at Andover, and was ordained in the Congregational Church in 1831. In 1854 he became president of Amherst College, his term being marked by extensive improvements of the institution and by the establishment of more than fifty scholarships. His publications include *Discourses and Addresses* (1855), and *A Plea for the Nation* (1876).

STEATITE. See SOAPSTONE.

STEBBING, THOMAS ROSCOE REDE (1835—). An English naturalist. He was born in London and was educated at King's College, London, becoming a fellow of Worcester College in Oxford. In 1858-84 he was engaged in teaching, and thereafter devoted himself to literary and scientific pursuits. He made a special study of crustacea, and besides being a large contributor to various reviews wrote *Essays on Darwinism* (1871), *The Naturalist of Cumbrae, a True Story, Being the Life of David Robertson by His Friend* (1891), and *A History of Crustacea* (1893).

STECCHETTI, stĕ-kĕt'tē, LORENZO. The pseudonym of the Italian poet Olindo Guerrini (q.v.).

STEDMAN, CHARLES (1753-1812). An English military historian, born at Philadelphia. He was educated at William and Mary College and studied law. At the outbreak of the Revolutionary War he adhered to the Crown. He served in the British Army at Lexington and Bunker Hill and the subsequent operations about Boston, later became commissary to the army of Sir William Howe, and during the latter part of the war was with Cornwallis in the South. In 1783 he settled in England. He published a *History of the Origin, Progress, and Termination of the American War* (1794), which remains the best contemporary account of the Revolution from a British standpoint, and is of particular value for its military maps. It called forth from Sir Henry Clinton a reply, *Some Observations upon Mr. Stedman's History* (1794).

STEDMAN, EDMUND CLARENCE (1833—). An American poet, critic, and essayist, born at Hartford, Conn., and educated at Yale. In 1852 he entered journalism as editor of the Norwich (Conn.) *Tribune* and the following year he became editor of the Winsted (Conn.) *Herald*, where he remained till 1855. He then went to New York and in 1859-61 was on the staff of the *New York Tribune*. At the outbreak of the Civil War he was sent to the front by the New York *World* as war correspondent, and there continued till 1863. In the meantime he studied law and was for a time private secretary to Attorney-General Bates in Washington, D. C. In 1864 he was interested in constructing and financiering the first Pacific railroad. The following year he entered Wall Street, New York, as a broker and banker, becoming a member of the Stock Exchange and holding his seat till 1900. His chief volumes of verse are: *Poems, Lyrical and Idyllic* (1860); *Alice of Monmouth, An Idyll of the Great War* (1864); *The Blameless Prince* (1869); *Hawthorne and Other Poems* (1877); *Lyrics and Idylls* (1879); and *Poems Now First Collected* (1897). His prose works include *The Victorian Poets* (1875) and *The Poets of America* (1885) and *The Nature and Elements of Poetry* (1892), a work of sound appreciation and technical knowledge. These volumes of critical writing he supplemented by *A Victorian Anthology* (1895) and *An American Anthology* (1900). He was also editor, with Ellen M. Hutchinson, of *A Library of American Literature* (1888-90, 11 vols.), and, with George E. Woodberry, of the *Works of Edgar Allan Poe* (1895, 10 vols.). Upon the death of Lowell many accorded to Mr. Stedman the primacy among living American poets and critics.

STEEDMAN, CHARLES (1811-90). An American naval officer, born at Charleston, S. C. He was appointed a midshipman in the navy in 1828. He distinguished himself in the Mexican War at Vera Cruz and at Tampico. From 1847 to 1855, with slight interruptions, he was attached to the United States Naval Observatory at Washington, attaining the rank of commander in the latter year; and in 1859 he commanded the *Dolphin* in the Paraguay expedition. He was loyal to the Union during the Civil War. He took part in DuPont's attack and capture of Port Royal, and in the capture of the Savannah forts and of Fort McAllister. In October, 1862, he captured the Confederate batteries at the mouth of the Saint John's River, Florida. In 1865 he was placed in command of the Mediterranean Squadron, and in 1866 was made a commodore. He commanded the Boston Navy Yard from 1869 to 1872, became a rear-admiral in 1871, and was retired in 1873.

STEEDMAN, JAMES BARRETT (1818-83). An American soldier, born in Northumberland

County, Pa. In 1837 he settled in Ohio, where he became interested in the Wabash and Erie Canal. In 1856-60 he was printer to Congress. He led the Fourth Ohio Volunteers at the battle of Philippi, was promoted to the rank of brigadier-general, and at the battle of Perryville brought his troops on the field just in time to fill a dangerous gap in the Federal battle line. At Chickamauga he led the vanguard of Granger's reserve corps to Thomas's aid on the afternoon of the second day. He served under General Sherman during the Atlanta campaign and then rejoined Thomas at Nashville, where he was given command of a provisional division of negro troops, with which on December 15, 1864, he opened the battle of Nashville. He resigned from the service in 1866 with the rank of major-general of volunteers. During President Johnson's administration he was collector of internal revenue at New Orleans, and in 1879 he was elected to the Ohio State Senate.

STEEL. See IRON AND STEEL.

STEEL, FLORA ANNIE (WEBSTER) (1847—). An English novelist, born at Harrow. In 1867 she married a Bengal civilian and went to India, where she lived till 1889. She was for some time inspectress for the Government and aided schools in the Punjab. While in India she published, in conjunction with Lieut.-Col. Richard Temple, a collection of Punjab folk-tales, under the title *Wide-Awake Stories* (1884). After her return to England she began a series of novels and short stories illustrative of native and Anglo-Indian life. Among them are: *Miss Stuart's Legacy* (1893); *Tales from the Punjab* (1894); *Flower of Forgiveness* (1894); *On the Face of the Waters* (1896); *Voices in the Night* (1900); *The Hosts of the Lord* (1900); and *In the Guardianship of God* (1903).

STEEL, Sir JOHN (1804-91). A Scottish sculptor, born in Aberdeen. He first gained prominence by the bronze group of "Alexander Taming Bucephalus," in Saint Andrew's Square, Edinburgh, and his colossal statue of the Queen, surmounting the Royal Institute, brought the appointment as sculptor to her Majesty in Scotland (1838). Among other works by him in Edinburgh are the seated marble figure of Sir Walter Scott, the equestrian statue of the Duke of Wellington (1852), and the memorial statue of Prince Albert. In the United States are a bronze statue of Robert Burns and one of Walter Scott, in Central Park, New York City. He executed many portrait busts. Steel was the first to introduce bronze-casting into Scotland.

STEELE, stā'le. A town in the district of Essen, Prussia, 4 miles east of Essen, on the Ruhr River. In the town are sandstone quarries, coal-mines, grist-mills, brick-kilns, distilleries, breweries, gas-works, and water-works. Population, in 1900, 12,243.

STEELE, stēl, ANNE (1717-78). An English hymn-writer. She was the daughter of a lay Baptist preacher living at Broughton in Hampshire. Her life mainly passed quietly in her native shire. In 1760 appeared her devotional *Poems*, which were reissued after her death with additions, and a memoir by Dr. Caleb Evans (3 vols., Bristol, 1780). Many of her hymns are in common use. Among them are "Far from These Narrow Scenes of Night" and "Dear Refuge of My Weary Soul." Consult her *Hymns, Psalms, and Poems*, ed. with memoir by J. Sheppard (London, 1863).

STEELE, JOEL DORMAN (1836-86). An American educator and author, born at Lima, N. Y., and educated at Genesee College. From 1862 until 1866 he was principal of the Newark, N. Y., High School, and from 1866 until 1872 of the Elmira Academy. In 1866 he published a popular text-book entitled *Fourteen Weeks in Chemistry*. Its success led him to publish a series of books, likewise intended for terms of fourteen weeks, upon *Astronomy* (1867), *Natural Philosophy* (1869), *Geology* (1870), *Human Physiology* (1873), and *Zoölogy* (1875). With his wife, Esther B. Steele, he also wrote an even more successful series of school histories, known, from the name of the publisher, as *Barnes' Brief Histories*. He bequeathed $50,000 to Syracuse University to found the Steele chair of theistical science.

STEELE, Sir RICHARD (1672-1729). An English essayist, playwright, and politician, born in Dublin. In 1684 he was sent to the Charterhouse School, where he formed a memorable friendship with Addison. In 1690 he was enrolled at Christ Church, Oxford, but he passed to Merton College (1691). In 1694 he left Oxford without a degree, and enlisted in the Life-Guards. An elegy which he wrote on the death of Queen Mary (December, 1694), wisely dedicated to Lord Cutts, Colonel of the Coldstream Guards, led eventually to a captaincy in the regiment. "Finding the military life exposed to much irregularity," Steele wrote *The Christian Hero* (1701), a moral treatise for his own guidance. It was not taken seriously by his associates, and seems to have had little effect on its volatile author. He now wrote three comedies: *The Funeral* (1701); *The Lying Lover* (1703); and *The Tender Husband* (1703). Though rather too deliberate in their moral purpose, they contain much delightful wit. After some vain searches, it was said, for the philosopher's stone, he married (1705) a Mrs. Stretch, who owned an encumbered estate in Barbados. She died about a year after the marriage. In 1706 Steele became gentleman waiter to Prince George; in 1707 he was appointed gazetteer, and seems to have left the army. The two positions brought him £400 a year. He now secretly married (September 9, 1707) Miss Mary Scurlock, of Llangunnor, in Wales, who figures as 'Prue' in his curious letters. He took a house in Bury Street, and lived far beyond his means. The death of Prince George in 1708 put an end to his place at Court, and three years later he lost his gazetteership. But he was appointed commissioner of stamps in 1710, a post with £300 a year. Meanwhile (April 12, 1709) had appeared the *Tatler*, a tri-weekly containing sketches and short essays on manners, written under the pseudonym of Isaac Bickerstaff. The periodical came to an end on January 2, 1711, and was succeeded on March 1 by the more famous *Spectator*. Though the plan of these papers was Steele's, Addison had contributed to the *Tatler*, and Addison now became the more important figure. When the *Spectator* suspended publication on December 6, 1712, Steele had written 236 papers and Addison 274. The *Guardian*, started March 17, 1713, was followed by several other short-lived periodicals, of which the most noteworthy is the *Englishman*. In these later

undertakings Steele, a strong Whig, involved himself in political controversy, and was handled without mercy by Swift. He resigned his commissionership of stamps and entered Parliament, but he was expelled (March, 1714) for seditious libel contained in *The Crisis*, a pamphlet in favor of the Hanoverian succession. On the accession of George I. Steele was again elected to Parliament (1715). He also secured the patent of Drury Lane Theatre (worth £1000 a year), for which he wrote his last comedy, *The Conscious Lover* (1722). Broken in health, he passed his last years at Carmarthen, in Wales, where he died September 1, 1729. He was buried there in Saint Peter's Church.

As a man Steele possessed no dark vices. He was improvident, generous, and light-hearted. As a poet he won no place. His political pamphlets, though of interest, are not convincing. His comedies, notwithstanding their aim to purge the stage of immorality, are still read for the wit and gayety in special scenes. As an essayist he has often been compared with Addison to his disparagement. Addison was indeed his superior in taste and humor. But Steele possessed the kindlier heart. Of his generation he stands almost alone in the respect he everywhere shows to women. Anent Lady Elizabeth Hastings he wrote that "to love her was a liberal education." The same sincere heart spoke out in his affection for children. Addison was a stylist. Steele composed off-hand with little attention to form. But he preceded Addison and thus became the father of the essay and sketch dealing with contemporary manners, which, under the hand of Fielding, was transformed into the novel. See ADDISON, JOSEPH.

Consult the excellent biographies of Steele by Aitken (London, 1889) and by Dobson ("English Worthies," ib., 1886); Thackeray, *English Humourists* (ib., 1853); *The Spectator* (ib., 1898); *The Tatler* (ib., 1899); and *Plays* ("Mermaid" series, ib., 1893), all admirably edited by Aitken.

STEEL-ENGRAVING. See ENGRAVING.

STEELHEAD (from the color and hardness of the head), or HARDHEAD. The large sea-trout or salmon-trout of the Pacific Slope (*Salmo Gairdneri*). It is found in coastwise streams from Santa Barbara County, Cal., northward nearly to Alaska. It reaches a length of 30 inches. See SALMON.

STEEL SHAPES. Structural steel produced by a rolling mill in certain fixed shapes such as angles, I bars, tees, bulbs, etc. See illustrations of typical shapes and description of process of manufacture under ROLLING MILL. See also BEAM.

STEELTON. A borough in Dauphin County, Pa., 3 miles southeast of Harrisburg; on the Pennsylvania and the Philadelphia and Reading railroads (Map: Pennsylvania, E 3). It has a public library. It is known for its steel interests, the extensive works of the Pennsylvania Steel Company being here. Other establishments are shirt and hose factories, brick-yards, and a flouring mill. The government is vested in a chief burgess, elected every three years, and a unicameral council. The water-works are owned by the municipality. Steelton was settled in 1865 and was incorporated in 1880. Population, in 1890, 9250; in 1900, 12,086.

STEEL WOOL. An abrading material used as a substitute for sand, glass, or emery paper for polishing wood or metal work. It is composed of sharp-edged threads of steel, which curl up like wool or excelsior.

STEELYARD. See BALANCE.

STEEN, stān, JAN (c.1626-79). A celebrated Dutch genre painter, foremost among the delineators of low life, which he illustrated with rare mastery. Born at Leyden, he is said to have been instructed first at Utrecht by Nicolas Knupfer (1603-60), then at The Hague by Jan van Goyen, whose daughter he married in 1649. He lived at Haarlem from 1661 to 1669, in constant pecuniary difficulties, varying his pursuit of art by renting a brewery at Delft and keeping a tavern at Leyden. With regard to his artistic training it seems likely that he received impressions from Frans and Dirk Hals. The influence of the latter is plainly traceable in Steen's early productions, notably in the "Wedding Party" (Ducal Palace, Dessau), the most characteristic specimen, but also in the humorous "Bridal Procession" (1653, Six Gallery, Amsterdam), in "After the Carousal" and "Revelry" (both in Amsterdam Museum), and in "Dissolute Company" (Berlin Museum). All these transplant us to the sphere in which so many scenes depicted by Steen are enacted, the atmosphere of low taverns, where the changes on the theme "Wine, Woman, and Song" are rung in all imaginable variations. Indubitably Jan Steen is the most genial among the masters of the genre in the entire Dutch school. His dated pictures belong, with a few exceptions, to the decade from 1660 to 1671, his Haarlem period, the most brilliant of his artistic activity. Its beginning is marked by the ingenious domestic scene known as "The Menagerie" (1660, Hague Gallery), and in strong contrast to it "Prince's Day" (Amsterdam Museum), with numerous figures. Other noteworthy examples at The Hague are: "The Painter's Family" (c.1663), "Oyster Party in Steen's Brewery," and "Doctor's Visit;" and in Amsterdam: "Eve of Saint Nicholas," a favorite and often repeated subject of the master, "Family Scene" (2), "The Parrot's Cage," "Cat's Dancing Lesson," "Rural Wedding," and "Lovesick," one of his most perfect works. The Brussels Museum contains "A Gallant Offer" and "The Rhetoricians;" the Louvre, "Evil Association," "Family Repast," and "A Village Festival" (1674), with many figures. Besides similar subjects in the galleries of Berlin, Munich, and Vienna, there are to be mentioned "The Feast of Beans" (1668, Cassel Gallery) and "The Marriage Contract" (Brunswick Museum), perhaps his most remarkable work for size, dramatic feeling, and equably carried out execution. A cabinet piece in the manner of Terborch is the "Music Lesson" (1671), in the National Gallery, London, and several fine interiors may be seen in Buckingham Palace, London, while over ninety of his works are in private collections in England. Consult: Van Westrheene, *Jan Steen, Etude sur l'art en Hollande* (The Hague, 1856); Lemcke, in Dohme, *Kunst und Künstler*, etc. (Leipzig, 1878); and Rosenberg, *Terborch und Jan Steen* (ib., 1897).

STEENKERKE, stān'kĕr-k*e*, or **STEENKERKEN**. A village in the Province of Hainault, Belgium, on the Senne, 19 miles southwest of Brussels. It is noted for the disastrous defeat of the Dutch and English troops under William of Orange, who here attacked the French army commanded by Marshal Luxembourg, August 3, 1692.

STEENSTRUP, stān'strup, JOHANNES JAPETUS SMITH (1813-97). A Danish zoölogist and archæologist, born at Vang. In 1845 he was elected adjunct professor of zoölogy of the University of Copenhagen. In this year appeared the work in which he established the fact of the alternation of generations in the hydroids, and more especially in trematode worms, entitled *On the Alternations of Generations, or the Propagation and Development of Animals Through Alternate Generations*. He was also an authority upon the kitchen-middens (q.v.) of Denmark.

STEENWIJCK, stān'vĭk, **STEENWYCK**, or **STEINWICK**, HENDRIK VAN, the Elder (c.1550-c.1605). A Dutch architectural painter, born at Steenwijck. He painted many interiors of churches, and was the first to attempt the effect of artificial light on architectural forms. His works include: "Interior of Aix Cathedral" (1573, Schleissheim Gallery); "The Courtyard of a Palace" (1588, Dessau Gallery); and "The Liberation of St. Peter" (1604, Vienna Museum). His son, HEINDRIK, the Younger (c.1580-c.1650), was born in Frankfort and went early to Antwerp and Amsterdam, settling finally in London (1629). He, too, painted architectural subjects. Many of Van Dyck's backgrounds were executed by him, and Brueghel and Thulden put figures upon his own canvases. Examples of his work are: "A Church Interior" (1605, Vienna); "View of a Public Square" (1614, The Hague); and "Jesus with Mary and Martha" (1620, Louvre).

STEEPLECHASING. Flat racing over a course selected by reason of the obstacles, such as fences, hedges, hurdles, and ditches. It is popularly supposed to have originated in the hilarious spirit of excited fox-hunters, taking a bee line from the point where they were to a distant village church steeple. The Grand National Steeplechase of Liverpool, established in 1839, is the great event of the steeplechase year. In the United States the Meadowbrook Club has been the pioneer organization for steeplechasing.

STEER'FORTH. In Dickens's *David Copperfield*, a friend of the hero, and the seducer of Little Em'ly. He is drowned in a shipwreck, with Ham Peggotty, who attempts to rescue him.

STEERING. That branch of practical navigation which involves the actual control of the direction of a moving vessel. Steering usually involves the manipulation of the helm, or rudder, tiller, and necessary adjuncts, as described under HELM. In addition the effect of sails, paddle-wheels, screws, etc., must be considered, and sea, currents, winds, and other conditions taken into account, these varying from time to time, and different types of vessels requiring different methods. A double-screw steamer, for example, will steer differently from one with a single screw, having a greater power of manœuvring. The steering of a vessel depends upon the course followed. (See SAILINGS and NAVIGATION), and also upon the rules of the road (q.v.). An interesting practical discussion of the subject will be found in Knight, *Modern Seamanship* (3d ed., New York, 1903).

STEEVENS, GEORGE (1736-1800). An English Shakespeare commentator, born at Poplar. He was educated at Eton and at King's College, Cambridge, but left the university without a degree (1756). Inheriting a small fortune from his father, a director of the East India Company, he was able to give his time to the study of Shakespeare. He reprinted 20 plays from the quartos (4 vols., 1766), collaborated with Dr. Johnson on an edition of Shakespeare (1773), which was revised by Isaac Reed (1785), and, in conjunction with Reed, brought out a new edition (15 vols., 1793). Steevens mutilated the text, but his notes are still valuable.

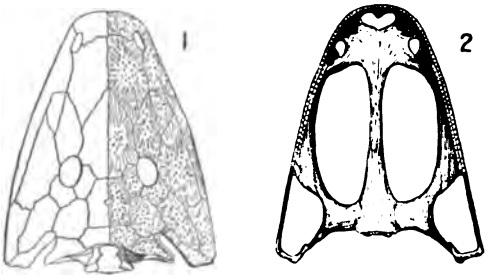
STEEVENS, GEORGE WARRINGTON (1869-1900). An English journalist, born at Sydenham. He was educated at the City of London School and at Balliol College, Oxford. In 1893 he left Oxford for London, where he joined the editorial staff of the *Pall Mall Gazette*. In 1897 he became a special correspondent of the *Daily Mail*, for which he visited in succession the United States, Greece, Egypt, India, Rennes (the scene of the trial of Dreyfus), and South Africa. His letters to the *Daily Mail* were republished under the titles: *The Land of the Dollar* (1897), *With the Conquering Turk* (1897), *Egypt in 1898* (1898), *With Kitchener to Khartum* (1898), *In India* (1899), *The Tragedy of Dreyfus* (1899), and *From Cape Town to Ladysmith* (1900). The last volume, left incomplete, was edited by Vernon Blackburn. All this journalistic work has a distinct literary value from the author's remarkable perceptive and descriptive powers. Before his connection with the *Daily Mail* he had published *Naval Policy* (1896) and the clever *Monologues of the Dead* (1896). He died of enteric fever at Ladysmith, then besieged by the Boers.

STEFFANI, stā-fä'nē, AGOSTINO, Abbate (1655-1730). An Italian composer and statesman, born at Castelfranco, Venetia. He studied music in Venice and under Ercole Bernabei (c. 1620-87) in Munich, where he became organist in 1675 and director of the Elector's chamber music in 1681. He took holy orders in 1680, was appointed Court kapellmeister at Hanover in 1688, and brought out his Italian operas with great splendor in the garden of Schloss Herrenhausen. They were also produced in German at Hamburg, in 1690-1700. He is, however, chiefly remembered for his numerous chamber duets, set to Italian texts, which rank as models of their kind. His compositions are preserved in manuscript in the royal library, London; of the few that appeared in print, may be mentioned: *Psalmodia Vespertina*, for eight voices (1674); *Sonate da camera a due violini, alto e continuo* (1679); *Duetti da camera a soprano e contralto* (1683); and *Janus Quadrifons*, motets with basso continuo for three voices. In 1710 he resigned his post in favor of Handel, and, being made Privy Councilor by the Elector Palatine and bishop in partibus of Spizza, Dalmatia, by the Pope, devoted himself principally to diplomatic and ecclesiastical affairs and died at Frankfort.

STEFFECK, stā'fĕk, KARL (1818-90). A German animal and portrait painter, born in Berlin, where he studied under Krüger and Begas. In 1839 a pupil of Delaroche and of Horace Vernet in Paris, he continued his studies in Italy in 1840-42, and after his return to Berlin attracted attention first with historical, then with sporting subjects, and soon was reputed the foremost painter of horses. In 1880 he became director of the Academy at Königsberg. His principal paintings include: "Margrave Albrecht Achilles Fighting the Nurembergers, 1450" (1848); "Two Spaniels at Play" (1850), "Mare with Colt" (1877), all in the National Gallery, Berlin; "King William at Königgrätz" (1867), Royal Palace, Berlin; "Capitulation at Sedan" (fresco, 1884), Arsenal, Berlin; "Queen Louise with Two Sons" (1886), Breslau Museum; besides many portraits, especially equestrian.

STEGANOPODES (Neo-Lat. nom. pl., from Gk. *στεγανόποδες, steganopous,* web-footed, from *στεγανός, steganos,* covered + *πούς, pous,* foot). A group of birds within the Ciconiiformes, characterized by having all four toes 'totipalmate,' or connected by a common web, also a more or less developed gular pouch. The skull is desmognathous and the wing is aquinto-cubital. The neck is without apteria; the tongue is rudimentary. The Steganopodes are cosmopolitan, aquatic piscivorous birds of large size. About 60 species are known, of which half are cormorants (q.v.). These constitute one of the six families, the other five being the pelicans, darters, tropic-birds, gannets, and frigate-birds (qq.v.).

STEGOCEPHALIA (Neo-Lat. nom. pl., from Gk. *στέγειν, stegein,* to cover + *κεφαλή, kephalē,* head). The name proposed by Cope to designate a well-defined order of fossil amphibia, found in strata from the Lower Carboniferous to the Upper Trias. They are distinguished from other amphibians by a dermal armor of overlapping bony scales which usually protects the ventral, and in some cases the dorsal surface. The group is important as representing the earliest and most primitive tetrapoda or four-footed vertebrates adapted to at least partial land-living habits, and breathing by means of lungs. The majority of stegocephalians are salamander-like or lizard-like in form, with a long tail, flattened head, and two pairs of limbs. The presence of gills in the young and grooves for sensory mucous canals on the skull-bones of some forms proves an aquatic habit. A carnivorous diet is indicated by the conical pointed teeth.



SKULL OF A STEGOCEPHALIAN.

1, Plates of roof of skull (*Capitosaurus*); 2, Palatal view (*Cyclotosaurus*).

The dermal armor, the most distinctive feature of the group, consists chiefly of bony scales, arranged in regular rows on the ventral surface, but scattered or wanting on other portions of the body. Three large plates, one median and two paired, on the pectoral region, represent the interclavicle and the clavicles. The skull, of flattened triangular form, is characterized by a solid roof of paired plates of dermal bone, and the cranial roof is always pierced by five openings — the paired nares and orbits, and the median opening for the pineal body, which may have served as a light-perceiving organ. The teeth are simple hollow cones in the smaller Paleozoic genera, but in many of the later types the dentine and cement exhibit a system of extremely complicated folds — hence the name Labyrinthodontia often applied to these forms. The vertebral column presents widely divergent conditions in different types, as regards the nature and degree of ossification of the centra. As a rule the Paleozoic genera have the notochord largely persistent, the vertebral column thus remaining permanently in the larval condition, while the large Triassic labyrinthodonts have well-developed centra. The limbs are known for but few forms, and in these they do not differ remarkably from those of modern urodeles. The hind foot is always pentadactyl, but, in the fore-foot (except in Keraterpeton, Melanerpeton, and a few related forms) the number is reduced to four, the fifth or outer digit probably being the one lacking. In any attempt to trace the phylogenetic relationships of vertebrate classes the Stegocephalia are of the greatest importance, since it is in this group only, with its solid skull-roof, that we find on the one hand a close approximation to the Paleozoic bony fishes, and on the other to the most generalized Permian reptiles, the Cotylosauria. See REPTILE.

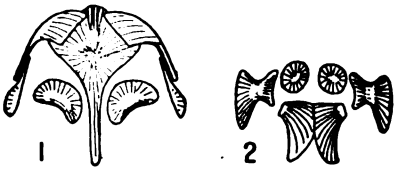


LABYRINTHODONT TOOTH-STRUCTURE.

Cross-section of labyrinthodont tooth, showing the folded structure.



STEGOCEPHALIAN TEETH.



LIMB-GIRDLES IN STEGOCEPHALIA.

1, Pectoral arch; 2, Pelvic arch of Discosaurus.

The classification is as follows: A.—Suborder Leptospondyli. Small animals, usually salamandriform, occurring in the Carboniferous and Permian. The suborder is divided into three fam-

ilies: (1) Branchiosauridæ; (2) Microsauridæ; (3) Aistopodidæ, the serpent-like footless forms. Dolichosoma, which attained a length of three feet, and Ophiderpeton are the best known forms.

B.—Suborder Ganocephala or Temnospondyli. The most familiar type is *Archegosaurus Decheni* from the Lower Permian of Germany, a species which attained a length of four feet. Cricotus and Eryops, from the North American Permian, measure ten feet, and are the largest American amphibia.

C.—Suborder Labyrinthodontia or Stereospondyli. The true labyrinthodonts are clearly differentiated by the form of the teeth, which have the dentine infolded in a more or less complicated manner, and by the vertebræ, which are completely ossified, with biconcave centra sometimes perforated for the passage of the constricted notochord. A few genera occur in the Carboniferous and Permian, but the maximum development of the group is attained in the Trias, chiefly of Europe. The genera Labyrinthodon, Capitosaurus, Trematosaurus, and Mastodonsaurus, from the European Trias, are all enormous animals, the last-named, with a skull four feet in length, being the largest amphibian known. Consult: Woodward, *Vertebrate Palæontology* (London, 1898); Zittel, *Text-book of Palæontology* (ib., 1902).

STEG'OSAU'RUS (Neo-Lat., from Gk. *στέγειν, stegein*, to cover + *σαῦρος, saurós*, lizard). A Jurassic dinosaur of most peculiar appearance. Fossil skeletons are found in Wyoming and Colorado. It was from 25 to 30 feet long, had a very small head, highly arched back, short fore and long hind legs, and heavy long tail. The great bulk of the hinder part of the body depended for its nervous control upon a ganglion in the neural cavity of the sacrum, and this ganglion was of a size several times greater than the brain in the head, which latter is by comparison very small. See DINOSAURIA.

STEIER, stī'ẽr. A town of Upper Austria. See STEYR.

STEIN, stīn, CHARLOTTE VON (1742-1827). A friend of Goethe. She was platonically intimate with him from 1775 to the time of his Italian journey (1786), by which he won emancipation. To her he addressed the *Briefe aus der Schweiz* (1779), which are among the classics of travel, and a multitude of letters, first published in 1848, and best edited in the Weimar edition of his *Works* (1886). Her letters to Goethe were long supposed destroyed, but they have recently been recovered in part. After Goethe's union with Christiane Vulpius there was an estrangement between him and Frau von Stein, gradually overcome later on. Consult: Höfer, *Goethe und Charlotte von Stein* (Stuttgart, 1878); Düntzer, *Charlotte von Stein* (ib., 1874).

STEIN, HEINRICH FRIEDRICH KARL, Baron VOM (1757-1831). A Prussian statesman. He belonged to an old Franconian family, and was born at Nassau. He studied at Göttingen, entered the Prussian civil service, and in 1784 was at the head of the Department of Mines for Westphalia. In 1786 he visited England and made a study of its institutions, and his experiences bore fruit at a later period in his guidance of Prussian affairs. In October, 1804, he entered the Prussian Ministry as chief of indirect imposts, taxes, manufactures, and commerce. He introduced useful reforms in his department, particularly by abolishing various restrictions on the internal trade of the nation; but he was hampered in his endeavors by the spirit of Prussian conservatism. In 1807 he was dismissed from office by the King, but the Peace of Tilsit opened the eyes of the sovereign to the wisdom of Stein's policy, and he was recalled, with the approbation of Napoleon, who had as yet no idea of the deep and earnest patriotism of the Minister. Seeing clearly that, from a military point of view, Prussia was powerless for the moment, he set about developing her internal resources by initiating a series of administrative and political reforms, the principal of which were the abolition of serfdom, with indemnification to the territorial lords; the subjection of the nobles to manorial imposts; promotion in the State service by merit alone, without distinction of caste; and the establishment of a modern municipal system. While he was paving the way for German unity, the Prussian army was being reorganized by Scharnhorst and Gneisenau (qq.v.) As the result of a letter criticising Napoleon's policy, which was brought to the knowledge of the French Emperor, Stein was obliged to resign (November 24, 1808), and retired to Austria. In danger of being surrendered by Austria to Napoleon, Stein was summoned in 1812 to Russia by the Emperor Alexander, and contributed by his counsels to the formation of the coalition of the German States against Napoleon. After the battle of Leipzig, in 1813, Stein became head of the council for the administration of the reconquered German countries, as well as of the territory which France had annexed west of the Rhine. He was a leader in all the military diplomacy of that stirring time up to the Congresses of Vienna and Aix-la-Chapelle. After his retirement from political life he devoted himself to the promotion of German science and art and formed the society for the study of early German history whose publications are celebrated as the *Monumenta Germaniæ Historica*. He died at Kappenberg (Westphalia) June 29, 1831. Consult: Seeley, *Life and Times of Stein* (London, 1879); Pertz, *Leben des Freiherrn vom Stein* (1885).

STEIN, LORENZ VON (1815-90). A distinguished German political scientist, born at Eckernförde, in Schleswig. He studied law and philosophy at Kiel and Jena; became a professor in Kiel in 1846; and from 1855 till 1885 was professor of political science at Vienna. He published: *Französische Staats- und Rechtsgeschichte* (1846-48); *System der Staatswissenschaft* (1852-56); *Lehrbuch der Volkswirtschaft* (1858, 1878, 1887); *Lehrbuch der Finanzwissenschaft* (1885-86).

STEIN, MARK AUREL (1862—). An English Orientalist, archæologist, and educator. He was born at Budapest, Hungary. He studied at Vienna and Tübingen, and in England at Oxford and London. In 1888 he was appointed registrar of the Punjab University and principal of the Oriental College at Lahore, and in 1899 principal of the Calcutta Madrasah. He was deputed by the Indian Government to conduct archæological and topographical explorations in Chinese Turkestan. The first results of his discoveries on this journey are published in his *Preliminary Report* (London, 1901). On his return from

Turkestan he became inspector of schools in the Punjab. Among the more important of his publications are a critical edition of Kalhana's *Rājatarangiṇī, or Sanskrit Chronicle of the Kings of Kashmīr* (1892), together with an English translation and commentary on the same (2 vols. 1901); *A Classified Catalogue of Sanskrit MSS. in the Raghunath Temple Library, Jammu* (1894); and *The Sand-buried Cities of Khotan* (1903).

STEINAMANGER, stīn'ăm-äng'ĕr (Hung. *Szombathely*). The capital of the County of Eisenburg (Vas), Hungary, 68 miles south of Pressburg (Map: Hungary, E 3). It has a beautiful modern cathedral, a fine county building, and a theological seminary. Important State railway workshops are located here, and two factories for agricultural machinery. Steinamanger is on the site of the Roman *Sabaria*, and has ruins of a triumphal arch, amphitheatre, and aqueduct in the vicinity, with many remains in the local museum. Population, in 1900, 24,751.

STEINBOCK (Ger., stone-goat), or **STEINBUCK.** (1) The European ibex (q.v.). (2) In South Africa, by transference, the Dutch name (also 'steenbok') for the small antelopes of the genus Nanotragus, specifically the widespread *Nanotragus campestris*, which abounds in open or thinly wooded and hilly places from the Cape to the Zambezi River. It is of an indeterminate reddish hue, about 24 inches tall, long-necked, with short, erect, forward-curving ringed horns, and exceedingly swift and active, and skillful in hiding. Other species of the genus are the oribi, grysbok, and royal antelope (qq.v.), with still others in Zanzibar and Abyssinia. Consult *Proceedings of the Zoölogical Society of London* for 1900.

STEINER, stī'nĕr, JAKOB (1796-1863). A Swiss mathematician, born at Utzenstorf, near Solothurn. He studied at Heidelberg, gave private instruction in Berlin, and in 1834 was made assistant professor in the university and member of the Academy of Sciences. Steiner's chief work is the *Systematische Entwicklung der Abhängigkeit geometrischer Gestalten* (1832; in the Ostwald Classics, 1896). He also wrote: *Die geometrischen Konstruktionen ausgeführt mittels der geraden Linie und eines festen Kreises* (1833; in the Ostwald Classics, 1895). His *Vorlesungen über synthetische Geometrie* (3d ed. 1887) and his *Gesammelte Werke* (1881-82) appeared posthumously. Consult Graf, *Der Mathematiker Jakob Steiner von Utzenstorf* (Bern, 1897).

STEINHEIL, stīn'hīl, KARL AUGUST (1801-70). A German physicist and astronomer, born in Rappoltsweiler, Alsace. He studied law at the University of Erlangen, and astronomy at Göttingen and Königsberg. He became professor of physics and mathematics in the University of Munich; later entered the Austrian Government service, organized and perfected the telegraph system in that country, and brought about the Austrian-German Telegraph Association; performed a similar service for Switzerland; and in 1852 returned to Munich. In 1854 he founded an establishment for making superior optical and astronomical instruments, where the great telescopes of the observatories of Upsala, Mannheim, Leipzig, Utrecht, etc., were made, and where he began the making of the photograph objectives since known by his name.

Steinheil devised an electromagnetic telegraph, in 1836 constructed the first printing telegraph, and in 1838 discovered the possibility of leading back the current through the ground. He invented the electrical clock, constructed an excellent pyroscope, and made the first daguerreotype picture in Germany. He also completed the laws of electrotype, and constructed several optical instruments. Consult Marggraff, *Karl August Steinheil und sein Wirken* (Munich, 1888).

STEINITZ, stī'nĭts, WILHELM (1836-1900). A German chess master, born in Prague, Bohemia, and educated at the Vienna Institute of Technology. In 1866 he defeated Anderssen in a contest for the world's championship. At the London tournament of 1872 he won every game, and in 1873, at Vienna, he secured the Kaiserpreis of 2000 florins. After defeating Blackburne in England, he withdrew from active tournament play, but the increasing success of Zukertort, whom he had defeated in 1872, forced him back into the field. At a tournament in London (1883) Zukertort defeated him for first place, but at a second match in 1886 Steinitz won from his great rival with 10 to 5 games won and 5 drawn. He defended his title in 1889 at Havana against Tchigorin, but lost the championship in 1894 to Lasker, who again defeated him in 1897. Steinitz was the first to see the value of a steady development of position with an accumulation of minute advantages over the more dashing and open game. After 1883 he lived in the United States, and from 1885 to 1891 he was the editor of the *International Chess Magazine*. His published works were *Book of the Sixth Chess Congress of 1889* and *The Modern Chess Instructor* (1889).

STEINLE, stīn'le, EDUARD VON (1810-86). A German historical painter, born in Vienna, the son of an engraver. First instructed at the Academy, he then became a pupil of Kupelwieser, and from 1828 to 1834 worked in Rome under the influence of Veit and Overbeck. In 1843 he settled at Frankfort, where he had been commissioned to paint "The Judgment of Solomon" (1844), and the portraits of Albrecht I. and Ferdinand III. for the Kaisersaal in the Römer, and in 1850 was appointed professor at the Städel Institute. There Frederick Leighton was among his pupils. Steinle's creative sphere embraces with equal command subjects of profoundly religious aspect and scenes of the merriest playful humor. His works are distinguished by finished grace and beauty of form, masterly technique in drawing, and inexhaustible power of invention. After executing, at Cologne, the "Angel Choirs" (1844), in the cathedral, and the frescoes illustrative of "The Artistic and Cultural Development of the City" (1860-63), in the staircase of the museum, he painted in seven scenes the "Immaculate Conception" (1865-66), in Saint Mary's at Aix-la-Chapelle, designed mural decorations for Saint Ægidius at Münster, and frescoed the apsis of Strassburg Cathedral (1877-80). In Frankfort he designed and in part executed the entire decoration of the cathedral, also the cartoons for some of the stained-glass windows, besides many others for churches in Cologne,

Treves, Fürth, and Vienna. His oil paintings, of rare coloristic charm, include "The Visit of Mary to Elizabeth" (1848) and "Saint Luke Painting the Virgin," both in the Karlsruhe Gallery; "Sibylla Tiburtina" (1848, Städel Institute, Frankfort); "Madonna," altar-piece (Saint Boniface, Wiesbaden); "The Warder" (1858); "Loreley," "Adam and Eve," and "Tartini Playing on a Tower at Padua" (all in the Schack Gallery, Munich); and "Madonna in a Garden" (1884, National Gallery, Berlin). He also composed many cycles in water colors and sepia, such as the "Legend of Saint Euphrosine," Brentano's "Rheinmärchen," several from Shakespeare's plays, and "Parsifal" (Pinakothek, Munich). Consult: Wurzbach, *Ein Madonnenmaler unserer Zeit* (Vienna, 1879); Valentin, *Eduard von Steinle* (Leipzig, 1887); and Reichensperger, *Erinnerungen* (Frankfort, 1887).

STEINLEN, stān'lān', THÉOPHILE ALEXANDRE (1859—). A French draughtsman and illustrator, born in Lausanne, Switzerland. He first became known by his drawings in the newspapers, especially those done in color for the *Gil Blas Illustrée*. Afterwards he became a successful poster designer. He was also successful in portraying Paris street life, particularly about Montmartre. Some of the best of his later work is included in Pelletan's *L'Almanach du Bibliophile*. His publications include the album *Les Chats*.

STEINMETZ, stīn'mĕts, KARL FRIEDRICH VON (1796-1877). A Prussian field-marshal, born at Eisenach. He fought in the wars against Napoleon, and against Denmark in 1848; became lieutenant-general in 1858, and in the campaign against Austria of 1866 won great distinction as commander-in-chief of the Fifth Army Corps, by his victories at Nachod, Skalitz, and Schweinschädel. At the beginning of the Franco-German War he was made commander-in-chief of the First Army. Owing to his surpassing self-confidence, he engaged in disputes with other commanders and the general staff. After his rashness had almost caused a disaster at Gravelotte (q.v.), he was deprived of his command. In September, 1870, Steinmetz was appointed Governor-General of Posen and Silesia, and in April, 1871, he was made general field-marshal.

STEINSCHNEIDER, stīn'shnī'dĕr, MORITZ (1816—). A distinguished bibliographer and Orientalist, born at Prossnitz, Moravia. He studied at Prague, Vienna, Leipzig, and Berlin, and taught in Prague and Berlin. The most important of his publications are his catalogues, and among them the chief are *Catalogus Librorum Hebræorum in Bibliotheca Bodleiana* (1852-60), *Katalog der hebräischen Handschriften zu Leyden* (1857), and lists of the Semitic manuscripts in the Royal Library of Munich (1875; 2d ed. 1895), in the Hamburg Library (1878), and in the Berlin Royal Library (1878). He wrote *Hebräische Uebersetzungen des Mittelalters* (crowned by the French Academy, 1893); an article on Jewish literature in Ersch and Gruber's *Encyklopädie*, translated by Spottiswoode as *Jewish Literature from the Eighth to the Eighteenth Centuries* (1857); *Uebersetzungen aus dem Griechischen* (1891-96); and *Die arabische Litteratur der Juden* (1902). Consult the *Festschrift zum 80. Geburtstage M. Steinschneiders* (Leipzig, 1896), with a full bibliography by George Kohut.

STEINTHAL, stīn'tāl, HEYMANN (1823-99). A German philologist, born at Gröbzig, in Anhalt, and educated at Berlin, where he became privatdocent in 1850 and extraordinary professor in 1863, lecturing on language and mythology. After 1872 he also lectured on criticism of the Old Testament, ethics, and the history of religion at the school for the science of Judaism. With Lazarus he edited from 1860 to 1890 the *Zeitschrift für Völker-Psychologie und Sprachwissenschaft*, and his works include: *Der Ursprung der Sprache* (1851, 4th ed. 1888); *Die Entwickelung der Schrift* (1852); *Geschichte der Sprachwissenschaft bei den Griechen und Römern* (1863, 2d ed. 1889-91); *Die Mande-Negersprachen, psychologisch und phonetisch betrachtet* (1867); *Abriss der Sprachwissenschaft* (1871 et seq.); *Allegemeine Ethik* (1885); *Zur Bibel und Religions-Philosophie* (1890-95). Consult Achelis, *Heymann Steinthal* (Hamburg, 1898).

STEINWAY, stīn'wā, HEINRICH ENGELHARD (1797-1871). A German-American piano manufacturer, originally named Steinweg, born at Wolfshagen, Harz Mountains. He began to manufacture guitars and zithers in Brunswick, and finally undertook the making of pianofortes. In 1850 he went to New York City with his four sons—Charles, Henry, William, and Albert—leaving the German business to his oldest son, Theodor. In 1853 they established the firm of Steinway & Sons.

STEJNEGER, stī'ne-gĕr, LEONHARD (1851—). An American naturalist. He was born in Bergen, Norway, and graduated at the University of Christiania in 1871. Ten years later he came to the United States, and became connected with the United States National Museum, of which he became curator of reptiles and batrachians in 1889. He prepared the greater part of the fourth volume of the *Standard Natural History, Birds* (1885); the *Poisonous Snakes of North America* (1893); *Report of the Rookeries of the Commander Islands* (1897); *The Asiatic Fur Seal Islands and Fur Seal Industry* (1898); and *The Herpetology of Porto Rico* (1903).

STELLA. See SWIFT, JONATHAN.

STELLA. (1) The name applied by Sir Philip Sidney, in his splendid collection of sonnets, entitled *Astrophel and Stella*, to Penelope Devereux, Lady Rich. (2) The name given by Swift to Esther Johnson, who is generally known as Stella.

STELLENBOSCH, stĕl'len-bŏs. A town of Cape Colony, 25 miles east of Cape Town, with which it has railway connection (Map: Cape Colony, E 9). After Cape Town it is the oldest settlement of the colony, having been founded by Huguenot refugees near the close of the seventeenth century. Population, about 6000.

STELVIO (stĕl'vē-ō) **PASS** (Ger. *Stilfser Joch*). A lofty Alpine pass leading across the Ortler group of Tyrolese Alps on the boundary between Tyrol and Italy, 68 miles southwest of Innsbruck (Map: Austria, B 3). The carriage road passing through it is the highest in Europe, being 9055 feet above the sea. It forms part of the great road between Milan and Innsbruck, and

was completed by the Austrian Government in 1820-24, at an expense of 3,000,000 florins.

STEM (AS. *stemn*, OHG. *stam*, Ger. *Stamm*, stem; connected with OIr. *tamon*, stem, and ultimately with Eng. *stand*). In general, stems of plants are axes distinguished from roots by bearing leaves or leaf-like organs. Although there are stem-like structures among the thallophytes and bryophytes, it is only among vascular plants (pteridophytes and spermatophytes) that real stems appear.

Stems may be variously classified. By duration, they are annual or perennial; by structure, herbaceous or woody; by direction, erect, decumbent, prostrate, climbing, etc. Perhaps one of the most important classifications is upon the basis of character of foliage organs produced, as follows: *Foliage-bearing stems*, which generally give style to the whole plant body, are the most conspicuous, since they display green leaves, and are necessarily aerial. As a consequence, they are inclined to branch, and the leaf-bearing joints are well separated. *Scale-bearing stems*, which bear the comparatively small and colorless (not green) leaf-like bodies (scales), may be subterranean or aerial, and the joints may be so near together that the scales overlap, as in the aerial scale bud of shrubs and trees, or the subterranean bud-like structures called bulbs, whose scales and stem become gorged with reserve food. Other prominent subterranean types are tubers (potato), comparatively short, thick stems, with much reduced and not overlapping scales, and the more slender rootstocks and rhizomes (Fig. 1). *Stems bearing flower parts* are very much modified, and constitute the so-called flowers of angiosperms (q.v.). The most essential classification of stems is on the basis of their anatomical structure (see below). The bracing of stems, especially those bearing foliage and flowers, is a conspicuous feature. (For structural details of stems, see ANATOMY OF PLANTS; HISTOLOGY.) Certain broad outlines must be presented here as a basis of the most fundamental classification. At the tip of the stem there is a single apical cell (some pteridophytes) or a group of apical cells, which by their power of continuous division increase the stem in length and give rise to all the tissues. Just behind this growing tip the three great regions begin to be defined (Fig. 2). On the outside is a layer of cells (dermatogen) that gives rise to the epidermis. In perennial stems that increase in diameter the epidermis is sloughed off on the older parts, and the region beneath develops a cork tissue of greater or less thickness, which constitutes the bulk of the bark (q.v.). Within the dermatogen is a zone consisting of several layers of cells (periblem) that gives rise to the cortex. Within the periblem is a central solid cylinder of cells (plerome) that gives rise to the stele, characterized by developing the vascular or woody bundles. The arrangement and character of the woody bundles developed in

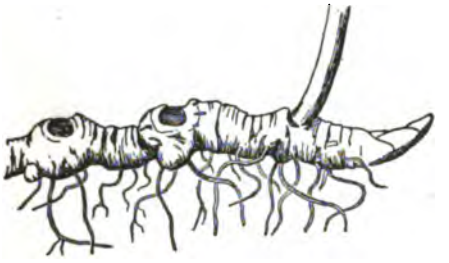


FIG. 1. UNDERGROUND STEM OF SOLOMON'S-SEAL.

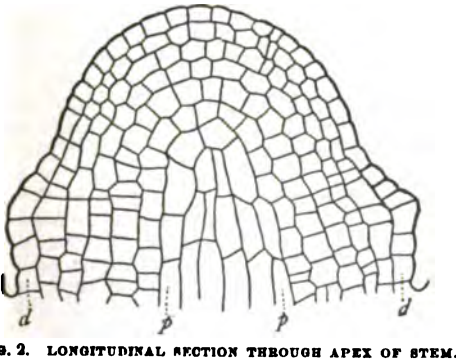


FIG. 2. LONGITUDINAL SECTION THROUGH APEX OF STEM. Showing dermatogen (*d*), plerome (*p*), and between them the periblem.

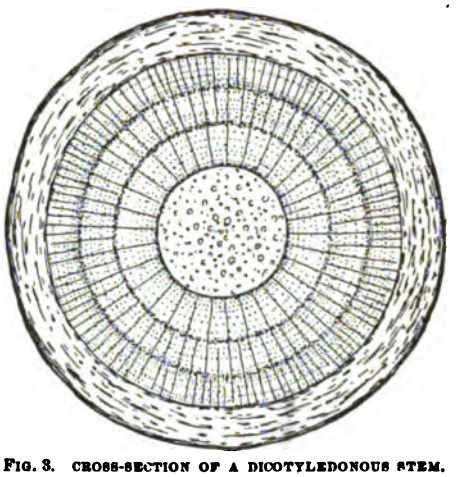


FIG. 3. CROSS-SECTION OF A DICOTYLEDONOUS STEM. Showing pith, three growth rings, and cortex.

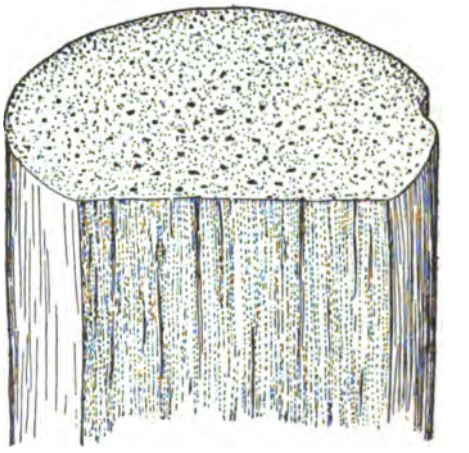


FIG. 4. CROSS AND LONGITUDINAL SECTION OF CORN STEM. Showing the monocotyledonous structure.

the stele determines the three general and most fundamental types of vascular stems. In the dicotyledon and conifer types (Fig. 3) the woody bundles are arranged in a hollow cylinder surrounding a central pith. Around the woody tissue of perennial stems there is developed a layer of actively dividing cells, the cambium, that adds a new outer zone of woody bundles each growing season, in cross-section giving the appearance of concentric annual rings. This power of increasing in diameter is one of the prominent features of these stems. In the monocotyledon type (Fig. 4) the woody bundles are scattered irregularly through the stele, as in the cornstalk and palm, so that there is no defined central pith region. Such stems show no annual increase in diameter. In the pteridophyte type usually a single large woody bundle of peculiar structure appears in the stele, in such a way that there can be no annual increase in diameter.



FIG. 5. BRANCH OF CACTUS (*Opuntia arborescens*), GROWN IN THE DARK.

The stem form above differs from the normal stem below in general shape, in the loss of protuberances and spines, and in the gain of leaves.

The primary function of the stem is to develop foliage leaves and display them to the air and sunlight, and also to act as a great conducting region between the root system and the leaves. (See CONDUCTION.) Subsidiary functions are vegetative propagation (as in horizontal ground stems); the storage of foods (as in bulbs and tubers); and the manufacture of foods, as in leafless stems, such as Equisetum and the cacti. Among the external factors which influence stem development, light and moisture are perhaps most important. In general, light is thought to retard stem development, as seen when stems grown in full light are compared with those grown in weak light and in the case of tubers. In some cases, however, as in the cacti, light has been found to favor stem development. Experiments seem to show that much of the so-called influence of light is due to a moisture influence (Fig. 6).



FIG. 6. BRANCHES OF GORSE (*Ulex Europæus*).

Showing the influence of moisture; the spiny branch at the right grew in dry air, the other branch in moist air.

STEM-GIRDLER. A horn-tail fly (*Phylloecus flaviventris*) which with its ovipositor girdles the twigs of currant bushes and deposits an egg below the cut. The resulting larva bores downward into the pith, which it devours, with the adjacent woody portion of the stem. In the autumn it spins its cocoon in the burrow, transforms to a pupa in the following spring, and shortly after emerges. An allied species (*Phylloecus integer*) works similarly in willows. See WILLOW INSECTS.

STENDAL, stĕn'dăl. A town in the Province of Saxony, Prussia, on the Uchte, 36 miles north-northeast of Magdeburg (Map: Prussia, D 2). It has a fifteenth-century late-Gothic cathedral restored in 1893. There are railway repair shops, and factories for iron furniture, cloth, gilt cornices, agricultural implements, and sugar. Stendal, founded in the twelfth century, was the capital of the Altmark of Brandenburg. Population, in 1900, 22,081.

STENDHAL, stän'dăl'. The name assumed by MARIE HENRI BEYLE (1783-1842). A French novelist remarkable for the keenness of his analysis of character. Though never popular, Stendhal has been much read and admired by

Flaubert and the naturalistic school, and by the later psychologic novelist Bourget. Stendhal was born at Grenoble. At seventeen he entered the service of Bonaparte, for whom he conceived great admiration. After Napoleon's downfall he resided in Italy. In 1821 he was expelled by the Austrians and returned to Paris. In 1831 he became French Consul-General at Civitavecchia. In the age of Chateaubriand Stendhal sympathized with Voltaire, in the day of the Romantic carnival he was practicing the restless dissection of character that marks the work of Taine and Bourget. Hardly one of his books could have paid the expense of printing, and of his now admired essay on love (*De l'amour*) it is said that seventeen copies were sold in eleven years. Nisard, the great literary historian of his time, does not name him. To-day he takes his place among the 'great French writers.' His works are collected in twenty-four volumes, of which five are posthumous. They begin with a book of Italian travel and an essay *De la peinture en Italie* (1817); *De l'amour* follows in 1822, with a striking essay on *Racine et Shakespeare*, participating much in the contention of the Romanticists. His first novel, *Armance* (1827), was followed by *Le rouge et le noir* (1831) and *La chartreuse de Parme* (1839). In all these he analyzes the various forms of restlessness into which the fall of Napoleon had thrown a generation trained to expect a life filled with violent emotion. All the novels are realistic studies of social types, but of types of energy and passion. The greatest of his creations is Julien Sorel, the criminal hero of *Le rouge et le noir*, whose career, founded on fact, is a veritable breviary of hypocrisy, though the Fabrice of *La chartreuse de Parme* is hardly inferior. But, though skillful in the dissection of motive, Stendhal's novels are careless in style, slovenly in construction, much inferior in this to his posthumously published *Vie de Napoléon* (1876). Consult: Sainte-Beuve, *Causeries du lundi*, vol. ix. (Paris, 1857-62); Zola, *Les romanciers naturalistes* (ib., 1881); Bourget, *Essais de psychologie contemporaine* (ib., 1883); Rod, *Stendhal*, in "Les grands écrivains français" (ib., 1892); Farges, *Stendhal diplomate* (ib., 1892); Brun, *Stendhal* (ib., 1900).

STEN'NIS, The Standing Stones of. A name applied to two circles of stone pillars on two headlands in the Loch of Stennis, Scotland.

STE'NO, Nicholas, or, in Danish form, **Niels Stensen** (1639-86). A distinguished anatomist and Roman Catholic bishop. He was born and educated as a Protestant at Copenhagen. In 1660-63 he lived at Amsterdam and Leyden and won renown for his discoveries in anatomy. In 1666 he became head of a hospital in Florence and body physician to the Grand Duke of Tuscany. In 1667 he accepted the Roman Catholic faith. From 1672 to 1674 he was professor of anatomy at the University of Copenhagen. In 1675 he became a priest and gave up his scientific studies. In 1677 he was made a titular bishop, and thenceforth he labored zealously among the northern missions as vicar apostolic. He wrote several religious works, including *Prüfung der Reformatoren* (1678). Consult his *Life* by Plenkers (Freiburg, 1884).

STENOGRAPHY. See Shorthand.

STEN'SEN, Niels. See Steno, Nicholas.

STENTOR (Lat., from Gk. *Στέντωρ*). In Homer's *Iliad*, a Grecian herald in the Trojan War. His voice was as loud as that of fifty men together. His name is preserved in the adjective stentorian.

STENZLER, stĕnts'lĕr, **Adolf Friedrich** (1807-87). A German Sanskrit scholar, born at Wolgast. He studied at Greifswald, Berlin, and Bonn, and in Paris and London. In 1833 he became professor of Oriental languages at Breslau. He edited, with Latin versions, the *Raghuvainça* (1832) and the *Kumâra Sambhava* (1838) of Kalidasa; with German translations, Yâknavalkya's *Book of Laws* (1849), and *Indische Hausregeln* (1864-78; containing the *Açvalâyana* and the *Pâraskara*); Kalidasa's *Meghadûta*, with commentary and glossary (1874); and *The Institutes of Gautama* (1876); as well as a very valuable *Elementarbuch der Sanskritsprache* (1868; 6th ed. 1892).

STEPHAN, stĕ'fän, **Heinrich von** (1831-97). A German administrator. He was born at Stolp, in Pomerania; entered the Prussian postal service in 1848 and was rapidly promoted until in 1875 he became Postmaster-General of the German Empire, having under his control the telegraph lines as well as the mails. In 1877 he assumed charge of the national printing offices. He introduced many internal reforms, invented the postal card, and brought about the formation of the Postal Union. He published *Geschichte der preussischen Post* (1859) and *Das heutige Aegypten* (1872).

STEPHANITE (named in honor of Archduke *Stephan*). A mineral silver sulphantimonite crystallized in the orthorhombic system. It has a metallic lustre and is iron-black in color. It occurs in veins with other silver ores, especially in Freiberg, Bohemia, in Hungary, Mexico, Peru, and in the United States at the Comstock lode in Nevada, and at various localities in Idaho.

STEPH'ANUS, or **ÉTIENNE,** â'tyĕn'. A famous French family of printers and scholars. Henricus (c.1460-1520), the founder of the establishment with which the family is identified, set up a press in Paris in 1501. His publications, about 120 in number, of which only one was in French, were mostly scientific.—His second son, Robertus (1503-59), had a good classical training and on his father's death carried on the business. In 1531 his *Thesaurus Linguæ Latinæ* began to appear, and in 1539 he was appointed royal printer to Francis I. In 1551, after the King's death, he was forced to leave Paris for Geneva, where in the same year he published the Greek New Testament, with his verse divisions, which are still in use. His various editions of the Bible, in Hebrew, Greek, Latin, and French, several works of the Genevan reformers, a *Dictionnaire français-latin* (1539-40 and 1549), French and Latin grammars, and a work on pedagogy, the first book from his press (1526), are the more important titles in a list of neary 400, all of which are marked by wonderful typographical clearness and accuracy.—His son Henricus, the younger (1528-98), after three years in his father's establishment in Geneva, in 1554 became independent. From his extensive travels he brought

back valuable collections of classical manuscripts. But his scholarly enthusiasm in launching the editions of Plato (1578), and the *Thesaurus Linguæ Græcæ* (1572), which were so long the source of all Greek lexicons, outran his business prudence. The great printing house was nearly ruined and his later works were printed by others. Thirty first editions of Greek authors constitute a claim to renown second only to that won by the *Thesaurus*.—His son PAULUS (1566-c.1627) succeeded him, edited Euripides (1602) and Sophocles (1603), and in 1602, implicated in the Escalade (see GENEVA), had to leave Geneva.—His eldest son, ANTONIUS (1592-1674), momentarily renewed the glories of the house of Paris, but eventually died in the Hôtel Dieu, old, blind, and poor. Consult: Renouard, *Annales de l'imprimerie des Etienne* (2d ed., Paris, 1843); Feugère, *Essai sur la vie et les œuvres de Henri Etienne* (ib., 1853). For Robert's work in connection with the Greek New Testament, Scrivener, *Introduction to the Textual Criticism of the New Testament* (3d ed., London, 1883).

STEPHEN, stē'vn. The first Christian martyr. He was chosen first among the seven deacons whose selection is related in Acts vi., and the account of his martyrdom is given in the following chapter. His execution does not seem to have had the sanction of the Roman authorities, and therefore was illegal. The authenticity of the speech in chapter vii. has been questioned, but, on the whole, there does not seem to be valid reason for doubting that the account is trustworthy. Saint Stephen's festival is celebrated in the Roman Catholic and Anglican churches on December 26th. His relics were believed to have been discovered at Jerusalem in 415 and a minor festival on August 3d commemorates this event. Consult the commentaries on Acts vi. and vii.; also McGiffert, *The Apostolic Age* (New York, 1897); and for the discovery of the relics, Lagrange, *Saint Etienne et son sanctuaire à Jérusalem* (Paris, 1894).

STEPHEN. The name of nine popes. STEPHEN I., Pope 254-257. The chief interest of his pontificate lies in the controversy over the validity of baptism by heretics, in which Stephen declared definitely that baptism, no matter by whom administered, was valid so long as the proper matter and form were employed. (See HERETIC BAPTISM.) He is called a martyr in the *Liber Pontificalis*, but the tradition cannot be traced further back than the sixth century.—STEPHEN II., Pope 752-757. During his pontificate occurred the epoch-making Donation of Pepin (q.v.), which was the real foundation of the Papal States in the modern sense. Consult Schnüren, *Die Entstehung des Kirchenstaates* (Cologne, 1894).—STEPHEN III., Pope 768-772, a Sicilian by birth. He held a synod at the Lateran in 769, supported by the sons of Pepin, at which an attempt was made to exclude secular influence in Papal elections, and a decree passed against the Eastern Iconoclasts. The relations between the Franks and Lombards troubled the latter years of his reign, and Desiderius, King of the Lombards, had the chief influence in Rome until after Stephen's death.—STEPHEN IV., Pope 816-817. He was closely allied with the Emperor Louis the Pious, whom he crowned at Rheims.—STEPHEN V., Pope 885-891.—STEPHEN VI., Pope 896-897. The most striking event of his pontificate is characteristic of the darkness of the times. Urged on by the faction to whom he owed his elevation, Stephen had the body of his predecessor Formosus disinterred, and after the formality of a trial and condemnation stripped of its sacerdotal robes and thrown into the Tiber. Stephen himself was soon imprisoned by a popular uprising, and died in prison.—STEPHEN VII., Pope 929-931, during the period when Theodora and Marozia held sway in Rome.—STEPHEN VIII., Pope 939-942, while Marozia's son Alberic II. held the temporal power and restricted the Pope to purely spiritual functions. He was able, however, by threats of excommunication to reduce to obedience the rebellious vassals of Louis IV. of France.—STEPHEN IX., Pope 1057-58, Frederick by baptism, brother of Gozelo, Duke of Lorraine. He was made a cardinal and chancellor of the Roman Church by Leo IX. On his return from an embassy to Constantinople he entered the Monastery of Monte Cassino, and became its abbot in 1057. As Pope he followed his German predecessors in their zeal for reform, but died in less than a year. Consult Will, *Die Anfänge der Restauration der Kirche im 11. Jahrhundert* (Marburg, 1864). Some lists of popes enumerate ten Stephens. The confusion arises from the fact that another of the name was elected immediately before Stephen II., but died four days after, before he had received episcopal consecration, and is therefore not properly called Pope.

STEPHEN (c.1097-1154). King of England from 1135 to 1154. He was the third son of Stephen, Count of Blois and Chartres, by Adela, daughter of William the Conqueror, and was thus the nephew of Henry I. of England. He was brought over to England at an early age and became a favorite with his uncle, who bestowed on him large estates and obtained for him in marriage the hand of Matilda, heiress of Count Eustace of Boulogne. Henry's only son having died in 1120, the King sought to secure the crown for his daughter Matilda, widow of Henry V. of the Holy Roman Empire, and Stephen was among the first of the great barons to take the oath of fealty to Matilda. Nevertheless, on the death of Henry I. in 1135, Stephen hastened from Normandy to England, seized the royal treasure, and was crowned King at Christmastide. Revolts in the south and west occurred in 1136, and though these were speedily suppressed, they broke out anew in the following year. In 1138 David I. of Scotland invaded England in support of the claims of his niece Matilda, but he was badly beaten in the battle of Northallerton (q.v.). Robert, Earl of Gloucester, half brother of Matilda, also rose in rebellion, but was for the time defeated. Stephen, however, foolishly entered into conflict with the Church, whose cause was espoused by his own brother, Henry of Winchester, the Papal legate. While the quarrel was in progress, Matilda and Robert of Gloucester landed in England, toward the end of 1139, and began a civil war which lasted for fourteen years and plunged England into utter misery. The nobles took advantage of the civil strife to make themselves virtually independent, and their castles, which Stephen had unwisely permitted them to build up, became mere robber strongholds and places of terror for the unhappy peasantry. The writer in the *Anglo-Saxon*

Chronicle says: "In this King's time all was dissension and evil and rapine. . . . Thou mightest go a whole day's journey and not find a man sitting in a town or an acre of land tilled. The poor died of hunger and those who had been men well-to-do begged for bread. . . . To till the ground was to plow the sands of the sea." "Men said openly that Christ and His saints slept." In 1141 Stephen was taken prisoner at the battle of Lincoln, and was deposed by a Church council, Matilda being chosen Queen. She soon alienated her supporters by her harsh government, and Stephen, who had been released in exchange for Robert of Gloucester, was declared the lawful King by a second Church council and was crowned on Christmas Day. In 1148 Matilda left England; Robert of Gloucester was now dead and the struggle was henceforth carried on by Henry, the son of Matilda and Geoffrey Plantagenet, Count of Anjou, who in 1151 succeeded his father and by his marriage to Eleanor of Aquitaine, the divorced wife of Louis VII. of France, became one of the richest princes in Europe. Stephen's son, Eustace, died in 1153, and in November of the same year Stephen and Henry concluded the Treaty of Wallingford, by which the former remained King, while the succession was vested in Henry. Stephen died October 25, 1154. Consult: Stubbs, *Constitutional History*, vol. i. (6th ed., Oxford, 1896); id., *The Early Plantagenets* (5th ed., London, 1886).

STEPHEN, Henry John (1787-1864). An English jurist. He was born at Saint Christopher's, West Indies, studied for a time at Saint John's College, Cambridge, and in 1815 was called to the bar. His legal treatises have given him a permanent place among English jurists. In 1824 appeared his *Treatise on the Principles of Pleading in Civil Actions*, which is a model of form and clearness, and was styled by Kent "the best book that was ever written in explanation of the science." His *New Commentaries on the Laws of England* (1841) enjoyed great contemporary popularity. He also published a *Summary of the Criminal Law at Its Present State* (1834). Consult L. Stephen, *Life of Sir James Fitzjames Stephen* (London, 1895).

STEPHEN, Sir James Fitzjames (1829-94). An eminent English jurist and writer on legal subjects, born in London. He was educated at Trinity College, Cambridge, and was admitted to the bar at the Inner Temple in 1854. He was recorder of Newark-on-Trent in 1859-69, and was legal member of the Legislative Council of the Governor-General of India in 1869-72, doing much to consolidate, abbreviate, and simplify the Indian law of crimes and of evidence, it being due to his efforts that the Indian Evidence Act was passed in 1872. He returned to England in 1872 and employed his time until 1875 in the work of codifying the law of evidence and criminal law of England. He was appointed professor of common law to the Inns of Court in 1875, and in 1879 was appointed a judge of the Queen's Bench Division of the High Court, which position he held until 1891, when he was disabled by nervous trouble resulting in insanity. His greatest work was his *History of the Criminal Law of England* (1883). It is the best work upon the subject for the period it covers, although marked by a certain bias due to his peculiar temperament; and his *Digest of the Law of Evidence* (1876) is widely used in England and the United States. He also published: *Essays of a Barrister* (1862); *Liberty, Equality, and Fraternity* (1873); *Digest of the Criminal Law* (1877); *A View of the Criminal Law in England* (1863). Consult Leslie Stephen, *Life of Sir James Fitzjames Stephen* (London, 1895).

STEPHEN, James Kenneth (1859-92). An English verse-writer, born in London. At King's College, Cambridge, from which he graduated in 1882, he was elected to the Whewell scholarship in international law, and to a fellowship (1885). In 1884 he was called to the bar at the Inner Temple, and in 1888 he was appointed clerk of assize for the South Wales Circuit. Two years later he resigned to return to Cambridge as tutor. In the meantime he had contributed to the *Saint James Gazette* and had conducted a weekly journal called *The Reflector*. The year before his death Stephen published two slender volumes of light verse, *Lapsus Calami* and *Quo, Musa, Tendis?* which met with instant success. In recent verse there is nothing cleverer than some of the parodies, as those on Browning, Wordsworth, Clough, Whitman, and especially Kipling. To the one on Browning there is a noble apology. Other poems show a keen critic of contemporary life.

STEPHEN, Sir Leslie (1832-1904). An English biographer and critic, son of Sir James Stephen. He was born in London and was educated at Eton and at King's College, London, and Trinity Hall, Cambridge, where he graduated in 1854 (M. A. 1857) and remained as fellow and tutor until 1864. In that year he went to London and engaged in literary work, writing much for leading periodicals. His first wife (died 1875) was a daughter of Thackeray. In 1865 he published *Sketches from Cambridge*, reprinted from the *Pall Mall Gazette*, and in 1871 became editor of the *Cornhill Magazine*, the reputation of which he maintained by securing such contributors as Stevenson, Hardy, and Henry James. He resigned this post in 1882 to undertake the editorship of the *Dictionary of National Biography*, which, though ill health forced him to hand the management over to Sidney Lee in 1891, will always be a monument to his scholarship and judgment. He wrote nearly four hundred of the articles himself, including Addison, Burns, Byron, Carlyle, Coleridge, Dickens, George Eliot, Fielding, Gibbon, Hume, Johnson, Milton, Pope, Scott, Swift, Thackeray, and Wordsworth. Practically all his work on the *Dictionary* was excellent, but his type of mind and literary method achieved the happier results, perhaps, with the eighteenth-century subjects. For a year (1883) he held the Clark lectureship in English literature at Cambridge. In addition to biography and literature Stephen showed a keen interest in philosophy and ethics. In this field he was utilitarian and fortified his position with an irony, a subtlety of thought, and a trenchantly critical method that won him high regard among literary men and scholars at the expense, perhaps, of popularity. His works include: *Hours in a Library* (three series, 1874-76-79), able and impartial criticisms about which there plays a delightful humor; *The History of English Thought in the Eighteenth Century* (1876, new ed. 1902); *Essays on Freethinking and Plain Speaking* (1879) *The Science of Ethics* (1882), widely used as a

text-book; *Life of Henry Fawcett* (1885); *An Agnostic's Apology* (1893); *Life of Sir James Fitzjames Stephen* (1895), his brother; *Social Rights and Duties* (1896); *Studies of a Biographer* (1898); *The English Utilitarians* (1900); and, in the "English Men of Letters" series, lives of Swift, Pope, Johnson, Hobbes, and George Eliot. Stephen was knighted in 1902.

STEPHEN BÁTHORY, bā'tō-rē. See BÁTHORY.

STEPHEN DUSHAN, dōō'shän (c.1308-55). Czar of Servia from 1331 to 1355. Profiting by the disorders in the Byzantine Empire, he obtained possession of a large part of Macedonia and of Northern Greece. He also extended his sway over most of Albania, while Bulgaria acknowledged his overlordship, and he defied the power of Louis the Great of Hungary. Stephen was great as a ruler, as a soldier, and as a lawgiver. In 1346 he had himself crowned Emperor (Czar) of the Servians and Greeks. In 1349 an independent patriarchate was instituted for Servia. Under Stephen there was, for a brief period a great Slavic realm in the southeast of Europe. His death was followed by its speedy disruption. Stephen Dushan is regarded as a national hero by the Servians.

STEPHENS, stē'vənz, ALEXANDER HAMILTON (1812-83). An American statesman, and the Vice-President of the Confederate States; born in Taliaferro County, Ga., February 11, 1812. His boyhood was one of poverty and toil, with occasional attendance at 'old-field' schools. A society for the education of young men for the Presbyterian ministry became interested in him and provided him with the means for education at Franklin College, now the State University, where he graduated at the head of his class in 1832. He did not enter the ministry, but he returned, with interest, the money advanced for him by the society, in accordance with the understanding upon which he had received it. He taught school for a time, and after three months' study of law without a tutor was admitted to the bar at Crawfordville, his county-town, at the age of twenty-two. At twenty-four he was elected to the State Legislature, and after five years' service there was sent to the United States House of Representatives, where he remained from 1843 until he voluntarily retired in 1859.

In 1861 he became Vice-President of the Confederate States and remained so while that government lasted, though not wholly in accord with its policy. He headed the Confederate Commission that met President Lincoln and Secretary Seward at Hampton Roads in February, 1865, to confer upon terms of peace. (See HAMPTON ROADS CONFERENCE.) There is no foundation in fact for the story that Lincoln told Stephens that he might write his own terms if restoration of the Union were agreed upon as the first condition of peace. After the fall of the Confederacy he was imprisoned in Fort Warren, Boston Harbor, from May until October, 1865. Elected to the United States Senate in 1866, he was not permitted to take his seat, and he did not reënter official public life until 1873, when he became a member of the National House of Representatives, from which he again voluntarily retired in 1882. In the fall of that year he was elected Governor of Georgia, and died in the executive mansion, Atlanta, March 4, 1883, leaving a creditable record as statesman, orator, and writer.

His career is one of the most remarkable in American annals. With moral as well as physical courage, he was independent of party. Hence, until 1855, though he had never been in thorough accord with the Whig Party, he generally acted with it simply because he preferred its policy, on the whole, to that of the Democrats. When the Whig Party became disorganized by affiliations of its Northern members with the Free-Soilers, he acted with the Democrats, opposed the Know-Nothing Party, and supported Douglas for the Presidency in 1860. But as, in 1852, he would not act with the Whig Party in support of Scott, so in 1872 he would not act with the Democratic Party in support of Greeley. While he rejected as fallacious and inconsistent the doctrine of nullification, he believed in the right of secession; but he was opposed to the policy of resorting to it in 1861 as a remedy for the political situation at that time. He was devoted to the Union, but believed his ultimate allegiance due to his State, and when she seceded he went with it; but in the conflict that ensued his efforts were directed to a peaceful adjustment based on the principles upon which the Union was formed, for he held the Union itself secondary in importance to those principles. Besides editing the Atlanta *Daily Sun* from 1871 to 1873, he published: *A Constitutional View of the War Between the States* (1868-70); *The Reviewers Reviewed* (a reply to his critics); and *A School History of the United States* (1872). Consult: Cleveland, *Alexander H. Stephens in Public and Private, with Letters and Speeches* (Philadelphia, 1866); Johnston and Browne, *Life of Alexander H. Stephens* (ib., 1878; new ed. 1883).

STEPHENS, GEORGE (1813-95). An English archæologist, born in Liverpool. He was educated at University College, London. In 1834 he settled in Stockholm, Sweden, as a teacher of English. He translated Tegner's *Frithiof* into English verse (1841); was one of the founders of the Society for the Publication of Ancient Swedish Texts (1843), for which he edited several works; and published a *Catalogue of English and French Manuscripts in the Royal Library at Stockholm* (1847). In 1851 he moved to Copenhagen, and was appointed professor of English and Anglo-Saxon in the university there (1855). While holding this position he prepared his best known work, *The Old Northern Runic Monuments of Scandinavia and England, Now First Collected and Deciphered* (vol. i., 1866; vol. ii., 1868; vol. iii., 1884), which was abridged under the title *A Handbook to the Old Northern Runic Monuments*. As a collection of inscriptions, this work has great value; but the interpretations were proved worthless by Wimmer and other scholars.

STEPHENS, HENRY MORSE (1857—). A British-American historian, born in Edinburgh. He graduated at Balliol College, Oxford, in 1880, became a staff lecturer on history to the Oxford Extension Delegacy in 1891, and in 1892 was chosen lecturer on Indian history at Cambridge University. He was professor of modern European history at Cornell University from 1839 to 1903, when he became professor of history and

director of university extension at the University of California. His published works include: *History of the French Revolution* (1886); *Portugal* (1891), in the "Story of the Nations Series;" *Albuquerque and the Early Portuguese Settlements in India* (1891); *History of Europe, 1789-1815* (1899), in the "Periods of European History Series;" *Modern European History, 1600-1890* (1899). He also edited *Principal Speeches of the Statesmen and Orators of the French Revolution* (1891), and, in collaboration with G. B. Adams, *Select Documents of English Constitutional History* (1901).

STEPHENS, JAMES (1824-1901). An Irish agitator and Fenian leader, born in Kilkenny. After participating in the Young Ireland rising of 1848, he fled to Paris. In 1853 he instituted the foundation of the Irish Republican Brotherhood, commonly known as the Fenian Society (q.v.). His system depended on complete preparation of the people. A favorable opportunity was to be awaited when England should be embroiled in foreign troubles. By 1863, both in point of view of numbers enrolled and revenue raised, the organization had assumed formidable proportions, but from that time dates its decline. The *Irish People*, a newspaper which he founded in Dublin in 1863 as a Fenian organ, he conducted on a private basis. The rising in the autumn of 1865 was an ill-timed affair that had hung fire from the preceding spring, and the leaders were arrested. Stephens's facile escape from Dublin Castle was a cause of reproach on the ground that he sacrificed his lieutenants to his own chances instead of taking them with him. He proceeded to the United States and devoted his energies to pacifying and uniting the branch of the society there, but in 1867 he was formally deposed. He fled for his life to Paris, and in 1891 returned unnoticed to Ireland.

STEPHENS, JOHN LLOYD (1805-52). An American traveler and author, born at Shrewsbury, N. J. He graduated at Columbia College in 1822; from 1825 until 1834 practiced law in New York City, and then traveled for two years in Southern and Eastern Europe and in Palestine and Egypt, writing letters for the *American Monthly Magazine* that attracted widespread attention. Later he published *Incidents of Travel in Egypt, Arabia Petræa, and the Holy Land* (1837) and *Incidents of Travel in Greece, Turkey, Russia, and Poland* (1838). In 1839 he was sent by President Van Buren on an unsuccessful mission to Central America. On his return he published *Incidents of Travel in Central America, Chiapas, and Yucatan* (1841). He again went to Central America in 1841 and made further explorations, the results of which appeared in *Incidents of Travel in Yucatan* (1843). Both works were widely read at the time and attracted attention to the archæological remains in Yucatan. In 1849 Stephens became interested in the plan for building a railroad across the Isthmus of Panama, and was made vice-president and afterwards president of the company that was formed for that purpose. A monument was erected in his honor on the highest point traversed by the railroad.

STEPHENS, WILLIAM (1671-1753). An English colonial Governor, born at Bowcombe, Isle of Wight. He graduated at King's College, Cambridge, in 1684, and was admitted to the Middle Temple. About 1736 he went to South Carolina to survey a barony and met General Oglethorpe. He removed to Georgia in 1737 and became secretary of the trustees. In 1741 he became president of Savannah, one of the two counties into which the colony was divided, and in 1743 was made president of the colony. He was requested to resign on account of his age in 1750, and gave up his office in April, 1751. He published *Journal of the Proceedings in Georgia, Beginning October 20, 1733* (1742). One volume was printed separately as *State of the Province* (1742). His life was written by his son, Thomas, under the title *The Castle-Builders* (2d ed., 1759).

STEPHENSON, stē'ven-son, GEORGE (1781-1848). An English engineer and inventor and the 'founder of railways.' He was born at Wylam, near Newcastle, where his father was fireman at a colliery. After a boyhood spent in farm work he became assistant to his father and was steadily advanced. He got some education while working as fireman and brakeman, and in addition to his regular duties undertook the cleaning and repairing of clocks. He became acquainted with William Fairbairn at this time and the two were in frequent conference. After serving as engineer at various collieries and other establishments he was made engine-wright of the Killingworth High Pit, having by this time gained a thorough practical knowledge of the operation and construction of engines and pumping machinery. Devoting his leisure to scientific pursuits, he invented a miner's safety lamp (q.v.) known as the 'Geordie' (1815), and there resulted a controversy over the priority of the invention, as a similar idea had been successfully worked out by Sir Humphry Davy (q.v.). His attention was meanwhile turned to the experiments of Blackett and Hedley with locomotives, then in progress at Wylam, and he induced the owners of the Killingworth Colliery to undertake the construction of a locomotive. (See LOCOMOTIVE.) In 1821 he became chief engineer of the Stockton and Darlington Railway (see RAILWAYS), and in 1824 he was appointed engineer of the Liverpool and Manchester Railway. In 1825 the Stockton and Darlington road was opened, and was the first regularly operated in the world where locomotives were employed to haul freight and passengers. In 1829 his *Rocket* won in the celebrated competitive trial of locomotives on the Liverpool and Manchester Railway, and in 1830 the line was formally opened. Subsequent improvements were made in the locomotive and Stephenson became chief or consulting engineer to nearly all of the railway projects that were soon set on foot. His success in this field made it possible for him to become interested also in the development of coal mines. Stephenson visited the Continent in 1846, where he was received with unusual honors. He was the first president of the Institution of Mechanical Engineers, which he founded in 1847, but was never a candidate for political honors. In the latter part of his life he devoted himself to farming at his country place at Tapton House, where he died. By his successful development of the locomotive and of the railway Stephenson ranks as one of the foremost mechanical engineers of the nineteenth century. Not only was

his influence felt in the purely mechanical and engineering difficulties to be overcome, but also in the conservative organization and prosecution of the railway enterprises of his time. Consult Smiles, *Lives of the Engineers*, vol. iii. (London, rev. ed., 1874). Read in this connection articles on LOCOMOTIVE and RAILWAYS.

STEPHENSON, ROBERT (1803-59). A British civil engineer. He was the son of George Stephenson (q.v.) and was born at Wallington Quay, near Newcastle. He was educated at Newcastle and received practical engineering experience at the Killingworth Colliery and with his father in railway surveying and the construction of locomotives, being, in the meanwhile, a student for six months at Edinburgh University. After managing his father's locomotive factory in Newcastle for a few months he went to South America on account of ill health (1824) and engaged in mining. Coming back to England in 1827, he returned to the locomotive works and supervised the construction of the *Rocket* (see LOCOMOTIVE), incorporating in its mechanism many original and serviceable ideas, and assisted his father in other work. In 1833 he became the engineer of the London and Birmingham Railway, one of the first in which great engineering difficulties were encountered in the construction, but which was completed in 1838. The firm of Robert Stephenson & Co. by this time had become the leading engine builders of the world and a standard type of locomotive was evolved which was subsequently enlarged and improved. Robert Stephenson was interested in every department of railway construction, and particularly in the design of bridges, where he achieved the highest reputation. Among the bridges he designed were the high-level bridge over the Tyne at Newcastle, the Victoria Bridge at Berwick, the famous Britannia Tubular Bridge across Menai Strait, the Conway Bridge, and the Victoria Bridge over the Saint Lawrence. (See BRIDGE.) In 1847 Stephenson was elected to Parliament from Whitby as a Conservative, and in 1856 became president of the Institution of Civil Engineers. See Smiles, *Lives of the Engineers* (London, rev. ed., 1874); Jeafferson and Pole, *The Life of Robert Stephenson* (ib., 1864). See LOCOMOTIVE; RAILWAYS; STEAM ENGINE; BRIDGE.

STEP'NIAK' (pseudonym of KRAVTCHINSKI), SERGEI MIKHAILOVITCH (1852-95). A Russian revolutionary exile and writer, born in Southern Russia. He graduated at the Saint Petersburg School of Artillery, and entered the Forestry Institute at Saint Petersburg. In 1872 he joined a Nihilist circle and engaged in spreading revolutionary ideas among the factory workmen in the capital. He was arrested in 1874 in the Government of Tver, but escaped, and henceforth led the life of an outlaw. He engaged in conspiracies in Italy, took an active part at Geneva in the publication of *The Commune*, and smuggled into Russia a press and type for illegal publications in 1878. When the revolutionists resolved upon the death of General Mezentseff, chief of the gendarmes, Stepniak, chosen by lot for the purpose, stabbed him on August 16, 1878, and somewhat later published *Life for Life* in justification of the act. During the years 1879-83 he lived in Switzerland and Italy, where appeared his famous *Underground Russia* (1882). In 1884 Stepniak settled in London. In 1885 appeared his *Russia Under the Tsars*, followed by *The Russian Storm Cloud* (1886), *Russian Peasantry, Career of a Nihilist* (1889), *The Little Cottage on the Volga*, and *King Stork and King Log* (1895). He edited *Free Russia* (founded in 1890), the monthly organ of the English Society of Friends of Russian Freedom. He died in London.

STEPPE (Russ. *stepi*, waste, heath, steppe). The name given to the undulating plains of Southeastern Europe and Northern Asia which correspond in general to the prairies and pampas of America, but are marked by some peculiarities due to their elevation and dry climate. The steppes are covered with grass in the rainy season or early summer and afford pasturage to great herds of cattle, sheep, and horses, and are largely occupied, where not brought under cultivation, by nomadic tribes of Tatars. See GRASSLANDS; PRAIRIE.

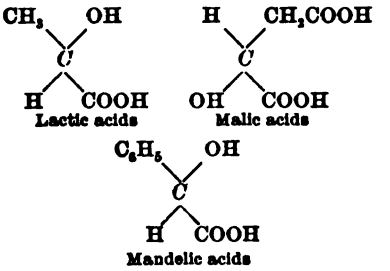
STERE (Fr. *stère*, from Gk. *στερεός*, *stereos*, solid). Another name for a cubic meter. The measure is much used for wood, especially firewood. See METRIC SYSTEM.

STEREO-CHEMISTRY. A branch of chemistry dealing with those cases of isomerism that cannot be explained by the doctrine of the linking of atoms, and explaining those cases on the assumption that the combining forces of an atom act in certain definite directions in space. Isomerism (i.e. the existence of compounds having the same qualitative and quantitative composition and the same molecular weight, yet differing more or less in their properties) and the doctrine of the linking of atoms (the structural theory) have been discussed in the article CARBON COMPOUNDS, which should be read in connection with the present sketch.

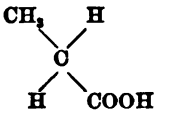
OPTICAL ISOMERISM. Most of the cases not explained by the doctrine of the linking of atoms are presented by compounds identical in all their chemical and physical properties except the power of rotating the plane of polarized light. It is well known that this power is possessed by a number of crystalline substances in the solid state, and that every such substance can be obtained in two 'enantiomorphous' crystalline forms, rotating the plane of polarized light through equal angles but in opposite directions. But when melted or dissolved such substances usually lose that power completely—which shows that their optical property is peculiar, not to their nature, but to the particular crystalline form which they assume in the solid state. These are not the substances that stereo-chemistry has to deal with: such substances, inasmuch as they lose their difference of optical rotatory power with their crystalline form and are therefore identical in the liquid, gaseous, or dissolved state, cannot be considered as different chemical individuals, and hence cannot form the subject of a theory of chemical compounds. Cases of optical isomerism proper are presented by substances retaining or acquiring their difference of optical rotatory power in the liquid, gaseous, or dissolved state.

In 1874 Le Bel and Van 't Hoff discovered, independently and almost simultaneously, that *all optically active compounds, and only optically active compounds, contain one or more 'asym-*

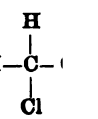
metric' carbon atoms, i.e. carbon atoms directly linked to four atoms or groups of atoms different from one another. The following formulas, containing asymmetric carbon atoms (denoted by an italic *C*), represent optically active compounds:



On the contrary, formulas like that of propionic acid,



which contains no asymmetric carbon atom (i.e. no atom combined with four *different* atoms or groups), have in no case been found to represent optically active compounds. The relation between the optic rotatory power and the asymmetric carbon atom must therefore form the cornerstone of any explanation of optical isomerism that might be advanced. Altogether three different explanations suggest themselves as possible: (1) the assumption that the four valencies of the carbon atom are unequal and that cases of isomerism may result from different distributions of the four atoms or groups combined with the carbon atom, among its different valencies; (2) the assumption that the atoms or groups combined with the carbon atom are in constant motion around it and that the molecules of optically different compounds may be made up of the same atoms or groups in different motions around the carbon atom; and (3) the assumption that the molecules of different compounds may be made up of the same atoms or groups, similarly linked to the carbon atom, but differently arranged in space around it. The first of these assumptions compels us to recognize the possible existence of isomers that are positively known to be impossible. For instance, if the assumption were correct, two different nitro-methanes would be possible; yet a systematic experimental investigation carried out by Henry showed that nitro-methane can exist in one form only. The second of the above assumptions is altogether incapable of either purely theoretical development or systematic correlation with facts, and must therefore be abandoned. The third assumption, viz. that the difference between optical isomers is due to differences in the configuration of the atoms in their molecules, presents itself, therefore, as the only possible explanation. Furthermore, even this explanation must first of all discard the hypothesis of the arrangement of atoms in a plane. Indeed, were the plane graphical formulas, as we ordinarily write them, true to reality, then, for instance, two methylene chlorides would be possible, the configurations of whose atoms would be represented by the following formulas:



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models, why only one acetic acid, $CH_3(COOH)$, is possible; why only one mono-chlor-acetic acid, $CH_2(Cl)(COOH)$, is possible; why only one di-chlor-acetic acid, $CHCl_2(COOH)$, is possible; why only one tri-chlor-acetic acid, $CCl_3(COOH)$, is possible; why two optically isomeric chloro-bromo-acetic acids, $C(H)(Cl)(Br)(COOH)$, are possible; and why two optically isomeric chloro-bromo-fluor-acetic acids, $C(Cl)(Br)(F)(COOH)$, are possible.

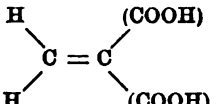
As already pointed out above, optical isomers are invariably found to possess precisely the same chemical and physical properties and to differ only with regard to the direction in which they rotate the plane of polarized light. The question now suggests itself, How can such isomers be separated from each other when mixed? This problem is so much the more important because all reactions by which compounds with asymmetric carbon atoms may be produced from compounds containing no such atoms cause the simultaneous production of both optical isomers in precisely equal quantities; so that a separation is required whenever optically active compounds are to be prepared artificially (in nature either one or the other of a pair of optical isomers is often found isolated). Three methods have thus far been found for effecting the separation. First, it is possible, in many cases, and under certain conditions of temperature, to separate the isomers mechanically—in those cases, namely, in which the two crystallize from their solutions separately. In all such cases the two isomers are found to form enantiomorphous crystals. Below, or sometimes above, the point or interval of temperature at which this takes place, the two isomers usually crystallize together, forming a double compound, the so-called 'racemic' modification of the given compound. The racemic modification is optically inactive because its two components tend to rotate the plane of polarized light to the same extent in opposite directions. The second method of separating optical isomers is applicable only to acids and bases. If a mixture of two optically isomeric acids is treated with an optically active base, two salts result differing more or less considerably in solubility, and therefore capable of being separated by fractional crystallization. The result is similar when a mixture of two optically active isomeric bases is treated with an optically active acid. Finally, the third method is based on the fact that certain processes of fermentation often destroy one of the optical isomers and leave the other intact. Thus, *levo*-glucose may be prepared by subjecting to fermentation its mixture with *dextro*-glucose, the latter alone being affected by the fermentation. The reason of such facts is not yet understood. It has been assumed by some that the living organisms (e.g. Penicillium glaucum) causing fermentation are capable of discriminating, by a sort of instinct, between the isomers, and, while feeding on one, reject the other. But the lifeless enzymes (q.v.) obtained from ferments have been shown to exercise the same action as the ferments themselves; and hence the peculiar action of the latter may be assumed to be due to the purely chemical properties of their enzymes.

Passing now to the consideration of compounds whose molecules contain more than one asymmetric carbon atom, the most important case to be mentioned is that of tartaric acid, $(COOH)C(H)(OH)\cdot C(H)(OH)(COOH)$, with two asymmetric carbons in its molecule. By the use of models like those mentioned above, it is easy to convince one's self that three different arrangements are possible: (1) a right-handed arrangement of the groups around either of the asymmetric carbons; (2) a left-handed arrangement of the groups around either of the asymmetric carbons; (3) a right-handed arrangement around one, and a left-handed arrangement around the other asymmetric carbon. Corresponding to these are the well-known *dextro*-rotatory, *levo*-rotatory, and inactive modifications of the acid, the last named being inactive because one-half of its molecule rotates the plane of polarized light to the same extent in one direction as the other half does in the opposite direction. Besides these there is the racemic modification ('racemic acid'), which is a double compound of the dextro-rotatory and levo-rotatory tartaric acids (q.v.). The compounds containing more than two asymmetric carbon atoms include the sugars (q.v.)—an important class of compounds whose theory could not have been developed, and many of which could hardly have been discovered without the concepts of stereo-chemistry.

Geometrical Isomerism. It may be seen from the preceding paragraphs that the fundamental hypothesis of stereo-chemistry, viz. that the valencies of a carbon atom act symmetrically around it in space, while indispensable for correlating optical isomers, also throws additional light on the phenomena of chemical isomerism proper. Take, for example, again the case of methylene chloride, CH_2Cl_2. Were optical isomerism unknown and the stereo-chemical hypothesis non-existent, the question as to why only one modification of this compound is possible would be answered by pointing out that the four carbon valencies are identical and that, hydrogen and chlorine atoms being univalent, only one mode of linking the atoms is possible. If it were further asked, "But how do we know that two methylene chlorides might not exist, in whose molecules the atoms are *linked* similarly, but *arranged* differently?"—chemists would answer: "Of course, such a state of things is not inconceivable; only in all the innumerable cases thus far discovered, the doctrine of the linking of atoms is sufficient, the number of known isomeric compounds never exceeding the number of possible modes of linking; and so we deem it unnecessary to enter into speculations as to the arrangement of atoms in space." From the standpoint of stereo-chemistry the answer is thorough: only one methylene chloride is possible, (1) because the four valencies of carbon are identical; (2) because only one mode of linking the atoms is possible; (3) because only one arrangement of the atoms in space is possible, as may be readily demonstrated by the use of tetrahedron models.

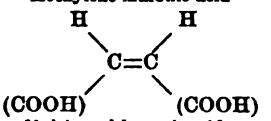
It is, therefore, clear that stereo-chemistry not only explains, and hence permits of foreseeing, all possible cases of optical isomerism, but also explains thoroughly why more cases of chemical isomerism than are explained and foretold by the doctrine of the linking of atoms are not possible. But stereo-chemistry has still another important application. Its fundamental hypothesis applied to the so-called 'unsaturated' compounds

(see CARBON COMPOUNDS) leads to a clear explanation of cases of isomerism which, again, cannot be explained by the doctrine of atomic linking alone. In the simplest class of unsaturated compounds one carbon atom is united by *two* valencies to another carbon atom. In stereo-chemistry this means that two carbon tetrahedra have an edge in common, the four atomic groups held by the two carbons being situated at the four free corners of the tetrahedra. Take, for example, the case of two carbon atoms united by a double bond and holding two hydrogen atoms and two carboxyl (COOH) groups. In this case the doctrine of the linking of atoms recognizes the possibility of two isomeric modifications, viz.:



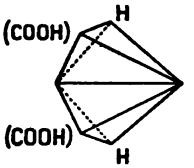
Methylene-malonic acid

and

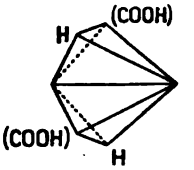


Maleic and fumaric acids

Stereo-chemical doctrine recognizes that with the second of these modes of linking two different arrangements in space are possible, as may be seen from the accompanying diagram, and

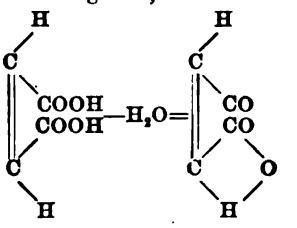


Maleic acid



Fumaric acid

better still by the use of models. As a matter of fact, three unsaturated acids $C_2(H_2)(COOH)_2$ are known, viz. methylene-malonic acid characterized by the first of the above modes of linking, and two acids—maleic and fumaric—both characterized by the second mode of atomic linking, and differentiated from each other by the different *configuration* of their atoms. Optical activity is of course out of question, because none of the molecules under consideration contains an asymmetric carbon atom. But corresponding to the difference in configuration are certain differences in the chemical behavior of maleic and fumaric acids, although the close relationship between the two is indicated by the great readiness with which they are transformed into each other. The most important difference between the two consists in the fact that maleic acid readily forms an anhydride, its two carboxyl groups losing the elements of water and becoming joined together, thus:



Maleic acid — Maleic anhydride

The two carboxyl groups must be nearer together than in fumaric acid, and therefore the first of the above two stereo-chemical formulas is assigned to maleic, the second to fumaric acid. See FUMARIC AND MALEIC ACIDS.

As to compounds with triple bonds in their molecules (see CARBON COMPOUNDS), the verdict of stereo-chemistry is that no more isomers are possible than can be foreseen by the doctrine of atomic linking. This, too, may be best demonstrated by means of models.

HISTORY. In conclusion it may be mentioned that the optical rotary power of a substance in the non-crystalline state (sugar in solution) was first observed by Biot in 1815. The optically isomeric tartaric acids were thoroughly investigated by Pasteur, who in 1860 discovered the three known methods of separating such isomers (see above). Ten years later Wislicenus studied the isomeric lactic acids, and in a memoir published in 1871 expressed the view that the doctrine of atomic linking was no longer sufficient for the purposes of organic chemistry. Wislicenus's remark attracted the attention of Van 't Hoff, who advanced the stereo-chemical theory of optical isomerism in 1874. Meanwhile Le Bel, in Paris, had undertaken to continue the work of Pasteur, and soon independently arrived at the same conclusions as Van 't Hoff. Remarkably enough, Le Bel's and Van 't Hoff's memoirs appeared within one month. The theory of geometrical isomerism was worked out by Van 't Hoff about 1878. At present stereo-chemistry forms quite an extensive science, and its theories, to which no exception has yet been found in the case of carbon compounds, are being gradually extended also to the compounds of nitrogen.

Consult: Wislicenus, *Ueber die räumliche Anordnung der Atome*, etc. (Leipzig, 1887); Hantzsch, *Grundriss der Stereochemie* (Breslau, 1893; French trans., Paris, 1896); Van 't Hoff, *Die Lagerung der Atome im Raume* (Brunswick, 1894); Bischoff, *Handbuch der Stereochemie* (Frankfort-am-Main, 1893). Consult also the works on theoretical and organic chemistry recommended in the article CHEMISTRY. See CHEMISTRY; CARBON COMPOUNDS; LACTIC ACID; TARTARIC ACID; FUMARIC AND MALEIC ACIDS; VALENCY.

STEREOCHROMY, stĕr'ê-ŏk'rō-mĭ (from Gk. *στερεός, stereos*, solid + *χρῶμα, chrōma*, color). A process of wall-painting, invented in 1896 by Prof. J. N. von Fuchs, of Munich, and first practiced by the painter Joseph Schlotthauer. Upon a thin coating of mortar forming a part of the wall, mineral water colors mixed with soluble glass are applied, thus admitting of any part of the picture being retouched, as in the case of oil paintings. A coating of liquid glass is then added to protect it from the effects of the atmosphere. Experience has shown, however, that the surface of the painting cracks, and the process is no longer practiced.

STEREORNITHES, stĕr'ê-ôr'nĭ-thêz (Neo-Lat. nom. pl., from Gk. *στερεός, stereos*, solid + *ὄρνις, ornis*, bird). A group of extinct ratite birds of gigantic size whose remains are found in the Miocene strata of Patagonia. The propriety of this name as indicative of a distinct group has been criticised, and it is believed that,

on the contrary, many of the species are not ratite at all, but carinate, one, at least, having been determined to be a vulture. The most conspicuous genus is Phororhacos. See BIRD, FOSSIL. Consult Newton, *Dictionary of Birds* (New York, 1893-96).

STEREOSCOPE (from Gk. *στερεός, stereos*, solid + *σκοπεῖν, skopein*, to view). An optical instrument that enables one to see the pictures of objects not merely as plane representations, but with an appearance of solidity or relief. When a person looks at a solid body with both eyes the pictures formed on the retina of the two eyes are not alike, as the right eye is able to see more of the right side of the object and vice versa. When these two impressions are blended the object is seen with an appearance of depth or relief. It was not until 1838 that an attempt was made to produce this effect. This was accomplished in the first stereoscope, which was devised by Wheatstone (q.v.) and consisted of two plane mirrors at an angle of 90° and two similar clamps or supports for holding the picture. The face of the observer was placed close to the meeting point of the two mirrors and the light from each picture was reflected into the eye by the adjacent mirror. The pictures for use in this instrument were drawn as they would appear to each eye separately, and consequently were reflected to the eyes as they would actually be seen. The apparatus was successful so long as the pictures were confined to representations of geometrical objects of three dimensions, which could be constructed readily, but the reproduction of more complex objects, such as natural scenery, was beyond the skill of the artists, and it did not occur to the inventor to use photography, which was then being developed. The stereoscope was brought to its present state by Sir David Brewster, who in 1849 constructed a lenticular stereoscope in which lenses were substituted for the reflectors used by Wheatstone. In this way he was able to obtain a magnified image as well as one characterized by the stereoscopic effect. Instead of employing whole lenses he divided a double convex lens transversely into halves, which were placed in front of the two pictures with their thin edges adjacent. This was done so that the rays would be deviated by such an amount that they would apparently originate in a common point between the two pictures, the lens acting as a prism which always bends the rays around its base. In this way the two pictures, which are placed directly in front of the two lenses at a distance equivalent to the principal focus, are united into one image. The growth of photography and the ease with which pictures for the stereoscope could be produced soon made the instrument extremely popular, and the open form used in the United States was devised by Dr. Oliver Wendell Holmes, the poet. Brewster also invented a form of photographic camera with two lenses to take stereoscopic pictures. Instead of two lenses, which in modern stereoscopic cameras are generally of the rapid rectilinear type, the position of the camera can be shifted, but the results are not as good as those obtained with two similar lenses mounted on a camera with a vertical partition which enables two pictures to be taken on the same plate. The lenses, generally speaking, should be about 2½ inches apart, though a slight increase does not make any great difference, the relief becoming more prominent. Too great a difference, however, makes an exaggerated and unnatural picture. In printing, the negative reverses conditions, and the prints must be interchanged, as the pictures taken on the right-hand side must always be seen with the right eye.

The opera glass furnishes a familiar instance of the application of the binocular principle, and in the more modern double-tube telescopes and field glasses, particularly for military operations, great success has been attained in securing the stereoscopic effect with considerable magnifying power. Consult: Brewster, *The Stereoscope* (Leipzig, 1856); Helmholtz, *Physiologische Optik* (ib., 1856-66); Le Conte, *Sight* (New York, 1881); Müller-Pouillet, *Lehrbuch der Physik* (9th ed., Brunswick, 1897).

STEREOTYPING. See PRINTING.

STERILITY (Lat. *sterilitas*, barrenness, from *sterilis*, barren; connected with Gk. *στερεός, stereos*, solid, stiff, barren, *στέριφος, steriphos*, hard, barren). Barrenness, infecundity. In a woman, sterility consists of an incapacity for conception; in a man, of the inability to procreate the species. T. G. Thomas, of New York, has analyzed exhaustively the cause of sterility in a woman as follows: (1) Causes preventing the entrance of semen into the uterus, including absence of the uterus or vagina, obturator hymen, vaginismus, atresia vaginæ, occlusion of cervical canal, conical shape of cervix, cervical endometritis, polypi or fibroids, displacements, very small os internum or externum. (2) Causes preventing the production of a healthy ovule, including chronic ovaritis, cystic disease of both ovaries, cellulitis or peritonitis, absence of ovaries. (3) Causes preventing passage of ovule into uterus, including stricture or obliteration of Fallopian tubes, absence of Fallopian tubes, detachments and displacements of Fallopian tubes. (4) Causes destroying the vitality of semen or preventing fixation of impregnated ovum, including corporeal or cervical endometritis, membranous dysmenorrhœa, menorrhagia or metrorrhagia, abnormal growths, areolar hyperplasia.

Sterility in man is *organic* when there is anatomical derangement of the apparatus; *atonic* when erections are wanting or feeble; *anæsthetic* when there is a diminution of sensitiveness in the nerves supplying the male organ; or *psychic* when mental conditions (as of fright, repulsion, etc.) inhibit the genital centre in the spinal cord. The determination of which partner in marriage is sterile is of great importance. In many countries obloquy and derision attach to the wife who fails to bear children, and her legal status is impaired. The woman is much less often to blame than has been supposed.

STERILIZED FOOD. Food that has been subjected to an agent (usually heat) capable of destroying the germs of fermentation or disease which may be present. The articles of diet which are not usually prepared by heat before ingestion, and which are capable of conveying disease, are fresh fruits and certain vegetables, water, and milk. The two latter are particularly likely to act as carriers of pathogenic microörganisms. Water may be rendered sterile by boiling or by distillation. It is then best kept for use in sterile bot-

tles, sealed, and maintained at a low temperature. Ice may be the means of carrying disease, since many bacteria, although retarded in their growth, are not killed by freezing.

Milk is the food around which the question of sterilization centres, because it is the sole nourishment of infants and swarms with bacteria, particularly during the summer months. Although it comes sterile from the breast of the suckling mother or the udder of the healthy cow, milk is almost a perfect culture medium for many varieties of bacteria, pathogenic and non-pathogenic, which multiply with astonishing rapidity. It may become contaminated during the interval between milking and ingestion in various ways. Unclean materials may be introduced into the milk from the udders of the cow or the milker's hands. Impure water used either as an adulterant or for cleansing containers may be a means of contamination. Typhoid fever has been proved to have been conveyed in this manner. Exposure to the air alone is sufficient to introduce, through dust, many different forms of bacterial life.

The diseases most likely to be propagated through milk are typhoid fever, tuberculosis, scarlet fever, cholera, suppuration, and especially the summer diarrhœa of children. Besides producing their specific diseases bacteria produce poisonous elements in milk which are capable of giving rise to ptomaine poisoning (q.v.) in individuals who drink it. It has been proposed at various times to prevent the development of germs in milk by the addition of non-poisonous antiseptic substances. But it has been found that even with such drugs as salicylic acid and boric acid quantities too large to be wholesome must be employed. Formalin has been extensively used of late years to keep milk sweet and aseptic. Cold is a very imperfect means of sterilization. A low temperature retards development of bacteria for a time, but does not destroy them nor their spores.

Milk is usually sterilized by boiling or by exposure to superheated steam. Germs existing in this fluid can be absolutely destroyed only by heating to 212° F. or higher on two or three successive occasions. The ordinary method of sterilizing milk is to place it in sealed jars or bottles containing sufficient for one feeding, which are then subjected to the action of steam. It is then cooled rapidly, kept sealed from the air, and placed on ice until needed. Exposure to such high temperatures alters the character of milk very materially, both as to its digestibility and nutritive qualities, and it is therefore rendered unfit for use except as a makeshift in very hot weather and in cases of infantile summer diarrhœa. Prolonged use of sterilized milk for children dependent solely upon it for nutriment has resulted in symptoms of scurvy. To obviate this difficulty milk is often subjected to a process known as pasteurization. This consists in heating it to a temperature of 167° F. and maintaining it at this point for a period of twenty minutes. Pasteurization has been shown to be sufficient to kill the microörganisms most commonly found in milk, and in particular those giving rise to diarrhœal diseases, which are very vulnerable to heat. Spores, however, are not destroyed. The tubercle bacillus is more resistant, but, as has been said before, tuberculosis is not often conveyed by milk. Pasteurized milk will keep two or three days at ordinary temperatures or several days on ice, and its taste, digestibility, and nutritive value are believed to be unchanged. See ADULTERATION; MILK.

STERLING. An epithet generally applied to the coinage of Great Britain. Charlemagne superseded earlier systems by a coinage in which a pound of 12 ounces became the money weight. The older *silfer* or scruple of 24 wheat-corns being superseded by the penny of 32 wheat-corns, the term sterling seems to have been applied to the latter, in consequence of its being in use among the Ripuarian or Austrasian Franks, sometimes called the *Esterlings*. In England the word 'sterling' came in the course of time to indicate the fineness of the silver. The superiority of the English standard silver was generally acknowledged over Europe; and hence the adjective 'sterling' has become a synonym for 'pure' or 'genuine.'

STERLING, stĕr'lĭng. A city in Whiteside County, Ill., 109 miles west of Chicago, on Rock River, and on the Chicago and Northwestern and the Chicago, Burlington and Quincy railroads (Map: Illinois, C 2). It is of considerable industrial importance, having good water power. The principal manufactures are agricultural implements, caskets, watches, canned goods, flour, paper, and foundry and machine-shop products. There is a public library with more than 9000 volumes. Population, in 1890, 5824; in 1900, 6309.

STERLING, JOHN (1806-44). An English author, born on the island of Bute. He was educated at Glasgow and at Cambridge. He went to London and began writing for the *Athenæum*. Owing to ill health, he passed two years in the West Indies (1830-32). Returning to England, he took orders and served eight months as a curate. In 1838 he formed the Anonymous (afterwards the Sterling) Club, which included Lord Houghton, Carlyle, and Tennyson. Among his writings are *Arthur Coningsby* (1833), *Poems* (1839), *The Election*, a poem (1841), and *Strafford*, a drama (1843). Sterling, a man of many friends, cut down with consumption in the prime of life, has been immortalized by Carlyle in a *Life* (Boston, 1851). Consult *Essays and Tales* with a memoir by J. C. Hare (London, 1848).

STERN, stĕrn, ADOLF (1835—). A German literary historian, born in Leipzig. He studied at the Universities of Leipzig and Jena, and in 1868 was appointed professor of the history of literature in the Polytechnikum of Dresden. His publications include the compilation *Fünfzig Jahre deutscher Dichtung* (1871); two collections of essays, *Aus dem achtzehnten Jahrhundert* (1874) and *Zur Litteratur der Gegenwart* (1880), and his most important work, *Geschichte der neuern Litteratur* (7 vols., 1882-85).

STERN, DANIEL. See AGOULT, Comtesse d'.

STERNBERG, stĕrn'bĕrk. A town in Moravia, Austria, 12 miles north-northeast of Olmütz (Map: Austria, E 2). It is the chief seat of the Moravian cotton and linen industry, and there is a large tobacco factory. Population, in 1900, 15,195.

STERNBERG, CONSTANTIN (1852—). A Russian-American pianist and composer, born at Saint Petersburg. In 1871 he became conductor

of the Court Opera at Strelitz; in 1875 director of the music school, and Court pianist at Schwerin. He settled in the United States in 1885, becoming director of the College of Music at Atlanta, Ga. In 1890 he became the head of the Sternberg School of Music in Philadelphia. His compositions include some admirable pianoforte music.

STERNBERG, GEORGE MILLER (1838—). An American bacteriologist and army surgeon, born in Otsego County, N. Y. He was graduated from the College of Physicians and Surgeons, New York City, in 1860, and was appointed assistant surgeon in the United States Army in 1861; he served through the war. After the close of the Civil War he was assigned to several posts until 1875, when he was promoted to the rank of surgeon and major. In 1879 he was sent to Havana, Cuba, by the National Board of Health as a member of the yellow fever commission. In 1885 the American Public Health Association awarded to him the Lomb prize of $500 for his essay on "Disinfection and Individual Prophylaxis Against Infectious Diseases." In 1893 Sternberg was made surgeon-general of the United States Army, with the rank of brigadier-general, and in this capacity he directed the medical affairs of the United States Army during the Cuban War. Among his published works are *Photomicrographs and How to Make Them* (1883) and *Malaria and Malarial Diseases* (1884).

STERNE, LAURENCE (1713-68). An English author. He was born at Clonmel, in Ireland. Carried about in the regiment in which his father was an officer, he saw many phases of life in Ireland and England. From ten to eighteen he was at school at Halifax, in Yorkshire. Later he went to Jesus College, Cambridge, where he took his degree in 1736. He was ordained two years later, probably with a view to taking the family living of Sutton, near York, which was immediately given him, to be followed in 1741 by the prebend in York Minster. In 1743 the living of Stillington, which carried with it another prebendal stall in the cathedral, was given to him. He passed twenty years in his Yorkshire home, preaching curious sermons, associating with boisterous squires and reading Cervantes, Rabelais, and the old romances. He found himself suddenly famous when the first two volumes of his *Tristram Shandy* apeared at York at the end of 1759. He went up to London, became the lion of the moment, and published a collection of sermons. In 1760 he was presented to the living of Coxwold. There he went on with *Tristram*, publishing the ninth and last volume in 1767. During these years he spent much time in London and traveled on the Continent. The outcome of his tour in the autumn of 1765 was *A Sentimental Journey Through France and Italy* (1768). Less than a month after its publication Sterne died in a London lodging. In 1775 appeared *Letters to His Intimate Friends*, with the fragment of an autobiography, edited by his daughter, and *Letters from Yorick to Eliza* (i.e. Mrs. Elizabeth Draper).

Sterne's work reached a wide popularity at once, and had a following in England, France, and Germany for years. His sentimentality, the deliberate self-conscious indulgence in feelings of pathos, became the fashion of the day. His work is curiously subjective, dependent upon the moods and whims of the moment; and its formless, easy-going style, such a contrast to the ordered regularity which had marked English prose from Dryden to Addison, thus admirably represents his thought. His characters are remarkable for their genuine human quality, remote as they live from the interests of the ordinary people of the time, and belong to the small class of positive creations in literature. Consult the biographies by Fitzgerald (London, 1864; 2d ed. 1896) and Traill (ib., 1882); Stapfer, *Laurence Sterne, sa personne et ses ouvrages* (Paris, 1870); Texte, *Rousseau et le cosmopolitisme littéraire au XVIIIème siècle* (ib., 1895); Thackeray, *English Humourists* (London, 1853). His works, collected in 1780, were reprinted with newly discovered letters under the editorship of J. P. Browne (London, 1873). A convenient but less complete edition was edited by G. Saintsbury (London, 1894).

STERNHOLD, THOMAS (c.1500-49). One of the authors of the metrical English version of the Psalms. He was probably born in Gloucestershire, England. According to Wood he studied at Christ Church, Oxford, but did not take a degree. He held the office of groom of the robes to Henry VIII. and Edward VI. The first edition (undated, but about 1547) contains nineteen psalms. A second edition (1549) with additions by John Hopkins (d. 1570) contains 37, and in the complete psalter (1562) 40 bear the name of Sternhold. The rest were by Hopkins and several others. The rendering is very literal, but somewhat coarse and homely in phrasing. It was used in England long after the new version by Tate and Brady (1696). "My Shepherd is the Living God" (Psalm xxiii.) is still current. Consult Julian, *Dictionary of Hymnology* (London and New York, 1892).

STERNUM (Neo-Lat., from Gk. *στέρνον*, breast-bone), or BREAST-BONE. A narrow flat bone in the median line of the chest in front, giving attachment to the first seven ribs through their costal cartilages and thus closing anteriorly the thoracic cavity. In the adult it consists of three parts, the upper or manubrium, the middle or gladiolus, and the inferior or ensiform. A sternum is not present in fishes, batrachians, or serpents, but it does occur in all warm-blooded vertebrates and reaches its highest development in the flying birds, where a heavy ridge or keel furnishes a joint of attachment for the powerful muscles of the wings. In the tortoise it is represented by the lower shell or plastron.

STERRETT, JOHN ROBERT SITHINGTON (1851—). An American classical scholar, born at Rockbridge Baths, Va. He was educated at the University of Virginia and in Europe. Later he engaged in important archæological expeditions in Asia Minor, the results of which were published in the papers of the American School at Athens under the titles *Wolf Expedition to Asia Minor* (1885), *Epigraphical Journey in Asia Minor* (1888), and also in *Leaflets from the Notebook of a Traveling Archæologist* (Texas, 1889). After holding professorships of Greek at Miami University and the University of Texas, he was called in 1892 to a similar position at Amherst College; he remained there until 1901, when he became head of the department of Greek in Cornell University. In 1896-97 he was

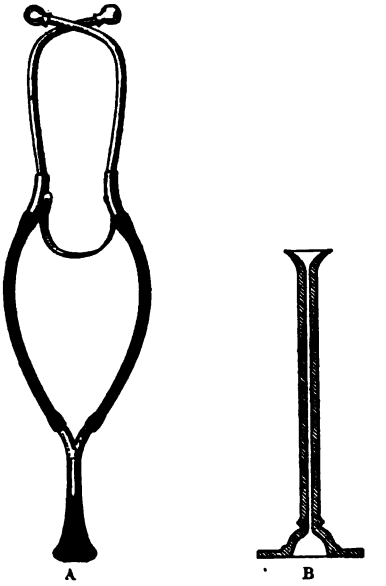
professor in the American School of Classical Studies at Athens. Other publications by him are *Qua in re Hymni Homerici quinque maiores inter se differunt* (1881); *Inscriptions of Assos; Inscriptions of Tralles* (1885).

STERRY, JOSEPH ASHBY-. An English critic.. See ASHBY-STERRY, JOSEPH.

STESICHORUS, stē-sĭk'ō-rŭs (Lat., from Gk. Στησίχορος) (c.640-555 B.C.). A famous Greek lyric poet, born in the Locrian Mataurus, but considered as a Himeræan, since he spent the greater part of his life in the city of Himera, of which his father seems to have been one of the early settlers. It is reported that he was at first the friend of Phalaris, the tyrant of Agrigentum, but that later, recognizing the cruel character of that tyrant, he warned his fellow-citizens against his schemes by telling them the fable of the horse that gave himself up to man in order to revenge himself on the stag. The Himeræans did not listen to his advice and he was compelled to flee to Catana, where he died. The Himeræans, however, in later times honored him with a statue which was seen by Cicero; his figure was also stamped on their coins. A famous story connected with Stesichorus relates that he was struck with blindness because of his attack on Helen, but recovered his sight after he had published a recantation in which he declared it was only the shade of Helen, not Helen herself, that went to Troy.

In his hands the religious hymn, which had been cultivated by previous lyricists, was somewhat secularized. The content also was epic, although the form continued to be that which had been established for melic verse. He treated in his *Destruction of Troy* the story of Æneas's wanderings, which thereafter was established in literary tradition. He also employed folk-tales and was the forerunner of the Greek romance in that he established in Greek literature the impersonal love poem, and he was the first to give literary treatment to the Sicilian story of Daphnis, which was later handled by Theocritus and other bucolic poets. His dialect was a combination of epic with Doric. He also contributed to the development of the strophic and epodic structure of lyric poetry. His poems were written in strophe, antistrophe, and epode, and this arrangement became the norm for lyric poetry, which was thereafter changed only in minor details. The fragments are published by Bergk, *Poetæ Lyrici Græci* (Leipzig, 1882). Consult, also: Welcker, *Stesichorus' Kleine Schriften* (Bonn, 1884); Rizzo, *Questioni Stesichoree* (Messina, 1895).

STETHOSCOPE (from Gk. στῆθος, *stēthos*, breast + σκοπεῖν, *skopein*, to view). An instrument for examining the heart and lungs through their sounds. In its simplest form, invented by Laennec (q.v.), the stethoscope consists of a tube of wood, from 10 to 12 inches long, with a flanging end to be placed on the chest to receive the sound, an open canal to conduct it, and a broad flat ear piece at the other end for apposition to the ear and excluding extraneous sounds. (See Fig. B.) An improvement upon this is the binaural stethoscope, introduced by Dr. Camman of New York, in the form of a binaural or double instrument having an ear piece for each of the ears and flexible rubber tubes connecting them with the chest piece. (See Fig. A.) A still finer instrument is the phonendoscope, which conveys with greater minuteness and intensity. The chest piece of the phonendoscope consists of a shallow metal cup covered by a disk of ebonite, with a perforation in the cup for attaching the rubber tubes for the ears. From the centre of



STETHOSCOPE.
A, stethoscope with ear tubes; B, older form.

the disk of ebonite springs a small rod ending in a button, which is placed upon the spot to be auscultated. This instrument is useful in the finer phases of diagnosis, particularly to distinguish between pericardial and endocardial sounds and to detect the fœtal heart. See AUSCULTATION; RESPIRATORY SOUNDS.

STETTIN, stĕt-tēn'. The capital of the Province of Pomerania, Prussia. The city is situated on both banks of the Oder, 17 miles south of the Stettiner Haff, an inlet of the Baltic, and 83 miles by rail northeast of Berlin (Map: Prussia, F 2). The district on the right bank of the river comprises the former suburbs of Lastadie and Silberwiese. The site of the town is hilly, and consequently the streets are uneven, but the houses are well built. The extensive fortifications were demolished in 1874. The castle, dating from 1577, formerly occupied by the Dukes of Pomerania, is now a Government building. The Königs-Thor and the Berliner Thor are interesting sandstone gates built by Frederick William I. Saint James is an imposing thirteenth-century church in the centre of the town, restored in 1897; Saint Peter and Saint Paul is the oldest church in Pomerania, restored 1816-17; and the fine new Roman Catholic church (1890) is also worthy of note.

Stettin is the most important manufacturing town in Pomerania. Its principal industrial establishment is the Vulcan ship-building yard, employing over 6000 men, and covering 65 acres. There is also a large iron foundry, where all the anchors for German ships are forged. The clothing industry ranks second in importance only to ship-building, and employs over 10,000 men,

women, and children. There are numerous large factories for the manufacture of chemicals and cement, bicycles and sewing machines, soap and candles, sugar, paper, glass, etc. A new harbor on the east bank of the Oder was opened in 1900. This, together with the deepening of the Oder to the Stettiner Haff, enabling large vessels, which formerly stopped at Swinemünde, to reach the city, has made Stettin the third port of Germany. It has direct steamship communication with New York, London, and other foreign cities. The port was cleared in 1900 by 4594 vessels, of 1,552,543 tons burden. The chief exports are corn, spirits, lumber, sugar, and cement; the imports, iron, petroleum, wine, groceries, and coal. Population, in 1890, 116,228; in 1900 (Greater Stettin), 210,680.

Stettin is of Slavic origin. It first came into notice in the twelfth century. As a member of the Hanseatic League it became a flourishing commercial town. It belonged to Sweden from 1648 until 1720, when it passed to Prussia. It was held by France from 1806 to 1813. Consult W. H. Meyer, *Stettin in alter und neuer Zeit* (Stettin, 1887).

STEUBEN, stū'ben, *Ger. pron.* stoi'ben, FRIEDRICH WILHELM VON, Baron (1730-94). A German-American soldier, born at Magdeburg, Prussia. He was educated at the Jesuit colleges of Neisse and Breslau, and at the age of fourteen served as a volunteer under his father at the siege of Prague. In 1747 he was appointed cadet of infantry, and in 1758, after several promotions, became an adjutant-general with the rank of captain. He fought with distinction in the Seven Years' War, at the close of which he was appointed grand marshal of the Prince of Hohenzollern-Hechingen, in which position he remained until about 1774. While in Paris in 1777 he was induced by Saint Germain to go to America and arrived at Portsmouth, N. H., on December 1st. He immediately offered his services as a volunteer to Congress, and was directed to join the army at Valley Forge. This he did February 23, 1778, and in May, 1778, he was appointed instructor-general of the Continental army with the rank of major-general. He devoted himself to the task of reorganizing the army on the European model, drilling the awkward and untrained soldiers and introducing order and system. He increased enormously the general efficiency of the army and thus contributed in no small degree to the success of ensuing campaigns. At Monmouth he rendered valuable service, and in 1780 he was sent with a separate command to coöperate with General Greene in Virginia, where he opposed the marauding expedition of Benedict Arnold, and finally took an active part in the siege of Yorktown. In 1780 he prepared a manual for the army entitled *Regulations for the Order and Discipline of the Troops of the United States*, which came into general use. After the war he received grants of land from several States, and finally Congress voted him a tardy pension of $2400. For several years he lived in New York City and then removed to the tract of land (Steuben Township) granted to him by New York, where he lived in a rude log cabin (near the site of the present Utica) until his death, November 28, 1794. Friedrich Kapp has written the most trustworthy biography (New York, 1859).

STEUBENVILLE, stū'ben-vil. The county-seat of Jefferson County, Ohio, 43 miles west by south of Pittsburg, Pa., on the Ohio River and on the Pennsylvania, the Wheeling and Lake Erie, and other railroads (Map: Ohio, J 5). It is favorably situated for commerce and industry. Noteworthy features are the Carnegie Public Library, city hall, court house, Gill Hospital, Stanton Park, and Altamont Park and Casino. The surrounding section has coal deposits, natural gas, and petroleum wells. There are manufactures of glassware, chimneys and electric light bulbs, paper, foundry and machine shop products. Several plants are connected with the iron and steel industry. The water-works are owned and operated by the municipality. Population, in 1890, 13,394; in 1900, 14,349. A fort named in honor of Baron Steuben was erected here in 1787 and the town was laid out in 1798. The city was chartered in 1851 and its limits were extended in 1891. Consult Howe, *Historical Collections of Ohio* (Columbus, 1890-91).

STE'VENS, ABEL (1815-97). A Methodist Episcopal clerical writer. He was born at Philadelphia and entered the New England Conference (1834). He was editor of *Zion's Herald* (Boston, 1848-60), of the *National Magazine* (New York, 1852), of the *Christian Advocate* (ib., 1856-60), corresponding editor of the *Methodist* (ib., 1860-74). He was the author of *Memorials of the Introduction of Methodism Into the Eastern States* (1852), *Memorials of the Early Progress of Methodism in the Eastern States* (2d series, 1854), *The History of the Religious Movement of the Eighteenth Century Called Methodism* (1858-61), *History of the Methodist Episcopal Church in the United States of America* (1864-67), *Supplementary History* (1899), *Madame De Staël, A Study of Her Life and Times* (1880).

STEVENS, ALFRED (1828—). A Belgian genre painter. He was born at Brussels, and studied principally with Roqueplan and under Ingres in the Ecole des Beaux-Arts, Paris. He first exhibited in Brussels, but in 1849 settled at Paris where he has since resided. Among his works are the "Discouragement of the Artist" and "Love of Gold" (1853); "Masquerade on Ash Wednesday" (1853, Marseilles Museum); "Consolation" (1857, Ravené Gallery, Berlin); "The Lady in Pink," "La bête a Bon Dieu" (Brussels Museum); "The Japanese Robe" (Metropolitan Museum, New York). He painted in fresco "Allegories of the Four Seasons" (in the Royal Palace, Brussels). His most characteristic subjects depict the interiors of modern houses as background and accessories for the figures of piquant women and children of fashionable life. He revels in the arrangements of furniture and rich stuffs, by means of which he secures remarkable effects of texture and quality. His management of tone and light is scientific, at the same time pure and admirable. His type of women possess the quality of charm with a reserve of expression and a refinement not shown by the ultra-moderns in his genre.

STEVENS, ALFRED GEORGE (1818-75). An English sculptor. He was born in Dorset County, England, and received his artistic training in Italy (1833-42). In 1841 he studied for a year under Thorwaldsen, after which he returned to England, where, in 1845, he was made professor in the Art School at Sheffield. His great-

est achievement in sculpture is the Duke of Wellington monument, Saint Paul's Cathedral, including the powerful groups of "Truth Tearing Out the Tongue of Falsehood" and "Valor Triumphing Over Cowardice," which decorate the canopy above the edifice. He is also celebrated for his designs for metal articles of daily use, executed in exquisite classical taste, as well as for more ambitious efforts like the vases decorating the railing in front of the British Museum, and the lions on the posts, since placed in the Museum; the mantelpiece in the dining-room of Dorchester House, Park Lane; and the mosaics designed to fill the spandrels under the dome of Saint Paul's. He was almost unrecognized by the British public. His Italian training, exempt from English influence, accounts for his excellence at a time when English sculpture was in the decline. Consult Stannus, *Alfred Stevens and His Work* (London, 1891).

STEVENS, Benjamin Franklin (1833-1902). An eminent American bibliographer, born in Barnet, Vt. He joined his brother, Henry, in London in 1860; for many years had charge of the Chiswick Press, acted as purchasing agent for American libraries, and became United States dispatch agent. For more than thirty years he and his agents searched the archives of England, France, Holland, and Spain for papers relating to America. His publications include: *American Manuscripts in European Archives* (1887); *Campaign in Virginia in 1781* (1888); *Facsimiles of Manuscripts in European Archives Relating to America, 1773-83* (25 vols., 1889-98); *Gen. Sir William Howe's Orderly Book at Charlestown, Boston, and Halifax* (1890); *Columbus, His Own Book of Privileges, 1502* (1893); *Introduction to Calendar of American Papers in the Earl of Dartmouth's Collection* (1895).

STEVENS, Ebenezer (1751-1823). An American soldier, born in Boston, Mass. He enlisted as a lieutenant in a Rhode Island artillery regiment in May, 1775, and by successive promotions rose to the rank of lieutenant-colonel in April, 1778, serving in the expedition against Quebec (1775), and commanding the artillery at Ticonderoga, at Freeman's Farm, and, for a time, at Yorktown. He was one of the founders of the Society of the Cincinnati, became prominent as a merchant in New York, and was made a major-general of militia.

STEVENS, Edward (1745-1820). An American soldier. He was born in Culpeper County, Va., became colonel of Virginia militia early in 1775, was in command at the skirmish at Great Bridge (December 9, 1775), saved part of Washington's army from capture at Brandywine (September 11, 1777), served with gallantry and marked ability at Germantown, Camden, and Guilford Court House, and became a brigadier-general of militia in 1779.

STEVENS, Edwin Augustus (1795-1868). An American capitalist, railroad organizer, and ship-builder, born at Hoboken, N. J. With his brother Robert L. Stevens (q.v.) he succeeded to the large shipping and railroad interests of their father, John Stevens (q.v.), and became one of the most prominent railroad organizers in the United States. After his brother's death he tried to dispose of the famous Stevens Floating Battery, and on his own death bequeathed it to his native State, together with $1,000,000 to insure its completion. This sum proved inadequate, however, and the State disposed of the vessel to the United States Government, which finally sold it for old iron. Another vessel of his, the *Naugatuck*, was accepted by the Federal Government and was used during the Civil War. He founded the Stevens Institute of Technology (q.v.).

STEVENS, George Alexander (1710-84). An English wit, the son of a London tradesman. He joined a company of strolling players, and for many years followed the stage as an actor in minor parts. He became famous for his *Lecture on Heads*, first delivered at the Haymarket in 1764 and repeated for many years throughout Great Britain and in America. The lecture is a humorous and extravagant series of hits on contemporary follies as represented by various heads. Stevens also wrote many popular songs, as "Cease, rude Boreas, blustering railer." Consult the *Lecture* with heads executed by Charlton Nesbit from designs by Thurston (London, 1799), and *Songs, Comic and Satirical*, with cuts by Berwick (Oxford, 1772; and numerous reprints).

STEVENS, George Barker (1854—). An American theologian, born in Spencer, N. Y., and educated at the University of Rochester (class of 1877) and at Yale Divinity School, where he graduated in 1880. He was pastor of the First Congregational Church of Buffalo (1880-83) and of the First Presbyterian Church of Watertown, N. Y. (1883-85), and then, after a year's study in the University of Jena, became professor of New Testament criticism and interpretation at Yale, a chair which he left in 1895 for that of systematic theology in the same university. He wrote *The Pauline Theology* (1892); *The Johannine Theology* (1894); *A Short Commentary on Galatians* (1894); *The Epistles of Paul in Modern English* (1898); *The Messages of the Apostles* (1900); and *The Teaching of Jesus* (1901).

STEVENS, Henry (1819-86). An American bibliographer, born at Barnet, Vt. He graduated at Yale in 1843 and studied law at Harvard. Attracted to colonial history, he visited England in search of Americana in 1845, and remained there till his death, acting as purchasing agent for the British Museum and for many libraries, public and private, noteworthy among which was the Lenox Library of New York, whose collection of Americana he formed. He published many bibliographical catalogues and pamphlets, highly prized for their minute accuracy, and made a collection of Franklin documents which was purchased by the United States Government. Of his very numerous publications the more noteworthy are: *Catalogue Raisonné of English Bibles* (1854); *Catalogue of American Books in the Library of the British Museum* (1857); *Bibliotheca Americana* (1861); *Bibliotheca Historica* (1870); *Historical Collections* (1881-86); *Who Spoils Our New English Books* (1885); and *Recollections of James Lenox* (1886).

STEVENS, Isaac Ingalls (1818-62). An American soldier and administrator, born at North Andover, Mass. He graduated at West Point in 1839. He joined General Scott's army in Mexico as adjutant of engineers in 1847, and

participated in all of its important engagements. In 1849 he became the assistant in charge of the United States Coast Survey office at Washington, but resigned from the army in 1852 to accept the Governorship of Washington Territory. In 1855 the Washington Indians revolted. Stevens at once sternly suppressed the insurrection, and arrested Chief Justice Edward Lander, who had issued writs of habeas corpus for Indian prisoners. On the outbreak of the Civil War he was commissioned colonel of the Seventy-ninth New York Volunteers, and a few months later was promoted to the rank of brigadier-general. He participated in the actions on Stone River and at Secessionville. On July 4, 1862, he was promoted to the rank of major-general, and during August he took part in the campaign in northern Virginia, participating in the second battle of Bull Run and the battle of Chantilly. While leading his men in a charge during the latter, he was killed, September 1, 1862. He published *Campaigns of the Rio Grande and Mexico, with Notices of the Recent Work of Major Ripley* (1851); and a *Report of Explorations for a Route for the Pacific Railroad near the 47th and 49th Parallels of North Latitude, from Saint Paul, Minn., to Puget Sound*, printed by order of Congress (1855-60).

STEVENS, JOHN (1749-1838). An American inventor, engineer, and steamboat builder. He was born in New York City, and in 1768 graduated at King's (now Columbia) College. He then studied law, and in 1771 was admitted to the bar. In 1790 he petitioned Congress for legislation for the protection of American inventors, and through his efforts a bill was passed which laid the foundations for the present patent system of the country. As early as 1788 he had begun experiments in the application of steam as a motive power, and in 1792 took out two patents for marine engines under the new law. Subsequently, in association with Nicholas Roosevelt and Robert R. Livingston, he built a steamboat, and attempted to obtain from the New York State Legislature the exclusive right of navigation of the Hudson River, but the boat, when completed in 1801, failed to fulfill the speed conditions imposed, and Livingston subsequently became associated with Fulton in his more successful attempt. In 1804 he built a steamship propelled by twin screws, and in 1807, with his brother Robert, built the paddle-wheeled steamboat *Phœnix*, which was put in successful operation only a few days after Fulton's *Clermont*. The *Phœnix* was shut out of the waters by the monopoly of Fulton and Livingston, but was operated for six years on the Delaware River, to reach which the *Phœnix* sailed around from New York City, and was thus the first steamship to navigate the ocean successfully. In October, 1811, between Hoboken and New York City he established the first steam ferry in the world. He invented and designed many improvements in steamboat and steam-engine construction, and designed in 1812 a circular iron-clad floating battery for harbor defense. In 1826 he constructed a locomotive model after his own designs, which he exhibited in operation in Hoboken, and which was said to have been the first locomotive ever to run on a track in America.

STEVENS, JOHN AUSTIN (1795-1874). An American banker and financier, born in New York City. He graduated at Yale in 1813, and in 1818 became a partner in the extensive mercantile business of his father, Ebenezer Stevens, in New York City. During the Civil War he was one of the principal financial advisers of the Government, and his greatest public service was rendered as chairman of the famous 'treasury note committee' of New York, Boston, and Philadelphia bankers, which played a prominent part in placing the first 7-30 and later war loans.

STEVENS, JOHN AUSTIN (1827—). An American author, born in New York City. He graduated at Harvard in 1846; was secretary to the New York Chamber of Commerce from 1862 to 1868; and later was for some years librarian of the New York Historical Society. He founded the Society of the Sons of the Revolution and the Loyal League. In 1877 he established the *Magazine of American History*, of which he was the editor until 1883. His publications include: *The Valley of the Rio Grande* (1864); *Colonial Records of the New York Chamber of Commerce* (1867); *The Expedition of Lafayette Against Arnold* (1878); and *Life of Albert Gallatin* (1884), in the "American Statesmen Series."

STEVENS, JOHN LEAVITT (1820-95). An American journalist and diplomat, born at Mount Vernon, Me. In 1855 he became associate editor of the Kennebec (Me.) *Journal*, and in 1857 chief editor of the paper. He was an advocate of the Republican Party, in whose organization in Maine he assisted. He was Minister Resident to Uruguay and Paraguay from 1870 until 1873. In 1877-83 he was Minister Resident to Sweden and Norway, and in 1889 became Minister Resident to the Hawaiian Islands. His title was made Envoy Extraordinary and Minister Plenipotentiary in 1890. Upon the outbreak of a revolution against the royal Government in 1893, and the establishment of a provisional government (see HAWAIIAN ISLANDS, *History*), he established a protectorate over the islands. This action was disavowed by the Secretary of State of the United States, and subsequently Stevens was recalled, and was exonerated by the Senate. His publications include a scholarly and valuable *History of Gustavus Adolphus* (1884).

STEVENS, PHINEAS (1707-56). A colonial soldier in America, born at Sudbury, Mass. About 1711 he removed with his father to Rutland, N. H. (now in Vermont), and in 1723 was a captive for a time among the Saint Francis Indians. He was one of the pioneer settlers of "Township No. 4" (now Charlestown, N. H.), and in April, 1747, during King George's War, as commandant of the fort there, repelled the attack of 400 French and Indians under Niverville. He was twice (1749 and 1752) sent to Canada to negotiate an exchange of prisoners. A journal kept by him during his first trip to Canada is printed in the *New Hampshire Historical Collections*, vol. v.

STEVENS, ROBERT LIVINGSTON (1787-1856). An American inventor and marine engineer, son of John Stevens (q.v.), born in Hoboken, N. J. He applied the wave line to shipbuilding, invented a percussion shell (the rights to which were bought by the Government), was one of the first to use anthracite coal in steam navigation, and introduced many improvements in the con-

struction of steamships and marine engines. In 1842 he was commissioned by the Government to build the first iron-clad warship ever constructed, generally known as the Stevens Floating Battery; but, owing to improvements in ordnance and the consequent changes in specifications, he died without completing it. See STEVENS, EDWIN AUGUSTUS.

STEVENS, THADDEUS (1792-1868). An American statesman and Congressional leader, born at Danville, Vt., April 4, 1792. He graduated at Dartmouth College in 1814; taught school in York, Pa., and studied law; began to practice in Gettysburg, and removed to Lancaster, Pa., in 1842. In 1833 he became a member of the State Legislature, in which he sat for a number of years, serving with credit. In 1836 he was a delegate to the State Constitutional Convention, winning notoriety by his advocacy of negro suffrage. Stevens affiliated with the Anti-Masonic Party (see ANTI-MASONS), and was an active member of its Baltimore convention in 1831; but from the time of his election to the Legislature he acted with the Whigs. His career in the Legislature was varied, but indicative of his energy and ability, and although his business interests suffered severely, he conquered the 'machine' in his own party, and in December, 1849, took his seat in Congress. During two terms that he filled there he opposed not only the Fugitive Slave Law, but also every form of concession to the South. After an interval of six years devoted to the practice of law he returned to Congress in 1859, and from then until his death was the recognized leader of the House of Representatives, being chairman of the Committee on Ways and Means throughout the war, and later chairman of what was then the equally important Committee on Reconstruction. He was regarded as the most radical anti-slavery advocate in Congress. He was one of the authors of the so-called Wade-Davis Reconstruction Bill of 1865 and reported the Reconstruction Act of 1867 from the committee of which he was chairman. (See RECONSTRUCTION.) He was chairman of the House committee in charge of the impeachment of President Johnson (q.v.). He died at Washington, August 11, 1868. Biographies have been written by E. B. Callender (Boston, 1882), and by S. W. McCall (Boston, 1899), the latter being one of the "American Statesmen Series."

STEVENS, WALTER LE CONTE (1847—). An American physicist. He was born in Gordon County, Georgia, and graduated from the University of South Carolina in 1868. He was professor at Oglethorpe College, Atlanta, Ga.; Chatham Academy, Savannah, Ga.; Packer Collegiate Institute, Brooklyn, N. Y.; Rensselaer Polytechnic Institute, Troy, N. Y.; and in 1903 occupied the chair of physics at Washington and Lee University, Lexington, Va.

STEVENS INSTITUTE OF TECHNOLOGY. A school of mechanical engineering, in Hoboken, N. J., established in 1870, and named for its founder, Edwin A. Stevens, who bequeathed to it a block of land and $650,000. The school was opened in 1871 with Henry Morton as its first president. The curriculum embraces thorough training in applied mathematics, in the theory of machine construction with a study of existing systems, mechanical drawing and designing, shop practice and experimental mechanics, physics, chemistry, and applied electricity, with English branches and the modern languages. Admission is by examination solely; the only degree conferred is that of mechanical engineer. The institute has been the recipient of many benefactions, the most notable being those of Henry Morton, who, during his presidency of thirty years, gave to the institute about $150,000, and those of Andrew Carnegie, whose gifts amounted to $290,000 in 1903, in which year the endowment was $820,000, with an income of $91,000. The grounds and buildings were valued at $390,000, with a total estimated value of $1,250,000 for the property under its control. The Institute had in that year an attendance of 296, with 22 instructors, and the academic department an enrollment of 254, with 15 instructors. The library contained about 8000 volumes. In 1901 Alexander C. Humphreys became president of the Institute.

STEVENSON, ADLAI EWING (1835—). An American politician, Vice-President of the United States in 1893-97. He was born in Christian County, Ky., and was educated at Centre College, Danville, Ky., but removed with his parents to Bloomington, Ill., before graduating. At Bloomington he studied law and in 1857 was admitted to the bar. He was a master in chancery from 1860 to 1864, became prominent in Democratic local politics, and was a member of the 44th Congress (1875-77), and of the 46th Congress (1879-81). As First Assistant Postmaster-General during President Cleveland's first administration he antagonized civil-service reformers by his sweeping removal of Republican postmasters. In 1892 he was chairman of the Illinois delegation to the Democratic National Convention, by which he was nominated for Vice-President on the Cleveland ticket, which was elected. In 1897 he was appointed by President McKinley a member of the commission sent to Europe to inquire into the feelings of European Powers in regard to the possible establishment of international bimetallism. In 1900 he was again the candidate of the Democratic party for Vice-President.

STEVENSON, GEORGE JOHN (1818-88). An English hymnologist, educated at Saint John's College, Battersea, London. In 1846 he became head master of the Philanthropic Institute, a reformatory at Southwark; and in 1848, head master of the parochial school at Lambeth Green. Resigning his position in 1855, he started as a London bookseller and publisher, and continued this business until a short time before his death. In 1831 he became a Methodist, and thereafter gave much time to the history and the literature of his sect. From 1861 to 1867 he edited the *Wesleyan Times*. His *Methodist Hymn Book and Its Associations* (1869; enlarged with slightly changed title, 1883) is a valuable work. Among other publications are books on Spurgeon (1857 and 1867), *Memorials of the Wesley Family* (1876), and *Methodist Worthies* (1884). Consult Julian's *Dictionary of Hymnology* (London, 1892).

STEVENSON, JOHN JAMES (1841—). An American geologist, born in New York City. He graduated at New York University in 1863. He became professor of chemistry at West

Virginia University in 1869 and in 1871 was appointed professor of geology in New York University. He served as geologist on the United States Geological Survey west of the 100th meridian in 1873-74 and 1878-80. He was also on the Pennsylvania Geological Survey in 1875-78 and in 1881-82. In this work he made out the classification of the upper coal measures of Ohio and Pennsylvania, and also described the coal area of New Mexico and southeastern Colorado. He became corresponding member of the more important scientific societies and academies of foreign countries. He was president of the New York Academy of Sciences from 1896 to 1898, and president of the Geological Society of America in 1898. His publications include: *The Geology of a Portion of Colorado Explored and Surveyed in 1873* (1875); *Report of Progress in the Greene and Washington District of the Bituminous Coal Fields of Western Pennsylvania* (1876); *Report upon Geological Examinations in Southern Colorado and Northern New Mexico During 1878 and 1879* (1881); *Origin of the Pennsylvania Anthracite* (1893); *Lower Carboniferous of the Appalachian Basin* (1903); and more than a hundred other memoirs, many of the greatest importance, on geological topics.

STEVENSON, Joseph (1806-95). A Scottish antiquary, born at Berwick-upon-Tweed. In 1831 he was appointed to a post in the manuscript department of the British Museum, and in 1834 became a sub-commissioner of the public records. He was ordained a priest in the Church of England (1839), but his studies in the Reformation period of English history led him to the Roman Catholic Church (1863). In 1877 he entered the Society of Jesus. For his services he was granted a Government pension, and was honored by Saint Andrews with the degree of LL.D. At the suggestion of Stevenson, the English Government began in 1857 the valuable *Chronicles and Memorials of Great Britain and Ireland*, otherwise known as the *Rolls Series*. The Government also sent him to Rome to make an exhaustive examination of the Vatican archives. The thirteen volumes of his manuscript were deposited in the Public Record Office, but were not published. Stevenson edited nearly fifty works for the leading learned societies.

STEVENSON, Robert (1772-1850). A Scotch engineer, born at Glasgow. His progress in the study of engineering was so rapid that in 1791 he was entrusted with the erection of a lighthouse on Little Cumbrae. During forty-seven years' service as engineer and inspector of lighthouses, he planned and constructed twenty-three lighthouses round the Scottish coasts, employing the catoptric system of illumination, and his valuable invention of intermittent and flashing lights. The most remarkable of these structures was that on the Bell Rock (q.v.). The enterprise was unprecedented in lighthouse engineering, for the Bell Rock was never uncovered except at the lowest ebb tides. Stevenson was the author of four volumes of professional printed reports, a large work on *The Bell Rock Lighthouse* (Edinburgh, 1824), and articles in the *Encyclopædia Britannica* and in the *Edinburgh Encyclopædia*.—His son Alan (1807-65) was also an engineer of prominence, and was the author of a *Treatise on Lighthouse Illumination*. See Lighthouse. Consult Stevenson, *Life of Robert Stevenson* (Edinburgh, 1878).

STEVENSON, Robert Alan Mowbray (1847-1900). An English art critic, a cousin of Robert Louis Stevenson. He was born in Edinburgh, was educated at Sussex College, Cambridge, and studied art in the Edinburgh School of Art, and in Paris and Antwerp, but never attained much success as a painter. In 1882 he began to teach art at Cambridge and in 1889 became professor of fine arts at University College, Liverpool. He was one of the most gifted and just of English critics. His sympathies were with the impressionist school, but his judgment was impartial, and he possessed a keen analytical mind and an effective style. His works include: *Engraving* (1886), from the French of Delaborde; *Peter Paul Rubens* (1898); *The Art of Velazquez* (1895; revised ed. in Williamson's series of *Great Masters*, 1899); and an *Essay on Raeburn* (1900).

STEVENSON, Robert Louis (properly Robert Lewis Balfour) (1850-94). A Scottish romancer, essayist, and poet, born in Edinburgh, November 13, 1850, the only son of Thomas Stevenson, a distinguished lighthouse engineer. After beginning his education at various schools and under private tutors, he entered Edinburgh University in 1867, with the intention of becoming an engineer. On this profession he turned his back in 1871, and prepared for the bar, to which he was called in 1875. He had already written several essays and tales and some verse, but chiefly with a view of, in his own forcible phrase, "playing the sedulous ape" to the great masters. His strong bent to a literary career was now encouraged by the friendship of such men as Edmund Gosse, Andrew Lang, and Sidney Colvin, whom he met in London. A canoeing trip in Belgium and France and a walking tour in the Cévennes furnished material for *An Inland Voyage* (1878) and *Travels with a Donkey* (1879), sketches in which he gave full proof of his exquisite literary art. Without attracting much attention, he was contributing to the *Cornhill Magazine* and *Temple Bar* short stories, and some of his best essays, those which were afterwards collected under the titles of *Virginibus Puerisque* (1881) and *Familiar Studies of Men and Books* (1882). To this period also belong the fascinating, fantastic *New Arabian Nights* (1882), first published between 1876 and 1878. In 1876 he had met, in an artistic colony near Paris, Mrs. Osbourne, an American lady, who was afterwards to be his wife. In 1879, hearing from California that she was seriously ill, he made up his mind to go there. His resources were so limited that he made the long journey in an emigrant ship and train, noting his curious experiences and publishing them afterwards in *The Amateur Emigrant* (1894) and *Across the Plains* (1892). He spent two years in California, often in very delicate health, and in 1880 married Mrs. Osbourne. The next few years were spent in various health resorts—Davos, the Riviera, Bournemouth, and the Adirondacks. Often under the most discouraging conditions, but with that brave cheerfulness which was the distinguishing note of his character, he worked incessantly. Success first came to him with the publication in 1883 of *Treasure*

Island, a tale of pure adventure. *Dr. Jekyll and Mr. Hyde* (1886), a striking ethical parable under the guise of fiction, attracted the more thoughtful and was recommended from many a pulpit. In the same year appeared *Kidnapped*, which, with its sequel *David Balfour* (1893) and the *Master of Ballantrae* (1889), offered vivid pictures of the Scottish life of the past. In 1888, still in quest of health, he left San Francisco with his family on a voyage to the South Seas. Pleased with the scenery and the people of Samoa, he made a permanent home for himself there in 1890 and acquired a position of commanding influence among the natives. After an heroic struggle against consumption, he died, through the rupture of a blood-vessel in the brain, December 3, 1894, and was buried on the peak of Mount Vaea, above Vailima, his Samoan home. Active to the last, he left several manuscripts, among which were two romances, *Weir of Hermiston* (1896) and *St. Ives* (completed by Quiller-Couch, 1897). The former, which no writer was bold enough to touch, is generally considered, even in its unfinished state, Stevenson's masterpiece. Others of his works which deserve special mention are: *The Silverado Squatters* (1883); *Prince Otto* (1885), a dainty romantic tale; three books written in collaboration with his stepson, Lloyd Osbourne, *The Wrong Box* (1888), *The Wrecker* (1892), and *The Ebb Tide* (1894); a volume of exquisite verse, *Underwoods* (1887); *A Child's Garden of Verses* (1885); *The Merry Men and Other Tales* (1886), a volume of short stories in which his mastery over the grim and terrible best shows itself; *Memoir of Fleeming Jenkin* (1887); and *Father Damien, an Open Letter* (pamphlet, 1890), unique among Stevenson's writings, and one of the most powerful *apologia* in English.

In both fiction and essays Stevenson displays the possession of an exquisite and finished style; his work is that of a true artist in words, and his example stimulated many of the younger artists of the day to more or less conscious imitation. His influence was also great in regard to the subject-matter of fiction. At a time when the novel had forgotten to tell a story and was running into minute philosophical analysis, Stevenson came forward with adventure as purely romantic as Scott's, though in structure, in method of description and narrative, and in brilliancy of style he marks the great technical advance which had been made since the days of the *Waverley Novels*. But it was not only the many delightful qualities of his written work which made Stevenson the best loved writer of his time; even more, perhaps, he was endeared to countless readers by the frank revelation of a most engaging personality, which shines through all his works—of a serene undaunted cheerfulness, gained not by shutting his eyes to the pathos and the difficulty of human conditions, but by a brave rising to the height of their demands and an unwavering sense of the compensations which such an attitude offers.

The most nearly completed collection of his works is the sumptuous Edinburgh edition, edited by Sidney Colvin (1894-98); two volumes of charming letters arranged by the same editor, with much biographical matter, appeared in 1899, and the *Vailima Letters*, written from Samoa in 1895. Consult also the biographies by his cousin Graham Balfour (London, 1901), Baildon (ib., 1901), Black (Edinburgh, 1898), and Cornford (ib., 1899); also Simpson, *Stevenson's Edinburgh Days* (London, 1898); Fraser, *In Stevenson's Samoa* (ib., 1895); Osbourne and Strong, *Memories of Vailima* (ib., 1903); and critical studies by Raleigh (London, 1895); James, in *Partial Portraits* (ib., 1888); Chapman, in *Emerson and Other Essays* (New York, 1896). See also ENGLISH LITERATURE; NOVEL; ROMANTICISM.

STEVENSON, SARA (YORKE) (1847—). An American archæologist, born in Paris, France. She was educated in Paris at the Cours Rémy and the Institut Descauriet, resided in Mexico in 1862-67, and later became known as an archæologist. In 1889 she was an organizer of the department of archæology of the University of Pennsylvania, in 1890 became curator of its Egyptian and Mediterranean sections, and in 1894 its secretary. She also received the secretaryship of the American Exploration Society in 1897 and the presidency of the Pennsylvania branch of the Archæological Institute of America in 1899; in 1898 visited Egypt for the Exploration Society and the city of Philadelphia; and in 1893 was vice-president of the jury on ethnology at the World's Columbian Exposition. Among her writings are various papers and articles on archæology, and the volume *Maximilian in Mexico* (1898).

STE'VENS POINT. The county-seat of Portage County, Wis., 150 miles northwest of Milwaukee, on the Wisconsin River, and on the Wisconsin Central Railroad (Map: Wisconsin, D 4). It is the seat of a State normal school, and has a Polish normal academy and a public library. The region is one of the richest lumbering sections in the State. It also has some mineral wealth and there is excellent water power. There are saw mills, paper mills, knitting mills, a foundry, and manufactories of sashes and doors, furniture (including tables and desks), engines, boxes, wall paper, etc. The manufacture of artificial flies for fishing is an important industry. The government is vested in a mayor, elected biennially, and a unicameral council. Stevens Point was settled in 1836, and received its present charter in 1897. Population, in 1890, 7896; in 1900, 9524.

STEVIN, SIMON (1548-1620). A Dutch mathematician, physicist, and engineer, born in Bruges. After being a merchant and traveling extensively through Europe, he enjoyed the favor of Prince Maurice of Orange, holding under his appointment civil and military offices, his scientific qualifications making him particularly valuable in military engineering, where he enjoyed a high reputation. He is best known for his mathematical work which led to the introduction of decimal fractions, and he stated that the universal use of a decimal system of coinage, measures, and weights was bound to come. He also made valuable contributions to mechanics and physics, demonstrating the resolution of forces, the equilibrium of forces on an inclined plane, showing the difference between stable and unstable equilibrium, and the fact that the pressure of a liquid is independent of the shape of the containing vessel and depends merely upon the height and area of the base. He wrote on double-entry bookkeeping and adapted it to the material needs of Prince Maurice. Stevin's mathematical

works, a part of which were published in Dutch in 1568 were collected and translated into French, being published in 1634. For his work in mathematics consult: Cantor, *Vorlesungen über Geschichte der Mathematik* (Leipzig, 1892); for his work in physics, Gerland and Traumüller, *Geschichte der Physikalischen Experimentier Kunst* (Leipzig, 1899).

STEWARD (AS. *stigweard, stiweard,* from *stig,* pen for cattle, sty + *weard,* guard), LORD HIGH. The first of the great offices of State in England. Although of ancient origin, it owes its eminence to John of Gaunt (1340-99). It was hereditary in various lines until the accession of Henry IV. (1399), when it was merged with the Crown, and has since been in abeyance except when temporarily revived from time to time under the great seal *pro hac vice.* It is now revived only on the occasion of a coronation, when the Steward is of great ceremonial importance, or the trial of a peer by the House of Lords for treason or felony, when the Steward presides. The last session of this character occurred in 1901, before which the Lord High Steward's Court had not met for sixty years. When the proceedings are at an end, the Lord Steward terminates his commission by breaking his wand of office.

STEWART, stū'ĕrt. A Scotch and English royal family. See STUART.

STEWART, ALEXANDER TURNEY (1803-76). An Irish-American merchant, born at Lisburn, near Belfast, Ireland, of Scotch parentage. He entered Trinity College, Dublin, with the intention of studying for the ministry, but left before graduating and in 1823 emigrated to America. Settling in New York City, he taught school for two years, and in 1825, having fallen heir to a small legacy from some Irish relatives, he established himself in the dry-goods business. In 1848 he built the store at Broadway and Chambers Street, which at the time was the largest dry-goods store in the world. In 1862 he removed his retail business to a new store, which he erected at a cost of $2,750,000, at Broadway and Ninth and Tenth Streets, retaining his old store for wholesale trade. At the time of his death the business of A. T. Stewart and Company comprised branches and agencies in the principal cities of Europe, and several mills and factories in the United States.

STEWART, ALVAN (1790-1849). An American abolitionist, born at South Granville, Washington County, N. Y. After teaching in the Royal School of the seigniory of Saint Armand, Canada, in 1811-12, and practicing law at Utica, N. Y., he devoted himself chiefly to advocating temperance and the abolition of slavery. In 1835 he called together in Utica an anti-slavery convention that was dispersed by mob violence. According to William Godell, Stewart was the first to insist "on the necessity of forming a distinct political party to promote the abolition of slavery." When such a party was formed, he was its candidate for Governor, but was, of course, defeated. Years before Lincoln made his famous 'house divided against itself' speech or Seward his 'irrepressible conflict speech,' Stewart declared that "these States must necessarily be in eternal conflict until liberty conquers slavery, or slavery overturns the liberty of all." A collection of his speeches, with a slight memoir, was published by his son-in-law, Luther R. Marsh (New York, 1860).

STEWART, BALFOUR (1828-87). A British physicist and meteorologist. He was born at Edinburgh, and was educated at Saint Andrews University and Edinburgh University. After a brief career in business in 1856 he became connected with Kew Observatory, later (1859) being appointed its director. He was appointed professor of natural philosophy in Owens College, Manchester, in 1870, where he served until his death.

Professor Stewart's researches in radiant heat procured for him the Rumford medal of the Royal Society. He also devoted himself to the study of terrestrial magnetism and meteorological problems, particularly those connected with solar radiation. He was also a devout churchman and was a member of a committee appointed to promote the interchange of views of scientific men of orthodox religious opinions. In *The Unseen Universe,* a popular work written by Stewart in conjunction with Professor Tait, an attempt was made to combine theological doctrines with the scientific ideas then current to demonstrate the existence of the soul and of a transcendental universe. He published an *Elementary Treatise on Heat* (1866, 5th ed. 1888); *Lessons in Elementary Physics* (1871); *Physics* (1872); *The Conservation of Energy* (1875); and *Lessons in Practical Physics,* with W. H. Gee (vol. i., 1885; vol. ii., 1887).

STEWART, CHARLES (1778-1869). An American naval officer, born in Philadelphia, Pa. At the age of thirteen he shipped on board a merchant vessel as cabin boy, and in a few years rose to be captain of an Indiaman. In 1798 he entered the United States Navy as fourth lieutenant of the frigate *United States,* on which he served until 1800, after which he was given command first of the schooner *Enterprise* and then of the *Experiment.* Soon afterwards he captured the French schooner *Deux Amis,* and a few days later the schooner *Diane.* While on this cruise he captured the British privateer *Louisa Bridger* by a night action, but on discovering her nationality made suitable reparation. In 1804, in command of the *Siren,* he joined the Mediterranean Squadron. He then returned to the United States in command of the *Constellation,* and in 1806 was promoted to be captain. During the following years he was for a time in the merchant service, but he reëntered the navy, and at the outbreak of the War of 1812 aided Commodore Bainbridge in persuading the Administration to send the United States warships to sea instead of keeping them in New York Harbor. In 1813 he was transferred to the *Constitution,* which on February 20, 1815, captured two British war-vessels, the *Cyane,* 34 guns, and the *Levant,* 18 guns. Soon afterwards, however, he was surprised by a British squadron and the *Levant* was recaptured. He commanded the Mediterranean Squadron from 1817 to 1820, after which he was sent to the Pacific Station. On his return in 1823 he was tried by court-martial on a number of charges, but was acquitted. He commanded the Home Squadron in 1842-43, and for several years was commandant of the Philadelphia Navy Yard. In 1862 he was promoted to the rank of rear-admiral. During

the last seventeen years of his service he was senior officer of the navy.

STEWART, DAVID, Duke of Rothesay and Earl of Carrick. See ROTHESAY.

STEWART, Sir DONALD MARTIN (1824-1900). A British field-marshal. He was born near Forres, Elginshire; completed his education at Aberdeen University, and in 1840 joined the Bengal Army. He saw active service on the frontier; served with distinction during the Indian Mutiny at the sieges of Delhi and Lucknow; commanded the Bengal troops in the Abyssinian War in 1867-68; and from 1869 to 1874 was chief commissioner of the Andaman and Nicobar Islands. During the Afghan War in 1878 he was in command of the Kandahar field force, and in 1880 on his celebrated march from Kandahar to Kabul won the battles of Ahmed Khel and Urzu. As military and civil commander in Northern Afghanistan, he sent Sir Frederick Roberts on his famous march from Kabul to Kandahar, while he withdrew with the remainder of the army through the Khyber Pass.

STEWART, DUGALD (1753-1828). A Scottish philosopher, born in Edinburgh. He studied at the University of Edinburgh from 1765 to 1769. In 1771 he went to Glasgow, partly with a view to one of the Snell scholarships at Balliol College, Oxford, and partly to attend the lectures of Dr. Reid. It was there that he wrote an essay on dreaming, which was his first effort in mental philosophy and contained the germs of many of his subsequent speculations. He lived in the same house with Archibald Alison, the author of the *Essay on Taste*, and the two became intimate friends through life. He was at Glasgow only one session. In 1772, in his nineteenth year, he was called upon by his father, whose health was failing, to teach the mathematical classes in the University of Edinburgh; in 1775 he was elected joint professor, and acted in that capacity till 1785. In 1778 Adam Ferguson was absent from his post on a political mission to America, and Stewart taught the moral philosophy class in addition to his mathematical classes. On the resignation of Ferguson in 1785, he was appointed professor of moral philosophy, and continued in the active duties of the chair for twenty-five years. In 1792 appeared his first volume of the *Elements of the Philosophy of the Human Mind.* In 1793 he published his *Outlines of Moral Philosophy.* In 1806, on the accession of the Whig Party to power, he received a sinecure office worth £300 a year. In 1810 Stewart gave up his active teaching work and retired to Kinneil House, Linlithgowshire, which the Duke of Hamilton placed at his service. In the same year he published his *Philosophical Essays;* in 1814 the second, and in 1827 the third volume of the *Elements;* and in 1828 *Philosophy of the Active and Moral Powers.* He died in Edinburgh, June 11, 1828.

The philosophy of Stewart was the following up of the reaction against the skeptical results that Berkeley and Hume drew from the principles of Locke. Both Reid and Stewart professed the Baconian method of observation and induction, but considered that these processes of investigation could establish certain ultimate truths of a higher certainty than themselves. His collected works were edited by Sir W. Hamilton, in 11 vols. (Edinburgh, 1854-59), to which Professor Veitch contributed a biography.

STEWART, MATTHEW, Earl of Lennox (1516-71). A Regent of Scotland. He was born in Dumbarton Castle and was the son of John, third Earl of Lennox. After negotiations with Henry VIII. of England which resulted in treason to his own country, he married Henry's niece, Lady Margaret Douglas, and engaged in several fruitless expeditions in the attempt to bring Scotland under the control of England. When Mary Stuart came to the throne of Scotland, Lennox returned to his native country, was reinstated in his forfeited estates, and arranged the marriage between Mary and his eldest son, Henry, Lord Darnley (q.v.). After his son's murder he took an active part in the seizure and imprisonment of Mary in Lochleven Castle, and was provisionally appointed Regent on behalf of his infant grandson, afterwards James VI. He was appointed lieutenant-general of the kingdom and confirmed in the Regency after the assassination of Murray, in 1570; he led his forces against and gallantly defeated the Queen's supporters, capturing the castles of Doune and Dumbarton; and convened a parliament at Leith which was adjourned to be held later at Stirling. While on his journey to the latter town he was mortally wounded during a skirmish with some of the Queen's partisans.

STEWART, ROBERT, second Marquis of Londonderry, best known as VISCOUNT CASTLEREAGH (1769-1822). An eminent English statesman. He was the eldest surviving son of Robert, first Marquis of Londonderry, and was educated at Saint John's College, Cambridge. He entered the Irish Parliament in 1790 at the age of twenty-one. In 1796 he became Viscount Castlereagh; and in 1798 he was made Chief Secretary for Ireland. In suppressing the rebellion of that year he was resolute and energetic. In helping to bring about the Parliamentary union with England he made free use of English money in corrupting opponents of the plan. He entered the Imperial Parliament, and in 1805-06 was Secretary of State for the War and Colonial departments. Resigning on Pitt's death in 1806, he resumed the office of War Minister next year, and organized the disastrous Walcheren expedition (1809). Canning (q.v.), then Foreign Secretary, attacked Castlereagh on this account with much bitterness. The result was that both resigned, and a duel took place between them, September 21, 1809, in which Canning was wounded. After the assassination of Perceval in 1812, Castlereagh became Foreign Secretary, a post which he held during the period famous for the achievements of the Duke of Wellington. By this time the general direction of British policy was unalterably fixed by circumstances, and it was the merit of Castlereagh that he pursued this course with steadiness and even obstinacy. His personal influence and his untiring exertions kept together the coalition against Napoleon. He represented England at the Congress of Vienna in 1814-15, at the Treaty of Paris in 1815, and at the Congress of Aix-la-Chapelle in 1818. His foreign policy was favorable to the principles of the 'Holy Alliance' abroad and he constantly recommended despotic measures at home. As the leader of the Liverpool Government in the Lower

House, he carried the suspension of the Habeas Corpus Act in 1817. The 'Six Acts' of 1819 made him extremely unpopular. The retirement of Canning from the Ministry (1820) threw the whole weight of business on Castlereagh. By the death of his father in 1821 he became Marquis of Londonderry. The great toil and responsibility of his office deranged his mind, and he died by his own hand at his seat at North Cray Place, Kent, August 12, 1822. Consult his *Memoirs and Correspondence* (12 vols., London, 1848-53).

STEWART ISLAND. See NEW ZEALAND.

STEYN, stīn, MARTINUS THEUNIS (1857—). A South African statesman, the last President of the Orange Free State. He was born at Winbury, Orange Free State, and was educated at Grey College, Bloemfontein, and in Holland, after which he studied law at the Inner Temple, London, and was called to the bar in 1882. Returning to South Africa, he resided at Bloemfontein, where he at once gained distinction as a lawyer and in 1889 became State Attorney. In the same year he was elevated to the bench as second puisne judge, and in 1893 was appointed first puisne judge. In 1896 he was chosen by universal suffrage President of the Republic. His policy was at once manifested in an attempt to draw the two Boer States closer together, and the defensive alliance agreed upon by the Orange Free State and the Transvaal in 1897 had his hearty support. In the summer of 1899 he represented his State in the conference at Bloemfontein with Sir Alfred Milner (q.v.) and President Kruger (q.v.) in an attempt to adjust the difficulties existing between the British and the Boers. Upon the failure of negotiations and the breaking out of hostilities he at once called out the Free State troops to act in coöperation with those of the Transvaal. During the course of the war he continued actively assisting and advising the generals in the field, moving his capital from place to place. In May, 1900, after the British had annexed the Orange Free State by proclamation, he issued a counter-proclamation reasserting the State's independence, and calling on the burghers to continue their defense. After Kruger's departure for Europe he became the virtual head of the Boer forces in the field. He took part in the peace conference that led to a cessation of hostilities in 1902 and subsequently took up his residence in London.

STEYNE, LORD. A clever and wicked old nobleman in Thackeray's *Vanity Fair*, who is involved in a scandal with Becky Sharp.

STEYR, stīr, or **STEIER.** A town of Upper Austria, at the confluence of the Steyr and the Enns, 90 miles west by south of Vienna (Map: Austria, D 2). Its principal structures are the Gothic church (1443) and the palace of Count Lamberg (tenth century). It is an important centre of the Austrian iron and steel industry. There is here a large Government rifle factory; the manufactures are cutlery, leather, paper, woolens, hosiery, etc. Population, in 1890, 21,499; in 1900, 17,592.

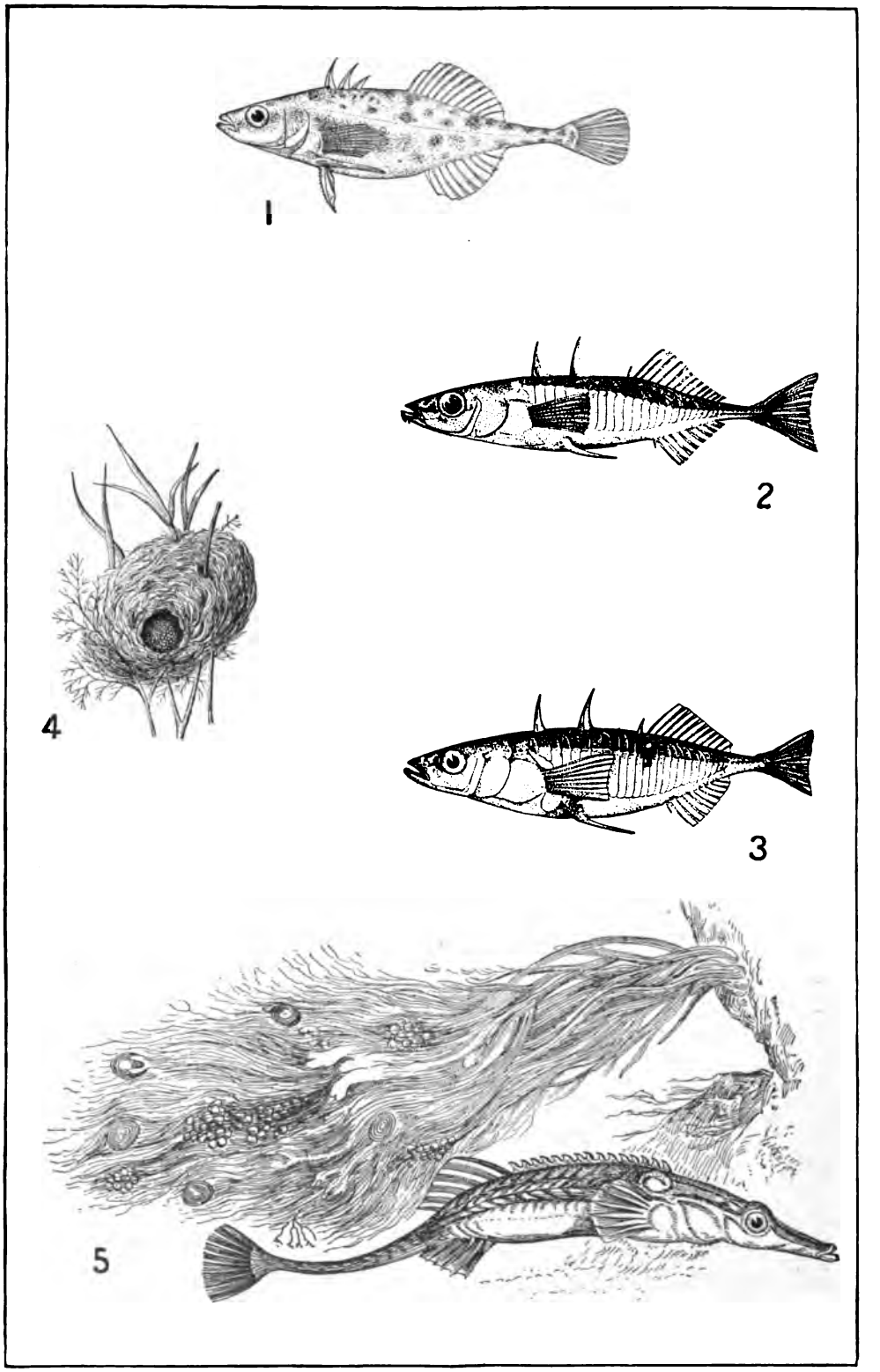
STIBNITE (from Neo-Lat. *stibium*, from Gk. *στίβι, stibi, στίμμι, stimmi*, sulphuret of antimony, probably from Egypt. *stm*, stibium). A mineral tri-sulphide of antimony crystallized in the orthorhombic system. It has a metallic lustre, and is red to steel-gray in color. It occurs with quartz, in beds or veins, in granite or gneiss, often with other antimony minerals and metallic sulphides. It is found in the Harz, Freiberg, Cornwall (England), Algeria, Borneo, Japan, and in the United States in Maine, New Hampshire, Maryland, Arkansas, and at various localities in California and Utah. It was used by the ancients for coloring the hair, eyebrows, etc. Stibnite is an important ore of antimony.

STICKLEBACK (so called from the sharp spines on its back). A general name for the small active fresh-water hemibranch spiny-rayed fishes of the family Gastrosteidæ, interesting because of their nest-building. They are natives of Northern America, Europe, and Asia. There are a dozen or so species, none exceeding six inches long. The body is slender and more or less compressed, without scales, but usually mailed with plates. The anterior dorsal fin is replaced by several strong, widely separated spines. The ventral fin consists of a strong spine and one or two rudimentary rays. The typical form is the common European stickleback or 'burnstickle' (*Gasterosteus aculeatus*), represented in Eastern North America by the very similar or identical *Gasterosteus bispinosus*. It is four inches long, is olivaceous and dotted on the back, and has three dorsal spines. In the spring the male of this species builds upon the bottom of the stream a nest composed of bits of straw, sticks, leaves of plants, and sand, glued together by a secretion produced by a special gland. This secretion is drawn out into a silk-like thread by which the materials are entangled or woven together as the fish in moving about trails it after him. The completed shape is like that of a hand-muff, smooth inside, and with its openings in the direction of the current. When the house is completed the male induces a female to enter and deposit her eggs, a process lasting only a few minutes. The female then leaves by one of the openings and the male enters by the other to deposit milt over the eggs. In turn other females are invited in, until the nest contains layer after layer of eggs and milt. These the male guards with care against many enemies, until the young are hatched and able to shift for themselves. Sticklebacks are remarkably voracious and extremely destructive to the young fry of fishes. Consult authorities cited under AQUARIUM; and FISH. See the accompanying Plate of STICKLEBACKS.

STIELER, stē'lĕr, ADOLF (1775-1836). A German cartographer, born at Gotha, and educated at Jena and Göttingen. He was employed in the Government service at Gotha. His principal cartographic work, establishing a remarkable standard of accuracy and completeness, is *Der Handatlas* (1817), and his other publications include: *Schulatlas* (1821); *Kleiner Atlas der deutschen Staaten* (1876); *Taschenatlas* (revised by Habenicht, 1885); and *Deutschland, Niederlande, Belgien, Schweiz und angrenzende Länder* (1829).

STIELER, JOSEPH (1781-1858). A prominent German portrait painter, born at Mainz. Self-taught, he practiced miniature painting early in life, then studied at Würzburg under Christoph Fesel (1737-1805) and at the Vienna Academy under Füger. After painting portraits in Hungary and Poland, he spent two years (1807-9) in

STICKLEBACKS



1. COAST STICKLEBACK (Apeltes quadracus).
2. EUROPEAN STICKLEBACK (Gasterosteus aculeatus).
3. SALMON-KILLER (Gasterosteus cataphractus).
4. NEST OF EUROPEAN STICKLEBACK (Gasterosteus aculeatus).
5. SEA-ADDER (Spinachia spinachia) and its eggs hidden among the seaweed.

Paris, a pupil of Gérard, then worked at Frankfort and Milan, and in 1811 went to Rome, where he executed the large altar-piece "Liberation of Saint Leonhard" (Saint Leonhard's, Frankfort). Called to Munich in 1812, he portrayed all the members of the royal family, then in Vienna, where he remained from 1816 to 1820, the Emperor Francis and his consort, besides many notables, among them Beethoven (1819). After his return to Munich Stieler became the most fashionable portraitist of his day, among whose numerous paintings of royalties, statesmen, scholars, artists, and other celebrities may be noted the familiar portrait of Goethe (1828, New Pinakothek, Munich), reproduced in an earlier volume (see GOETHE), and the famous "Gallery of Beauties" (1827-47, Royal Palace, Munich).

STIELER, KARL (1842-85). A Bavarian dialect poet and author, born in Munich, son of the preceding. After studying law in his native city he undertook extensive travels, which he described in letters to the *Allgemeine Zeitung.* Afterwards he became State archivist in Munich. His poems, written in the dialect of Upper Bavaria and overflowing with fresh, delicious humor, appeared in the following collections: *Bergbleameln* (1865), *Weil's mi freut* (1876, 11th ed. 1896), *Habt's a Schneid'?* (1877), and others, all of which met with great favor, as did also his High German poems *Hochlandslieder* (1879, 8th ed. 1896), *Neue Hochlandslieder* (1883, 4th ed. 1892), and *Wanderzeit* (1882, 3d ed. 1893). Posthumously were published *Ein Winteridyll* (21st ed. 1897), *Kulturbilder aus Bayern* (2d ed. 1895), *Natur- und Lebensbilder aus den Alpen* (1890), *Aus Fremde und Heimat* (1886), and *Durch Krieg zum Frieden* (1895). For his biography, consult Heigel (Bamberg, 1891).

STIFF-NECK. See WRYNECK.

STIFTER, stĕf'tĕr, ADALBERT (1805-68). An Austrian poet, novelist, and painter, born at Oberplan, Bohemia. He studied law at the University of Vienna, but gave the preference to history, philosophy, and natural science, embraced the profession of teaching, and in 1850 was appointed superintendent of public schools in Upper Austria. His idyls and novelettes, collected under the title *Studien* (1844-51, 13th ed. 1895-96), rank with the best prose writings of his time, and from their first appearance evoked unstinted admiration. Their purely idyllic character, utterly alien to all worldly problems and tendencies, the masterly details in the author's original conceptions and descriptions of nature, constituted so grateful a contrast to the current belletristic productions as to atone for the merely accessory rôle assigned to the human element. The *Studien* were followed by *Bunte Steine* (1852; 9th ed. 1892); and the novels *Der Nachsommer* (1857) and *Witiko* (1865-67). His letters, with biography, were published by Aprent (1869). An edition of his complete works appeared in Prague (1901 et seq.). Consult: Kuh, *Zwei Dichter Oesterreichs* (Pressburg, 1872); and the biographies by Markus (Vienna, 1877), Pröll (Prague, 1891), and Stoessl (Berlin, 1902).

STIGMA (from Gk. *στίγμα, stigma,* mark, brand, puncture). In anatomy, a spot or mark on the skin or a small cicatrix; in botany, an

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mark). The generic name given to fossilized plant remains with pitted surfaces, found in the coal measures. They were first thought to represent a distinct species of plant, but they are now known to be the roots of Sigillaria and other trees that lived in Carboniferous times.

STIGMATIZATION (from ML. *stigmatizare*, from Gk. *στιγματίζειν*, *stigmatizein*, to mark, brand, from *στίγμα*, *stigma*, mark, brand, puncture, from *στίζειν*, *stizein*, to mark, puncture). The name applied to the impression on certain individuals of the 'stigmata' or marks similar to the wounds made in the body of Christ during His torture. These stigmata comprise not only the wounds of the hands and feet and of the side received in the crucifixion, but also those impressed by the crown of thorns and by the scourging. In some cases the stigmata have been only subjectively felt and could not be seen by others. In a few cases, wherein it has been claimed that the impression was made upon the heart alone, special marks have been found on that organ after death. The impression of the stigmata, being held in certain cases to be miraculous, was regarded as a mark of signal favor. The first and most remarkable example of stigmatization is that of Saint Francis of Assisi (q.v.). In his case these mysterious markings are said to have persisted for three years, until his death, and to have been seen by Saint Bonaventure and by several popes, and closely observed by multitudes after his death.

Since Saint Francis's time there have been many such cases. Dr. Imbert Gourbeyre in 1894 was able to collect 321 examples, in every century since the thirteenth, in every European country and in every station in life. While the great majority were religious, mostly Dominicans or Franciscans, many were not and some twenty were in the married state. Nearly 100 were reported during the nineteenth century. The most noteworthy of these are Anna Katherine Emmerich (died 1824) and Louise Lateau (1850-83) of Bois d'Haine, Belgium. This last case attracted great attention and provoked public discussion, in which the Salpêtrière school of neurology took the position that stigmatization is only a neurotic phenomenon in hysterical individuals. Dr. Lefebvre, an eminent physician, professor of medicine at the University of Louvain, who had been for many years in attendance at two insane asylums, after a prolonged investigation of Louise Lateau's case, pronounced it miraculous. On the other hand, Theodor Schwann, the distinguished biologist, also a professor at Louvain and himself a Catholic, refused after careful examination to admit the preternatural character of the phenomena. There seems no doubt that phenomena of a nearly similar kind have been produced by suggestion in susceptible individuals. In the *Comptes Rendus* of the Society of Biology of Paris for July 11, 1885, there is a report of a case in which bleeding through the unbroken skin was produced by hypnotic suggestion. Consult: Gourbeyre, *Les stigmatisés* (Paris, 1873); id., *La stigmatisation, l'extase divine et les miracles de Lourdes* (ib., 1894); Bourneville, *Le science et le miracle* (ib., 1878); Lefebvre, *Louise Lateau* (Louvain, 1870); Bourneville, *Louise Lateau* (Paris, 1875); Richer, *Etudes cliniques sur l'hystéro-épilepsie ou grande hystérie* (ib., 1881).

STILES, stīlz, EZRA (1725-95). An American clergyman and college president, born at North Haven, Conn. He graduated at Yale in 1746, was tutor there from 1749 to 1755, was ordained by the Congregational Church in 1749, and preached for a time to the Stockbridge Indians. Transient religious doubts induced him to abandon the ministry and study law (1752); and he was admitted to the bar in 1752, and practiced in New Haven in 1753-55. Returning to the ministry in 1756, he was pastor of the Second Church in Newport, R. I., in 1756-77, and during this period spent a large part of his time in literary and scientific studies, learning several European and Oriental languages and carrying on an extensive correspondence with learned men in many parts of the world. In 1777-78 he was pastor of the North Church, Portsmouth, N. H., and in 1778 became the president of Yale, which position he held until his death. In addition to his presidential duties, he occupied the chair of ecclesiastical history from 1780 to 1795, and lectured on mathematics, astronomy, natural philosophy, and mental and moral philosophy. Both during and preceding the Revolution he was an ardent patriot. Besides several orations and sermons, he published *An Account of the Settlement of Bristol, R. I.* (1785), and a rambling, diffuse *History of Three of the Judges of King Charles I.* (1794); while his *Literary Diary* and bound manuscripts preserved at Yale fill over 45 volumes. The diary edited by Dexter was published in 1901. Consult *Life*, by his son-in-law, Abiel Holmes (1798), and by J. L. Kingsley in *Sparks's American Biography*.

STILES, HENRY REED (1832—). An American physician and author, born in New York City. He was educated at the College of the City of New York, and at Williams, subsequently studied medicine, and practiced for a short time. In 1857 he began the publication of *The American Journal of Education*. In 1859 he resumed his medical practice, and in 1863 became librarian of the Long Island Historical Society. In 1873 he became superintendent of the New York Homœopathic Insane Asylum at Middletown, N. Y., and from 1877 to 1881 was director of the Homœopathic Dispensary at Dundee, Scotland. From 1882 to 1885 he was professor of mental and nervous diseases in the New York Woman's Medical College. His publications include: *The History and Genealogies of Ancient Windsor, Connecticut* (1859); *Monograph on Bundling in America* (1861); *The Wallabout Prison-Ship Series* (1865); and *The History of the City of Brooklyn, New York* (1867-70). He edited *Illustrated History of the County of Kings and City of Brooklyn* (1884).

STILETTO-FLY. A small, slender predatory fly of the family Therevidæ, frequently of varied color and closely resembling one of the robber-flies (Asiliidæ). It does not catch its prey on the wing as do the robber-flies, but lies in wait upon leaves and bushes and even upon the ground, springing on weaker insects as they approach. The larvæ are very long and slender, and live in rotten wood and in rich earth, and seem to feed upon both decaying animal and vegetable matter.

STILICHO, stĭl'ĭ-kō, FLAVIUS (?-A.D. 408). A Roman general, one of the most notable figures in the history of the sinking power of Rome and

the German invaders. He was the son of a Vandal who served as an officer in the Roman Army under Valens, Emperor of the East (364-378), and himself followed a military career, earning the special recognition of the Emperor Theodosius (379-395), who, in 383, sent him at the head of an embassy to the Court of the Persian King Sapor III. Here, though still a young man, he proved such a successful diplomatist that a very advantageous peace was at once arranged; and on his return to Constantinople, at the end of 384, he married Serena, the Emperor's niece, and received the titles of *comes stabuli sacri* and *comes domesticorum*. During the next decade he was engaged in military operations in various parts of the Empire, attaining the grade of commander-in-chief (*magister militum*) of the army in Thrace in 385, and directing the campaign in Britain against the Picts, Scots, and Saxons in the same year. In 386 he was battling with his Emperor against the barbarians on the banks of the Hebrus. In 392 he was most successful in campaigns against the Bastarnæ, Goths, Alani, and Huns, but was prevented from gaining greater glory by the jealousy of the Consul Rufinus, who exercised a great influence over the Emperor. In 394, however, he received a greater honor; for Theodosius made his own son Honorius *augustus*, giving him the sovereignty of Italy, Spain, Gaul, and Africa, and appointing Stilicho and Serena his guardians. Thus Stilicho found himself on a footing with his hated rival Rufinus, for he became the real ruler of the West, with headquarters at Rome, as the young Honorius was wholly indifferent to the cares of State. While Theodosius lived, Stilicho and Rufinus were forced to maintain a semblance of peace, but no sooner was he dead, in 395, than their rivalry broke out openly. Stilicho had the advantage of a stronger personality and a close connection with the Imperial family, for his daughter Maria was betrothed to his ward, the Emperor Honorius. After successful campaigns on the Rhine, he marched to the East, nominally to drive back the Goths and Huns, whom Rufinus had persuaded to invade the Empire, but really with the design of overthrowing Rufinus, and by connivance with these same Goths Stilicho procured his assassination at the close of 395. He was now the virtual master of the Empire, for Honorius and Arcadius, the joint Emperors, were mere puppets in his hands; but Stilicho never aspired to the throne for himself, remaining as yet loyal to the worthless son of his old patron. His attention, indeed, was now wholly occupied with the formidable invasion of the Goth Alaric, who had forced his way into the Peloponnesus with a great army, and was abetted by Arcadius from jealousy of Stilicho. Alaric was almost caught in a trap, but managed to escape northward, where he held his own for six years, often making predatory incursions even into Italy. At the end of 402 the final contest was fought out. Alaric had invaded Northern Italy, and the cowardly Honorius fled from Mediolanum (Milan) to Ravenna. Stilicho gathered all the available troops from the western provinces and made a brave stand. He was blockaded in Milan, but early in 403 he broke the blockade and won a victory over Alaric at Pollentia, near Turin, and another at Verona. Alaric withdrew from Italy, but retained his power at the Court of Arcadius. In 406 a new invasion threatened Italy. A countless horde of Germans and Celts was led down from the north by their chief, Radagaisus, who occupied the heights of Fæsulæ, above Florence, where Stilicho, by a brilliant movement, that was regarded as miraculous, hemmed him in and forced him to surrender. Radagaisus was treacherously put to death and all his followers were sold into slavery. This was the last great achievement of Stilicho. His ultimate downfall was due to his ambition to see his own son Eucherius on the throne of Rome; and in this he might have succeeded, had it not been for the wily Olympius, who gained influence over Honorius and warned him of Stilicho's designs. Honorius now for the first time showed signs of energy. He aroused the soldiers by a clever speech and won over many partisans of Stilicho, who, deserted by his friends, met death by assassination at Ravenna in 408.

STILL, JOHN (c.1543-1608). An English prelate, born at Grantham, Lincolnshire. He was educated at Christ's College, Cambridge. He became successively Margaret professor of divinity at Cambridge (1570), prebendary of Westminster (1573), master of Saint John's College, Cambridge (1574), Archdeacon of Sudbury (1576), master of Trinity College, Cambridge (1577), and Bishop of Bath and Wells (1593). To him has been ascribed on insufficient evidence *A Ryght Pythy, Pleasaunt, and Merie Comedie, intytuld Gammer Gurton's Nedle*, the second English comedy extant. It contains the spirited drinking song beginning "Backe and side go bare, go bare." On the authorship of the comedy, consult *Modern Language Notes* for June, 1892 (Baltimore).

STILLBIRTH. See ABORTION.

STIL'LINGFLEET, EDWARD (1635-99). An Anglican prelate, born at Cranborne, in Dorsetshire. He received his education at Cambridge. In 1659 he published the *Origines Sacræ, or Rational Account of the Christian Faith, as to the Truth and Divine Authority of the Scriptures*, a work which made his reputation, and is still esteemed as one of the most masterly treatises extant on the subject of which it treats. In 1664 appeared his *Rational Account of the Grounds of the Protestant Religion*, a defense of the Church of England from the charge of schism in its separation from Rome, which was received with great favor, and led to his appointment as preacher at the Rolls Chapel. In 1670 he became canon of Saint Paul's Cathedral, and in 1678 was made dean. After the Revolution of 1688 he received the appointment to the Bishopric of Worcester. Stillingfleet's chief works, besides those mentioned, were the *Origines Britannicæ, or Antiquities of the British Churches* and *The Doctrines and Practices of the Church of Rome Truly Represented* (1686; 3d ed. 1851), a standard work. His complete works were published in six volumes (London, 1710, with life by Richard Bentley, supplementary vol., 1735).

STILLINGIA, stĭl-lin'jĭ-ȧ (Neo-Lat., named in honor of Benjamin *Stillingfleet*, an English botanist of the eighteenth century). A genus of plants belonging to the natural order Euphorbiaceæ. The species are mostly trees or shrubs of tropical Asia and America, and of the islands of Bourbon and Mauritius. The leaves are alternate, petiolate. One species, *Stillingia sylvatica*,

queen's delight or yaw shrub, a perennial herb two to three feet high, is found from Virginia to Kansas and south to the Gulf. The root of this plant has been variously used in medicine. *Stillingia sebiferum* or *sapium*, the tallow tree of China, from the fruit of which the Chinese obtain tallow, and which was introduced into the East and the West Indies, has a trunk and branches like the cherry and foliage resembling that of the black poplar.

STILL LIFE. The name applied to that branch of art which concerns itself with the representation of lifeless objects such as game, fruits, flowers, vases, and house furniture. See PAINTING.

STILL'MAN, SAMUEL (1738-1807). An American clergyman. He was born in Philadelphia, Pa., removed to Charleston, S. C., in 1748, was ordained as a Baptist minister in 1759, and preached first at James Island (S. C.), then at Bordentown (N. J.), and finally at Boston. He was one of the incorporators of Brown University (1764). He was an exceedingly effective preacher, and just before and during the Revolutionary War exerted a powerful influence on the side of the Patriot Party. Among his published sermons are *A Sermon on the Repeal of the Stamp Act* (1766), *Election Sermon* (1779), *Masonic Discourse* (1785), and a *Sermon Occasioned by the Death of George Washington* (1799).

STILLMAN, WILLIAM JAMES (1828-1901). An American journalist, landscape painter, and author. He was born in Schenectady, N. Y., and after graduating at Union College took up landscape painting under Frederick Church. In 1849 he studied in England, where he was influenced by the Pre-Raphaelites, becoming acquainted with Turner, whose work he admired, and with Ruskin, whose influence upon his painting was a baneful one. In 1852 he was commissioned by Louis Kossuth to go to Hungary to carry away the Crown jewels which Kossuth had hidden during the Revolution. From there he went to Paris, where he studied under Yvon, and continued to practice painting until 1855, when he adopted journalism as his profession, devoting himself to political and artistic subjects. Stillman was United States Consul at Rome (1861-65), and at Crete (1865-69). From 1883 to 1885 he was art critic of the *Evening Post*, and from 1875 to 1885 correspondent on political affairs for the London *Times*. He lived in Italy from 1878 to 1898, after which he retired to Surrey, England, where he died in 1901. His published works include the *Cretan Insurrection of 1866-68* (1874), *On the Track of Ulysses* (1888), *Billy and Hans* (1897), *Francesco Crispi* (1899), a biographical study, and the *Autobiography of a Journalist*, with many interesting reminiscences. His most noted painting is the "Procession of the Pines" (1858). Stillman was also an expert photographer, and published series of views of Athens, the Acropolis, and the temples of Sicily.

STILL'WATER. The county-seat of Washington County, Minn., 18 miles northeast of Saint Paul, on the Saint Croix River and Lake, and on the Chicago, Milwaukee and Saint Paul, the Chicago, Saint Paul, Minneapolis and Omaha, and the Northern Pacific railroads (Map: Minnesota, F 5). It has a situation of great natural beauty at the foot of the celebrated 'dalles' of Saint Croix, cliffs which extend for 30 miles above the city. Stillwater has the Minnesota State Prison, a public library, a United States Government building, a fine city hall, Stillwater City Hospital, and Saint Joseph's and Saint Mary's convents. The city is known for its extensive lumber interests. There are breweries, foundries and machine shops, grain elevators, a brick yard, and manufactories of flour, wagons, boats, farm implements, boots and shoes, boxes, etc. The government, under the revised charter of 1891, is vested in a mayor, chosen every two years, and a common council. Stillwater was settled in 1843, was incorporated as a village in 1848, and was chartered as a city in 1854. Population, in 1890, 11,260; in 1900, 12,318.

STILLWATER, BATTLES OF. See SARATOGA, BATTLES OF.

STI'LO, LUCIUS ÆLIUS PRÆCONINUS (called also Philologus). A celebrated Roman grammarian. He was learned in both Greek and Latin and was an instructor of Cicero in rhetoric and of Varro in grammar. His sympathy with the aristocratic party led him to accompany Quintus Metellus Numidicus into exile at Rhodes in B.C. 100. His works include commentaries on the *Axamenta*, or Songs of the Salii, and the *Twelve Tables*, and a volume entitled *De Proloquiis*. The treatise *Ad Herennium*, generally found in editions of Cicero, has been conjecturally assigned to him.

STILT (Swed. *stylta*, OHG. *stelza*, Ger. *Stelze*, stilt, crutch). A large, handsome, long-shanked shore-bird of the genus Himantopus, related to the avocets. The common Old World species (*Himantopus himantopus*) is widely distributed. The American species (*Himantopus Mexicanus*) is common to both continents; and others are known in other parts of the world along seacoasts. They frequent muddy flats in small flocks, and walk with long, measured steps, seeking for food among the reeds, and catching small fishes in the pools and shallows. See Plate of BEACH BIRDS.

STILT-BUG. A plant-bug of the family Berytidæ, which includes very slender species with long, thin legs in which the thighs are thickened at the tip. Only six species are known to occur in the United States.

STIM'SON, FREDERIC JESUP (1855—). An American lawyer and author, born in Dedham, Mass. He graduated at Harvard in 1876 and at the Harvard Law School in 1878, and began practice in Boston. In 1884-85 he was Assistant Attorney-General of Massachusetts, and in 1899-1901 general counsel to the United States Industrial Commission. He is best known as the author of law books, including *American Statute Law* (2 vols., 1886), the standard work on the subject; *Stimson's Law Glossary* (1890); *Government by Injunction; Labor in Its Relation to Law* (1894); *Handbook to the Labor Law of the United States* (1895); and *Uniform State Legislation* (1896). Under the pen-name of "J. S. of Dale" he also wrote several novels and short stories.

STIMULANTS (from Lat. *stimulare*, to urge, prick, from *stimulus*, goad, incitement; connected

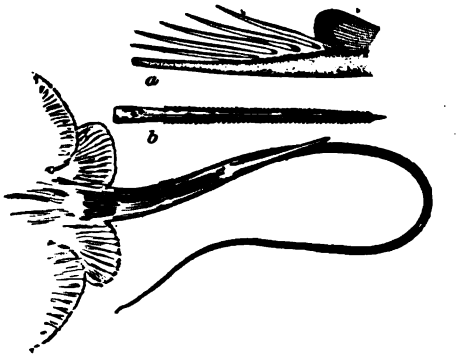
with Gk. *στίζειν*, *stizein*, to pierce, Skt. *tij*, to be sharp, OHG. *stehhan*, Ger. *stechen*, Eng. *stick*). Agents which increase temporarily the functional activity of the organism as a whole or of the various organs of the body. These may be cardiac, respiratory, nervous, hepatic, renal, gastric, etc., depending on the organ or system affected. Stimulants embrace a wide range of therapeutic agents, but popularly the term is applied to those acting especially on the circulatory, respiratory, and nervous systems. Alcohol is the most generally employed, in the form of whisky, brandy, or wines. The various preparations of ammonia, inhaled or given as the aromatic spirits of ammonia, are very serviceable diffusable stimulants. Ether may be taken as an inhalation, a hypodermic injection, or in solution by the mouth, and acts rapidly. Among the other general stimulants may be mentioned camphor, strychnine, lavender, ginger, peppermint oil, and the other essential oils. This class of remedies is useful in fainting, hysteria, shock, and similar conditions.

STIMULUS (from Lat. *stimulus*, goad, incitement). A mechanical, molecular, chemical, or ethereal change in the conditions external to a plant cell or to the plant body, which produces a change (reaction) in the cell, a particular organ, or the whole plant. Mechanical stimuli, due to the mass movement of the external agents, are contact, pressure, traction, friction, torsion, etc. (See MOVEMENT; THIGMOTROPISM; TENDRIL.) In the absence of knowledge as to its nature, gravity may be included in this group, since it depends upon the mass of the body acting (the earth), although it is not in itself mechanical. (See GEOTROPISM.) Molecular stimuli depend upon molecular movements. Osmotic pressure has been proved capable of acting as a stimulus. The reactions of organisms to solutions of varying concentration are interpreted as due not to the chemical nature but to the number or impact of the solute molecules, since they are alike with all substances of the same osmotic pressure. (See OSMOSIS.) Chemical stimuli depend not upon the mass, but upon the chemical composition of the body acting. They are, therefore, almost as various as chemical compounds, although many substances are nearly or quite inert. The most common acting upon plants are water, organic acids, mineral salts and other solutes in the water. (See CHEMOTROPISM.) Ethereal stimuli are propagated in the ether, light and heat. (See HELIOTROPISM; THERMOTROPISM.) Here also may be included electricity, whose action in nature is little understood. (See IRRITABILITY.)

STINDE, stĭn'de, JULIUS (1841—). A German humorist. He studied and practiced chemistry, became editor of a Hamburg trade journal, contributed to periodicals, and was gradually drawn wholly to literature, wherein he won popularity by *Buchholzens in Italien* (1883), *Die Familie Buchholz* (1884, translated), a second part of this (1886), *Frau Buchholz im Orient* (1888), *Frau Wilhelmine Buchholz' Memoiren* (1895), and *Hotel Buchholz, Ausstellungserlebnisse* (1896). His other writing, dramatic and otherwise, is of slight worth, but in the *Buchholz* series the lower middle class of Berlin is depicted with a fresh, genial, healthy humor.

STING (from AS. *stingan*, Goth. *us-stiggan*, to push out; connected with OHG. *stanga*, Ger. *Stange*, obsolete Eng. *stang*, sting). An organ possessed by various kinds of animals, by means of which they not only inflict a mechanical wound in their prey, but also insert into it an irritant or poisonous chemical. Stinging or nettling cells (see NEMATOCYST) occur in all the Cœlenterata except ctenophores, in some tubularian worms, and on the cerata of the nudibranch Eolis. The sting of scorpions (q.v.) is in the tail. The poison, secreted by a gland, exudes through small openings into the wound, and is powerful enough to cause death in the small natural prey. Among insects, several forms are provided with a sting. This organ, which is of especial use as a means of defense to the so-called aculeate Hymenoptera, a group which includes the bees, wasps, and many ants, and to the Mutillidæ or 'cow-ants' or 'velvet ants,' is simply a modified ovipositor connected with a poison gland. The sting of a bee consists of three distinct pieces: two barbed needles and one gouge-like piece, the 'director;' the needles move up and down on the director, controlled by muscles attached to their bases. In the anterior part of the director there is a slight projection on the needle which catches a bit of the poison in the chamber and carries it to the wound. The director itself is composed of a united pair of stylets, and without the director is a third pair of stylets which are thick and hairy. (See INSECTS, section on *Poisonous Insects*.) The poison is secreted by poison glands which pour their poison into the chamber. The poison of the bee is said to be secreted by two glands, one producing an acid and the other an alkaline fluid. Only acid poison glands are said by some investigators to be present in those wasps which only stupefy the prey that they store up for the nourishment of their young.

STING-RAY, or **STINGAREE**. A ray (q.v.) of the family Dasyatidæ, characterized by the usual possession of a long whip-like tail, bearing near its base one or more long, strong, sharp spines retroversely serrated. When broken off the spine is replaced by the coming forward of one of a succession growing behind it. The family includes about fifty species, inhabitants of the warmer seas, some species occurring in the fresh waters of

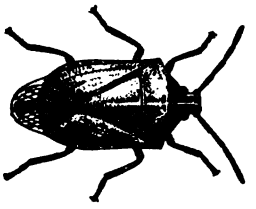


TAIL OF A STING-RAY.

a, enlarged view of the base of the tail of a sting-ray, having several spines; *b*, a single spine, barbed on both sides.

Northern South America, some of which are ten or twelve feet in length. They are generally much dreaded because of the ugly wound they are capable of inflicting with the spine or 'sting.' The sting is not poisonous, as is frequently supposed, although the mucous secretions of the skin may be responsible for the serious inflammations frequent in the wounds. See RAY and accompanying Plate; DEVILFISH.

STINK-BUG. Any one of the heteropterous insects of the family Pentatomidæ, very many of which are protected from their natural enemies by a nauseous, penetrating, and persistent odor, which remains with berries over which these bugs may have walked. The family is a large one and 4000 species have been described, of which 300 are found in the United States. They are broad, flat insects with five-jointed antennæ, and are usually green, gray, or brown, although some have a brilliant combination of black and red or yellow and black. They vary strangely in habit, some species being exclusively carnivorous and others exclusively plant-feeders, while others seem to feed indifferently upon the juices of plants or upon other insects. See SOLDIER-BUG.



A STINK-BUG.

STINT (from AS. *styntan*, to make blunt, short, from *stunt*, dull, stupid). One of the small sandpipers (q.v.) of the genus Tringa. The American stint (*Tringa minutilla*) is the smallest of the sandpipers, less than 6 inches long, breeds only in the Arctic regions, and is common throughout North America during the migrations. The plumage in summer is variegated bright bay, blackish, ashy and whitish above, whitish beneath; in winter the color is simply ashy above, whitish beneath.

STIPA. See FEATHER-GRASS.

STIPENDS, CLERICAL (Lat. *stipendium*, tax, tribute, salary, from *stips*, gift, donation + *pendere*, to weigh out). A general designation of the means of support provided for the clergy. There have developed in Western civilization five general methods of providing clerical support, together with all sorts of combinations of those methods. Those methods may be defined as those of (1) voluntary offerings, (2) tithes, (3) endowments, (4) State aid, and (5) contracts. No country shows any one method prevailing to the exclusion of the others. Without doubt the earliest method of supporting a priesthood was by means of voluntary contributions. Tithes (q.v.) were commanded of Hebrews by revelation, and the system continued in Christian times. State aid may be considered as of two kinds, the direct and the indirect, the latter to be considered first, as of the greater antiquity. When the political power under the Emperor Constantine came openly to the support of the Christian religion one of the first results of the friendly coöperation of the State was the legal capacity given to the churches in a corporate character to receive gifts *inter vivos* and by bequest, and to hold the same in perpetuity. This was an indirect method of State aid. Direct State support of the clergy is a comparatively modern institution, which has developed since the Reformation era. It is now in operation in those European States of Roman Catholic allegiance which have entered into a treaty, technically known as a concordat, with the See of Rome for the support of the clergy. Such treaties came about as a return for the sequestration of the older ecclesiastical endowments in land. France, Spain, Portugal, and Austria give such direct support to the Roman Catholic clergy. The Protestant German and Scandinavian States furnish a like support to the Protestant ministry. Russia supports the hierarchy of the orthodox Church. A similar system of direct State support prevails in the Central and South American States for the Roman Catholic clergy, and under Spanish rule prevailed also in Cuba, Porto Rico, and the Philippines. The fifth method, that of contracts, is essentially American. It consists first of a contract between a local church (in the Protestant denominations) and its minister for the payment of a definite sum for his support, and then a series of contracts between the church as a corporation and the attendants at public worship for the rental of pews and sittings. As a reaction from this method has developed what is known as the 'free church' movement, which seeks to abolish pew rentals and to substitute systems of voluntary contributions.

STIPPLE (from Dutch *stippeln*, to speckle, from *stippen*, to dot, prick, from *stip*, point, dot), or STIPPLING. In engraving, a process of producing light and shade, and sometimes color, by means of points, dots, or small, short marks, hardly to be considered lines. In water-color work the dots of color inevitably run together, so that the process is somewhat like cross-hatching in ordinary drawing. This is a process used by artists who are in search of very minute detail. See LINE ENGRAVING and ETCHING.

STIPULATION (Lat. *stipulatio*, bargain, *stipulare*, to bargain, covenant). In law, a material clause or provision in a contract. The term is also sometimes applied to a written agreement between attorneys as to some matter of practice. In admiralty practice it is a bond or undertaking filed with the court by one of the parties to an action or proceeding. A libellant must file a stipulation for costs. When a vessel is attached under a libel, the owner must file a 'stipulation for value' to obtain her release. See BOND.

STIRLING, stĕr'lĭng. A river-port and capital of Stirlingshire, Scotland, on the Forth, 35 miles northwest of Edinburgh (Map: Scotland, D 3). The rich agricultural, mining, and manufacturing districts around it are the main basis of its prosperity. Situated at the head of navigation of the Forth, Stirling, strongly fortified by nature, was the key to the Highlands. It owes its origin to the strong natural fortress of Castle Hill, crowned by the venerable castle, which commands an extensive view of great beauty. From this hill, covering the declivity which slopes north and eastward to the plain, extends the oldest part of the town. Stirling Bridge, which existed in 1571, was until recent years the only one by which wheeled carriages could cross the Forth. Noteworthy are the East

and West Churches—the former erected by James IV. about 1494—and 'Mar's Work,' an incomplete and richly ornamented structure, built in 1572. Ropes, malt, leather, soap, and mineral oils are manufactured. Vessels of one hundred and fifty tons can reach the port of Stirling, but its river trade has decreased since the advent of railroads.

Stirling (formerly *Stryvelyne*, or *Estrivelin*) is one of the most ancient and historically important towns of Scotland. Alexander I. died in the castle in 1124. Near by, the battle of Stirling was fought in 1297. (See WALLACE, WILLIAM.) The town was taken by Edward I. after a siege of three months, in 1304. In the vicinity, at Bannockburn (q.v.), the famous battle of that name was fought in 1314. The castle was the birthplace of James II. and of James V. James III. built the Parliament House in the castle, and otherwise improved and embellished the fortress. James V. built the palace, the walls of which are profusely covered with grotesque ornamentation. In the older part of the castle is the 'Douglas Room,' in which William, Earl of Douglas, was assassinated by James II. In 1651, after the battle of Dunbar, the castle was taken by Monk; and it withstood a siege by the Highlanders in 1745. Population, in 1891, 16,800; in 1901, 18,403. Consult: *History of the Chapel Royal of Stirling* (Grampian Club, 1882); *Charters of Stirling* (1884).

STIRLING, EARL OF (1726-83). See ALEXANDER, WILLIAM.

STIRLING, JAMES (1692-1770). A mathematician, born at Garden, Stirlingshire, Scotland. He was educated at Glasgow University and Balliol College, Oxford. He was expelled from Oxford (1715) on account of his relations with the Jacobites, and went to Venice, where he took up the study of mathematics. It was during his residence in Venice that he wrote his work *Lineæ Tertii Ordinis Newtonianæ* (1717), and his paper *Methodus Differentialis Newtoniana Illustrata*, which was communicated to the Royal Society through Newton (*Philosophical Transactions*, 30: 1050). Stirling returned to London in 1725 and devoted himself to the teaching of mathematics, enjoying the friendship of Newton and corresponding with many of the noted mathematicians of the day. His greatest contribution to mathematics was his *Methodus Differentialis, sive Tractatus de Summatione et Interpolatione Serierum Infinitarum* (1730; 2d ed. 1764; English trans. 1749).

STIRLING, JAMES HUTCHINSON (1820—). A Scottish philosopher, born at Glasgow, January 22, 1820; studied arts and medicine at the Glasgow University. He practiced medicine for some years, but soon gave up medicine to study philosophy. He published *The Secret of Hegel* (1897); a translation of Schwegler's *History of Philosophy* (1867); *As Regards Protoplasm* (1869); *Lectures on the Philosophy of Law* (1873); *Text-Book to Kant* (1881); *Philosophy and Theology* (1890); *Workmen and Work* (1894); etc.

STIRLING-MAXWELL, Sir WILLIAM (1818-78). A Scotch author, born near Glasgow. He bore the name of Stirling until 1866, when by the death of Sir John Maxwell, his maternal uncle, he succeeded to a baronetcy and

form was the *stoa diple*, in which a row of columns replaced the dividing wall. The forms of the stoa multiplied; two inner rows of columns were often used and additional stories were added. The stoa originated among the Ionian Greeks in Asia Minor, whence they were introduced into Greece. Celebrated examples were the simple Stoa Poikile (many-colored) upon the marketplace of Athens, the walls of which were decorated with scenes from the battles of Marathon and Œnoë by Polygnotus; the *stoa diple* of Thoricos; the three-aisled "Basilica" of Pæstum; and the two-storied stoa of King Attalus II. at Athens. Stoas were frequently adorned with statuary and painting.

STOAT. The British name for a weasel (q.v.).

STOBÆ'US, JOANNES (Lat., from Gk. Ἰωάννης ὁ Στοβαῖος, *Iōannēs ho Stobaios*). A Greek writer, apparently a native of Stobi, in Macedonia. The date at which he lived is not certain, but was probably about A.D. 500. To him we owe the preservation of a large number of our fragments of over five hundred early Greek poets and prose writers. This excerpt work in four books bore the name *Florilegium* (Ἀνθολόγιον), but in the course of the Middle Ages was divided into two parts, one of which is known as the *Eclogæ*, the other as the *Florilegium*. The best critical edition is by Wachsmuth and Hense (Berlin, 1884-94).

STOCK (AS. *stocc*, OHG. *stoc*. Ger. *Stock*, post, trunk; probably connected with Skt. *tuj*, to thrust). In corporation law, the rights or interest which the organizers of a corporation, or persons who contribute to its capital, have in its assets, franchises, management, and profits. The amount fixed by the charter of a corporation as the sum which is to be paid into its treasury for use in its business operations is called the *capital stock*. The latter term is sometimes inaccurately applied to the actual property owned by a corporation, as the capital stock of a corporation may not represent its actual assets, even at the time of its organization. The total capital stock of a corporation is divided into shares, which are represented by certificates, and the latter are distributed to subscribers according to the amounts of their respective subscriptions. Shares of stock may be made of any value, the par value being fixed by dividing the number of shares issued into the total amount of capital stock. The usual par value is $100, but shares representing other sums, even so small as $1 each, are sometimes issued, especially in industrial enterprises. Many States require stock to be issued at its par value.

Treasury stock is that which is not allotted to subscribers, but retained by the corporation for the purpose of selling it from time to time to raise funds.

Stock may be divided into *preferred* and *common* shares. The amount in dividends which the former can receive in each year is usually fixed and certain, and if more is paid as dividend it must be paid on the common stock. Preferred stock may be *cumulative* or *non-cumulative*. If the former, any deficiencies in dividends in one year must be made up later, before a dividend can be declared on the common. For example, if 7 per cent. cumulative preferred stock is issued, and the earnings are only sufficient to pay 5 per cent. on it in a given year, the deficiency of 2 per cent. must be made up later. If such stock were non-cumulative, the preferred stock would only receive 5 per cent. for that year, even though the earnings the next year were sufficient to pay 15 per cent. on the amount of the capital stock, and an 8 per cent. dividend were declared on the common stock.

The name of each person to whom a share of stock is issued is entered upon the books of the corporation.

Shares of stock are transferable by assignment, and the transferee obtains a right to have his name entered upon the books of the company as a stockholder in the place of his transferrer. However, shares of stock are not negotiable instruments in the strict sense of that term, but they are commonly indorsed in blank and transferred from one person to another as if such transfer were protected by the same rules of law. For this reason the courts in the United States generally protect an innocent purchaser for value, on the ground of estoppel. The English courts do not go so far in this respect, and the only safe course there is for a purchaser of stock to have the transfer entered on the books of the corporation immediately. Dividends are paid to the record owner of stock irrespective of who holds the certificates. A record owner of stock is called a stockholder. See Cook, *Stock and Stockholders* (New York, 1887); Dos Passos, *The Law of Stock Brokers and Stock Exchanges* (New York, 1882); also CORPORATIONS and authorities there cited.

STOCK (so called from its woody stem), GILLIFLOWER, or GILLYFLOWER (*Matthiola*). A genus of about thirty species of herbs or half shrubs of the natural order Cruciferæ, natives of the Mediterranean regions. Most of the species are thickly clothed with white or grayish stellate



STOCK (*Matthiola incana*).

hairs; the fragrant, generally beautiful flowers are in racemes; the pods are cylindrical or compressed. *Matthiola incana*, indigenous in Southern Europe, is probably the parent of the greater number of the cultivated hoary-leaved kinds known as Brompton stock, etc., while those

with smooth leaves, called ten-week stock, German stock, etc., are referred to *Matthiola fenestralis*, which, perhaps, is a mere variety of the one species *Matthiola incana*. The sandy shores of Wales and of Cornwall produce a species (*Matthiola sinuata*) the large purple flowers of which are fragrant only at night, a characteristic also of several other species. Stocks are generally raised by gardeners from seed. The hoary-leaved stocks are usually treated as biennials, although they may almost be reckoned perennial. The smooth-leaved stocks are treated as annuals.

STOCKADE. A means of defence consisting of stakes, logs, timbers, tree trunks, etc., firmly set in the ground and adjoining each other, and provided with loopholes through which the fire of the defenders may be delivered. Stockades are one of the oldest forms of fortifications, having done duty since the time of arrows and javelins, and are still useful as a protection against musketry fire under certain circumstances, though of course valueless when subject to attack by artillery. As the logs, etc., are usually considerably higher than a man's head and are sharpened on the top, stockades are also valuable as obstacles and can be defended readily. It is essential that the logs or timber should be firmly planted and bound together and reinforced by horizontal timbers or logs, earth, rails, or other material at the engineer's command, while the loopholes must be advantageously placed. Stockades may be useful where timber is plentiful, but their construction involves considerable labor and skillful working of timber. For details of construction of stockades and other field defences, consult Beach, *Manual of Military Field Engineering* (3d ed., Kansas City, 1897). See FORTIFICATION.

STOCK'BRIDGE. A North American Indian tribe. See MAHICAN.

STOCKBRIDGE. A town, including two villages, in Berkshire County, Mass., 17 miles south of Pittsfield, on the Berkshire Division of the New York, New Haven and Hartford Railroad (Map: Massachusetts, A 3). It is picturesquely situated in the Berkshire Hills. Noteworthy features are the Bell Tower, commemorating the early Indian Mission; a fine park, the gift of Cyrus W. Field; the Edwards Monument, the Indian Burial Ground, Williams Academy, and the Jackson Library and Reading Room. In the vicinity are Ice Glen, a narrow gorge, with caves whose sides are coated with ice all the year; Prospect Hill, commanding an extended view; and Lake Mahkeenac, near which are the remains of the house where Hawthorne wrote the *House of the Seven Gables* and other works. Population, in 1890, 2132; in 1900, 2081.

An Indian mission was established here in 1736, and three years later the place was incorporated as a town under its present name (from Stockbridge, England). Jonathan Edwards was a missionary here from 1750 to 1758, and here he wrote his most famous works. In 1785 the Indians moved to New Stockbridge, N. Y. Consult: Jones, *Stockbridge Past and Present* (Springfield, 1854), and *History of Berkshire County* (New York, 1885).

STOCKBRIDGE, HENRY (1822-95). An American political leader, born at North Hadley, Mass. He graduated at Amherst College in 1845 and was admitted to the bar in Maryland in 1848. He remained loyal to the Union during the Civil War, and in 1864 became a member of the State Legislature. He was a member of the Constitutional Convention which met to decide the question of the abolition of slavery in the State, was active in securing the adoption of the Constitution framed by its members, and defended it before the courts. It was largely by his exertions that the indentures of apprenticeship, which threatened to take the place of slavery, were omitted from the statutes, and enfranchisement secured, without possibility of evasion, to the negroes of Maryland.

STOCKDOVE (so called either because formerly regarded as the parent stock of the domestic pigeons, or because it breeds in the trunks of trees). A wild pigeon (*Columba œnas*) of Europe, gray, with a burnished metallic purple breast, scarlet eyes, orange-colored bill, and red legs. It is about fourteen inches in length.

STÖCKER, stĕ'kĕr, ADOLF (1835—). A German theologian and politician, born in Halberstadt. He studied theology and philosophy in Halle and Berlin, entered the ministry, and in 1874 became cathedral preacher and Court pastor in Berlin. In 1879 he was elected to the Prussian Chamber of Deputies, and from 1881 till 1893 he was a member of the Reichstag. During this period he was a leader of the agitation against the Jews. In 1890, because of his activity as a Socialist agitator, he was removed by the Emperor from his position as pastor of the Court. Six years afterwards, with a considerable number of followers, he seceded from the Conservative Party, to which he had hitherto belonged, and organized the Christian Socialists. In 1892 Dr. Stöcker became the editor of the *Deutsche evangelische Kirchenzeitung*. Among his published works are: *Christlich-Social* (1884 and 1890); *Wach' auf evangelisches Volk!* (1893); and *Dreizehn Jahre Hofprediger und Politiker* (1895).

STOCK EXCHANGE. An institution where sales and purchases may be made of securities of corporations and municipalities, and in some cases of certificates representing commodities of trade, such as silver bullion, petroleum, etc. In their origin stock exchanges appear to have been free to the use of any one who wished to buy or sell, and it was probably with this function in view that some of the older exchanges, notably the Paris Bourse, were located in buildings erected at the public expense. It was very quickly discovered, however, that in order to enforce bargains some formal organization was necessary. Membership in stock exchanges therefore came to be limited on the general basis used by clubs or other associations. As the profits of the use of the exchange became large possession of a membership became a valuable privilege.

The London Stock Exchange has for many generations occupied the most conspicuous place in the history of finance, for the reason that transactions on its floor were conducted by the great aggregation of capital, home and international, which made its abiding place in that city. Originally confining its dealings to British Government stock, the London Exchange became active, at the opening of the nineteenth century, in securities of other nations which applied to

London capitalists for the placing of their public loans. To this class of securities were later added railway shares. After 1888 stocks of incorporated industrial enterprises, and more recently of mining and exploration companies, grew into high favor, the Stock Exchange merely acting as the medium for the transfer of such shares from the hands of the capitalists behind the enterprise to those of the general public.

The New York Stock Exchange devoted itself during most of its history almost exclusively to securities of railway enterprises, even the dealing in United States Government bonds and in other American public securities being chiefly conducted outside of the Exchange. In recent years, however, along with the development of the London movement of industrial incorporation, the New York Stock Exchange has been largely utilized for the exploiting of shares of American companies of this nature. This movement, which flagged during the hard times of the early nineties, was renewed in enormous volume during the great 'boom' in trade which followed 1897. In the course of this time listing of industrial securities on the New York Exchange attracted an immense business to that branch of its activities. The New York Stock Exchange has never dealt to any noteworthy extent in foreign securities, thereby reflecting the general tendency of American investors. Even the large purchases of British consols by American bankers during the Exchequer's loan issues of 1900, 1901, and 1902 were disposed of privately, and were never allowed a place in the formal trading of the Stock Exchange.

There has been some rather notable diversity in the business of the New York Exchange and other American exchanges. For example, the Philadelphia Stock Exchange has long been noted as the market for various street-railway securities. This was because Philadelphia capitalists had interested themselves particularly in that form of investment. For similar reasons the Boston Stock Exchange, though not an organization which commanded the resources and capital of New York, monopolized for many years, and largely controls now, the trading in shares of copper-mining companies.

Stock exchanges of Continental Europe have in general devoted themselves to transportation enterprises of their own countries, to their own Government's securities, and to securities of other European governments which came to those markets to raise capital. More recently the stock exchanges of Paris, Berlin, and Vienna have followed London's example in taking up on a large scale shares of incorporated industrial enterprises. This has been particularly true of Berlin, where the iron industry has been extensively exploited in this form.

HISTORY. Stock exchanges as an institution had their origin at the time of the creation of public debts on the modern plan, at the close of the seventeenth century. The incorporation of the East India Company in London further developed the possibilities of the raising of public capital for corporate uses through the medium of stock-exchange trading. In 1720 the enormous public speculation in the shares of the South Sea Company in London and of the Mississippi Company in Paris brought stock-trading to a height never before conceived of. No city at that time, however, possessed a stock exchange in the sense now attached to the term. In London transactions in stocks were conducted through stock brokers, whose headquarters were at Jonathan's and Garraway's Coffee Houses in 'Change Alley. There does not appear to have been any formal organization among these brokers. Addison in the *Spectator* speaks humorously of having been taken for one of their number by the stock-jobbers at Jonathan's. The London Stock Exchange Building was not erected until 1801; the Paris Bourse not until 1826. The New York Stock Exchange membership, even after it had become a formal organization, conducted its business in hired rooms until December, 1865, when the building was erected on Broad and Wall Streets, which has been replaced by the new structure on the same site, dedicated in April, 1903. The history of stock exchanges is very largely a mirror of the financial history of the community in which they are situated. The New York Stock Exchange rose to a position of real prominence only after the Civil War. Even at that time the fact that it did not deal in gold as a commodity threw a great part of the community's highly speculative business over to the Gold Exchange, which was formed for that purpose exclusively. The dramatic incident of this period was the gold panic on Black Friday in September, 1869, when a combination of several unscrupulous speculators, among them James Fisk, Jr., and Jay Gould, attempted to corner and put to extravagant figures the gold supply of the market. Operations on the Stock Exchange proper at that time were largely made up of the personal struggles of rival capitalists, notably in connection with the Erie and New York Central railroads.

The completion of the Pacific Railway (1869) caused extensive speculation in shares of the two transcontinental railways, and as capital increased and the railway mileage of the country extended the transactions of the Exchange became of a national rather than provincial character. The leading operators of that time were Gould, Fisk, Daniel Drew, Cornelius Vanderbilt, and their associates. None of the capitalists named was accustomed to trade personally on the Stock Exchange; indeed, such a practice has always been the rare exception among active financiers.

The crisis of 1873 was felt in its full force on the New York Stock Exchange, which was obliged to close for two days at the height of the panic in order to stem the tide of liquidation in securities. With the great trade revival which followed the resumption of specie payments and the profitable grain harvests of 1879 the New York Stock Exchange entered upon a period of renewed activity. During the year 1880, which marked the climax of the 'boom' of that period, trading on the Exchange reached an enormous volume, and the value of seats in the Stock Exchange rose to an unprecedented figure. In 1881, when a reaction in the tide of prosperity began, the New York Stock Exchange reflected the change by a contraction in the volume of business done and by an extensive fall in prices. Speculation by the general public was again rife in 1882, but was checked with great violence by the sudden fall in railway and industrial profits at the close of the year. The severe reaction of 1883 was followed by the panic of May, 1884,

in which half a dozen Stock Exchange houses failed and two important banks were compelled to close their doors.

The period from 1886 to 1888 inclusive was chiefly marked by the large issues of securities to provide funds for the very extensive railway building then in progress. There were several excited markets on the Stock Exchange, though the tendency at the close of the period was toward depression of values, largely because of the enormous creation of new securities. The year 1890 was again marked by great activity and rising prices on the Stock Exchange. This 'boom' was checked by the Baring panic of November, 1890, in London, which was reflected by a prompt recall of English capital from the United States, and by a New York Stock Exchange panic, in the course of which two or three broker houses failed. From then until the outbreak of the more serious panic of 1893, a shrinkage in business was the chief characteristic of the New York Stock Exchange's history.

The panic of 1893 was in many respects one of the most dramatic episodes in the Stock Exchange history. There was at one time, during July of that year, talk of repeating the expedient of 1873 and closing the Exchange. This turned out to be unnecessary, as foreign capital came to the market's relief in the moment of emergency. The following year, 1894, was a period of great depression, when the volume of Stock Exchange business fell to the lowest point since 1878. Recovery followed in 1895, when foreign capital was again commanded in connection with the international syndicate to float the United States Government's bond issue and protect the Treasury gold reserve. A panic of smaller proportions swept over the Stock Exchange at the close of this year, in connection with the collapse of the protective operations and the international clash between America and Great Britain over Venezuela. The two ensuing years were chiefly characterized by the reorganization of the great number of important railways which had failed during 1893 and 1894, and whose new securities, largely increased in quantity, were placed through the medium of the Stock Exchange in 1896 and 1897.

The financial revival which began at the close of the last-named year introduced a new epoch in the history of the New York Stock Exchange —an epoch in all respects the most remarkable of its history. Supply of American capital available for investment purposes seemed suddenly to have become unlimited—largely because of the country's immensely profitable harvests at a time of European famine, but also on account of a wholly unprecedented increase in our general export trade, in manufactures as well as in agricultural products, which gave to our markets a command over foreign capital which they had never before possessed. This increase in capital was made use of by promoters of all kinds of enterprises, and their shares found active reception on the Stock Exchange. A highly excited movement for the rise at the opening of 1899 converged chiefly on shares of industrial companies organized to buy up independent plants. Checked by the excess of the speculators and by an industrial reaction during the Presidential contest of 1900, this movement was renewed with immense force at the opening of 1901. At that time all precedents of every kind in Stock Exchange history were broken. Where, a few years before, transactions of 200,000 shares a day had been regarded as constituting a large market and half a million shares as a day of extreme activity, scarcely a day now elapsed in which the volume of business did not run from one to two million shares, culminating on April 30, 1901, in transactions of 3,200,000 shares. Prices in the meantime were advancing at a rate which brought the entire financial public into the field as a speculator. The real force underlying the movement was the purchase of stock companies by other companies which pledged their credit to raise the funds requisite to provide for the purchase. This movement culminated in the famous Northern Pacific corner of May 9, 1901, when the efforts of two rival groups of capitalists to get hold of that railroad property forced its shares to the price of $1000, the stock having never touched $100 until three weeks before. Apprehension that operators who were unable to deliver stock which they had pledged would be dealt with summarily, caused one of the most violent collapses of values in the Stock Exchange's history. Recovery was prompt, and both 1901 and 1902 were characterized by numerous sensational movements for the advance, the second of those years scoring as a rule the higher values. In general, however, it was recognized that high-water mark in Stock Exchange activity had been reached. In the autumn of 1901 and in the fall of 1902 and the early part of 1903 severe reaction in values supervened.

The noteworthy characteristic of the period was the employment of enormously wealthy syndicates to sustain prices for the newly issued shares on the Stock Exchange until the public could be induced to buy. Such syndicates were remunerated at first by large allotments of stock and later by heavy cash payments, the syndicate formed in March, 1901, to 'underwrite' the billion-dollar stock issued by the United States Steel Corporation to take up the shares of other steel and iron combinations, pledging itself, in case of necessity, to advance $200,000,000 capital for the purpose. The stock issue worked out so successfully, however, that only a small fraction of the guarantee was called for, and two years later the original capital subscribed was returned to subscribers, with an additional cash allotment sufficient to raise profits to 200 per cent. A second syndicate, formed in 1902 to underwrite a $50,000,000 bond issue by the same corporation and the conversion of $200,000,000 of its stock into bonds, fared less fortunately, being obliged to perform the whole of its guarantee at a time of falling prices. In the spring of 1903 it was generally recognized that the extensive employment of the syndicate underwriting plan had 'tied up' immense amounts of capital which were usually available in the general market. The investing public having bought very sparingly and the syndicate banking interests being unable to support prices, a very severe and general decline on the Stock Exchange ensued.

VOLUME OF BUSINESS. Stock exchanges keep no official record of transactions on their floor. In New York such records are carefully kept by unofficial chroniclers; but as this is not done in London or on the Continent, comparison is impossible. It is safe to say, however, that in recent years the volume of business done

on the New York Stock Exchange has far exceeded that transacted in any other institution of the world. Following is the unofficial record of sales in that institution during a series of years:

	Stocks	Corporation Bonds	Government Bonds	State Bonds
1902	$188,503,000	$879,749,000	$1,378,000	$3,675,000
1901	265,944,000	994,235,000	1,892,000	2,502,000
1900	138,380,000	569,159,000	7,012,000	2,082,000
1899	176,421,000	826,711,000	10,582,000	2,013,000
1898	112,699,000	888,747,000	24,581,000	3,642,000
1897	77,324,000	529,843,000	10,394,000	2,004,000
1896	54,654,000	363,158,000	26,494,000	2,284,000
1895	66,583,000	499,758,000	7,480,000	5,583,000
1894	49,075,000	339,950,000	4,345,000	10,929,000
1893	80,977,000	351,854,450	2,143,000	3,792,000

METHOD OF BUSINESS. Stock exchanges as at present constituted are limited in membership and governed by strict rules which cover both methods of business, rates of commission to be charged, and conduct on the floor. The rules governing methods of business in New York prescribe a minimum commission of one-eighth of one per cent. on the face value of securities purchased for outside customers, one thirty-second of one per cent. for purchases made on account of fellow members, and one-fiftieth of one per cent. for purchases made on the order of another member on the floor.

In London commissions vary from 1s. per hundred to 2s. 6d. per hundred, according to the nature of the security. The Paris *agents de change* charge one-fourth of one per cent. In New York the Stock Exchange member may both transact business on the floor of the Stock Exchange and solicit business from outside customers. In London these functions are divided between the two functionaries known as 'jobber' and 'broker,' which correspond roughly to the divisions in other English professions, as, for instance, the barrister and solicitor in law. Members of the London Stock Exchange are forbidden to advertise; New York Stock Exchange houses advertise freely. *Agents de change* in Paris are forbidden to solicit outside business.

Acceptance of a bid or offer of stock makes the transaction official on a stock exchange and binds each participant to the fulfillment of his bargain. Stocks thus sold must be delivered to the buyer by 2:15 P.M. of the ensuing day. The New York Stock Exchange practices daily settlement of such accounts. In London settlements are made fortnightly, the bargain being carried for the account, that is to say, on credit, during the intervening period.

No security may be dealt in on the Stock Exchange which has not been formally 'listed' by the committee. In New York a statement of the company's condition, with a balance-sheet, is required before listing; also proof that proper facilities for transfer and registry of shares have been provided, and that with bonds the mortgage has been properly drawn and recorded. Corporations unwilling to make public statements have, however, been allowed since 1885 to obtain a place in what was called the 'unlisted department.' Since stocks in this department enjoy all the facilities of 'listed stocks,' the discrimination has been entirely futile. Listings on the New York Stock Exchange in recent years have been as shown in the preceding table, 60 to 70 per cent. being securities issued to replace others formerly listed.

	Stocks	Bonds
1902	$533,519,300	$784,032,595
1901	923,010,100	1,642,013,715
1900	443,713,000	620,935,000
1899	525,384,240	704,172,605
1898	700,064,680	528,153,996
1895	257,275,450	143,373,900

MEMBERSHIP PRICES AND RULES. With the limitation of stock exchange membership title to a seat in the exchange becomes valuable property. In New York the price of Stock Exchange seats has fluctuated with great irregularity. In 1879 their price was $9000; they rose to $20,000 in 1881, and to $37,000 in 1883, but by 1893 had declined to $15,250. From that price they gradually recovered, and in the recent great activity of business reached unprecedented figures. During the 'boom' of May, 1901, they sold for $66,000, and subsequently, in 1902, went as high as $84,000. The price at the opening of 1903 was $80,000. Ownership of a New York Stock Exchange seat does not necessarily imply the privilege of the floor; for that the owner must apply in due form to the committee on admissions. In the London Stock Exchange applicants for admission must be recommended by three members of at least four years' standing, who pledge themselves to the extent of £500 apiece to reimburse his creditors in case of his default within four years. If he is of foreign birth he must have been two years naturalized. In Paris, where the number of *agents de change* is limited to sixty, an applicant must be proposed by his predecessor or that predecessor's heirs, and must be approved by the governing committee and the Minister of Finance.

STOCK EXCHANGE SEAT AS PROPERTY. Owing to the peculiar personal nature of a member's rights and privileges, the exact legal status of a seat as a property right is not settled in all jurisdictions. By the general weight of authority, however, a seat may be considered as a species of incorporeal property held subject to such rules and regulations as may be adopted by the exchange. This gives a seat an anomalous position in the law of property because of the qualified and restricted character of an owner's rights. As it cannot be transferred except with the consent of the exchange, and to a person acceptable to the latter, it is held that it cannot be seized and sold upon an execution, but it seems settled in most jurisdictions where the question has arisen that a receiver appointed in proceedings supplementary to execution may apply to the court for an order requiring the judgment debtor to arrange for a transfer of his seat to a person acceptable to the exchange, and apply the proceeds to the satisfaction of the judgment. This may also be done by a judgment

creditor's bill in some jurisdictions. Thus, it will be seen that the courts do not assume to proceed against the seat itself, but attain the desired end through their power over the debtor. The United States Supreme Court has held that the rights of a member to his seat in an exchange pass to his assignee in bankruptcy, and the latter may take such steps as may be necessary to compel the bankrupt to procure a transfer of his seat subject to the rules of the exchange. By the rules of probably all exchanges the claims of members must be first satisfied upon the sale of a seat. A seat cannot be bequeathed or devised by will, nor is it strictly descendible, as the person to whom it might be thus given or descend might not be acceptable to the exchange; but the rules generally provide for the sale of a seat on the death of a member, an application of the proceeds to any claims the other members may have against the deceased, and a distribution of the proceeds to his personal representatives. The courts are loth to interfere with any reasonable rules and regulations of a stock exchange and with any action it may take to maintain discipline or enforce its rules, and their aid could probably only be invoked in cases of gross fraud or imposition upon a member.

DISCIPLINE. Strict discipline over the conduct of members is maintained by all the larger exchanges. The penalty is suspension from the privileges of the exchange for a given period or expulsion in the case of serious offense. On the New York Stock Exchange these penalties may be imposed for fictitious sales, for trifling bids, for acceptance of smaller commissions than those prescribed by the Exchange, and for 'obvious fraud.' More recently discipline has been exercised for dealing with a rival exchange contrary to the regulations of the member's own exchange, and for questionable business conduct outside of the exchange. In London the same penalties are made applicable on the general ground of failure to comply with the committee's decision or of dishonorable and disgraceful conduct. The rules of the Paris Bourse prescribe penalties in case the member "does not confine himself strictly to his duties" or "introduces injurious innovations."

CURB TRADING. An institution which has grown to considerable proportions in recent years has been the so-called 'curb trading,' so named because the transactions are usually conducted on the street outside the entrance to the stock exchange. In London, Paris, and New York this trading has at times reached very large proportions, though the system which it represents is radically different in the three cities. In London curb trading is utilized for the sake of dealing in foreign shares whose home market is open after the official closing of the London Exchange. For example, trading in American securities is conducted in Shorter's Court, behind the London Stock Exchange, frequently until 6 P.M. or later, the New York Stock Exchange, on account of the five hours' difference in time, being actively at work at that hour. In Paris the curb market, under its French title of the 'Coulisse,' has had a longer history. It has represented virtually a rival exchange, not subject to the numerous and rather vexatious limitations of the older Bourse. The Coulisse has frequently been suppressed by law, but has invariably revived, and has probably conducted a larger total business than the Bourse itself, except, perhaps, in Government securities. At present the Coulisse conducts its operations on the portico of the Bourse and is a recognized institution. In New York curb trading devotes itself exclusively to securities which have not been admitted to the list of the Stock Exchange. In this category are comprised many very important enterprises, including shares of the Standard Oil Company and of the various banks. The curb also provides a market for newly organized enterprises which have not reached a stage where they can apply for a place on the Stock Exchange list, and it gives an opportunity for fixing values of a forthcoming security before the share or bond certificates are formally issued. In the conversions of the United States Steel Corporation stock, for instance, the shares and bonds were bought and sold 'when, as, and if issued' on the curb, and on these terms their values fluctuated in some cases 14 or 15 points before the security itself ever legally existed. There is no restriction of the right to deal in the 'curb' market, but in practice its privileges are limited to regular and responsible parties, whose position or credit is known to the other party to a bargain.

STOCK EXCHANGE CLEARING HOUSE. In recent years the system of 'clearing' stock exchange transactions, on the plan of the bank clearing house, has been generally adopted by stock exchanges. As introduced on the New York Exchange in 1892, the system provides for the offsetting of securities which a broker has contracted to deliver by an equivalent amount of the same securities which he may have contracted to receive. Thus, if broker A has sold 1000 New York Central shares to B and bought 1000 of the same shares from C, the two transactions are settled by the delivery of 1000 shares by C to B. The price may be different in the two transactions, but such differences are adjusted by the clearing house, to which the broker is 'debtor' or 'creditor' on his daily sheet. The same principle is followed even where the amounts bought and sold do not agree. Thus A, in the above case, may have sold only 500 shares to B and bought 1000 from C. In that case C delivers 500 shares to A and 500 to B, and payment is made accordingly. The economy consists in the lessening of the number of individual checks which must be drawn for settlement, and against which bank balances must be maintained. Supposing the price of New York Central, in the transactions last described, to have been 100, the old plan of individual deliveries would have necessitated drawing of checks, for settlement, in the total amount of $150.000. The clearing-house plan requires only $100,000. The aggregate saving in checks drawn, during an ordinary year, has exceeded $500,000,000.

The plan was adopted by the Frankfort Stock Exchange in 1867, at Berlin in 1869, at Hamburg in 1870, at Vienna in 1873, at London in 1876, and by various American stock exchanges between 1880 and 1887.

STOCK EXCHANGE TERMS. The stock exchange has a dialect or slang of its own, many of the terms in which had their origin at the time of the South Sea speculation in 1720. A 'bull' is a buyer of stocks which he hopes to sell at higher prices. He may buy altogether with his own capital; but if he is merely a stock exchange

speculator, he borrows most of the requisite funds, depositing the purchased stock as security. He can usually borrow 80 per cent. of the cost value of his shares the difference, 20 per cent., being his 'margin.' If the price falls, the lender calls on him to 'make good his margin.' If he fails to do so, and the margin continues 'impaired,' he is 'closed out' by the sale of his collateral. A 'boom' is a successful upward movement of prices; this term is of American origin. The opposite of a 'boom,' in stock exchange phraseology, is a 'slump.' The 'bear' is a seller of stocks which he hopes to obtain, later on, at lower prices. He may be selling his own holdings and delivering them to the purchaser. But if a speculator, he may borrow stocks as the 'bull' borrows money. Generally he obtains the stocks by lending their equivalent in money to the owner. He is said to be 'short' of stocks, where the bull is 'long.' The bull 'realizes' when he sells to take his profits; similarly, the bear 'covers' when he buys on the market the stock in which he has been speculating, and returns the shares which he has borrowed. Stocks are said to be 'carried' when they are accepted as security from a bull speculator. A 'manipulated' market is one in which speculators have caused an artificial appearance of real buying or selling. A 'rigged' market is much the same thing, though in a more intensified form. 'Puts' are contracts sold at a fixed percentage by capitalists to bull speculators, whereby the capitalist undertakes to pay a set price for a given number of shares within a stipulated time. This insures the speculator against more than a certain amount of loss if he buys stocks. 'Calls' are contracts similarly sold by capitalists, who agree within a given time, and at a set price, to deliver the shares agreed upon to the speculator. This is a guarantee against losses on a falling market. Both sorts of contracts are classified as 'privileges.' 'Wash sales' are transactions in which buyer and seller are employed by the same person, with a view to creating a semblance of activity. They are prohibited under severe penalties by the stock exchanges, but are rarely detected and are very frequently utilized.

STOCKHOLDER. In the strict sense of the term, a person who owns one or more shares of stock in a corporation, and who has been recognized by the latter as having the rights commonly incidental to such ownership. Entry of a person's name on the books of a corporation as the owner of stock is the best evidence of his standing as a stockholder, and as long as his name remains there he may generally exercise all a stockholder's privileges. However, a person to whom shares of stock have been transferred, but whose name has not yet been entered on the books, is sometimes treated as if he were a stockholder and spoken of as such. A corporation is protected in paying dividends to a person whose name remains on its books as a stockholder, even if he has transferred his shares of stock, provided the purchaser has not given notice of that fact. A stockholder of record has the right to vote in certain meetings, the most important of which, perhaps, is one for the election of officers. Each stockholder may vote the number of shares he owns, and thus one person owning the majority of the stock of a corporation may control its elections and policy against the wishes of a great number of holders of a small number of shares aggregating less than the majority. Among the rights of a stockholder are: the right to protest and invoke the aid of the courts against a misuse of the funds of the corporation, or against fraud by the majority stockholders or the officers; to object to a change in the kind of business which the charter authorizes it to carry on; the right to inspect all or any of the books of the corporation at reasonable times and places; and to receive dividends out of the earnings, when a surplus has accumulated, which is not needed for running the business, or for improvements. In many States a stockholder is only liable for the debts of the corporation to the amount of his stock, that is, he only loses what he has paid in, assuming he has paid in the par value of his stock, in case of insolvency of the corporation. If a subscriber to the stock of a corporation has not paid in the full par value of the amount of stock subscribed for by him, creditors of the corporation may hold him for the balance remaining unpaid. A stockholder is not strictly a creditor of the corporation to the amount of his stock, as he is deferred to corporate creditors on a final distribution of assets; but he may become a creditor by a loan of money or sale of goods, and thus stand on an equal footing with the others as to such claims, in most jurisdictions. See CORPORATION; STOCK; and consult authorities there referred to.

STOCKHOLM, stŏk'hōlm. The capital of Sweden, situated at the outlet of the Mälar Lake into the Baltic Sea, in latitude 59° 20′ N., longitude 18° 3′ E. (Map: Sweden, H 7). The situation is extremely picturesque, the city being built partly on a number of islands, partly on peninsulas cut off from the mainland by deep fiords, while the waterways both toward the Mälar and toward the sea lead through labyrinths of fiords and islands. Stockholm has been called the 'Venice of the North,' but its aspect is entirely different from that of Venice. Both the islands and the mainland are rocky and hilly, with granite knolls exposed on all sides, while a primæval forest penetrates almost to the heart of the city. The old nucleus, known as Staden (The City), is built on an island lying across the mouth of the Mälar channel, and connected by bridges with the northern and southern shores and with the little Riddarholm (knight's island) on the west. It has narrow streets falling steeply on all sides from the central Stortorget. Skeppholmen, to the east of Staden, is almost wholly occupied by military and naval depots. The remaining parts of the city, Södermalm on the south shore, Norrmalm and Oestermalm on the north shore, and Kungsholmen in the northwest, are for the most part regularly laid out with broad and straight streets. Here are also a number of handsome squares, parks, and promenades, such as the Gustaf Adolfs Torg, with an equestrian statue of Gustavus Adolphus, the Kungsträdsgård on the water front with a handsome fountain, and the Humlegård, a large and beautiful pleasure garden, containing a colossal bronze statue of Linnæus. From Oestermalm a bridge leads to the easternmost part of the city—an island about two miles long and three-fourths of a mile wide, known as Djurgården from its having formerly been a deer park. It is now laid out as a city park.

The principal churches are the Storkyrka (great church), founded in the thirteenth cen-

tury, rebuilt in the eighteenth and restored in 1892; the Riddarholms Kyrka, a Gothic structure with a perforated iron spire 290 feet high, and the burial place of Swedish kings; the Tyska Kyrka (German Church), a German Renaissance building of the seventeenth century; and the conspicuous Katarina Kyrka crowning the heights of Södermalm. The royal palace, on the northeastern corner of the Stadsholm, was begun in 1697 in the Italian Renaissance style, and is a large and beautiful rectangular building with four wings inclosing a quadrangle. At the western end of the island stands the Riddarhus (knight's house), containing portraits and armorial bearings of Swedish nobles. Noteworthy also are the new opera house, finished in 1898; the handsome Renaissance building of the National Museum, built in 1850-66, opposite the royal palace on the Blasieholm; and the large and imposing new building of the Northern Museum, begun in 1898, in the Djurgård.

Although Stockholm has no university, it has numerous establishments for higher technical and popular education and an excellent elementary school system. The Royal Library had in 1899 381,900 volumes and 11,000 manuscripts. There are the National Museum, containing fine art collections and a collection of Swedish antiquities; the Northern Museum (Nordiska Museet) for Scandinavian ethnology and archæology; a museum of natural history; a biological museum showing groups of Scandinavian mammals in their natural surroundings; an astronomical observatory; and numerous scientific and literary associations, the principal of which are the Swedish Academy, the Academy of Sciences, and the Academy of Fine Arts, History, and Archæology.

Stockholm is the largest industrial centre of Sweden next to Göteborg. There are iron foundries and machine shops, breweries, sugar and cotton mills, and tobacco factories, and manufactures of furniture, soap, food products, and miscellaneous articles, while shipbuilding is also carried on. The city ranks first among Swedish ports in the value of imports, and third in exports; the imports in 1897 amounted to $3,307,520, and the exports to $866,680. The chief exports are iron and timber. In 1900 the shipping at the port amounted to 2255 entries and clearings with a total of 964,367 tons, but in the number and tonnage of its home vessels the city is exceeded by Göteborg. The approaches to the harbor are intricate and rendered somewhat dangerous by rocky reefs, but the harbor itself is good and provided with dry docks and extensive wharfage accessible for large ships. Up to 1895 the harbor was closed by ice about twenty-five days in the year, but recently a new ice-breaker has been put into service to keep it open. The city is, in general, very progressive in the matter of public works. The population increased slowly during the first half of the nineteenth century, having been 75,000 in 1780 and 93,000 in 1850. In 1890 it was 246,454, and in 1901 303,356.

Stockholm was founded in 1255 by Birger Jarl, and was for centuries confined to the Stadsholm and Riddarholm, which were fortified. It was several times besieged and taken by Danish armies, and its wooden buildings were often destroyed by fire until they were supplanted by stone structures. In 1520 the city was the scene of the 'Stockholm Blood Bath,' when the Danish King Christian II., in order to strengthen his position in Sweden, had a large number of Swedish nobles decapitated on the Stortorg. Consult Wattenbach, *Stockholm, ein Blick auf Schwedens Hauptstadt* (Berlin, 1875).

STOCKING FRAME. See KNITTING.

STOCKINGS. See HOSIERY.

STOCK'PORT. A manufacturing town in Cheshire, England, on the Mersey, at the junction of its main feeders, 6½ miles southeast of Manchester (Map: England, D 3). Its prosperity is of modern date. The streets lie on the slopes of a narrow gorge, and are irregular and occasionally precipitous; to the south they rise in terraces above the river. The principal buildings are the court-house, market hall, mechanics' institute, infirmary, and the institution for the blind, deaf, and dumb. The free grammar school was founded and endowed in 1487. The town possesses seven fine parks, the chief of which is Vernon Park, which contains a museum. Stockport owns an electric lighting plant, street railways, sewage works, gas, water supply, and markets. It has extensive manufactures of cottons, woolens, silks, machinery, brass and iron goods, shuttles, and brushes. Population, in 1881, 59,544; in 1891, 70,263; in 1901, 78,871.

STOCKS. An apparatus of wood, much used in former times for the punishment of petty offenders. The culprit was placed on a bench, with his ankles fastened in holes under a movable board, and allowed to remain there for an hour or two. The period of the first introduction of the stocks in England is uncertain, but in the second statute of laborers, 25 Edward III. (1350), provision is made for applying the stocks to unruly artificers. Combined with the stocks was often a whipping-post for the flagellation of vagrants. The use of stocks was general in the English colonies of North America and was employed frequently for the punishment of common scolds.

STOCK'TON. The county-seat of San Joaquin County, Cal., 78 miles east by north of San Francisco; on an arm of the San Joaquin River, at the head of navigation, and on the Atchison, Topeka and Santa Fe and the Southern Pacific railroads (Map: California, C 3). It is in a region noted for its great natural beauty and equable climate and is very attractive. The State Hospital for the Insane is here, and there are also a public library with over 36,500 volumes, the San Joaquin County Law Library, Saint Mary's College, and Saint Agnes Academy. The county court-house, constructed at a cost of $300,000, the high school ($150,000), the post-office, county jail, opera house, Masonic Temple, Saint Joseph's Home, and the County and the Pacific hospitals, are also noteworthy features. In addition to possessing large grain, live stock, and fruit interests, Stockton has considerable industrial importance. Agricultural machinery and implements, flour, foundry products, window glass, lumber, leather, beer, fuel briquettes, canned goods, and woolens constitute the leading manufactures. The government, under the charter of 1889, is vested in a mayor, chosen biennially, and a unicameral council. Stockton was founded in 1849 by Charles M. Weber, the owner of a large Mexican grant, and was named in honor of Robert

Field Stockton, of the United States Navy, who took possession of California for the United States. In its early days it was the starting and outfitting point for miners bound for Calaveras, Tuolumne, and Mariposa counties. Population, in 1890, 14,424; in 1900, 17,506.

STOCKTON, Francis Richard (1834-1902). A popular American writer of humorous tales, born in Philadelphia. In early life he was a wood-engraver and designer; in which capacity he contributed pictures to periodicals. Meanwhile he busied himself also with literary and journalistic work. He was first employed on the Philadelphia *Morning Post*, and in 1872 gave up designing definitively to join the New York *Hearth and Home*. Soon he joined the staff of the *Century Magazine* (then *Scribner's Monthly*) and in 1873 was made assistant editor of the newly founded magazine for children, the *Saint Nicholas*, remaining here till about 1880. He was a prolific writer. His books for children include: *Ting-a-Ling Stories* (1870); *Roundabout Rambles* (1872); *What Might Have Been Expected* (1874); *Tales Out of School* (1875); *A Jolly Fellowship* (1880); *The Floating Prince* (1881); *The Story of Viteau* (1884); and *Personally Conducted* (1889). Even more numerous are his longer works; they are well known for the agreeable impossibility of the situations they narrate. The chief are: *Rudder Grange* (1879), which brought him into prominence; *The Lady or the Tiger?* (1884), perhaps his most popular story; *The Late Mrs. Null* (1886); *The Christmas Wreck* (1886); *The Casting Away of Mrs. Lecks and Mrs. Aleshine* (1886); *The Bee-Man of Orn* (1887); *The Hundredth Man* (1887); *The Dusantes* (1888); *Amos Kilbright* (1888); *The Great War Syndicate* (1889); *The Stories of Three Burglars* (1889); *The Merry Chanter* (1890); *Ardis Claverden* (1890); *The House of Martha* (1891); *The Squirrel Inn* (1891); *The Clocks of Rondaine* (1892); *The Watchmaker's Wife* (1893); *The Adventures of Captain Horn* (1895); *The Great Stone of Sardis* (1897); *The Girl at Cobhurst* (1898); *Afloat and Ashore* (1900); and *The Captain's Toll-Gate*, with memoir by his wife (1903). In the character of his humor Stockton stands alone. His situations are whimsical and his characters grotesque; usually, however, the eccentricity is not merely superficial, and the story, quietly rather than boisterously amusing, and told with apparent sincerity, produces an illusion that pleasingly conceals its absurd premises and its logical though equally absurd conclusions.

STOCKTON, Richard (1730-81). An American lawyer, and a signer of the Declaration of Independence. He was born near Princeton, N. J., graduated at the College of New Jersey (Princeton) in 1748, was admitted to the bar in 1754, visited England in 1766-67, where he made the acquaintance of many distinguished men, and in 1774 became a judge of New Jersey's Supreme Court. He at first advocated a reconciliation between the colonies and England, and in December, 1774, wrote to Lord Dartmouth, proposing a scheme of colonial self-government; but he soon began to take an active part in the opposition to the British Ministry and as a member of Congress in 1776 voted for and signed the Declaration of Independence. In September, 1776, he was sent by Congress, with George Clymer of Pennsylvania, to inspect the northern army.

STOCKTON, Robert Field (1795-1866). An American naval officer, grandson of Richard Stockton (q.v.). He was born at Princeton, N. J., studied for a time at Princeton, and in 1811 became a midshipman in the United States Navy. He joined Commodore Rodgers on the frigate *President* in 1812, was for a time an aide to the Secretary of the Navy, took part in the defense of Baltimore, and was promoted to be lieutenant in September, 1814. In 1815 he distinguished himself in the Algerine War on board the *Spitfire*. He returned to the United States in command of the *Erie* in 1821, and in the fall of the same year sailed in the *Alligator* for the African coast, where he negotiated successfully for the land upon which the American Colonization Society founded Liberia (q.v.). During the early part of the Mexican War he commanded the Pacific Squadron. To his energy, and that of General Frémont, with whom he cooperated, was largely due the success of the American operations on the coast. He captured Los Angeles and San Diego, fought several battles, organized a civil government for California, and installed Frémont as Governor, relinquishing the command to Shubrick in 1847. He resigned from the navy in 1850, and was a United States Senator from New Jersey in 1851-53. Having resigned in 1853, he was for some time president of the Delaware and Raritan Canal Company. Consult *Life and Speeches of Robert Field Stockton* (1856).

STOCKTON-ON-TEES. A seaport in the County of Durham, England, 11 miles east-northeast of Darlington, on the left bank of the Tees (Map: England, E 2). The broad and handsome High Street is nearly a mile in length. A new town known as South Stockton has sprung up on the right bank of the river, the two being connected by an iron bridge of three arches, built in 1887. Shipbuilding, chiefly in iron, is carried on; and blast furnaces, foundries, engine works, extensive potteries, and iron works are in operation. Sailcloth, ropes, and linen are manufactured; and there are corn mills and spinning mills. At Stockton the Tees is navigable for vessels of large tonnage. The moated Norman castle, long an episcopal residence, was taken for the Parliament in 1644, and totally destroyed by the Roundheads in 1652. At the Restoration it had become so poor a place that it contained only 120 houses. Its growth and prosperity date from the development of the iron and steel industry. The Stockton and Darlington Railway, the first to commence the conveyance of passengers and goods, was opened September 27, 1825. Population, in 1891, 49,700; in 1901, 51,500.

STODDARD, Charles Augustus (1833—). An American Presbyterian clergyman, born in Boston, Mass. He was educated at Williams College, at the University of Edinburgh, at the Seminary of the True Church of Scotland, and at the Union Theological Seminary, where he graduated in 1859. He was pastor of the Washington Heights Presbyterian Church, New York City, until 1893. In 1869 he became connected with the New York *Observer*, and in 1885 succeeded Samuel I. Prime as editor. His publications include: *Across Russia from the Baltic to the Danube* (1891); *Spanish Cities, with*

Glimpses of Gibraltar and Tangier (1892); and other books of travel.

STODDARD, CHARLES WARREN (1843—). An American traveler and author, born at Rochester, N. Y. As a youth he was in business in San Francisco, Cal., and in 1864 visited the Hawaiian Islands, where he subsequently lived for long periods. He traveled much about the world from 1873 to 1878 as correspondent of the San Francisco *Chronicle*. In 1885 and 1886 he was professor of English at Notre Dame College, Ind., then spent some time in travel, and became lecturer on English literature in the Catholic University at Washington, D. C. His books were chiefly poetry and sketches of travel, and include: *Poems* (1867); *South Sea Idyls* (1873); *Summer Cruising in the South Sea* (1874); *Mashallah! A Flight into Egypt* (1880); *The Lepers of Molokai* (1885); *A Troubled Heart, and How It Was Comforted at Last* (1885); *Hawaiian Life; or, Lazy Letters from Low Latitudes* (1894); *The Wonder Worker of Padua* (1896); *A Cruise Under the Crescent* (1898); *Over the Rocky Mountains to Alaska* (1899); *In the Footprints of the Padres* (1902); *Exits and Entrances* (1903).

STODDARD, RICHARD HENRY (1825-1903). An American poet, critic, and journalist, born at Hingham, Mass. He was educated in the public schools of New York City, worked in an iron foundry, gained attention in 1849 by a privately printed volume of verse, *Footprints*, obtained a place in the Custom House (1853-70), and was confidential clerk to George B. McClellan (1870-73), pursuing meantime literature as an avocation as literary reviewer, especially for the *World*, the *Mail*, and the *Mail and Express*. Noteworthy among his numerous publications are: the juvenile *Adventures in Fairyland* (1853); verses collected in *Songs of Summer* (1857); *The King's Bell*, a poem (1862); *The Story of Little Red Riding Hood*, verse (1864); *The Children in the Wood*, verse (1865); *Abraham Lincoln*, a commemoration ode (1865); *Putnam the Brave* (1869); *The Book of the East*, verse (1867); *The Lion's Cub and Other Poems* (1890); and *Under the Evening Lamp* (1892). A collected edition of his verses was issued in 1880. Stoddard also edited several noteworthy anthologies, among them *Melodies and Madrigals* (1865); *Poets and Poetry of America* (1872); *Female Poets of America* (1874). For many years he was an important figure in the literary life of New York.—His wife, ELIZABETH (BARSTOW) (1823-1902), collaborated with him in editorial work and wrote three novels, *The Morgesons* (1862), *Two Men* (1865), and *Temple House* (1867). Her *Poems* were collected in 1895. Consult Stoddard's *Recollections Personal and Literary*, ed. by R. Hitchcock (New York, 1903).

STODDARD, WILLIAM OSBORN (1835—). An American author and journalist, born at Homer, N. Y., and educated at the University of Rochester, where he graduated in 1857. After three years of farming and newspaper work in Illinois, where he edited the Chicago *Daily Ledger* and the *Central Illinois Gazette*, and three months' service as a volunteer at the outbreak of the Civil War, he acted from 1861 to 1864 as private secretary to President Lincoln and then engaged in literary work. His publications include: *The Heart of It* (1880); *Life of Abraham Lincoln* (1884); *Lives of the Presidents* (10 vols., 1888-89); *Table Talk of Lincoln* (1892); *Quirt Ten Eyck* (1893); *The Swordmaker's Inn* (1896); *With the Black Prince* (1898); *Lincoln at Work* (1899); and *Jack Morgan* (1901).

STOD'DART, JAMES HENRY (1827—). An American actor, born in Yorkshire, England. He was the son of an actor and during his youth in Glasgow he often took juvenile parts with his father. At seventeen he began an independent career, winning at length in Liverpool considerable success as a comedian. He came to the United States in 1854 and became a member of Wallack's company. Afterwards for a time he played with Laura Keene; then with Dion Boucicault; and subsequently for twenty years was under the management of A. M. Palmer. Even in comparative youth, Stoddart was best known in 'old man' parts. Among his most popular characters were Mr. Moneypenny in *The Long Strike*, Colonel Preston in *Alabama*, the curate in *Saints and Sinners*, and, later, Lachlan Campbell in *The Bonnie Brier Bush* (1901). Consult: Stoddart's own *Recollections of a Player* (New York, 1902); McKay and Wingate, *Famous American Actors of To-day* (New York, 1896).

STOD'DERT, BENJAMIN (1751-1813). An American soldier and Cabinet officer. He was born in Charles County, Md., joined the Continental Army in 1776, became a captain in January, 1777, and was severely wounded at Brandywine in September, resigning his command in April, 1779. He then served as secretary of the Board of War until 1781, and from 1798 to 1801 was Secretary of the Navy, being the first to discharge the duties of this office, though George Cabot (q.v.), who resigned within a few weeks, was the first to be appointed. His services in connection with the organization of the department were very valuable.

STOHMANN, stō'mân, FRIEDRICH KARL ADOLF (1832—). A German agricultural chemist, born in Bremen, and educated at Göttingen and London. He was Graham's assistant at University College from 1853 to 1855, and afterwards assisted Henneberg at Celle. In 1862 he started the station for agricultural experiments at Brunswick. He was called to Halle in 1865 and to Leipzig in 1871, where he was director of the agricultural physiological institute of the university. His principal investigations had to do with the nourishment of animals. He wrote: *Beiträge zur Begründung einer rationellen Fütterung der Wiederkäuer* (1860); *Biologische Studien* (1873); *Handbuch der technischen Chemie* (1872 and 1874); *Handbuch der Zuckerfabrikation* (1878); and *Die Stärkefabrikation* (1878).

STOICS (Lat. *stoicus*, from Gk. *στωϊκός, stōïkos, στοϊκός, stoikos*, relating to a colonnade, stoic, from *στόα, stoa*, colonnade). The name of the school of ancient moralists opposed to the Epicureans in their views of human life. The stoical system dates from the end of the fourth century B.C.; it was derived from the system of the Cynics, whose founder, Antisthenes, was a disciple of Socrates. Indeed, the doctrines, but still more the manner of life, and most of all the death of Socrates, were the chief foundations of the stoical philosophy.

The founder of the system was Zeno (q.v.),

from Citium in Cyprus, who opened his school in a portico called the Stoa Pœcile ('painted porch') at Athens, whence the origin of the name of the sect. Zeno had for his disciple Cleanthes, from Assus, in the Troad (died c. 220 B.C.), whose Hymn to Zeus is the only fragment of any length that has come down to us from the early Stoics, and is a remarkable production, setting forth the unity of God, His omnipotence, and His moral government. Chrysippus, from Soli in Cilicia (c. 280-207 B.C.), followed Cleanthes, and, in his voluminous writings, both defended and modified the Stoical creed. He was regarded as a second founder of the school, and it was a saying in antiquity that without Chrysippus there had been no Stoa. Chrysippus was succeeded by Zeno of Tarsus and Diogenes of Babylon; then followed Antipater of Tarsus, who taught Panætius of Rhodes (died B.C. 112). Panætius introduced Stoicism to Rome, and also made such modification in the system that it is customary to regard Stoicism as entering with him upon a second period, characterized by a "nearer approach to the Peripatetic and Platonic teaching" (Windelband). Among the most prominent Stoics of this period are to be mentioned Boëthius of Sidon and Posidonius of Apamea in Syria. The third period of Stoicism is the Roman period, represented by L. Annæus Cornutus, L. Annæus Seneca, Epictetus, and the Emperor Marcus Aurelius Antoninus.

Stoicism was mainly an ethical theory, but it had a logic and a physics as well. Under logic it included both dialectic and rhetoric. Dialectic was predominantly a theory of knowledge. The main question here was: How can we test truth? In answer to this question the Stoics worked out a sensationalistic epistemology. The soul is originally like a blank wax tablet. Things cause alterations or impressions on the soul, and those alterations or ideas which refer to particular things compel assent. These impressions are kept in memory, and, partly without and partly with conscious intention, concepts arise. These are entirely subjective; thus in ancient times we find the germ of nominalism (q.v.). The highest value is attached to the involuntarily formed concepts, for these compel assent from all men (*consensus gentium*). Physics included, for the Stoics, cosmology, psychology, and theology. All reality is corporeal, but falls into two classes, the active and the passive, which, however, are inseparable. The active principle is sometimes represented as fire, sometimes as spirit. The spirit-fire is God, and is self-conscious. Out of it is developed air, water, earth, the whole universe of separate beings, and all nature is rational. Every individual soul is a part of the universal world-soul for a time individualized, but ultimately to be absorbed into the world-soul again, at the time when all the differentiation of the universe is consumed in all-devouring fire. This process takes place by Fate, i.e. in accordance with irreversible laws, but is also purposeful, i.e. mechanism is conceived of as compatible with teleology. When one cycle of differentiation and absorption is complete, another begins.

The Stoic ethics was the ethics of apathy. The soul or the divine principle in man should not allow itself to be carried away by the passions aroused in it by external things. A man must be self-controlled. The passions are due to false judgments and mental disturbances, hence they can be overcome by wisdom and by a refusal to assent to their dictation. A man is not, indeed, master of his fate, but he can keep his self-control and proud self-complacency through all the vicissitudes of life. The Stoic formula was a life in accordance with nature. As we have seen that for Stocism nature is all rational, to live in accordance with nature was to live in accordance with reason. Such a life is happy. Pleasure is an accessory, not an end, of a reasonable life. The Stoics took a very rigorous view of virtue, which they claimed admitted of no degree. One may be virtuous, but if he is not thoroughly so he is not so at all. There may be approximation to virtue, short of virtue, but such approximation is not virtue. Only very few men are virtuous; the vast majority are fools. The four cardinal virtues of the Stoic system are insight, courage, temperance, and justice, a classification which in essence does not depart from the Platonic. One very distinctive feature of Stoicism was its cosmopolitanism. Because all men are manifestations of the one universal Spirit, they should live in brotherly love and readiness to help each other. Differences of rank and wealth are external, and should not interfere with social relations. Thus, long before Christianity taught that there is neither Greek nor Jew, nor male nor female, nor bond nor free, Stoicism had recognized and lived up to the brotherhood of man.

Consult: Capes, *Stoicism* (London, 1880); Zeller, *Die Philosophie der Griechen* (3d ed., Leipzig, 1880; Eng. trans. by Reichel, London, 1880).

STOKES, stōks, George Thomas (1843-98). An Irish divine and author, born in Athlone, Westmeath, Ireland. He was educated at Queen's College, Galway, and Trinity College, Dublin, and, after acting as curate in Killaloe and Newry, he became, in 1869, vicar of All Saints, Blackrock, which position he retained until his death. In 1883 he was called to the chair of ecclesiastical history in Dublin University, and in 1893 he became canon of Saint Patrick's in Dublin. Among his publications are: *Ireland and the Celtic Church* (1886); *Sketch of Mediæval History* (1887); *Ireland and the Anglo-Norman Church* (1889); *Bishop Pocock's Tour Around Ireland in 1752* (1891); *The Acts of the Apostles* (1891); and *Greek in Gaul and Western Europe Down to A.D. 700* (1892).

STOKES, Sir George Gabriel (1819-1903). An English mathematician and physicist, born in Skreen, County Sligo, Ireland. He was educated at Cambridge, and became fellow of Pembroke College in 1841, and was elected in 1849 to fill the Lucasian chair of mathematics in Cambridge. In 1885 he was appointed president of the Royal Society. Stokes was the first to explain in his lectures the scientific principles on which spectrum analysis depends, while to him is due also the first thorough study and explanation of the phenomena of fluorescence, in his paper *On the Change of the Refrangibility of Light* (*Philosophical Transactions* for 1852-53), for which he received the Rumford Medal. He greatly extended and improved the application of mathematics to physico-mathematical treatment of questions connected with the distortion of elastic solids, the motion of waves in water, the undulatory theory of light, the summation

of series, the internal friction of fluids, and other subjects in hydrodynamics, etc. He also discussed the variation of gravity over the surface of the earth and wrote an important paper on the nature of Röntgen rays. For his work in optics Stokes stood preëminent among the scientists of the nineteenth century, and he did much to mold current thought and theory in this field. He published the *Burnet Lectures on Light* (1892); *Mathematical and Physical Papers* (3 vols., 1880-1902); and *Gifford Lectures on Natural Theology* (1891-93). He was made a baronet in 1889.

STOKES, HENRY NEWLIN (1859—). An American chemist. He was born in Moorestown, N. J., and was educated at Haverford College and Johns Hopkins University, after which he studied chemistry in Munich and in Zurich. In 1889 he became an assistant chemist in the United States Geological Survey, which office he relinquished in 1892 to accept the place of assistant professor in the University of Chicago, where he remained until 1893, when he returned to the service of the Geological Survey. He accepted an appointment with the Bureau of Standards in 1903. His researches include studies in organic chemistry, especially on phosphimic and metaphosphimic acids.

STOKES, WHITLEY (1830—). A distinguished Celtic scholar and authority on Anglo-Indian law, born in Dublin, Ireland. He was educated at Trinity College, and became a barrister of the Inner Temple in 1855. In 1862 he went to India, where he occupied various legal positions under the Government. He drafted the present *Code of Civil Procedure* and did other important legal work, but became best known, and is likely to be longest remembered, for his contributions to Celtic scholarship, a branch of research which he took up before he went to India, and continued during his governmental service there. The greater part of his work deals with early Irish, but his studies included the other Celtic languages, investigations of Cornish and British monuments, and contributions to Celtic grammar. It has been said that his researches have done more than those of any other scholar to make accessible the literary and historical monuments of the ancient Irish language. His writings are intended mainly for scholars, but his texts usually are accompanied by translations, and some of these possess high literary worth. Conspicuously good are his renderings of the "Death of the Sons of Usnach" (*Irish Texte*, vol. ii.), and of the "Briden Da Derga" (*Revue celtique*, vol. xxii.). His principal publications are: *Irish Glosses* (1860); *Three Irish Glossaries* (1862); *The Play of the Sacrament* (1862); *The Passion, a Middle-Cornish Poem* (1862); *The Creation of the World: A Cornish Mystery* (1863); *Three Middle-Irish Homilies* (1871); *Goidelica* (2d ed. 1872); *Beunans Meriasek* (1872); *Middle-Breton Hours* (1876); *The Calendar of Œngus* (1880); *The Tripartite Life of Saint Patrick* (1887); *The Old Irish Glosses at Würzburg and Carlsruhe* (1887); *Lives of Saints from the Book of Sismore* (1889); *Urkeltischer Sprachschatz* (1894); *The Martyrology of Gorman* (1895).

STOKE-UPON-TRENT. A manufacturing town in Staffordshire, England, 15 miles north of Stafford (Map: England, D 4). The principal public buildings are the town hall, New Market hall, and Minton Memorial building. There are statues to Wedgewood, Minton, and Colin Minton Campbell. The town is the centre of the 'Potteries' district, and owes its importance to porcelain and earthenware manufactures, carried on in about 200 factories. It has manufactures of iron, engines, machinery, and bricks, and in the vicinity are numerous coal mines. The town, incorporated in 1874, is of modern growth. Population, in 1891, 24,000; in 1901, 30,450. Consult Ward, *Stoke-upon-Trent* (London, 1843).

STOLBERG, stōl'bĕrk, CHRISTIAN, Count (1748-1821). A German poet, born at Hamburg, of an ancient family, originally from Thuringia. Christian studied at Göttingen (1769-74), where he and his brother joined the literary Hainbund, was twenty-three years in the public service, and lived from 1800 till death near Eckernförde, Schleswig. He translated Sophocles (1787), and wrote several volumes of poems (*Gedichte*, 1779, 1782, 1787, 1810) noteworthy for their pictures of family life.

STOLBERG, FRIEDRICH LEOPOLD, Count (1750-1819). A German poet and translator, brother of Christian. He was born at Bramstedt, Schleswig, studied at Halle and Göttingen, and from 1777 to 1780 was Ambassador of the Prince-Bishop of Lübeck at Copenhagen. He became Ambassador of the Danish Court at Berlin in 1789, and filled other official positions until in 1800, with his whole family, he became a convert to Roman Catholicism, an event which caused much excitement throughout Protestant Germany. During his later years he lived in comparative retirement, devoted mainly to literary work of the most varied kind, ranging from verse of great facility and boldness of imagery, through translations of Greek authors, prose romance, and travels, to a fifteen-volume history of Christianity from his later standpoint (1807-18). He died at Sondermühlen, near Osnabrück. Consult biographical studies by Menge (Gotha, 1862), Hennes (Frankfort, 1876; Mainz, 1875), and Janssen (Freiburg, 1900).

STOLE (Lat. *stola*, from Gk. *στολή*, *stolē*, long robe, from *στέλλειν*, *stellein*, to array, despatch). A narrow band of silk worn over the shoulders by the clergy of the Roman Catholic and Anglican communions, corresponding to a vestment known as *orarion* in the Eastern churches. See COSTUME, ECCLESIASTICAL.

STOLEN GOODS. In law, chattels which have been the subject of larceny and have not been restored to the possession of their owner. Inasmuch as the larceny does not divest the owner of his property in the stolen goods, a buyer cannot acquire title to them even if the purchase be made in good faith. In England, however, this rule does not apply if stolen goods were bought in market overt (q.v.), and the owner had not prosecuted the thief, in which case the *bona fide* purchaser acquires valid title. In the United States there are no markets overt, and any person buying stolen goods acquires no better title to them than the thief has. That is, the owner has a right to take them wherever he may find them. This rule is subject to the qualification that current money and negotiable papers payable to bearer or indorsed in blank may pass to and become the absolute property of

a *bona fide* purchaser even if they have been stolen from their lawful owner. See NEGOTIABLE PAPER.

To constitute the crime of receiving stolen goods, the goods must have been stolen and not acquired by embezzlement or false pretenses. The receiver must either know that they have been stolen or have reasonable grounds for believing that they have been unlawfully taken from their owner. The crime becomes complete when the receiver takes them into his possession or they are taken for him with his knowledge by a servant or agents. If the goods after being stolen come back into the possession of the owner or are delivered to the receiver by the owner's authority, they cease to be stolen goods, and the crime of receiving cannot be committed with reference to them.

In England it early became the law that if goods were stolen in one county and carried into another by the thief, he was deemed to have committed larceny in both counties, and could be indicted and placed on trial in either. As the offense, wherever committed, was an offense against the same sovereignty, this rule as to larceny amounted simply to a convenient method of determining the place of trial. The English courts refused to apply the rule where goods were stolen in a foreign country and brought to England. Courts in many of the United States have somewhat illogically applied this rule to the several States, holding that if goods are stolen in a sister State and then brought within the State larceny is committed in both States, notwithstanding the fact that the original offense was committed against an independent sovereignty so far as the administration of the criminal law is concerned, and that the having in possession of stolen goods is a very different offense from the larceny of the goods. A few States, as Ohio, have refused to follow this rule, and one, Vermont, has applied the rule to goods stolen in other States and brought within the State, but has declined to follow it in case of goods stolen in foreign countries. (See LARCENY.) The crime of receiving stolen goods is now generally defined by statute and the punishment imposed varies in the different States. In most States the offense is deemed a felony. See CRIME; JURISDICTION.

STOLP, stölp. A town in the Province of Pomerania, Prussia, on the Stolpe, 12 miles from the Baltic Sea, and 65 miles west by north of Danzig (Map: Prussia, G 1). The fourteenth-century Marienkirche, with its lofty tower, is worthy of note. The town has an old castle. Its most important industries are amber turning and carving, and linen weaving. Machinery, furniture, leather, and cigars are also manufactured. Stolp was a member of the Hanseatic League, and belonged to the Dukes of Pomerania until 1637, when it passed to Brandenburg. Population, in 1900, 27,272. At the mouth of the Stolpe lies Stolpmünde, the port of Stolp, with a population of about 2000.

STOLTENBERG-LERCHE, stōl'ten-bĕrk-lĕrk'e, VINCENT. See LERCHE, VINCENT STOLTENBERG.

STOLZ, stôlts, FRIEDRICH (1850—). An Austrian classical philologist, born at Hall, in Tyrol, and educated at Innsbruck and Leipzig. He established himself as docent at the University of Innsbruck in 1879, and was appointed professor in 1887. Besides his great work, the first volume of the *Historische Grammatik der lateinischen Sprache* (1894-95), he wrote *Zusammengesetzte Nomina in den homerischen und hesiodischen Gedichten* (1874); *Die lateinische Nominalkomposition* (1877); *Studien zur lateinischen Verbalflexion* (1882); *Lateinische Laut- und Formenlehre* (in Müller's *Handbuch*, 3d ed. 1899); *Homeri Odysseæ Epitome* (1893); *Entwickelung der indogermanischen Sprachwissenschaft* (1899); and an ethnographical study, *Die Urbevölkerung von Tirol* (2d ed. 1892).

STOMACH (Lat. *stomachus*, from Gk. *στόμαχος*, throat, gullet, stomach, from *στόμα*, *stoma*, mouth). The principal organ of digestion, receiving the food through the œsophagus, and, after certain digestive changes have taken place, emptying it into the intestines, where the process is completed. The stomach is irregularly conical, curving somewhat upon itself so that the lower curvature is much greater than the upper curvature. The size varies according to the amount of food received, but when empty the walls are in apposition. It lies in the left hypochondriac and epigastric regions, behind and partly protected by the ribs and in close relation with the left lobe of the liver and the diaphragm. The stomach has an external peritoneal coat, a muscular coat consisting of longitudinal, circular, and oblique fibres, a submucous or areolar layer, and a lining mucous membrane. In this mucous membrane are the so-called pyloric and peptic glands, which secrete the gastric juice necessary for the digestive processes carried on here. The main blood supply is through the gastric artery, and the nerve supply is derived from the pneumogastric nerves and the sympathetic system. See ALIMENTARY SYSTEM; DIGESTION; FOOD; GASTRITIS; RUMINANT.

STOMACH, DISEASES OF THE. The organic diseases of the stomach with constant lesions include gastritis (q.v.), ulcer, erosions, and cancer. The 'functional' diseases, with variable lesions, include hyperchlorhydria, gastrosuccorrhœa, achylia gastrica, and isochymia.

Ulcer of the stomach is usually characterized by a deep circumscribed loss of substance of the mucous membrane lining the stomach, refusing to heal, and occasioning pain, vomiting, and hemorrhage. The cause cannot always be assigned, although the affection is of so frequent occurrence as to be found, either active or cicatrized, in about 5 per cent. of all persons who go to autopsy for all diseases (Brinton). It is twice as frequent in females as in males, and occurs most generally during middle life. Its mortality is most frequent between the ages of forty and sixty. While anæmia seems to play some part in the causation of ulcer, it is deemed more probable that hyperacidity of the gastric juice is more often accountable. Ulcers generally occupy the posterior surface, the lesser curvature, and the pyloric sac. When they heal they leave behind depressed scars with contractile tendency, producing, when at the pylorus, a stricture. When they do not heal, corrosion of neighboring blood-vessels may ensue, with hemorrhages, possibly fatal; or there may arise adhesions to neighboring organs, or perforations. The symptoms named increase in severity till death occurs from

perforation, hemorrhage, or starvation; or, they gradually disappear and the patient recovers. The prognosis is only fair. About half of the cases recover, about 13 per cent. die of perforations and peritonitis, about 20 per cent. die of tuberculosis, about 5 per cent. die of starvation, and about 5 per cent. die of hemorrhage. The treatment of ulcer includes rest, diet by mouth and by rectal enemata, correction of acidity by proper alkalies, the administration of nitrate of silver or bismuth, and the proper management of the accidents: hemorrhage, peritonitis, and collapse.

Erosions of the stomach consist really of small, superficial ulcers of the mucous lining. They occur commonly in chronic gastritis; often their cause is unassignable. The symptoms include pain, a feeling of weakness, and emaciation. The emaciation is progressive to a certain point, during the earlier part of the attack, but after reaching a certain level the patient grows no thinner, and does not present a cachexia.

The patient may suffer from erosions for many years. The treatment consists of the use of nitrate of silver, intra-gastric galvanization, diet, general hygiene and out-of-door exercise, condurango, nux vomica, and iron.

Cancer of the stomach is more frequent than cancer of any other organ. It is apparently on the increase. Gastric cancer occurs more frequently at the age of fifty; it is rare before thirty. It is probably equally divided between the sexes. The tendency to cancer is possibly hereditary. It follows trauma and ulcers, and it is probably also due to primary infection with the suspected bacillus which bacteriologists hope to discover as the cause of cancer. The new growth may be an epithelioma, a medullary carcinoma, a scirrhus, or a colloid carcinoma. See TUMOR.

The general symptoms of cancer of the stomach are pain, loss of appetite, vomiting, hemorrhage, tumor, fever, constipation, and a decided cachexia. Examination of the blood reveals a leucocytosis in some cases during fasting, and an absence of the normal leucocytosis of digestion. Little can be argued from the urine, although in some cases the chlorides are diminished and indican is increased, and rarely peptonuria is present. Examination of the stomach contents after a test meal reveals decrease of the free hydrochloric acid as well as of the total acidity, and the presence of lactic acid. The prognosis is hopeless for cure. If the disease be of slow progress, the patient may gain relief enough from surgical interference to live along several years. When the neoplasm invades the pylorus, resection of this part of the stomach may be made; or excision, if in other parts of the organ. Among palliative operations are gastrotomy and gastro-enterostomy. The former is suitable in cases of cancer of the œsophagus or of the cardiac orifice, the latter in cases of pyloric stenosis. The medical treatment consists of diet, the iodides, condurango, methyl blue, chloral, and such analgesics as may be expedient.

Of the 'functional' diseases, *hyperchlorhydria* is a condition in which the gastric juice possesses more acidity and ferments than it should. A test of the stomach contents decides the diagnosis, and the condition is met by hygiene, diet, alkalies, bromides, and in some cases opiates and electricity.

Gastrosuccorrhœa is a periodical and continuous production of the normal gastric juice, causing vomiting and intense pain, restlessness, nausea, and a feeling of pressure in the epigastrium. Analysis of the contents of the stomach is the best diagnostic test. The treatment of this rare affection is largely by the use of atropine, nitrate of silver, galvanization, and lavage.

Achylia gastrica is a condition in which there is a constant absence of gastric juice, accompanied by atrophy of the stomach, and following severe catarrhal disease of that organ. The gastric contents decide the diagnosis. Lavage, faradization of the stomach, and attention to diet constitute the treatment.

Isochymia is a distressing condition in which food is always found in the stomach, even when fasting. The stomach is dilated and the mechanical insufficiency of the organ is so great as to fail of emptying the chyme into the intestines. Paresis of the gastric muscular coat or contraction of the pylorus is the cause of this condition. Indifferent appetite, thirst, dryness of the throat, oppression, pain, and eructation of gas, together with vomiting of chyme, are among the notable symptoms. Constipation is present and emaciation becomes pronounced. Ulcer may be the cause of the pyloric stenosis. The course of the condition varies with the etiology. Lavage, diet, nitrate of silver, rectal alimentation, massage, and the administration of alkalies may all be of advantage, as also the galvanic current. See CARDIALGIA; INDIGESTION; SARCINA. Consult Einhorn's *Diseases of the Stomach* (New York, 1903).

STOMACH-PUMP. An instrument used to remove poisons from the stomach, to feed persons who cannot swallow, or who attempt to starve themselves, or to wash out the stomach during disease. It is a syringe with a flexible tube, inserted into the stomach through the œsophagus, by which fluid is injected and removed.

STOMATA (Neo-Lat. nom. pl., from Gk. *στόμα, stoma*, Av. *staman*, mouth). The so-called breathing pores especially numerous in foliage leaves and developed in any epidermis overlying green tissue. Each stoma consists of two crescentic guard cells whose concave surfaces face one another, leaving a slit which is opened or closed as required by the plant, hence the name 'automatic gateway.' See LEAF.

STOMATITIS. See MOUTH, DISEASES OF THE.

STOM'ATOP'ODA. See CRUSTACEA; MANTIS-SHRIMP.

STONE. See BUILDING STONE.

STONE. See WEIGHTS AND MEASURES.

STONE. See CALCULUS.

STONE, ARTIFICIAL. The name given to various artificial compositions of which the basis is hydraulic cement, which are plastic when first made and assume with age a stone-like hardness and consistency. Some of these compositions possess undeniable merit for certain kinds of work and are considerably used. The chief stones of this character are Béton-Coignet, Portland stone, McMurtrie stone, Ransome stone, and Sorel stone. *Béton-Coignet* was invented by Coignet, a Frenchman, and as made by him was composed of Portland cement, siliceous hydraulic cement, and clean sand very thoroughly mixed with a

small amount of cold water. This plastic mixture is then placed in molds to harden for use. *Portland stone* is a mixture of Portland cement and sand or sand and gravel wet to make a plastic mixture and rammed into molds to harden. Under various trade names Portland stone has quite an extensive use in the United States. It is molded into blocks of numerous forms and sizes, with or without ornament, for buildings and other structures. *Sand bricks* are an artificial stone made by mixing sand and lime into a moist paste, molding this paste into bricks or blocks, and setting the molded blocks to harden in heated chambers. *McMurtrie stone* is formed by adding alum and potash soap to the mixture for Portland stone. These ingredients form compounds of alumina in the pores of the stone, which reduce the capacity of the stone to absorb water and add somewhat to its strength. *Ransome stone* is made by mixing sand and silicate of soda, molding the mixture into blocks or slabs, and setting them to harden under pressure in a hot solution of chloride of calcium. This material is used mostly in England, where it is applied to a variety of purposes. *Sorel stone* is a French product, and is made by adding to oxide of magnesium a solution of chloride of magnesium. It is used mainly in making emery wheels. Consult Baker, *Treatise on Masonry Construction* (New York). Excellent articles on the manufacture of sand brick are contained in the *Transactions of the American Ceramic Society*, vols. iv. and v. See CONCRETE; PAVEMENT.

STONE, AMASA. (1818-83). An American railroad builder and philanthropist. He was born at Charlton, Mass., and early engaged in the building of railroads and bridges, being made superintendent of the New Haven, Hartford and Springfield Railroad in 1845. He was one of the contractors for building the Cleveland, Columbus and Cincinnati and the Cleveland and Erie railroads, and during the Civil War he was often an adviser of the Government in matters of transportation of men and material. Stone gave $600,000 to Adelbert College of the Western Reserve University at Hudson, on condition of its removal to Cleveland, and also made many charitable benefactions in the city of Cleveland.

STONE, CHARLES POMEROY (1825-87). An American soldier, born at Greenfield, Mass. He graduated at West Point in 1845, entered the ordnance department, and served under General Scott during the war with Mexico. On the outbreak of the Civil War he organized the District of Columbia Volunteers, and in May, 1861, was made brigadier-general. He participated in several actions during June and July, 1861, took part in General Patterson's operations in the Shenandoah Valley, and commanded at the disastrous affair at Ball's Bluff (q.v.). Though charges were never preferred against him, he was arrested and confined for six months in military prisons. In August, 1862, he was released, and in May, 1863, he was assigned to the Department of the Gulf. He participated in the siege of Port Hudson in 1863, and then for nearly a year served as chief of staff to Major-General Banks. On August 21, 1864, he was given command of a brigade before Petersburg, and on September 13, 1864, resigned his commission. In 1870 he entered the service of the Khedive of Egypt as chief of staff and with the rank of brigadier-general. He was later appointed general aide-de-camp to the Khedive. In 1883 he returned to the United States.

STONE, EDWARD JAMES (1831-97). An English astronomer, born in London. He received his education at Queen's College, Cambridge, and in 1859 was elected fellow of his college. In 1860 he became chief assistant at the Royal Observatory at Greenwich. From 1866 to 1870 he was secretary of the Royal Astronomical Society, and its president (1882-84). In 1870 he was appointed her Majesty's astronomer at the Cape of Good Hope, and in 1879 Radcliffe observer at Oxford, which position he retained till his death. From observations made in 1862 Stone deduced a value of the solar parallax, which fixed the solar distance as slightly over 91,000,000 miles. The reversal of the Fraunhofer spectrum, a confirmation of Young's spectroscopic discovery of the reversing layer of the sun, was observed by him during the solar eclipse at Klipfontein in 1874.

While at the Cape Observatory he prepared a catalogue of 12,441 stars (1880), containing all stars down to the seventh magnitude between the South pole and 25° S. declination, for which he was awarded the Lalande prize of the French Academy in 1881. This survey of the southern heavens was completed in the *Radcliffe Catalogue* for 1890, in which he gives the places of 6424 stars to the seventh magnitude between the equator and 25° S. declination. Consult Royal Society's *Catalogue of Scientific Papers.*

STONE, SAMUEL JOHN (1839-1900). An English hymn-writer, born at Whitmore, in Staffordshire. He was educated at the Charterhouse and at Pembroke College, Oxford. He became curate of Windsor (1862-70) and of Saint Paul's, Haggerston (1870-74), vicar of Saint Paul's, Haggerston (1874-90), and rector of All Hallow's on the Wall, London (1890). He is widely known for his many hymns, as "Round the Sacred City Gather," "The Church's One Foundation," and "Lord of Our Soul's Salvation." Consult his *Hymns* (1886), also his *Lyra Fidelium* (1866), *The Knight of Intercession and Other Poems* (1872), *Sonnets of the Sacred Year* (1875), and *Lays of Iona* (1897). For bibliography of hymns, consult Julian's *Dictionary of Hymnology* (London, 1892).

STONE, THOMAS (1743-87). A signer of the Declaration of Independence. He was born in Charles County, Md., studied law at Annapolis, began practice at Frederickton in 1764, and was a delegate to the Continental Congress in 1775-77, and again in 1783-84, being president *pro tem.* in 1784. He was a member of the Committee on Confederation in 1776-77, and, returning to Maryland in 1777, urged the State Convention to ratify the Articles of Confederation. Consult Sanderson, *Signers of the Declaration of Independence*, vol. ix. (Philadelphia, 1823-27).

STONE, WILLIAM LEETE (1792-1844). An American journalist and historical writer, born at Newpaltz, N. Y. After editing several provincial journals he became editor of the New York *Commercial Advertiser* in 1821. He earnestly furthered a plan for collecting the colonial documents of New York, and was defendant in a famous suit brought by the novelist Cooper for criticisms that had appeared in his journal on that novelist's *Home as Found* and the *History*

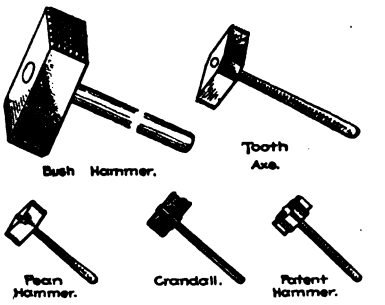
of the Navy. (See COOPER, J. F.) He was active in furthering benevolent institutions for the deaf and dumb and for juvenile delinquents. Among his many publications the revolutionary *Tales and Sketches* (2 vols., 1834), *Maria Monk and the Nunnery of the Hôtel Dieu* (1836), and a social satire *Ups and Downs in the Life of a Distressed Gentleman* (1836) are still of interest. Better known probably are his *Life of Joseph Brant* (1838); *Life of Red Jacket* (1840); and *Uncas and Miantonomeh* (1842). An account of his other works is given in *Life and Writings of Col. William L. Stone* (1866), by his son, WILLIAM LEETE STONE, JR. (b. 1835), himself the author of many works of antiquarian research connected with the Revolutionary epoch, among which the more noteworthy are: *The Life and Times of Sir William Johnson, Bart.; Revolutionary Letters; Burgoyne's Campaign; History of New York City; Reminiscences of Saratoga and Ballston.* He edited also *Ballads of the Burgoyne Campaign and Other Revolutionary Memorials.*

STONE AGE. A term commonly used to denote the earliest recognized stage in the development of human culture as defined by the materials used by man for weapons, utensils, etc. The phrase is somewhat misleading, however, since it is quite probable that primitive man made use of wood and other perishable materials to a far greater extent than of stone, and as a consequence the stage is defined by the prevailing material of the relics rather than by that of the actual implements in common use.

The term Stone Age represents in no sense a chronological division of human progress, but is a loose equivalent for a stage of cultural development varying widely in duration in different parts of the world. There are, for example, tribes still in the Stone Age, while, on the other hand, some groups had progressed beyond it before the dawn of history. It is also worth noting that some tribes commonly classed as belonging to the Stone Age produced objects of a superior artistic and industrial merit to those of peoples who had advanced to the use of metals. The evidence for the existence of such an age in most parts of the world is conclusive, but it is from the prevalence and character of the relics in certain parts of Europe rather than in America that the idea and the term have come into general use.

A very common and well-recognized subdivision of the Stone Age is into the *paleolithic* and *neolithic* periods. In the paleolithic period man's best tools were extremely crude, and he is considered to have understood how to chip stone into shape, but not how to grind or polish it. In the neolithic period both these advances had been made. The terms *protolithic* and *technolithic* have also been proposed to indicate the earlier and later periods of the Stone Age, but have not come into general use. Relics of the Stone Age abound in practically all parts of the world, and are found in great numbers in all archæological museums. The most characteristic types are knives, scrapers, arrow-points, spear-heads, celts, axes, mortars, and pestles. See ARCHÆOLOGY, AMERICAN.

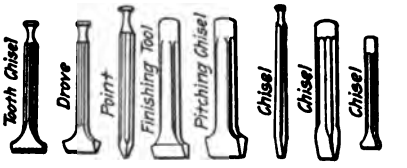
STONE CUTTING AND DRESSING. Processes employed in preparing quarried stone for structural and ornamental purposes. These processes range in character from the rough shaping of the stone into squared blocks, which is generally performed at the quarry, to the cutting and polishing of carefully modeled and ornamental pieces such as columns, cornices moldings, and balustrades, and they may be carried out either by means of hand tools or by



STONE-WORKING HAMMERS.

stone-working machines. The hand tools used in stone cutting and dressing are various shaped hammers and chisels and simple forms of measuring instruments, templates, and gauges.

After a block is broken from its quarry bed by one of the methods described in QUARRYING, it is trimmed to the desired size and shape by a variety of means according to the hardness of the stone and the kind of finish desired. By means of the pitching chisel the rough block is trimmed down to a line, then the irregular surface is worked down by the point, after which it is finally dressed. If the stone is to be polished it is first scoured with wet sand. Small blocks are now usually ground with wet sand on a re-



STONEWORKING CHISELS.

volving iron bed, while large blocks are ground by dragging a slab of stone back and forth across them with wet sand as the abrading material. For securing a finer polish, emery, hones, pumice stone, and polishing putty (oxide of tin) are used. A high grade of polish can be secured by skilled workmen only, and each man usually has his own peculiar methods for securing the result desired.

In most large establishments *grinding and polishing* machines are much employed. For flat surfaces a circular horizontally revolving iron plate or grating, attached to the lower end of a vertical shaft, with an elbow joint, is used, the workman guiding the plate to various parts of the surface, and using sand or emery as the abrading material. By attaching felt to the plate the same machine is used for polishing. Blocks of such small size as can be handled by the workmen are usually ground upon horizontally revolving iron beds some eight or ten feet in diameter. Pendulum machines are used for polishing simple moldings. The molding being first cut as smoothly as possible with the chisel, a plate of cast iron, fitted as accurately as pos

sible, is made, by means of a long arm, to travel back and forth along the molding, with sand, emery, putty powder, or other abrasive.

For turning posts and pillars *lathes* are now generally used. For the softer stones a simple pointed cutting tool similar to that used in turning metals and held and operated by a similarly constructed machine is employed. In turning hard stones like granite the cutting tool is in the form of a thin steel disk some 6 inches or 8 inches in diameter, so arranged as to revolve with the stone when pressed against it at a sharp angle. Lathes of this type are used, which are capable of turning a block 25 feet long and 5 feet in diameter to a perfect column. *Planers* for rough work, such as flagstone, resemble the same machine for planing metals. See METAL-WORKING MACHINES.

Stone-sawing machines are made in various forms. The most familiar form consists of a smooth flat blade of soft iron which is given a reciprocating motion by machinery and fed with sharp sand and water. Such saws are commonly worked in gangs of ten or a dozen blades set parallel the desired distances apart and operated by a single saw frame. This method of sawing is not applicable to cutting granite, on account of its hardness. Frequently, in place of sand, use is made of small globules of chilled iron or of crushed steel as an abrasive. Circular saws set with diamonds have proved very efficient tools, but their use is generally prohibited by their expense. Slate is sawed by circular saws such as are used for sawing lumber. In Europe considerable use has been made of twisted cords of steel made to run around pulleys like a band saw. Among other machines for stone cutting and dressing mention may be made of pneumatic hammers and the sand blast.

BIBLIOGRAPHY. The literature relating to stone cutting and dressing is somewhat scattered. Two books which may be consulted with advantage, however, are: Merrill, *Stones for Building and Decoration* (New York, 1891), and Baker, *Treatise on Masonry Construction* (New York, 1900).

STONE-FLY. One of the aquatic insects of the family Perlidæ and order Plecoptera—flat-bodied insects with two pairs of wings. The hind wings are very broad and when folded lie flat on the back of the insect. The larvæ live in water, clinging to the under sides of stones, and in general appearance are much like the adult insects, except in the lack of wings and ocelli; they are carnivorous, living largely upon the nymphs of May flies (q.v.). The well-aërated water in which the nymphs live is correlated with a peculiar rudimentary tracheal system for breathing. The eggs are produced in enormous numbers and a single female may deposit more than 5000; they are small, and are probably dropped during flight upon the surface of the water as with the May flies.

STONEHAM, stōn'am. A town in Middlesex County, Mass., 8 miles north of Boston, on the Boston and Maine Railroad (Map: Massachusetts, E 3). It has a public library with 10.000 volumes, and a high-school building which cost $50,000; also a public park, included in the system of the Metropolitan Park District. Boots and shoes, boxes, and automobiles are the principal manufactures. The government is administered by town meetings. Population, in 1890, 6155; in 1900, 6197. Settled about 1670, Stoneham was under the jurisdiction of Charlestown and was called Charlestown End until 1725, when it was incorporated under its present name. Consult Stevens, *History of Stoneham* (Stoneham, 1890).

STONEHENGE (AS. *Stanhengist*, hanging stones). A celebrated stone circle, or cromlech, the ruins of which stand on Salisbury Plain, 1½ miles from Amesbury, in Wiltshire, Southern England. When entire it consisted of two concentric circles of monoliths, the outer 100 feet in diameter, inclosing two smaller rows in form of a horseshoe, the opening to the northeast. Within there is a block of blue marble 15 feet long which is called the 'Altar Stone.' On a northeast line from the altar is a flat stone on the edge of the trench surrounding the whole ruin, and the line prolonged cuts another large stone some distance away called the 'Friar's Heel.' This arrangement, also observed in numerous other stone circles, points to a means of determining the time of the summer solstice, and it is thought for this reason that Stonehenge was connected with sun-worship. In any case the monument, whether it was a temple, a court of justice, or a battle ring, has been designed with reference to the northeast. Modern research clearly proves that the structure dates from at least as early as the Bronze Age. The tumuli in the vicinity of the cromlech yield Bronze Age remains. Consult Flinders Petrie, *Stonehenge: Plans, Descriptions, Theories* (London, 1881).

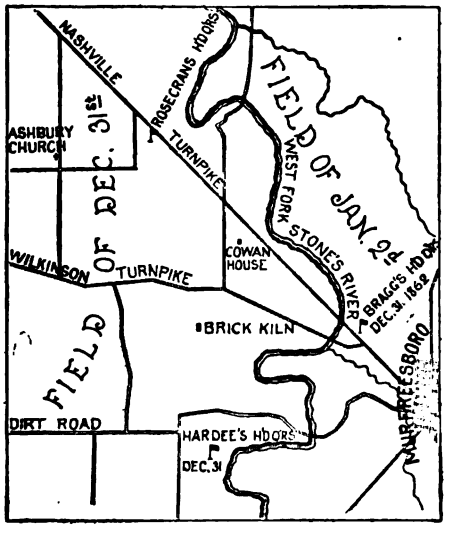
STONE'HOUSE, EAST. See EAST STONEHOUSE.

STONE'MAN, GEORGE (1822-94). An American soldier and Governor of California. He was born at Busti, Chautauqua County, N. Y., and graduated at West Point in 1846. Just before the outbreak of the Civil War he was in command of Fort Brown in Texas, and was ordered by his superior officer, General Twiggs, to surrender to the Confederates, but refused to do so, and escaped with his troops on a steamer to New York. After some service in West Virginia he was appointed chief of cavalry in the Army of the Potomac. By overtaking the Confederate troops after the evacuation of Yorktown in May, 1862, he brought on the battle of Williamsburg. On November 15, 1862, he was made commander of the Third Army Corps, which he commanded at Fredericksburg on December 13th. During Hooker's Chancellorsville campaign he led a cavalry raid toward Richmond. In April, 1864, he was put in command of a cavalry corps in the Army of the Ohio, and in the Atlanta campaign undertook a raid against Macon and Andersonville. He was captured with a part of his force at Clinton, Ga., and was kept a prisoner for three months. In December, 1864, he led a raid from East Tennessee into southwestern Virginia, and destroyed the salt works at Saltville. In the following March he again entered southwestern Virginia, destroyed a part of the Virginia and Tennessee Railroad, and did much other damage. In the following month he moved into North Carolina, took Charlotte and other towns, and at Salisbury captured about 1400 prisoners. In 1871 he retired from the army and settled in California.

There he served for six years as a railroad commissioner, and in 1883 was elected Governor by the Democrats.

STONE MARTEN. See MARTEN.

STONE RIVER, BATTLE OF, or MURFREESBORO, BATTLE OF. An indecisive battle fought near Stone River, in the vicinity of Murfreesboro, Tenn., on December 31, 1862, and January 2, 1863, between the Federal Army of the Cumberland, numbering about 41,000 effective men, under General Rosecrans, and the Confederate Army of Tennessee, numbering about 35,000 effective men, under General Bragg. Soon after replacing General Buell on October 30, 1862, in command of the Army of the Cumberland, General Rosecrans occupied Nashville, while General Bragg, after having been manœuvred out of Kentucky by General Buell, took up a position in and near Murfreesboro, Tenn. On December 26th Rosecrans advanced from Nashville against Bragg, and on the 30th, after having encountered considerable resistance along the way, arrived in the immediate vicinity of Murfreesboro. Both generals arranged to attack on the following morning, and by a singular coincidence both adopted the same general plan of battle, each issuing orders for an attack by his left, heavily reënforced, upon his opponent's right. As the two armies faced one another, Crittenden, commanding the Federal left, was opposed to Breckenridge, commanding the Confederate right; Thomas, commanding the Federal centre, was opposed to Polk, commanding the Confederate centre; and McCook, commanding the Federal right, was opposed to Hardee, commanding the Confederate left. At 6 A.M. on the 31st,



STONE RIVER.

while Crittenden was preparing to cross the river and advance against Breckenridge, Hardee vigorously and with vastly superior numbers attacked McCook, who seems to have made an unwise arrangement of his line, and who, though he had assured Rosecrans of his ability to hold his position for three hours, soon gave way, his three divisions under Johnson, Davis, and Sheridan, after having offered a stubborn resistance, being gradually forced back to the Nashville Pike, in the rear of the Federal left and left centre. The Federal centre, however, under Thomas, successfully beat back the attacks of the Confederate centre and parts of the Confederate left, and, though a realignment of the troops in this part of the field had to be made, the Federals held their position. Meanwhile the Federal left, which, in pursuance of Rosecrans's plan of battle, had begun at 8 A.M. to advance against the Confederate right, had been recalled when the defeat of the Federal right became known, and was instrumental in beating back the final Confederate attacks. The fighting virtually ceased at dark. At the close of the day the advantage was decidedly with the Confederates, who, besides capturing 28 guns and a large number of prisoners, had driven part of the Federal army from its position and had forced Rosecrans to act on the defensive instead of carrying out his own plan of battle. On January 1st the two armies retained their positions, and there was little fighting, except along the skirmish lines. Van Cleve's division of Crittenden's Federal corps was, however, sent across the river to occupy a position on high ground opposite one of the fords of the river. On the following day, the 2d, at 4 P.M. Breckenridge's Confederate division made a furious assault upon this position, the capture of which was necessary to prevent the enfilading of the Confederate line; but, after being at first successful, it was finally driven back with great loss. On the night of the 3d Bragg evacuated Murfreesboro and retreated toward Tullahoma, 36 miles distant. For some months thereafter the Army of the Cumberland remained at Murfreesboro. Throughout the North the battle was claimed as a Federal victory, as it was strategically, though tactically it may be considered to have been drawn. The Federal loss in killed, wounded, and missing was about 12,900; that of the Confederates, about 11,700. Consult: Johnson and Buel (eds.), *Battles and Leaders of the Civil War*, vol. iii. (New York, 1887); Ropes, *Story of the Civil War*, vol. ii. (ib., 1894-98); Cist, *The Army of the Cumberland* (ib., 1882), in the "Campaigns of the Civil War Series;" Nicolay and Hay, *Abraham Lincoln: A History* (ib., 1890); Van Horne, *History of the Army of the Cumberland* (Cincinnati, 1875); and the *Official Records*, vol. xx., parts i. and ii.

STONE-ROLLER, or STONE-LUGGER. One of two fresh-water fishes of the Mississippi Valley: (1) A small and worthless sucker (*Catostomus nigricans*), which inhabits clear streams throughout the West. It usually rests quietly on the bottom, but darts swiftly away when alarmed, scattering the pebbles. It is olive green with brassy sides, and has a flattened, concave head and thick lips. (2) A small brown cyprinoid (*Compostoma anomalum*), remarkable for the fact that in the nuptial season the males become covered about the head and often over the whole body with large rounded tubercles. They frequent the deep pools of small streams.

STONES OF VENICE, THE. A treatise on the art and architecture of Venice by John Ruskin (1851-53), undertaken to record the vanishing glories of the city. It had great influence on the appreciation of Venetian art and on the Gothic revival of that day, and especially on

William Morris, though it was sharply criticised from an art standpoint.

STONEWARE. A kind of pottery distinguished by an advanced vitrification of the whole mass. It is for this reason that stoneware has been employed for jugs and flagons and vessels of all shapes and size intended to hold valuable liquids. The decoration of these vessels was often very elaborate. The color of this ware, when finished, was a nearly uniform soft gray, to which was added on many occasions a certain amount of blue. The ware is also very strong. The French word *grès* is commonly applied in the trade and by collectors to such pieces of stoneware as are of decorative character.

STONEWORK. Structural and decorative work in stone, whether for buildings of an architectural or of all engineering character; including, therefore, all kinds of masonry (q.v.) for foundations, piers, walls, vaults, etc., and all kinds of stone-cutting, both constructive and decorative. As other varieties are treated under the appropriate titles, it remains only to treat in this article, very briefly, of the artistic applications of stonework. These applications, as distinguished from sculpture and carving, are found chiefly in decorative details of works of architecture, including such engineering works in stone as are treated with decorative intent, like moldings, columns, bases and caps, pilasters, pedestals, pediments, finials, rustications, balustrades, parapets, and the like. On the technical side, the treatment of these details varies with the material and the design. All such stonework is first 'roughed out,' either at the quarry or at the stone-cutting yard, into blocks rudely approximating the intended form. If the stone is soft and friable, and the decorative detail complex or delicate, it is usually built into the structure in this rough form, and finished afterwards. The harder kinds of stone, blue-stone, granite and hard marble, and all moldings and blocks of simple form, are cut at the yard, carefully crated or packed and delivered finished at the building. The carved detail of the softer stones is executed 'in place' with the chisel by carvers specially trained for this. On the artistic side stonework is treated with greater or less fineness of finish according to the grain of stone, and the decorative effect sought. The harder granites and marbles are often highly polished, when used as shafts or panels. In heavy work, as on bridges, embankments and the basements of buildings, a rough fractured surface, called 'rock-face' or 'quarry-face' is often left on each block.

STONINGTON, stŏn'ĭng-tŏn. A town, including the borough of Stonington, in New London County, Conn., 50 miles southwest of Providence, R. I., on Long Island Sound, and on the New York, New Haven and Hartford Railroad (Map: Connecticut, H 4). It is attractively situated and has some reputation as a summer resort. A good harbor makes it also of considerable commercial importance. There are the shops of the New York, New Haven and Hartford Railroad, machine shops, printing press works, thread mills, and manufactories of silk machinery, cotton, woolen, and silk goods, velvets, and fertilizers. The government is administered by town meetings, convening annually. Population, in 1890, 7184; in 1900, 8540.

In 1649 William Cheesebrough of Plymouth Colony made the first permanent settlement at Stonington and called it Poquatuck. At first within the bounds of Massachusetts, whose General Court chartered it as Southertown in 1658, it passed to Connecticut in 1662, was named Mystic in 1665, and Stonington in 1666. In 1775 it was attacked by a British fleet under Commodore Wallace, and in 1814 it was bombarded for four days by Admiral Hardy, Nelson's favorite officer. For many years Stonington was prominent for its participation in the seal-catching and whale-fishing industries. It was the early home of Roger Sherman. Consult Wheeler, *History of the Town of Stonington from 1649-1900* (New London, 1900).

STONO FERRY, BATTLE OF. An engagement near a ferry over the Stono River, a short distance from Charleston, S. C., on June 20, 1779, during the Revolutionary War, between a small force of British, strongly intrenched, under Lieutenant-Colonel Maitland, and a superior American force under General Lincoln. General Prevost, on withdrawing from his invasion of South Carolina, left temporarily a small force of about 800 men at Stono Ferry and another small force on John's Island. In the early morning of June 20th General Lincoln attacked the British at Stono Ferry, but, owing to the failure of General Moultrie properly to coöperate with Lincoln, the garrison was reinforced from John's Island, and the American attack was repulsed. Lincoln then withdrew, beating off the attacks of the British, who followed for a short distance. The loss of the British in killed, wounded, and missing was about 130; that of the Americans was about 200.

STONYHURST COLLEGE. A leading Catholic college, situated at Stonyhurst Lane, England. It had its inception in the English college at Saint Omer, in the Province of Artois, France, founded by Robert Person, S.J., in 1592, under the protection and patronage of Philip II. of Spain, to which country that province then belonged. The school, in spite of many difficulties, prospered, and when Artois was ceded to France in 1659 a special article in the capitulation insured the safety of the institution. In 1760 it obtained from Louis XV. the much-desired title of 'Collège Royal.' At the expulsion of the Jesuits from France the college with all its movable belongings was removed to the city of Brûges in the Austrian Netherlands. When the Society of Jesus was suppressed by Pope Clement XIV. in 1773 an attempt was made by the Austrian Government to conduct the school with the aid of English Dominicans, but such was the attachment of the pupils to their old teachers that the college had to be closed owing to their rebellious attitude. Some of the masters and pupils then took refuge in Liège, where the authorities were more kindly disposed toward the Jesuits. In 1794, when the Revolutionary armies were marching upon Liège, the college was offered a final resting place by Thomas Weld, who gave it his estate at Stonyhurst, England. In 1808 the attendance outgrew the accommodation, and the construction of the first of a series of five buildings was begun. In 1832-36 a church was erected and in 1837 the college library was presented with the famous Arundell collection. The well-known observatory was erected in 1838.

In 1840 it became affiliated with the University of London. Henceforth the sciences were introduced and the curriculum which was based on the Ratio Studiorium (q.v.) was generally enlarged. The regular course of study covers a period of seven years.

STONY POINT. A town in Rockland County, N. Y., 35 miles north of New York City, on the Hudson River, and on the West Shore Railroad (Map: New York, F 4). Population, in 1890, 4614; in 1900, 4161. Stony Point was fortified by the Americans early in the Revolutionary War and was captured on May 31, 1779, by Sir Henry Clinton. On July 16th it was recaptured by General Anthony Wayne, who, with 1200 men, stormed the works and took 543 prisoners, the American loss being 15 killed and 83 wounded, and the British 63 killed besides the prisoners, among whom the wounded were included. Two days later the fortifications were dismantled and the place abandoned, the British reoccupying it soon afterwards. The site of the Revolutionary fort and battlefield has been converted into an historical reservation which was formally opened in 1902. Consult Johnston, *The Storming of Stony Point* (New York, 1900).

STOPPAGE IN TRANSITU. The stoppage by an unpaid seller of goods while on their way from him to the buyer, after title has passed to the latter. The right so to stop goods is not founded on any contract between the parties, nor upon any principle of equity, but upon mercantile usage. Its first recognition in the judicial reports of England appears in an equity case decided in 1690. Prior to this it was a well-established rule of the law merchant (q.v.). From courts of equity it was adopted by the courts of common law, and for three centuries has been a recognized rule of English jurisprudence. The term 'unpaid seller' is here employed in a broad sense. It includes not only the ordinary seller, but the factor of the buyer, who has paid for goods placed to his credit for the price—any one, indeed, whose position can be shown to be analogous to that of an ordinary seller, who is unpaid either wholly or in part.

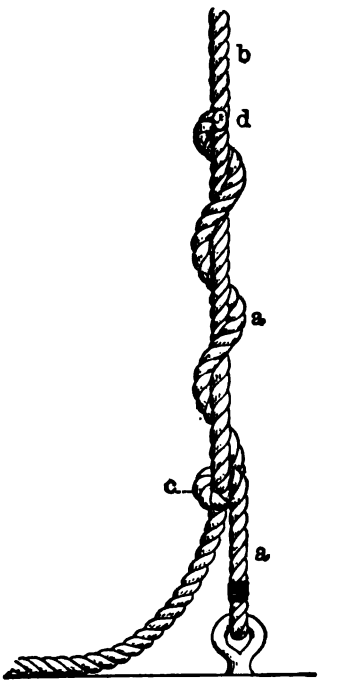
The second requisite is that the buyer shall have become insolvent, and that the knowledge of this insolvency shall have come to the seller after dispatching the goods. Insolvency, in this connection, is used in its popular sense, meaning the financial condition of one who cannot pay his debts as they fall due in the ordinary course of business; and if he lets his commercial papers go to protest, or by other conduct affords the ordinary opponent evidence of insolvency, the unpaid seller is safe in treating him as insolvent.

The third requisite is that the goods shall have left the possession of the seller, but shall not have reached the possession of the buyer—that they shall be in transit. The transit begins as soon as they have left the seller's possession for transportation to the buyer. It continues as long as they are in the possession of a carrier, or other middleman, on their way to the buyer. "Such middleman may be the buyer's agent for certain purposes; and yet if, by the agreement of the parties or by the usage of trade, he is not a mere servant of the buyer, but is a person interposed between the seller and the buyer, having a possession of his own and liable, in his capacity as bailee, to an action by the buyer, in case the goods are carelessly lost or misdelivered, the goods are still in transit." Such transit may be intercepted by a new and distinct agreement between the carrier and the buyer, under which the carrier is thereafter to hold the goods subject to new orders from the buyer. It is not intercepted, however, by the levy of an execution or an attachment on the goods on behalf of a creditor of the buyer. Such a levy gives the creditor only the right of the buyer; and that right is subject to the unpaid vendor's right to stop the goods. If a bill of lading (q.v.) has been given to the buyer by the seller, its transfer to a *bona fide* purchaser cuts off the seller's right. This comes from the *quasi* negotiable character of the bill of lading under the law merchant.

Although no particular form of notice is required, a valid stoppage *in transitu* cannot be made without a notice of some kind to the carrier. If the goods are in the hands of an agent of the carrier, notice that the seller stops the goods may be given to either the agent or the principal. If given to the latter it must be given at such time and under such circumstances that the principal, by the exercise of reasonable diligence, may communicate it to the agent in time to prevent a delivery to the buyer.

The exercise of this right restores to the seller the possession of the goods, but does not revest title in him. The buyer or his transferee is entitled to the goods upon paying cash for them, but not otherwise.

STOPPER. A short length of rope or chain or an iron contrivance used on board ship for



STOPPER FOR ROPE.

a, Rope stopper.
b, Rope held by the stopper.
c, Point where a gripe *b*.
d, Loose end of *a*. This is usually held in place by a man until the stopper *a* is removed from *b*.

checking the running of a rope or chain, or for holding it firmly. A stopper for ropes is a short

length of soft manila secured at one end to the structure of the ship; the other end is passed around the rope to be stoppered with a jamming hitch. It is used to keep the rope from slipping while it is being belayed or secured. A stopper for a chain cable is usually of wire rope and four to six feet long. At one end it is spliced into the eye of a hook, and at the other has an



STOPPER FOR CHAIN CABLE.

eye formed around a short bar of iron. The hook is placed in a ringbolt in the deck, and the body of the stopper lashed to the chain by two 'tails' of soft manila rope. When ships are at anchor the chain is held by such stoppers.

STORAGE (from *store*, OF. *estorer, estaurer*, from Lat. *instaurare*, to renew, make, provide, from *in*, in + **staurare*, to set up; connected with Gk. *σταυρός*, *stauros*, stake, Skt. *sthāvira*, firm, AS. *stēor*, rudder, and ultimately with Eng. *stand*). Since most plants absorb or produce food in excess of their immediate needs, they provide for temporary or long-continued storage. These foods are transformed for permanent storage and mobilized for subsequent translocation by specific activities of the cell, self-regulated through irritability (q.v.). The chief regions of storage are spores, seeds, fleshy fruits, roots, tubers, bulbs, leaves, and stems. As a rule the regions of the higher plants specially adapted for storage are thick, fleshy, and abundantly supplied with thin-walled parenchyma cells. (See HISTOLOGY.) Storage occurs only in living cells. Occasionally the cell walls in storage regions are thick and woody, and in some cases, e.g. in the endosperm of seeds, the walls themselves are made up mainly of the stored material, reserve cellulose. The chief forms in which reserve food is stored are as follows:

(1) CARBOHYDRATES. Reserve carbohydrates are either soluble, such as sugars (saccharose, glucose, fructose, mannose, and galactose) and inulin, or insoluble, as starch and cellulose (qq.v.). Starch is organized into granules by the leucoplasts (q.v.). Reserve cellulose is deposited upon the cell walls as a complex carbohydrate, whose composition is unknown, though it seems to have somewhat the same relations to ordinary cellulose as the most complex of the dextrins, amylodextrin, holds to starch. It is found especially in the endosperm, or in various parts of the embryo, in bud scales, etc.

(2) FATS. Fats occur in the form of minute droplets (oil) in the protoplasm, not infrequently accumulated by special organs of the cell, the leucoplasts. They are found in the endosperm or embryos of seeds (probably in the seeds of nine-tenths of all seed plants), in spores, tubers, and the wood of trees.

(3) PROTEIDS. Proteids are found either as amorphous grains, the so-called aleurone, or as crystals, which are not infrequently associated with or imbedded in aleurone grains. These are sometimes formed by leucoplasts, but at other times appear to be deposited in the sap cavity (vacuoles) of cells, where the proteid appears to accumulate in increasing concentration until it solidifies in the form of the vacuole, or in one or several crystals. (See ALEURONE.) Crystals of proteid are also found in chromatophores, nuclei, and even in the cytoplasm itself. They are often distinguished as crystalloids, because they have the capacity of swelling (see IMBIBITION), a rare quality among inorganic crystals.

(4) AMIDES. Amides are nitrogenous compounds intermediate in complexity between proteids and carbohydrates and readily crystallizable. Most nitrogenous materials are ordinarily translocated as amides. They are rare in seeds, but especially abundant in the sappy reservoirs, such as bulbs, tubers, rhizomes, etc., where they constitute 40 to 70 per cent. of the total food.

The different kinds of storage materials are more or less definitely associated. Thus the reserve food may consist of proteids and sugar (e.g. the pea and onion); proteids and starch (e.g. the potato, the embryo of beans, pea, etc.); proteids and oil (e.g. the endosperm of the castor bean and the cotyledons of the soja bean); or proteids, oil, and reserve cellulose (e.g. the endosperm of the date and coffee); or proteids, with oils in the cotyledons and mucilage in the endosperm walls (e.g. clover). The reason for the special association of reserve foods is not known. Insoluble reserve foods are only transportable after digestion (q.v.).

STORAGE BATTERY. An accumulation of energy which is able to produce directly an electric current. The term is a misnomer, as electricity itself cannot be stored. A so-called storage battery or accumulator when acted upon by a current undergoes certain chemical changes. The chemicals which are thus separated recombine again when the circuit of the battery is closed, and in uniting give off a current of electricity about equal to that by which they were decomposed. Lead is the metal most commonly used in accumulators, the positive plate having a coating of lead peroxide, PbO_2, and the negative plate a surface of spongy lead.

The idea of the storage cell may be traced back to 1801, at which time Gautherot showed that platinum wires used in the electrolysis of saline solutions developed secondary currents. Later, in 1803, Ritter constructed a secondary pile of copper disks separated by cloths moistened with a solution of sal ammoniac. By charging this a few moments with a powerful galvanic battery the pile gave a strong shock. Volta, Becquerel, and others discovered that platinum and other metals—gold, silver—gave secondary electric currents when subjected to electrolytic action in certain solutions. In 1842 Grove produced his celebrated gas battery, which gave a current by means of the difference in polarity of oxygen and hydrogen, the constituents of water. In Faraday's *Researches* he mentions the high conductivity of peroxide of lead at the negative pole. Gaston Planté was the first to apply this principle, and constructed in 1860 his cell with coiled plates, the first practical storage battery, which was afterwards developed and modified by Faure, Metzger, Brush, and others.

Storage batteries may be divided into two general classes: Those in which the active material (peroxide of lead) is formed on the surface of the plates by chemical or electro-chemical action, and those in which some easily reducible salt of

lead is applied mechanically. The former are known as the Planté type, and the latter as the 'pasted' or Faure type.

The Planté cell is the simplest form of storage battery. The earliest cells were formed of two lead plates immersed in dilute sulphuric acid in water. The solution should have a specific gravity of 1.17 before charging, and as the charge proceeds the specific gravity increases to 1.195 at full charge. At each successive charge the peroxide formed on the positive plate sinks deeper into the metal, and this action continues until the metal is covered to a sufficient thickness to protect the lead from electrolytic action. There is no difficulty in forming the positive plate in a Planté cell, but with the negative plate the action is very slow. The latter is the great difficulty with all Planté cells. The usual method of forming the spongy lead is to charge the cell, allow it to rest, then reverse the charge through the cell. At each reversal of current the peroxide is liberated at the surface, leaving metallic lead in a very finely divided state. The voltage of a lead-sulphuric acid cell is about two volts. The above description is applicable in a general way to all cells of the Planté type, of which there are a great many varieties. Most of the modifications introduced by the different manufacturers are mechanical changes with a view to exposing more surface of lead to the action of the electrolyte. The Planté accumulator is a very efficient cell when once formed, but the great amount of time it requires for forming is its chief drawback. To avoid the great loss of time consumed in forming the Planté cells, Faure in 1880 devised the method of pasting a layer of chemically prepared oxide of lead to the surface of the plates. This was done by spreading the plates with minium, or litharge, made into a thick paste by the addition of acidulated water. After drying these plates were placed in a bath of dilute sulphuric acid, and then subjected to an electric current. A piece of felt was placed between the plates to prevent the lead salts from disintegrating. After charging, the salt on the positive plate is reduced to peroxide of lead, while that on the negative plate is converted into porous lead. The chief fault of the early Faure cells was the disintegration of the active material, which would drop away from the plate. Many methods have been devised for holding the active material on the plates, the most common of which is to cast a grid, or plate with cells or perforations, into which the active material is pressed. All the modern cells are made with perforated plates of this description. Besides these two types of accumulators, which are the most important ones, there are a number of others, in which the elements are composed of lead, zinc, copper, etc., none of which are in very extensive use.

Storage batteries are employed in many central stations to aid the dynamos at the time of the maximum output and to act as equalizers or reservoirs of electrical energy. The efficiency varies from 80 to 85 per cent. in laboratory tests, but in commercial practice it is about 70 per cent. or less. The depreciation, however, may be very rapid if the batteries are not operated with care. It is very important not to discharge accumulators faster than the rate for which they are built, as it results in the speedy destruction of the plates. They are not well adapted to traction purposes, as the motion of the car jars out the active material from the plates, and in starting the car a high rate of discharge is required. The weight and bulk of accumulators is also against their use on cars. With light vehicles, as well as with delivery wagons and trucks, accumulators have been employed very successfully, while for telephone and telegraph work in large cities they are rapidly supplanting primary cells, the change being attended not only with economy, but also with increased cleanliness and available space. Consult: Benjamin, *Voltaic Cell* (New York, 1893); Treadwell, *The Storage Battery* (ib., 1898).

STORAX (Lat. *storax*, styrax, from Gk. *στύραξ*, sort of fragrant resin, from Heb. *ṣŏrī*, heart of the mastic or of the turpentine-tree). A fragrant resinous substance, the styrax of the ancients, obtained from the storax-tree (*Styrax officinale*) of the natural order Styracaceæ, native of the Mediterranean region. Storax, which exudes from wounds in the bark and hardens in the air, appears in the form of reddish-yellow, opaque, soft, adhesive tears about the size of a pea, or in dry, brittle masses, wrapped in the leaves of a kind of reed. It has a fragrant odor and an aromatic taste, and was formerly much used in medicine. Benzoin (q.v.) is the product of a species of Styrax. Liquid storax is doubtfully regarded either as produced by *Styrax officinale* or by a species of liquidambar (q.v.). It seems probable that there are two kinds.

STO'RER, DAVID HUMPHREYS (1804-91). An American physician and naturalist. He was born in Portland, Me., and graduated at Bowdoin in 1822. After studying medicine he settled in the practice of his profession in Boston and continued there until his death. In 1854 he was called to the chair of obstetrics and medical jurisprudence in the Harvard Medical School. Storer was for many years associated with Louis Agassiz in his studies of zoölogy and herpetology. He published: *Report on the Ichthyology and Herpetology of Massachusetts* (1839); *Synopsis of the Fishes of North America* (1846); and a *History of the Fishes of Massachusetts* (1853-67).

STO'REY, MOORFIELD (1845—). An American lawyer, born in Roxbury, Mass. He graduated at Harvard in 1866, studied at the Harvard Law School, and in 1869 was admitted to the bar. In 1867-69 he was private secretary to Senator Charles Sumner, and in the latter year began the practice of his profession in Boston. An Independent in politics, he was prominent in the 'Mugwump' movement of 1884, and after the Spanish War became an ardent Anti-Imperialist and was defeated for Congress in 1900. He published the *Life of Charles Sumner* (1900) in "American Statesmen Series."

STORK (AS. *storc*, OHG. *storah*, Ger. *Storch*, stork; connected with Gk. *τόργος*, *torgos*, vulture). The popular name for a family of birds, the Ciconiidæ, allied to the herons and ibises. They are large birds, with long legs, half-webbed toes; the bill longer than the head, straight, strong, pointed, and without any groove; the nostrils pierced longitudinally in the horny substance; the eyes surrounded by naked skin. The species are about twenty-five in number and are of very wide geographic distribution. The common

white stork (*Ciconia alba*), a migratory native of the greater part of the Old World, is about three and a half feet in length. The head, neck, and whole body are pure white; the wings partly black; the bill and legs red. The neck is long, and generally carried in an arched form; the feathers of the breast are long and pendulous, and the bird often has its bill half hidden among them. The stork frequents marshy places, feeding on eels and other fishes, batrachians, reptiles, young birds, and small mammals. It makes a rude nest of sticks, reeds, etc., on the tops of tall trees, or of ruins, spires, or disused chimneys. The stork has no voice. Its flight is powerful and very high in the air. The flesh is rank, and not fit for food. Another species, the black stork (*Ciconia nigra*), rather smaller, the plumage of the upper parts glossy black, the under parts white, is also common in many parts of Europe, Asia, and Africa. The South American stork (*Dissoura maquari*) is very similar to the common stork.

The only birds of this family occurring in North America are the wood ibises of the Southern States and the jabiru (q.v.). They are large birds, three and a half feet long, with the head and neck bare, wings and tail black, and rest of plumage white. They are found in large flocks and nest in colonies. See ADJUTANT; MARABOU; SHOEBILL; etc.; and Colored Plate of WADERS.

STORM (AS. *storm*, OHG. *sturm*, Ger. *Sturm*, storm; probably connected with Gk. ὁρμή, *hormē*, attack, Skt. *sar*, to flow, hasten). Any unusual, severe, or destructive atmospheric phenomenon, such as a windstorm, sandstorm, tornado, typhoon, or hurricane, in which the wind is the destructive agent; a rainstorm, hailstorm, or snowstorm, monsoon, cloudburst, or flood, in which the precipitation is the prominent feature; a thunderstorm in which the thunder is impressive and the lightning is destructive; a blizzard, in which the combined cold wind and snow is the prominent feature. All these storms attend the flow of air from areas of high to those of low barometric pressure, or so-called storm centres or 'lows.' In general the winds blow around and in toward these low areas, thereby producing still lower barometric pressures near the centre. The lower air, being forced to rise above the earth's surface, expands, cools, and precipitates its excess of moisture, thereby giving us rain, snow, or hail.

Storms are often classified as attending areas of low pressure (cyclonic storms); or as attending areas of high pressure (anti-cyclonic). In all cases the flow of the air is primarily due to differences of density; the denser air is impelled to the earth's surface and is also pushed toward the equator by gravity. But the centrifugal force due to the diurnal rotation of the earth also pushes the denser air toward the equator harder

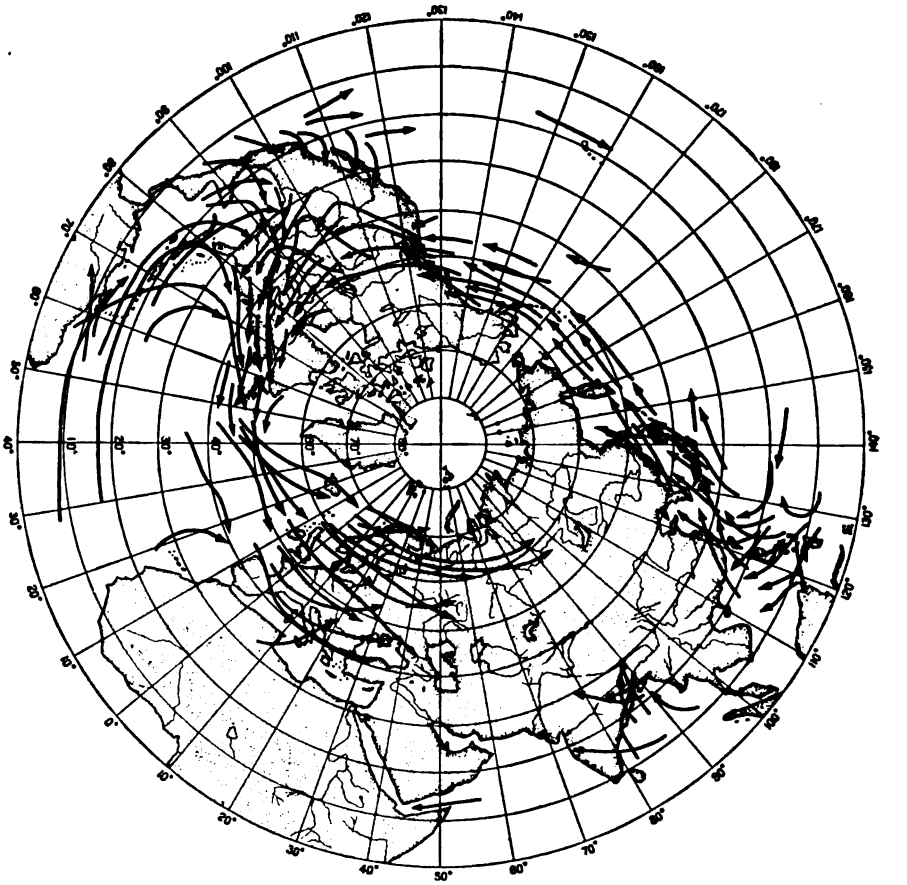


FIG. 1. CHART SHOWING STORM-PATHS.

than it does the lighter moist air. For both reasons, therefore, the lighter is raised up by the denser air, and overflows toward the pole. Now a body on the earth's surface and in motion relative to it, while at the same time rotating with it, will appear to an observer on the earth to be deflected toward the right hand as it moves forward in the Northern Hemisphere, but to the left hand in the Southern Hemisphere. By virtue of this deflection the winds that are blowing toward a region of low pressure acquire, each for itself, a deflection toward the right or the left respectively, so that instead of meeting at the centre they whirl around it in an inflowing spiral curve. By reason of this circulation an outward centrifugal pressure is produced, and the barometric pressure in the central region is much smaller than it would be if the winds flowed directly to the centre, without any spiral circulation. In extensive storm areas this general tendency of the lower winds to circulate around a centre may exist over a region a thousand miles or even more in diameter.

The mechanical and thermal problems connected with the generation and maintenance of storms are set forth without technical mathematics by Prof. William Ferrel in his *Popular Treatise on the Winds* (1st ed., New York, 1889). They are discussed most elaborately in a technical manner by Prof. F. H. Bigelow in his *Report on International Cloud Work* (published as vol. ii. of the *Report of the Chief of the Weather Bureau for 1898*). A full presentation of the work that has been done upon this subject by all students during the past century will be found in the *Lehrbuch der Meteorologie*, by Prof. Dr. Julius Hann (Leipzig, 1901), of which an English translation is promised in the near future.

As far as possible the paths pursued by storm centres during past years are platted upon charts, then they are classified according to their general characteristics and studied with reference to their relations to the topography of the continents and the general distribution of the barometric pressure, temperature, and moisture, and especially to the so-called general circulation of the atmosphere. The frequency of storms and the general types of storm paths are, of course, best known for the continental portions of the Northern Hemisphere, but there is also sufficient data for the oceanic regions to justify an attempt at presenting the accompanying sketch chart of the Northern Hemisphere showing the general character of the storm paths and the locations where they most frequently occur. (See Fig. 1.) This chart shows by its numerous lines and arrow heads the occurrence and the direction of motion of storm centres along the lines of greatest frequency, so far as now known. The Arctic region, Northern Africa, and Central Asia must be considered as blanks; we have no daily maps for these regions, and only know that general cyclonic storms are infrequent in Africa and Asia. The chart shows that storm centres move slowly westward when within the tropics and also slowly toward the pole, but move more rapidly eastward between the tropics and the Arctic Circle, as well as more rapidly northward. The zone of greatest storm frequency lies between latitudes 45° and 55°. In general the path of any observed storm may be predicted on the basis of a simple study of this chart of storm tracks. But individual temporary departures from average conditions are so great that in actual weather forecasts it is necessary to allow these general maps of types and averages to have only a very slight influence upon the work. It is, in fact, always necessary to consider what the special individual storm has been doing during the preceding few days, and to what extent it is normal, and to what extent it is abnormal, as to the direction and velocity of its motion, and

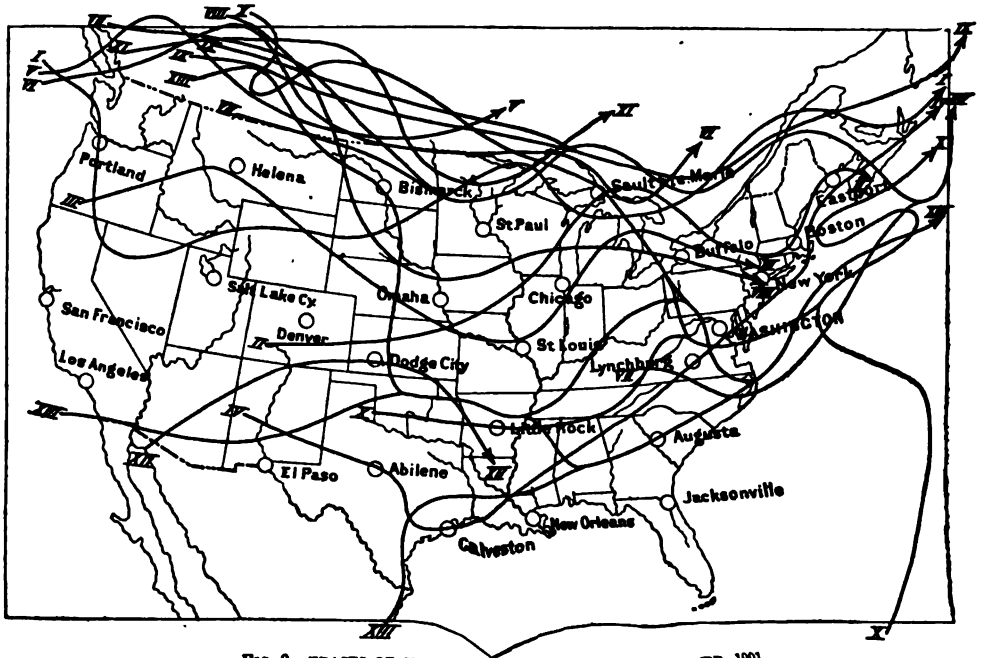


FIG. 2. TRACKS OF CENTRES OF LOW AREAS, JANUARY, 1901.

the rate of its increase or decrease in intensity. This can only be done by a careful comparison of several successive weather maps. As these maps are made up at least twice a day and sometimes more frequently, the forecaster is in a position to say how fast the storm is moving and whether it is growing more intense or rapidly dying away.

The great irregularities in individual storm paths may be appreciated by studying the accompanying chart (Fig. 2) showing the tracks of all the centres of low pressure which passed over the United States during January, 1901. The storms in that month were unusually severe over the North Atlantic Ocean. Of the thirteen tracks that are here charted four moved with a velocity of over one thousand miles daily; one of them at a velocity of less than five hundred miles daily; and one was stationary for one day. Further details in regard to these storms are given in the text of the *Monthly Weather Review* for the month in question. More than one-half of the cyclonic storms that pass over the United States have been developed somewhere in the Pacific Ocean. Perhaps one-quarter originated within the United States. The others are first perceived off the coasts of the West Indies or on the Gulf of Mexico. The most severe storms are the hurricanes that begin in the tropical portion of the Atlantic, move westward and northward into the South Atlantic or Gulf States, then turn toward the northeast and disappear while still moving toward Europe. The paths pursued by general cyclonic storms are apparently determined by the so-called general circulation of the atmosphere, but are modified considerably by the formation of cloud and rain or snow attending the storm.

The most extensive condensed collection of data relative to American storms is found in the "Contributions to Meteorology," by Professor Loomis, as revised and published in the *Memoirs of the National Academy of Sciences*, vols. iii., iv., and v. (Washington, 1885, 1887, and 1889). The details of current storm phenomena are published regularly by the Weather Bureau in the *Monthly Weather Review*. The physical-mathematical theories founded by Espy and Ferrel have been further developed in numerous memoirs, some of which will be found in a collection of translations published by the Smithsonian Institution in 1891. The current literature is contained in the successive volumes of the *Meteorologische Zeitschrift* (Berlin). A general summary of our knowledge of the mechanics of storms is given by Prof. F. H. Bigelow in his *Report on International Cloud Work* (Washington, 1900).

STORM, stôrm, GUSTAV (1845-1903). A Norwegian historian, born at Lom. He studied at Christiania, where he became professor of history in 1887. His publications, which include a large number of articles in German and Scandinavian journals, deal chiefly with early Scandinavian history. They include *Sagnkredsene om Karl den Store og Didrik af Bern* (1874), *Kritiske bidrag til vikingetidens historie* (1878), and a translation of Snorre Sturlasson's *Kongesagaer* (1897), on which he had previously written his *Snorre Sturlassöns historieskrivning* (1873). He also edited the important *Monumenta historica norvegica* (1880). In 1900 the Norwegian Storthing appropriated twenty thousand kroner for a popular edition of Storm's Dano-Norwegian rendering of the *Heimskringla*, which had appeared in 1886-89.

STORM, THEODOR (1817-88). A German poet and novelist, one of the great masters of that peculiarly German creation, the short story of character and sentiment. He was born at Husum, Schleswig, on September 14, 1817, studied jurisprudence at Kiel and Berlin, and, returning to Kiel in 1839, became intimate with the brothers Theodor and Tycho Mommsen, poetry being the bond of union, especially their mutual admiration for the Swabian poet Mörike. The result was the publication of the *Liederbuch dreier Freunde* (1843), now a great rarity, which contained Storm's first essays in poetry. For ten years he practiced law in his native town and returned to it as Landvogt in 1864, having entered the Prussian civil service in 1853, and occupied judicial offices at Potsdam and Heiligenstadt, near Göttingen. In 1880 he retired and settled at Hademarschen, in Holstein, where he died on July 4, 1888.

Storm began his literary work at Husum by collecting the popular sagas and stories of Schleswig-Holstein, then assisted Biernatzki in editing his *Volksbuch*, in which, besides some exquisite lyrics, his first three important stories, *Martha und ihre Uhr* (1848), *Im Saale* (1849), and *Immensee* (1850), saw the light. The last-named novelette, the author's most popular and perhaps also his most characteristic work, was the crowning achievement of his first period; it is the best specimen of that retrospective type of story with which Storm's name is most intimately associated, and deservedly occupies a place in the front rank of the short stories of any land or age. Through various translations it has become familiar also to English readers. Of about a dozen stories written during the eleven years of absence from his native soil, *Im Sonnenschein* (1854) and *Angelica* (1855) are sketches of by-gone days, tinged with the elegiac melancholy which forms the key-note of most of the author's stories; *Im Schloss* (1861) and *Von jenseits des Meeres* (1864) boast of happy endings, and *Auf der Universität* (1862) is the most ambitious story of this period, in which scenes from Storm's own student life are charmingly interwoven. *Die Regentrude* (1864) is the best of several delicious fairy-tales. With Storm's return to Husum in 1864 his work enters an essentially new phase, in which the passive retrospective novel gives place to a more active and dramatic form of romance. On the one hand is here to be considered a series of chronicle-novels, written in an archaic style, comprising *Der Spiegel des Cyprianus* (1865), a romantic tale of the Thirty Years' War, *Aquis submersus* (1876), *Renata* (1878), *Zur Chronik von Grieshuus* (1884), and *Ein Fest auf Haderslevhuus* (1885); on the other hand some artist-novels, such as *Ein stiller Musikant* (1874), and *Psyche* (1875). On psychological lines are *Viola tricolor* (1873), *Carsten Curator* (1878), *John Riew* (1885), *Ein Bekenntnis* and *Der Schimmelreiter* (1888). Nor should the delightful children's story *Pole Poppenspäler* (1874) be forgotten. Consult Schütze, *Theodor Storm, sein Leben und seine Dichtung* (Berlin, 1887); Wehl, *Theodor Storm, ein Bild seines Lebens und Schaffens* (Altona, 1888); Schmidt, *Charakteristiken*, I. (Berlin, 1886); Stern, *Studien zur Litteratur der Gegen-*

wart (Dresden, 1895); Robertson, in *The Gentleman's Magazine* (London, 1895); and Remer, *Theodor Storm als norddeutscher Dichter* (Berlin, 1897).

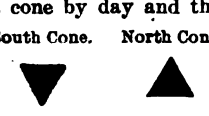
STORM AND STRESS (Ger. *Sturm und Drang*). The name of an emancipatory movement in German literature. It received the title from that of a typical drama by Klinger (1776), who wrote under the influence of Rousseau, with 'originality' and 'genius' as his watchwords. To this movement belong Goethe's *Götz von Berlichingen*, Schiller's *Die Räuber*, and countless works of similar striving but inferior worth. See GERMAN LITERATURE.

STORM AND WEATHER SIGNALS. Flags, semaphores, lanterns, steam whistles, and other devices exhibited or sounded to inform mariners and others of storms or weather conditions. The display of such warnings resulted from the personal studies in more or less coöperation about the middle of the nineteenth century. Storm and weather signals, properly so called, began to be displayed about 1863 in England by Captain Fitzroy; in France by Leverrier; and in Belgium by Buys-Ballot. The American system of observations began in 1870 and storm signals were first displayed in the autumn of 1871. At the present time every civilized nation and every port of any importance has some method of signaling or otherwise informing navigators of approaching storms. Among the systems that are now in use are the following:

The *semaphore* is a simple vertical post having two or more arms attached that can be set at different angles with the vertical. The semaphore was introduced as a telegraphic apparatus about 1790, and numerous semaphore stations are still maintained in Europe and in various colonies. See SIGNALING AND TELEGRAPHING, MILITARY, for illustration.

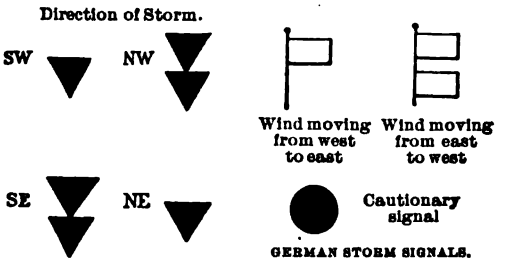
The Dutch and Belgian *aëroclinoscope* (q.v.) is a modified semaphore, in which the position of the arm indicates the direction of the barometric gradient and consequently of the wind that is nearly perpendicular to that.

The British system of storm warnings utilizes a cone by day and three red lights, arranged as a triangle, by night. If the cone point downward it indicates a storm-wind from the southeast, veering through south to the northwest. If the cone point upward it indicates a northwest gale veering through the north to northeast.



BRITISH STORM SIGNALS.

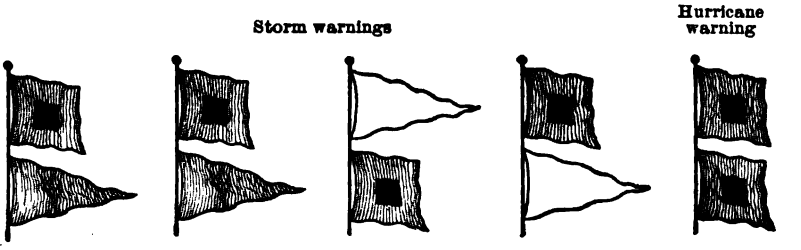
The German system consists of cones and double cones by day, and a single red lantern by night. The accompanying diagram shows the arrangement of the cones. The change in direction of the wind is indicated by red flags. If the wind is expected to vary from west of north to east, a single flag is raised; if the movement is in the opposite direction, two flags.



GERMAN STORM SIGNALS.

The symbols and signals used at the ports of the Orient depend upon the nationality of the port.

The arrangement of flags used in the United States by the United States Weather Bureau for storm warnings differs from that for weather forecasts and is shown in the accompanying illustrations.



EXPLANATION OF UNITED STATES WEATHER BUREAU STORM AND HURRICANE WARNINGS.

Storm Warning. A red flag with a black centre indicates that a storm of marked violence is expected.

The pennants displayed with the flags indicate the direction of the wind; red, easterly (from northeast to south); white, westerly (from southwest to north). The pennant above the flag indicates that the wind is expected to blow from the northerly quadrants; below, from the southerly quadrants.

By night a red light indicates easterly winds, and a white light above a red light, westerly winds.

Hurricane Warning. Two red flags with black centres, displayed one above the other, indicate the expected approach of a tropical hurricane, or one of those extremely severe and dangerous storms which occasionally move across the lakes and northern Atlantic coast.

No night hurricane warnings are displayed.

Signals for the weather forecasts are as follows:



INTERPRETATION OF DISPLAYS.

No. 1, alone, indicates fair weather, stationary temperature.

No. 2, alone, indicates rain or snow, stationary temperature.

No. 3, alone, indicates local rain or snow, stationary temperature.

No. 1, with No. 4 above it, indicates fair weather, warmer.

No. 1, with No. 4 below it, indicates fair weather, colder.

No. 2, with No. 4 above it, indicates rain or snow, warmer.

No. 2, with No. 4 below it, indicates rain or snow, colder.

No. 3, with No. 4 above it, indicates local rain or snow, warmer.

No. 3, with No. 4 below it, indicates local rain or snow, colder.

When a steam-whistle is used for weather signals a warning blast of from 15 to 20 seconds'

duration is first sounded and then the longer blasts (4 to 6 seconds), which refer to weather, and the shorter blasts (1 to 3 seconds), which refer to temperature, the former being sounded first. The signals are as follows:

BLASTS	Indicate
One long	Fair weather
Two long	Rain or snow
Three long	Local rain or snow
One short	Lower temperature
Two short	Higher temperature
Three short	Cold wave

These signals may be repeated to avoid error.

STORM KING. A rocky peak of the Highlands of the Hudson, 1530 feet in height, 4 miles north of West Point. Its Dutch name was Boterberg, Butter Mountain. At its foot lies the town of Cornwall.

STORMS, CAPE OF. See CAPE OF STORMS.

STORM VAN 'SGRAVESANDE, vän sgrä'-ve-zän'de. A name sometimes applied to the Dutch mathematician Willem Gravesande (q.v.).

STOR'NOWAY. The chief town of Lewis with Harris (q.v.), an island of the Outer Hebrides, Scotland (Map: Scotland, B 1). Its chief feature is the palatial Stornoway Castle, completed in 1870. It is an important fishing station, exporting large quantities of fish to home and Baltic ports, and has a fine harbor, covering a square mile. Urban population, in 1901, 3711; of parish, in 1901, 12,983.

STORRS, CHARLES BACKUS (1794-1833). An American Congregational minister. He was born at Longmeadow, Massachusetts, and entered Princeton College, but, owing to ill health, did not graduate. He studied theology at Andover and was ordained in South Carolina in 1821. He was pastor in Ravenna, Ohio, 1822-28, was chosen professor of divinity in Western Reserve College in 1828, and president, in 1831.

STORRS, RICHARD SALTER (1821-1900). An American Congregational minister, born at Braintree, Mass. He graduated at Amherst College, 1839, and Andover Theological Seminary, 1845; was ordained pastor of the Harvard Congregational Church, Brookline, Mass., the same year; pastor of the Church of the Pilgrims, Brooklyn, N. Y., 1846, and so remained till his death. He was much sought after as an orator on special occasions and as lecturer, and his best-known works were composed in answer to such demands. But he united learning with oratorical power, and his works have permanent elements. Among them are: *The Wisdom, Power, and Goodness of God as Manifested in the Constitution of the Human Soul* (the Graham Lectures, 1857); *The Conditions of Success in Preaching Without Notes* (1875); *The Early American Spirit and the Genesis of It* (1875); *The Declaration of Independence and the Effects of It* (1876); *John Wycliffe and the First English Bible* (1880); *The Recognition of the Supernatural in Letters and Life* (1881); *Manliness in the Scholar* (1883); *The Divine Origin of Christianity Indicated by Its Historical Effects* (1884); *The Puritan Spirit* (1890); *Bernard of Clairvaux, the Times, the Man, and His Work* (1892).

STORRS, WILLIAM LUCIUS (1795-1861). An American jurist, born at Middletown, Conn. He graduated at Yale College, 1814; studied law at Whitestown, N. Y.; was admitted to the bar in 1817; resided and practiced law in Middletown; and was a member of Congress 1829-33 and 1839-40. He was a Whig in politics. In the latter year he was appointed associate judge of the State Supreme Court of Errors; Chief Justice, 1856; and was professor of law in Yale College, 1846-47. His decisions are printed in the Connecticut *Reports*.

STORTHING, stōr'ting. The legislative assembly of Norway (q.v.).

STO'RY, JOSEPH (1779-1845). An eminent American jurist and judge, born at Marblehead, Mass. He graduated from Harvard College in 1798, studied law, and was admitted to the bar in 1801. For a time he gave considerable attention to general literature and poetry. In 1804 he published *The Power of Solitude*, and other poems, which were not favorably received. He was discouraged by this failure, which he always felt keenly, and thereafter devoted himself to law and politics. He was elected to the State Legislature in 1805 and became a leader of the Republican, or, as it was afterwards called, the Democratic Party, and defended the measures of Jefferson. In 1808 he was elected to Congress, and although he was not in sympathy with the administration, President Madison, in 1811, appointed him associate justice of the Supreme Court of the United States. He was then only thirty-two years of age. In 1820, as a member of the Massachusetts Constitutional Convention, he advocated a property basis for the Senate. In 1829 he was appointed professor of law at Harvard, and taught law very successfully for sixteen years, at the same time serving on the Supreme Court bench. He was opposed to slavery, and was accordingly very unpopular in certain sections of the country. He presided as acting Chief Justice of the Supreme Court for some time after the death of Marshall, and probably only his attitude toward the administration prevented his selection as the permanent Chief Justice. During his long service on the bench he decided many admiralty and patent law cases which are authority at the present time, and he shared with Chancellor Kent the distinction of molding American equity jurisprudence. He wrote the opinion in the celebrated Dartmouth College case, which has been the subject of much criticism, although recognized as an able effort. He received the degree of LL.D. from Brown in 1815, from Harvard in 1821, and from Dartmouth in 1824. He continued his labors on the bench and in the law school until his death at Cambridge in 1845. His legal writings and decisions are still frequently quoted in the highest courts of the United States and England. He published the following legal works: *Commentaries on the Law of Bailments* (Boston, 1832); *Commentaries on the Constitution of the United States* (1833); *Conflict of Laws* (1834); *Commentaries on Equity Jurisprudence* (1835-36); and works on *Bills and Notes, Partnership, Agency, and Equity Pleadings*, at later dates. All of his works have gone through many editions, and are still used. See *Life and Letters of Joseph Story*, by W. W. Story (Boston, 1851).

STORY, WILLIAM WETMORE (1819-95). An American author and sculptor. He was born at Salem, Mass., the son of Justice Story of the United States Supreme Court. After studying

law at Harvard College, and under his father's direction, he was admitted to the bar, and practiced his profession in Boston. He published several legal books, among them: *Reports of Cases Argued and Determined in the Circuit Court of the United States* (1842-47); a *Treatise on the Law of Contracts* (1844); and a *Treatise on the Law of Sales of Personal Property* (1847). In 1848 he gave up law and went to Italy, where he made his home, residing principally at Rome, and died at Vallombrosa. The list of his works as a sculptor includes monuments, statues, ideal figures, and portrait busts. In the Metropolitan Museum, New York City, are the statues of Cleopatra (1864) and Semiramis (1874); other works by him include a statue of his father (Mount Auburn Cemetery); Edward Everett (Boston Public Gardens); a bronze statue of George Peabody, erected in London (replica, Baltimore, 1888); and the monument of Francis Scott Key in the Golden Gate Park, San Francisco. His last work was the "Angel of Grief," a monument erected to his wife, whom he survived but a year. His work is done in the classical style, showing, however, some slight tendency toward realism. Story was prolific in literature as well as in art. He published *The American Question* (1862); *Roba di Roma* (1862); *Proportions of the Human Figure* (1866); *Graffiti d'Italia* (1869); five volumes of his poems; and the *Life and Letters of Joseph Story* (1851). Story was United States commissioner on fine arts to the World's Fair at Paris (1879), and received decorations from France and Italy. An admirable *Life* of Story by Henry James appeared in 1903 (London and New York).—His son, JULIAN STORY, a portrait painter, was a student of Duveneck, Boulanger, and Lefebvre. He received a gold medal in Berlin in 1891, was elected a member of the Society of American Artists in 1892, and won a silver medal at the Paris Exposition of 1900. Among his sitters were King Edward VII. and Emma Eames, whom he married.

STOSCH, stôsh, ALBRECHT VON (1818-96). A German general and naval administrator, born at Coblenz. He received a military education and was commissioned lieutenant in 1835. He entered the general staff in 1855, and became chief of staff of the Fourth Army Corps in 1861 and major-general in 1866. In the Seven Weeks' War he was quartermaster-general of the Second Army. In the same year he was appointed director of the commissary department with the rank of lieutenant-general, and was chief of staff with the army left in France after the conclusion of peace. In 1872 he was appointed chief of the admiralty, and in 1876 received the title of admiral. While holding these offices he greatly increased the power and efficiency of the German navy. He retired in 1883 and died February 29th, 1896.

STOSS, stôs, VEIT (c.1440-1533). A celebrated German sculptor and engraver, the chief master of wood-carving in Germany. Beyond the fact that Nuremberg was his birthplace, nothing certain is known of his parentage, his youth and apprenticeship, but very probably he was reared in the school of Michel Wohlgemuth. The first definite mention of him dates from 1477, when he removed to Cracow, where he was held in great esteem and whence he returned in 1496, a well-to-do man, since in 1499 he bought a stately mansion at Nuremberg and made other investments besides. As to his subsequent life, we are informed that he caused much distress to the honorable council of Nuremberg, involved the city in litigation, and forged an obligatory bill, a crime which was then punishable by death. The council, however, by a special act of mercy, commuted the sentence to having him branded (1503), both his cheeks being pierced with a hot iron by the executioner. For breaking his oath not to leave the city, he subsequently had to suffer imprisonment, and in 1533 died, it is said, totally blind, at the age of ninety-three. This restless and graceless citizen, this forger and perjurer was nevertheless an artist of the most tender and feeling conception, whose works display the youthful purity of the Madonna and other saints as few of the masters of his time have done.

His earliest work on record is the "High Altar," in Saint Mary's at Cracow, executed in 1477-89, with the "Death of the Virgin" and the "Assumption" in the middle shrine, a work praised as a wonder of art by the master's contemporaries and to this day reckoned among the most perfect creations of its kind, exhibiting the artist's chief characteristics: vivid description, varied and animated figures, and rich drapery. Next followed, in 1492, the "Monument of King Casimir IV.," in the Cross Chapel of the Cathedral, a work of solemn splendor and withal of dignified simplicity. The earliest of his sculptures executed at Nuremberg are the three stone reliefs of the "Last Supper," "Christ on the Mount of Olives," and "Taking of Christ" (1499), in the ambulatory of Saint Sebaldus; over the high altar in the same church rises the "Crucifix and Figures of Mary and Saint John," designated as his last work (1526). Of the main altar in the Frauenkirche, only the heroic size statue of the "Madonna" (1504) is preserved, besides two reliefs. The taper-bearing angels in the choir of this church are also by Stoss. In the Germanic Museum may be seen the noble high-relief of the "Crowning of the Virgin by God and Christ," clear in composition and executed with masterly perfection; and the wooden paneling known as the "Rose Garland," in the centre reliefs of the Last Judgment and of the Heavenly Host grouped around a cross of Saint Anthony within a garland of roses, the whole framed by twenty-three minute reliefs of scenes from biblical history. Seven more reliefs, which formed part of this work, are now in the Berlin Museum. Noteworthy is the large "Pietà" in the Jacobskirche, which also contains several smaller but very able works of the master, but his best-known and chief work in carved wood is "The Angel's Salutation" (1518), in the Church of Saint Lawrence, the central group of heroic size surrounded by a chaplet of roses in which are set seven medallions with the Joys of the Virgin in bas-relief, a work unique in beauty and conception. He executed the superbly carved altar-pieces in the parish church at Schwabach (1506) and in the upper parish church at Bamberg (1523). His engravings, scenes from the Passion, severe in style and dating from his early period, are now very rare. Consult: Bergau, *Der Bildschnitzer Veit*

Stoss und seine Werke (Leipzig, 1877); Rée, in *Allgemeine deutsche Biographie*, xxxvi. (ib., 1893); Bode, *Geschichte der deutschen Plastik* (Berlin, 1887); and Lübke, *History of Sculpture*, trans. by Bunnett, ii. (London, 1872).

STOTHARD, stŏth'ĕrd, CHARLES ALFRED (1786-1821). An English antiquarian draughtsman, the second son of the painter Thomas Stothard. He was born in London, studied at the Royal Academy Schools, and exhibited his best painting, "The Death of Richard II.," in 1811. Afterwards he worked on the *Magna Britannia* (1815), and became historical draughtsman to the Society of Antiquaries. In that capacity he made drawings of the Bayeux tapestry, which were published in the society's *Vetusta Monumenta* (1821-23). His most important work was the *Monumental Effigies of Great Britain* (1811-21), which was completed by other artists, and republished in 1876. His drawings are all of remarkable accuracy.—His widow, ANN ELIZA KEMPE (1790-1883), who afterwards married Edward Atkyns Bray, was a well-known author. She wrote *Memoirs of C. A. Stothard* (1823). See BRAY, MRS. ANN ELIZA KEMPE (STOTHARD).

STOTHARD, THOMAS (1755-1834). An English illustrator and painter, born in London. In 1777 he entered the schools of the Royal Academy, and exhibited his first picture, the "Holy Family," in 1778. In 1779 he entered upon his career as an illustrator of books. More than 3000 of his designs were engraved, the greater number of which are to be found in the British Museum. Although lacking in temperament, his illustrations are characterized by grace and charm and by a sympathetic touch, especially when he depicted the loveliness of childhood. Stothard illustrated the novels of Fielding, Richardson, and Sterne; *Don Quixote*, *Gil Blas*, *Robinson Crusoe*, *Gulliver's Travels*, the *Arabian Nights*, *Clarissa Harlowe*, and *Tristram Shandy;* he also made designs to Miltou (1792-93), Pope's *Rape of the Lock* (1798), and Shakespeare's *Seven Ages of Man* (1790). As a painter he is less important. He designed decorations for the staircase at Burghley (1799), the cupola of the upper hall of the Signet Library (1822) at Edinburgh, and the decorations of the drawing-room, throne-room, and great staircase of Buckingham Palace. Of his easel pictures, the National Gallery possesses "Venus and Cupid Attended by the Graces" (1824), the "Woodland Dance," and the "Myth of Narcissus" (1793). Consult Mrs. Bray, *Life of Thomas Stothard* (London, 1851).

STOUGHTON, stō'ton. A town, including several villages, in Norfolk County, Mass., 18 miles south of Boston, on the New York, New Haven and Hartford Railroad (Map: Massachusetts, E 3). It has a public library with over 7000 volumes, and a handsome town hall. Boot and shoe making, and the manufacture of woolens, rubber goods, boxes, and wire are the chief industries. The government is administered by town meetings, convening annually. The waterworks are owned and operated by the town. Population, in 1890, 4852; in 1900, 5442. Stoughton, named in honor of Governor William Stoughton, was set off from Dorchester and incorporated in 1726. Consult Hurd, *History of Norfolk County* (Philadelphia, 1884).

STOUGHTON, ISRAEL (?-c.1645). An American colonist, born in England. He was one of the founders of Dorchester, Mass., and in 1633 he became a freeman of the colony. Though a member of the General Court in 1634 and 1635, he wrote a pamphlet denying the right of the assistants to act as magistrates. As a punishment, the Government debarred him from holding public office for three years, but upon his making a humble submission revoked the sentence. From 1637 to 1643 he himself was chosen an assistant, and in 1637 he was appointed commander of the colony's troops in the Pequot War. In 1639 he was a commissioner in the boundary controversy with Plymouth. Five years later he went to England, where he entered the Parliamentary forces with the rank of lieutenant-colonel and probably fought at the battle of Naseby. At his death he left 300 acres of land in Dorchester to Harvard University. Consult Quincy, *History of Harvard University* (Boston, 1860).

STOUGHTON, JOHN (1807-97). An English dissenting preacher and ecclesiastical historian. He was born in Norwich, and after receiving an elementary education entered a law office. He abandoned the law for the ministry, and after some preparation in Highbury College he was ordained in 1833. In 1872 he was elected professor of historical theology in New College, Saint John's Wood, though he still occasionally preached. In 1862 he published *Church and State, Two Hundred Years Ago . . . 1660-63*. His other important works are: *Ecclesiastical History of England from the Opening of the Long Parliament to the Death of Oliver Cromwell* (1867); *The Church of the Restoration* (1870); *The Church of the Revolution* (1874); *Religion in England Under Queen Anne and the Georges* (1878); *Religion in England from 1800 to 1850* (1884). Though somewhat diffuse, these histories are thorough and impartial: Consult his *Recollections of a Long Life* (London, 1894).

STOUGHTON, WILLIAM (c.1632-1701). A colonial Governor of Massachusetts. He was born in England, early emigrated to America, graduated at Harvard in 1650, and was a fellow at New College, Oxford, from 1652 until ejected at the time of the Restoration (1660). Returning to Massachusetts, he was a selectman from 1671 to 1674, an assistant from 1671 to 1686—though in 1684 he refused to serve—and a commissioner of the United Colonies from 1673 to 1677, and again from 1680 to 1686. In 1677 he went to England as the agent of his colony in a boundary dispute with New Hampshire. He was a member of Governor Andros's Council, but, nevertheless, served on the Council of Safety that deposed him, and from 1692 until his death was Lieutenant-Governor of Massachusetts, being acting Governor from the recall (1694) of Sir William Phipps until the arrival (1699) of Lord Bellomont. In 1692 he was chief justice of the special court of oyer and terminer by which the Salem 'witches' were tried, and, as such, treated the accused with relentless severity. He was a liberal benefactor of Harvard, and it was for him that Stoughton Hall was named. He published *New England's True Interest Not to Lie*, the election sermon preached by him in Boston in 1668, and a pamphlet en-

titled *A Narrative of the Proceedings of Andros* (1691).

STOUGHTON MUSICAL SOCIETY. See CHORAL SOCIETIES.

STOURBRIDGE, stĕr'brĭj. A town in Worcestershire, England, 20 miles north-northeast of Worcester, on the Stour (Map: England, D 4). It contains iron, glass, earthenware, and fire-brick factories. 'Stourbridge clay,' upon which the action of fire has less effect than upon most varieties of clay, is an article of export. Conservatory pots, crucibles, etc., are made of it. In the grammar school founded in 1552, and rebuilt in 1864, Samuel Johnson received part of his education. Population, in 1891, 14,891; in 1901, 16,302.

STOURM, stōōrm, RENÉ (1837—). A French economist, born and educated in Paris. He was employed in a department of the Ministry of Finance, became professor of finance in the Ecole Libre des Science Politiques, and in 1896 succeeded Léon Say as a member of the Academy of Political and Moral Sciences. On the history of finance, and more especially of taxation, he wrote *Les finances de l'ancien régime et de la révolution* (1885); *Le budget, son histoire et son mécanisme* (1889); *Systèmes généraux d'impôts* (1893); *Bibliographie historique des finances de la France du XVIIIème siècle* (1895); and *Les finances du consulat* (1902).

STOUT. See BEER.

STOUT, GEORGE FREDERICK (1859—). An English psychologist, born at South Shields, and educated at the Charlotte Terrace School in his native town and at Saint John's College, Cambridge. He was made a fellow at Saint John's College in 1884, and succeeded Croom Robertson as editor of *Mind* in 1891. After holding various academic positions in the field of philosophy and psychology, he was appointed in 1903 professor of logic and metaphysics in the University of Saint Andrews. His chief published works are: *Analytic Psychology* (1896); *Manual of Psychology* (1899); "Truth and Error," in *Personal Idealism* (1902); *Groundwork of Psychology* (1903). As a pupil of James Ward (q.v.), Stout infused into the traditional English psychology something of his teacher's critical spirit. His *Analytic Psychology* is planned, however, as a preliminary to a larger work on genetic psychology, in which especial attention is to be devoted to ethnographic evidence.

STOVE. See HEATING AND VENTILATION.

STOW, JOHN (1525-1605). One of the earliest and most diligent collectors of English antiquities. He was brought up to his father's trade of a tailor, but ultimately abandoned it for antiquarian pursuits. His principal works are his *Summary of English Chronicles*, first published in 1561, and subsequently reprinted every two or three years, with a continuation to the date of each new publication; *Annals of England*, 1580, and reprinted in 1592, to which year the annals are brought down; and *A Survey of London*, the most important of his writings, published in 1598. Besides these original works, Stow assisted in the continuation of Holinshed's *Chronicle*, Speght's edition of Chaucer, Leland's *Collectanea*, etc.

STOWE, stō, CALVIN ELLIS (1802-86). An American clergyman and author, born in Natick, Mass. He was educated at Bowdoin College and at Andover Theological Seminary. From 1830 to 1832 he was professor of Greek at Dartmouth College, and in the latter year became professor of sacred literature at Lane Theological Seminary, Cincinnati, where in 1836 he married Harriet, the daughter of Lyman Beecher, then president of the seminary. From 1850 to 1852 he was professor of divinity at Bowdoin College, and from 1852 until his retirement in 1864 was professor of sacred literature in Andover Theological Seminary. Among his published works are: *The Hebrew Commonwealth* (1829), from the German of Gahn; *Lectures on the Sacred Poetry of the Hebrews* (1829), from the Latin of Lowth; *Introduction to the Criticism and Interpretation of the Bible* (1835); *Elementary Education in Europe* (1837); *The Religious Element in Education* (1844); and *The Origin and History of the Books of the Bible* (1867).

STOWE, HARRIET ELIZABETH (BEECHER) (1811-96). A famous American novelist, born in Litchfield, Conn. She was the daughter of the Rev. Lyman Beecher, and sister of Henry Ward Beecher. She attended school at Litchfield Academy and later at Hartford. In 1832 her father was called to the presidency of Lane Theological Seminary at Cincinnati, Ohio. While living in that city she gained a personal acquaintance with the ways of slavery, especially in regard to the handling of fugitive slaves and the attitude of the South toward the abolitionists. The impression was strengthened by several journeys into some of the slave States with her husband, the Rev. Calvin E. Stowe, a strong anti-slavery man, whom she married in 1836. In 1843 Mrs. Stowe published her first book, entitled *The Mayflower, or Sketches of Scenes and Characters Among the Descendants of the Pilgrims.* In 1850 her husband was called to Bowdoin College, Brunswick, Maine, and in the interval before his transfer to the chair of sacred literature at Andover (Mass.) Theological Seminary, two years later, she wrote the book by which she is most widely known, *Uncle Tom's Cabin, or Life Among the Lowly.* The novel appeared in the *National Era* of Washington, D. C., between June, 1851, and April, 1852, in which latter year it was issued in book form in Boston. As a serial it attracted no unusual notice, but as a book its success, after a few weeks, was unprecedented. Five hundred thousand copies were sold in the United States in five years, and many more in England, and it has been translated into at least nineteen foreign languages. In the following year Mrs. Stowe, in reply to various inquiries, criticisms, and censures, published *A Key to Uncle Tom's Cabin.* She also wrote, in the same year, *A Peep into Uncle Tom's Cabin, for Children.*

The health of Mrs. Stowe was impaired by the excitement of her work, and in 1853 she went to Europe. On her return she published (1854) *Sunny Memories of Foreign Lands*, two volumes relating her travels. She then returned to the attack against slavery in *Dred: A Tale of the Great Dismal Swamp* (1856; at one time entitled *Nina Gordon*), but without the unction and success of her former work. Thenceforth her writing consisted chiefly of novels of quiet New England life, with which she was familiar, and except for her polemic book, *Lady Byron Vindi-*

cated: A History of the Byron Controversy (1869), and her article in *Macmillan's Magazine* which had occasioned that discussion, her works were comparatively free from the didactic spirit. The chief titles are: *The Minister's Wooing* (1859); *The Pearl of Orr's Island* (1862); *Agnes of Sorrento* (1862); *Religious Poems* (1867); *Oldtown Folks* (1869); *Pink and White Tyranny* (1871); *Sam Lawson's Fireside Stories* (1871); *My Wife and I* (1871); *Palmetto Leaves* (1873); *We and Our Neighbors* (1875); and *Poganuc People* (1878). Of these, the best are *The Minister's Wooing* and *Oldtown Folks*, which were greatly praised by such critics as Lowell. She removed from Andover to Hartford in 1864, and in 1868 became associated with D. G. Mitchell in the editorship of *Hearth and Home*.

Mrs. Stowe is remembered chiefly as the author of probably the most potent and widely read novel in modern literature. Though, like almost all her novels, loose and rambling in structure, *Uncle Tom's Cabin* has abundant vitality, and is the work of a genuine story-teller. It also has the unusual fortune of being at once a cause and an outcome of a heated national struggle; no novel was ever better timed for an occasion, and few have aroused so much admiration and dislike. Soon after its publication the book was dramatized, and probably no other play has been produced so many times or seen by so many people. Both in its original and in its numerous stage versions it still holds popular favor in spite of occasional protests. The character Uncle Tom was drawn from the life of Josiah Henson (q.v.).

Consult: the *Life* by Charles E. Stowe (Boston, 1889); and *Life and Letters*, by Mrs. Annie Fields (Boston, 1899).

STOWELL, stō'el, WILLIAM SCOTT, Baron (1745-1836). A British admiralty and ecclesiastical judge and jurist. He was the eldest brother of Lord Eldon (q.v.). He was born at Heworth, Durham, was educated at Newcastle, went to Oxford in 1761, and became a college tutor. In 1779 he removed to London, was called to the bar (1780), and admitted to the faculty of advocates at Doctors' Commons. In 1788 he was appointed judge in the Consistory Court, knighted, and nominated a privy councilor. In 1798 he became judge of the Court of Admiralty. Both as an ecclesiastical and admiralty judge he won high distinction. He practically created much of the admiralty law of England. He drew on the Roman law, and the maritime law of all nations, ancient and modern, and his opinions, therefore, were very scholarly. He wrote no systematic treatise or text-book, but his judgments were admirably reported, and supply the best evidence of his extensive legal learning, his sagacity, and his great literary ability. He is the highest English authority on the law of nations, and his judgments—those especially relating to the rights of belligerents and neutrals—have been described as the most valuable contribution made by an English judge to general jurisprudence since the time of Lord Mansfield. He represented Oxford in the House of Commons for twenty years, but he took no part in the business of Parliament, although he was a zealous supporter of the Conservative Party and the Established Church. At the coronation of George IV. he was raised to the peerage under the title of Baron Stowell of Stowell Park.

STRABISMUS (Neo-Lat., from Gk. *στραβισμός*, a squinting, from *στραβός*, *strabos*, crooked, from *στρέφειν*, *strephein*, to twist, turn about), or SQUINT. A well-known and common deformity which may be defined as a want of parallelism in the visual axes when the patient endeavors to direct both eyes to an object at the same time. The eye which is directed toward the object looked at is called the fixing eye, the other the squinting eye. The squint is said to be *convergent* when the eye or eyes are directed toward the nose, *divergent* when they are directed toward the temple, and *vertical* when directed upward or downward. The last is often associated with convergent squint. The divergent form is comparatively rare, and occurs most often with myopia.

Squint is of two kinds: (1) *paralytic*, and (2) *concomitant*. Paralytic squint is caused by paralysis of one or more of the ocular muscles. There is inability to move the affected eyeball away from the side toward which it is directed. When both eyes are turned toward the side to which the squinting eye is directed, the squint disappears. The head is held in a characteristic position in every variety of paralysis of the muscles of the eyeball, an attempt of nature to compensate for the squint by turning the head in such a direction that the squinting eye is directed toward objects in front of the body. There is diplopia, double vision, unless the squinting eye is the one fixed on the object. By the position of the double image, it is possible to determine which muscle is affected. The eye involved is often closed in order to avoid the second image, which is confusing in walking. For example, a person with paralysis of the superior oblique muscle while descending stairs sees two steps instead of one, and is often led to attempt to reach the false image, with disastrous results. The paralysis may be due to a lesion at any point between the cerebral cortex and the muscle. Syphilis is the most common cause; others are cold, rheumatism, and acute infectious disease. The treatment is that of the cause, exercise of the muscles, the use of prisms to relieve the diplopia, and operation as in concomitant squint if necessary. In *concomitant squint* there is the same deviation of the eyes in every position, and both eyes possess a normal range of movement. Squint may be *alternating*, in which the patient fixes with either eye; *fixed*; or *unilateral*, in which the squint is confined to one eye; in regard to permanency it may be *constant* or *periodic*. In concomitant squint there is rarely double vision, one image being disregarded. Uncorrected errors of refraction, congenital feebleness of vision, opacities of the cornea or media, or other disease of the eye, combined with weakness of a muscle, leads to concomitant squint, for, as the sight in one eye is imperfect, there is little inducement to make the muscular effort to keep the two parallel. The treatment includes correction of errors of refraction by glasses, exercise of the muscles by prisms, and operative methods. The last may be division of the short tendon or advancement of that of the opposing muscle, or a combination of these procedures.

STRABO (Lat., from Gk. *Στράβων*, *Strabōn*) (c. 64 B.C.-19 A.D.). A famous Greek geographer

and historian, born at Amasia, in Pontus. He received his education first at Nysa, on the Meander, from the grammarian Aristodemus and appears to have come to Rome with the Peripatetic Xenarchus and the grammarian Tyrannion, whose pupil he had also been. The date of his arrival seems to have been about B.C. 29. In B.C. 24 he left Rome in the train of Ælius Gallus, traveled in Arabia, and, returning to Rome in B.C. 20, made it his home until his death. Yet during this latter period he must have undertaken great journeys, for he informs us in his own work that he had traveled from Armenia in the east to Sardinia in the west, and from the Pontus Euxinus on the north to the borders of Ethiopia. While we lack certain information with regard to these journeys, Strabo's scanty knowledge of events in Rome in the latter half of Augustus's rule gives basis to the conjecture that he was absent during this period, very probably at the Court of Pythodoris, Queen of Pontus, of whom he makes frequent mention in his work. Strabo is most famous for his *Geography*, extant in 17 books, of which the first two deal with physical geography, books 3 to 10 with the geography of Europe, 11 to 16 with that of Asia, and book 17 with that of Africa. It is quite clear from internal evidence that the author did not complete his original plan. The sources of his knowledge were first of all his own observations made during his long journeys, and secondly the earlier geographers, of whom the most famous were Eratosthenes, Artemidorus, and Apollodorus of Athens. For Spain and Gaul his chief sources were Polybius and Posidonius.

His other work, of which we have but scanty fragments, was his *History*, which comprised 43 books. It was intended as a supplement to the work of Polybius and was divided into two parts. The first part sketched the history down to the period at which Polybius began; the latter treated in greater detail the history from Polybius to B.C. 27. The fragments of this work are published by Müller, *Fragmenta Historicorum Græcorum*, vol. iii. Consult also Otto, "Strabonis *ἱστορικῶν ὑπομνημάτων* Fragmenta," in *Leipziger Studien*, vol. xi. (1889). The *Geography* is edited by Kramer (Berlin, 1844-52); Meineke (Leipzig, 1866-77). English translation by Hamilton in Bohn's Classical Library (London, 1887); translation of selections, with introduction, maps, and plans, by Tozer (Oxford, 1893).

STRACHAN, străk'an, JOHN (1778-1867). A Canadian Anglican bishop. He was born in Aberdeen, Scotland, was educated at King's College in that city and at the University of Saint Andrews, and in 1799 emigrated to Canada. In 1812 he removed to York, now Toronto, and was appointed rector there. In 1839 he was made Bishop of Toronto. The chief cause of the violent opposition his policy aroused was his determined effort to establish the Church of England as a State Church. When the University of King's College was changed from its character as an Anglican institution, Bishop Strachan founded Trinity College in its stead. His personality and work as ecclesiastic and politician did much to bring about the Rebellion of 1837. Consult: Melville, *The Rise and Progress of Trinity College, Toronto, with a Sketch of the Life of the Lord Bishop of Toronto, as Connected with Church Education in Canada* (Toronto, 1852); and Bethune, *Memoir of Bishop Strachan* (1870).

STRACHEY, strā'chĭ, WILLIAM. A colonist and historian of early Virginia. He was a member of Gray's Inn, London. In May, 1609, he sailed for Virginia with Sir George Somers, and was wrecked on the Bermudas on July 28th. Strachey wrote one of the numerous accounts of the colonists' adventures which were widely circulated in manuscript before being printed in 1625, in Purchas's *Pilgrims*. In May, 1610, Strachey reached Virginia, where he became secretary and recorder of the colony. He edited the code of laws drawn up by Gates and Dale, and commonly known by the latter's name. Returning to England in 1612, he began writing his *Historie of Travaile into Virginia Britannia*. It was first printed in 1849, by the Hakluyt Society of London. It is the most reliable single narrative of events during the period of Virginia history with which he deals. Besides the 1849 edition of the *Historie*, consult Brown, *Genesis of the United States* (Boston, 1891).

STRACHWITZ, sträg'vĭts, MORITZ, Count (1822-47). A German poet, born in Peterwitz, Silesia, and educated for the law in Breslau and Berlin. His first volume, *Lieder eines Erwachenden* (1842), was mostly written while he was still in the gymnasium. More typical is the collection posthumously published, *Neue Gedichte* (1847), with its sharp attack on Heine and the other revolutionists, its protests against the 'Everlasting No,' and its famous and popular lyrics, "Der Himmel ist blau" and "Germania." A complete edition of his poems appeared in 1850, and in Reclam's *Bibliothek* in 1878.

STRACK, sträk, HERMANN LEBERECHT (1848—). A German theologian and Oriental scholar. He was born in Berlin and was educated there and at Leipzig. In 1877 he became professor in the theological faculty at Berlin. Among his more notable publications are: *Prophetarum Posteriorum Codex Babylonicus Petropolitanus* (1875); *Einleitung in das Alte Testament* (5th ed. 1898); *Lehrbuch der neuhebräischen Sprache und Litteratur* with Siegfried (1884); *Einleitung in den Talmud* (3d ed. 1900); *Das Blut im Glauben und Aberglauben der Menschen* (8th ed. 1900); *Grammatik des biblischen Aramäisch* (3d ed. 1901); *Das Buch Jesus Sirach im hebräischen Texte* (1903). He also published editions of several Mishma tracts; became editor of the *Porta Linguarum Orientalium* (Berlin), for which he wrote the Hebrew grammar (1883; 8th ed. 1902; Eng. trans., 1886); and, with O. Zöckler, editor of *Kurzgefasster Kommentar zu den Schriften Alten und Neuen Testaments* (Munich, 1886 et seq.). He prepared lexicons to the *Anabasis* (9th ed. 1902) and *Cyropædia* (2d ed. 1892) of Xenophon. In 1885 he began to edit *Nathanael*, a periodical devoted to Christian missionary work among the Jews.

STRADELLA, strȧ-dĕl'lȧ, ALESSANDRO (c.1645-c.1681). An Italian composer, born in Naples. Trustworthy information regarding his life and his works, the oratorios *San Giovanni Battista* (1676), *Susanna* (1681), and the operas Corispero (c.1665), *Orazio Cocle sul ponte* (c.1666), Trespolo *tutore* (1667), *La forza del amore paterno* (1678), may be obtained

from Richard, "Stradella et les Contarini," in *Le Ménestrel* (Paris, 1865 and 1866). The opera *Stradella*, by Flotow, is founded on Bonnet-Bourdelot's story of an incident in the life of Stradella, in his *Histoire de la musique et de ses effets* (1715). He is thought to have been murdered in Genoa, about 1681.

STRADIVARI, strä'dê-vä'rê, or **STRAD'IVA'RIUS**, ANTONIO (c.1644-1737). The most famous violin-maker of the Cremonese School. He was born in Cremona, and was probably apprenticed at a very early age to Nicola Amati, who at that time was regarded as the greatest of all the Cremonese masters. His first instruments were made between 1670 and 1685 and were largely of the Amati model, in consequence of which they are usually described as 'Amatese Strads.' They are distinguished by their lack of symmetry compared with his later works, their plain wood, and generally squatty design. About 1685 his originality began to assert itself, and by the following year he had evidently acquired his own peculiar style, which subsequent makers have largely used as a model. The period known as the 'long Strad' period was from 1690 to 1700, and incidentally it may be pointed out that the instruments made during that time were not any longer in design than those of the following years, from which they differed only in their treatment. For instance, the middle bouts, edges, and corners were longer and more graceful, and were possessed of a contour which has been described as a mingling of the feminine character of Nicola Amati's work and the masculine massive style of Stradivari from 1700 to 1737. In 1684 Nicola Amati died and bequeathed all his wood, models, and tools to Stradivari, thus providing the latter with a large and choice stock of tempered and seasoned wood, which was more than anything else responsible for the improved quality of his instruments dating from 1685. All the work of Stradivari was marked by minuteness of detail; the high quality of the wood and varnish; and the beauty of tone, which has a sympathetic quality altogether distinct from the best work of any other maker. His violins must have numbered fully two thousand, although comparatively few specimens are now in existence. He died at Cremona. —FRANCESCO STRADIVARI (1671-1743), the second son of Antonio, was born at Cremona. He carried on his father's business, adopting Antonio's model of the period of 1700-1712, and produced instruments of a commanding style and an invariably good tone. Like his father, he was exceedingly careful in the artistic finish of his work, using wood of the finest quality and a rich red-brown varnish.—OMOBONO STRADIVARI (1679-1742), the fourth child of Antonio, was chiefly remarkable for his skill in repairing valuable instruments.

Consult: Fétis, *Antoine Stradivari* (Brussels, 1856); Niederheitmann, *Cremona* (Leipzig, 1897).

STRAFFORD, THOMAS WENTWORTH, first Earl of (1593-1641). An English statesman. He was born April 13, 1593, in London, of an old Yorkshire family. He was educated at Saint John's College, Cambridge, and later (1607) became a student of the Inner Temple. He was married in 1611 and knighted in the same year, after which he traveled on the Continent. In 1614 his father died and he succeeded to the title of baronet and a large estate. He was a member of the last three Parliaments of James I. In the Parliaments of 1621 and 1624 he supported the Crown against those who were trying to force England into a war with Spain. In the first Parliament of Charles I. he opposed Buckingham, who had now adopted the same policy of war with Spain, yet he was not in sympathy with Eliot and the Puritans. In the Parliament of 1628 he became the real leader of the House of Commons, though no formal leadership was recognized in those days. He introduced a bill similar in tenor to the Petition of Rights (q.v.), but containing no declaration that the law had been violated in the past. Charles, however, refused to accept it, and Wentworth, unwilling to resist the King further, allowed the opposition to pass into other and more hostile hands. He supported the Petition of Right and was then apparently satisfied that the 'ancient government' of the kingdom had been restored. In June, 1628, he was made baron, on December 10th viscount, and on December 25th president of the Council of the North. On November 10, 1629, he was made member of the Privy Council. As president of the Council of the North he was the royal executive in that region and he exercised his authority vigorously and a little roughly in checking insubordination. His anti-Puritan sympathies had already drawn him into intimate relations with Laud, which ripened into a lifelong friendship. On January 12, 1632, Wentworth was made Lord Deputy of Ireland and he went to Dublin in July, 1633. His administration lasted six years before events in England drew his attention away. His task was a difficult one and his actions were arbitrary and often harsh, but on the whole extremely beneficial. Trade and industry were encouraged, disorders and numerous abuses were suppressed, and Ireland enjoyed unprecedented material prosperity. In 1639 Wentworth visited England. On January 12, 1640, he was created Earl of Strafford, and thenceforth he was the King's most influential adviser. Already the Scottish troubles had reached an acute stage. On account of his long absence, Strafford failed to appreciate the changed temper of the English people, and habits of arbitrary rule had grown upon him. He advocated the strongest measures and hurried back to Ireland to raise money and troops for Charles. This was made the basis of his impeachment on the meeting of the Long Parliament. Charles promised him that if he would come to London to meet the charges, he "should not suffer in his person, honor, or fortune." Inasmuch as the charges against him, even if proved, did not constitute treason as defined by the statute of Edward III., Parliament changed the impeachment into a bill of attainder, though Strafford was still heard in his own defense. His doom was sealed when Parliament discovered that Charles was plotting to rescue him by force. On May 8, 1641, the attainder bill was passed and on the 10th Charles, daring to resist no longer, signed it with Strafford's consent. Strafford was beheaded two days later.

Our estimate of Strafford's character will always rest principally upon his own recorded words. They will be found in *The Earl of Strafford's Letters and Despatches, with an Essay Towards His Life*, ed. by Radcliffe (2 vols., Lon-

don, 1739). Consult also Gardiner, *History of England 1603-42* (10 vols., London and New York, 1883-84).

STRAIGHT UNIVERSITY. A coeducational institution for negroes exclusively, at New Orleans, La., founded by Seymour Straight and incorporated in 1869. The institution has an endowment of $17,000, and is sustained by voluntary contributions, through the American Missionary Association. Its buildings and grounds are valued at about $100,000. Its library contains about 2500 volumes. In 1903 the faculty numbered 28, and the students about 750 in all departments.

STRAIN, Isaac G. (1821-57). An American naval officer and explorer, born in Roxbury, Pa. He entered the navy as a midshipman in 1837, in 1845 was in command of an exploring expedition that penetrated into the interior of Brazil, and in 1848 explored Lower California. In 1849 he made the overland journey from Valparaiso to Buenos Ayres, publishing an account of the trip entitled *The Cordillera and Pampa: Sketches of a Journey in Chile and the Argentine Provinces in 1849* (1853). He became a lieutenant in 1850, served with the commission to locate the boundary line between Mexico and the United States, and in 1854 was placed in charge of a party sent to survey and explore the Isthmus of Panama and report upon the best route for the construction of an interoceanic canal. In 1856 in the *Arctic* he made soundings in the North Atlantic Ocean to ascertain the feasibility of a submarine cable. Returning to Panama, he died there from exposure in the following year. Consult Headley, *The Darien Exploring Expedition Under command of Lieutenant Strain* (New York, 1885), in the "Franklin Square Library."

STRAITS SETTLEMENTS. A crown colony of Great Britain, comprising some of the British possessions on the Malay Peninsula and a few of the adjacent islands, viz. Singapore (q.v.), Malacca (q.v.), Dindings (q.v.), Penang (q.v.), or Prince of Wales Island, the Province of Wellesley, the Keeling Islands (q.v.), and Christmas Island (q.v.). The total area, excluding Christmas Island and the Keeling group, is 1542 square miles. The colony has little natural wealth. It is important for its extensive transit trade, which passes almost entirely through Singapore and Penang. The total trade amounted in 1901 to nearly $288,000,000, of which the imports represented over $127,000,000. The trade of Singapore alone amounted to about $233,000,000. The principal imports are rice, cotton goods, and opium; the exports consist chiefly of tin (which is brought from the Federated Malay States), gums, and spices. All the ports are free. The total shipping during 1901 was 16,000,000 tons. The Governor is assisted by an executive council, and a legislative council composed of nine official and seven unofficial members, five of the latter being nominated by the Crown and two by the chambers of commerce at Singapore and Penang, and confirmed by the Crown. The Governor is also High Commissioner for the Federated Malay States and Borneo. The population (exclusive of Christmas Island and the Keeling group) was 512,342 in 1891, and 572,249 in 1901. In the latter year the population was composed of 281,933 Chinese, 215,058 Malays, and 5058 Europeans and Americans. There is an extensive immigration from China and India, chiefly coolies, the immigrants from the two countries in 1901 numbering 178,778 and 25,357 respectively. The crown colony was organized April 1, 1867. The capital is Singapore.

Bibliography. Swettenham, *Malay Sketches* (London, 1895); id., *The Real Malay* (ib., 1899); Rathbone, *Camping and Tramping in Malaya* (ib., 1898); Belfield, *Handbook of the Federated Malay States* (ib., 1902); Skeat, *Tribes of the Malay Archipelago* (ib., 1902).

STRAKOSCH, strä'kôsh, Moritz (1825-87). An Austrian composer and pianist, born in Lemberg, Galicia. He was the brother-in-law and teacher of Adelina Patti, and was educated in music at Vienna, coming to America in 1845, where he won considerable success as a teacher and concert pianist. In 1856 he became an impresario and introduced many great musicians to the American public. He was the composer of several salon pieces for the pianoforte and one opera, *Giovanna di Napoli*, which had its first presentation in New York. He died in Paris.—Max Strakosch, brother of the preceding, succeeded him in the management of the various concerts and opera undertakings. He died in New York in 1892.

STRALSUND, străl'zŭnt. A seaport in the Province of Pomerania, Prussia, situated on the Strelasund, which separates the mainland from the island of Rügen, 149 miles by rail north-northeast of Berlin (Map: Prussia, E 1). It is entirely surrounded by water. The natural strength of the place was greatly increased by formidable fortifications, which, however, were converted into promenades in 1873. Stralsund has narrow but regular streets, and many of the houses are finely gabled, giving the town a quaint and ancient appearance. There are three splendid Gothic churches erected in the fourteenth and fifteenth centuries. The handsome town hall contains a picture gallery, a collection of antiquities, and a public library of 60,000 volumes. There is a school of navigation. Stralsund is noted for its manufactures of playing cards. Oil, machinery, arc lights, furniture, and bricks are also produced. There is considerable shipping and a large export trade, chiefly in grain, sugar, fish, and malt. Stralsund, founded in 1209, was in the fourteenth century an important member of the Hanseatic League. The most notable event in its history was its eleven weeks' siege by Wallenstein during the Thirty Years' War (May-August, 1628). It was a possession of Sweden from the Peace of Westphalia (1648) to 1815, when it passed to Prussia. Population, in 1890, 27,814; in 1900, 31,083.

STRAMONIUM (Neo-Lat., of uncertain etymology), Stinkweed, Jamestownweed, Jimsonweed, Thorn-Apple (*Datura Stramonium*). A common weed of the natural order Solanaceæ. De Candolle refers it to countries bordering on the Caspian Sea; others regard it as coming from Northern India. It is a coarse, strong, vigorous, branching weed, from two to six feet high, with ovate toothed or angled leaves, large funnel-shaped flowers followed by prickly globular two-celled pods containing numerous angular black seeds which are reputed narcotic but are

little used. All parts of the plant have a disagreeable smell.

STRANAHAN, străn'â-an, James Samuel Thomas (1808-98). An American contractor and philanthropist, born in Peterboro, N. Y. He was successively school teacher, surveyor, and trader, and then became a railroad contractor in Newark, N. J., gradually acquiring large interests in the companies by accepting stock as payment for construction. He removed to Brooklyn in 1844 and until his death was closely identified with the city's commercial expansion and public improvement. From 1860 until 1882 he served as president of the Brooklyn Park Commission. His greatest achievement was the planning and building at an enormous cost of Prospect Park, one of the largest and most beautiful civic parks in the United States. In 1891 Brooklyn erected a statue of him at the main entrance to Prospect Park.

STRAND. See Rope; Knotting and Splicing.

STRAND, The. An important business thoroughfare of London, so named because it led through the marshy land bordering the former banks of the Thames. It extends from Charing Cross to Temple Bar, and in the sixteenth century was bordered by the mansions of the nobility, some of which survive in the names of various streets and buildings. It contains a number of theatres and newspaper offices, and is at all times busy and animated.

STRANDBERG, strănd'bâr-y', Karl Wilhelm August (1818-77). A Swedish poet, born in Södermanland, and educated at Upsala and Lund. The greater part of his earlier writing was of a patriotic nature. His works show great purity of form and depth of patriotism. Under the pseudonym Talio Qualis he published *Sånger i pansar* (1845); *Vilda Rosor* (1854); and his *Samlade vitterhetsar 'beten* (1877). He translated Byron's *Don Juan* and selections from Molière.

STRANGE, Sir Robert (1721-92). A Scottish engraver. He was born in Kirkwall, on one of the Orkney Islands. He made an attempt at law, but drawing claimed his chief attention, and he became an apprentice to Richard Cooper, at Edinburgh, for six years. To gain the hand of Isabella Luminsden, he joined the rebel army at the time of the Jacobite uprising, and after its defeat he was rescued by his lady-love, who hid him under her hooped skirt from the officers in search of him, and continued singing over her needlework. After their marriage, in 1747, he went to Paris and studied dry point under Le Bas. He made an improvement upon this process that gave a more beautiful finish to the engravings. He moved to London in 1751, devoting himself to historical engravings, but a refusal to engrave the portraits of the Prince of Wales and Lord Bute in 1759, supposedly for political reasons, was the cause of his departure for Italy. There his welcome was most cordial and he was made a member of the Academies of Rome, Florence, and Bologna, and professor of the Royal Academy at Parma. During a subsequent stay in Paris he was made a member of the Royal Academy of Painting. After his return to London in 1780 he made his peace with the reigning family by his engraving of West's "Apotheosis of the Princes Octavius and Alfred," and was awarded the honor of knighthood in 1787. Strange's engravings are chiefly after the great Italian masters, including Guido Reni, Salvator Rosa, Raphael, and Correggio, and after Van Dyck. Though often defective in draughtsmanship, his work is characterized by grace of line and the excellency of his rendition of the flesh. Consult: Dennistoun, *Memoirs of Sir Robert Strange* (London, 1855); introduction to Marshal Keith's *Memoir* (ib., 1843); and the *Life* by Woodward prefixed to *Twenty Masterpieces of Strange* (ib., 1847).

STRANGE, Robert (1796-1854). An American lawyer. He was born in Virginia; was educated at Hampden-Sidney College; studied law, and after his admission to practice, settled at Fayetteville, N. C. He served as a member of the North Carolina House of Delegates in 1822-23 and 1826, was judge of the Superior Court 1826-36, United States Senator 1836-40, and some time later Solicitor of the Fifth Judicial District. The Indian legends of the region about Fayetteville were attractively related in his novel, entitled *Eoneguski; or, the Cherokee Chief.*

STRANGE CASE OF DOCTOR JEKYLL AND MR. HYDE, The. A story by R. L. Stevenson (1886). It illustrates the struggle between good and evil in a human soul. Dr. Jekyll is a physician of excellent standing, but with concealed propensities which by secret indulgence have developed his lower nature into an almost distinct individual known as Mr. Hyde. By a powerful drug he has learned to transform himself at will into this terrible, debased creature, who commits hideous crimes. At last the power of the evil side of his nature gains the ascendency. Dr. Jeykll, without the intervention of the powder, becomes transformed into Mr. Hyde, and, unable to regain his better self, kills himself in despair.

STRANGLES (from *strangle*, OF. *estrangler*, Fr. *étrangler*, from Lat. *strangulare*, from Gk. στραγγαλᾶν, *strangalan*, στραγγαλίζειν, *strangalizein*, to strangle, from στραγγάλη, *strangalē*, halter; connected with στραγγός, *strangos*, twisted, Lat. *stringere*, to draw tight), Distemper, or Colt-Ill. An infectious disease of the horse, ass, and mule, most frequently observed in young animals, especially pure-bred. The animal seems dejected, has a capricious appetite, dry, staring coat, reddish eyes, and accelerated pulse and breathing. After about two days a cough and a nasal discharge are noted. A large puffy abscess is developed under the lower jaw, which opens later to the outside. Abscesses sometimes develop in other parts of the body. Light cases require little treatment except proper care and dieting, the opening of the abscesses, and the alleviating of fever when excessive.

STRANGULATION. The mechanical constriction of the neck so as to prevent the passage of air and to suspend respiration, and consequently life. Strangulation may be produced by throttling or hanging. Death is sudden when the obstruction to respiration is complete, but otherwise it is gradual in its onset. In hanging, especially in judicial executions where a long drop is used, death is probably due to fracture of the cervical vertebræ, with compression of the medulla oblongata, the seat of the nerve centre controlling respiration. When breathing has been interrupted for only a short time, and there



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is no mechanical obstacle to respiration, nor injury to the medulla, life may sometimes be restored by proper measures, such as artificial respiration, stimulant applications, and a plentiful supply of fresh air. To relieve cerebral congestion it is advantageous to abstract blood, and if this is replaced with normal saline solution by transfusion (q.v.) into the veins, the additional advantage will be gained of diluting the carbon dioxide in the blood.

When death has taken place by hanging, proofs of this, concerning which medico-legal questions may arise, depend upon the position of the body when found, the presence of marks upon the neck, and of the signs of asphyxia in the internal organs, and the absence of any other possible cause of death. The mark on the neck is gencally a hard, dry, yellowish, horny furrow running obliquely. The face is turgid, with blood-stained froth about the nostrils and lips; the tongue is swollen and protruding. The right side of the heart and the right lung are engorged with venous blood, while the left side is empty. See ASPHYXIA.

STRANGURY (Lat. *stranguria*, from Gk. *στραγγουρία*, *strangouria*, retention of urine, from *στράγξ*, *stranx*, drop squeezed out; connected with *στραγγαλίζειν*, *strangalizein*, to strangle + *οὐρεῖν*, *ourein*, to urinate, from *οὖρον*, *ouron*, urine). A variety of retention of urine, in which, while urine is present in the bladder and a desire to micturate is present, spasm or painful contraction permits of the passage of but a few drops. The spasm is usually of the urethra, but the rectum may share in the condition. It occurs after the use of cantharides or turpentine internally (both of which are eliminated by the kidneys) or by the use of a large Spanish-fly blister from which a considerable amount of the drug has been absorbed into the lymphatics, or sometimes during gonorrhœa. Hot applications to the genital region, a hot sitz-bath, hot enemata, and the ingestion of bland fluids which render the urine less irritating, will give relief. Opium is a valuable drug in the treatment of this condition.

STRAPAROLA, strä'pä-rō'lä, GIOVANNI FRANCESCO (?-c.1557). An Italian author, who was born at Caravaggio, near the end of the fifteenth century. Nothing is known of his life, and his name is only a sobriquet signifying loquacity. He published *Sonetti, strambotti, epistole e capitole* in 1508. He is remembered, however, by his *Tredici piacevoli notti*, "Facetious Nights," which is one of the most amusing imitations of the *Decameron*, and was published in two parts, in 1550 and 1554, at Venice. An English translation of the *Nights* by W. G. Waters appeared in 1894. Consult Dunlop, *History of Fiction* (London, 1851).

STRASBURGER, strüs'bo͝orK-ĕr, EDUARD (1844—). A German botanist, born at Warsaw, and educated at Bonn and at Jena, where he became professor in 1869 and director of the botanical garden in 1873. With Haeckel he visited the East, and in 1881 he accepted a call to the University of Bonn. In his special field of histology of plants he wrote: *Die Befruchtung bei den Koniferen* (1869); *Ueber Zellbildung und Zellteilung* (3d ed. 1880); *Ueber den Bau und das Wachstum der Zellhäute* (1882); besides *Das kleine botanische Praktikum* (4th ed. 1902); *Histologische Beiträge* (1888-93); and, with Noll, Schenck, and Schimper, *Lehrbuch der Botanik für Hochschulen* (5th ed. 1902). Conjointly with Pfeffer he edits the *Jahrbücher für wissenschaftliche Botanik* (Berlin, 1894 et seq.).

STRASCHIRIPKA, strä'shê-rĭp'kä, JOHANN. The correct name of the Austrian painter more commonly known as Johann Canon (q.v.).

STRASSBURG, strä's'bo͝orK. A city of Germany, the capital of Alsace-Lorraine. It is situated at the junction of the Breusch and the Ill, two miles west of the Rhine, 28 miles east of the French frontier, and 88 miles by rail north of Basel (Map: Germany, B 4). The Ill divides into five arms in the city. Strassburg is a fortress of the first class, and possesses a garrison of 15,000 men. A circle of fourteen forts and an inner rampart defend the city. The centre of the city forms an oval, and is surrounded by two arms of the Ill. Here the streets are narrow and crooked, and the picturesque ancient houses and frequent specimens of pure mediæval architecture, reflect a period when the city was both art-loving and wealthy. In this section, on the south-east, rises the structure for which Strassburg is best known—the cathedral, or Minster. It is said to have been founded about 600. The present edifice dates from 1176. The fore part of the cathedral is Romanesque, and the rest (the nave, 435 feet long) Gothic. The remarkable façade, the work of Erwin of Steinbach, with its galleries and rose window, especially commands admiration. Noteworthy also is the late Romanesque south portal, which is embellished with images. The tower is 465 feet high. A scarcely less celebrated feature of the Minster is its astronomical clock, the mechanism of which was constructed in 1839-42 to replace that of the famous clock of the sixteenth century. (See CLOCK.) Southwest of the cathedral is the Protestant Saint Thomas Church, a composite edifice embracing the Gothic and Romanesque, begun about 1200. It contains a marble monument to Marshal Saxe, executed by Pigalle. Near the cathedral is the ancient episcopal palace, identified with the Rohans, and now containing the unimportant municipal art museum. In the Grosse Metzig—the market hall—dating from 1588 is the valuable Museum of Industrial Art.

North of the Ill extend the handsome new quarters of the city, where, in the Kaiserplatz, may be seen the splendid Imperial Palace, in Florentine Renaissance. It was completed in 1888, and has a cupola 115 feet high. The modern Hall of the Provincial Diet and the provincial and university library are near by. The library has some 700,000 volumes. Farther on in a northeasterly direction is the Contades Park. Some little distance east of the city, and reached by the fine Ruprechtsauer Allée, lie the beautiful municipal grounds of the Orangerie—a pleasure-garden with Oriental features and lovely promenades. South of the town formerly stood the important citadel, built by Vauban, and destroyed during the siege of 1870. Between it and the city is the extensive arsenal. Strassburg has a statue of General Kléber, who was born there, and of Gutenberg; also a bust of Goethe, which marks the house where the poet lived as a student.

The university (see STRASSBURG, UNIVERSITY

OF) is situated across the Ill to the southeast of the city. There are, in addition, the important Protestant Gymnasium, the academy with its collections, a lyceum, a Roman Catholic seminary, a very fine municipal conservatorium of music, a mechanics' school of art, and an industrial art school. The municipal theatre is an admirable institution. The Frauenhaus contains an architectural and sculptural collection. The city archives are very valuable. The numerous excellent hospitals are mostly situated in the southern part of the city.

The city government is administered by the burgomaster, with six associates, and a council of 36 members. The city is divided into four cantons. Strassburg is commercially important, having of late greatly increased its trade, a considerable part of the traffic between France, Germany, and Switzerland passing through the city. The Ill is canalized; the Rhine-Marne and other canals traverse the city; and Strassburg is a railway centre. The new port covers upward of 300 acres, with wharves and quays on the Rhine. Latterly manufactories have grown up to some extent and include foundries, locomotive works, tobacco factories, tanneries, piano factories, chemical works, etc. Much jewelry is manufactured. The population in 1900 was 151,041, of whom one-half or more were Roman Catholics.

HISTORY. Strassburg is the Argentoratum of the Romans. A bishopric appears to have been established before the seventh century, when the name Stratisburgum began to be used. In 1262 its citizens threw off the yoke of the bishop in a battle at Oberhausbergen. The city, free and independent, had reached a high degree of prosperity at the Reformation. The citizens embraced Protestantism at an early date—1520. In 1681 Louis XIV. suddenly took possession of Strassburg, which was fortified by Vauban. It remained a French city until it became a part of the German Empire as a result of the Franco-Prussian War. It was an important military point under the French, and in 1870 held out against the Germans for six weeks under its gallant commander Uhrich, who finally capitulated on September 27th with over 17,000 men. Great damage was wrought during the siege by the bombardment.

Consult: Krieger, *Topographie der Stadt Strassburg* (Strassburg, 1894); Förster, *Strassburg, die Hauptstadt des Reichslandes* (ib., 1894); Euting, *Beschreibung der Stadt Strassburg* (12th ed., ib., 1901); *Beiträge zur Geschichte der Stadt Strassburg* (ib., 1896 et seq.); and Staehling, *Histoire contemporaine de Strasbourg* (Paris, 1884).

STRASSBURG, UNIVERSITY OF. A German university, the outgrowth of an earlier gymnasium, formally founded by privilege of Ferdinand II., in 1621. It flourished greatly in the seventeenth and eighteenth centuries, and, though Strassburg became French territory in 1681, the university retained much of its German character. Goethe and Herder studied here in 1770. It disappeared in the Revolution, rose again in 1802 as a Protestant academy, and in 1808 became a part of the University of France by the university reform of Napoleon I. After the war of 1870 the institution once more became German and was reorganized as a university in 1872. It has since been greatly encouraged by the Imperial Government as a centre of German influence and culture in reclaiming Alsace-Lorraine, and is in consequence in a very flourishing condition. Its budget is more than 1,000,000 marks, and it had in 1901 about 1200 students. Its library contains more than 700,000 volumes. There are various institutes connected with the university.

STRASSER, sträs'ẽr, ARTHUR (1854—). An Austrian sculptor, born at Adelsberg, Carniola. After having studied at the Vienna Academy, in 1871-75, he worked in the studios of Pilz and Kundmann, but soon branched off independently into a line of naturalistic production, first exemplified by statuettes of Japanese jugglers and actresses. The dark complexion and picturesque costumes of the Oriental races next attracted him to fashion terra-cotta figures, which, by skillful coloring, he succeeded in making impressively true to nature, as well in the racial peculiarities of his models as in all material accessories. These qualities are especially apparent in the "Egyptian Snake-Charmer," "The Secret of the Tomb," and the "Hindu at Prayer." His figures in bronze are equally lifelike, witness his "Goose-Girl" and the "Glimpse into Eternity." He also produced animal figures, especially lions, on a large scale, of which the "Triumphal Chariot of Marcus Antoninus," in Vienna, is a sterling example.

STRATEGY (OF. *strategie*, Fr. *stratégie*, from Gk. στρατηγία, *stratēgia*, generalship, from στρατηγός, *stratēgos*, general, from στρατός, *stratos*, army, encampment, from στορεννύναι, *storennynai*, Lat. *sternere*, Skt. *star*, to spread, extend, strew + ἄγειν, *agein*, to lead). Strategy is one of the two great subdivisions of the art of war, and comprises all those larger measures which relate to the grand field of operations, the object of which is to have the troops enter the contest of arms, the *battle*, under the most favorable conditions, involving the direction of the troops toward the battlefield, as well as the measures taken to reap the rewards of success. It has been defined as the use of battles in war, in contradistinction to *tactics* (the other great subdivision of the art of war), which is the use of troops in battle; or, again, as the art of leading armies, while *tactics* is the art of leading the smaller subdivisions of armies and is fully treated under its own head. See TACTICS.

The scope of strategy has been greatly extended with time. Formerly, it did not enter as a factor in war until the armies were actually in the field; but to-day *national policy* is also a determining factor, and one of vast importance, in view of the fact that modern wars are conducted on a grand scale and with great rapidity, therefore requiring definite plans to be prepared beforehand, in which questions of statesmanship and diplomacy are necessarily leading factors. Moreover, finance and commerce must also be considered.

Among the principles upon which strategy is based or according to which it is directed are:

(1) National policy and strategy must be kept in perfect agreement in war, and closely allied at every point, to accomplish the best results.

(2) When countries are at war each will probably finally concentrate its troops in a single army, so as to be able to strike decisive blows with its united power; hence the principal ob-

jective, against which all efforts should be directed at the outset, is the enemy's main army.

(3) Every effort must be made to bring together at the decisive moment all available forces.

These relate to the general objects of the war, the theatre of operations, and the entire field army as a whole. Separate actions may take place in various parts of the theatre, and they, too, will involve strategic principles, similar in character, but of minor importance.

(4) The offensive alone promises decisive results.

(5) The defensive can only avoid defeat; it cannot win victory.

(6) It is impossible to be too strong for a decisive battle.

(7) Concentration of the forces is a necessary condition for decisive action.

(8) No alteration in the plan of operations should be made after the campaign has definitely opened, unless enforced by the enemy or by the elements or unforeseen circumstances.

During the progress of military events certain of the latter will generally have a common object, and will be closely related in other respects. Every such group of events, composed in general of marches, positions, and battles, is designated an *operation*. A group of closely related operations constitutes a *campaign*. To-day the operations of a campaign are practically continuous, but, in order to be so, there must be a *base* of supplies, where ammunition, food, forage, and so on are accumulated for the support and maintenance of the army in its advance. Formerly this base was fixed, and could be fortified and stocked with supplies beforehand, but modern war demands a movable base, usually a network of railroads, but sometimes furnished by a fleet.

The lines along which the army advances from its base toward its objective are called *lines of operation*, and those by which the army obtains its subsistence and supplies, *lines of communication*. The base, the lines of operation, and the lines of communication, being of vital importance to the operating army, are naturally the objects of the enemy's attacks and manœuvres.

The strategic events of a campaign will usually take place in the following order:

Preparation, mobilization, strategic deployment, plan of operations, and the military operations themselves.

The operations may be strategically *offensive* or strategically *defensive*, or finally alternately offensive and defensive. The strategical offensive may be combined with the tactical offensive or the tactical defensive; and the strategical defensive may also be combined with either tactical form. All strategists and tacticians unite in giving the preference to the strategical and tactical offensive combined, but circumstances may force one of the other combinations on an army, at least for a time, or perhaps only in a particular part of the theatre. In that case, however, the offensive must be taken up at the earliest opportunity, if decisive results are desired.

The great principles of strategy apply to naval warfare as well as to wars on land, but certain modifications result from the fact that the lines of communication in the case of a fleet are less clearly marked, and bases and coaling and repair stations which are absolutely essential to success in naval warfare can be improvised and, if need be, changed. Again, combined naval and land operations, the transition from the purely naval contest to extended operations on land, involve some new principles not set forth here: the control of the sea by the attacker's fleet is one of the first conditions for the success of such combined operations.

BIBLIOGRAPHY. Von der Goltz, *Kriegführung* (Berlin, 1895); English translation, *The Conduct of War* (Kansas City, 1901); Hohenlohe, *Letters on Strategy* (London, 1898); Günther, *Heerwesen und Kriegführung in unserer Zeit* (Berlin, 1902); Loringhoven, *Studien über Kriegführung* (ib., 1901-03); Napoleon, *Commentaries* (Paris, 1867); Maillard, *Eléments de la guerre* (ib., 1891); Bigelow, *Principles of Strategy* (Philadelphia, 1894); Keim, *Kriegslehre und Kriegführung* (Berlin, 1889); Derrécagaix, *La guerre moderne* (Paris, 1885); Gizycki, *Strategisch-taktische Aufgaben* (Leipzig, 1897); Pierron, *Les méthodes de guerres actuelles et vers la fin du XIXème siècle* (Paris, 1903); Frobenius, *Kriegsgeschichtliche Beispiele des Festungskrieges* (Berlin, 1903). See TACTICS, MILITARY; TACTICS, NAVAL; BATTLE; WAR.

STRAT'FORD. A town and suburb of London, in Essex, on the Lea, 4 miles east of Saint Paul's (Map: London, D 8). It has a fine town hall and is the seat of various extensive manufactures. There are flour mills, distilleries, and chemical works. The prosperity of the town has increased through its connection with the Eastern Counties Railway and the extensive works the company established here. Population, in 1891, 38,612; in 1901, 44,825.

STRATFORD. A port of entry and the capital of Perth County, Ontario, Canada, on the Avon River, and the Grand Trunk and the Georgian Bay and Lake Erie railroads, 88 miles west of Toronto (Map: Ontario, B 4). It has good water power, and there are flour, salt, and planing mills, and manufactures of iron castings, mill machinery, boots and shoes, and farming implements. The Grand Trunk Railroad shops are here. The county buildings are attractive. Population, in 1901, 9959.

STRATFORD DE RED'CLIFFE, STRATFORD CANNING, Viscount (1786-1880). An English diplomat, born in London. The influence of his famous cousin, George Canning, secured for Stratford in 1808 the secretaryship of the Embassy at Constantinople, under Adair, and on the latter's resignation in 1810 Canning was made Minister Plenipotentiary. In this position at a most critical moment in the great struggle against Napoleon, he negotiated the Treaty of Bucharest between Russia and Turkey, in 1812. In 1820 he was made Minister to the United States, where he was successful in the settlement of the difficult questions arising out of the War of 1812. After performing various diplomatic services and holding a seat in the House of Commons, he was sent in 1841 as Ambassador to Constantinople. The most dramatic and important event of his service at the Turkish capital was his diplomatic contest in 1853 with Prince Menshikoff, the Russian Ambassador Extraordinary. The result of the struggle—through which Canning obtained the name of 'Great Eltchi,' or *'the* great ambassador'—was a victory for Canning. He remained at Constantinople throughout the Crimean War and until

1858 and exerted great influence upon the Turkish Government with regard to its foreign relations and the inauguration of political reforms. He was raised to the peerage in 1852 under the title of Viscount Stratford de Redcliffe. He was the author of some creditable verse. In 1881 extracts from his papers and correspondence were published, with a preface by A. P. Stanley, under the title, *The Eastern Question*. Consult also: Lane-Poole, *Life of the Right Honourable Stratford Canning, Viscount Stratford de Redcliffe* (London, 1888).

STRATFORD-UPON-AVON, ā'von. A municipal borough and township in Warwickshire, England, 8 miles southwest of Warwick, on the Avon, famous as the birthplace of Shakespeare (Map: England, E 4). The town is neatly built, with wide, pleasant streets, containing numerous quaint, half-timbered houses. The house in which Shakespeare was born is still preserved, and there is a Shakespeare memorial building, including a theatre and a gallery of Shakespearean paintings, and a library of rare Shakespeareana. The poet is buried in the parish church of the Holy Trinity, a fine cruciform structure partly early English and Perpendicular, dating from the twelfth century and built on the site of a Saxon monastery which existed before 691. Other interesting remains of Shakespeare's time are the grammar-school endowed in 1482, in which he was educated, the guildhall, and the town hall. In the neighborhood at Wilmcote is the cottage of his mother, Mary Arden, and at Shottery, that of his wife, Anne Hathaway. Stratford is annually visited by 30,000 tourists, one-fourth of whom are from the United States. The town is an old free market borough with a governing charter since 1553. Population, in 1891, 11,400; in 1901, 10,600. Consult: Lee, *Stratford-on-Avon* (London, 1890); Savage, *The Registers of Stratford-on-Avon* (London, 1898).

STRATH'CLYDE'. A British kingdom which first appears prominently in the seventh century as one of the strongholds of the original Celtic inhabitants against the invading Anglo-Saxons. It lay in the western part of the island between the Clyde River and the Derwent in what is now Cumberland, though the name is sometimes applied to the entire territory between the Clyde and the Mersey. It was from an early time closely connected with the Scottish crown, to which it was united in 1124.

STRATH'CO'NA AND MOUNT ROYAL, Donald Alexander Smith, first Lord (1820—). He was born at Archieston, Morayshire, Scotland, and after receiving a common-school education entered the employ of the Hudson's Bay Company in 1838. After years of work on the coast of Labrador and in the Northwestern wilderness he was promoted to chief factor, and from that position to resident governor and chief commissioner of the company in Canada. In 1870 he was elected to the first session of the Manitoba Legislature, and to the Canadian House of Commons, and was appointed a member of the first executive council of the Northwest Territory. Four years afterwards he resigned from the Provincial Legislature, but, with the exception of the period from 1880 to 1887, he remained a member of the Dominion Parliament until 1896, when he was appointed High Commissioner to London and a member of the Queen's Privy Council of Canada. He became largely interested in railroads, and it was due to him more than to any other man that the Canadian Pacific Railway was completed. For this service Queen Victoria knighted him in 1886, and in 1897 raised him to the peerage as Baron Strathcona and Mount Royal.

STRATH'MORE'. In its most comprehensive sense, an extensive plain in Scotland (q.v.).

STRATH'NAIRN', Hugh Henry Rose, Baron (1803-85). A distinguished English general, born at Berlin, Germany. He served in 1840-41 under General Michell with the Turkish troops against Mehemet Ali; from 1842 till 1851 was British agent in Syria, and became chargé d'affaires at Constantinople in 1852. During the Crimean War he distinguished himself at Inkerman, and for his services was promoted to the rank of major-general. In the Indian Mutiny he commanded the Central India field force, and gained a great victory on April 1, 1858, over Tantia Topi, with 20,000 men, and captured Jhansi, the strongest fortress in Central India, April 5th; Kalpi, May 23d and Gwalior, June 19th. For these services he received the thanks of Parliament, was gazetted a G.C.B., and in 1860 was promoted to be lieutenant-general. He returned to England in 1865, and was soon after given command of the forces in Ireland, where he prevented the Fenian troubles from becoming formidable. In 1867 he was promoted to be general, and in 1877 became a field-marshal. Consult Low, *Soldiers of the Victorian Age* (London, 1880).

STRATHSPEY, străth'spā' (so called from *Strathspey* in Scotland). A rapid Scotch dance in $\frac{4}{4}$ time, somewhat resembling the reel (q.v.). Its music is composed of dotted eighths and sixteenths, and the dance itself is of a violent, jerky character. Its history dates from the latter part of the eighteenth century.

STRATIFICATION (from *stratify*, from Lat. *stratum*, pavement, coverlet, neu. sg. of *stratus*, p.p. of *sternere*, to spread, extend, strew + *facere*, to make, do). The term used in geology to define the arrangement of certain rocks into more or less parallel layers. Stratification is a very general characteristic of sedimentary deposits, sandstone, shale, limestone, etc., which for the most part have accumulated on the shores of the sea and the beds of lakes and rivers. The rock materials in each layer are of homogeneous character, due to the uniformity of conditions during the time of deposition, but the passage from one layer to another may be marked by a change in the nature and size of the materials, indicating a variation in the process of deposition. The layers are separated by divisional planes which mark periods of interruption in the desposition. When the layers are very thin, as in shale, for example, they are generally known as laminæ. A stratum is a group of one or more layers of the same mineral substance. See Geology.

STRAT'TON, Charles Sherwood (1838-83). An American dwarf, born in Bridgeport, Conn. Owing to his smallness of stature at the age of fourteen years, he was engaged by P. T. Barnum, and was exhibited throughout Europe and elsewhere, under the name of Gen. Tom Thumb; at the time of his engagement his weight was six-

teen pounds, and he was less than two feet high. In 1863 he was married to Lavinia Warren (q.v.), also a dwarf, and in company with Minnie Warren and 'Commodore' Nutt, they exhibited themselves far and wide.

STRATUM (Lat., pavement, coverlet, bed). The term applied in geology to the smallest subdivision of sedimentary rocks, practically synonymous with layer, seam, and bed. The distinctive characteristics of a stratum are homogeneity of composition and separation from adjacent beds or strata by well-marked divisional planes called bedding planes. A stratum represents a single uninterrupted period of accumulation, while the bedding planes are caused by longer or shorter pauses in the process. See GEOLOGY.

STRAUBING, strou'bĭng. A town of Bavaria, Germany, 23 miles southeast of Regensburg, on the right bank of the Danube (Map: Germany, E 4). The late Gothic Church of Saint James contains some notable paintings. The town has important manufactures of brick, lime, and cement. There are breweries and tanneries. Its population, in 1900, was 17,454, mostly Roman Catholic. Straubing stands on the site of the Roman colony *Sorbiodurum*. The present town dates from 1208, when Louis I. erected the Stadt-Thurm, which is still standing.

STRAUS, strous, OSCAR SOLOMON (1850—). An American diplomat, born at Otterberg, in Rhenish Bavaria. He came to the United States in 1854, and lived in Georgia until the close of the Civil War. He was educated at Columbia University. In 1887-89 he was Minister to Turkey, and so distinguished himself that in 1897 he was reappointed to the same position by President McKinley, remaining there till 1900. On January 14, 1902, he was named a member of the Permanent Court of Arbitration at The Hague to fill the place left vacant by the death of ex-President Harrison. His published works include: *The Origin of the Republican Form of Government in the United States* (1886); *Roger Williams, the Pioneer of Religious Liberty* (1894); *The Development of Religious Liberty in the United States* (1896); and *Reform in the Consular Service* (1897).

STRAUSS, DAVID FRIEDRICH (1808-74). A distinguished German theological and philosophical writer, born at Ludwigsburg, near Stuttgart. He was educated in the evangelical seminary of Blaubouren (where F. C. Baur was then teaching), whence he passed to the University of Tübingen. Here his religious convictions became disturbed. The theories of Schelling, of Jakob Böhme, and, finally, of Schleiermacher and Hegel successively claimed his allegiance. He left the university in 1830 to become assistant pastor of a small church and then taught in the seminary at Maulbronn. Here he remained but six months, and then went to Berlin in order to hear Schleiermacher and Hegel. The death of Hegel and Schleiermacher's apparent lack of sympathy determined him to quit Berlin after a very brief stay to take up the work of a 'repetent' at Tübingen (1832). Here his lectures on Hegelianism attracted attention. His skepticism was now quite pronounced, since his view of Hegelianism, which he accepted as the final philosophy, made a miraculous Christianity impossible. His theory of the origins of Christianity was formulated in the work that made him famous, *Das Leben Jesu, kritisch bearbeitet* (1835-36; Eng. trans. by George Eliot, 1846), in which he sought to explain the Gospel history on the mythical theory. The work aroused a storm of opposition, but nevertheless had a widespread influence. In consequence of his views, he was removed from his position and given a subordinate place in the Lyceum of Ludwigsburg. From 1836 until his death Strauss lived a somewhat wandering life, holding no position, though he had accepted, in 1839, an appointment in the University of Zurich, which position, on account of popular opposition, he had not been permitted to fill.

Because of his interest in the political agitations of the times he was elected a member of the Württemberg Diet in 1848. But he was not sufficiently radical for his constituents and so resigned. His second chief work, *Die christliche Glaubenslehre in ihrer geschichtlichen Entwickelung und im Kampf mit der modernen Wissenschaft dargestellt*, was even more skeptical than his *Leben Jesu*. After the publication in 1848 of *Sechs theologisch-politische Volksreden* Strauss turned from theological to literary criticism and biography. He wrote critical biographies of Schubart (1849), Märklin (1851), Frischlin (1855), Ulrich von Hutten (1857, 4th ed. 1878), Reimarus (1862), and Voltaire (1870, 5th ed. 1877), the last a work of remarkable merit. Not until 1864 did he again turn to theology, when he published *Das Leben Jesu für das deutsche Volk*, following it in the next year by *Die Halben und die Ganzen* and *Der Christus des Glaubens und der Jesus der Geschichte*. His last work was *Der alte und der neue Glaube, ein Bekenntnis* (1872, 11th ed. 1881). In these last works Strauss gave up entirely the faith he once may have had in Christianity. Strauss's popularity was doubtless due as much to his clear and captivating style as to any logical force in his arguments.

His *Gesammelte Schriften* were edited with an Introduction by his friend Eduard Zeller (Bonn, 1876-78, 12 vols.). For his life, consult: Zeller, *D. F. Strauss in seinem Leben und seinen Schriften* (Bonn, 1874); Hausrath, *D. F. Strauss und die Theologie seiner Zeit* (Heidelberg, 1876-78).

STRAUSS, JOHANN, the Elder (1804-49). An Austrian composer of dance music, born in Vienna. He received an imperfect musical education. In 1819 he was received into Pamer's orchestra, and four years later joined the celebrated Lanner Quartet as viola-player. He subsequently became assistant conductor of Lanner's orchestra, but in 1824 started an independent organization, with which he played at various resorts, and through which he gave to the world the waltzes which made him famous. In 1845 he was appointed conductor of the Court balls at Vienna. Conspicuous among the 152 waltzes which he published were the "Lorelei," "Gabrielen," "Taglioni," "Victoria," "Kettenbrücken," "Bajaderen," and the "Donau-Lieder." Both as conductor and as composer he succeeded in raising the dance form to an artistic plane, before unknown.

STRAUSS, JOHANN, the Younger (1825-99). A distinguished Austrian composer, born in

Vienna, son of the preceding. His father was averse to his adopting the profession of music, but, aided by his mother, he was enabled to secure instruction on the violin and in composition, and at nineteen years of age severed his home connections and secured an engagement as conductor of an orchestra at a popular restaurant in Hietzing. He used the opportunity to play his own waltz compositions and soon became widely popular. After his father's death he united both orchestras and began a concert tour through many European countries. From 1855 to 1865 he was the conductor of the Petropaulovski Park summer concerts in Saint Petersburg, and from 1863 to 1870 was also conductor of the Court balls. He composed nearly 500 dance pieces, which for the most part possess the highest merit. Among the best known may be mentioned: *The Beautiful Blue Danube; Roses from the South; Artist's Life; Vienna Blood; The One Thousand and One Nights; Wine, Women, and Song.* His operettas were entitled as follows: *Indigo* (1871); *Der Carneval in Rom* (1873); *Die Fledermaus* (1874); *Cagliostro* (1875); *Prinz Methusalem* (1877); *Der lustige Krieg* (1881); *Eine Nacht in Venedig* (1883); *Der Zigeunerbaron* (1885); *Simplicius* (1887); *Ritter Pasman* (1892); *Fürstin Ninetta* (1893); *Jabuka, oder das Apfelfest* (1894); *Waldmeister* (1895); *Die Göttin der Vernunft* (1897); and a ballet *Aschenbrödel.* For his biography consult Eisenberg (Leipzig, 1894) and Prochazka (Berlin, 1900).

His brothers, JOSEPH (1827-70), who became leader of the Vienna orchestra in 1863, and EDUARD (1835—), who assumed its direction in 1870, both did creditable work as musical conductors and composers of dance music.

STRAUSS, RICHARD (1864—). A German composer, the most ingenious disciple of the so-called school of Weimar. Born in Munich, he mastered the technics of the violin and piano when quite young, and in 1875-80 studied theory and composition with kapellmeister Wilhelm Mayer. In October, 1885, Strauss became musical director at Meiningen. In 1886-89 he was kapellmeister at Munich and was then called to Weimar. His radical tendencies were soon recognized, and his espousal of extremely modern music caused his conducting of Wagner to become of notable interest. On his return from a trip to Greece, Egypt, and Sicily, his music drama *Guntram,* opus 25, dedicated to his parents, was produced at Weimar, in 1894.

Strauss returned to Munich as Court kapellmeister in 1895, and in the same capacity went to Berlin in 1898. He wrote *Italia,* a symphonic fantasia, in 1886. It is fresh, vigorous, and characteristic in themes and coloring. Then followed a series of daring orchestral compositions. The chronology of the greater symphonic works is as follows: *Don Juan* (1888); *Macbeth* (1887); *Death and Apotheosis* (1889); *Till Eulenspiegel* (1895); *Thus Spake Zarathustra* (1895); *Don Quixote* (1897); *A Hero's Life* (1898). His later works include, besides numerous songs and choruses, an opera, *Feuersnot* (1901); a tone poem entitled *Sinfonia domestica;* and *Taillefer,* a choral work with orchestra, based on a poem by Uhland. Strauss's earlier productions tell no tale of genius; the mark of the file is upon them. But from his twentieth opus his originality shows itself. He invented the tone poem, in which the line of design is as sternly unwavering as the symphony, and the possibilities for expression almost illimitable. The Strauss themes condition their treatment, and if his harmonic scheme sometimes seems ugly, his melodic curve daring, and his orchestration polyodic, it must be remembered that the same criticisms were made of Richard Wagner's music. The developing sections in his tone poems are remarkable. Perhaps, following the trend of the Lied writers since Schumann in his songs, the voice is woven too closely in the dense fabric of harmony, yet many effects of pure, rhythmetic, and sensuous beauty are discovered. Here Strauss has often dared to be simple in sentiment. Such a song as the *Serenade* is heard with delight by audiences that do not realize the complexity of a scheme expressing itself so naïvely. It is the epical Strauss that appeals especially to the imaginative.

Consult: Fuller-Maitland, *Masters of German Music, with Illustrations* (London, 1894); Huneker, *Mezzotints in Modern Music* (New York, 1899); the monographs by Seidl and Klatte (Prague, 1896), and Brecher (Leipzig, 1900); and *The Musical Times,* vol. xliv., No. 719 (London, 1903).

STRAW BAIL. In old English law, the names of two or more fictitious persons entered on the records of a court as sureties for the appearance of a defendant in a civil action. In early times a defendant was first served with a summons, and if he did not appear he was considered to be guilty of contempt of court, for which the sheriff arrested him under a *capias,* and he was obliged to give bail for his appearance. Gradually, through the change of practice in serving only one process and the indulgence of the courts, this became a mere formality, and the fictitious names of 'John Doe' and 'Richard Roe' were entered as sureties. This was known as *common* or *straw bail.* This practice no longer prevails, but the name is retained to denote a financially irresponsible surety on a bail bond. See BAIL.

STRAWBERRY (AS. *strēawberie, strēawberige,* strawberry; perhaps so called either because the long stems resemble straws, or because of an old custom of stringing the berries on straws). Certain perennial herbs of the natural order Rosaceæ, widely distributed mostly in temperate regions throughout the world. The cultivated forms are all derived by the hybridization and crossing of three principal species, *Fragaria vesca, Fragaria Virginiana,* and *Fragaria Chiloënsis,* particularly the last named. The plants are low growing, have trifoliate leaves, white flowers either pistillate or polygamous, and numerous achenes on usually red, sometimes yellowish-white fleshy receptacles which constitute the edible part. The plants are hardy and may be grown in almost any region in America from Florida to Alaska. The varieties grown almost universally in America have a short season of fruitfulness, but several of the European varieties bear more or less continuously throughout the summer and early autumn.

Since young plants are most productive, the strawberry plantations are usually allowed to fruit only once, sometimes twice. The plants obtained from rooted runners are set in the field

in spring or in late summer, and are allowed to form matted rows from their runners or are grown in so-called hills, in which case the runners are cut off, and the plants made to form stools. The former method is by far the most popular, but finer and larger individual fruits, though in smaller number, are obtained by the latter method. The land may be any rich soil suitable for corn or potatoes, and should have been in cultivation for at least one year, preferably two or three, previous to the planting of the strawberries, in order to be free from the larvæ of certain insects that feed on the roots especially of grasses. The plants are usually set about 18 inches asunder, in rows three feet apart, and



COMMON WILD STRAWBERRY (*Fragaria Virginiana*).

given clean culture throughout the season. When the ground has frozen hard straw, marsh hay, or similar substance free from weeds is spread upon the plants as a winter mulch. This is raked between the rows when growth starts in the spring and allowed to remain to protect the berries from dirt during rains. Usually in the spring of the second year complete fertilizers are applied, but no cultivation is given. After the crop is gathered, the plants are plowed under and the land used for some crop such as cabbage, which will mature before frost. Land cropped with strawberries should be planted to other crops for two or three years before strawberries are again planted.

Since the introduction of refrigerator transportation the strawberry industry has vastly increased. Large areas in the Gulf States are devoted to the crop, shipments are made to the North in early spring, and as they cease areas farther to the north supply the demand until midsummer, when the market is furnished from northern localities. The whole industry has been developed since the introduction, in 1834, of the Hovey strawberry, a variety which originated in Massachusetts. Since that date thousands of varieties have been introduced, tested, and even if they were popular for a short time have been supplanted by superior ones. Strawberries are cultivated to a small extent under glass to supply a demand for forced fruits in some cities.

The principal disease to which the strawberry plant is subject is the blight or rust (*Sphærella fragariæ*), which appears on the leaves as small purple spots which increase in size and become brown with purple margins. Serious losses may follow severe attacks. Since the disease is carried over winter in the old leaves, all such should be collected and burned and the young foliage protected by two or three sprayings of Bordeaux mixture or other fungicide (q.v.). A mildew (*Sphærotheca castagnei*) sometimes appears on the leaves as a delicate cobweb which causes the crumpling of the leaves. It seldom causes much injury and is readily controlled as above indicated. Consult: Fuller, *The Strawberry Culturist* (New York, 1897); Terry and Root, *A B C of Strawberry Culture* (Medina, Ohio, 1902).

STRAWBERRY BUSH. See SPINDLE TREE.

STRAWBERRY INSECTS. The principal insect enemy of the strawberry in the Eastern United States is the strawberry weevil (*Anthonomus signatus*), which appears just before the blossoms expand lays an egg in the bud usually of the staminate varieties or those pistillate varieties rich in pollen, and then punctures the stem so that in a few days the bud drops to the ground. The larva develops within the severed bud and after pupation emerges as a dull red or nearly black beetle, about one-tenth of an inch long. Both larvæ and adults feed upon the pollen. Covering the beds, cultivating pistillate varieties, and clean culture are the remedies recommended.

The larva of the strawberry leaf-roller, a small reddish brown tortricid moth (*Ancylis comptana*), rolls the leaves of the strawberry into cylindrical cases during June, becomes a chrysalis within the folded leaf, and appears as a moth in July. A second generation occurs during August. An arsenical spray is the remedy.

The strawberry sawfly (*Harpiphorus maculatus*), a small, black insect, lays its eggs in the substance of the leaf early in May. The pale green larvæ, which feed upon the leaves, and when full-grown are nearly three-fourths of an inch long, burrow in the ground and form minute cocoons. A second generation appears in the late summer and hibernates under ground. Hellebore is recommended as a remedy. Consult: Saunders, *Insects Injurious to Fruits* (Philadelphia, 1889); Chittenden, *The Strawberry Weevil* (Washington, 1897).

STRAW MANUFACTURES (AS. *strēa*, *strēaw*, *strēw*, OHG, *strō*, Ger. *Stroh*, straw; connected with AS. *strēawian*, *strēowian*, Goth. *straujan*, OHG. *streuwen*, Ger. *streuen*, to strew, and with Lat. *sternere*, Gk. στορεννύναι, *storennynai*, στρώννυναι, *strōnnynai*, OChurch Slav. *streti*, Skt. *stṛ*, to scatter). Besides the use of straw for thatching, manufacture of paper (q.v.), straw is woven into great variety of forms, as hats,

baskets, and shoes. The most important branch of the straw-plaiting industry is the making of straw hats or of straw braid to be sewed into hats. Much of the straw braid which is used for hats in England and America is braided in China and Japan.

The conversion of straw into braid is a simple process, requiring few tools but deft fingers. Wheat straw is the material commonly used. The straw pipes must be sufficiently long between the joints, flexible, and of good color. The straw is prepared for braiding by first pulling, instead of mowing the crop. It is then cut into lengths and permitted to dry and bleach in the sun, after which the outer sheath is removed and the straw is again bleached, this time in sulphur fumes. The straw is then sorted as to diameter, length, and color.

It is estimated that in Saxony and Bohemia alone, from 20,000 to 30,000 persons of both sexes and all ages are engaged in this industry. The finest work is done in Tuscany, where the industry was established in the thirteenth century. Here a particularly fine grade of straw has been produced since 1718, from which the famous Leghorn braids are made. The Tuscan straws are not split. In 1840 looms were adapted to straw-braiding, but they have not superseded hand labor. The plaits are known by the numbers of bents into which they are worked as 7 or 11 bents. The production of the finer grades of Tuscan braids is a most delicate operation, so trying to eye and nerve that the workman cannot engage in it for more than two hours at a time.

Straw and Straw Manufactures Imported into the United States
(From the U. S. Statistical Abstract for 1900)

	1896		1897		1898		1899		1900	
	Tons	Dollars	Tons	Dollars	Tons	Dollars	Tons	Dollars	Tons	Dollars
Unmanufactured	7,879	31,140	9,386	31,768	1,448	4,463	2,075	4,564	5,495	15,750
Manufactured		1,199,284		1,006,201		260,437		259,185		336,287

STRAW-WORM. See Wheat Insects.

STRAY. See Estray.

STREATOR, strē'tor. A city in La Salle County, Ill., 94 miles southwest of Chicago; on the Vermilion River, and on the Chicago, Burlington and Quincy, the Chicago and Alton, the Wabash, the Indiana, Illinois and Iowa, and the Atchison, Topeka and Santa Fe railroads (Map: Illinois, D 2). There is an attractive park in the heart of the city. Streator has important railroad interests, and is the centre of an agricultural section noted also for its deposits of coal and clay. Bottle and window glass works, foundries and machine shops, and brick and tile manufactories are some of the leading industrial establishments. The government is vested in a mayor, chosen every two years, a unicameral council, and subordinate officials who are appointed by the mayor with the consent of the council. Streator was settled in 1860, and was laid out in 1867. It was incorporated as a village in 1870, and organized as a city in 1882. Population, in 1890, 11,414; in 1900, 14,079.

STRECK'ER, Adolf (1812-71). A German chemist, born at Darmstadt. He taught successively at Giessen, Christiania, Tübingen, and Würzburg. His extensive original work led to interesting discoveries in connection with the galls of various animals, to the isolation of the coloring matter of madder, to the preparation of the mercury compounds of many alcoholic radicles, and to several important syntheses in organic chemistry, notably those of lactic acid, alanin, and taurin. His publications include: *Das chemische Laboratorium der Universität Kristiania* (1854); *Theorien und Experimente zur Bestimmung der Atomgewichte* (1859); and a German edition of Regnault's well-known textbook of chemistry (begun 1851).

STRECKER, Herman (1836-1901). An American entomologist, born in Philadelphia. He acquired considerable skill as a sculptor and designer, but his chief claim to distinction is due to his study of butterflies. His collection of these insects was the largest in America and one of the largest in the world. He published: *Butterflies and Moths of North America* and *Lepidoptera, Rhopalocera and Heterocera, Indigenous and Exotic.* After his death in 1901 his collection was bought by Dean Hoffman for $20,000 and was presented to the American Museum of Natural History in New York City.

STRECKFUSS, strĕk'fŏos, Karl (1778-1844). A German poet and translator. He was born at Gera, studied law at Leipzig, and occupied high positions in the Prussian civil service. His original works include: *Gedichte* (1823), *Neuere Dichtungen* (1834), and *Erzählungen* (1830), but he is best known as the translator of *Ariosto* (1818-20), *Tasso* (1822 and often), and *Dante* (1824-26).—His son Adolf (1823-95), a novelist and historian, was the author of *Friedrich I. und die Quitzows* (1859); *Vom Fischerdorf zur Weltstadt; 500 Jahre Berliner Geschichte* (last ed., 1899); and of *Weltgeschichte, dem deutschen Volk erzählt* (1865).

STREET (AS. *stræt*, from Lat. *strata*, street, highway, fem. sg. of *stratus*, p.p. of *sternere*, Gk. στορεννύναι, *storennynai*, στρωννύναι, *strōnnynai*, OChurch Slav. *streti*, Skt. *star*, Goth. *straujan*, OHG. *strewen*, Ger. *streuen*, AS. *strēawian*, *strēowian*, Eng. *strew*). The term as here used denotes a way for foot and vehicular traffic in cities and other more or less closely inhabited areas.

Some of the points to be observed in planning a city's streets are as follows: The streets should radiate from the principal centre, and sometimes there should be sub-radiations from local centres. This will save time and distance and afford an opportunity for better artistic effects in the way of commanding central features, such as public squares, monuments, and buildings, and pleasing vistas. Placing pipes and wires in subways, or underground galleries, is a modern means for relieving overhead congestion. Much relief has been gained in a number of cities by placing the wires in inclosed underground conduits accessible from manholes, or covered chambers placed sufficiently near together to render street excavations unnecessary. See Subways; etc.

In building sidewalks care must be taken to secure an unyielding, well-drained foundation, in order to prevent uneven settlement, cracks, or breaks. Boards or planks are generally laid crosswise of the walk, on longitudinal string-pieces, or timbers, designed to keep the boards off the ground and postpone the inevitable decay. On account of this decay, wooden sidewalks are, in the long run, decidedly uneconomical. Curbstones are from four to six inches thick and deep enough to form the necessary rise above the gutter and to extend into the earth sufficiently to give a firm foundation. They are often set on broken stone, to insure good drainage, or on concrete, to give a solid foundation. They may be of stone or of concrete. Where concrete is used it sometimes extends so as to form the gutter as well, and has the upper and outer edge of the curb protected with an iron bar or rod, imbedded in the concrete.

See BOULEVARDS; ELECTRIC LIGHTING; ELECTRIC RAILWAYS; STREET RAILWAY; GAS; HEATING AND VENTILATION (paragraph *Central Heating Plants*); PAVEMENT; ROAD AND STREET MACHINERY; ROAD; SEWERAGE AND DRAINAGE; SUBWAYS FOR PIPES AND WIRES; WATER-WORKS; etc.

STREET, ALFRED BILLINGS (1811-81). An American author, born at Poughkeepsie, N. Y. He studied law and began practice at Monticello, N. Y., but in 1839 removed to Albany, where he became editor of *The Northern Light*, and was, for the latter half of his life, State librarian. His poems deal with the sights and sounds of the woodland and the life of the more primitive days of the settlement of America. Among his verses are: *The Burning of Schenectady, and Other Poems* (1842); *Drawings and Tintings* (1844); *Fugitive Poems* (1846); and *Frontenac; or, the Atotarho of the Iroquois* (1849), a poetical romance. His chief prose works are: *Woods and Waters* (1860); *The Indian Pass* (1869); *Lake and Mountain; or, Autumn in the Adirondacks* (1870); *Eagle Pine; or, Sketches of a New York Frontier Village* (1871); and one learned work, *A Digest of Taxation in the United States* (1863).

STREET, GEORGE EDMUND (1824-81). An English architect. He studied under Gilbert Scott, from whom he got his partiality for the Gothic style and his talent in restoring mediæval monuments. Among his principal buildings are the theological college at Cuddesden, and the churches of Saint Philip and Saint James, at Oxford, of Saint Margaret, at Liverpool, and many well-designed minor churches. Among his restorations are the cathedrals of York, Bristol, and Carlisle, Jesus College Chapel, Oxford, and Wantage church. Among his writings are *The Brick and Marble Architecture of North Italy in the Middle Ages* (1855), and *Gothic Architecture in Spain* (1865), which are classics in their fields.

STREET RAILWAY. A railway laid upon the public streets of a city or a town, and intended principally for the transportation of passengers. The street railway had its origin in the early tramways of Great Britain (see RAILWAYS), and such roads are still denominated *tramways* in all European countries. The street railway for passenger traffic is, however, distinctly an American development, and the modern passenger tramways of Europe owe their inception to the United States. A street railway was operated in New York City in 1831-32, on which a horse car, much like an old English stage coach in construction, ran from Prince Street on the Bowery to Yorkville and Harlem, following for some distance the route now occupied by the Fourth Avenue Railway, which still operates under the original charter granted in 1831. The road was known as the New York and Harlem Railroad, and it continued in operation as a horse-car line until 1837, when it was temporarily changed to a steam-car line. In 1845 the operation of the horse cars on the railway line was resumed, and it remained the only horse-car line in New York until 1852, when charters were granted for the Second, Third, Sixth, and Eighth Avenue lines. Street railways were first built in Boston, Mass., in 1856. Philadelphia, Pa., had its first line in 1857. The street railway was introduced into England in 1860 through the efforts of George Francis Train, the first line being started in Birkenhead opposite Liverpool. Roads were laid in Liverpool in 1868, in London in 1869-71, and afterwards in Glasgow, Edinburgh, and Dublin. A recent authority (Dumont, *Automobiles sur rails*, 1898) says that the first horse tramway in France was built in 1856 on a line extending from Paris to Saint-Cloud, and was called the 'American' railway; but that the first horse-car line in Paris itself was not built until 1875. Street railway enterprises began to be taken up by the South American countries in 1866.

The street railway rail of 1832 was a wrought-iron bar about 5 inches wide, with a groove from 1¾ inches to 2¼ inches wide and from 1 inch to 1½ inches deep, for the wheel flange. The wide and deep groove in this rail gave trouble by catching the wheel tires of ordinary vehicles and wrenching them. To remedy this fault the step rail was adopted. This consisted of a flat bar having a flat surface from 3 inches to 5 inches wide flanked by a ridge or tread about 1 inch high and 1¾ inches wide. This form of rail came into extensive use, especially in America. Another form of step rail had the tread in the centre flanked by a flat surface on each side. The next development was a return to the grooved rail, but with the groove wedge-shaped and narrow. These early forms of rails were simply iron bars spiked to the tops of longitudinal timbers. This timber was replaced by metal longitudinals, chairs, and supports of various sorts as experience suggested improvements, until finally the attempt of trying to maintain the tread or wearing surface of the rail separate from the supporting body was abandoned and the modern girder rail was originated. The girder rail consists of a base and web like the ordinary T-rail for railways, but has a wide grooved head. With the advent of the girder rail the former difficulty of insecure and uneven joints was largely decreased and at the same time a rail was developed which gave the necessary stiffness for carrying the rapidly increasing weights of cars which were made possible by the development of mechanical propulsion. The construction of modern street railway tracks is more fully described in the article on ELECTRIC RAILWAYS.

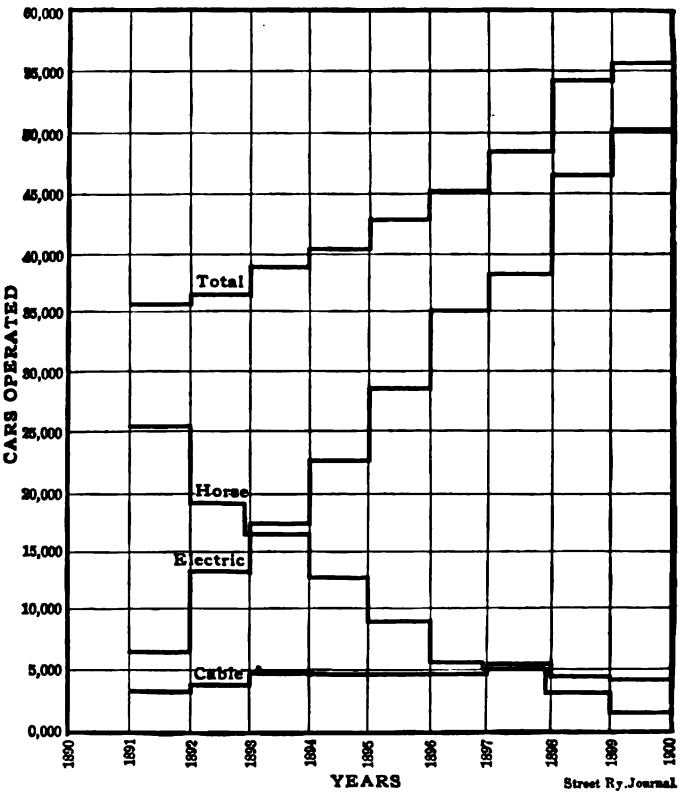
The success of the first street railways established, inventors and engineers turned their attention to devising means of mechanical propul-

sion. These various methods fall into seven classes as follows: Traction by steam motors, by compressed air, by gas motors, by carbonic acid engines, by ammonia engines, by cables, and by electricity. Steam, gas, compressed air, and vapor motors have been employed in comparatively isolated instances and under special conditions, although they have been the subject of considerable experimentation and are to be met with occasionally in Europe and to a less extent in the United States. The only systems of mechanical propulsion which have attained extended use in America (leaving elevated railways out of account) are cable power and electric motors. The development of electric propulsion for street cars is described in the article on ELECTRIC RAILWAYS.

CABLE RAILWAYS for city passenger service had their origin in San Francisco, and it was at first thought that the system was only applicable to straight lines with heavy grades in favorable climates, but this view was changed when cable traction was established in Chicago on level lines with sharp and difficult curves and was operated despite snow and other climatic disadvantages. As a result an enormous impetus was given to the construction of cable railways in America and such lines were built in a score or more of American cities. In 1886 the Tenth Avenue and 125th Street cable road was put in operation in New York City, and several years later this was followed by the Third Avenue line, 12 miles long, and the Broadway and Lexington Avenue lines. In 1891 there were 70 cable street railway lines in operation in the United States, with an aggregate mileage of 577½ miles. The new construction and extension of the next two or three years increased this total to about 700 miles, which marked the height of the cable railway in America. Since that time the mileage has steadily decreased under the competition of electric traction, until in 1900 there were but 300 miles of cable railway in operation in the United States.

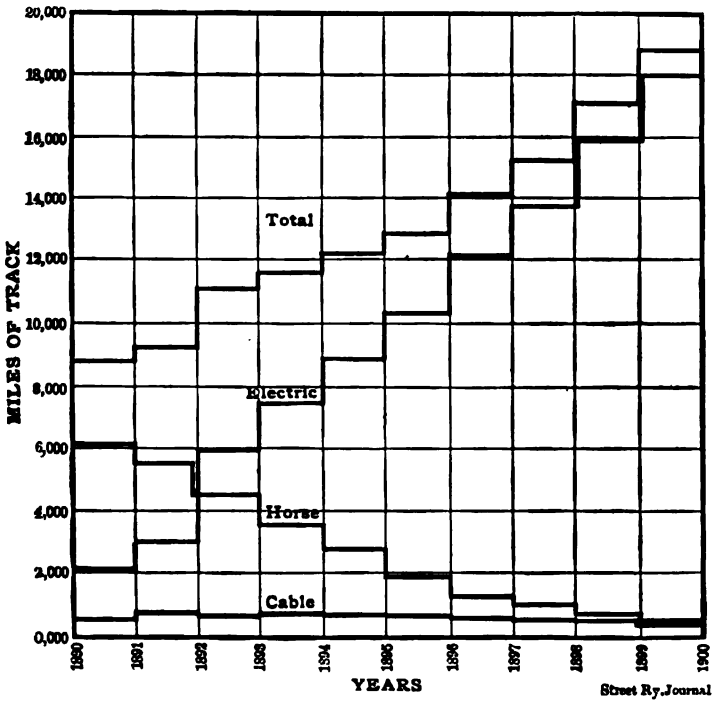
In construction the cable railway consists of a standard street railway track having an underground conduit between the rails. In this conduit there runs an endless wire rope cable guided by suitable pulleys. A slot at the top of the conduit permits a grip projecting downward from the bottom of the car to enter the conduit. This grip is provided at its lower end with jaws which can be so operated from the platforms of the car as to grasp and unloose the cable at will. Generally in modern practice duplicate cables are installed in the conduit, the purpose of which is to have a second cable ready for operation in case of breakage or other accident. Movement is given to the cable by means of a revolving drum around which the cable is wrapped, these drums being operated by powerful steam engines installed in power houses located at intervals along the line. Generally speaking, it is not desirable to operate a greater length of cable than 25,000 feet, but cables as long as 39,000 feet have been successfully operated. The prevalence of curves is perhaps the most important factor determining the length of cable which can be operated. As a general rule it is found that a right angle curve puts a strain upon the cable plant equal to that entailed upon it by 1000 feet of straight road. It may be assumed that from 40 per cent. to 60 per cent. of the power used in operating a cable railway is consumed in operating the cable itself. The size of cable most generally used is 1¼ inches, and the material favored is crucible steel. The life of street railway cables averages about fourteen months, giving from 70,000 to 80,000 miles of service, but there are records of cables having given 144,000 miles of service. In a few cases, of which the New York and Brooklyn Bridge is notable, the cable is not inclosed in a conduit, but is carried on pulleys above ground or on an elevated structure.

In respect to street railway transportation



generally the most notable facts are the enormous growth of street railways in mileage and capital invested, and the predominant position held by electric traction for street railway operation. Both of these facts are graphically illustrated in the accompanying diagrams, compiled by the *Street Railway Journal*. In the ten years

between 1890 and 1900 the street railway mileage of the United States more than doubled; the mileage of cable railways decreased about one-half; the mileage of horse railways decreased from over 6000 miles to 370 miles; and the mileage of electric railways increased from about 2000 miles to over 19,000 miles. A similar course of development has been recorded in the tramway systems of England and Continental Europe, although the totals do not reach the aggregates recorded for the United States. For a condensed statement of the development of electric railways in the countries outside of the United States and Canada, see ELECTRIC RAILWAYS.



BIBLIOGRAPHY. Outside of the electric railway field (see ELECTRIC RAILWAYS) there are no books of much value relating to street railways. There is, however, a large volume of periodical literature of high class available. Among the sources of information of this class the following may be consulted with advantage: *Reports of the American Street Railway Association* (Chicago); Volumes of the *Street Railway Journal* (New York), and the *Engineering News* (New York); *Street Railway Investments* (New York).

STREET RAILWAY EMPLOYEES, AMALGAMATED ASSOCIATION OF. See RAILWAY BROTHERHOODS.

STREITBERG, strīt'bĕrk, WILHELM (1864—). A German philologist, born in Rüdesheim, and educated in Leipzig, where he became docent in 1889. In the same year he was appointed professor of Indo-Germanic philology at Freiburg, a chair which he left in 1899 for a professorship in Sanskrit and comparative philology at Münster. In comparative grammar he ranks close to Osthoff and to Brugmann. In 1892 he became editor of the *Anzeiger für indogermanische Sprach- und Altertumskunde*, the annual bibliography of the *Indogermanische Forschungen*, and of a series, entitled *Germanische Elementarbücher*, in 1896, in which he wrote "Urgermanische Grammatik" (1896, revised 1903), and "Gotisches Elementarbuch" (1897). His earlier works on Germanics are *Die germanischen Komparative auf -oz-* (1890); *Zur germanischen Sprachgeschichte* (1892); and *Entstehung der Dehnstufe* (1894).

STRELITZ, strā'lĭts. A town in the Grand Duchy of Mecklenburg-Strelitz, about two miles south of Neustrelitz. It was formerly the capital of the country. It has some manufactures. Population, in 1900, 4165.

STREL'TSI, STRELTZI, or **STREL'ITZ.** The Russian Imperial guard, organized by Ivan IV. in the second half of the sixteenth century. At that time, and for long afterwards, they were the only standing force in Russia, and at times amounted to between 40,000 and 50,000 men. They were stationed at Moscow in time of peace, in a quarter of the capital which was set apart for them, and enjoyed special privileges. Incessant conspiracies rendered them in time dangerous. In 1698 a revolt of the Streltsi led to a bloody contest in which they were defeated with great loss. Peter the Great finally suppressed them (1705).

STREMAYR, strā'mĭr, KARL VON (1823-1904). An Austrian statesman, born at Gratz, where he also studied law, entered the Government service, and subsequently was Attorney-General and docent at the University. In 1868 he was appointed councilor in the Ministry of the Interior, and in 1870-79 was Minister of Public Instruction, when he brought about the repeal of the concordat of 1855. President of the Council after the going out of the Auersperg Ministry in 1879, he entered the Cabinet of Count Taaffe as Minister of Justice, but resigned in 1880, was appointed vice-president and, after Schmerling's resignation in 1891, president of the Supreme Court, from which post he retired in 1899. He was called to a seat in the House of Lords in 1889.

STRENGTH OF MATERIALS. A term which may be defined as the resistance which materials offer against deformation. Every load produces in the structure an internal resistance which balances it, and this internal resistance is called a *stress*. Three kinds of direct stress may be produced by load, viz. a stress tending to pull apart, or *tensile stress;* a stress tending to push together, or *compressive stress;* and a stress tending to slide on parallel planes, or shearing stress. Complex

stresses such as flexure and torsion are capable of being resolved into tension, compression, and shearing stresses. A *unit stress* is the stress per unit of area; the unit of area is the square inch in English-speaking countries and the square centimeter in countries where the metric system of measures prevails. In all cases of direct stress the total stress is supposed to be uniformly distributed over the area of the cross-section. When a tensile or compressive force is applied to a bar of metal it elongates or is shortened, and up to a certain limit the elongation or shortening is proportional to the load. Beyond this limit the elongation or shortening increases more rapidly than the load. The unit stress at which the deformations begin to increase in a faster ratio than the stress is called the *elastic limit*, or less commonly the elastic strength. When the unit stress in a bar is less than the elastic limit, the bar returns, when the stress is removed, to its original dimensions. When, however, the unit stress is greater than the elastic limit, the bar does not fully return to its original dimensions, but a permanent distortion remains. Therefore, if a material is strained beyond its elastic limit, a permanent injury results to its elastic properties; and for this reason it is the universal practice in designing engineering structures to make certain that the unit stresses never exceed the elastic limit of the material. When a material is under a stress exceeding its elastic limit it is usually in an unsafe condition. If the stress be increased the deformation rapidly increases until finally the material ruptures.

The unit stress which occurs just before rupture takes place is called the *ultimate strength* of the material. The ultimate strengths of materials are from two to four times as great as their elastic limits. The strength of materials is determined by straining a piece of the material to rupture and observing the elastic limit, ultimate strength, and other coördinate phenomena.

TENSION. In testing a material under tension a 'test piece' or 'test specimen,' usually eight inches long and one square inch in section, is broken by direct pull. The loads are gradually applied. At first each increment of load produces a proportionate increment of elongation, but after the load has reached a certain amount the elongation begins to increase more rapidly than the load. The unit load recorded just as this change in the rate of deformation takes place is the elastic strength or the elastic limit of the material. As the load continues to increase the elongation increases more rapidly than the load and is commonly accompanied by a reduction in area of the cross-section of the test piece. Finally the test piece breaks and its ultimate strength is recorded. Record is also taken of the total elongation of the piece and of the total reduction of area. These last two records are indices of the ductility of the material. The usual records of a tensile test of materials consist, therefore, of figures showing the elastic limit, the ultimate strength, the percentage of elongation, and, often, the percentage of reduction of area. These values vary greatly for different kinds of materials and considerably for different qualities of the same material. In printing figures for illustration, therefore, the best that can be done is to select rough average values. The following figures are taken from Prof. Mansfield Merriman's *The Strength of Materials* (New York, 1897), which will be found an excellent discussion of the subject for the non-technical reader:

MATERIAL	Elastic limit, lbs. per sq. inch.	Ultimate strength, lbs. per sq. inch.	Ultimate elongation, per cent.
Timber	3,000	10,000	1.5
Cast Iron	6,000	20,000	0.5
Wrought Iron	25,000	55,000	20.
Steel	50,000	100,000	10.

COMPRESSION. In testing for compressive strength the test piece used is short and thick, a cube and a short cylinder being the common forms of test pieces. The phenomena which occur are substantially as in tension, first a distortion proportional to the load until the elastic limit is reached, and then a distortion increasing more rapidly than the load increases until rupture occurs. The manner in which rupture occurs is quite different from the manner in which it occurs in tension. In tension the material draws down to a smaller diameter and finally parts by a more or less ragged fracture at approximately right angles to the direction of the pull; in compression the test piece first bulges to an increased diameter and then ruptures with a fracture oblique to the direction of the pressure. This method of fracture occurs only when the test piece is thick compared with its height; when the height is great compared with the thickness lateral flexure or bending occurs and the conditions of rupture are no longer those of simple compression, as it is explained in the succeeding paragraph on the strength of columns. As was the case with tension, only rough average figures of comparative strength can be given, owing to the fact that this strength varies for different materials and with different qualities of the same material. The following figures are quoted from the work of Professor Merriman which is named above:

MATERIAL	Elastic limit, lbs. per sq. inch	Ultimate strength, lbs. per sq. inch
Timber	3,000	8,000
Stone	—	6,000
Cast Iron	20,000	90,000
Wrought Iron	25,000	55,000
Steel	50,000	150,000

SHEAR. Shear is the stress produced by two parallel forces acting on the material in opposite directions, as, for example, do the blades of a pair of shears. If a weight be suspended by a bar which is composed of two shorter bars connected at one end by a rivet or bolt passing through them, the stress brought upon the rivet is a shearing stress. The same stress is exerted by a punching machine in punching holes in metal plates. The shearing strength of materials often differs according to the direction in which the shearing forces are exerted. Thus the shearing strength of timber is much less along the grain than at right angles to the grain. The following figures taken from Professor Merriman's book named above give the average ultimate shearing strengths of the more common structural materials:

MATERIAL	Pounds per sq. inch
Timber, longitudinal	600
Timber, transverse	3,000
Cast iron	20,000
Wrought iron	50,000
Steel	70,000

ACTUAL VALUES. The figures given in the preceding tabular statements show rough average values, useful chiefly to be memorized as a basis for approximation. In careful designing the engineer requires actual values as determined by authoritative tests upon the particular material he is using or proposes to use. These values vary within quite narrow limits for each kind or quality of any material and within broader limits for all kinds and qualities of the same material. The ultimate average strengths of six of the most common structural timbers are as follows:

TIMBER	Pounds per square inch	
	Tensile strength	Compressive strength
Hemlock	8,000	5,000
White pine	8,000	5,500
Chestnut	12,000	5,000
Red oak	9,000	6,000
Yellow pine	15,000	9,000
White oak	12,000	8,000

These values have been obtained by testing small pieces. Timbers of large size such as are actually used in engineering structures will fall from 20 per cent. to 50 per cent. below these values in strength. These values are also subject to a variation of about 25 per cent. according to time of cutting, place of growth, and methods of seasoning. The shearing strength of timber is more variable than either the tensile or the compressive strength. The values average about as follows:

TIMBER	Pounds per square inch	
	Along the grain	Across the grain
White pine	500	2,500
Chestnut	600	1,500
Yellow pine and oak	600	4,000

The elastic limit of timber is not well defined; it varies from one-third to one-half the ultimate strength in tension. The elongation at the point of rupture in tension is from 1 per cent. to 2 per cent. Tensile and shearing tests of brick are seldom made, but the compressive strength varies from 500 pounds per square inch for soft brick to 10,000 pounds for pressed brick, and to 15,000 pounds for the best qualities of hard burned paving brick. The crushing strengths of the principal building stones of the United States are about as follows:

STONE	Pounds per square inch	
	Minimum	Maximum
Trap rock	20,000	24,000
Granite	12,000	21,000
Marble	8,000	20,000
Limestone	7,000	20,000
Sandstone	5,000	15,000

Cast iron is so variable in quality that similar specimens will vary from 10 per cent. to 20 per cent. in strength. Fair average values are 20,000 pounds per square inch in tension and 90,000 pounds per square inch in compression. The elastic limit is poorly defined and the elongation is practically nil, indicating clearly the fact, known to every one familiar with this material, that it is a hard and brittle substance. A direct contrast to cast iron is afforded by wrought iron with a tensile and a compressive strength nearly equal and ranging between 50,000 and 60,000 pounds per square inch, and with an elongation of 20 per cent. to 30 per cent. and an elastic limit well defined at about 25,000 pounds.

Steel is manufactured in a variety of grades distinguished by the relative amounts of contained carbon, as mild steel, medium steel, hard steel, and extra hard steel. Ordinary structural steel for bridge and building construction has an ultimate tensile strength of from 60,000 pounds to 70,000 pounds per square inch and an elastic limit of from 30,000 pounds to 40,000 pounds per square inch. Nickel-steel, or steel containing a small percentage of nickel, has been made with a tensile strength of 277,000 pounds per square inch and an elastic limit of 100,000 pounds per square inch. The compressive strength of steel is always greater than its tensile strength. The maximum compressive strength recorded for hardened steel is 392,000 pounds or 196 tons per square inch.

The tensile strengths of some of the other more common metals are about as follows:

MATERIAL	Pounds per sq. inch
Brass, cast	23,500
Brass wire	49,000
Copper, cast	24,000
Copper wire	60,000
Gold, cast	20,000
Gold wire	27,500
Lead, cast	2,050
Lead wire	1,650
Platinum wire	56,000
Aluminum	25,000

Common mortar composed of one part lime and five parts sand has a tensile strength of from 15 to 30 pounds and a compressive strength of from 150 to 300 pounds per square inch at the age of six months. Natural hydraulic cement will test from 100 to 200 pounds per square inch in tension when one month old, and Portland cement will test from 600 to 800 pounds per square inch at the same age. Mortars and pastes of cement and lime increase in strength with age. For a concise statement of strengths of a great variety of other materials, see Trautwine, *Engineers' Pocket Book* (New York, 1900).

WORKING STRESSES. The loads carried by a structure should never strain the material to an amount at all close to its ultimate strength. Were they to do so the elastic limit of the material would be exceeded and distortion would ensue even though ultimate rupture did not occur. Therefore, in designing a structure a unit stress is adopted which is certain not to cause distortion or rupture, and the size of each member is determined by dividing this unit stress into the total load on the member. This assumed unit stress is called the working stress, and it varies for any material according to the character of the load it is to support. Thus the safe working stress for a varying load is less than for a steady load, and that for a sudden load or shock is less than for a varying load; a load producing tension and compression alternately requires the use of a smaller working stress than does a steady load or a va[illegible] in tension only. In all cases the wo[illegible]

must be less than the elastic limit of the material. It has long been the practice to call the ratio of the ultimate strength to the working stress *the factor of safety*. The factors of safety commonly employed for different materials and for different forms of load are given by Professor Merriman as follows:

MATERIAL	For steady stress (buildings)	For varying stress (bridges)	For shocks (machinery)
Timber	8	10	15
Brick and stone	15	25	35
Cast iron	6	15	20
Wrought iron	4	6	10
Steel	5	7	15

RESILIENCE. One of the most important properties of a material is its capacity to resist the work of external forces, or its resilience. If a bar is placed in a testing machine and pulled by a force gradually increasing from 0 to F, and this pull produces an elongation equal to *e*, the work done on the bar is the product of the average pull into the elongation, or one-half *Fe*. Since the internal stresses in the bar resist the work done by the external force, they must also perform an amount of work represented by one-half *Fe*, and the measure of resilience of a material is the product of the average force exerted upon it multiplied by the elongation which this force produces. Elastic resilience is that internal work which has been performed when the internal stress reaches the elastic limit; ultimate resilience is that internal work which has been performed when the material is replaced. Resilience, like work (see WORK), is measured in foot pounds, or, more commonly, in inch pounds. The higher the resilience of a material is the greater is its capacity to resist the work of external forces. Cast iron has very low resilience and wrought iron and steel have high resilience.

BENDING STRESS. When a beam is loaded it is bent from its original form and takes a curved shape. The fibres on one side of a loaded beam are, therefore, shortened or compressed and the fibres on the opposite side are lengthened or subjected to tension. Midway between the two sides where compression ends and tension begins there are fibres which are neither shortened nor lengthened, and this layer or surface of fibres is called the neutral surface. A simple beam is a bar resting upon supports at its ends and is the kind most commonly in use. A cantilever beam is a bar resting on one support at the middle, or if a part of a beam projects out from a wall or beyond a support it is called a cantilever beam. In a simple beam the lower part is under tension and the upper part is under compression; in a cantilever beam the reverse is the case. Beams almost universally fail by tearing apart under the horizontal tensile stress developed by bending. Mathematicians have calculated formulas for determining the resilience of beams to bending, the safe loads to be put on beams, etc., but a consideration of these is a matter of some intricacy and the reader is referred to the books mentioned at the close of this article for such information. From these studies, however, the following important laws regarding rectangular beams have been formulated: The strength varies directly as the breadth and directly as the square of the depth; the strength varies inversely as the length; a beam is twice as strong under a distributed load as under an equal concentrated load.

STRENGTH OF COLUMNS. A bar under compression whose length is greater than about ten times its thickness is called a column. Columns generally fail under stresses produced by combined compression and bending. The phenomena are very complex and their investigation is a problem of great intricacy, for whose solution the reader must consult special treatises on the subjects. Columns are of three kinds: Class *a* includes those with hinged ends; class *b* includes those with one end hinged and one end fixed (the piston rod of a steam engine is a column of this type); class *c* includes those having both ends fixed, these being used in bridge and building construction. It has been found by experiment that class *c* is stronger than class *b* and that class *b* is stronger than class *a*.

TORSION. Torsion is that kind of stress which occurs when external forces tend to twist a body round an axis. A shaft which transmits power is twisted by the forces applied to the pulleys and thus all its cross-sections are brought into stress. This stress is a kind of shearing, but the forces acting in different parts of a section are not parallel. Special formulas have been developed by engineers for calculating strength against torsional stress.

BIBLIOGRAPHY. Besides the work of Professor Merriman which has been mentioned, the reader may consult to advantage the following works: Johnson, *The Materials of Construction* (New York, 1897); Thurston, *Materials of Engineering* (ib., 1883); Unwin, *The Testing of Materials of Construction* (ib., 1899); Mehrtens, *Testing of Materials* (ib., 1901).

STRE'PHON. In Sidney's *Arcadia*, a shepherd in love with Mania. In literature, a stock name for a lover.

STREPSIP'TERA (Neo-Lat., from Gk. *στρέψαι, strepsai*, aor. of *στρέφειν, strephein*, to twist + *πτερόν, pteron*, wing). A group of insects of rather uncertain rank and position, comprising the curious family Stylopidæ, and now thought to fall in the Coleoptera. The group consists of a small number of species, very singular in structure and habits, apparently forming a connecting link between Coleoptera and Hymenoptera. The species are all small, and in their larval state live parasitically in the bodies of bees, wasps, and certain Hemiptera, forming the genera Stylops, Colacina, and Xenos. The first infests bees of the genus Andrena, and Xenos occurs in a genus of wasps (Polistes). Bees that are carrying or have carried Strepsiptera are said to be 'stylopized,' because the abdomen of the bee is deformed. These parasites do not cause the death of the host. When about ready to transform the larva pushes one end of the body out between two of the abdominal segments of its host. The metamorphosis of the female is very slight, while that of the male is complete. The male leads a short and extremely active life of a few hours only, or in some species of a day. The female never changes position and becomes little more than a sac filled with an enormous number of developing young. When the young emerge they are known as 'triungulins.' How the triungulins find their way to the bee-larvæ is not known. It is supposed by some writers that parthenogenesis occurs with the Strepsiptera,

but there appears to be no definite proof. The Strepsiptera are also sometimes called Riphiptera.

STREPTOCOCCUS. See BACTERIA; SEPTICÆMIA; PYÆMIA.

STRET'FORD. A manufacturing town in Lancashire, England, 3½ miles southwest of Manchester. Population, in 1891, 21,756; in 1901, 30,346.

STRET'TO (It., bound). In music, a term which signifies that the movement to which it is prefixed is to be performed rapidly, with a gradual acceleration toward the close. The term *stretto* is also applied to the finale of a fugue, where the subject and answer enter so closely together that they overlap. See FUGUE.

STRICK'LAND, AGNES (1796-1874). An English historian, daughter of Thomas Strickland, of Reydon Hall, near Southwold, in Suffolk, born in London. She was educated mostly at home under the direction of her father. After writing considerable verse and several historical tales for children, Miss Strickland planned a series of biographies of the Queens of England. In this undertaking she was much helped by her sister Elizabeth (1794-1875). *The Lives of the Queens of England* appeared in sections between 1840 and 1848, and filled twelve volumes (revised edition, 6 vols., 1864-65). Meanwhile, besides much miscellaneous work, Miss Strickland published *Letters of Mary Queen of Scots* (1842-43; complete ed., 5 vols., 1864); *Lives of the Queens of Scotland* (1850-59); *Bachelor Kings of England* (1861); and *Lives of the Last Four Stuart Princesses* (1872). Consult the *Life* by her sister Jane M. Strickland (Edinburgh, 1887), and *Pearls and Pebbles*, by another sister, Mrs. Catherine P. Traill (London, 1894).

STRICKLAND, HUGH EDWIN (1811-53). An English geologist. He studied at Oxford, and in 1850 became reader in geology at that university, succeeding Dr. Buckland, and retaining the post till his death. He was one of the founders of the Geological Society, and of the Ray Society, which on account of his representations undertook the publication of Agassiz's *Bibliographia Zoologiæ et Geologiæ*, three volumes of which he edited. He was associated with Sir Roderick I. Murchison in the recognition and study of the Silurian system.

STRICT CONSTRUCTIONISTS. A term in American politics applied to those who, for various reasons, have maintained that the Federal Constitution should be construed strictly in accordance with its letter, as opposed to those, known as 'broad constructionists,' who have believed that the Constitution should be construed liberally, and have claimed for the General Government more or less extensive powers, called 'indirect powers' or 'implied powers,' not granted specifically by the Fundamental Law. Conflicts between the adherents of the two views have recurred frequently in the history of the United States, e.g. in the controversies over the chartering of a United States Bank, over the question of 'internal improvements,' and over the power of the General Government with regard to the restriction or prohibition of slavery in the Territories; and it is upon this question that, directly or indirectly, party differences in the United States have been largely based. In general, it may be said that the strict constructionist view has been held, more or less consistently, by the Anti-Federalist and Democratic parties (qq.v.); and the broad constructionist view, more or less consistently, by the Federalist, National Republican, Whig, Free-Soil, and Republican parties (qq.v.); though there has been a tendency for the party in power, irrespective of its platform, to lean to the side of broad or liberal construction, and for the party in opposition, also irrespective of its platform, to lean to the side of strict construction. A broad constructionist policy has always had for its effect the strengthening of the Central Government as compared with the States; and a strict constructionist policy the strengthening of the States as compared with the Central Government. See CONSTITUTION; UNITED STATES, section on *History*.

STRICTURE (Lat. *strictura*, from *stringere*, to draw tight). A contraction in the calibre of one of the mucous-membrane-lined tubular structures of the body, such as the urethra, the rectum, the œsophagus, or the larynx. The most common form of stricture and the variety generally referred to when the term stricture is used alone is stricture of the urethra. Three varieties of stricture of the urethral canal are recognized: (1) spasmodic; (2) inflammatory; and (3) organic. The first form is due simply to reflex muscular contraction caused by irritation of some portion of the urethra, as from an ulcerating spot or a sensitive organic stricture. The second form is due to simple inflammatory swelling of some portion of the urethral tract, such as occurs in acute gonorrhœa or after the internal administration of such drugs as cantharides and turpentine. The third, and by far the most frequent and important variety of stricture, is caused by permanent changes in the tissues of the urethra and those surrounding it. These changes usually consist either in inflammatory thickening of the urethral wall and periurethral tissues or else in actual cicatrization and narrowing of the channel from the accompanying contraction; or both of these conditions may be present at the same time. The initial causes in bringing these changes about are chronic inflammation (*gonorrhœa*) or injuries by caustic or irritant substances.

The results of stricture of the urethra if allowed to persist are often far-reaching and disastrous. The bladder, ureters, and kidneys may finally in turn become the seat of disease from the continued retention of urine unable to find free and regular exit through the natural outlet, or rupture of the urethra from prolonged retention, allowing extravasation of urine into the surrounding tissues, with death resulting from uræmic poisoning.

The treatment of organic stricture of the urethra is mainly mechanical. It consists in dilatation of the contracted area by means of sounds or bougies, and where this method is inapplicable divulsion of the stricture by means of suitable cutting instruments is indicated. After division of the stricture the lumen of the urethra is kept open to the proper degree by the subsequent periodic passage of a sound. Consult Dennis, *American Text-Book of Surgery* (Philadelphia, 1892).

STRIEGAU, strē'gou. A town in the Province of Silesia, Prussia, 25 miles by rail south-

east of Liegnitz (Map: Germany, G 3). Leather products, cigars, sugar, brushes, and whips are the principal manufactures. Basalt and granite are mined in the vicinity. Population, in 1900, 12,858.

STRIGEL, strē'gel, BERNHARD (c.1460-1528). A German painter of the Swabian school, born at Memmingen and probably a pupil of Zeitblom at Ulm. He stood in high favor with the Emperor Maximilian I., in whose service he repeatedly journeyed to Augsburg, Innsbruck, and Vienna. His religious paintings, of which there are four interesting altar wings (1515) in the Berlin Museum and a Pietà, besides three others, in the Karlsruhe Gallery, do not quite equal his portraits, notable specimens of which are that of the Augsburg patrician Konrad Rehlinger (1517), in the Pinakothek, Munich; "Councilor Cuspinian and Family" (1520), in the Berlin Museum; and "Emperor Maximilian with Family" and "King Louis II. of Hungary" (1524), both in the Vienna Museum.

STRIGEL, VIKTORIN (1524-69). A theologian of the Reformation period. He was born at Kaufbeuren, Swabia, studied under Melanchthon in Wittenberg, and became professor at Jena in 1548. He became involved in the synergistic controversy (see SYNERGISM) and was imprisoned for several months in 1559. Ultimately he was forced to leave Jena, and went to Leipzig (1562), and later to Heidelberg (1567). Here he was charged with holding Calvinistic views. His chief work was the *Loci Theologici*, published posthumously (1581-84). Consult: Otto, *De Victorino Strigelio* (Jena, 1843); Döllinger, *Die Reformation*, vol. iii. (Regensburg, 1848).

STRIKE (AS. *strīcan*, to advance quickly, OHG., *strīhhan*, Ger. *streichen*, to stroke, Goth. *strīks*, stroke; connected with Lat. *stringere*, to draw tight, Gk. *στραγγάλη*, *strangalē*, halter, *στραγγός*, *strangos*, twisted). A term used in geology to indicate the line of intersection of a stratum with the plane of the horizon, the strike thus being at right angles to the dip. The line of strike coincides with the outcrop when the surface of the ground is level, or when the dip is vertical. If the dip is constant in one direction, the strike will be a straight line; but with a gradually changing dip, as from south through southeast to east, the strike will be a curve. In the case of a quaquaversal fold it is a complete circle. The strike is usually measured by placing the compass so that the north and south line is at right angles to the dip and then reading the number of degrees from the north pole of the needle to the north and south line; a strike of N. 45° E. thus means 45° east of north or northeast. See DIP.

STRIKES and LOCKOUTS. A strike, in industry, occurs when there is a cessation of work on the part of a body of employees acting in concert to enforce some demand upon the employer, or to resist some demand which the employer has made. The employees are here assumed to take the initiative in ceasing work. When, on the other hand, the employer shuts down his establishment in order to compel workmen to comply with some demand, the suspension is called a lockout. It is not always easy to distinguish the two in practice, especially as an employer may not infrequently lock out his men in anticipation of, or on threat of, a strike.

Certain popular movements in the Middle Ages bear resemblance to strikes, such as the disturbances in England in the second half of the fourteenth century. More like the modern strikes were the contests between different guild organizations, or between journeymen and guildsmen, in both English and Continental towns. But as a social problem, as a frequent and apparently enduring feature of the industrial system, strikes belong to the nineteenth century. The strike has usually been an essential part of the policy of trade unions (q.v.). Misused though the strike has sometimes been, the existence of the union as its directing and controlling agency has been the chief means in transforming local, half-insurrectionary outbreaks into carefully planned attempts to attain well-recognized ends.

The detailed causes of strikes are manifold, but the chief causes concern the wages question. In prosperous times strikes are likely to be made for increase of wages; in times of depression, against a decrease. Demand for a reduction of hours is a relatively frequent cause. Also of importance are strikes for the enforcement of union rules of work, for recognition of the union against the employment of non-union men, and in sympathy with strikes in other trades. The strike is often the first weapon employed by a newly organized body of laborers to strengthen their position. Laborers have sometimes complained that they were forced into a strike by their union, and an unsuccessful strike often results in the dissolution of a local union or in the decay of a larger body. The sympathetic strike has not generally proved advisable, and is regarded with disfavor by the best unions. To avoid or put down strikes employers may form organizations or use the lockout. They have at times been accused of instigating violence in order to bring the strike into public disfavor and obtain the aid of troops. On the employees' side boycotting and 'picketing' of all sorts are likely to occur in a serious strike. The bitter feeling against men who refuse to strike or who come to take strikers' places often makes the more peaceable forms of persuasion end in intimidation or violence. Public sympathy is an almost essential element in the success of any large strike, and is likely to be alienated by violence or the destruction of property. This is well realized by the better trade unions, but when disorder or riots occur—often due to a semi-criminal floating population—the public may probably fail to lay the blame elsewhere than on the strikers. The magnitude of some recent strikes in important industries has emphasized the harm done to general business, and the interest which the public has in labor disputes as a third and impartial party. Conciliation and arbitration have come prominently forward as remedies for strikes. In 1888 a Federal law provided for the appointment by the President of strike commissioners in disputes involving inter-State commerce, and the Chicago Strike Commission recommended a permanent commission on the subject. The improved organization of trade unions, their increased responsibility, and the use of the trade agreement may lessen the waste of strikes in the future.

LEGAL ASPECT. Any combination of laborers to raise wages was illegal in England until 1824,

and in France until 1864. In the United States strikes as such have never been illegal, but until after 1830 it was not definitely settled that strikers could not be arraigned for civil and criminal damages under the conspiracy laws. When a strike represents a combination to injure property or a definite person it is illegal, and the same is true of acts of intimidation, the destruction of property, or the forcible prevention of work. Some forms of sympathetic strikes and of the boycott have been held illegal. Riots are covered by the criminal law. In many States there are special statutes regarding strikes. Thus the common law of conspiracy has been expressly repealed in New York, Pennsylvania, New Jersey, and several Western States, but the statutes usually provide for punishment of the use of force or intimidation. Certain States have special laws regulating strikes on railways or in mines, a few make the municipality or county responsible for damages due to strikes, while Missouri and Wyoming forbid the employment of private officers from without the State for the protection of the employer's property against violence on the part of the strikers. The use of injunctions has been regulated by statute only in Kansas. A difficult question is often involved in determining how far workmen may go in persuading others to join a strike. A leading case is that of the Northern Pacific Railroad (Arthur *vs.* Oakes, 63 F. R., 310), in which the employees were enjoined from (1) intimidating, (2) persuading others to strike, or (3) combining to strike themselves in such manner as to cripple the railroad. On appeal, however, the second and third clauses were abolished. Since the passage of the Inter-State Commerce Act (1887) and the Anti-Trust Law (1890), the courts of equity have acquired enlarged powers. Interference with the United States mails or with inter-State commerce (in railroad strikes) may be a serious offense. The United States can obtain an injunction against strikers, who, if they violate its provisions, may be summarily punished for contempt of court. In cases where railroads are under receivers the receiver is regarded as an official of the court, and a strike against the road may be as such unlawful. The use of injunctions in labor disputes is by no means new, but was brought into special prominence by the Chicago strike of 1894. As a method of dealing with strikes the injunction is prompt and effective, but its execution practically involves arrest without indictment and trial without jury; it implies very great power in the hands of courts; and its frequent employment, not always in the wisest way, has created much bitter feeling and distrust of courts among workingmen.

HISTORY. In the United States there are a few records of strikes previous to 1800, such as those of the journeymen bakers in New York in 1741, and of the journeymen shoemakers in Philadelphia in 1796, 1798, 1799, and 1805. Something like a modern strike occurred in New York in 1802 among the sailors. They paraded the streets and compelled others to join them, but were dispersed by constables, and their leader was punished. From 1821 to 1834 there are accounts of only a few strikes each year, the records being doubtless very incomplete. These were generally among the building trades, hatters, tailors, shoemakers, and laborers on the Chesapeake and Ohio Canal. "In 1835," says the report of the Commissioner of Labor (1901, p. 721), "strikes had become so numerous as to call forth remonstrant comments from the public press." A number of strikes for a ten-hour day occurred in the thirties, while strikes for eight hours were general in 1872-73. From 1881 to 1900, according to the Reports of the United States Department of Labor, there have been 22,793 strikes, involving 117,509 establishments and 6,105,694 employees thrown out of employment. Of the latter 90 per cent. were males. The duration of strikes varies of course within wide limits, the average for twenty years being 23.8 days. The statistics of wage loss to employees ($257,000,000) and to employers ($122,000,000) have very little significance. More than $16,000,000 was contributed by labor organizations (the figure is probably too low). Considered by States, 28 per cent. of all strikes occurred in New York, 12½ per cent. in Pennsylvania, 11.6 per cent. in Illinois, 7½ per cent. in Massachusetts, and 6 per cent. in Ohio. In New York City 5090 strikes are recorded, in Chicago 1737. Considered by industries 19½ per cent. of all strikes occurred in the building trades, 11 per cent. in coal and coke, 9 per cent. in the metal trades, 6.6 per cent. in tobacco, 5.6 per cent. in transportation. The largest strikes usually occur in mining and railroading, as is shown by the fact that of the total number of striking employees 31 per cent. were in coal and coke, 7.9 per cent. in transportation, and only 10.9 per cent. in the building trades.

Labor organizations ordered 63.46 per cent. of the total strikes, and of these 52.86 per cent. (of establishments involved) were successful, 13.6 per cent. succeeded partly, and 33.54 per cent. failed. The corresponding figures for strikes not ordered by organizations are 35.56 per cent., 9.05 per cent., and 55.39 per cent., this advantage of organization appearing for each of the twenty years. As to cause, 28.7 per cent. of the strikes were for increase of wages, 11.23 per cent. for the same with reduction of hours, 11.16 per cent. for reduction of hours, 7.17 per cent. against reduction of wages, 3.47 per cent. in sympathy with a strike elsewhere, 2.34 per cent. against employment of non-union men, and 2.35 per cent. involving recognition of the union.

Among historic American strikes have been the great strikes of 1877 on the Baltimore and Ohio, Pennsylvania, and other railroads, in which much damage to property was done and troops were called out; the telegraph operators' strike in 1883; the strike on the Gould system in 1885; the Homestead strike at the Carnegie works in 1892, the bitterest in American history and involving a sanguinary battle between Pinkerton detectives and unionists; the Chicago strike of 1894, which grew out of an effort of the newly organized American Railway Union to boycott Pullman cars in order to aid strikers at the Pullman works; the bituminous coal strike in the summer of 1894; street railway strikes in several large cities (1900-01); the steel strike (1901); and the great anthracite coal strikes of 1900 and 1902.

In England, strikes being illegal, until 1824 participants could be and were punished for conspiracy. At that date the combination laws were repealed, and since then a number of statutes have defined the legal position and rights of

workmen in labor disputes. The better-developed English unions have adopted a conservative policy in regard to strikes. Employers are more accustomed to dealing on equal terms with their men than is true in the United States. The formation of unions of unskilled laborers has been accompanied by many strikes, among which the great Dock strike of 1889 attracted a remarkable amount of public sympathy and assistance. The engineering strike of 1896 roused much discussion as to the effect of unionism on English trade supremacy. In 1900 there occurred in Great Britain 648 strikes and lockouts, involving directly 135,145 employees; 202 of the disputes resulted in favor of the employees, 211 in favor of employers, and 221 were compromised. In Germany (1900) there were reported 1433 strikes, involving 122,803 workmen; 275 strikes succeeded and 505 succeeded partly. In France for the same year are recorded 1229 strikes and 432,324 strikers; 371 were wholly and 368 partly successful. In 1890 a famous strike occurred in New South Wales, beginning as a strike of the Shearers' Union against non-union men, but spreading to the railroads, and finally to nearly all industries. The report (Sydney, 1891) of the commission appointed to investigate it is one of the most valuable books upon the subject.

BIBLIOGRAPHY. GENERAL: Webb, *History of Trade Unionism* (London, 1902); Wright, *Industrial Evolution of the United States* (New York, 1895); Howell, *Conflicts of Labor and Capital* (London, 1890); Crouzel, *Les coalitions et les grèves* (Paris, 1887); McNeil, *The Labor Movement* (Boston, 1886). ON THE CHICAGO STRIKE: *Report of the United States Strike Commission* (Washington, 1895); Ashley, *The Railroad Strike of 1894* (Cambridge, 1895). ON THE COAL STRIKE OF 1902: *Report of Strike Commission*, Bulletin of the Department of Labor (May, 1903). LEGAL: Stimson, *Handbook to the Labor Law of the United States* (New York, 1896); *Report of the Industrial Commission*, vol. v. (Washington, 1900). STATISTICS: *Report of the United States Commissioner of Labor* (1887, 1894, and 1901); *Bulletin of the Department of Labor* (bi-monthly, digesting foreign statistics); *Report of Board of Mediation and Arbitration* (New York, annual since 1887); *Report of Board of Arbitration and Conciliation* (Massachusetts, annual since 1887); *Report of the Labor Correspondent to the (British) Board of Trade on Strikes and Lockouts* (annual since 1888); *Statistique des grèves* (France, annual since 1891); Mayo-Smith, *Statistics and Economics* (New York, 1899).

STRINDBERG, strĭnd'bĕry', AUGUST (1849—). A Swedish novelist, dramatist, and miscellaneous writer, the most prominent exponent in Swedish literature of the modern realistic tendency. He was born in Stockholm, and after some success as a dramatic author became at once more widely known through his novel *Röda rummet* (The Red Room, 1879), satirical sketches of the literary and artistic world. In the same vein was *Det nya riket* (The New Kingdom, 1882), which caused such violent discussion on the part of the reactionary journalistic faction as to induce its author to repair to foreign parts, principally Paris, Germany, and Switzerland. Since 1897 he settled again in Sweden. His other novels include *Hemsöborna* (The Natives of Hemsö, 1887), *Skärkarlslif* (Life on the Skerries, 1888), and *I Hafsbandet* (Sea-girt, 1890). Worthy of notice are also several collections of short stories, to wit: *Från Fjerdingen och Svartbäcken* (From Fjerdingen and Svartbäcken, 1877); *Giftas* (Marriages, 1884), which treated satirically of the relation between the sexes in the present age, and which involved him in a lawsuit for alleged irreverent attacks on religious institutions; and *Utopier i verkligheten* (Utopias Realized, 1885), advocating the solution of the labor question from the socialist point of view. Of his dramas *Mäster Olof* (1872) constituted his first stage success and was followed by *Gillets hemlighet* (The Secret of the Guild, 1880), *Herr Bengt's hustru* (Mr. Bengt's Wife, 1882), *Fadren* (The Father, 1887), and *Fröken Julie* (Miss Julia, 1888). Among his other works are *Svenska folket i helg och söken* (The Swedish People in Every Walk of Life, 1882), on which was based the series of seventeen stories *Svenska öden och äfventyr* (Swedish Destinies and Adventures, 1882-90), and *Gamla Stockholm* (Old Stockholm, 1882), in collaboration with Claes Lundin. He published an autobiography entitled *Tjensteqvinnans son* (The Servantmaid's Son, 1886). Consult Hansson, *Das junge Skandinavien* (Dresden, 1891), and Brandes, *Menschen und Werke* (Frankfort, 1894).

STRING (AS. *strenge*, OHG. *strang*, Ger. *Strang*, string, either from AS. *strang*, OHG. *strengi*, Ger. *streng*, strong, or connected with Lat. *stringere*, to draw tight, Gk. *στραγγός*, *strangos*, twisted). The strings of musical instruments are made either from silk, from the entrails of sheep, or from metal. Formerly the metal strings were made of brass or copper, but now they are generally made of steel (for the pianoforte). For the string-instruments (violin, guitar) gut strings are generally used. The thinner the string the higher is the pitch. Excessive thickness for the lower strings is avoided by winding them with thin copper or silver wire. Recently strings, especially those which are overspun, have been manufactured from silk. For the violin the highest or E string is also sometimes made of silk, but its tone quality is inferior to that of a gut string. The silk strings are chiefly used by violinists for the purpose of practicing in warm weather, when the moisture of the fingers causes the gut strings to snap in a short time. See VIOLIN.

STRINGED INSTRUMENTS. See MUSICAL INSTRUMENTS.

STRINGEN'DO (It., drawing tight, compressing). A term used in music to denote a rather sudden acceleration in the time.

STRINGHALT (corruption of *spring* + *halt*, lame). A peculiar catching up of the horse's legs, usually the hind ones. It is most noticeable when the animal is first brought out of the stable, when he is excited, or made to turn suddenly round; it is a form of chorea or Saint Vitus's dance. It does not interfere with usefulness, and is difficult to treat. When due to local injury the habit may be corrected by local treatment.

STRINGHAM, strĭng'am, SILAS HORTON (1798-1876). An American naval officer, born at Middletown, N. Y. He was appointed midship-

man in the navy in 1809, served on the frigate *President* in her conflict with the *Little Belt*, and in the engagement in which she was captured by a British squadron; fought in the war with Algiers, and served on the *Hornet* against the West India pirates. In 1847, as commander of the *Ohio*, he assisted in the bombardment of Vera Cruz. When the Civil War began he was made flag-officer of the North Atlantic blockading squadron, and in August, 1861, coöperated with Gen. B. F. Butler in the capture of the forts on Hatteras Inlet. In the following month he asked to be relieved of command, probably because of the criticisms that had been made against him for not following up his success. In 1862 he became a rear-admiral on the retired list.

STRIPPING (from *strip*, AS. *strypan*, Ger. *streifen*, to strip, plunder). A term used to designate the useless rock which overlies a bed of ore, coal, or building stone, and which has to be removed before the mineral or rock desired can be quarried.

STROBEL, strō'b'l, EDWARD HENRY (1855—). An American diplomat, born at Charleston, S. C. He was educated at Harvard. From 1885 to 1890 he was secretary of the United States legation at Madrid, and for a considerable period served also as chargé d'affaires. In 1888-89 he acted as a special diplomatic agent of the United States to Morocco. Returning to the United States, he became in April, 1893, Third Assistant Secretary of State. In April, 1894, he was appointed United States Minister to Ecuador, but later in the year was transferred to Chile, where he remained until 1897. In the latter year he acted as an arbitrator in a dispute between France and Chile, and in 1899 was counsel for Chile before the United States and Chilean Claims Commission. In 1898 he became Bemis professor of international law in the Harvard Law School. In 1903 he was granted leave of absence to accept the post of general adviser to the Government of Siam under a two years' agreement. He published *The Spanish Revolution* (1898).

STROBOSCOPE. An instrument used for studying the motion of a body where by means of a rapid succession of slits or other openings, or its illumination at regular intervals, the eye receives a series of images on the retina. Where these impressions occur with sufficient rapidity the illusion of motion is produced, and advantage of this is taken in certain toys and scientific instruments. In its simplest form the stroboscope, which was first devised by Stampfer and Plateau, consists of a disk or cylinder with a series of slits through which the observer looks at the pictures or moving object. As the disk or cylinder revolves the slits come successively before the eye and through them the observer gets a series of glimpses of the moving object. If each of the pictures represents a successive stage in an action such as the motion of a pendulum, a man or animal running, etc., the illusion of motion is produced, provided that the interval between the glimpses of the pictures is less than the duration of the image on the retina a time, which varies from 1-10 to 1-50 of a second. A simple stroboscope or zoëtrope is illustrated in the article ILLUSION, while under KINETOSCOPE will be found descriptions of some of the more complex apparatus based on this principle. Anschütz (q.v.), a German photographer, who had achieved considerable success at instantaneous photography, made an important application of the stroboscope principle in his "tachyscope," by rotating transparent pictures on a drum or disk, and having them illuminated by the momentary glow produced by the passage of a spark from an induction coil through a Geissler tube. Although the period of discharge is very brief, yet the sparks follow with regularity, and as the successive pictures always occupy the same position relative to the eye of the observer, the illumination appears continuous, and the effect of motion is produced. See ILLUSION; KINETOSCOPE.

STRODTMANN, strōt'män, ADOLF (1829-79). A German author, born at Flensburg. He studied at Kiel, and, while taking part in the insurrection of 1848, was wounded and captured by the Danes. On being set at liberty he published *Lieder eines Gefangenen auf der Dronning Maria* (1848). He resumed study at Bonn under Kinkel, but was suspended on account of his political activity. He then published *Lieder der Nacht* (1850) and a biography of Gottfried Kinkel (1850). He went to Paris, to London, and in 1852 to America, where for four years he was by turns bookseller and journalist in New York City and Philadelphia. Returning to Germany in 1856, he became known as a biographer of Heine and as war correspondent for several newspapers during the Franco-German campaign. He translated much from English writers. His most noteworthy volume in this field is *Amerikanische Anthologie* (1870), a group of successful renderings from American lyric poets.

STROGANOFF, strō'gà-nôf. A family of Russian nobles, descended from ANIKA, a wealthy merchant of Novgorod, who, in the beginning of the sixteenth century, owned extensive salt pits and iron works in the Ural Mountains. His sons YAKOFF and GRIGORI obtained from Czar Ivan IV. important territorial grants and trade monopolies, founded several cities and fortified towns, and in 1574 received a deed of gift for the Siberian territory bordering on their possessions. The conquest was, however, not accomplished until after their death in 1581, by their youngest brother, SEMEN ANIKITCH, with the coöperation of Yermak, ataman of the Don Cossacks, when Western Siberia was subdued within two years and annexed to the Russian crown. The extraordinary privileges granted to the family were taken, in 1722, from the then living representatives, the brothers ALEXANDER, NIKOLAI, and SERGEI, by Peter the Great, who in exchange conferred upon them only the baronial title. A great-grandson of Nikolai was SERGEI GRIGORYEVITCH (1794-1882), the chief promoter of the archæological excavations on the shores of the Black Sea. He founded and endowed a school of design at Moscow, and acted as curator of the Moscow educational district in 1835-47. His sound judgment in the selection of professors, his munificence and liberal spirit, made this the most brilliant period in the history of the University of Moscow.

STRO'MATOP'ORA (Neo-Lat., from Gk. στρῶμα, *strōma*, covering + πόρος, *poros*, pore). An extinct genus of hydroid corals, which formed extensive coral reefs during some periods of Paleozoic time. The colonies formed rounded or

incrusting and sometimes branching masses that show a concentric lamination and an irregular, cellular, microscopic structure. These hydroid corals are found in fossil coral reefs in the Chazy, Niagara, Lower Helderberg, and Onondaga limestones of New York State, and large specimens, which when polished are of great beauty, have been obtained in the Upper Devonian of the Central States.

STROMB (Lat. *strombus*, sort of spiral snail, from Gk. *στρόμβος*, pine-cone, snail, from *στρέφειν*, *strephein*, to turn, twist). A large gastropod mollusk of the family Strombidæ, or more particularly its shell. The species are numerous, and are mostly inhabitants of tropical seas. *Strombus gigas*, the 'queen conch,' is the largest known univalve. It is found in the West Indies, on reefs in shallow water, and is fished both for the table and on account of the shell. Great numbers of the shells are imported into Europe and America, and are sometimes called 'fountain-shell,' from their aptness as garden ornaments. Their chief use, however, is by cameo-makers. Pearls of a delicate pink color are sometimes found in this shell.

STROMBOLI, strôm'bô-lē. A volcanic island belonging to the Lipari Islands (q.v.).

STRONG, Augustus Hopkins (1836—). An American clergyman, educator, and author. He was born at Rochester, N. Y., and graduated at Yale in 1857 and at the Rochester Theological Seminary three years afterwards. He became a Baptist minister, and in 1872 was made president of the Rochester Theological Seminary and professor of biblical theology in that institution. Among his published works are: *Systematic Theology* (1886; 3d ed. 1890); *Philosophy and Religion* (1888); *Great Poets and Their Theology;* and *Christ in Creation and Ethical Monism* (1899).

STRONG, Caleb (1745-1819). A Governor of Massachusetts, born at Northampton in that State. He graduated at Harvard College in 1764, and was admitted to the bar in 1772. During the Revolution he served in the Massachusetts General Court and on the Committee of Safety of his town, and from 1779 till 1780 sat in the Massachusetts Senate. He was a member of the Philadelphia Constitutional Convention of 1787. From 1789 till 1796 he was a United States Senator, and he was Governor of Massachusetts from 1800 till 1807, and again from 1812 till 1816. In politics he was an ardent Federalist, and as such was bitterly opposed to the War of 1812. On June 26, 1812, he issued a proclamation for a public fast on account of the war just declared "against the nation from which we are descended, and which for many generations has been the bulwark of the religion we profess." By the advice of the State Supreme Court he refused to comply with the President's request to call out the State militia to help in the prosecution of the war. In explanation of this refusal he said that to the Governor, not to the President, belonged the power to decide when to call out the militia. Afterwards he placed the militia of the State under a State major-general; was active in other measures looking toward the practical nullification of the national authority; and approved the report of the Hartford Convention (q.v.). He published *Patriotism and Piety; or Speeches and Proclamations of Governor Strong* (1808). His *Life* was written by Alden Bradford (Boston, 1820). Consult also Dwight, *The Strong Family* (Albany, 1871).

STRONG, George Crockett (1832-63). An American soldier, born in Stockbridge, Vt. He graduated at West Point in 1857; was an ordnance officer with the rank of lieutenant on the staff of General McDowell in the first battle of Bull Run, and later served successively on the staffs of Generals McClellan and Butler. He commanded an expedition sent from Ship Island against Biloxi, Miss., in April, 1862, and another sent against Pontchatoula, and was commissioned brigadier-general of volunteers in November, 1862. He commanded a brigade in the operations against Charleston, S. C., in June and July, 1863; made a successful descent on Morris Island on July 10th; and on the 18th of the same month was mortally wounded while gallantly leading the assault on Fort Wagner. A commission as major-general of volunteers was made out to date from the day of the battle. He published *Cadet Life at West Point* (1862).

STRONG, James (1822-94). An American Methodist lay biblical scholar and educator. He was born in New York City and studied medicine for a time, then entered Wesleyan University, Middletown, Conn., graduating 1844. He taught languages at Poultney, Vt., in 1844-46; lived in Flushing, L. I., in 1848-57, teaching privately and acting as president of the Flushing Railroad and president of the village. He was professor of biblical literature and acting president of Troy University in 1858-63; professor of exegetical theology in Drew Theological Seminary, Madison, N. J., 1868-93. He traveled in the East in 1874, and was a member of the Anglo-American Bible Revision Committee, 1871-81. In 1853 he became associated with Dr. John McClintock in the preparation of the *Cyclopædia of Biblical, Theological, and Ecclesiastical Literature* (revised edition 1890), and in 1870 became editor-in-chief. The best-known of his works besides the *Cyclopædia* are *English Harmony and Exposition of the Gospels* (1852), *The Tabernacle of Israel in the Desert* (1888), *Doctrine of a Future Life* (1892), *Exhaustive Concordance of the Bible* (1895), a work upon which he was engaged for thirty-five years. The *Student's Commentary on the Book of Psalms* (1896) was issued posthumously with prefatory memoir by Rev. Henry A. Buttz.

STRONG, Sir Samuel Henry (1825—). A Canadian jurist, born at Poole, England. He went to Canada in 1836 and in 1849 was admitted to the bar. In 1856 he was appointed a member of the commission for consolidating the statutes of Upper Canada and Canada; in 1863 was created Queen's counsel, and in 1869 was made a vice-chancellor of the Court of Chancery. He was called to the Ontario Court of Error and Appeal in 1874, and in 1875 was made puisne judge in the newly constituted Canadian Supreme Court, of which he became Chief Justice in 1892. In 1897 he was sworn of her Majesty's Privy Council.

STRONG, Theodore (1790-1869). An American mathematician, born in Massachusetts. He was educated at Yale, and after graduation (1812) became tutor in mathematics at Hamilton College, and in 1816 professor of mathe-

matics. In 1827 he accepted the chair of mathematics and natural philosophy in Rutgers College, a position which he retained till 1862, when he retired from active life. Strong made many important contributions to mathematical science. A new geometrical demonstration of the values of the sines and cosines of the sum and difference of two arcs was given by him in 1818. He also gave a solution of the irreducible case of the cubic equation, and devised a method for the application of the binomial theorem to the extraction of the roots of whole numbers. His two principal systematic works are *A Treatise on Elementary and Higher Algebra* (1859) and *A Treatise on the Differential and Integral Calculus* (1869).

STRONG, William (1808-95). An American jurist, born in Somers, Conn. He graduated at Yale in 1828, and was admitted to the bar in Reading, Pa., in 1832. In 1846 and again in 1848 he was elected to the national House of Representatives as a Democrat; and from 1857 until 1868 he was a justice of the Pennsylvania Supreme Court. From 1870 until 1880 he was associate justice of the United States Supreme Court. He was a member of the Electoral Commission that decided the disputed Presidential election of 1876 and in that capacity contended that Congress had no power to canvass State returns for Presidential electors. He was for many years connected with societies for the advancement of Sunday schools and missionary work.

STRONG, William L. (1827-1900). The last Mayor of New York previous to the formation of Greater New York. He was born in Richland County, Ohio; was a drygoods salesman in Wooster and then in Manchester, Ohio; in 1853 went to New York City, where he engaged in similar business, and in 1869 became the head of the firm of William L. Strong & Co. In politics he was a Republican. From 1895 to 1898 he was Mayor of New York, having been elected on a fusion ticket supported by Republicans and anti-Tammany Democrats.

STRONGBOW. A surname of Richard Fitz Gislebert, Earl of Pembroke, one of the leaders in the Anglo-Norman conquest of Ireland (q.v.).

STRONGYLUS (Neo-Lat., from Gk. *στρογγύλος*, round). A genus of nematode worms, parasitic in man and other animals. The only true Strongylus infesting man is *Strongylus bronchialis*. The male usually measures rather more than half an inch, while the female is upward of an inch in length. It is apparently a rather uncommon parasite, as few cases have been reported, though allied species occur in the lungs and air passages of pigs, calves, and sheep. Closely allied to Strongylus is the genus *Eustrongylus*, which contains the species *Eustrongylus gigas*, which is the largest nematode worm at present known to infest man or any other animal, the male measuring a foot in length, and one-fourth of an inch in diameter, while the female is more than three feet, its transverse diameter being fully half an inch. The body is cylindrical, and more or less tinged with redness; the head obtuse, and furnished with a simple oval aperture surrounded by six chitinous nodules. This worm occurs in the kidneys and bladder, sometimes in the abdominal cavity and the omentum, more rarely in the lungs and liver of man and other animals. Fortunately, it is very rare in man; it is said that weasels are the animals in which it is most commonly found.

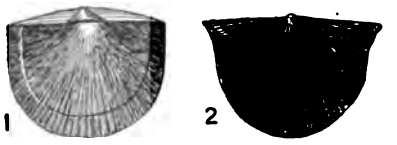
STRONTIUM (Neo-Lat., from *Strontian*, Argyllshire, Scotland). A metallic element first isolated by Davy in 1808, its earth having been recognized as a distinct chemical substance after Cruikshank (1790), Hope (1792), and Klaproth (1793) had discovered that it gives a peculiar coloration if introduced into a flame. Strontium occurs as the carbonate (strontianite), as the sulphate (celestite), as the silicate in combination with barium and calcium (brewsterite), also in small quantities in other minerals, such as arragonite, calcite, and dolomite. It further occurs in mineral and sea waters, and also in the ashes of certain plants. The metal may be obtained by the electrolysis of the moistened hydroxide or the chloride. Strontium (symbol, Sr; atomic weight, 87.61) is a yellow metal with a specific gravity of 2.5; it melts at a moderate red heat. It is both malleable and ductile, is less electro-positive than calcium and the alkali metals, oxidizes quickly on exposure to the air, and burns brilliantly when heated, forming the oxide. It combines with oxygen to form a monoxide (SrO) and a dioxide (SrO_2). The former is a gray-white, porous, infusible solid that is usually prepared by igniting the nitrate. The hydrate formed by the action of water on the oxide has the property of combining with crystallizable sugar to form a saccharate easily decomposed by carbon dioxide, and hence is extensively used for the separation of sugar from beet-root molasses. The nitrate, which may be prepared by dissolving the carbonate in warm dilute nitric acid and evaporating to crystallization, finds use for pyrotechnic purposes, owing to the red flame with which it burns.

STROPHADES, strŏf'ȧ-dēz (Lat., from Gk. *Στροφάδες*). Two small islands in the Ionian Sea, now Strofadia and Strivali. The name was given from the legend that the sons of Boreas pursued the Harpies to the islands, thence returning (*στρέφειν*, to turn) from their expedition.

STROPHANTHUS (Neo-Lat., from Gk. *στρόφος*, *strophos*, twisted, bent, from *στρέφειν*, *strephein*, to turn, twist + *ἄνθος*, *anthos*, flower). A drug consisting of the seed of Strophanthus hispidus, a climbing African plant of the order Apocynaceæ. From the seed can be obtained its active principle strophanthin, a bitter glucoside. This is a white, amorphous, or crystalline powder, soluble in water or alcohol. The physiological action of the drug is much like that of digitalis (q.v.). It slows the action of the heart, increases its contractility, and increases the arterial tension, though less than digitalis. Its action is more rapid, less protracted, and less certain than that of digitalis. It is also less diuretic, less apt to disturb the stomach, and is not cumulative. In large doses it is a direct poison to the voluntary muscles, which become tonically contracted and pass into a condition resembling *rigor mortis*. Strophanthus is a valuable cardiac stimulant and is used in cases in which digitalis is indicated, but in which, for any reason, it is necessary to substitute another drug. It is also of use when digitalis fails to act. The official tincture is the form generally employed.

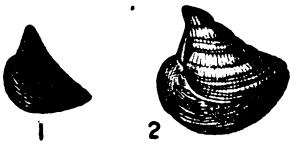
STROPHE, strō'fē (Lat., from Gk. *στροφή*, a turning, from *στρέφειν, strephein*, to turn, twist). A term which originally designated the evolutions of the Greek chorus from one position to another in the orchestra; then the portion of the song which accompanied this movement. In its ordinary sense, as applied to Greek and Latin lyric poetry, it designates a combination of rhythmical periods to which a following combination corresponds exactly or very closely; these are known respectively as strophe and antistrophe (q.v.). The name is also often applied to the stanza of modern poetry. See VERSIFICATION.

STRO'PHOME'NA (Neo-Lat. nom. pl., from *στρόφος, strophos*, twisted, bent + *μήνη, mēnē*, crescent). An important genus of fossil long-hinged brachiopods of Paleozoic age, typical of the family Strophomenidæ. The primitive members of this family are characterized by their general semicircular outline, long hinge lines,



1, *Orthothetes Chemungensis* (view from the brachia valve); 2, *Strophomena filitexta* (pedicle valve).

and well-developed cardinal teeth, distinct hinge areas, and low beaks. In the secondary derived members of the group the hinge line shortens, the beak lengthens, the hinge area increases in height, and the articulating processes undergo interesting modifications, while correlated modifications take



1, *Stroptorhynchus pelargonatus* (profile); 2, *Derbya Bennetti* (profile).

place in the interior of the shell. The simplest and earliest member is Rafinesquina (Ordovician), with valves normally concavo-convex dorso-ventrally, and hinge line simple. Strophomena (Ordovician and Silurian) in its embryonic stages has the general form of shell seen in Rafinesquina, but the adults have the valves resupinate or recurved so that the dorsal valve is convex and the ventral valve flat or concave. From Rafinesquina arises a long line of descendants reaching into Carboniferous times. These genetically related types are Strophomena (Ordovician to Silurian), Orthothetes (Silurian to Carboniferous), Derbya (Carboniferous), Stroptorhynchus (Upper Carboniferous to Permian). Consult Hall and Clarke, "An Introduction to the Study of the Genera of Palæozoic Brachiopoda," *Palæontology of New York*, vol. viii., part i. (Albany, 1892).

STROSSMAYER, strŏs'mī-ĕr, JOSEPH GEORG (1815-1905). An Austrian Roman Catholic bishop, born at Eszék, Slavonia. After being educated at Diakovár, Budapest, and Vienna he became professor in the seminary at Diakovár, afterwards Court chaplain in Vienna, and in 1849 Bishop of Diakovár. A leader of the Croatian national party, he promoted the cause of education in various ways, contributed largely to the establishment of the academy and university at Agram, and built the beautiful Romanesque cathedral at Diakovár. He came most prominently into notice at the time of the Vatican Council, in which he was considered the leader of the Inopportunists, or those who considered it inadvisable to define Papal infallibility.

STROTHER, strŏTH'ĕr, DAVID HUNTER (1816-88). An American author and illustrator, born at Martinsburg, W. Va. Educated as an artist, he first became known to the public in 1852 as 'Porte Crayon,' the author of a series of amusing papers published in *Harper's Magazine*, descriptive of travel, scenery, and manners in the South. Many of these were afterwards collected in *The Blackwater Chronicle* (1853) and *Virginia Illustrated* (1857). He entered the Union army as captain in 1861, became colonel, resigned in 1864, and in 1865 was brevetted brigadier-general. After the war he continued to write and sketch for periodicals, and from 1879 to 1885 was Consul-General to Mexico.

STROUD, stroud. A town in Gloucestershire, England, 9 miles south-southeast of Gloucester, at the confluence of the Frome and Slade (Map: England, D 5). It is the centre of the woolen manufactures of Gloucestershire. The water of the Frome is peculiarly adapted for use in dyeing scarlet and other grain colors; and on this account cloth factories and dye works have been built along its banks for a distance of twenty miles. Population, in 1901, 9188. At the Domesday survey Stroud was part of Bisley Parish, from which it separated in 1304.

STROUDSBURG. The county-seat of Monroe County, Pa., 53 miles southeast of Scranton, on the Analomink River, and on the New York, Susquehanna and Western and the Delaware, Lackawanna and Western railroads (Map: Pennsylvania, F 3). It is in a beautiful region. But four miles distant is the famous Delaware Water Gap. In East Stroudsburg is a State Normal School. There are flour and woolen mills. Population, in 1890, 2419; in 1900, 3450.

STROZZI, strôt'sê. A noble Florentine family which first attained prominence toward the end of the thirteenth century. From that time until 1530 they appear as the rivals of the Medici, with whom they shared the great offices of State. At their most flourishing period toward the end of the fifteenth century they numbered eighty heads of families. Then was built from the plans of Benedetto da Majano and Cronaca that famous palace which has been ranked with the Farnese at Rome and the Vendramin at Venice as one of the three finest in Italy. Cosmo I. de' Medici upon his accession in 1537 brought about the fall of the rival house. Various branches of the family took foreign service or settled in Naples, Mantua, and Ferrara.

STROZZI, BERNARDO (1581-1644). An Italian painter (called Il Prete Genovese and Il Capuccino). He was born in Genoa and began to paint at sixteen, but gave up his art to become a Capuchin monk. The necessities of his family required his aid, however, and he was temporarily permitted to leave the monastery in order to give himself again to painting. When he refused to return to the cloister after the death

of his mother and the marriage of his sister he was arrested and imprisoned in the dungeon of his Order for three years, when he escaped to Venice and there worked privately and for the State, decorating the library of Saint Mark's and the churches of San Benedetto and of the Incurabili. His best efforts were portraits.

STRUENSEE, strōō'en-zā, JOHANN FRIEDRICH VON, Count (1737-72). A Danish statesman, born August 5, 1737, at Halle, Saxony. He studied medicine, became the physician of King Christian VII. (q.v.) of Denmark (1768), and rose to the highest favor. In 1771 he was made Minister of State with unusual powers. Since the Revolution of 1660 Denmark had been under the domination of the nobility, who as a council of State governed the country. Struensee dissolved the council, and proclaimed the establishment of the ancient royal power. These measures amounted in reality to a revolution, and to a declaration of war against the aristocracy. The Queen and Struensee, in whose hands the whole power now was, chose new ministers, and excluded the feeble Christian entirely from the management of affairs. In opposition to the policy of his predecessors, Struensee endeavored to free Denmark from Russian influence, and to find a natural ally in Sweden. He put the finances in order, reduced the expenditure, freed industry and trade, encouraged education, mitigated the penal laws, and brought order into the administration. Serfdom was partially abolished. The haste with which this revolutionary course was pursued produced a reaction, while the clergy were aroused by Struensee's outspoken skepticism. The Queen and Struensee were accused of criminal relations and the King was prevailed upon, apparently against his will, to sign warrants for the arrest of Struensee. The Minister was accused of having conspired against the person and throne of the King, and of being the lover of the Queen. He was sentenced to death and executed April 28, 1772. Queen Carolina Matilda left Denmark in May, 1772, and died in 1775 in the castle of Celle in Hanover. Consult *Struensee et la cour de Copenhague—mémoires de Reverdil* (Paris, 1858).

STRÜMPELL, strŭm'pel, LUDWIG (1812-99). A German philosopher, born at Schöppenstedt. He studied philosophy at Königsberg, where he was influenced by Herbart, and continued his studies at Leipzig. In 1845 he became professor of philosophy at Dorpat, and after 1872 he held a similar position at the University of Leipzig. He became known as a prominent representative of Herbart's philosophy and published *Erläuterungen zu Herbarts Philosophie* (1834), *Die Hauptpunkte der Herbartschen Metaphysik kritisch beleuchtet* (1840), *Gedanken über Religion und religiöse Probleme* (1888), *Abhandlungen zur Geschichte der Metaphysik, Psychologie und Religionsphilosophie* (1896), and *Vermischte Abhandlungen aus der theoretischen und praktischen Philosophie* (1897).

STRUTT, JOHN WILLIAM. An English physicist. See RAYLEIGH.

STRUTT, JOSEPH (1749-1802). An English antiquary. He studied engraving and painting, but devoted himself mostly to research in the British Museum. Among his works are *The Regal and Ecclesiastical Antiquities of England* (1773); *The Chronicle of England* (1777-78); *Complete View of the Dress and Habits of the People of England from the Establishment of the Saxons in Britain to the Present Time* (1796-99); *Sports and Pastimes of the People of England* (1801); and a curious historical romance, entitled *Queenhoo Hall*, edited and completed by Sir Walter Scott (1808). Strutt's work as antiquary was so well done that it has not yet been superseded. His engravings in the 'chalk' or dotted style are much sought after.

STRUVE, strōō've, FRIEDRICH GEORG WILHELM VON (1793-1864). A Russian astronomer, born at Altona, Germany. He was educated at the University of Dorpat, and appointed to a post in the observatory in 1813, and continued with the utmost assiduity his observation and researches respecting double and multiple stars, adding immensely to our knowledge of these systems. In 1839 he became director of the newly organized observatory at Pulkova, and here he continued again his classic researches concerning double stars. Struve also executed a number of important geodetic operations, such as the triangulation of Livonia, in 1816-19, and the measurement of an arc of the meridian in 1822-52. He published: *Observationes Dorpatenses* (1817-39); *Catalogus Novus Stellarum Duplicium* (1827); *Stellarum Duplicium Mensuræ Micrometricæ* (1831); *Stellarum Fixarum, Imprimis Compositarum Positiones Mediæ* (1852). All these works are fundamental in the history of double-star astronomy. He published also *Arc du méridien entre le Danube et la Mer Glaciale* (1857-60).

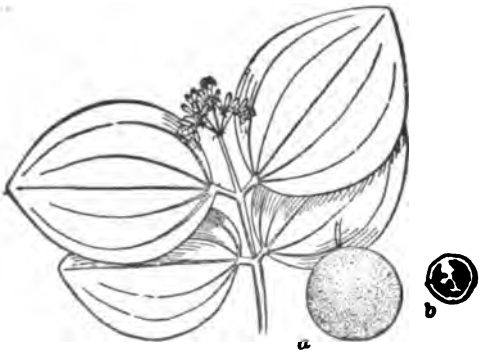
STRUVE, GUSTAV VON (1805-70). A German revolutionist, born in Munich. He was an ardent Liberal, and in 1848 took part with Hecker and others in the first revolt in Baden. After the defeat at Staufen he was captured and sentenced to five years of solitary confinement. Released by the Revolutionists in 1849, he became the leader of the Republican Party in the Constituent Assembly of Baden. Forced to flee again, he went first to Switzerland, then to England, and finally, in 1851, to the United States. Here he composed his *Allgemeine Weltgeschichte* (1853), a history of the world from the standpoint of radical republicanism. When the Civil War broke out he served for a time as an officer in the Eighth New York Regiment, but in 1863 returned to Europe, where he lived for a time in Coburg, then in Vienna until his death. Among his numerous other works are: *Das öffentliche Recht des deutschen Bundes* (1846); *Geschichte der drei Volkserhebungen in Baden* (1848); and *Das Revolutionszeitalter* (1860).

STRUVE, OTTO WILHELM (1819—). A Russian astronomer, born at Dorpat. In 1837 he became his father's chief assistant at Pulkova. In 1862 he became the director of Pulkova Observatory, a position which he held till 1889, when he retired to Karlsruhe. In his examination of the northern heavens he discovered 500 binary stars and also determined the parallax of several stars, and observed the variability of the light coming from the nebula of Orion and the several stars hidden in the nebula. He also determined a new value of the precession constant (1841),

calculated the dimensions of the ring of Saturn, determined the mass of Neptune, and made observations on solar velocity and the extent of the corona. Struve wrote: *Uebersicht der Thätigkeit der Nicolai-Hauptsternwarte während der ersten 25 Jahre ihres Bestehens* (1865); *Zum 50-jährigen Bestehen der Nikolai-Hauptsternwarte* (1887); *Observations de Pulkova* (1869-93).

STRYCHNINE, or **STRYCHNIA** (from Lat. *strychnos*, from Gk. *στρύχνος*, *strychnos*, plant of the nightshade kind). A poisonous alkaloid resembling brucine (q.v.), obtained from various species of plants, especially from the seeds of the Saint Ignatius bean and from nux vomica. It occurs in right square octahedrons or prisms, colorless and inodorous, scarcely soluble in water, but easily so in alcohol, ether, and chloroform. Pure sulphuric acid forms with it a colorless solution, which, on the addition of bichromate of potash, acquires an intensely violet hue, speedily passing through red to yellow. If, indeed, the solution is diluted with water while it is red and ammonia is added, it becomes a violet purple, changing to yellow. Another test for strychnine is its action upon animals. In nitric acid it ought, if pure, to form a colorless solution; if the solution is reddish it is a sign that brucine is also present. Strychnine combines with numerous acids, and forms well-marked salts, which are amenable to the same tests as the base itself and are soluble in water. Strychnine is intensely bitter, and will impart this quality to 20,000 times its weight of water. See ANTIDOTES.

STRYCHNOS (Lat., from Gk. *στρύχνος*, *strychnos*, *τρύχνος*, *trychnos*, plant of the nightshade kind). A genus of trees and shrubs of the natural order Loganiaceæ. To this genus belongs *Strychnos Nux-vomica*, an East Indian tree of medium size, whose fruit, which is produced in great abundance, is about the size of a small orange. Its disk-shaped seeds, which are the nux vomica of commerce, yield the alkaloids strychnine and brucine. The wood of the tree is very hard and durable. The clearing-nut and Saint Ignatius bean are produced by species of this genus, to which also belongs the South American tree (*Strychnos toxifera*) from which



NUX VOMICA (*Strychnos Nux-vomica*).
a, fruit; *b*, seed.

curare or woorali is obtained. Another species is the upas tieuté (*Strychnos Tieute*) of Java, a large climbing shrub, whose bark is reputed poisonous. The wood of a climbing species (*Strychnos colubrina*), found in the north of India, is said to cure snake bites. The bark of *Strychnos Pseudo-quina*, a Brazilian species, is used as a substitute for cinchona. The climbing species are provided with curious hooked tendrils by which they attach themselves to trees. Despite the popular ill-repute attached to many of the species, their fruits, especially those of *Strychnos Nux-vomica*, seem to be harmless, since they are often eaten by birds.

STRYJ, strĭ'y'. A town in Galicia, Austria, 40 miles south of Lemberg (Map: Austria, J 2). It has a castle. Its industries include the manufacturing of leather, matches, and iron products. Population, in 1890, 16,515; in 1900, 23,673.

STRY'KER, MELANCTHON WOOLSEY (1851—). An American educator, born at Vernon, N. Y. He graduated at Hamilton College in 1872 and at the Auburn Theological Seminary four years later. Between 1876 and 1892 he was pastor of churches in Auburn, N. Y.; Ithaca, N. Y.; Holyoke, Mass.; and Chicago. In the latter year he was elected president of Hamilton College. His publications include *The Song of Miriam* (1888), a hymnal *Church Song* (1889), *Dies Iræ* (1893), *Lattermath* (1896), and a number of addresses.

STRYPE, JOHN (1643-1737). A Church of England historian and antiquary. He was born in London, studied at Cambridge, entered the Church, and held for many years, with other smaller livings, the rectory of Leyton, in Essex. His works fill 13 large folio volumes. *Ecclesiastical Memorials*, relating to religion and the Church of England under Henry VIII., Edward VI., and Mary, is his best work, forming, with Burnet's more readable *History of the Reformation*, a consecutive and full account of the reformed Anglican Church. As a writer he is heavy, but honest and plodding, and he was a faithful transcriber of the ancient papers he published, which, he says, were all copied with his own hand. His complete works were reprinted with general index by R. F. Laurence (28 volumes, Oxford, 1820-28).

STU'ART, or **STEWART**. A Scotch and English royal family. Its origin is traced to Fitzflaald, a Norman, who accompanied the Conqueror to England. His second son, Walter (d. 1117), entered the service of David I. of Scotland, who conferred large territorial possessions on him, along with the dignity of Steward of Scotland, which became hereditary in his family, and was assumed by his descendants as a surname, some branches of the house later modifying the orthography to Steuart, or the French form Stuart. For seven generations the stewardship continued unbroken from father to son. Walter, the third steward and grandson of the first steward, held, in addition, the office of justiciary of Scotland. Alexander, fourth steward, was Regent of Scotland in Alexander III.'s minority. James, the fifth steward, was one of the six Regents of Scotland after the death of Alexander III.; and Walter, the sixth steward, by his marriage with Marjory, daughter of Robert Bruce, eventually brought the crown of Scotland to his family. His son, Robert, seventh high steward, was Regent from 1338 to 1341, and afterwards during the captivity of his uncle, David II., from 1346 to 1357. On the death of David II., in 1371, he ascended the throne as Robert II., and died in 1390. (For the subsequent history of the royal family see articles ROBERT II. and

III.; JAMES I., II., III., IV., V.; MARY STUART; JAMES I. (of England); CHARLES I. and II.; JAMES II.; MARY II.; and ANNE.) In the person of James II. the line of Stuart was driven from the English and Scottish thrones. The claims of the house were upheld by James's son, the Old Pretender (see STUART, JAMES EDWARD), and by the latter's son, known as the Young Pretender. (See STUART, CHARLES EDWARD.) A brother of the latter was HENRY BENEDICT MARIA CLEMENT, Cardinal York, born 1725. After Culloden (1746) he went to Rome, took orders, and was advanced to the purple by Benedict XIV. in 1747. During his brother's life he was known as Cardinal York; but after his death he assumed the regal style as Henry IX., King of England. The expulsion of Pius VI. from Rome, and other events following upon the French Revolution, drove him to Venice, aged and infirm and reduced to absolute poverty. George III. settled on him an annuity of £4000. He died in 1807 at the age of eighty-two, the last direct descendant in the male line of the royal Stuarts.

The female line of the Stuarts is represented by the descendants of Henrietta Maria, daughter of Charles I., who was married to Philip, Duke of Orleans, brother of Louis XIV. of France. This princess had two daughters, of whom the elder, Mary, was Queen of Charles II. of Spain, and died childless; the younger, Anna Maria, married Victor Amadeus II., Duke of Savoy and King of Sardinia, and was mother of Charles Emmanuel III., King of Sardinia, and grandmother of Victor Amadeus III. of Sardinia. See SAVOY, HOUSE OF.

The branch of the family which the Act of Settlement called to the throne on the death of Queen Anne was descended from the Electress Sophia of Hanover, granddaughter of James I. (VI.) by her mother, the Princess Elizabeth Stuart (q.v.), Electress Palatine and Queen of Bohemia.

The cadets of the House of Stuart, descendants of Robert II., are represented by some of the most noble titles in Scotch and English history. Consult: Stewart, *Historical and Genealogical Account of the Royal Family of Scotland, and of the Surname of Stewart* (Edinburgh, 1739); Noble, *Historical Genealogy of the Royal House of Stewart* (London, 1795); Thornton, *The Stuart Dynasty* (ib., 1890); Gibb and Skelton, *The Royal House of Stuart* (ib., 1890).

STUART, Lady ARABELLA, or ARBELLA (1575-1615). The daughter of Charles Stuart, Earl of Lennox, a younger brother of Lord Darnley (q.v.). She was the next in the line of succession to her cousin James I. of England, and her relationship to Elizabeth gave rise to a number of plots, including one by Sir Walter Ralegh in 1603, to place her on the throne. Several schemes to marry her were defeated by Elizabeth, but in 1610 it was discovered that she had made a secret marriage with William Seymour (q.v.), grandson of the Earl of Hertford. Seymour was imprisoned in the Tower of London and his wife put in the custody of the Bishop of Durham, but she escaped to a French vessel, in which her husband, who had escaped from the Tower, was also to sail. He did not reach it, but escaped in another vessel, while the vessel in which Arabella sailed was captured, and she spent the last five years of her life in the Tower, dying insane. Consult Cooper, *Life and Letters of Lady Arabella Stuart* (1866).

STUART, CHARLES EDWARD LOUIS PHILIP CASIMIR, often called the YOUNG PRETENDER (1720-88). A claimant to the British throne. He was the eldest son of James Edward, known as the Old Pretender, and was born at Rome. After some military service on the Continent, Charles, encouraged by the French Government, decided to make an armed attempt to obtain the British crown. The French aid, however, did not materialize, and Charles landed almost alone on August 2, 1745, on an islet in the Hebrides. The Highland clans flocked to his standard, and Charles pressed on to Perth, where he was joined by Lord George Murray. The troops of the Government were defeated at Prestonpans on September 21, 1745, and Carlisle was taken in November. Lord George Murray completely outmanœuvred his opponents, and soon had a clear road to London. In the first days of December the Highlanders were in Derby. Panic prevailed in London. But England did not rise in behalf of the Stuarts as had been expected, and Murray was cut off from his base of supplies. In consequence the retreat began on December 6, and the Duke of Cumberland pursued. On April 16 (new style April 27), 1746, the rebels were totally defeated at Culloden Moor. From April to September Charles Edward lay concealed in the Highlands and on the Hebrides with a price on his head, and hunted by the soldiers, but safe in the devoted loyalty of the clansmen. He finally reached France after many hairbreadth escapes. Thereafter his life was chiefly marked by its dissoluteness. It seems that he was in London in 1750, and again in 1752 and 1754, in the vain hope of fomenting another rising. In 1772 Charles married Louisa, Princess of Stolberg (see ALBANY, LOUISA MARIA CAROLINE), but she was unable to tolerate his brutality, and they separated in 1780. Thereafter Charles lived chiefly at Florence in the company of a daughter born to him by Miss Walkenshaw, his mistress. He died at Rome. Consult: Ewald, *Life and Times of Prince Charles Stuart, Count of Albany* (London, 1875); Lang, *The Prince Charles Edward* (ib., 1900).

STUART, ELIZABETH (1596-1662). See ELIZABETH STUART.

STUART, GILBERT (1755-1828). An American portrait painter. He was born at Narragansett, R. I., December 3, 1755. He painted his first portraits when thirteen, having had no instruction. In 1770 he was taught by a Scotsman, Cosmo Alexander, who took him to England, but upon Alexander's death Stuart was forced by poverty to return to America after a year's absence. A maturing talent brought him frequent commissions, and thus he was enabled in 1775 to return for further study to England. In London he formed the acquaintance of Benjamin West, who gave him instruction and a home in his own house. After much adversity, during which he supported himself as an organist, he attained a distinguished position. He returned to America in 1792, his impelling motive being to paint the portrait of Washington. He established a studio in New York, but removed to Philadelphia, where the first Washing-

ton portrait was painted in 1795; at a still later period he lived in the city of Washington, and finally in 1806 took up his permanent residence at Boston, where he died. The Stuart portraits of Washington, representing the subject in the later years of his life, are the most famous of both artist and sitter. The first of these, representing the right side of the face, the artist destroyed as unsatisfactory, though six replicas exist; after 1796 he painted the portrait known as the 'Athenæum portrait' (Boston Museum), showing the left side. A full length was painted for the Marquis of Lansdowne in 1796. Nearly forty replicas of his various Washington portraits have been traced. The Historical Societies of Boston, New York, and Philadelphia have many examples of his work, as do the Metropolitan Museum and other American collections.

Stuart was an entirely independent master, who followed neither West nor any other model, but nature alone. Though sometimes deficient in drawing, he was a good colorist, and in his best productions deserves to rank beside Gainsborough. He devoted his chief attention to the heads, which are rendered with force and truth, but rather neglected the rest of the portrait. The list of his sitters includes the first five Presidents of the United States, Edward Everett, John Jay, Jacob Astor, Judge Story, W. E. Channing, Josiah and Edmund Quincy, O. H. Perry, Jerome and Mme. Bonaparte. During his residence in England he painted King George III., also George IV. while Prince of Wales, Louis XVI. of France (at Paris), Mrs. Siddons, Sir Joshua Reynolds, Benjamin West, and a notable picture of "W. Grant Skating in Saint James's Park," which made his reputation in England. Consult Mason, *Life and Works of Gilbert Stuart* (New York, 1879); Caffin, *American Masters of Painting* (New York, 1896).

STUART, Henry Benedict Maria Clement, Cardinal York (1725-1807). The second son of James Edward Stuart, the Elder Pretender. See Stuart.

STUART, James. Regent of Scotland after the abdication of Queen Mary. See Murray or Moray, James Stuart, Earl of.

STUART, James (1713-88). An English painter, archæologist, and architect, born in London. Until nearly thirty years of age he was a poor fan-painter, but in 1741 he found means to go to Rome, where he studied Latin and Greek and became interested in archæology. From 1751 till 1755 he, together with Nicholas Revett, studied antiquities in Athens. Upon their return to England they published, through the encouragement and aid of the Society of Dilettanti, *The Antiquities of Athens, Measured and Delineated by James Stuart, F.R.S. and F.S.A., and Nicholas Revett, Painters and Architects* (1762). The book attracted widespread attention. Through its influence the classical style in architecture became widely popular. A second volume of the *Antiquities* was published posthumously in 1789; a third in 1795; and a fourth in 1814. A third edition of the first three volumes was published in 1841 for Bohn's *Illustrated Library.*

STUART, James Francis Edward (1688-1766). The son of James II. of England by his second wife, Mary Beatrice, daughter of the Duke of Modena, known as the Chevalier Saint George, or the Old Pretender. Prince James, who was born but a few months before his father's dethronement, was commonly but groundlessly alleged to be a supposititious child, and was involved in his father's exclusion from the crown. In 1715 the party who supported him, known in history as the Jacobites, endeavored to place him on the throne by force of arms. In Scotland the Earl of Mar, with about 5000 men, was checked by the royal forces under the Duke of Argyll at Sheriffmuir (q.v.), and in England the rising, headed by the Earl of Derwentwater, ended by the unconditional surrender of the insurgents at Preston, when Lords Derwentwater and Kenmure were beheaded and other persons of note executed and attainted. James escaped to France, and for the rest of his life resided in obscurity, principally at Rome. In 1719 he married one of the wealthiest heiresses in Europe, Maria Clementina Sobieski, granddaughter of John Sobieski, King of Poland. His son Charles Edward was the Young Pretender.

STUART, James Ewell Brown (1833-64). An American soldier, prominent as a cavalry leader in the Confederate service during the Civil War. He was born in Virginia, attended Emory and Henry College, and graduated at the United States Military Academy in 1854. He then served as lieutenant on the Texas frontier, taking part in several actions with the Apache Indians. In 1857 his regiment was sent to Kansas to maintain peace, and later he saw service against the Cheyenne Indians. In April, 1861, he was promoted to the rank of captain, but resigned from the United States Army upon receiving notice of the secession of Virginia, and was shortly thereafter commissioned lieutenant-colonel of Virginia troops. At the first battle of Bull Run he won distinction as a cavalry commander, and was rewarded in September following by promotion to the rank of brigadier-general. He made several successful raids and took a conspicuous part in the Seven Days' Battle before Richmond. In July, 1862, he was commissioned major-general of cavalry, and shortly afterwards made a dash upon General Pope's headquarters, capturing his official correspondence and making prisoners of several of his staff. This was followed the same night by a successful raid on Manassas Junction. He participated with distinction in the second battle of Bull Run and in the battle of Antietam, made a raid into Pennsylvania, guarded the Confederate right at Fredericksburg, and aided Stonewall Jackson at Chancellorsville. After the death of Jackson and the wounding of A. P. Hill, the command of Jackson's corps devolved temporarily upon him. He took part in Lee's Gettysburg campaign without adding anything to his reputation as a cavalry commander. In the campaign of the Wilderness he won several successes; and when Sheridan advanced upon Richmond General Stuart confronted him at Yellow Tavern, where the Confederates were defeated and General Stuart mortally wounded. He died May 12, 1864. Consult his *Life and Campaigns*, by H. B. McClellan, his chief of staff (Boston, 1885).

STUART, John. See Bute, third Earl of.

STUART, John McDouall (1815-66). A British explorer, born at Dysart, in Fifeshire. In 1838 he emigrated to South Australia. He was

with Captain Sturt on an expedition to explore Central Australia, and in 1858 began the work of exploration on his own account. In October, 1861, he started northward, and in July, 1862, arrived at Van Diemen's Gulf. For this exploit he received from South Australia the grant of £2000, which had been offered to the first colonist who should cross the continent.

STUART, Moses (1780-1852). An American scholar and teacher. He was born at Wilton, Conn., and graduated at Yale in 1799. After several years as a teacher he was admitted to the bar in 1802, but abandoned the law for theology. He was pastor of a church in New Haven (1806-09), but is best known for his service as professor of sacred literature at Andover Theological School (1810-48). He was an inspiring teacher, an indefatigable student, and one of the first to make German scholarship known in America. He prepared several Hebrew grammars, the first of which was used by his classes in manuscript because he was unable to find type or compositors to print it; the last was a translation of Rödiger's *Gesenius* (1846); with Edward Robinson he translated Winer's grammar of New Testament Greek (1825); he also translated writings of Jahn and others on methods of biblical study (1821), and Ernesti's *Elements of Interpretation* (1822).

STUART, Ruth McEnery (1856—). An American writer of stories dealing chiefly with Southern scenes. She was born in Avoyelles Parish, La., and was educated at New Orleans. Her chief publications are: *A Golden Wedding and Other Tales* (1893); *Carlotta's Intended* (1894); *The Story of Babette* (1894); *Solomon Crow's Christmas Pockets and Others* (1896); *Sonny* (1896); *In Simkinsville* (1897); *Moriah's Mourning* (1898); *Holly and Pizen* (1899); *The Woman's Exchange* (1899); *Napoleon Jackson* (1902).

STUBBES, stŭbz, Philip (c.1555-c.1610). A Puritan pamphleteer of the sixteenth century. In 1583 he wrote, in denunciation of the social follies and vices of the age, *The Anatomie of Abuses;* and in the same year he published *The Rosarie of Christian Praiers and Meditations.* He wrote also *A Christall Glasse for Christian Women* (1590), and numerous pamphlets. Both *The Anatomie of Abuses* and *A Christall Glasse* were very popular, and were several times republished. The former was reprinted in 1836 by Trumbull, and afterwards was edited in two parts with 'forewords' by Dr. Furnival, for the Shakespeare Society (1877, 1882). Consult volume ix. of Morley's *English Writers* (London, 1892).

STUBBS, Charles William (1845—). An English divine and author, born in Liverpool. From the Royal Institution School of Liverpool he passed to Sidney Sussex College, Cambridge, where he graduated B.A. in 1868. He became senior curate of Saint Mary's, Sheffield (1868-71), vicar of Granboro in Buckinghamshire (1871-84), of Stokenham in Devonshire (1884-88), rector of Wavertree, Liverpool (1888-94), and Dean of Ely (1894). Among his writings are: *Christ and Democracy* (1883); *God's Englishmen* (1887); *The Land and the Labourers* (1890); *Christ and Economics* (1893); *Christus Imperator* (1894); *A Creed for Christian Socialists* (1896); *Charles Kingsley and the Christian Social Movement* (1898); *The Social Teaching of the Lord's Prayer* (1900); *Pro Patria* (1900). He is also the author of two volumes of poems, *The Conscience* (1884) and *Brightnoth's Prayer* (1899).

STUBBS, George (1724-1806). An English animal painter and anatomist. He was born in Liverpool, where he began the study of his father's profession of surgery. In 1751, however, he went to Rome to study art. Upon his return to England he was soon receiving good prices for paintings of horses, and after 1758 devoted most of his time for six or seven years to the preparation of his famous *Anatomy of the Horse* (1766), a work which, from the standpoint both of anatomy and art, is still authoritative. In 1790 he was engaged to paint all the famous race-horses from the time of the Godolphin Barb, but he only completed 16 in the series. He did some notable work in enameling on large plates. Some of his rustic and heroic pieces were very popular as engravings, but his paintings of horses have never been surpassed for realism and accuracy. Among his best known pictures are "The Grosvenor Hunt," "Horse Affrighted by a Lion," "The Brick Cart," "Warren Hastings," and "Horse and Jockey." In 1900 he exhibited his largest picture, measuring more than 13 feet by 8, which represents "Hambletonian beating Diamond at Newmarket."

STUBBS, or **STUBBE,** John (c.1543-1591). A Puritan zealot, born in Norfolk, England. He was possessed of a fiery zeal against Catholicism, and was so opposed to the Queen's proposed marriage with the Duke of Anjou that, in 1579, he published a pamphlet entitled *The Discoverie of a gaping gulf wherein England is like to be Swallowed by Another French Marriage if the Lord Forbid not the Banes by Letting Her Majestie see the Sin and Punishment Thereof.* Though the pamphlet spoke of the Queen in respectful and loyal terms, Stubbs, his publisher, and the printer were found guilty on a charge of disseminating seditious writings and were sentenced to have their right hands cut off. This cruel punishment was, in fact, inflicted upon Stubbs and the publisher in the market-place at Westminster. When Stubbs's right hand was stricken off, he waved his hat with his left, and cried out, 'God save the Queen!' Nor did the treatment he had received ever lessen his fidelity to his sovereign.

STUBBS, William (1825-1901). An English historian and prelate. He was born at Knaresborough, in Yorkshire, and educated at Ripon Grammar School and at Christ Church, Oxford, being elected to a fellowship at Trinity in the year of his graduation (1848), and ordained in the same year. His *Registrum Sacrum Anglicanum,* a calendar of the English bishops from Saint Augustine (1858), attracted the attention of Archbishop Longley by the learning displayed in it, and won for him the appointment of librarian at Lambeth Palace. In 1866 he was appointed regius professor of modern history at Oxford, and during the eighteen years of his tenure of this chair he had an exceedingly wide influence on historical study in England. His great *Constitutional History of England* (1874-78) at once took rank as the standard authority on the subject, down to the times of the Tudors. He was appointed canon of Saint Paul's in 1879,

Bishop of Chester in 1884, and Bishop of Oxford in 1889. He died in London. His historical work was all of the careful modern type, based on faithful study of contemporary documents, many valuable specimens of which he edited. His *Historical Introductions to the Rolls Series* have now been rendered generally accessible by publication in one volume (ed. Hassall, London, 1903). Other notable works are: *Seventeen Lectures on the Study of Mediæval and Modern History* (1886; 3d ed. 1900); and *Councils and Ecclesiastical Documents Relating to Great Britain and Ireland*, edited with A. W. Haddan (1869-73). A volume of *Ordination Addresses* appeared after his death (1901). A complete list of his historical works may be found in Gross, *Sources and Literature of English History* (New York, 1900).

STUCCO (It., from OHG. *stucchi*, Ger. *Stück*, AS. *stycce*, piece, patch; connected with OHG. *stoc*, Ger. *Stock*, AS. *stocc*, Eng. *stock*, stake, club, Skt. *tuj*, to thrust). A composition used for the finer parts of plaster-work, such as cornices and enrichments. Gypsum (q.v.), or plaster of Paris, is used for this purpose. A coarser kind of stucco is also used for making floors, and for plastering the exterior of buildings. The Greeks used stucco to give a finer surface to their coarse stonework, even in their columns, before the finer marbles were used. The Romans also in the temples they built after the Greek manner in the late Republic stuccoed nearly all their exterior surfaces. This stucco was made partly of marble dust, was extremely fine and of a hard and brilliant finish, equal to marble. Stucco was also used for more artistic purposes in late classic art. While wet it was fashioned into ornamental or figured low reliefs. Ceilings and walls in baths (e.g. Pompeii and Roman thermæ), tombs (on the Via Latina), and private houses have preserved these decorations under the Empire, probably from Alexandrian models. Those found near the Farnesina in Rome and now in the Museo delle Terme are among the most charming decorative works of any period. Early Christian art continued the style, as is shown by the well-preserved internal decoration of the baptistery of the cathedral in Ravenna. It was not unknown to the Middle Ages, witness the angels in the church at Hildesheim, and it again became popular during the Renaissance, being profusely used in the ceilings of the later period, often with Rococo designs.

STUCK, stụk, FRANZ (1863—). A German painter and sculptor, one of the leaders of the so-called Secessionists (q.v.). Born at Tettenweis, Bavaria, he studied at the Munich Academy under Lindenschmit, and became first known through his drawings for the *Fliegende Blätter*, and the two series of art-industrial designs which appeared in Vienna under the titles *Allegorien und Embleme* and *Titel und Vignetten*, rugged rather than refined, but full of vitality and bold in treatment. His first paintings, "The Guardian of Paradise," "Innocentia," and "Fighting Fauns,' exhibited in Munich in 1889, were awarded the gold medal, initiating a series of artistic successes attendant upon his well-known landscapes enlivened with centaurs, fauns, and nymphs, and his impressive delineations of human passions, of which the figure of "Sin" (1893), Eve enfolded by a huge serpent, and, on a larger scale, the allegory of "War" (1894), both in the Pinakothek at Munich, have become particularly famous. In the meanwhile he had painted "Expulsion from Paradise," a "Pietà" (1892), and "Crucifixion" (1892, Stuttgart Museum), a startling deviation from the traditional treatment of this subject. A marked progress in the artist's power of expression was shown in "The Sphinx" (1895, National Museum, Budapest), "Evil Conscience" (1896), and "Procession of Bacchants" (1897). His plastic work, all small figures in bronze, exhibits the same powerful realism in the treatment of form as do his paintings. A characteristic example is the statuette of a "Faun" (National Gallery, Berlin; replicas Kunsthalle, Hamburg, and National Museum, Budapest). Consult the monographs by Bierbaum (Leipzig, 1899), Meissner (Berlin, 1899), and Weese (Vienna, 1903); also Schultze-Naumburg, in *Magazine of Art*, vol. xx. (London, 1896-97).

STÜCKELBERG, stụ'kel-bĕrk, ERNST (1831-1903). A Swiss genre and landscape painter, born in Basel. He studied under Dietler of that city, and in Antwerp, Paris, Munich, and Italy. In 1869 he won the gold medal at Munich. Among his pictures may be mentioned "A Procession in the Sabine Mountains" (1859, Basel), "The Children's Service" (1867), and "Charcoal Burners in the Swiss Mountains" (Zurich). In 1877 Stückelberg was commissioned to execute a large symbolic fresco, "The Awakening of Art," for the Gallery of Basel. He also won a competition, in the same year, for designs to fresco the Tell Chapel on the Lake of the Four Cantons. The work was completed in 1887.

STUCKENBERG, stụk'en-bĕrg, JOHN HENRY WILBURN (1835-1903). An American Lutheran clergyman and author, born at Bramsche, Hanover. He emigrated to America with his parents when a very young man and settled in the West, was graduated from Wittenberg College, Ohio, in 1857, and studied in the universities of Halle, Göttingen, Berlin, and Tübingen. Coming back to America, he was ordained a Lutheran minister and held pastoral charges in Pennsylvania and Iowa. In 1873 he was made professor of theology in Wittenberg College, but in 1880 went to Germany again, where he became pastor of the American Chapel in Berlin. After many years in this service he returned to America and took up his residence in Cambridge, Mass. His later years were largely devoted to the study of theoretical sociology, to which he made valuable contributions. His chief works are: *History of the Augsburg Confession* (1869); *Christian Sociology* (1880); *Life of Immanuel Kant* (1882); and *Sociology* (1903).

STUCLEY, stūk'lĭ, or **STUKELY**, THOMAS (c.1525-78). An English adventurer. He was the third son of Sir Hugh Stucley of Devonshire. About 1552 he went to France, and there gained the favor of the King, Henry II., who sent him to England to obtain information to be used in a projected attack on Calais. Stucley, however, revealed the nature of his mission to the English Government, but, instead of being rewarded, was imprisoned in the Tower. In 1563, with the patronage of Queen Elizabeth, he pretended to join Ribault's colonization expedition to Florida, but instead turned privateer, and seized many French, Spanish, and Portuguese vessels. After

two years of this life he was seized at Cork, but apparently was not brought to trial. For several years afterwards he was employed in Ireland, but, having intrigued with Spanish agents, he ultimately fled to Spain. In 1571 Stucley commanded three vessels at the battle of Lepanto, and seven years later, while in the service of Sebastian of Portugal, was killed in the battle of Alcazar in Morocco. He became the hero of numerous ballads and plays. One of these, *The Famous History of the Life and Death of Captain Thomas Stukely*, was printed "as it hath been acted," in London in 1605. It was reprinted in Simpson's *School of Shakespeare* (1878), with a biography of Stucley prefixed.

STUD-BOOK. A genealogical record of blooded stock. The British Stud-Book for horses is the oldest in existence and was first commenced in 1791. All the facts that are in existence regarding the evolution through systematic breeding of the modern horse is obtained through the British Stud-Book. There are similar records for cattle and dogs.

STUDER, stōō'der, BERNHARD (1794-1887). A Swiss geologist, born at Büren, Canton of Bern. He studied at Bern, Göttingen, and Paris, and in 1825 was made professor of geology in Bern, where he labored continuously until 1873. Some of the more important of his works are: *Beiträge zu einer Monographie der Molasse* (1825); *Geologie der westlichen Schweizeralpen* (1834); *Lehrbuch der physikalischen Geographie und Geologie* (1844-47); *Geologie der Schweiz* (1851-53); and *Zur Geologie der Berner Alpen* (1866).

STUHLMANN, stōōl'män, FRANZ (1863—). A German zoölogist and African explorer, born in Hamburg. After studying at Tübingen and Freiburg, he went to East Africa in 1888, and during the revolt of the Arabs in 1890 entered the German corps of defense as a lieutenant, and was severely wounded at Mlembule. After his recovery he joined the expedition of Emin Pasha to the lake region, was sent ahead from Undussuma to Lake Victoria, and reached the coast in July, 1892, at Bagamoyo, whence he returned to Germany with valuable cartographic material and rich collections, to which he added copiously on another trip to German East Africa, undertaken in 1893-94 by order of the Government. He published *Zoologische Ergebnisse einer in die Küstengebiete von Ostafrika unternommenen Reise 1888-90* (1893-1901), and *Mit Emin Pascha ins Herz von Afrika* (1894).

STUHLWEISSENBURG, stōōl'vī'sen-bōōrk (Hung. *Székes-Fehérvár*). A royal free city, capital of the county of the same name, Hungary, 35 miles southwest of Budapest (Map: Hungary, F 3). The episcopal palace and the cathedral are noteworthy edifices. The manufactures of woolens, silks, and knives are extensive and the agricultural interests prominent. Stuhlweissenburg is the Alba Regia of the Romans. From the eleventh to the sixteenth century the kings of Hungary were crowned there; afterwards the ceremonial took place at Pressburg. The city was held by the Turks from 1543 to 1688, with the exception of the period 1601-02. Population, in 1890, 28,942; in 1900, 32,167.

STUKELY, stūk'lī, WILLIAM (1687-1765). An English antiquary, born at Holbeach, Lincolnshire. He graduated at Bennet (Corpus Christi) College, Cambridge, in 1708. With Roger Gales he made long antiquarian tours in various parts of England. Among his many published works are: *An Account of a Roman Temple and Other Antiquities, near Graham's Dike in Scotland* (1720); *Itinerarium Curiosum* (1724, 2d ed. 1776); *Stonehenge* (1740); *Abury, a Temple of the British Druids* (1743); *Palæographia Britannica* (1743-52); and *The Medallic History of M. A. V. Caurasius* (1757-59).

STÜLER, stü'lēr, FRIEDRICH AUGUST (1800-65). A German architect, born in Mühlhausen, Thuringia. He studied first in Berlin and afterwards in France and Italy. Appointed Court inspector of buildings at Berlin in 1830, he was two years later put at the head of the architectural commission of the royal palace. His principal buildings include the New Museum (1843-55), the churches of Saint Bartholomew (1854-58), Saint James (1845), Saint Mark (1848-55), and Saint Matthew (1846), as well as parts of the royal palace in Berlin, the Academy of Sciences at Budapest, the National Museum of Stockholm (1850-66), the Museum at Cologne (1855-61), the reconstructed Winter Palace at Saint Petersburg, the University at Königsberg (1844-63), and the reconstruction of the Stolzenfels Castle and the Hohenzollern Castle (1850-67).

STUMM, stum, KARL FERDINAND, Baron von Halberg (1836-1901). A German manufacturer and politician, born in Saarbrücken. He studied in Bonn and Berlin, and in 1858 became the head of the family firm which had for many years owned the great iron works at Neunkirchen. He was a member of the Prussian Chamber from 1867 till 1870, and of the Reichstag from 1867 till 1881, and from 1889 till his death in 1901; and was one of the founders of the German Reichspartei. Over his thousands of workmen he exercised a sort of paternalistic rule, and he furnished them with hospitals, technical schools, a library, model dwellings, and many other advantages. He was bitterly hostile to socialism.

STUMPF, stumpf, KARL (1848—). A German psychologist, born at Wiesentheid, Bavaria. He studied at Würzburg and Göttingen, being especially influenced by the teachings of F. Brentano and R. H. Lotze. After qualifying as privat-docent at Göttingen, in 1870, he was appointed to the chair of philosophy successively at Würzburg (1873), Prague (1879), Halle (1884), Munich (1889), and Berlin (1894), where he instituted the psychological seminar. In 1895 he became a member of the Prussian Academy of Sciences. His publications include numerous monographs upon psychology, æsthetics, ethnology, epistemology, and especially upon physical and psychological acoustics. They comprise: *Ueber den psychologischen Ursprung der Raumvorstellung* (1873); *Tonpsychologie* (1883-90); *Tafeln zur Geschichte der Philosophie* (2d ed. 1900); *Psychologie und Erkenntnistheorie* (1891); *Beiträge zur Akustik und Musikwissenschaft, I. Consonanz und Dissonanz* (1898). He is best known by his contributions to the psychological study of sensations of tone and their use in music.

STUNDISTS (from Ger. *Stunde*, hour lesson; so called from their meetings to read the

Bible). A Russian sect, which owes its origin to German influences. It has gained many converts among the peasants, particularly since 1870, and has attracted the hostile attention of the Government. The Stundists bear some resemblance to the Anabaptists, give to the sacrament a purely symbolic interpretation, and hold communistic views concerning property. They are most numerous in Little Russia and Bessarabia.

STUPA. A form of Buddhist architecture in India. See TOPE.

STURDY. A disease of sheep. See GID.

STURDZA, stōōrd'zȧ, ALEXANDER (1791-1854). A Moldavian publicist and diplomat, educated in Germany and afterwards in the service of Russia. His *Mémoire sur l'état actuel de l'Allemagne,* published at the Congress of Aix-la-Chapelle in 1818, by order of Alexander I., aroused great indignation in Germany because of the unbecoming levity with which its author arraigned the German national character and branded the universities as hotbeds of the revolutionary spirit and atheism. In 1819 he settled at Dresden, married a daughter of Hufeland, and subsequently retired to his estate of Mansyr, Bessarabia. Of his other writings may be mentioned *La Grèce en 1821* (1822); a biography of Hufeland (1837); and *Œuvres posthumes religieuses, historiques, philosophiques et littéraires* (1858-61).

STURDZA, DEMETER (1833—). A Rumanian statesman and author. He studied political science at Munich, Göttingen, Bonn, and Berlin, became Minister of Public Instruction in 1859, and was one of the most zealous promoters of the overthrow of Cuza and the election of Prince Charles of Hohenzollern, in 1866. In the Cabinet of Bratianu, 1876-88, he held repeatedly ministerial posts, and in 1895-96 presided over a National-Liberal Ministry. Again in 1897-99 and since 1901 he was at the head of the Government as president of the Council and Minister of Foreign Affairs. He wrote *La Marche progressive de la Russie sur le Danube* (1878); *Uebersicht der Münzen und Medaillen des Fürstentums Rumänien* (1874); *Europa, Russia, Romania* (1888); *La question des portes de fer et des cataractes du Danube* (1899); and *Charles I., roi de Roumanie* (1899 et seq.).

STURE, stōō're. A noble family of Sweden which played a very prominent part in the affairs of that country in the fifteenth and sixteenth centuries and became extinct in 1616. Its chief representatives were: (1) STEN STURE the Elder (d.1503). He was a son of Gustaf Sture and the nephew of King Charles VIII., on whose death, in 1470, he became Regent of Sweden, in spite of the opposition of the Swedish nobility, who supported the claims of Christian I. of Denmark. He defeated the Danish King in the battle of Brukeberg, near Stockholm (1471). He introduced printing, and founded the University of Upsala (1477). In 1497 he was forced to resign his place to John of Denmark, but regained power in 1501 and ruled till his death (1503). He was followed by (2) SWANTE NILLSON STURE, a kinsman, who also kept the Danes and the nobility in check and died in 1512. (3) The latter's son, STEN STURE the Younger, aided by the peasantry, foiled the plan of the nobles to place Trolle, one of their own number, in power, gained the Regency for himself, twice defeated (1517 and 1518) Gustaf Sture, Archbishop of Upsala, whom he had deposed in 1517, and was himself defeated and mortally wounded in a battle against Christian II. of Denmark at Bogesund in 1520. His widow, Christina Gyllenstierna, held Stockholm until the new King guaranteed a constitutional government. (4) His son, SWANTE STURE, though a loyal partisan of the House of Vasa, was murdered by Eric XIV. (1567).

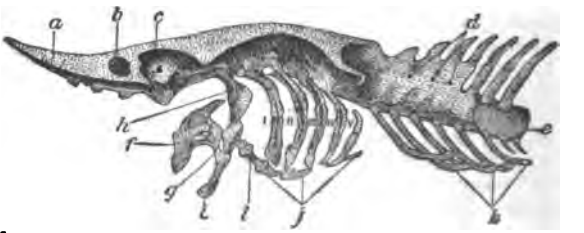
STURGEON (AF. *sturjoun,* OF., Fr. *esturgeon,* Sp. *esturion,* It. *storione,* from ML. *sturgio, sturio,* from OHG. *sturjo, sturo,* Ger. *Stör,* AS. *styria, stiriga,* sturgeon; perhaps connected with OHG. *stōran,* Ger. *stören,* AS. *styrian,* Eng. *stir*). A large fresh-water fish of the ganoid family Acipenseridæ. Sturgeons have an elongated, subcylindrical body, armed with five rows of bony plates or bucklers, each bearing a median keel. The head is covered by bony plates joined by sutures. The snout is produced; the mouth is inferior, opening on the under side of the head,



A FOSSIL STURGEON.

A long-beaked sturgeon (*Belonorhynchus striolatus*) fossil in the Trias and Lias formations of the Old World.

protractile and without teeth. Just anterior to the mouth there are four barbels. The tail has the upper lobe much larger than the lower. There is a single dorsal fin, placed like the anal fin far back. They have a large air bladder, connected by a tube with the œsophagus. About 25 species, in two genera, are recognized, all inhabitants of the fresh waters and seas of the northern regions. Most of the species are migratory and ascend streams to spawn, but some live permanently in fresh waters. They spawn in the spring and summer, and are very prolific, a large female producing from two to three million eggs, constituting from a fifth to a third of its

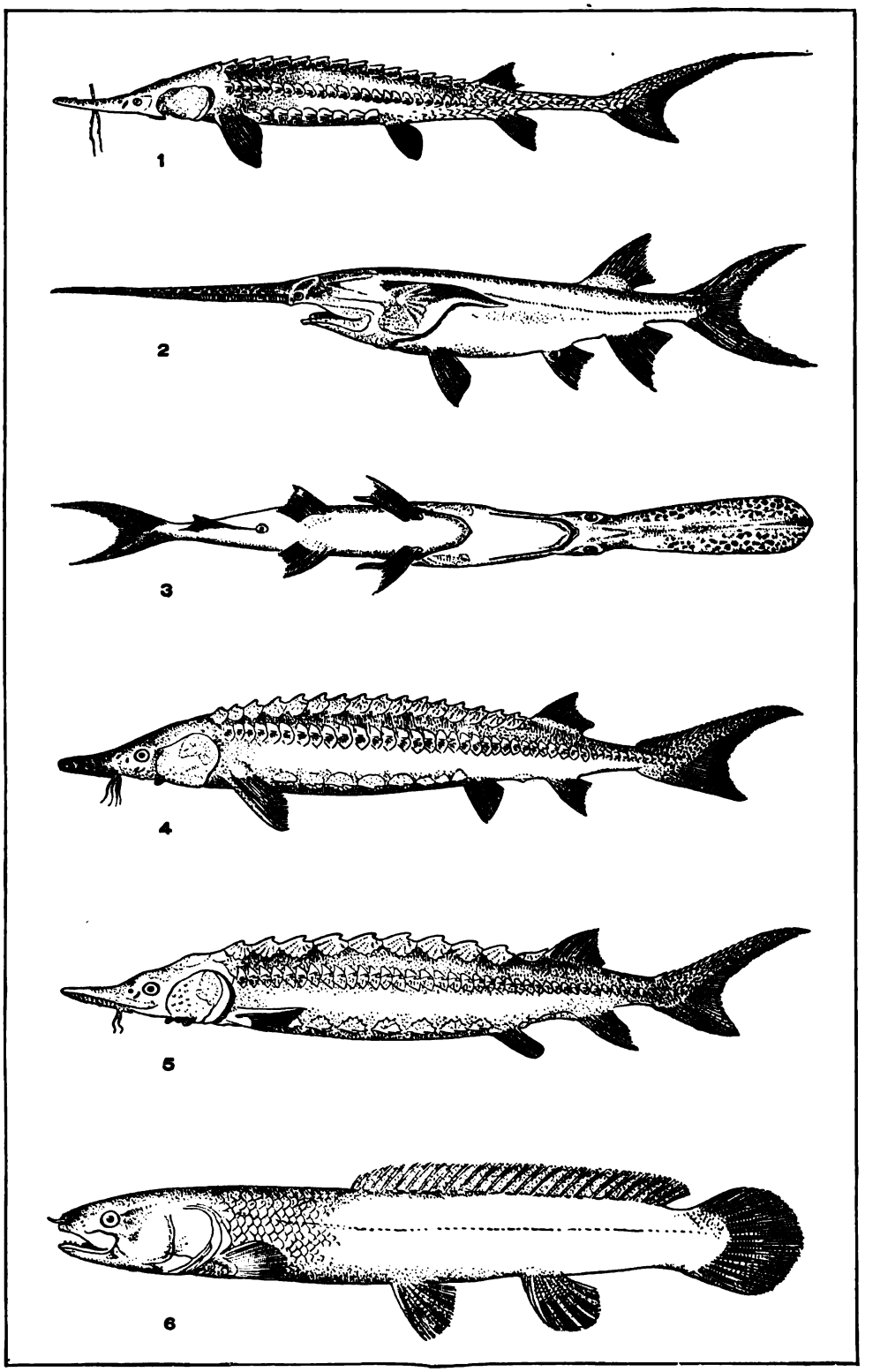


SKULL OF A STURGEON WITH MEMBRANE BONES REMOVED.

a, Rostrum; *b,* nasal capsule; *c,* eye-socket; *d,* foramina for spinal nerves; *e,* notochord; *g,* quadrate bone; *h,* hyomandibular bone; *i,* mandible; *j,* basibranchials; *k,* ribs; *l,* hyoid bone; I, II, III, IV, V, branchial arches.

entire weight. They feed on small animals and plants, which they suck into their mouth. The common sturgeon (*Acipenser sturio*), of the coasts and rivers of Europe and Northeastern America, has been known to weigh 500 pounds. The lake or rock sturgeon (*Acipenser rubicundus*), once very abundant in the Great Lakes and the Mississippi Valley, attains a weight of 200 pounds,

STURGEONS, PADDLE-FISH, AND BOWFIN



1. SHOVEL-NOSED STURGEON (Scaphirhynchus platyrhynchus).
2. PADDLE-FISH (Polyodon spathula), side view.
3. PADDLE-FISH, ventral view.
4. LAKE STURGEON (Acipenser rubicundus).
5. COMMON STURGEON (Acipenser sturio).
6. BOWFIN (Amia calva); in proportion to the other figures much enlarged.

but the average is much less. Its sides are reddish, often with irregular blackish spots. Very peculiar in its prolonged paddle-shaped snout is the 'shovelnose' or 'white' sturgeon (*Scaphirhynchus platyrhynchus*), which is pale olive in color and about five feet long. It is a denizen of the Western and Southern States. Similar species occur in Asia. The largest of American sturgeons is that of the Pacific Coast (*Acipenser transmontanus*) called 'white' in comparison with the rare 'green' sturgeon (*Acipenser medirostris*). The former weighs 300 to 600 pounds, and is used as food, but the latter, which is nearly as large, but olive green, is not eaten. A giant beside these is the great Russian 'bielaga' or 'huso' (*Acipenser huso*), which has been known to attain a length of 20 to 25 feet and a weight of 3000 pounds. It is this species, once extremely abundant in the Danube, Volga, and other large rivers emptying into the Black and Caspian seas, which has furnished mainly the salted roe called caviar (q.v.), though some comes from the diminutive sterlet (*Acipenser ruthenus*) of the same region. The air bladder is also utilized for making isinglass.

Fossil sturgeon remains indistinguishable from the corresponding portions of the skeletons of modern species have been found in rocks as old as the Eocene. Earlier less specialized ancestral forms are Chondrosteus of the Jurassic and perhaps also the still older Palæoniscus of the Permian and Cheirolepis of the Upper Devonian. See CHIROLEPIS; CHONDROSTEUS; PALÆONISCUS.

Consult authorities cited under FISH and FISHERIES; and see Plate of STURGEONS.

STURGEON, stûr'jŭn, WILLIAM (1783-1850). An English electrician, born at Whittington, in Lancashire. As early as 1823 he constructed a soft-iron electro-magnet, and in 1830 described for the first time the process of amalgamating the zinc plate of a battery with mercury. In 1832 he constructed an electro-magnetic rotary engine, the first contrivance by means of which any considerable mechanical force was developed by the electric current; and he shares the honor of this invention with Oersted. Five years afterwards he produced an electro-magnetic coil for giving shocks. About the same time he ascertained by means of kites that in fair weather the atmosphere is positive with regard to the earth. Later he devised and constructed the commutator, now in universal use. Among his works are: *Experimental Researches in Electro-Magnetism, Galvanism, etc.* (1830); *Lectures on Electricity Delivered in the Royal Victoria Gallery, Manchester* (1842); *Twelve Lectures on Galvanism* (1843); and *Scientific Researches* (1850).

STURGEON BAY. The county-seat of Door County, Wis., 45 miles northeast of the city of Green Bay, on a canal connecting Green Bay and Lake Michigan, and on the Ahnapee and Western Railroad (Map: Wisconsin, F 4). It has considerable industrial importance. There are canning establishments, ship yards, and manufactories of lumber, beer, flour, foundry and machine-shop products, etc. Population, in 1890, 2195; in 1900, 3372.

STURGIS, RUSSELL (1836—). An American architect and author, born in Baltimore, Md. He studied architecture in New York and in Europe, and practiced his profession from 1865 till 1880. In that time he designed Battell Chapel, Farnam Hall, Durfee Hall, and Lawrence Hall of Yale College; the Homœopathic Medical College and Flower Hospital in New York, and many other buildings in various parts of the country. In 1878 he became professor of architecture and the arts of design in the College of the City of New York, but resigned in 1880 on account of ill health, and went abroad for five years. After 1885 he was editor of decorative art and mediæval archæology of the *Century Dictionary;* editor of fine arts of *Webster's International Dictionary;* and editor of archæology and fine arts of *Johnson's* (now Appleton's) *Universal Cyclopædia* (ed. of 1893-95). In January, 1898, he began editing the "Field of Art," a department in *Scribner's Magazine.* His published works include: *Manual of the Jarves Collection of Early Italian Pictures* (1868); *European Architecture: An Historical Study* (1895); *Annotated Bibliography of Fine Art* (1897); and *How to Judge Architecture* (1903). He contributed articles on art subjects to the *New International Encyclopædia,* and he was the editor and chief author of the *Dictionary of Architecture and Building* (1901-02).

STURGIS, SAMUEL DAVIS (1822-89). An American soldier, born at Shippensburg, Pa. He graduated at West Point in 1846, served through the Mexican War, and was taken prisoner during the operations before Buena Vista. At the outbreak of the Civil War he was obliged to abandon Fort Smith, Ark., of which he was commandant, but succeeded in saving his command. As major of the Fourth Cavalry he served in 1861 under General Lyon, and succeeded to his command at Wilson's Creek (q.v.). He was prominent at South Mountain, Antietam, Fredericksburg, and had command of the cavalry of the Department of the Ohio in 1863-64, in January of the latter year capturing General Vance and his command and routing General Martin's Confederate cavalry. Later he took an important part in an expedition against General Forrest. In 1869 he was promoted to be colonel of the Seventh Cavalry. From 1881 to 1885 he was governor of the Soldier's Home near Washington, and the next year he retired from active service.

STURLUSON, SNORRI. See SNORRI STURLUSON.

STURM, stŭrm, JACQUES CHARLES FRANÇOIS (1803-55). A French mathematician, born at Geneva. He was educated at the Academy of Geneva, and in 1827, with his friend Colladou, took the *Grand prix de mathématiques* for the best memoir on the compression of liquids. The famous theorem that bears his name was discovered in 1829. A statement of the results secured by this theorem requires the definition of Sturm's functions: If $f(x) = 0$ be freed from equal roots, and $f(x)$ be divided by $f'(x)$ (the derivative of $f(x)$), and the last divisor by the last remainder, changing the sign of each remainder before dividing by it, until a remainder independent of x is obtained, or else a remainder which cannot change its sign, then $f(x)$, $f'(x)$, and the successive remainders, constitute Sturm's functions. The theorem asserts that if, as x increases, $f(x)$ passes through the value zero, Sturm's functions lose one change of sign; if any other of Sturm's functions vanishes, there is neither

loss nor gain in the number of changes of sign; the number of roots of $f(x)=0$ between a and b is equal to the difference in the number of changes of sign in Sturm's functions, when $x=a$ and when $x=b$. In 1838 Sturm began teaching in the Ecole Polytechnique, and two years later was elected to the chair made vacant by the death of Poisson.

STURM, or **STURMIUS**, JOHANNES (1507-89). A prominent educator of the sixteenth century. He was born near Cologne, and was educated at Leyden and Louvain. In 1537, at the instance of the magistrates of Strassburg, he organized the Strassburg Gymnasium, which he directed for forty-three years. He was relieved from his position in 1581 on account of religious disputes and differences. Through his system of gradation of classes, practically the same that still prevails in all German gymnasia, the classification of literary material for use in schools, the writing of text-books, and the organization of school management, he shaped the practice of secondary education not only in the German schools, but also in the great secondary schools of England and France.

STURM, stōōrm, JULIUS (1816-96). A German poet, born at Köstritz, Reuss. After studying theology at Jena (1837-41), he was private tutor to the hereditary prince Henry XIV. of Reuss, then pastor at Göschitz, near Schleiz, in 1851-57, and at Köstritz from 1857 to 1885. He died at Leipzig. All his lyrics reveal him as a poet of deep religious sentiment and genuine national spirit. The religious poems are incorporated in the collections *Fromme Lieder*, three parts (1852, 1858, 1892); *Zwei Rosen oder das Hohe Lied der Liebe* (1854); *Von der Pilgerfahrt* (1868); *Gott grüsse dich* (1876); *Dem Herrn mein Lied* (1884); *Palmen und Krone* (1888); and others; while the volumes with secular contents include: *Für das Haus* (1861); *Lieder und Bilder* (1870); *Kampf- und Siegesgedichte* (1870); *Spiegel der Zeit in Fabeln* (1872); *Kinderleben* (1877), illustrated by Ludwig Richter; *Immergrün* (1880); *Natur, Liebe, Vaterland* (1884); *In Freud und Leid* (1896). For his biography consult Hepding (Giessen, 1896) and Hoffmann (Hamburg, 1898).—His son AUGUST (1852—), born at Göschitz, also won reputation as a poet. He studied at Jena, Leipzig, and Berlin, first theology, afterwards law, which he practiced at Naumburg, since 1884, having in the meanwhile lived as assessor at Rudolstadt (1880-82) and, given to literary pursuits, in Berlin (1882-84). Besides the epic poems, *Merlin* (1892), *Kaiser Friedrich der Edle* (1896), *König Laurins Rosengarten* (1897), and *Der König von Babel* (1902), he published *Hohenzollernsagen, Balladen* (1898); the lyrics *Auf Flügeln des Gesanges* (1883); *Lied und Leben* (1889); *Auf der Höhe* (1902); and others; several dramas and the sketches in prose, *Sylter Skizzen* (1887); also a series of juridical works, notably *Revision der gemeinrechtlichen Lehre vom Gewohnheitsrecht* (1900).

STURT, Sir CHARLES (1806-69). An Australian explorer. He was born in Bengal, India, of English parents; was educated in England; entered the British Army; and in 1825 went to New South Wales. In 1828 he headed an exploring expedition which penetrated the interior of Australia and discovered the Macquarie, Castlereagh, and Darling rivers, and in 1830 the Murray River, which he descended to Lake Alexandrina. Another expedition in 1844 reached the desert in the centre of the continent. He subsequently held high colonial positions. He became totally blind as a result of the hardships he had undergone, and returned to England in 1853; he was knighted shortly before his death. He published *Two Expeditions into the Interior of Southern Australia, 1828-31* (2 vols., 1833), and *Narrative of an Expedition into Central Australia in 1844* (2 vols., 1849).

STURZ, stōōrtz, HELFERICH PETER (1736-79). A German author, born at Darmstadt. He studied law (1753-58) at Jena, Giessen, and Göttingen, was appointed secretary in the department of foreign affairs at Copenhagen in 1764, soon after private secretary to Count Bernstorff, and in 1768 accompanied King Christian VII. to England and France. Involved in Struensee's downfall in 1772, he was imprisoned and banished from Copenhagen, but appointed again to a position at Oldenburg in 1773, and died at Bremen. His title to the reputation as one of the most tasteful German prose writers is amply demonstrated by the exquisite *Briefe eines Reisenden* (1777), and his *Erinnerungen aus dem Leben des Grafen von Bernstorff*. Consult the biography by Max Koch (Munich, 1879).

STUTTERING. Imperfect action of the organs of articulation resulting in defective speech. See STAMMERING.

STUTTGART, stut'gärt. The capital of the Kingdom of Württemberg, Germany, situated at an elevation of 890 feet, about 2 miles south of the Neckar, and 45 miles north of Tübingen (Map: Germany, C 4). Stuttgart occupies a delightful site surrounded by attractive suburbs and amid lovely vine-clad heights. The pronounced adherence of its many fine architects to the Renaissance types explains the stately appearance of the city.

The spacious Königstrasse extends diagonally from southwest to northeast through the old or inner city and borders the majestic Schlossplatz—the centre of interest. Here rises the impressive King William column (93 feet) embellished with allegorical figures. Here too are the splendid Königsbau, the palace of the Crown Prince, the Residenz-Schloss (palace), the royal theatre, and the royal stables. The fine statue of Schiller by Thorwaldsen, erected in 1839 by national subscription, is near by. Adjacent also is the striking Gothic Stiftskirche, begun in 1436. Southeast of the Old Palace is the palace of King William II., where the fine modern Neckarstrasse begins its course northeastward. In the immediate vicinity are housed the Württemberg archives and also the extensive and valuable natural history collections of Stuttgart. The royal public library near at hand contains upward of 500,000 volumes, 4000 manuscripts, and many specimens of early printing. The library building holds also the museum of Württemberg antiquities, among which may be seen ceramics, weapons, and articles taken from ancient tumuli and lake dwellings. In the rear of the library is the large modern Palace of Justice. Between the library and the Residenz-Schloss stands a spacious and famous academy —the Karlsschule. Extending northeast from

this vicinity and along the Neckarstrasse is the beautiful Schlossgarten. It embraces 200 acres, is 2 miles long, and is embellished with ponds, flower designs, and sculptures. Here are found the botanic garden, the mint, and the notable Stuttgart museum of art with its collections of sculpture and painting. In the northwest section of the city stands the Polytechnic Institute (over 1000 pupils) building facing the delightful Stadtgarten—one of the popular resorts. In the eastern part of Stuttgart is the immense new Liederhalle. In the vicinity of the Schlossplatz is found the modern Renaissance edifice of the Landesgewerbe Museum.

Among the prominent new buildings in Stuttgart are the Queen. Olga buildings, the new Town Hall, the Catholic Church of Saint Nicholas, and the Peace Church. The Uhlandshöhe and the Jägerhaus may be especially noted among the delightful resorts in the environs, as well as the royal country seat Wilhelma—a fine Moorish structure begun in 1842. Stuttgart has an art academy, the Württemberg Art Union with a permanent exposition of modern masters, an architectural school, an exposition of export products, the provincial industrial museum, a famous conservatory of music, an industrial and commercial library, and a chemical laboratory. It is the leading printing and book-publishing city of Southern Germany. Among its prominent manufactures are furniture, carriages, pianos, paper, leather, chemicals, colors, jewelry, bells, cigars, portmanteaus, chocolate, and especially cottons. Hops, cloth, and horses form special items in the trade. The city—the seat of all the important administrative offices of the kingdom—is under the general supervision of the royal Government. There are an over-burgomaster, two advisers, and a council of some 24 members. The population, in 1900, was 176,699, mainly Protestants.

HISTORY. Stuttgart is first mentioned in 1229. It became the official capital of Württemberg in 1482; but it did not begin to improve and assume its present splendid proportions until about 1800. Consult: Klaiber, "Stuttgart," in *Europäische Wanderbilder* (Zurich, 1892); Widmann, *Wanderung durch Stuttgart und Umgebung* (Stuttgart, 1896).

STUYVESANT, stī'vę-sant, PETER (1592-1672). A Dutch Governor of New York. He was born in Holland; early entered the military service of the Dutch in the West Indies, and in 1634 was made Director of the Colony of Curaçao. In 1646 the Dutch West India Company appointed him Director-General of their colony in North America, New Netherland, where he soon gained the confidence of the colonists by his efficient administration and public improvements. He reconciled the Indian tribes who had been made hostile by former unjust treatment, and succeeded in arranging with the New England commissioners, in 1650, the boundaries between the English and Dutch territories, but this was not entirely satisfactory to the Dutch colonists, who claimed that the Governor had ceded considerable territory to which they were rightfully entitled. A convention of delegated colonists in 1653 demanded for the people, among other things, a share in the appointment of local officers, but Stuyvesant ordered them to disperse forthwith, claiming that his authority was not from the people, but from God and the Dutch West India Company. The protracted contentions of the Dutch and the Swedes dwelling near the Delaware River about governmental jurisdiction became more critical in 1654, when the Swedish Governor seized the fort built by the Dutch where Newcastle now stands. To end this trouble, Stuyvesant in 1655 with 600 men sailed up the Delaware, recaptured the fort, and established the Dutch authority over the entire territory. After nine years of undisturbed quiet, in 1664 a force of English soldiers arrived under Colonel Nicolls, who demanded a surrender of the Government, on the ground that the whole territory had been given by royal charter to the Duke of York. The town at the time contained 1500 inhabitants and was defended by a stone fort and twenty cannon. Stuyvesant at first refused, but finding the people anxious to exchange rulers, he yielded to the English demand. Stuyvesant, in 1665, reported personally to the authorities in Holland, but soon returned to New York, where he spent the remainder of his life, cultivating an extensive farm called the Bouwerij (Bowery). He was buried where Saint Mark's Church now stands, and the elaborately inscribed stone that covered his grave is built into the eastern wall of the church. Consult the brief biography by Tuckerman (New York, 1893); and O'Callaghan, *The History of New Netherland* (ib., 1848).

STYE, or **STY** (formerly also *stian*, from AS. *stīgend*, stye, pres. part. of *stīgan*, Goth. *steigan*, OHG. *stīgan*, Ger. *steigen*, to rise; connected with OIr. *tiágaim*, I go, Lat. *ve-stigium*, footprint, Lett. *stiga*, path, OChurch Slav. *stignanti*, to hasten, Gk. *στείχειν*, *steichein*, to go). The popular name for an acute inflammation occurring around the follicle of an eyelash. It generally goes on to suppuration. It is known to surgeons under the term *hordeolum*. It begins as a small, red, tense swelling, accompanied with considerable itching and a feeling of stiffness. As the inflammation goes on, the lid may become so swollen as to keep the eye closed. In a few days pus forms; a yellowish point appears at the apex of the swelling; and when the cuticle gives way, pus and a small slough of connective tissue escape, after which there is a general remission of the symptoms, and the eyelid soon resumes its natural state.

The treatment includes the use of cold compresses to abort the stye, hot ones to hasten suppuration, and evacuation of pus when it appears. Errors of refraction should be corrected and the general health improved in order to prevent recurrence. The stye should never be rubbed (notwithstanding the common prejudice in favor of rubbing it with a gold ring).

STYLITE. See PILLAR SAINT.

STYLOBATE (Lat. *stylobata*, *stylobates*, from Gk. *στυλοβάτης*, base of a pillar, from *στῦλος*, *stylos*, pillar + *βαίνειν*, *bainein*, to go). The topmost step of the crepidoma (*κρηπίδωμα*) or substructure of a Greek temple. This consists of the foundations, or stereobate, and the surrounding steps, usually three in number. On the topmost step, the true stylobate, rest the columns. The term is sometimes extended to apply to the whole series of steps.

STYLONURUS (Neo-Lat., from Gk. *στῦλον*, *stylon*, acc. of *στῦλος*, *stylos*, pillar + *οὐρά*,

cave, tail). A gigantic extinct arthropod, allied to Eurypterus, with a body about 6 feet in length and with five pairs of legs, of which the posterior pair is much elongated, and a long spine on the tail. It is found in the Silurian and Devonian of Scotland and in the Upper Devonian of New York and Pennsylvania. Consult Beecher, "Restoration of Stylonurus lacoanus, a Giant Arthroped from the Upper Devonian of the United States," *American Journal of Science*, 4th series, vol. x. (New Haven, 1900). See ARTHROPODA; EURYPTERUS; MEROSTOMATA.

STYPTIC. An agent employed in surgery for the purpose of checking the flow of blood by application to the bleeding orifice or surface. See BLEEDING.

STYRAX. See STORAX.

STYRIA, stĭr'ĭ-ȧ (Ger. *Steiermark*). A duchy and crownland of Austria, bounded by Lower and Upper Austria on the north, Hungary on the east, Carniola and Carinthia on the south, and Carinthia and Salzburg on the west (Map: Austria, D 3). Its area is 8670 square miles. Styria is very mountainous. Its northern part belongs to the region of the central Alps, of which Styria takes in the Niedere Tauern, Rottenmanner Tauern, Dachstein, Totes Gebirge, and the Erzberg, the last named famous for its abundance of iron. The southern part is occupied by the Styrian Alps. The plains are generally small, but there are a large number of fruitful valleys along the Mur, Enns, and other rivers. Styria is watered chiefly by the Enns, Mur, Drave, and Save. There are many mountain lakes and mineral springs. Styria has a large proportion of productive land; the forests cover nearly one-half of the surface. Wheat, rye, corn, oats, and barley are the principal cereals. Hay is grown in large quantities, and cattle-raising is very important, especially in Upper Styria. Grapes and fruits are cultivated to a lesser extent. In mineral production Styria is one of the most important crownlands of Austria. In the output of lignite it ranks next to Bohemia, while in regard to iron it occupies the first place, supplying about 60 per cent. of the total output of Austria. It has also lead, zinc, sulphur, graphite, salt, and a great variety of useful earths and stones. The value of the mineral output of 1899 was about $5,000,000. The manufacturing industries are chiefly connected with the mineral products. There are large mills for the production of rails, sheet iron, wire, and smaller iron and steel articles. There are also several extensive machine shops, glass-works, distilleries, breweries, tobacco factories, and paper mills. The principal domestic exports are fruits, timber, cattle, and metal products. The Diet of Styria is composed of 60 members, of whom 12 represent the landed aristocracy, 19 the towns and industrial centres, 23 the rural communities, and 6 the chambers of commerce and trades of Gratz and Leoben. In the Lower House of Austria Styria is represented by 27 delegates. In 1898 Styria had 903 public schools, attended by 182,000 children, or 95 per cent. of the total school population. The population was 1,282,708 in 1890, and 1,356,058 in 1900. About 68 per cent. are Germans and the remainder Slovenians. The population is Roman Catholic. Capital, Gratz (q.v.).

HISTORY. Under Roman control the territory of Styria formed a portion of both Pannonia and Noricum, and was even then famous for its iron and steel. During the period of the great migration of nations the various invaders of the Italian peninsula swept through or settled in this district and at the close its population was essentially Slavic. It was a portion of the empire of Charles the Great, and was later included in the Carinthian mark erected against the Hungarians. Soon after the middle of the eleventh century the Margrave Ottokar styled himself Margrave of Steier, whence the region came to be known as Steiermark (Styria). In 1192 the region that is now the Duchy of Styria became a portion of the possessions of the dukes of Austria, and after belonging for a time to Ottokar II. of Bohemia, passed in 1276 into the possession of the Hapsburgs. The Reformation was welcomed by the people, but the intolerance of the Austrian rulers drove many of the inhabitants into exile.

BIBLIOGRAPHY. *Die Oesterreichisch-ungarische Monarchie in Wort und Bild*, vol. vii. (Vienna, 1890); Gsell-Fels, *Die Steiermark* (ib., 1898); Imendörfer, *Landeskunde von Steiermark* (ib., 1903); Rosegger, *Das Volksleben in Steiermark* (Gratz, 1895); Zahn, *Styriaca* (ib., 1894; new series, 1896); Mayer, *Geschichte der Steiermark* (ib., 1898).

STYX (Lat., from Gk. Στύξ, from στυγεῖν, *stygein*, to hate, loathe). In Greek legend, one of the rivers of the lower world. Probably originally the only stream which separated the region of the dead from the living. It was said that one-tenth of Oceanus streamed down to form the Styx, while the other nine-tenths surrounded the earth. As the goddess of this stream, Styx was the eldest daughter of Oceanus, and by the Titan Pallas mother of Zelos, Nike, Cratos, and Bia (Emulation, Victory, Might, and Force), with whom she joined Zeus at the beginning of the struggle with the Titans. For this she was made the guardian of the sacred oaths which bound the gods. She was described as living in the far west, in a house with silver pillars, where the water streamed from above. Thence Iris brought the water by which the gods swore, and terrible suffering awaited the divinity who committed perjury. With the development of the conceptions of the lower world, the rivers received various names, and Charon was introduced as the ferryman of souls across the Styx. The name was also given to a waterfall in northeastern Arcadia near Nonacris. The water descends over a cliff some 600 feet high on the side of Mount Chelmos into a wild and rugged glen, and the surroundings suggested to the Greeks the gloomy entrance to the lower world.

SUABIA. See SWABIA.

SUAHELI, swȧ-hē'lĭ. A people of Africa. See SWAHILI.

SUAKIM, swä'kĭm, or **SUAKIN.** A seaport of Egyptian Sudan, on a small island in the Red Sea in about latitude 19° N., and longitude 37° E. (Map: Africa, H 3). It is connected with the desert mainland by a railroad bridge. The town consists of two main parts. The Government buildings and the residences of the official class in the one section present an imposing appearance in direct contrast to the wretched dwellings of the natives in the other section. Suakim is conspicuous as the embarking place

for African pilgrims traveling to Mecca. It has a well-protected harbor and is an important shipping point for the products of the interior. These include ivory, tobacco, and gums. The imports for 1899 were valued at $900,000. The trade is increasing. The domestic manufactures are lance-heads, cutlery, and leather cases. Suakim was founded by the Turks, and was a leading slave port until the traffic was suppressed. The vicinity of Suakim was a battle-ground between the Anglo-Egyptians and Osman Digna in 1884 and 1890.

SUANITIANS, or **SWANS.** One of the Georgian peoples of the Caucasus, dwelling in the Transcaucasian Government of Kutais between the Imeritians and the Mingrelians.

SUÁREZ, swä'räth, FRANCISCO (1548-1617). A Spanish theologian and scholastic philosopher. He was born at Granada, entered the Jesuit Order in 1564, and came under the direction of the great ascetic Rodriguez during his novitiate at Medina del Campo. The general of the society, Aquaviva, called him in 1578 to teach in Rome, where he remained seven years. Returning to Spain for reasons of health, he taught at Alcalá, Salamanca, and Coimbra. Besides his thorough knowledge of the Schoolmen, and especially of Thomas Aquinas, whom he usually follows, he displays remarkable familiarity with the writings of the first Christian centuries. His complete works were reprinted in 28 volumes (Paris, 1856-61). Consult Werner, *Franz Suarez und die Scholastik der letzten Jahrhunderte* (Regensburg, 1861).

SUBANDHU, sōō-bŭnd'hōō. A Sanskrit novelist, who lived probably in the seventh century A.D. Apart from a few verses he is known only as the author of the *Vāsavadattā,* a highly artificial romance dealing with the love of Prince Kandarpaketu for the Princess Vasavadatta. The action of the novel is very slight, and the style abounds in long compounds, puns, and assonances. The novel is important in Sanskrit literary history as being the first of the romantic school, and thus being the acknowledged model for the *Kādambarī* and the *Harṣacarita* of Bana (q.v.). It has been edited, with an admirable introduction, by Hall (Calcutta, 1859) and Vidyasagara (ib., 1874), and in Telugu script at Madras (1862). See NOVEL.

SUBANO, sōō-bä'nō. A Malay people in Sibuguey Peninsula, Zamboanga Province, Mindanao. See PHILIPPINE ISLANDS.

SUBCONSCIOUSNESS. A term used somewhat indefinitely to cover weak and obscure mental processes which lie just above the limen of consciousness. Common instances are the sound of a clock and the roar of a stream which pass out of attention if long continued; or the overtones which determine the 'color' or timbre of a musical note, although they are not ordinarily recognized as distinct tonal qualities. Many psychologists hold that subconscious processes, even though they do not attract the attention, do nevertheless exert a determinate influence upon the course of mental events. It is, however, important to distinguish between mind considered for itself alone, without external reference, i.e. consciousness that is properly anoetic, and the vague background against which the more luminous parts of mind are focalized. (See ATTENTION.) The factual existence of obscure processes which elude direct introspection and analysis by the attention is not to be confused with the *hypothesis* of the subconscious, which asserts that all past experience is conserved, not physiologically merely, but in a weakened form of consciousness. Consult: James, *Principles of Psychology* (New York, 1890); Stout, *Analytic Psychology* (ib., 1896). See NOETIC CONSCIOUSNESS.

SUBDEACON. A member of an order in the ministry of the early Church and of the Roman Catholic and Eastern churches at the present day. The subdiaconate apparently originated later than the episcopate, presbyterate, and diaconate, and probably developed from the last named as deacons rose in importance. The function of the office is to assist the deacon, in modern times especially in the celebration of the Eucharist. In the Roman Catholic Church the subdeacon of the mass, who sings the epistle and in other ways assists in the service, is usually a priest. Consult Reuter, *Das Subdiaconat* (Augsburg, 1890), and see ORDERS, HOLY; DEACON.

SUBDOMINANT. The interval one-fifth below the tonic, and the fourth degree of the scale.

SUBIACO, sōō'bē-ä'kō (Lat. *Sublaqueum*). A city in the Province of Rome, Italy, in the Sabine Mountains, 50 miles (of which 36 is by rail, 14 by diligence) east of the city of Rome, on the Teverone (ancient Anio) (Map: Italy, H 6). Here are to be seen walls and terraces of one of Nero's villas, and the famous monasteries of Santa Scolastica (founded in 530) and of San Benedetto. Here in 1465 the Germans Arnold Pannartz and Conrad Schweinheim published the first book printed in Italy, and copies of their editions of Lactantius, Cicero, and Augustine are still in the monastery library, which has lost, however, most of its precious manuscripts. San Benedetto contains thirteenth-century frescoes and paintings. Population (commune), in 1881, 7017; in 1901, 8005.

SUBINFEUDATION (from Lat. *sub,* under + ML. *infeudatio,* infeudation, from *infeudare, infeodare,* to confer in fee, from *in,* in + *feudum,* feud, fee, from OHG. *fihu,* AS. *feoh,* cattle, Lat. *pecu,* Skt. *paśu,* cattle). The act by which a feudal lord granted a portion of his lands to a tenant upon condition that the latter hold of the former subject to the incidents of feudal tenure. This was accompanied with the feudal ceremonies usual in those times. It was by this means that the feudal manors of England were created. As this practice tended to evade the feudal rules against alienation it was forbidden by the famous statute of Quia Emptores. See FEUDAL SYSTEM; MANOR.

SUBJECT (OF. *subject, suject, sujet, suget,* Fr. *sujet,* from Lat. *subjectus,* subject, inferior, p.p. of *subjicere,* to place under, from *sub,* under + *jacere,* to throw). A person who by reason of birth in a country or naturalization under its laws owes allegiance to its sovereign power. The term is almost exclusively employed to denote such a person under a monarchical form of government; whereas, the word citizen is applied to a member of a republic. The rights, privileges and duties of subjects, of course, depend upon the form of government, and they may

differ in political rank and station; thus a duke or an earl is as much a subject of the crown of England as a peasant, although the former is entitled to certain dignities and honors which the latter does not possess. Until comparatively recent times (until 1870 in England) the governments of Europe almost universally refused to recognize the right of a subject to change his allegiance, but they now generally concede this privilege. The policy of the United States in permitting aliens to become citizens by naturalization has probably influenced such nations in changing their arbitrary and despotic attitude on this question, as, of course, it would lead to international difficulties if a naturalized citizen of the United States were to be treated as a subject of the nation whose sovereignty he had renounced in order to become a citizen of the Republic. See ALIEN; ALLEGIANCE; CITIZEN; NATURALIZATION, and the authorities referred to under these titles. Consult Morse, on *Citizenship*.

SUBKINGDOMS, ANIMAL. See CLASSIFICATION OF ANIMALS.

SUBLAPSARIAN. See INFRALAPSARIAN.

SUBLICIAN BRIDGE (Lat. *Pons Sublicius*). The most ancient of the bridges over the Tiber at Rome, ascribed by tradition to Ancus Marcius. The Sublician remained the only bridge at Rome until the second century B.C. It was twice carried away and restored and its piers remained through the Middle Ages. The last remnants were destroyed in 1877.

SUBLIMATION (Lat. *sublimatio*, an uplifting, from *sublimare*, to uplift, from *sublimis*, lofty, from *sub*, under + *limen*, threshold). A term applied to the distillation of those volatile solids that, when heated, pass into the gaseous state without melting. Such substances, including iodine, arsenic (i.e. arsenious acid), the chlorides of iron and aluminus, certain organic compounds, etc., may be readily freed by sublimation from non-volatile impurities. It may be observed that all solids, theoretically without exception, give off more or less vapor, i.e. sublime, even at extremely low temperatures, and of course the evaporation (q.v.) is accompanied by absorption of heat. Ordinarily the rate of evaporation of solids is too small to prevent the temperature from rising to the melting-point on the application of heat. But in the case of solids that are very volatile and have a somewhat high melting-point the heat applied may be largely used up by the rapid evaporation, and so the temperature cannot rise high enough for the substances to melt. Of course, by placing such substances in a closed vessel and thus preventing free evaporation, they may be readily caused to melt.

SUBLIME (from Lat. *sublimis*, lofty). A term applied either to objects arousing a certain æsthetic emotion, or to the emotion itself. The treatise "On Sublimity" ascribed to Longinus (q.v.), but probably belonging to the first century of our era, represents the first attempt to deal with the differentiating characteristics of the sublime. See ÆSTHETICS.

SUBLIME PORTE. See PORTE.

SUBLIMINAL CONSCIOUSNESS (from Lat. *sub*, under + *limen*, threshold). Literally a degree of consciousness below a certain theoretical limit of intensity and clearness.

Such a consciousness cannot be proved to exist by direct introspection, but has been assumed to account especially for four groups of facts. (1) People often execute blind, impulsive actions or feel curious likes and dislikes (e.g. shivering at grating sounds), for which no adequate reason can be found in consciousness. Hence they may be the product of subconscious processes. (2) Many complicated movements, like piano-playing, which at first necessitate highly attentive conscious control, become, with time, decreasingly conscious and finally automatic, yet they seem too complex ever to be purely mechanical. (3) Ideas sometimes appear in consciousness from no assignable source, i.e. neither connected with previous thoughts nor traceable to sense-perception. These may have originated subliminally and thence risen to clear consciousness. (4) A mass of 'borderland' and pathological phenomena, such as automatic writing, trance, post-hypnotic suggestion, double personality, reveals many instances in which complex, seemingly quite intelligent, and hence apparently conscious, actions are executed by individuals who are, nevertheless, entirely ignorant of what they say or do. In the phenomenon of alternating personality such experiences are so frequent and so well organized as to become aggregated into a so-called subconscious 'mind' or 'personality,' which, under certain conditions, e.g. trance, hysteria, and the like, becomes the conscious, dominating personality.

If, with the best authorities, we deny a subliminal consciousness, all four groups of facts must obviously be explained in terms of nervous action without consciousness. Organic tendencies, constitutional dispositions, and various hereditary instincts will then account for the first group of facts, secondary reflexes for the second, inaccurate introspection and unconscious (or marginally conscious) association for the third, and similar principles, supplemented perhaps by neuropathic conditions, for the fourth. The most elaborate argument in favor of a subliminal self is that of F. W. H. Myers.

See ATTENTION; NOETIC CONSCIOUSNESS; SUBCONSCIOUSNESS.

BIBLIOGRAPHY. Carpenter, *Principles of Mental Physiology* (6th ed., London, 1891); Pierce, in *Proceedings of the Society of Psychical Research*, vol. xi. (ib., 1892); Morgan, *Introduction to Comparative Psychology* (ib., 1894); Stout, *Analytic Psychology*, vol. i. (ib., 1896); Myers, *Human Personality and Its Survival of Bodily Death* (ib., 1903); and Flournoy, *From India to the Planet Mars* (New York, 1900).

SUBMARINE BOAT. See TORPEDO BOAT, SUBMARINE.

SUBMARINE GUN (from Lat. *sub*, under + *marinus*, pertaining to the sea, from *mare*, sea). A gun which discharges its projectile beneath the surface of the water. In 1797 a Frenchman, M. Reveroni Saint-Cyr, proposed to arm a catamaran with a submarine gun, but it does not appear that any attempts were made to do so. Robert Fulton and several other Americans attempted the actual construction of effective submarine guns, but with no practical results. Ericsson was the most successful, and his experiments with a submarine gun mounted in

the bow of the specially built vessel the *Destroyer* extended over several years. The difficulty of securing accuracy, the shortness of range, and the improvement of the automobile torpedo have tended to discredit the gun. The *Destroyer* was sold to the Brazilian Government in 1892, but it was never thereafter used, and no subsequent attempts to employ a submarine gun have been made. Torpedoes are now discharged from submerged tubes, but these are not properly guns, as the projectile force is merely sufficient to force the torpedoes clear of the ship's side. See TORPEDO.

SUBMARINE MINES. See TORPEDO.

SUBMARINE TELEGRAPH. See TELEGRAPHY, SUBMARINE.

SUBMAXILLARY GANGLION (from Lat. *sub*, under + *maxilla*, jaw, jaw-bone). One of the four sympathetic ganglia lying in the cephalic region, sometimes called cranial ganglia. The latter term is rather misleading, as none of the ganglia are within the cranial cavity. The submaxillary ganglion is situated above the deep portion of the submaxillary gland. (See SALIVARY GLAND.) It is connected by filaments with the lower border of the gustatory nerve (nerve of taste, supplying the tongue). It also receives motor filaments from the chorda tympani nerve, a branch of the facial. It is small, rounded, and of a reddish-gray color; its filaments of distribution, five or six in number, arise from the lower part of the ganglion, and supply the mucous membrane of the mouth and Wharton's duct, some being lost in the submaxillary gland. The other three ganglia are Meckel's, the ophthalmic, and the otic (qq.v.).

SUBORDINARY. A class of charges in heraldry (q.v.).

SUBORNATION OF PERJURY. The offense of procuring a person to commit perjury. Although only a misdemeanor at common law, in most jurisdictions to-day it is punished with the same severity as perjury. See PERJURY.

SUBPŒNA (Lat. *sub pœna*, under penalty, the initial words of the writ in its original form). A mandatory writ or process issued by a court, a quasi-judicial body, or an official having judicial powers, commanding a person or persons named therein to appear at a certain time and place and testify or furnish documentary evidence in an action or judicial proceeding. Originally a subpœna was used only to compel attendance of witnesses in court, but by statute in most States many officials and bodies having judicial powers, such as boards of commissioners, coroners, etc., are authorized to compel the attendance of witnesses by this process.

A subpœna intended only to compel the attendance of a witness for the purpose of giving testimony is known as a subpœna *ad testificandum*. Where it is necessary to put in evidence documents which are in the possession of a witness, he may be compelled to appear and produce them by a subpœna *duces tecum*. This form of subpœna is substantially like the one above mentioned, except that it specifically enumerates as far as possible the books, papers, and documents desired. In some code States a 'notice to produce' served by one attorney in an action on his opponent serves the same purpose.

In most States a subpœna may be served by any person of discretion, who usually must be eighteen years of age or upward, and service is made by delivering a copy of the subpœna to the witness personally, at the same time showing him the original, and paying or tendering his legal fees and expenses, which are fixed by statute.

Failure to appear in obedience to a subpœna is a contempt of court. It is usual for the party who caused the service of the subpœna to apply to the court for an order directing the witness to show cause why he should not be punished for contempt. Such a witness is also liable in a civil action for all damages which may have been caused by his non-appearance to the party calling him. A witness may be excused, in the discretion of the court, upon showing a reasonable cause for his absence, such as illness, death in family, etc.

Prior to 1852 a defendant was summoned to answer an action in a court of chancery in England by a subpœna *ad respondendum*. This practice has been superseded there by service of a copy of the bill instead, but still obtains in some jurisdictions in the United States. Such a subpœna corresponds more nearly in its purposes to a summons than a subpœna as above described. See SUMMONS; WITNESS; EVIDENCE. Consult the authorities referred to under PROCEDURE.

SUBROGATION (ML. *subrogatio*, from Lat. *subrogare*, *surrogare*, to substitute, from *sub*, under + *rogare*, to ask). The treatment of one who has paid the debt of another, which as between himself and that other should have been paid by the latter, as though he were the assignee of the creditor's claim. The payer is then said to be subrogated to all the rights and remedies of the creditor against the primary debtor. The doctrine upon which this subrogation is based was originally applied by courts of equity, but is now generally applied by courts of law to all cases where one pays a debt on which he is secondarily liable, although the debt may be legally discharged by the payment. Equity, for the purpose of working out justice between the parties by repaying the advances made, deals with the case as though the debt were still in existence, and gives to the person paying the debt precisely the same rights and remedies as belonged to the original creditor, but in no case does one by subrogation acquire any higher or different rights. It will thus be seen that the analogy between subrogation and assignment is complete, one who is entitled to be subrogated to a claim or demand being treated as though he were an assignee of the claim or demand. The only difference between them is the source and not the character of the right, the right to subrogation arising by operation of law and the right of an assignee arising by voluntary act of the parties.

Some of the more important cases in which the doctrine is applied are: (1) Where a junior mortgagor pays off a mortgage prior to his own, when equity will compel an actual assignment of the mortgage by the prior mortgagee. (2) When one pays a debt to the payment of which he is entitled to contribution by others, or for which others are primarily liable and he only secondarily, as in the case of a surety. In these cases, since the sole relief sought is payment of money, courts of law apply the doctrine, and give a complete remedy. (See CONTRIBUTION; SURETYSHIP; QUASI CONTRACT.) (3) In some jurisdic-

tions, particularly in England, when one paying money to a corporation under an *ultra vires* contract cannot recover in quasi contract, although it is used by a corporation in paying its corporate indebtedness, in which case the person so advancing money is subrogated to the rights of the original creditor. (4) In the case of insurance contracts and contracts of indemnity generally whenever the insurer or indemnitor pays the indemnity due under his contract, when he is entitled to be subrogated to the rights of the person indemnified against third parties which may in any manner reduce the loss or obligation indemnified against. See INSURANCE; INDEMNITY; also CHANCERY; EQUITY.

SUBSCRIPTION (Lat. *subscriptio*, from *subscribere*, to subscribe, write under, from *sub*, under + *scribere*, to write). A popular rather than a technical term in law signifying a written contract by which a person agrees to contribute a sum of money for a specified purpose. The subscription may be made either as a gift, or it may be made as an offer to pay the money subscribed in exchange for property to be delivered to the subscriber. Whenever the person or corporation in whose favor the subscriptions are made has performed work or incurred expense or liability, relying upon such subscriptions, the courts have generally held that such expense or liability is a sufficient consideration for the subscription to make it a legally enforceable contract, entitling such persons or corporation to sue upon it. It has also been held that when there are several subscribers and each subscriber has fair notice that others are expected to subscribe to the same object or purpose, the promise of each subscriber is consideration for the promises of all the others. The soundness of such a doctrine may well be doubted and the authorities upon this point are in conflict. A subscription for stock of an existing corporation is generally deemed to be a mere offer which may be withdrawn at any time before acceptance, but which may be accepted at any time before withdrawal of the subscription by an allotment of the stock to the subscriber. Upon such acceptance the subscription becomes a valid contract which may be enforced by the corporation. See CONTRACT; CONSIDERATION.

SUBSIDIES (Lat. *subsidium*, relief, aid, auxiliary force, from *subsidere*, to sit down, remain, subside, from *sub*, under + *sedere*, to sit). A term in English history having reference to special tax assessments upon persons and not directly upon real property; in general European politics it has reference to grants of money to an ally to aid in the prosecution of war; while as a current economic term it applies to grants of money made by the State in aid of individual enterprises.

SUBSIDY AS A TAX. The subsidy was an income tax of 4s. in the pound upon the annual value of lands and a property tax of 2s. 8d. in the pound upon the actual value of goods. In this sense it was first used in the later part of the fifteenth century, but did not come into prominence until the reign of Henry VIII. From then until the Commonwealth it was the most important of the Parliamentary levies. The amount of the subsidy varied. In the eighth year of Elizabeth it brought £120,000; in the fortieth it was not above £78,000; it afterwards fell to £70,000. The subsidy finally became so unequal and uncertain that Parliament changed it into a land tax. This was first done under the Commonwealth, and, owing to its popularity, Charles II. continued it, though he did get one or two grants of subsidy.

SUBSIDIES TO ALLIES. Examples of subsidies of this kind are numerous in English history. Thus during the Seven Years' War England granted large sums to Prussia, one of her allies, as a means of enabling Frederick the Great to cope with his enemies, which included France. Again during the Napoleonic wars England furnished subsidies to several foreign powers.

GRANTS TO INDIVIDUALS. With regard to this class of subsidies, which is by far the most important at present, it may be said that almost the only enterprises that are the direct beneficiaries from Government aid are transportation companies, although it sometimes happens that other enterprises receive indirect benefit on account of Government patronage. Certain bounties, too, very nearly approach the idea of a subsidy. This is especially true of those on beet sugar, which, beginning in the days of Napoleon, have steadily increased in amount, until to-day the question of bounties on sugar has become one of great international importance.

RAILWAY SUBSIDIES. In most of the States of Continental Europe a large part of the original cost of railway construction was defrayed by Government aid. In Great Britain no railroads were subsidized, though some in Ireland were. In Canada the Canadian Pacific received large subsidies in the form of land grants from the Government. In the United States it has been a common practice to encourage and aid railway construction by State and municipal grants, chiefly in the form of subscriptions to their stock. The national Government has also contributed considerable toward the construction of certain railroads, and with one exception this has been in the form of land grants. (See LANDS, PUBLIC.) During the Civil War the importance of attaching the Far West to the Union by means of more direct railroads was seen, and in 1862 Congress passed an act granting to the Union and Central Pacific railroads a subsidy of more than $25,000 per mile in the form of a loan, which it was practically understood would never be repaid, together with 30,000,000 acres of land.

STEAMSHIP SUBSIDIES. See the article SHIPPING SUBSIDIES.

SUBSOILING. See PLOW, PLOWING.

SUBSTANCE (OF. *substance, substaunce*, Fr. *substance*, from Lat. *substantia*, being, essence, material, from *substare*, to stand under or among, from *sub*, under + *stare*, to stand). A term frequently used in logic and metaphysics. Substance is correlative with quality or attribute. Every substance must have attributes, and every attribute must be the attribute of some substance. The substance gold has the attributes weight, color, etc. But as every power or property of a thing, every way that the thing affects us, may be called an attribute or quality, if all the attributes are counted off, there is nothing left except the relations in which they stand to each other. But popular thought and popular philosophy assume that

everything whatsoever possesses, besides its attributes, an unknown substratum; that they rest upon or inhere in a mystical and inscrutable thing, that holds the attributes together, without being itself an attribute.

This view appears at the very dawn of philosophical speculation, having been doubtless an inheritance from pre-scientific and pre-critical thinkers, and has persisted through all the centuries up to the present. It appears in the doctrine of the Ionic philosophers (see IONIAN SCHOOL) as air or earth or water, in Heraclitus (q.v.) as fire, and in Parmenides (q.v.) as pure being. In Aristotle we have a more critical view, according to which the individual realities of experience are substances, while species are second substances. But Aristotle did not answer the question what it is in the individual realities of experience that constitutes their substantiality. The Stoics returned to the idea of a substrate as the bearer of attributes, and this view persisted through the Middle Ages as the only one advocated, except by the Nominalists (see NOMINALISM). In modern philosophy Descartes and Spinoza share this substrate theory. Leibnitz moved away from this static conception and regarded substance as a being capable of action or 'primitive force,' but it was his great opponent Locke who put definitely away the old substrate theory. "All our ideas of the several sorts of substances are nothing but collections of simple ideas, with a supposition of something to which they belong, and on which they subsist, though of this supposed something we have no clear distinct idea at all." "All the simple ideas, that thus united in one substratum make up our complex ideas of several sorts of substances, are no others but such as we have received from sensation or reflection," while "most of the simple ideas that make up our complex ideas of substances, when truly considered, are only powers."

Berkeley went further. Locke had accepted the existence of material as well as spiritual 'powers;' Berkeley maintained that "the supposition of external bodies is not necessary for producing our ideas; since it is granted they are produced sometimes, and might possibly be produced always in the same order we see them in at present, without their concurrence." Hence "there is not any other substance than *Spirit*, or that which perceives." About this substance, however, Berkeley could give no consistent account. At one time we are told that thing or being "comprehends under it two kinds entirely distinct and heterogeneous, which have nothing in common but the name, viz. Spirits and Ideas. The former are active, invisible substances—the latter are inert, fleeting, or independent beings, which subsist not by themselves, but are supported by or exist in minds or spiritual substances." But in another place we are told that "*the soul always thinks;* and in truth whoever shall go about to divide in his thoughts, or abstract the *existence* of a spirit from its *cogitation*, will, I believe, find it no easy task." Hume developed the idea contained in the last quotation and arrived at the result that all substance is an 'unintelligible chimæra.'

Kant emphasized these 'relations' which united perceptions, and found in them the essence of substance. Substance with him is a category of relation, which when schematized, i.e. brought into relation with time and space, becomes "the permanence of the real in time, or the idea of the real as presupposed in the empirical determination of time, and as persisting while all else changes." But this view has a defect. There is too much absoluteness in the conception. It is not necessary that there should be anything which persists through all changes. It is only necessary that there should be some quality which remains *relatively* unchanging, while other qualities change. The quality forms then the nucleus around which the changes gather as variations of a thing. The same thing does not always remain unchanged in the same quality. Now it may be this quality, now that. Were it necessary that some one quality should remain unchanged, that quality would come to be considered the substance of the thing. But the fact that the relatively permanent quality of one stage of change becomes the relatively changing quality of another stage makes it impossible to identify the substance with any one quality. On this account some philosophers prefer to regard substantiality as shifting from time to time.

But perhaps a more satisfactory definition of substance can be obtained from the true theory of judgment. Going back to Aristotle's conception of substance (*οὐσία*) as that of which predication is made, we find (see JUDGMENT) that predication is always made of a synthesis of attributes. The orange of which yellowness is predicated is an object which is yellow, grows on a tree, developed from a flower, is going to be eaten by me next minute, etc. The orange is the synthesis of all these quantities or attributes, some of which may be past and some not yet existent. The only object of which all the qualities of an orange are predicable is the totality of the predicable qualities. This totality exists at any one time, not as a whole, but in part. At no one moment is it consummated as a whole. All the stages of its history are necessary to its totality, but it is not necessary that these stages should be taken out of the real order of succession in which they stand and made to exist contemporaneously before the totality of the process can exist. A temporal whole is from its very nature not a whole at any one time shorter than the whole time of its existence, and the whole time of its existence has within it the distinctions of priority and subsequence which make it impossible to summate the whole into one moment. Now the synthesis of all the qualities which appear to common sense as the qualities of a thing is itself the substance of that thing. Used in this sense substance is no longer what its etymology indicates, viz. a something standing behind phenomena, but it is what the Greek term *οὐσία* means, viz. the being of which attributes are predicable. See PHILOSOPHY; METAPHYSICS; SCHOLASTICISM.

SUBSTANTIVE LAW (Lat. *substantivus*, self-existent, substantial, real, from *substantia*, being, essence, material). That branch or division of the whole law which defines and establishes human rights and privileges with reference to property and prescribes rules of conduct to be observed by mankind in the various relations of life. All other law may be classed as adjective or remedial, that is, as dealing with the methods of enforcement and maintenance of the normal

conditions established by the substantive law, and the rectification of such abnormal social conditions as may arise. For convenience, the substantive law is subdivided into various branches according to the subject matter to which it relates. For example, we speak of the law of real property, of personal property, the law of domestic relations or persons, etc. It is to be found both in legislative enactments and in the rules and precedents of the common law. See LAW and the authorities there referred to.

SUBSTITUTION (Lat. *substitutio*, a putting in the place of another, from *substituere*, to put in the place of another, from *sub*, under + *statuere*, to place, from *stare*, to stand). A mathematical operation by which one expression is replaced by another. The term has, however, come to have a technical meaning in modern mathematics, and this has led to an important branch known as the theory of substitutions. If n elements, $a_1, a_2, a_3, \ldots a_n$ are given, and $a_1, a_2, a_3, \ldots a_n$ and $a_2, a_1, a_3, \ldots a_n$ are two arrangements of these elements, the operation of passing from the first of these arrangements to the second is called a substitution of the n elements. It follows that there are no substitutions of n elements, including the identical substitution, which leaves the order of the letters unchanged. A substitution which in place of the arrangement $a_1, a_2, a_3, \ldots a_n$ gives $a'_1, a'_2, a'_3, \ldots a'_n$, is represented by the symbol

$$\begin{pmatrix} a_1 & a_2 & a_3 & \ldots & a_n \\ a'_1 & a'_2 & a'_3 & \ldots & a'_n \end{pmatrix}$$

If, however, a_1 is replaced by a_2, a_2 by a_3, ... a_{n-1} by a_n, and a_n by a_1, the substitution is said to be *cyclic*, and is more conveniently represented by $(a_1, a_2, a_3 \ldots a_n)$, or even by $(1, 2, 3, \ldots n)$, than by the more elaborate symbol

$$\begin{pmatrix} a_1 & a_2 & \ldots & a_{n-1} & a_n \\ a_2 & a_3 & \ldots & a_n & a_1 \end{pmatrix}$$

Similarly a substitution like $\begin{pmatrix} abcdef \\ cedafb \end{pmatrix}$ may be written $(acd)\,(bef)$, meaning that while a changes to c, c to d, and d to a, b at the same time changes to e, e to f, and f to b. This symbolism is further extended thus: Consider $(ab)\,(ac)$; this means that a changes to b, b to a, and a to c, and c back to a, a result which evidently may also be indicated by (abc), so that $(ab)\,(ac) = (abc)$. But the same reasoning shows that $(ac)\,(ab) = (acb)$. Hence if $s_1 = (ab)$ and $s_2 = (ac)$, $s_1 s_2 \pm s_2 s_1$. For convenience, $s_1 s_2$ is called the *product* of s_1 and s_2 in the order given, from which it appears that the commutative law of multiplication does not hold true in the theory of substitution. If in the product $s_1 s_2 s_3 \ldots s_n$ we have $s_1 = s_2 = \ldots s_n$, the product is called the *power* of each substitution. If a substitution leaves all the elements unchanged in order it is called an *identical* substitution and is represented by 1. If the product of two substitutions, like

$$\begin{pmatrix} a_1 & a_2 \ldots a_n \\ a'_1 & a'_2 \ldots a'_n \end{pmatrix} \text{ and } \begin{pmatrix} a'_1 & a'_2 \ldots a'_n \\ a_1 & a_2 \ldots a_n \end{pmatrix}$$

is 1, each is called the *inverse* of the other, and if the first is represented by s, the second is represented by s^{-1}, ss^{-1} equaling 1.

A collection of substitutions is said to form a *group*, if the product of any two is another of the same collection. This may be illustrated outside the field of substitutions by the three cube roots of unity $1, -\frac{1}{2} + \frac{1}{2}\sqrt{-3}, -\frac{1}{2} - \frac{1}{2}\sqrt{-3}$, the product of any two being another of the same collection. The six substitutions $s_0 = 1$, $s_1 = (xyz)$, $s_2 = (xzy)$, $s_3 = x\,(yz)$, $s_4 = y\,(zx)$, $s_5 = z\,(xy)$ also form a group. The number of substitutions of a group is its *order*, and this is always a factor of $n!$. Thus in the group given the order is 6, and this is a factor of 3!. If all substitutions of a group H are contained in another group G, H is called a *sub-group* of G and the order of H is a factor of that of G. A group whose operations are all permutable with one another is called an *Abelian group*.

Lagrange (1770) was one of the first to undertake a scientific treatment of substitutions in connection with the theory of the quintic equation. He invented a 'calcul des combinaisons,' the first real step toward the theory of substitutions. Ruffini (1799) was the next to undertake a serious study of the subject, again in the attempt to show the impossibility of solving the quintic. To Galois (q.v.), however, the honor of establishing the theory is usually ascribed. He found that if $r_1, r_2, r_3, \ldots r_n$ are the n roots of an equation, there is always a group of permutations of the r's such that (1) every function of the roots invariable by the substitutions of the group is rationally known, and (2), reciprocally, every rationally determinable function of the roots is invariable by the substitutions of the group, a discovery that eventually led to the proof of the insolubility of the quintic (Liouville's *Journal*, vol. xi.). Consult also *Œuvres mathématiques de Galois* (Paris, 1897). Cauchy was the first of the well-known French mathematicians to recognize the importance of the theory, and numerous important propositions are due to him (*Journal de l'école polytechnique*, 1815; *Exercices d'analyse et de physique mathématique*, vol. iii., Paris, 1844). Serret was the first to give a connected account of the theory (*Cours d'algèbre superieure*, in the 3d ed., Paris, 1866). This was followed by Jordan's *Traité des substitutions et des équations algébriques* (Paris, 1870). Sylow (1872) was the first to treat the subject apart from its applications to equations (*Math. Annalen*, vol. v.). He was followed by Netto, whose *Substitutionstheorie* (Leipzig, 1882) was translated by Cole (Ann Arbor, 1892), thus making the theory accessible to English readers. Burnside, *Theory of Groups of Finite Order* (Cambridge, 1897), has brought the theory even more prominently before English and American scholars. The first to attempt to simplify the applications of the theory to the subject of equations in an elementary text-book was Petersen, *Theorie der algebraischen Gleichungen* (Copenhagen, 1878).

SUBSTITUTION, THEORY OF. See CHEMISTRY (historical section).

SUBTRACTION (Lat. *subtractio*, a taking away, from *subtrahere*, to take away, from *sub*, under + *trahere*, to draw, drag). The inverse of addition, and one of the fundamental processes of arithmetic and algebra. It is the operation which has for its object, given the sum of two expressions and one of them, to find the other. The given sum is called the *minuend*, the given addend is called the *subtrahend*, and the addend

to be found is called the *difference* or the *remainder*.

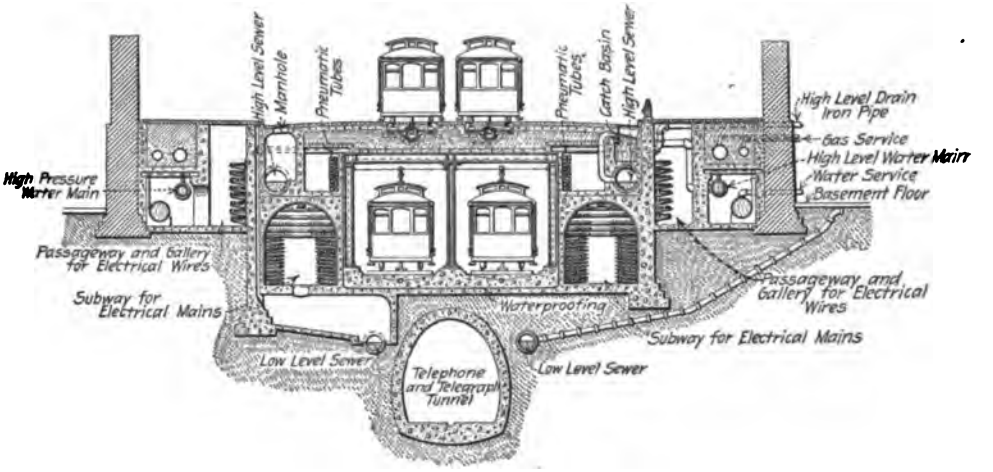
SUBURRA. A district of ancient Rome in the valley between the Esquiline, Quirinal, and Viminal Hills. It was thickly populated and bore an evil reputation as the resort of peddlers, footpads, and prostitutes.

SUBWAYS (FOR PIPES AND WIRES). Underground galleries which contain and render accessible at any point the multitudinous pipes and wires beneath city pavements; or else ducts for inclosing underground wires only, in such a way as to make them accessible at intervals. Subterranean passages for the accommodation of street traffic are either nothing more than streets or footpaths placed in tunnels, which need no description, or they are underground railways, which are described in the article on TUNNEL.

The chief advantages of subways for pipes and wires are: (1) They increase the life and general serviceability of pavements and prevent the interruption to traffic caused by street excavations to gain access to pipes when simply buried in the ground. (2) They facilitate both the inspection and repair of all classes of underground furniture, and thus lessen the number of troublesome and dangerous leaks from water and gas mains; they also aid in the prevention of electrolysis, or the electrical decomposition of iron and lead conduits through stray electrical currents from overhead trolley systems. (3) Ventilated and relatively dry subways may greatly lengthen the life of pipes and wires through better protection against corrosion than is possible when such furniture is laid directly in the earth.

One of the earliest attempts to avoid the disturbance of pavements was carried out in Liverpool, where a gallery 2½ feet wide was built under the sidewalk and in it were placed an oval pipe sewer 27×18 inches, a 10-inch water main, and a 10-inch gas main. The bottom of the trench was 13 feet below the surface of the sidewalk. Little or no provision for repairs was made. The London subways date from 1861 or 1862, when one was built in a new street from Covent Garden Market to Saint Martin's Lane. A few months later a subway was built at Nottingham, England. Subsequently a number of subways were added to the first ones built in London and Nottingham. The London subways range in size from 14 feet wide and 7 feet high to 8×7 feet. The walls are of brick, laid in cement. The roofs are formed by semicircular brick arches, with ventilators extending to the streets at intervals of 100 feet. The London subways contain gas, water, electric light, hydraulic power supply, telephone, and telegraph mains. The placing of wires and a great variety of pipes in the sewers of Paris is one of the notable features of that city.

In the United States the nearest approach to subways like those of Europe is at Saint Paul, where a number of miles of sewers have been constructed in the form of tunnels in the soft sand-rock which underlies the city, and water mains have also been placed, separately, in similar tunnels. Branch tunnels connect with the houses, in the same general way as branches lead to the buildings along the line of the European subways. Besides the sewers and water mains at Saint Paul some private companies have placed telephone lines in like tunnels. Tunnels for telephone cables have been constructed in Chicago.



CROSS-SECTION OF CHICAGO STREET, SHOWING PROPOSED ARRANGEMENT OF SUBWAYS.

ELECTRICAL SUBWAYS. Although there are no instances of subways for both pipes and wires in the United States, the practice of putting wires underground is rapidly growing. It is getting to be a comparatively common practice, even in small towns, for telephone companies to bury their wires; and though the work is often done cheaply and rather crudely, the wires are nevertheless removed from overhead and at the same time are so arranged that little subsequent disturbance of the street is necessary. In a growing number of the larger cities electrical wires for light and power, together with the ordinary and the police and fire alarm telegraph lines, are also placed underground. Electrical subways consist of a single pipe or tube, or a group of such, designed to protect underground wires from injury due to settlement of the earth or the picks and shovels of workmen. At the same time these subways afford access to the wires through manholes placed at intervals, for repairs, connections, or the drawing in of new wires. Some

of the underground systems have the conductors built in the tubes before the latter are laid, in which case new wires cannot be added without laying additional tubes, but provision is made for service connections without digging up the street. The most common materials used for the conduits or ducts are wrought iron, earthenware, and wood, but sometimes cast iron, and again ordinary or more rarely bituminous cement concrete is used. In place of tubes troughs of cast iron, earthenware, or wood, covered with the same material, are sometimes employed. The diameters of the various ducts are about three inches, and if one is not sufficient for the various wires to be buried any desired number may be placed in the same trench. Wrought iron pipes similar to gas pipes are commonly imbedded in concrete, and they may be laid in trenches lined with cement or wood. Earthenware or terra-cotta ducts are generally surrounded with concrete, but the latter sometimes gives place to boards at the top. Each piece of conduit is eighteen inches long. If a group of ducts is desired they are laid up one on another, breaking joints, much like brickwork; or multiple ducts may be bought from the manufacturers. Concrete ducts are formed in place. Wooden ducts are in the form of square timber, with holes bored through the centre, or constructed more cheaply from boards. Wood-fibre pipes are also used. (See PIPE.) In the Edison three-conductor tube system three copper rods are so wound, separately and collectively, with rope, as to insulate them from wrought iron pipe, some twenty feet long, in which they are placed. These sections are filled with a fluid insulating compound before being shipped from the factory. Special insulated joints are made in the trenches, both for ordinary joints and for branch lines. Edison tubes of a simpler type but embodying the same principles are also made. The various classes of electrical wires and cables are generally insulated before being placed in subways. (See ELECTRIC LIGHTING; ELECTRIC RAILWAYS; TELEGRAPH; TELEPHONE, etc.) The wires and cables are drawn into the closed electrical subways through manholes at intervals of 200 to 300 feet by means of ropes or rods. If ropes are used a steel wire with a round metal head is first pushed through, and by means of this a rope sufficiently large to haul the electric cable is drawn in. The rods are pushed through from manhole to manhole, one short rod after another being jointed onto the line. Ordinarily electrical subways need be placed but three feet or so underground.

Consult: Mason, "Street Subways for Large Towns," and discussion thereon, in *Transactions of the Society of Engineers* (London, 1895); article in *Engineering News* on "Street Subways for Pipes and Wires" (New York, March 15, 1900), describes all subways for both pipes and wires known to be in use up to early in 1900; also chapter on underground electrical construction in vol. ii. of Crocker, *Electric Lighting* (New York, 1901), and similar chapters in Hopkins, *Telephone Lines and Their Properties* (ib., new ed., 1901).

SUCCESSION (Lat. *successio*, from *succedere*, to follow, succeed, from *sub*, under + *cedere*, to yield). At civil law (q.v.) succession signifies in general the substitution of one person for another in an existing legal relation. Acquisition of a right previously held by another is termed *active* succession; subjection to a duty previously resting upon another, *passive* succession. When single rights or duties are thus transferred the succession is said to be *singular*. When a person receives all the rights and duties of another that are capable of transfer the succession is said to be *universal*. The most important case of universal succession is inheritance, which at civil law signifies the transfer to one or more heirs of the rights and obligations of a person deceased. Heirs may be designated by a last will or testament (q.v.); in the absence of a valid testament they are designated by general laws. In the latter case civilians speak of inheritance or succession *ab intestato* (q.v.). Inheritance may also be determined, in part, by laws which give certain persons rights of succession of which they cannot be deprived by a testator except on legally defined grounds. For such limitations upon the power of testation at civil law, see TESTAMENT.

SUCCESSION AB INTESTATO (Lat., from one intestate). I. ROMAN LAW. In early Roman law, as in early law in general, succession was governed by the organization of the family. According to the Twelve Tables the inheritance vested (1) in the *sui*, i.e. the members of the decedent's family, who were under his household authority. (See PATRIA POTESTAS.) The sons and the unmarried daughters and the widow who had been *in manu* (see MARRIAGE) had equal shares. Children of a pre-deceased son received their father's share. Failing *sui*, the inheritance passed (2) to the nearest agnate (i.e. the nearest collateral relative in the male line). If there was no agnate the inheritance went (3) to the *gens* or clan. Under this system kinship gave no right except in so far as it coincided with the family organization. Emancipated sons and daughters, married daughters and their descendants, and all cognates (relatives in the female line) were excluded from succession. On the other hand, adopted children and the wife *in manu* had the same rights as the other *sui*. In the subsequent development of the law there was a steady movement toward fuller recognition of kinship. This movement began with the prætorian reforms at the close of the Republican period. Emancipated sons and daughters and married daughters were admitted to inherit with the *sui*, on condition of 'collating' (i.e. putting into hotch-pot) their separate property. Failing agnatic relatives, cognates were admitted; and failing cognates, the husband and wife who had established a free or 'consistent' marriage succeeded one to the other's estate. Later Imperial legislation placed cognates and agnates on the same footing, as far as the direct line was concerned (ascendants and descendants). Justinian in his 118th Novel abolished all preference of agnates. Under Justinian's rules the inheritance went (1) to descendants; (2) to ascendants, brothers and sisters of the full blood and their children; (3) to brothers and sisters of the half blood and their children; (4) to the nearest collateral relative; (5) to the surviving spouse; and (6) to the fiscus. Illegitimate children had no rights of succession except from the mother.

II. MEDIÆVAL EUROPEAN LAW. The early

German law of inheritance, with the Roman, was based on the family, but it gave no such preference to kinship in the male line, except as regarded succession to real property. As regarded such property, however, a preference not only of the male line over the female, but of male heirs over female, is visible in the earliest written laws; and this preference was emphasized and made general in mediæval Europe by the development of the feudal system. In German law there appeared also a distinction between sword-goods and spindle-goods, i.e. between things used by men and things used by women, and a tendency to prefer male heirs as regarded sword-goods and female as regarded spindle-goods. Another German idea was that, when the nearest heirs were of the half blood, property that had come to the decedent from the father's side should go to the paternal relatives, while property that had come from the mother's side should go to the maternal relatives ('paterna paternis, materna maternis;' in Spanish law, 'troncalidad'). Sporadically manifested, moreover, was a disinclination to allow property to ascend, with resultant rules preferring brothers and sisters and their descendants to parents.

As between collaterals rights of succession at German law did not depend wholly on nearness of kinship. Descendants of a nearer common ancestor were regularly preferred to descendants of a more remote common ancestor. Inheritance vested (1) in descendants of the decedent; (2) in descendants of his parents; (3) in descendants of his grandparents; (4) in descendants of his great-grandparents, and so on. Within each such group the nearest of kin took the inheritance. This is described by modern writers as the 'lineal-gradual' or 'parentela' system. Coupled with a preference of the male line and of males within that line it became the (original) feudal law of succession, and (with preference of the eldest male added) it determined the English law of inheritance of real property.

III. Modern Civil Codes. In modern European legislation the Roman principle of universal succession has generally reasserted itself: the same rules generally govern inheritance of realty and of personalty. In all the codes the inheritance vests primarily in descendants. Failing these different rules prevail. At French law the inheritance passes, in second instances, to parents, brothers, and sisters and the children of brothers and sisters, all of whom take precedence of grandparents. The Spanish code prefers all ascendants, and the German code prefers parents, to brothers and sisters. In the absence of descendants, ascendants, and of brothers and sisters and their descendants, the French, Italian, and Spanish codes confer the inheritance upon the nearest collateral; but the French code provides that if there be collaterals both on the paternal and the maternal side the inheritance shall be divided. The Austrian and the German codes follow the parentela system.

The surviving spouse is better treated than at Roman law. Under the Code Napoléon, indeed, the surviving spouse had no right except by ante-nuptial contract or, in the absence of such contract, by operation of the general law of matrimonial property; but by the law of March 9, 1891, he or she has a life interest in a portion of the property, which is at most one-fourth if there are children, but rises to one-half if there are no children. There are similar provisions in the Italian and Spanish codes; but at Spanish law if the decedent has neither descendants, ascendants, nor brothers or sisters or nephews, the surviving spouse takes the whole estate absolutely; and at Italian law, if there are no legitimate children, the surviving spouse takes from one-fourth to one-third absolutely as against parents and illegitimate children, two-thirds as against collaterals, and the whole estate if there is no collateral within the sixth degree (e.g. a second cousin). The German law is even more liberal: the surviving spouse takes one-fourth absolutely as against children; one-half to three-fourths as against parents, brothers and sisters, and grandparents; and the whole as against the decedent's other relatives.

As to illegitimate children different rules prevail. The French, Italian, and Spanish codes give no rights of inheritance to such children unless they have been 'recognized.' Such a recognized child inherits in concurrence with legitimate children, taking, however, only half the share of a legitimate child. When there are no legitimate children the rights of recognized illegitimate children are greater. By the French law of March 25, 1816, they take the whole estate as against all collaterals, except brothers and sisters and their children. In the German code the illegitimate child, although 'recognized,' has no right of succession in the estate of his father or in those of his father's relatives; but in the mother's estate and in those of her relatives such a child has the same rights as if born in wedlock. For a treatment of subjects in English and American law, see Descent; Distribution; Heir; and Inheritance.

SUCCESSION WARS. The name given to wars arising out of conflicting claims of succession to the throne. Among such wars that have been waged in Europe the following deserve special notice: (1) The War of the Spanish Succession, 1701-14; (2) that of the Polish Succession, 1733-35; (3) that of the Austrian Succession, 1740-48; and (4) that of the Bavarian Succession, 1778-79.

The War of the Spanish Succession arose on the death without male heirs of Charles II. (q.v.), King of Spain, of the House of Hapsburg, November 1, 1700. The nearest natural heir to the throne was of the royal Bourbon line of France, Charles's elder sister having married Louis XIV.; but, to prevent any possible union of the two crowns, a solemn renunciation had been exacted both from Louis and his Queen, for themselves and their heirs. Failing the Bourbons, the next heirs were the descendants of the younger sister of Charles, who had married the German Emperor Leopold I., ruler of the Austrian realm, and from whom no renunciation had been exacted; and the only issue being a daughter, who had married the Elector of Bavaria, and borne a son, Joseph Ferdinand, this prince was during his lifetime regarded both by Charles II. and the Spanish people as the rightful heir. As he died in 1699, the question of succession was reopened. Louis XIV. claimed the throne for himself, as the son of Philip IV.'s eldest sister, being, however, again legally barred here by another solemn renunciation. The Emperor Leopold maintained that the Bourbons had by these two renunciations lost all rights of succession,

and he claimed the throne as the son of Philip IV.'s younger sister. (See genealogical table, *The Hapsburg Family*, under HAPSBURG.) Leopold handed over his claim to his second son, the Archduke Charles. The Austrian party at first preponderated in Spain; but Louis succeeded in undermining the Austrian influence, and his grandson, Philip of Anjou, was declared the heir (October 2, 1700). On the death of King Charles, Philip appeared in Spain and was recognized as monarch. The Emperor Leopold at once took up arms and sent an army into Italy under Prince Eugene, who defeated the French general Villeroi at Chiari on September 1, 1701. William III., regarding the union of France and Spain under the Bourbons as a menace to the naval interests of England and Holland, and stirred up by the action of Louis XIV. in recognizing the Pretender, James Edward Stuart, determined to revive the Grand Alliance against France, and entered into a coalition with Austria and her allies in the German Empire, including Prussia. Savoy, Bavaria, and some of the other German States joined the Bourbons. William's policy was continued by Queen Anne, who succeeded to the English throne in March, 1702, and immediately declared war.

In 1702 Churchill (the future Marlborough), at the head of an English-Dutch-German army, made a victorious advance against the French in the Spanish Netherlands; while a German army under the Margrave of Baden crossed the Rhine and encountered Villars, who proved too powerful for him. In Italy, Prince Eugene, after taking Villeroi prisoner at Cremona (January, 1702), was checked by Vendôme. In 1703 Marlborough gained fresh successes and the Duke of Savoy joined the Grand Alliance. The first great blow was struck on August 13, 1704, when the combined Austrian-German-British army under Marlborough and Prince Eugene totally defeated the French and the Bavarians under Tallard at Blenheim (q.v.). A few days before Gibraltar had fallen into the hands of the English. The campaigns of Marlborough in Germany and of Eugene in Italy in 1705, while successful, were not very important. In 1706 Marlborough suddenly attacked the French and Bavarians under Villeroi at Ramillies (q.v.), and routed them with great slaughter. The victory of Eugene over Marsin at Turin in the same year shattered the French power in Italy.

In the meanwhile in 1704 the Archduke Charles landed at Lisbon with a British and Dutch army and invaded Spain. In the following year the Earl of Peterborough and Sir Clowdisley Shovell landed with a small body of troops in Catalonia. Then, attacked from both east and west, the Bourbon forces were beaten and driven across the Pyrenees. After the departure of Peterborough, however, the Bourbon commander, the Duke of Berwick (q.v.), made head against his antagonists, and by his victory at Almanza (April 25, 1707) he recovered the whole of Spain except Catalonia. In the Netherlands Marlborough and Prince Eugene fell upon Vendôme's army at Oudenarde (1708) and inflicted upon it a severe defeat. The capture of Lille, Ghent, and Bruges followed. France now began to show symptoms of exhaustion, and made overtures of peace, but the demands of the allies were of so exorbitant a character that Louis XIV. preferred to continue the war. The French under Villars suffered another great defeat in September, 1709, at the hands of Marlborough and Prince Eugene at Malplaquet (q.v.). The death of the Emperor, Joseph I., the successor of Leopold I. (April 17, 1711), and the accession in the Austrian dominions and in the German Empire of his brother, Charles VI., came to the rescue of France, for England became immediately lukewarm in support of a cause the success of which would result in the union of Austria and Spain; and the English Tories having come into power, England concluded an armistice with France in 1712. Prince Eugene still carried on the war, aided by Holland, but was compelled to give way; and in the following spring (1713) Holland, Prussia, and Savoy joined England as parties to the Peace of Utrecht (q.v.). The Emperor Charles VI. found himself forced to conclude a treaty of peace at Rastatt, March 7, 1714, and later on the more formal treaty of Baden (in Aargau), September 7, 1714, ended the struggle, leaving Philip in possession of the Spanish throne, but with the provision that the crowns of France and Spain should never be united in the same person, while Austria obtained the Spanish Netherlands, the former Duchy of Milan, Naples, and Sardinia. Sicily was awarded to Savoy, which exchanged it for Sardinia. Gibraltar and Minorca were ceded to England, which acquired Arcadia from France. The conflict waged between the English and French in America as part of the War of the Spanish Succession is known as Queen Anne's War.

Consult: Stanhope (Lord Mahon), *History of the War of the Succession in Spain* (London, 1836); Coxe, *Memoirs of the Kings of Spain of the House of Bourbon* (ib., 1813); Von Noorden, *Europäische Geschichte im 18ten Jahrhundert*, "Der spanische Erbfolgekrieg" (Düsseldorf, 1874-83), perhaps the best work on the subject. See LOUIS XIV.

THE WAR OF THE POLISH SUCCESSION. In 1733 Augustus II. of Poland and Saxony died and Stanislas Leszczynski (q.v.), whose daughter had married Louis XV. of France, was elected King by the Diet through French influence. Some of the nobles, however, were determined that the crown should pass to Augustus (Frederick Augustus II. of Saxony), son of the late King. Russia and Austria supported Augustus and a Russian army placed him on the throne. Stanislas withdrew to the fortress of Danzig, where he held out until June, 1734. France, in retaliation for Austria's support of Augustus III., declared war on the Emperor. The French forces invaded Lorraine and fought successfully on the Rhine (1733-34). Charles Emmanuel III. of Sardinia took up arms against Austria, and in 1734 Don Carlos, son of Philip V. of Spain, seized the opportunity to undertake the conquest of the Two Sicilies, which had been wrested from Spain in the War of the Spanish Succession. The Austrians were overthrown at Bitonto on May 25, 1734, and in 1735 Don Carlos was crowned King of the Two Sicilies. By the preliminaries of Vienna (October 3, 1735), Austria relinquished the possession of these regions. Augustus III. was recognized as King of Poland, though Stanislas retained the royal title and was given for his life the duchies of Lorraine and Bar, which

were afterwards to revert to France. Francis Stephen, the dispossessed Duke of Lorraine, received the Grand Duchy of Tuscany as compensation. France lent its guarantee to the Pragmatic Sanction (q.v.) and Parma and Piacenza were handed over to the Emperor by Don Carlos. The definitive Peace of Vienna was not signed till 1738.

THE WAR OF THE AUSTRIAN SUCCESSION. This struggle arose after the death of the Emperor Charles VI. (q.v.), in 1740. In accordance with the Pragmatic Sanction (q.v.) Charles VI.'s daughter and heiress, Maria Theresa, had received assurances of support from most of the European powers, but hardly had she ascended the Austrian throne when she found her dominion contested on every side. Frederick the Great of Prussia reasserted an old claim and invaded and seized Silesia. Charles Albert, Elector of Bavaria, claimed to be the rightful heir to the Hapsburg possessions as a descendant through the female line of Ferdinand I., and in virtue of old arrangements. Augustus III. of Saxony and Poland put forward his claims as the husband of the eldest daughter of the Emperor Joseph I. The Bourbon courts of France and Spain seized the opportunity to make war upon Austria. England thereupon entered into an alliance with Maria Theresa. Charles Emmanuel III. of Sardinia was also among the princes who sought the dismemberment of the Austrian realm. Holland joined the Anglo-Austrian Alliance, and the Bourbon King of Naples joined the enemies of Maria Theresa. Some of the minor German princes engaged in the struggle, as allies of Prussia and France. On April 10, 1741, Frederick II. defeated the Austrians at Mollwitz. The Bavarians, the French, under Belleisle, and the Saxons poured into the Austrian dominions. Maria Theresa appealed for support to her Hungarian subjects at the Diet assembled at Pressburg and they responded chivalrously to her call. She was, however, unable to save Prague, which surrendered to Belleisle on November 26, 1741, but at the beginning of 1742 her forces entered upon a victorious campaign against Charles Albert. General Khevenhüller overran Bavaria, and on the very day of the Elector Charles Albert's coronation as Emperor Charles VII. took Munich (February 12, 1742). On May 17, 1742, Frederick won a victory over the Austrians at Chotusitz, which was followed by the Treaty of Breslau (terminating the first Silesian War), which provided for the cession of most of Silesia to Prussia. The French General Belleisle effected a masterly retreat from Prague.

In May, 1743, Bavaria again fell into the hands of the Austrians. In June the English, under George II., defeated the French at Dettingen. In the same year Saxony and Sardinia were won over to the side of Austria. France and Spain now remained the sole representatives of the coalition. Seeing the tide turn so strongly in favor of Austria, Frederick became alarmed and renewed hostilities in 1744 by an invasion of Bohemia (second Silesian War). In January, 1745, Charles VII. died and his son, Maximilian Joseph, made peace with Austria. On June 4, 1745, Frederick won a victory over the Austrians at Hohenfriedberg, and on December 15th the Prussians defeated the Saxons at Kesselsdorf. Frederick, displeased with the overbearing conduct of France, was willing to make terms with Austria, and the Peace of Dresden (December 25, 1745) between Austria, Saxony, and Prussia terminated the second Silesian War. On September 13, 1745, the husband of Maria Theresa had been elected Emperor as Francis I. In the meanwhile the French were being led to victory in the Austrian Netherlands by Marshal Saxe, who, on May 11, 1745, defeated the English, Hanoverians, Dutch, and Austrians at Fontenoy. One after another the principal towns of the region fell before his attacks, and on October 11, 1746, he won a splendid victory over the allies under Charles of Lorraine at Raucoux. In Italy the war was waged with varying fortune. In 1745 the French were successful. In 1746 the Austrians and Sardinians made a victorious advance, and Genoa, which had joined the enemies of Austria, was occupied. The city, however, had soon to be evacuated, and an attempt to recapture it in 1747 was frustrated by the French. In 1747 Saxe routed the Duke of Cumberland at Laffeld, near Aix-la-Chapelle (July 2d), while his celebrated chief of engineers, Count Löwendal, after a two months' siege, took Bergen-op-Zoom, a fortress believed by the Dutch to be impregnable. On the sea, however, the English gained victories in 1747 under Admirals Anson and Hawke. At this juncture the Empress Elizabeth of Russia came to the aid of Maria Theresa and sent her forces into the field. France was now willing to listen to proposals of peace. On October 18, 1748, the Treaty of Aix-la-Chapelle put an end to the war. It left the Hapsburgs in possession of their hereditary dominions, with the exception of Silesia. Parma and Piacenza (acquired in 1735) were handed over by Austria to Don Philip, brother of Ferdinand VI. of Spain. The principal event of the contest waged by the British and French in America (King George's War) was the taking of Louisburg in 1745. The French held their ground in India.

THE WAR OF THE BAVARIAN SUCCESSION. The Elector Maximilian Joseph of Bavaria died without issue on December 30, 1777. The natural heir was Charles Theodore, Elector Palatine, head of the elder line of the House of Wittelsbach.

This prince had no legitimate heirs, and with a view of furthering the interests of his illegitimate children, he had, in January, 1778, entered into a convention with the Emperor Joseph II. (the son of Maria Theresa, sovereign of Austria and Queen of Hungary) by which he agreed to transfer Lower Bavaria to Austria, which put forward an antiquated claim to a part of the Bavarian dominions. Frederick the Great would not consent to such an aggrandizement of Austria in South Germany, the more so as he felt that it might interfere with the claim of Prussia to the succession in the principalities of Ansbach and Bayreuth. As Austria refused to withdraw her pretensions, Frederick proceeded to make war on her, and in the summer of 1778 he invaded Bohemia. He was joined by the Elector of Saxony, who, as the husband of the only daughter of Maximilian Joseph, claimed a portion of the Bavarian inheritance. Maria Theresa and Joseph II. were in no haste to plunge into a war. Prussia, and the Austrian forces confronted the enemy without coming to an en-

gagement. The hostile attitude of Catharine II. of Russia toward Austria induced her to give way, and in the Treaty of Teschen, signed on May 13, 1779, she had to content herself with the acquisition of the Innviertel, a district on the east side of the Inn, with the exception of which the whole of the Bavarian inheritance passed to Charles Theodore. The Elector of Saxony received a money indemnity.

SUCCINIC ACID (from Lat. *succinum, sucinum*, amber), $COOH.CH_2.CH_2.COOH$. A di-basic organic acid found in amber, in unripe fruits, in brown coal, etc. In the animal organism it occurs in the spleen, the hydrocephalic and hydrocele fluids, and, according to some authors, also in normal urine. It has been known to chemists since the sixteenth century, and its acid character was discovered by Lemery in 1679. It may be obtained by a variety of synthetic chemical methods. Usually, however, it is prepared by the fermentation of a solution of ammonium tartrate. It is a crystalline substance melting at 180° C. and boiling at 235° C., though when distilled it loses the elements of water and is partly converted into its anhydride. Succinic acid is almost insoluble in ether; it is moderately soluble in cold and very soluble in hot water and alcohol.

SUCCORY. Another name for chicory (q.v.).

SUC'COTH (Heb. *sukkōth*, booths, thickets). A place name occurring several times in the Old Testament. In Joshua xiii. 27 a Succoth is described as situated in the territory of Gad, 'in the valley,' and within the ancient bounds of Sihon, King of Heshbon. A location east of the Jordan is indicated here and also in Genesis xxxiii. 17 and Judges viii. 5-16 (cf. Psalms lx. 6, cviii. 7). In I. Kings vii. 46 (II. Chron. iv. 17) it is stated that the metal work for Solomon's temple was cast "in the plain of Jordan between Succoth and Zarthan." It has been thought that this Succoth was in the west Jordan country. No satisfactory identifications, however, have been proposed. Succoth was also the name of the second station in the Exodus from Egypt (Ex. xii. 37, xiii. 20, Num. xxxiii. 5-6).

SUC'COTH-BE'NOTH. According to II. Kings xvii. 30, the name of a deity whose worship was carried on at Samaria by the colonists from Babylon settled there by Shalmaneser IV. No such god has been found in Babylonian inscriptions, and it is reasonable to conclude that the form is corrupt. In Amos v. 26 a deity (or a star), Sikkut, is mentioned by the side of Chiun (perhaps the planet-god Saturn-Ninib), and a deity Sakkut occurs in Babylonian literature. The bad state of the text in the passage from Amos, however, requires caution in drawing conclusions, and there is no necessary connection between Succoth and Sikkut.

SUCHER, sōō'kĕr, JOSEF (1844—). A prominent Austrian musical conductor and composer, born at Döbör, Eisenburg County, Hungary. First instructed in music as a chorister in the Imperial chapel at Vienna, he afterwards studied law at the university and composition under Sechter, became conductor of the Akademische Gesangverein and assistant conductor at the opera, and in 1876 went to Leipzig as kapellmeister at the Stadt Theater, where his rehearsals of Wagner's music dramas, especially of the *Ring of the Nibelung*, placed him in the front rank of modern conductors. In 1879 he was called to Hamburg and in 1888 to the Royal Opera in Berlin. As a composer he has earned reputation through choral and orchestral works, church music, and many lofty and spirited songs.—His wife, ROSA (1849—), born (Hasselbeck) at Velburg, Upper Palatinate, is a highly gifted dramatic singer, widely known as an interpreter of Wagner rôles. She appeared first in Munich, was subsequently connected with the stages at Treves, Königsberg, and Danzig, then at Leipzig, where she was married, and went with her husband to Hamburg and Berlin. Since 1898 she confined herself to starring engagements, notably for the Festspiele at Bayreuth, her impersonations of Isolde, Sieglinde, and Brunhilda being most highly commended.

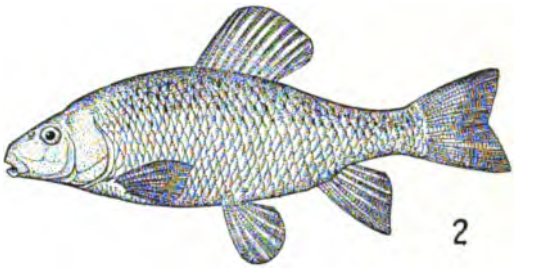
SUCHET, sü'shâ', LOUIS GABRIEL, Duke of Albufera (1770-1826). A marshal of France, born at Lyons, March 2, 1770. He began his military career by volunteering as a private in the Lyons National Guard in 1792. His intelligence and valor at Lodi, Rivoli, Castiglione, Arcole, and in battles of less note, laid the foundation of his military reputation. In 1797 he became a general of brigade and in the following year general of division, serving in Switzerland and Italy. In 1800 he kept Melas in check, with a force far inferior to that of the Austrian commander, and prevented the invasion of France. He took part in the campaigns against Austria (1805) and Prussia (1806-07), was sent to Spain in 1808, and in 1809 was appointed to the command of the French army in Aragon. He won the battle of Belchite (June 16-18, 1809) and took Lérida (May, 1810), and Tortosa and Tarragona (1811), earning the marshal's baton for his achievements. In January, 1812, he conquered Valencia, and was made Duke of Albufera. The misfortunes of the other French armies in Spain compelled Suchet gradually to relinquish his conquests. He was created a peer by Louis XVIII., but took service under Napoleon after his return from Elba, and was charged with the defense of the southwestern frontier. Deprived of his peerage at the Second Restoration, he did not return to Court till 1819. He died at the Château of Saint-Joseph, near Marseilles, January 3, 1826. Consult Suchet, *Mémoires sur ses campagnes en Espagne* (Paris, 1829-34).

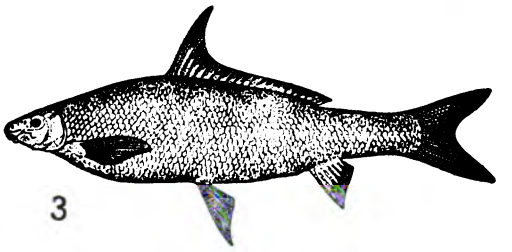
SUCHIER, su'shyâ', HERMANN (1848—). A German Romance philologist, born at Karlshafen, Hesse-Nassau, of a family of French refugees. After studying at Marburg and Leipzig, he qualified at Marburg in 1873 and became successively professor at Zurich (1875), Münster, and Halle (1876). Of his publications in the field of French and Provençal philology may be noted: "Ueber die französische Sprache," in Gröber's *Grundriss der romanischen Philologie* (1888), also separate in French, *Le Français et le Provençal* (1891); *Altfranzösische Grammatik* (1893). He edited *Aucassin et Nicolette* (4th ed., 1899); *Bibliotheca Normannica* (1879); *Denkmäler provençalischer Litteratur und Sprache* (1883); *Œuvres poétiques de Philippe de Remi* (1884-85). In collaboration with Birch-Hirschfeld he wrote a *Geschichte der französischen Litteratur* (1900).

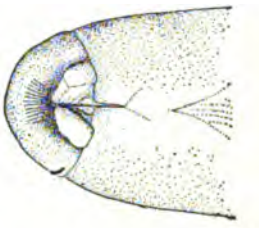
SU-CHOW, sōō'chou', or **SOO-CHOW.** A *fu* or departmental city of the Province of Kiang-su,

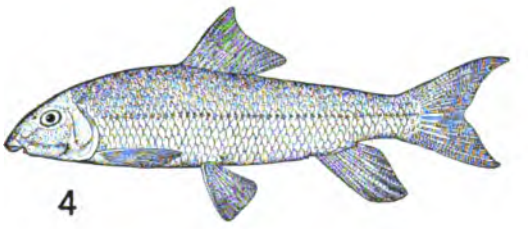
SUCKERS

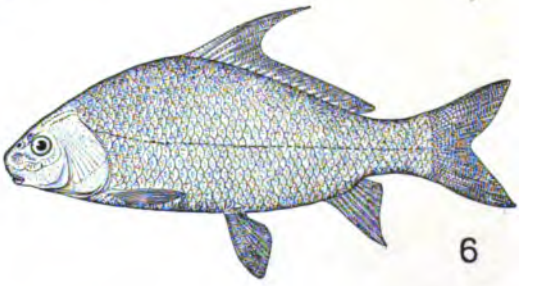


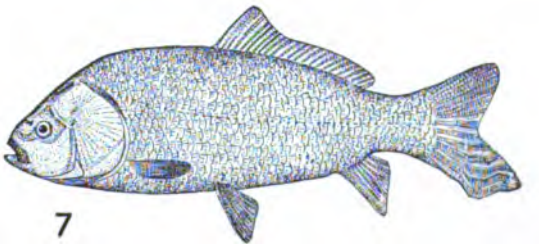












1. RAZOR-BACKED SUCKER (*Xyrauchen cypho*).
2. CHUB SUCKER (*Erimyzon sucetta*).
3. MISSOURI SUCKER (*Cycleptus elongatus*).
7. BUFFALO

CUTLIPS (*Lagochile lacera*).
LIPS (No. 4).
(*Carpiodes cyprinus*).

China (Map: China, F 5); the residence of the provincial judge, the *chih-fu* or head of the department of the same name, and three district magistrates. It is situated on the Grand Canal, 80 miles west of Shanghai and 40 south of the Yang-tse. Its walls are 30 feet high, are pierced with 6 gates and 5 water-gates, and have a circuit of 12 miles. Outside of five of these gates are large suburbs, the largest and busiest being that outside of the northwest gate or Ch'ang-mên, within which is the chief business quarter of the city. Su-chow was founded about B.C. 500. It is a great commercial and manufacturing place, and is the centre of a great silk and satin industry in which thousands of looms are employed. It has also steam factories, two cotton mills, a flour mill, and thousands of workers in wood, gold, silver, brass, iron, tin, ivory, glass, lacquer, etc. It has long been noted for its wealth and luxury, and the gayety and elegance of its life and manners. In 1860 it was captured by the Taiping rebels and reduced almost to a heap of ruins. Among the buildings that escaped destruction is a pagoda 240 feet in height, said to be the highest in China. There are several others both within and without the city. The streets are not wide enough for much traffic, but a great network of canals ramifies through the city and the surrounding country and supplies easy means of transportation. Population, estimated at about 500,000.

In September, 1896, Su-chow was opened by treaty as a place of foreign residence and trade.

SUCKER (from *suck*, AS. *sūcan*, *sūgan*, OHG. *sūgan*, Ger. *saugen*, to suck; connected with OIr. *sugim*, Lett. *sūkt*, OChurch Slav. *sūstai*, Lat. *sugere*, to suck). A fresh-water fish of the catfish family and belonging to the genus Catostomus and its allies, characterized by having the mouth inferior, and the lips thick and fleshy, the lower usually deeply divided. There are many species, all of moderate size and natives of the United States, except one in Siberia. Their general form is shown in the Plate of SUCKERS; in color they are dull, and with little tendency to markings, except that breeding males in most species acquire a rosy or orange lateral band. They inhabit rivers, lakes, and bayous, and obtain their food mostly by sucking up the mud and soft organic matter from the bottom. The most widely distributed species is the Northern or red sucker (*Catostomus catostomus*); the best known one, the common white sucker (*Catostomus Commersonii*), which is excessively abundant from Massachusetts to Kansas.

SUCKER STATE. Illinois. See STATES, POPULAR NAMES OF.

SUCKLING, Sir JOHN (1609-42). An English poet, born at Whitton, in Middlesex, where he was baptized February 10, 1609. His father, Sir John Suckling (knighted 1616), held high posts at the courts of King James and King Charles. In 1623 the poet entered Trinity College, Cambridge, but left without a degree. On the death of his father in 1627 he became heir to large estates. In 1628 he set out on extensive travels on the Continent and is said to have fought under Gustavus Adolphus. Returning to England in 1632, he soon became noted for wit, gallantry, and prodigality. Suckling took an active part in the plot to rescue Strafford from the Tower, and found it convenient to flee to the Continent. Impoverished and in despair, he seems to have poisoned himself in Paris in the summer of 1642. He was buried, says Aubrey, in the cemetery attached to the Protestant Church in Paris. Suckling's writings, few of which were published during his lifetime, were collected under the title *Fragmenta Aurea* (1646). The volume contains three plays, *Aglaura*, *The Goblins*, and *Brennoralt; Letters to Divers Eminent Personages;* a Socinian tract called *An Account of Religion by Reason;* and *Poems*. In a later edition (1658) appeared an unfinished tragedy, *The Sad One*. The fame of Suckling rests wholly upon his lyrics, inimitable for grace and gayety. Among the most beautiful are "Upon My Lord Brohall's Wedding," and the songs beginning "Why so pale and wan, fond lover?" and "I prithee send me back my heart." Consult *Selections*, with a memoir, by A. I. Suckling (1836; revised and enlarged by W. C. Hazlitt, London, 1874), and see the articles on the group of Cavalier or Court poets to which Suckling belongs: THOMAS CAREW; ROBERT HERRICK; and RICHARD LOVELACE.

SUCRE, sōō'krā. A department of Bolivia. See CHUQUISACA.

SUCRE. The official capital of the Republic of Bolivia, known also as Chuquisaca (Map: Bolivia, D 7). It is 8840 feet above the sea on a plateau of the Eastern Cordillera of the Andes, to the left of the upper valley of the Cachimayo, a branch of the Pilcomayo, and is 250 miles southeast of La Paz. It has the Supreme Tribunal of Justice. It contains the oldest university of South America, a fine cathedral, and the President's palace. Its industries are mining and agriculture, the latter being the more important; its population is about 26,000. Sucre was founded in 1536. The Spaniards first gave it the name La Plata, from the rich silver mines of the vicinity. Later as the seat of the *audiencia* of Charcas it served as the capital of Upper Peru. The city was the scene of the declaration of Bolivian independence from Spain, August 6, 1825, and later took the name of Sucre in honor of the Republic's first President. Though it has continued to be the official capital of Bolivia, the sessions of Congress, during the civil wars, have often been held at La Paz.

SUCRE, ANTONIO JOSÉ DE (1793-1830). A Venezuelan general, born at Cumaná, and educated at Caracas. He served in the various wars of independence in South America, from 1811 to 1824, was one of Bolivar's most valuable officers, and gained the victories of Pichincha (May 24, 1822), which freed Ecuador, and Ayacicho (December 9, 1824), which drove the Spaniards from Peru. He was elected first President of Bolivia in 1826, but resigned in 1828 to prevent a war with Peru, his resignation having been demanded by that country. The ex-President retired to Colombia, then at war with Peru, and gained for the Colombians the battle of Girón (February 26, 1829), which ended the war. He was elected President of the first Congress of the Republic of Colombia, and sent as commissioner to Venezuela. Upon his return from the Congress he was assassinated, it is supposed by political enemies, June 4, 1830.

SUCZAWA, sōō-chä'vä. A town of Bukowina, Austria, on the right bank of the Suczawa, 47 miles south of Czernowitz (Map: Austria, K 3).

The chief manufactures are linens, cottons, and fine leather goods; there are breweries, petroleum refineries, and potteries. The population, in 1900, was 10,946, of whom four-fifths were Germans.

SUDAMINA. See MILIARIA.

SUDAN, sōō-dän', or **SOUDAN.** A term now designating the vast region in Northern Africa lying between the Atlantic and the Red Sea, and between the Sahara Desert, on the north, and the Gulf of Guinea and the watersheds between Lake Chad and the Congo and between the Nile and the Congo, on the south. The northern line is about latitude 18° N., the southern about 4° N. The Sudan has been known as the 'Black Zone'—the home of the true negro race. The term is of somewhat confused signification both geographically and ethnically. Except Portuguese Guinea, Togo, and Kamerun, which belong to Germany, and the independent Liberia, all of the region of the Sudan is now virtually divided up between Great Britain and France. To Great Britain belong Gambia, Sierra Leone, the Gold Coast, Lagos, and Nigeria (both Northern and Southern); the government of the Egyptian Sudan (q.v.) is shared by England and Egypt; and Darfur is within the British sphere of influence. Under French control are Senegal, French Guinea, the Ivory Coast, Dahomey, French Congo, Bagirmi, and Wadai. The French Sudan (q.v.) was formerly the name of the territory in Western Africa lying between longitude 12° W. and Lake Chad and between the Sahara on the north and the countries (including Nigeria) along the north coast of the Gulf of Guinea. By the French decree of October 17, 1899, this region—generally known as West Sudan—was divided up. The western portion fell to Senegal, French Guinea, the Ivory Coast, and Dahomey. The remainder was formed into the three military territories of French Sudan (q.v.), the third of which reaches to Wadai on the extreme east. All the above French possessions, except French Congo, Bagirmi, and Wadai, are under a French Governor-General, whose seat is at Saint-Louis, Senegal. The third military territory above referred to connects on the southeast with French Congo, and thus forms the link uniting all the French possessions in Africa. This Governor-Generalship embraces also practically all of the Sahara (q.v.) in accordance with the French decree above named; for Great Britain has recognized the claims of France to all the region west of the Nile basin, thus embracing substantially all of the Sahara Desert (including the Libyan Desert).

For particulars as to topography, climate, commerce, races, etc., see articles on the different countries mentioned.

ETHNOLOGY. Within this broadest belt of Africa lying south of the Sahara, the following races and peoples are to be discriminated:

(1) *Semites*, consisting of Arabs, who under many names live in Kanem and Bornu about Lake Chad and eastward to Khartum and Kordofan.

(2) *Hamites*, whose main divisions are the Tibus, in many subdivisions, about Lake Chad; the Tuaregs, within the Niger bend and on the left bank of the Senegal; and the Fulah, Futa-Toro, and Futa-Jallon, scattered from Senegambia to Darfur and south to Adamawa.

(3) *Negroes*, who are divided into several groups. The west coast Negroes, including the Wolof, Serer, Sarakole, Toucouleur, Mandingo, Felup, and innumerable other tribes from the Senegal River to Sierra Leone; the Sierra Leone Negroes, comprising the Temne family and a multitude of pagan tribes; the Liberian Negroes, or Colonials, Kru, and many pagan tribes; the Ivory Coast Negroes, from Cape Palmas eastward, akin to the Kru; the Gold Coast Negroes, composed of the Tshi group, including the Fanti, Ashanti, and others, and the Ga groups, all pagans; the Slave Coast Negroes, making up the Ewe group, including the Dahomans (see DAHOMEY), and the Yoruba group; Niger Basin Negroes, including the Bambarra, Sonrhay, and Hausa (see HAUSA STATES); the Benue Negroes, composed of Moslem and pagan tribes in the region of the Benue River; the Lower Niger Negroes, or the Ibos (Niger delta), the Igbara (above the Benue confluence), and a multitude of pagan and Moslem tribes; the Chad Basin Negroes, comprising the Kanuris, the Baghirmi, the Mosgu, and many thousands of others chiefly pagan and mixed with Semites and Hamites; the Wadai Negroes, including the Maba and many other tribes all of more or less mixed blood, with a large percentage of Moslems; the Darfur and Kordofan Negroes, or Furs (Moslems), and Nuba (pagans); the Upper Nile Negroes, extending from Lake Victoria northward, and including the Madi, the Mittu, and a host of others, nearly all pagan; the Welle Negroes, comprising the Mombottu, the Momfu, the Niam Niam, the Akka, and a number of other tribes.

HISTORY. THE EGYPTIAN SUDAN. The Sudan has been apportioned by the events of the last few years into British and French spheres of influence. The Egyptian Sudan, now under British control, is practically coincident with the ancient Nubia (q.v.). It embraces the modern Egyptian mudirias, or provinces, of Khartum, Dongola, Berber, Kassala, Sennar, and Kordofan; and the muhafzas, or administrative districts, of Wadi Halfa, Suakim, and Fashoda. (See EGYPTIAN SUDAN.) The Eastern Sudan was brought under Egyptian control by Mehemet Ali (q.v.) in 1820-22 and so remained until in 1870 Ismail Pasha found it necessary to ask for assistance in restoring the waning authority of the Khedival government in the interior. The Englishman Sir Samuel Baker was made Governor-General of the Sudanese provinces and began their reduction and the suppression of the slave trade. He established his capital at Gondokoro, which he renamed Ismailia. Supposing that his work was accomplished, Baker returned to England. After his departure the slave trade was immediately revived and the administration of the provinces was intrusted to Charles George Gordon (q.v.), who with an able staff began the organization and development of this rich but little known region. Gordon continued his work in the face of all manner of discouragements and difficulties until his recall in 1879 upon the deposition of Ismail, and, though Gordon's organization was continued under his successor, Rauf Pasha,

there was a gradual reversion to earlier conditions. In 1882 the Sudanese tribesmen, for a long time restless under the greed and misgovernment of the Egyptian officials, took advantage of the difficulties in Lower Egypt and revolted. This, like the rising under Arabi Pasha (q.v.), with which it coincided in point of time, was primarily a revolt against foreign influence, but, unlike the latter, which was a political movement, it had its immediate origin in religious fanaticism. The incitement came from one of the alleged messiahs, known as mahdis (see MAHDI), who have been so common in Mohammedan countries. This man, Mohammed Ahmed, had some political genius and united the tribes in great numbers under his banner. For fifteen years he and his successor held the country under a religious and military tyranny. England had become so deeply involved in Egyptian affairs that she was compelled to take part in this struggle for the control of the Upper Nile country. A force of 11,000 English and Egyptian troops was dispatched to the Sudan under Hicks Pasha. This force was annihilated in a battle with the tribesmen at El-Obeid (November 3-4, 1883). England then determined to abandon the Sudan, but several posts were held by British garrisons and it was necessary to withdraw these troops. For this difficult task and for the settlement of the troubled affairs of the country, Gordon, because of his former success and his knowledge of the tribesmen, was given a new commission as Governor-General, and on February 18, 1884, he arrived at Khartum. In the meanwhile Osman Digna (q.v.) was making his power felt in the vicinity of Suakim, which became the scene of bloody fighting, Osman Digna being finally defeated (February-March, 1884). Gordon was surrounded at Khartum by the Mahdi's forces and cut off from all of his communications. After many delays, in part due to the fatal hesitation of the Gladstone Government, a relief force was sent out under Lord Wolseley, which after severe fighting arrived at Khartum, January 28, 1885. Two days before the city had been captured and Gordon killed. The English then retired and until 1894 gave up the attempt to reconquer the revolted provinces; but the growing British interest in East and Central Africa made it inevitable that England should seek to control a position of so great strategic importance. Upon the death of the Mahdi in 1885 his power passed to his chief lieutenant, the Khalifah Abdallah. In the interval of peace the Egyptian Army was reorganized and brought to an admirable state of discipline under its English officers, and in 1894, under the Sirdar, Sir Herbert Kitchener (q.v.), the struggle for the possession of the Sudan was resumed. This movement was stimulated by the threatened movement of Osman Digna (q.v.), the ablest Dervish leader, upon the Italian post at Kassala, where a victory might throw the Dervishes again upon the Egyptian frontier. After slow and patient preparation the advance up the Nile was made and Dongola was captured, September 23, 1896. Pushing forward his railway across the desert at the rate of about two miles a day, General Kitchener advanced steadily, always maintaining communication with his base on the Nile. The Khalifah was gradually hemmed in and on September 2, 1898, at Omdurman, opposite Khartum, he was defeated, his army annihilated, and his power completely broken. He himself was killed near Gedid in November, 1899.

The French had sent out a tentative expedition under Major Marchand (q.v.) to Fashoda, with a view to entering a wedge of French influence in the Eastern Sudan, but the French were themselves threatened by the tribesmen and were rescued by General Kitchener a few days after the victory at Omdurman. The aggressive attitude of England forced France to enter a diplomatic disclaimer. This led to the recognition by France in the supplementary treaty of 1899 of the English sphere of influence in the Sudan from Darfur and the Bahr-el-Ghazal eastward. By the Anglo-Egyptian convention signed January 19, 1899, the government of the Sudanese provinces was to be intrusted to a Governor-General appointed by the Egyptian Government with the approval of the British Government, the slave trade was prohibited, as well as the importation of arms and ammunition, and the British and Egyptian flags were to be used conjointly. The first Governor-General was General Kitchener. When he was called to South Africa, Col. Sir Reginald Wingate, his successor as Sirdar of the Egyptian Army, succeeded to the post.

FRENCH SUDAN. French exploration of the Sudan began in 1860, when Maze and Quintin penetrated east of Senegal as far as Segu Sikoro, which was again visited by Soleillet in 1878. The next year Bafoulabé was founded and a railway survey begun. The conquest of the country was begun in 1880 and pushed for fifteen years. Forts were erected, telegraph lines constructed, and acknowledgments of the French protectorate were gradually obtained from the native rulers. In 1894 Timbuktu was taken. On August 5, 1890, an Anglo-French agreement laid down the southern line of the French Sudan from Say on the Niger to Barrawa on Lake Chad. A further convention delimiting the French territory on the side of British Nigeria was framed June 14, 1898.

BIBLIOGRAPHY. Mardon, *Geography of Egypt and the Anglo-Egyptian Sudan* (London, 1902); Alfors and Sword, *The Egyptian Sudan, Its Loss and Recovery* (ib., 1898); Burleigh, *Sirdar and Khalifa* (ib., 1898); id., *The Khartum Campaign, 1898* (ib., 1899); Churchill, *The River War* (ib., 1898); Steevens, *With Kitchener to Khartum* (Edinburgh, 1898); Wingate, *Mahdiism and the Sudan, 1881-90* (London, 1891); Schweinfurth, *The Heart of Africa* (New York, 1874); Bois, *Senegal and Soudan* (Paris, 1886); Gaffarel, *Le Sénégal et le Soudan français* (ib., 1890); Junker, *Travels in Africa During 1875-86*, translated by Keane (London, 1890-92); Parke, *My Personal Experiences in Equatorial Africa* (New York, 1891); Gessi, *Seven Years in the Soudan* (London, 1892); Stanley, *In Darkest Africa* (ib., 1893); Robinson, *Hausaland; or Fifteen Hundred Miles Through the Central Soudan* (ib., 1896).

SUDERMANN, zōō'dĕr-män, HERMANN (1857—). A German dramatist and novelist, born at Matzicken, East Prussia, September 30, 1857. He studied history, philology, and literature at Königsberg and Berlin, and after some obscure years as tutor and journalist he won European and assured literary position by a drama [illegible] (1888), and the novel Frau

Sorge (1888; trans. as *Dame Care*, 1892). He followed these up with the novel *Der Katzensteg* (1889; trans. as *Regina*, 1898); the stories *Im Zwielicht* and a sensational drama, *Sodoms Ende* (1890); the humorous novel *Iolanthes Hochzeit* (1893); and his greatest drama, *Heimat* (1893; trans. as *Magda*, 1895); a fine novel of moral psychology, *Es war* (1894); an inferior drama, *Die Schmetterlingsschlacht* (1894); and *Das Glück im Winkel* (1896), a strong but unpleasant play. Then came three one-act dramatic scenes in verse collected under the appropriate title *Morituri* (1896); *Johannes* (1897), a realistic dramatic presentation of the story of John the Baptist; *Die drei Reiherfedern* (1898), an ethical and literary mystery in dramatic form. *Es lebe das Leben* (1902, translated *The Joy of Living*, 1902), is a powerful drama of the struggle between soul affinity and marital obligation. His work since 1894 shows failing power and has been much interrupted by sickness, but that for the six years preceding is, with the dramas of Hauptmann, the most significant in contemporary Germany, powerful in conception, admirable in technique, virile in its grasp of humanity in the more sombre aspects, and with occasional touches of delicate humor, though Sudermann is more skilled with the sterner weapons of satire. *Frau Sorge* is a pathetic Odyssey of duty with some romantic aberrations; *Katzensteg* is a declaration of 'naturalism;' *Iolanthes Hochzeit* breathes the serener realism of common life; *Es war* is a protest against the fruitlessness of brooding repentance. The dramas *Die Ehre*, *Sodoms Ende*, and *Heimat* are all social satires and militant democratic protests. By comparison the later dramas are increasingly out of touch with modern life. In *Die drei Reiherfedern* the evolution has become complete transformation. To some it seems a deepening, to others a sinking of his dramatic power. All Sudermann's greater works are translated into English. Consult: Brandes, *Menschen und Werke* (2d ed., Frankfort, 1895); Litzmann, *Das deutsche Drama* (Hamburg, 1896).

SUDETIC MOUNTAINS (Ger. *Sudeten*). A mountain system on the southwestern border of Silesia, Germany, which some of its ranges separate from Bohemia and Moravia (Map: Germany, G 3). It extends in a southeast direction from the water gap of the Elbe to the Moravian depression through which the Oder passes, and which separates the system from the Carpathian Mountains. The system is composed of a number of short, broken, more or less isolated and partly parallel ranges, consisting chiefly of crystalline slate, serpentine, and granite. These ranges inclose a number of large valleys. The best defined as well as the highest of the ranges, the Riesengebirge, lies near the centre of the system, and attains an average altitude of about 4000 feet, culminating in the Schneekoppe, 5266 feet above the sea. The higher ridges have an alpine flora, appearing above the large pine forests which cover the slopes. Many of the slopes afford fine pasturage and the foothills are well cultivated. The Sudetic Mountains are very rich in minerals, especially iron, zinc, lead, and copper, and in the southeastern portion there are large coal deposits.

ŚUDRA, shōō'drȧ (Skt. *śūdra;* possibly connected with Lith. *szúdas*, excrement). The name of the fourth caste of the Hindus. See CASTE.

ŚŪDRAKA (shōō'drȧ-kȧ). A Hindu king to whom tradition attributes the Sanskrit drama *Mricchakatika* (q.v.), which was probably composed in reality by Dandin (q.v.). The name Sudraka is not found in the history of India, and he seems to have been altogether mythical. He was, however, the centre of a number of legends, according to which he reigned either at Vidiśa, or Śobhavati, or Vardhamana. He is said to have been saved from death by a Brahman who killed himself to insure the king a life of a hundred years. According to another tradition he was the minister of a king named Śatavahana, who gave him half of his kingdom. Śudraka was the hero of two poems, the *Śūdrakakathā* of Ramila and Soimla, and the *Śūdrakavadha*, as well as of a drama, the *Vikrāntaśūdraka*, all of which have been lost. Consult Lévi, *Théâtre Indien* (Paris, 1890).

SUE, sụ, MARIE JOSEPH (known as EUGÈNE) (1804-57). A French novelist, born in Paris. He studied medicine, became an army surgeon, was transferred to the navy, cruised in the East, resigned in 1829, having inherited wealth, and gave himself successively to literature, dissipation, and socialistic agitation, writing *feuilletons* that rivaled those of Dumas in rapidity of production, fertility of imagination, and carelessness of execution. In 1831 he published *Plick et Plock*, the success of which led to *Atar-Gull* (1831), a novel of the sea, suggested by his own experience and by the American novels of Cooper. It revealed a gift of story-telling, but showed a reckless mingling of tragic and comic, pathetic and grotesque. Debts and disgust at his equivocal social position turned him into a socialist and convert to the propagandism of Fourier and Proudhon. His work in this spirit consists of long novels printed in cheap newspapers, but winning such hold on the masses and so swaying democratic opinion that the Government actually sought to check or divert his activity. As a critic of that day said, Sue was entering on an unexplored path when he began the *Mystères de Paris* (1842). As the novelist of the people he was undertaking to paint the sufferings, the needs, the possibilities of the working class with the intent of influencing their political action, and in doing this he won for the novel a new audience and a new interest. He entered on the task with an enthusiasm that fired his genius to the creation of types of character that still have power to horrify or charm. Both the *Mystères de Paris* and *Le Juif errant* (1844-45) were dramatized by Sue, and both have attained world-wide circulation. He wrote an *Histoire de la marine française* (1835-37) and two historical novels, *Latréaumont* (1837), and *Jean Cavalier* (1840). The later work of Sue is vast. He was elected to the Assembly in 1850, and was exiled in December, 1851. He died at Annecy in Savoy. Consult Mirecourt, *Eugène Sue* (Paris, 1858).

SUECA, swā'kȧ. A town of Spain, in the Province of Valencia, 23 miles south of the city of that name, on the left bank of the Júcar (Map: Spain, E 3). It is in a fertile valley. Population, in 1900, 14,422.

SUERA, swā'rȧ. A seaport of Morocco. See MOGADOR.

SUESS, sụs, EDUARD (1831—). An Austrian geologist. He was born in London, studied the natural sciences at Prague and Vienna, and from 1857 to 1891 was professor of geology at the University of Vienna. From 1873 to 1896 he was a member of the Austrian Lower House. In 1897 he became president of the Imperial Academy of Sciences. His more important contributions to geology, which have opened up a new path in geological inquiry, and laid the foundation for what is now frequently termed the 'new geology,' deal with the construction and relations of continents and mountain ranges, the dynamics of volcanoes and earthquakes, and the general movements of the earth's crust. His *Antlitz der Erde* (begun in 1885 and not yet completed) is a masterful exposition of the relations of the dominant features of the earth's surface, and the first luminous effort to correlate their multiform aspects and give to them their true geographic expression. His other works include: *Böhmische Graptolichten* (1852); *Brachiopoden der Kössener Schichten* (1854); *Brachiopoden der Kallstätter Schichten* (1855); *Ueber den Löss* (1860); *Die tertiären Landfaunen Mittelitaliens* (1871); *Die Entstehung der Alpen* (1875).

SUETONIUS TRANQUILLUS, GAIUS. A Roman historian, born probably a few years after the death of Nero. Pliny procured him the dignity of military tribune, which, by Suetonius's desire, was transferred to another. He was afterwards secretary of the Emperor Hadrian, whose favor he had secured. The date of his death is unknown, but it probably occurred about A.D. 160. All his works (among which, as we learn from Suidas, there were several on topics usually treated by grammarians) have been lost, except his Lives of the Cæsars, his Lives of Eminent Grammarians, and (in part only) his Lives of Eminent Rhetoricians. It is by the first of these works that he is most favorably known, containing information about the twelve Cæsars, from Julius Cæsar to Domitian, which is to be had nowhere else, and abounding with anecdotes which, while they too often prove the profligacy of his heroes, testify to the impartiality of their chronicler. The best editions are by Baumgarten-Crusius (Leipzig, 1816-18), Reifferscheid (ib., 1860), and Roth (ib., 1886). There are English translations of the Lives by Clark (London, 1732), and by Thomson and Forrester (ib., 1855).

SUEVI. The collective designation of a great number of Germanic peoples, as mentioned in Cæsar, *De Bello Gallico*, iv. 1. They occupied a district of indefinite extent on the eastern side of the Rhine, and may have been the same tribes as those subsequently known as Chatti, Longobardi, etc. Cæsar states that their territory comprised 100 cantons, and was densely wooded, that they had towns (*oppida*), but no strongholds, and that every year a part of the population left their homes to seek employment in war. The Suevi of whom Tacitus speaks (*Germania*, 38, etc.) seem to have dwelt north and east of the country of the Suevi of Cæsar, extending as far as the Elbe and the Baltic, which Tacitus calls the 'Suevic sea.' The peoples united under the rule of Maroboduus, the Marcomannic chief, were Suevic, and hence the Marcomanni and Quadi who figure in the reigns of Marcus Aurelius and Aurelian are often called Suevi. After the name had fallen into disuse as a collective designation, it reappeared in Ammianus Marcellinus, an historian of the third century A.D., as the name of a people occupying the same territory as the Suevi of Cæsar. We find them in alliance with the Burgundians, Alemanni, Alani, Vandals, etc. They are among the most notable of the barbaric peoples that broke up the Roman Empire in the northwest and west. Bursting through the passes of the Pyrenees (A.D. 409), they, along with the Vandals, overran and wasted Spain (q.v.). Those who remained at home in Germany seem to have spread during the fifth century east of the Neckar and the Raube Alb, and south as far as Switzerland. The mediæval Swabians were their direct descendants.

SUEZ, sōō-ĕz'. A town of Egypt, situated on the south coast of the Isthmus of Suez, at the northern extremity of the Gulf of that name, and near the southern terminus of the Suez Canal (Map: Egypt, F 3). It is built on a desert peninsula, and consists chiefly of unpretentious-looking houses. The European quarter, however, is regularly laid out, and contains the large warehouses of the Peninsular and Oriental Steamship Company. There are also a large English and a French hospital, and the town is supplied with water from a long distance through a fresh-water canal. To the south a large stone causeway, carrying a railroad, runs to the immense harbor of Port Ibrahim, at the entrance to the canal, 2 miles south of the town. Suez has railroad connection with Cairo and Ismailia, but its commerce is not very large, as only a small portion of the transit trade passing through the canal affects the town. Population, in 1882, 10,909; in 1897, 17,457. Previous to the discovery of the sea route to India around the Cape of Good Hope Suez was a flourishing emporium for the trade between Europe and the East. It subsequently fell into decay, and before the opening of the canal it was a wretched village of 1500 inhabitants.

SUEZ, GULF OF. One of the two arms in which the Red Sea terminates, and which inclose the Sinai Peninsula (Map: Egypt, F 3). It is the western and larger of the two, and its head is the extreme northern end of the Red Sea. It lies between the peninsula and the main portion of Egypt, and has an extreme length of 187 miles with a breadth of from 14 to 39 miles. It is artificially connected with the Mediterranean Sea by the Suez Canal.

SUEZ, ISTHMUS OF. The neck of land connecting Africa with Asia, and separating the Mediterranean from the Red Sea (Map: Africa, H 1). The shortest straight-line distance across it, between the site of the ancient Pelusium and the head of the Gulf of Suez, is 72 miles. The isthmus consists of a low, sandy, and stony desert, the lowest depressions being occupied by salt lakes and marshes, and it is almost wholly destitute of fresh water. A series of such depressions extends across the isthmus from the great coast lagoon in the north to the Gulf of Suez, and affords the route for the Suez Canal (q.v.).

SUEZ CANAL. A canal about 100 miles in length, which crosses the Isthmus of Suez and connects Port Said on the Mediterranean Sea with Port Thewfik on the Red Sea, by an artificial channel about 120 feet wide at the bottom, about twice as wide at the surface, and about 28 feet deep. In 1854 Ferdinand de Lesseps (q.v.) obtained permission from Said Pasha to form a company to construct a waterway from sea to sea without locks, and in 1855 an 'International Consultative Commission' selected from among the most celebrated civil engineers of Europe was appointed to report upon the scheme. The final report of this Commission was submitted to and accepted by the Viceroy in June, 1856. Its conclusions were in effect as follows: The system of indirect routes through the Delta of the Nile was rejected and a direct route through the isthmus from Suez to the Mediterranean was adopted. The dimensions of the channel were to be as follows: From the Red Sea to the Bitter Lakes, depth 26¼ feet, bottom width 210 feet, top width 320 feet; from the Bitter Lakes to the Mediterranean Sea, depth 26¼ feet, bottom width, 144 feet, top width 262 feet. At Port Said the plan of extending jetties directly seaward to protect the entrance was adopted. (See JETTY.) Basing his efforts on these conclusions, M. de Lesseps succeeded, in 1858, in forming a company, with a capital stock of £8,000,000, to build the canal.

TOPOGRAPHY. The construction of the canal was greatly facilitated by the existence along the route of four dried-up depressions which were formerly and have again become lakes of considerable area, namely, the two Bullah Lakes, the Great and Small Bitter Lakes, and Lake Timsah. (See Map of EGYPT.) These low-lying basins have an aggregate length of 27 miles. Excavation was required, however, through the Bullah Lakes, Lake Timsah, and the Small Bitter Lake, and also through a portion of the Great Bitter Lake. Consequently it was only for a length of eight miles of the Great Bitter Lake, where the natural depth exceeded that of the canal, that no excavation was necessary. The total distance from Port Said to Suez, Port Thewfik, is 88 nautical miles, or 100 English miles. The only serious obstacles to be overcome in the line of the canal were at El-Gisr, the summit of the work, situated between the Bullah Lakes and Lake Timsah, where the hills crossing the canal vary from 30 to 60 feet above sea-level over a length of 6 miles, and at the deep cutting of Serapeum, between Lake Timsah and the Great Bitter Lake. From Port Said to Kantara, a distance of 24 miles, the canal passes through Lake Manzaleh, a shallow lagoon which covers an area of nearly 1000 square miles. The soil encountered along the route was sand, sandy clay, and hard clay, with rare stretches of rock, and thus favorable to rapid and easy excavation. No serious engineering difficulties were presented by the harbor works at Port Said and Suez. In short, the canal works in general were of a very simple nature, but of vast magnitude, involving as originally proposed, the removal of 60,000,000 cubic meters of dry earth and 56,000,000 cubic meters of earth under water; and as they were situated in a country destitute of fresh water, a well-conceived organization was required to bring the colossal work to a successful issue.

PROGRESS OF THE WORK. Work on the canal was begun on April 25, 1859. The work progressed slowly at first, but the installation of a large fleet of dredges by means of which the dredged material carried by long and high projecting chutes was rapidly delivered on either bank of the canal at some distance from the slopes of the cuttings without the intervention of barges, and other mechanical appliances, had the effect of reducing by three-fourths the number of workmen needed to open the canal by the time originally estimated. More important than these, however, was the completion, in 1863, of a fresh-water canal and pipe line from Cairo by the way of Ismailia to Port Said. Financial difficulties were overcome, first, by decreasing the width of the bottom of the canal to 72 feet, and, second, by virtually increasing the capital of the company to £17,100,000. To compensate for the greatly reduced width of the canal, sidings were provided at every five or six miles between Port Said and Lake Timsah to allow vessels to bring up either for the purpose of passing each other or to moor for the night. In April, 1867, water from the Mediterranean was let into the marshy bed of Lake Timsah, and in March, 1869, it was allowed to flow into a near-by dry salt-incrusted basin of the Bitter Lakes. On November 17, 1869, the canal was opened to traffic with great pomp and ceremony. According to the expense account the canal had cost up to December 31, 1869, a sum of £16,632,953.

ENLARGEMENT OF THE CANAL. In 1883 it became evident that, owing to the great increase of traffic, a radical plan of improvement was demanded. In 1884, therefore, a second International Consultative Commission was appointed to consider the whole question and to report plans. This commission made its report in 1885, and shortly thereafter the enlargement works were begun according to the general plan recommended by the commission. The first stage of these enlargement works was completed in 1898; it consisted in an increase of the bottom width of the canal to 121½ feet, and of an increase of the navigable depth to 27 feet 10 inches. In addition to this uniform enlargement of section there were completed in 1899 nine new sidings, each 49 feet wide and 2460 feet long. In 1900 the average time of passage was 18 hours and 32 minutes for vessels navigating by night as well as day.

LIGHTING FOR NIGHT NAVIGATION. At the close of 1885 it was decided to make use of electric light in such a manner as to insure a safe passage by night through the canal, the company hoping in this way to diminish the traffic by day and thus to render the navigation less difficult until the full enlargement of the waterway was accomplished. After some experimenting with a system of landing marks, supplemented by Pintsch light buoys, it was decided that every vessel in motion during the night should itself be provided with the necessary apparatus to illuminate its passage through the canal. Accordingly it was arranged that every vessel passing by night should carry four lights, one astern, one on each side, and one ahead, to the last of which should be applied a powerful reflector capable of spreading light 4000 feet ahead of the vessel. The Mangin reflector is generally used. Men-of-war and large postal steamers carry their own apparatus. Smaller vessels

generally use portable apparatus which they hire upon entering and return upon leaving the canal. The effect of this system of lighting so as to permit night navigation has been virtually to double the carrying capacity of the canal.

TRAFFIC AND REVENUE. The toll charged for the passage of the canal was 10 francs per ton and 10 francs per passenger when the canal was first opened. Various changes were made in succeeding years, and in 1903 the toll was 8½ francs per net ton for loaded vessels, 7 francs for empty ships, and 10 francs per passenger. The accompanying table shows the traffic of the canal from 1869 to 1900, inclusive:

YEARS	Vessels	Gross tonnage	Net tonnage	Transit receipts
				Francs
1869	10	10,558	6,576	54,460
1870	486	654,915	436,609	5,159,327
1875	1,494	2,940,708	2,009,984	28,886,302
1880	2,026	4,344,520	3,057,422	39,840,484
1885	3,624	8,985,412	6,335,753	62,207,439
1890	3,389	9,749,129	6,890,094	66,984,000
1895	3,434	11,833,637	8,448,383	78,103,718
1900	3,441	13,699,238	9,738,157	90,623,608

In 1899, according to the United States Consular Reports, the tonnage passing the canal was 9,893,022, and the revenue was $17,510,142; in 1900 the corresponding figures were 9,738,152 tons and $17,480,356.

HISTORY. The plan of a water connection between the Mediterranean and the Red Sea goes back to early Egyptian history. Such a canal seems to have been constructed in the reigns of Seti I. and Rameses II. (about B.C. 1350-1300), extending from the Nile to Lake Timsah and thence to the Red Sea. When this had been choked up by the sands in the course of ages, a new canal was begun by Necho, a son of Psammetichus I. (about B.C. 600), between Bubastis on the Nile and the Red Sea, but was left unfinished till the time of Darius Hystaspis (B.C. 521-486), who completed the work. About the beginning of the Christian Era the canal was no longer navigable, but it was probably restored under Trajan. The last restoration was made in the seventh century by Amru, the Mohammedan conqueror of Egypt, who connected Cairo with the Red Sea. During Napoleon's invasion of Egypt (1798-99) the project of piercing the isthmus was carried to the extent of preliminary surveys being made, but, owing to a miscalculation on the part of the engineers which seemed greatly to enhance the difficulties of the work, the execution of the plan was delayed till the French were forced to abandon Egypt. An international commission of engineers made a preliminary survey in 1846 to ascertain the practicability of a level-water canal. The English engineer on the commission, George Stephenson, strongly opposed a canal and recommended to his Government a railroad from Cairo to Suez, and this was constructed by British capital in 1858. By the terms of the De Lesseps concession (see above) the canal was to be constructed without expense to Egypt, which was to receive 15 per cent. of the gross receipts for ninety-nine years, at the expiration of which period the canal was to revert to the Egyptian Government. When, however, De Lesseps found it impossible to enlist the large amount of capital necessary, he turned to Said Pasha, secured from him a large loan for preliminary work and promoting, and later a subscription for nearly half of the stock, which was about £17,000,000. Said was not able to pay his subscription and his warrants had to be cashed in London. The Egyptian Government had agreed to furnish labor at a nominal price, the fellaheen to be well treated and their health to be cared for. The violation of the latter condition on the part of the canal company aroused a protest in the name of humanity, especially from England, which had never looked with favor on the canal and suggested to the Sultan that the work be stopped. His approval of the concession, as suzerain, which had been provided for in the original contract with Egypt, had never been obtained. He now approved the concession, but decided that the fellaheen must not be forced to do the work. The company complained of the Egyptian Government's compliance with this order from Constantinople as a breach of contract, made heavy claims for damages, induced the Khedive to accept Napoleon III. as arbitrator, and on this and a later claim wrung from the exhausted resources of Egypt over eighty million francs. The direct and indirect cost of the canal to Egypt is estimated at about $85,000,000. In 1875 Ismail Pasha (q.v.) appealed to Europe for aid in his financial difficulties. Among other measures that were taken was the sale of his canal stock to England, 176,602 shares, for £4,000,000. This made England, which had originally opposed the canal project, the heaviest owner in it, and combined with the general financial assistance rendered to Egypt gave that power a direct interest in Egyptian affairs. A very short time sufficed to show that the canal was of the utmost value as the passageway between England and her Oriental possessions. England and France at first exercised together that tutelage over Egypt which the financial situation rendered necessary. Later events led England to assume this responsibility alone. The Suez Canal was the key to this political development, as it has become in part to the complicated situation in the near East. See EASTERN QUESTION; EGYPT.

SUFFOLK, sŭf'ok. A southeastern maritime county of England, bounded on the east by the North Sea, on the north by Norfolk, and on the south by Essex (Map: England, G 4). Area, 1489 square miles. Population, in 1891, 371,235; in 1901, 384,198. The surface is for the most part flat, falling away into marshes on the northwestern and northeastern borders. The tributaries of the Waveney and of the Stour, together with the river Lark, an affluent of the Great Ouse, and the Gipping, with its estuary, the Orwell, are the chief streams. The soil is of various kinds, some of which are very productive for the ordinary crops. Capital, Ipswich.

SUFFOLK. A town and the county-seat of Nansemond County, Va., 22 miles southwest of Norfolk; on the Nansemond River, and on the Norfolk and Western, the Seaboard Air Line, the Southern, the Atlantic Coast Line, and the Suffolk and Carolina railroads (Map: Virginia, H 5). It is an important railroad centre, and one of the largest peanut-cleaning markets in the State. There are car works, a stove foundry, various wood-working mills, iron works, hosiery mills, and brick plants. The surrounding region is fertile and is well adapted to farming. Population, in 1890, 3354; in 1900, 3827.

SUFFOLK, EARLS AND DUKES OF. Dignities held by several noted English families. The title Earl of Suffolk was conferred on ROBERT DE UFFORD (1298-1369), who held high office under Edward III. He was made admiral of the northern fleet in 1344, fought at Crécy and Poitiers and was repeatedly intrusted with diplomatic missions. He was succeeded by his son WILLIAM DE UFFORD, who was one of the most popular statesmen of the later part of Edward III.'s reign, took a share in the suppression of the peasant revolt of 1381, and died in 1382, leaving no male heirs. A new line of Suffolk was founded by MICHAEL DE LA POLE (1335?-89), who fought in the French wars, became in 1376 admiral of the northern fleet, negotiated the marriage of the young Richard II. with Anne of Bohemia, and in 1383 was made chancellor. By marriage he acquired extensive possessions in Suffolk and these were added to by royal grants. In 1385 he was created Earl of Suffolk. His rapid elevation and the great influence which he exercised over the King aroused the hostility of the nobles and in 1386 he was dismissed from office on the demand of Parliament, which proceeded to impeach him of treason and malfeasance. The King's favor could not protect him and in 1387 he fled the country. In his absence he was condemned to be hanged. He died at Paris. His son MICHAEL DE LA POLE (1361-1415) was restored to his father's dignities in 1397 and fell at Harfleur in 1415. He was followed by his eldest son, who was killed soon after at Agincourt, being succeeded by his younger brother WILLIAM DE LA POLE (1396-1450), best known of all that have borne the title. He served in the French wars under Henry V., the Duke of Bedford, and the Earl of Salisbury, upon whose death in 1428 he became head of the English forces in France. He failed to capture Orleans, which was relieved by Joan of Arc in 1429, and in the same year was taken prisoner. Ransomed at a heavy cost he took little part in military affairs, but for twenty years played a most important rôle in the government. As a member of the King's council he sought to bring about peace with France and was one of the English representatives at the abortive congress of Arras in 1435. The death of the Duke of Bedford in the same year left him one of the two most powerful men in the kingdom, his great rival being Humphrey Duke of Gloucester, uncle of the young Henry VI. In 1448 Suffolk was at the head of an embassy which arranged a truce with France and brought about the marriage of Henry VI. with Margaret of Anjou. This alliance gained him tremendous though temporary popularity. The government fell entirely into his hands and after the death of Gloucester in 1447 he was master in the kingdom. He became in rapid succession chamberlain, lord warden of the Cinque Ports, admiral, governor of Calais, and Duke of Suffolk. He was hated, however, by a large faction of the nobility, at whose head stood Richard, Duke of York. He lost his popularity owing to the surrender of Anjou and Maine, to which he had assented as one of the conditions of the King's marriage, and the feeling of hostility was intensified by the renewal of war with France in 1449, in the course of which Normandy was lost to the English. Popular opinion accused him also of having encompassed the death of the 'good Duke Humphrey.' In 1450 the Commons accused him of having betrayed the King to the French and brought articles of impeachment against him. The King whose favor he never lost senteneed Suffolk to five years' exile. On May 1, 1450, the Duke set sail for France, but the ship on which he embarked was intercepted by a royal man-of-war, Suffolk was compelled to go on board, and on the following day was taken into a small boat and beheaded. His body was cast upon the beach at Dover. The sanguinary deed was probably due to Richard of York, his mortal enemy.—JOHN DE LA POLE (1442-91) second Duke of Suffolk, only son of the preceding, regained the ducal title in 1455. He joined the York party, married a sister of Edward IV., and was in favor under the rulers of that family and under Henry VII. His eldest son John took part in Lambert Simnel's rebellion and fell at Stoke in 1487. He was attainted and the greater portion of the family estates was lost.—EDMUND DE LA POLE, a younger brother, received a part of the confiscated estates with the title of earl. He plotted to seize the throne with the aid of German troops but the plan miscarried and he fell into the hands of Henry VII., who, however, spared his life and sent him to the Tower. He was beheaded with his brother Richard in 1513, and left no male issue. The title Duke of Suffolk was subsequently borne by CHARLES BRANDON (died 1545), the favorite of Henry VIII. and husband of his sister Mary Tudor. He was succeeded by his two young sons, who died in 1551, on the same day.—HENRY GREY, third Marquis of Dorset, who had married a daughter of Charles Brandon, was next made Duke of Suffolk. He was the father of the unhappy Lady Jane Grey (q.v.). In 1553 he attempted to raise the north, was betrayed and beheaded. In 1603 THOMAS HOWARD, second son of Thomas, fourth Duke of Norfolk, was created Earl of Suffolk. His second son was created Earl of Berkshire in 1626 and in 1645 the two titles merged. The present bearer of the title is Henry, 19th Earl of Suffolk and Berkshire, born in 1877.

SUFFRAGAN (ML. *suffraganus, sufraganus*, from Lat. *suffragari*, to assist, to vote for, from *suffragium*, vote, originally probably a broken potsherd used in voting, from *suffringere, subfringere*, to break, from *sub*, under + *frangere*, to break). The name given to a bishop to express his relation, in a province, to the archbishop or metropolitan (q.v.). The name is also applied to coadjutor or assistant bishops, especially in the Church of England, where suffragan bishops are usually known by territorial titles, although they have no independent jurisdiction, and their local commission, given by the bishop of the diocese, terminates with his death. In the Roman Catholic Church similar assistant bishops are usually designated by the titles of extinct sees. See TITULAR BISHOPS.

SUFFRAGE (Lat. *suffragium*, vote). In a representative government, the act of a qualified voter in participating in the choice of government officials or in voting on laws or constitutions submitted to the electorate. There are two views as to the basis of suffrage. One holds that it is a privilege bestowed by the State upon such of its citizens as are capable of exercising it intelligently and for the public welfare. The other

view regards it as the natural right of all adult male citizens. This was the doctrine of the eighteenth-century philosophy, but has been rejected by most States, suffrage having been restricted by them on some of the following bases: ownership of property, payment of taxes, educational attainments, moral character, residence, religious profession, etc. An almost universal rule has been to exclude women, children, lunatics, idiots, convicted criminals, and aliens from the exercise of the suffrage, although there have been and are still exceptions.

In the American colonies the qualifications for suffrage varied greatly. Thus in Virginia the suffrage was restricted to 'freeholders and housekeepers;' in Massachusetts until 1664 it was restricted to church members; in the New Haven Colony it was the same; under the Massachusetts charter of 1692 it was restricted to freeholders of a certain amount of property. The religious tests were the first to be abolished, the last survival of the kind existing in South Carolina from 1778 to 1790. The right of each State to regulate the whole matter of the suffrage within its limits was recognized by the Federal Constitution and in hardly any two States were the requirements the same. During the early part of the nineteenth century a freehold qualification was required in Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Virginia, Maryland, North Carolina, and South Carolina, the amount ranging from £20 in New York to £60 in Massachusetts or from 25 acres of improved land in Virginia to 50 acres in Maryland and South Carolina. The payment of taxes alone was required in Pennsylvania, Delaware, and Georgia. During the first three decades of the nineteenth century the freehold requirement was abolished in nearly every State. Likewise the tax and ownership of personalty qualifications disappeared in most of the States, so that adult male suffrage became the general rule long before the outbreak of the Civil War. Free negroes were almost everywhere excluded.

A readjustment of the suffrage followed the Civil War. The Reconstruction Acts of 1867 conferred the right of suffrage on the freedmen. In all the States that had rebelled the negroes voted for the first time in 1867 in the elections for delegates to the reconstruction constitutional conventions, and in the following year on the question of adopting or rejecting the new constitutions. The States having once been readmitted to the Union, however, there was nothing to prevent them from withdrawing the right temporarily bestowed on the freedmen by Congress. The Fourteenth Amendment was intended to guard against such action on the part of the reconstructed States. On account of the difficulty of enforcing this amendment and the inadequacy of protection which it afforded the negro population, the reconstructionists advanced another step. In the first place, it was made a condition precedent to the readmission to the Union of the remaining unreconstructed States that they adopt constitutions with unamendable provisions guaranteeing the right of suffrage to negroes. At the same time the Fifteenth Amendment to the Federal Constitution was carried. But the Constitution confers the right of suffrage directly on no one, so that there are no United States voters. This is a prerogative of the individual States, and they may exclude any number of persons on other grounds than race or color, such as illiteracy, lack of citizenship, non-payment of taxes, etc., subject to the penalty of a reduction of representation in Congress.

The attainment of the twenty-first year of age is a qualification in every State. In a number of States women are allowed to vote in school elections and in several Western States they vote in State elections. The States may and generally do require voters to register within certain periods as a means of preventing frauds at the election, and this requirement indirectly excludes some. Residence within the State and district for a certain period previous to the election is an almost universal requirement. Educational tests have long existed in Massachusetts and Connecticut and have been introduced in a number of the Southern States, as a result of which the suffrage has been practically restricted to the whites in Mississippi, South Carolina, Louisiana, North Carolina, Alabama, and Virginia. In Louisiana and North Carolina the hereditary principle has also been introduced into the suffrage by the so-called 'grandfather' provision, which extends the right to vote to all adult males, without regard to intelligence or property, whose fathers or grandfathers possessed the right to vote on January 1, 1867. See the sections on government of the various countries and States for suffrage requirements.

SUFFREN DE SAINT-TROPÈZ, sụ'frăn' de săn trō'pā', PIERRE ANDRÉ DE (1726-88). A French naval hero, born at Saint-Cannat, near Lambesc. He was captured by Hawke in 1747 and after his exchange served for years with the Knights Hospitalers of Malta. From 1767 to 1771 he was again in the service of Malta. He was created Baillie in the order of the Knights, and was thereafter popularly known as the Baillie de Suffren. In 1772 he was commissioned captain in the French Navy. His most noteworthy services were rendered at the very close of his career, against the English, in the Indian Ocean, where he went in command of a squadron in 1781.

SUFIISM, sōō'fē-iz'm (from Ar. *sūfi*, mystic, clad in woolen, from *ṣūf*, wool; less plausibly derived from Gk. *σοφός*, *sophos*, wise). A coherent and organized system of Mohammedan mysticism.

Formerly Sufis were called *Urafa*, 'Gnostics' or 'theosophists.' To-day the most common name is Fakirs, or Dervishes, 'the poor,' but it must be understood that not all the poor in Persia, Egypt, or Turkey, the main homes of Suflism, are Dervishes, and that not all who are called or pretend to be Dervishes are Sufis. Aship Pasha (A.D. 1332) aptly said: "He who forsakes the world is a Dervish; he whom the world forsakes is a beggar."

The origin of Suflism is disputed. Some Sufis say that "The seeds of Suflism were sown in the time of Adam, germed in that of Nuh (Noah), budded in that of Ibrahim (Abraham), and began to develop in the time of Musa (Moses); reached maturity in Isa (Jesus), and produced pure wine in Mohammed." The word Suflism seems to have been first adopted by Abu Hashim, a Syrian (A.D. 780). Abul Said Abul Khair (about 820) is mentioned as founder, while Al-Ushairi (1073) states that the name was in common use about 815. Mythical tales give

the origin to Rabia al Adawiyya (752), a pious woman much spoken of in Sufiism. There seems to be historic evidence to prove that, in spite of Mohammed's precautions against mysticism, it originated with his favorite Ali. Those who maintain that Sufiism has its origin in the Vedanta (q.v.) place it, of course, much further back in time. Despite certain analogues, as the Persian *pir*, or sage, who corresponds to the *guru*, or teacher, of India, who initiates the neophyte into the esoteric mysteries, there are many fundamental differences between the two systems. Max Müller (Gifford Lectures of 1892), who only knew Sufiism second hand, derives it from the Vedanta and quotes Sir William Jones, who knew less than himself, on its principal doctrines. Both overlook the fundamental difference between the two. Sufiism is radically theistic and seldom swerves far from the Koran's intense belief in the One. The Vedanta is pantheistic with occasional theistic phraseology. The Sufiis are so strongly devoted to the Beloved (viz. God) that they look for Divinity everywhere and see Divinity anywhere; the superficial observer therefore easily comes to regard the Sufis' love pantheistically, and compares it with the Vedantic doctrine of absolute pantheism, summed up in the phrase *tat tvam asi*, 'That (the Universal Spirit) thou art.' It may, however, be admitted that later Sufiism shows forms of expression very similar to Vedanta, but also that no historic connection has been proved. It cannot be denied that the intellectual forms given to most of the Sufi doctrines in Persia are from foreign sources. Among historic forces which thus have molded Sufiism must be mentioned especially the Peripatetic philosophy, Neo-Platonism, and Zoroastrianism. The latter's formalism lent itself admirably to the Arabic intellect, and its doctrines of Light harmonized well with Sufiistic ascetic notions of the One. From Greek sources came dialectics and cosmological notions. The latter, though common in Sufiism, are alien to its primitive nature. The Greek influence is traceable to the philosophers Diogenes, Hermias, Eulalias, Priscian, Damascius, Isidore, and Simplicius, whom Justinian's intolerance drove into exile and who came to Nushirwan's court. The rich symbolism of Sufiism is either of Zoroastrian origin or indigenous, except its Alexander legends.

A few really great Sufis lived before the close of the second century of the Hejira (815). Among them and those immediately after are to be mentioned the Egyptian Dhun-Nun (859), who introduced the doctrine of ecstasy and mystical stages; Sirri Sagvati (867), who introduced unification; Junaid (910), who reduced Sufiism to writing; and Al-Nallaj, who became famous because he went about crying "I am the true One," for which he was put to death by torture (921). The *Fihrist* (987) represents him as a 'wily conjurer,' but Sufis consider his death the result of the workings of the occult law which brings death upon him who divulges divine secrets. Ghazali (q.v.) (d. 1111) and Jalal-ud-Din Rumi (q.v.) (d. 1273) were the two most famous Doctors in Sufiism. Omar Khayyam (d. 1123), reckoned by some as a Sufi, became known to the West through Fitz-Gerald's brilliant quatrains. Nizami (q.v.), Farid-ud-Din Attar (q.v.), Sadi (q.v.), Shamsi, Hafiz (q.v.), Anvari, Jami (q.v.), and Hatifi (q.v.) are sub-poets of renown. Jami (d. 1492) has been called the last Sufi, and with some justice. After him Sufiism slowly declined, but the nineteenth century saw its powerful revival in Turkey, though its Turkish representative names are almost unknown outside of Turkey. From Turkey and Egypt comes what may be called a Neo-Sufiism.

Primitive Sufiism is not doctrinal; it is an 'experience,' a 'feeling of God,' a 'mystery of godliness,' and does not primarily have anything to do with the notions of the intellect. Within two hundred years from its origin, however, it assumed doctrinal forms and it remained settled in them, though it never gave up the main characteristics of its beginning. The two chief doctrines of Sufiism are that of the One (*Ahad*) and that of 'the Way to the One' (*tariqat*). A Sufi first of all endeavors to realize that 'the One' is the only existence, that there is not only 'no god but God,' but that there is nothing but God. Next, he enters upon 'the journey to the rose-garden of Union.' The Sufi's belief is not pantheism in the Greek sense; he does not 'make everything God except God himself;' on the contrary, everything is naught except Divinity and it is Divinity that gives life to the dead Non-Being. The world is a phantasmagory, and the time will come when it shall pass away. God's reason for creating the world is found in this saying: "I was a Hidden Treasure and I wished to be known, so I created Creation that I might be known." The form of creation is not only truth and goodness, but also and essentially beauty. Sufis lay more stress upon the conception of Divinity as beauty than other mystics or religions.

The Sufi 'way to God' is similar to the well-known ideas on that subject among Western mystics. With the help of a guide, 'the traveler' ascends step by step to union with God or through awakening to regeneration and sanctification to union. The 'Way' is ascetic and full of occult practices, such as dances, silences, etc. All men may reach union. Every man is essentially both a *microtheos* and a *microcosmos*, or, as Shamsi of Tabriz sings in echo of numerous other Sufis: "My place is in the Placeless; my trace is in the Traceless." "I gazed into my own heart; there I saw One."

Sufi symbolism is a mystery and permeates the entire system of Sufiism. A symbol to a Sufi is not merely an object which stands for some other object or idea. For him every object has besides its own immediate signification also an ideal content, and it is this latter which is the real object of the Sufi's search. He finds it by means of Love (*isq*). The object is to the ecstatic a vivid, instantaneous revelation of the inscrutable. Objects are therefore 'veils,' not veils that hide, but 'veils' that reveal the One. All Sufi poetry is written with a double sense and the initiates can read five others besides. The now comparatively well-known ghazels of Hafiz, Sadi, Jami, and others abound in 'veils,' which the Occidental calls voluptuous and bacchanalian, but to the Sufi, Oriental as he is, they are not low or degraded, but simply descriptive of emotions or soul-life. As such they suggest to him deeper and more universal states of life. The *embrace* means discovery of the mysteries of Godhead; *wine* divine love and wisdom; a *tavern*

signifies what we call a church, because through the rapture of the wine and the wonder of the embrace the Sufi is filled with thoughts of the Beloved; a *red rose* is the beloved damsel and the *nightingale* is the lover; but the Beloved is always God.

There are many sects among the Sufis, but their differences are not strictly Sufiistic; they have arisen on external and unessential ground and are of little interest outside of Sufiism. Sufiism has exerted a powerful influence where Mohammedanism rules, especially in Arabia, Persia, and Egypt, and it is flourishing to-day in Turkey. India also has a large number of Sufis. Persian literature, more than any other, bears strong impress of it.

Consult: Jalal-ud-Din Rumi, *Mathnawi*, translated by Redhouse (London, 1881) and by Whinfield (ib., 1887); Farid-ud-Din Attar, *Mantiq at-Tair*, edited and translated by Garcin de Tassy (Paris, 1857-63); Mahmud Shabistari, *Gulšan-i-Rāz*, edited and translated by Whinfield (London, 1880); Tholuck, *Sufismus, sive Theosophia Persarum Pantheistica* (Berlin, 1821); id., *Blütensammlung aus der morgenländischen Mystik* (ib., 1825); Palmer, *Oriental Mysticism* (Cambridge, 1867); Brown, *The Dervishes, or Oriental Spiritualism* (London, 1868); Kremer, *Geschichte der herrschenden Ideen des Islam* (Leipzig, 1868); Ethé, "Der Çûfismus und seine drei Hauptvertreter in der persischen Poesie," in his *Morgenländische Studien* (ib., 1870); id., *Die mystische, didaktische und lyrische Poesie und das spätere Schrifttum der Perser* (Hamburg, 1888); id., "Neupersische Litteratur," in Geiger and Kuhn, *Grundriss der iranischen Philologie*, vol. ii. (Strassburg, 1896-97); Frank, *Beitrag zur Erkenntniss des Sufismus* (Leipzig, 1884); Pizzi, *Storia della Poesia persiana* (Turin, 1894); Gibbs, *History of Ottoman Poetry* (London, 1900); Browne, "Suflism," in *Religious Systems of the World* (ib., 1892); id., *Literary History of Persia* (ib., 1902); Bjerregaard, *Sufi Interpretations of the Quatrains of Omar Khayyam and FitzGerald* (New York, 1902); Macdonald, *Development of Muslim Theology, Jurisprudence and Constitutional Theory* (ib., 1903).

SUGAR, Manufacture of. Cane sugar is found in varying quantities in many plants, but sugar-cane (*Saccharum officinarum*), the sugar beet (*Beta vulgaris*), the sugar maple (*Acer saccharinum*), and various species of palms are its only commercially important sources. (See table.) At one time the United States Department of Agriculture experimented with sorghum (*Sorghum vulgare*), which seemed a promising source of cane sugar, but though several varieties containing from 10 to 20 per cent. of cane sugar were produced by seed selection, sorghum has never been more than locally important as a source of syrup, because great difficulty has been experienced in purifying the juice by any known process except that recommended by the department, a process which failed to attract investors, because alcohol, its principal factor, was subject to unfavorable revenue regulations. Several sorghum sugar factories were erected in Kansas and elsewhere about 1890, but development failed to pass the experimental stage. In 1889 the production of syrup was 24,235,219 gallons; in 1899, 16,972,783 gallons. (See Sorghum.) Experimentally, small quantities of cane sugar have been made from corn stalks and from melons. Owing to the presence of impurities, including saccharine substances other than cane sugar, raw sugars obtained from the various plants mentioned differ greatly in flavor, but, contrary to popular belief, the granulated or refined sugar derived from them differs not at all in sweetening power, since it consists of more than 99 per cent. of cane sugar and less than 1 per cent. of impurities including mineral matter, water, etc.

Cane Sugar. During the middle of the eighteenth century sugar-cane (q.v.) was introduced from Southern Europe into Louisiana, where the successful manufacture of sugar began during the last decade of that century. Formerly the juice obtained by more or less crude processes was evaporated in open pans ('kettles') and the molasses allowed to drain in barrels or other forms of coolers. The molasses, which was generally not reboiled, was superior in flavor and lighter in color than that remaining after the removal of several crops of crystals in a modern sugar factory, because of its smaller proportion of impurities.

The modern sugar factory is equipped with every apparatus suggested by scientific research. The juice of the cane is extracted in 'mills' consisting mainly of a system of rollers, often eight, arranged in three sets, through which the cane successively passes; first, two corrugated rolls, which break and prepare the cane for the heavier pressures applied by the succeeding sets of three rolls each. Between the second and third set the crushed cane is sprayed with water to facilitate the removal of sugar by the last set. This process removes from 50 to 85 per cent. of the sugar, according to the efficiency of the apparatus and the care with which it is operated. The crushed cane, called 'bagasse,' is used for fuel to furnish steam for the engines and pumps, and for the evaporation of the juice. The diffusion process, which is used in relatively few cane-sugar factories (see *Beet Sugar*), secures from 90 to 97 per cent. of the sugar, but the bagasse is unfit for fuel.

Aside from the minor details the process of manufacture is essentially the same in each case. For white sugar the juice is bleached with the fumes of burning sulphur. Lime is next added to neutralize it or to leave it faintly acid. In the subsequent heating the insoluble compounds of lime formed with the organic acids, the albuminous bodies, and other impurities rise to the surface and are removed by skimming or are precipitated. Since the quality of the sugar produced depends upon this process of clarification, considerable skill and care are bestowed upon it. The skimmings and stillings, which were formerly thrown away, are now filtered and saved, and in many factories the clear juice is often filtered also to remove all traces of insoluble matter.

In a new and efficient process adopted by many factories during the closing decade of the last century the limed juice is pumped continuously under high pressure through pipes surrounded by steam in a chamber ('superheater'); thence it passes through a cooler in which the same pipes, extended, are surrounded by the cold juice, which absorbs the surplus heat; and lastly it passes direct to the filter presses and settling

tanks. The process is continuous, accomplishes a high degree of purification, eliminates the labor of skimming, and is conducted in a closed apparatus.

The clarified juice containing from 10 to 18 per cent. of sugar is evaporated in multiple-effect vacuum evaporators, so called because the heating effect of the steam is utilized in vacuo as many times as there are pans in the series, steam being applied to the first pan and the vapor from the boiling juice to the second pan, and so on. From the last pan the vapor passes to a condenser, kept in constant vacuum by a continuously acting pump from which it flows away. The juice is pumped continuously through the pans, from the last of which it issues as a syrup containing about 50 per cent. of dissolved matter, including from 40 to 45 per cent. of sugar and 5 to 10 per cent. of impurities.

The syrup is then admitted to the 'strike' pan, a cylindrical cast-iron vessel provided with a vacuum pump, condenser, and several coils of copper tubing, to which steam may be admitted as desired. After further condensation, and when about one-fourth or one-third full of thick liquor, a fresh charge of cool syrup is admitted to cause the formation of minute sugar crystals ('grain'), the size of which can be controlled by the sugar-boiler, who regulates the boiling and the admission of fresh syrup so as to avoid the formation of new crystals, 'false grain.' The pan is emptied when it becomes filled with a dense mass of sugar crystals and syrup, 'massecuite,' which is conveyed to cylindrical metal vessels (centrifugal machines) with perforated walls and supported upon vertical shafts making from 1000 to 1500 revolutions a minute, the force throwing the syrup out through the walls. After the sugar is sprayed with water in which a little ultramarine or other harmless blue is added to correct the yellow tint, it is removed, and in the case of granulated sugar is dried in revolving drums (granulators) through which a current of warm air passes.

The molasses may be reboiled even three times for a 'second,' 'third,' and, if exceptionally pure, even a 'fourth' sugar. In these cases the massecuites, which contain no crystals when they leave the vacuum pan, are placed in 'sugar wagons,' tanks or metal boxes on wheels, for a few hours or days until crystals form. These second and third massecuites are frequently granulated in cylindrical 'crystallizers' while constantly stirred by revolving paddles, a method ('crystallization in movement') very generally adopted in modern beet-sugar factories.

BEET SUGAR. The manufacture of sugar from beet roots is a comparatively modern industry, having its inception in the investigations of Margraff, who in 1747 announced to the Berlin Academy of Sciences the analyses of several sugar-containing plants and predicted that the sugar beet (q.v.), being the most saccharine of the plants examined, would become the basis of a great industry. Nearly half a century later the problem was solved by a pupil of Margraff, Achard, who made a considerable quantity of beet sugar and announced his methods to the Berlin Academy of Sciences and to the Institute of France in 1797 and 1799, respectively. In Germany several beet-sugar factories were built within the next decade, and beginning with 1810 the industry, being stimulated by governmental aid in both countries, developed steadily. Astonishing improvements have been wrought in all branches. The percentage of sugar in the roots has been increased by selection from less than 7 per cent. at the beginning to an average in 1900 exceeding 14 per cent. and a maximum of more than 20 per cent.; the quality of the roots, the yield in tons per acre, and the improved processes of manufacture, which according to German statistics have reduced the weight of roots necessary to yield a pound of sugar from 18 pounds in 1837 to 7.02 pounds in 1899, have combined to make the industry profitable both in Europe, with its cheap labor, and in America, with its cheap lands.

In the manufacture of beet sugar the roots, already trimmed of leaves, are conveyed by water in little canals which extend through the bottoms of the V-shaped storage sheds, to the washing machine, where every particle of soil is removed by revolving brushes, the roots constantly progressing against a current of water toward the automatic weighing machine. After the weight has been recorded the roots go to the slicer. Here they are cut by corrugated knives into little V-shaped slices (cossettes) that drop into large iron tanks (cells), a series of 12 to 14 of which constitute a 'diffusion battery,' so called because the sugar is removed from the cossettes by water into which the sugar diffuses and which passes by a complicated system of pipes and valves through all the charged cells of the series, always from the longest filled cell, containing nearly exhausted cossettes, to the most recently filled, thus removing the largest possible quantity of sugar with the smallest quantity of water. One of the two uncharged cells is always being filled with fresh cossettes, the other being emptied, its cossettes containing less than 0.5 per cent. of sugar. Thus the process is continuous. The exhausted cossettes, which are used as stock food, are pressed to remove the excess of water and in some cases are dried to enhance their transporting and storing qualities.

NUMBER AND NOMINAL DAILY CAPACITY OF ESTABLISHMENTS IN 1900, 1899, AND 1889

[From the Twelfth Census]

STATES AND TERRITORIES	1900		1899		1889	
	Number of establishments	Nominal daily capacity in tons of beets	Number of establishments	Nominal daily capacity in tons of beets	Number of establishments	Nominal daily capacity in tons of beets
The United States	37*	22,310	31†	19,110	15	7,560
California	8	9,900	8†	9,900	5	4,400
Colorado	3	1,850	1	350	...	.....
Illinois	1	700	1	700	...	.....
Michigan	10	4,450	9	4,100	1	400
Minnesota	1	400	1	400	1	400
Nebraska	3	1,260	3	1,260	2	660
New Mexico	1	200	1	200	1	200
New York	3	1,000	2	400	2	400
Ohio	1	400	...	.....	...	.....
Oregon	1	350	1	350	1	350
Utah	4	1,450‡	3	1,100§	2	750
Washington	1	350	1	350	...	.....

* Includes two idle establishments. † Includes one idle establishment. ‡ Includes two auxiliary factories. § Includes one auxiliary factory at which no sugar is manufactured, but juice is extracted from the beets and pumped to a central factory for treatment. In November, 1903, other factories not mentioned in the above table were opened as follows: Michigan, 6; Utah, 2; Colorado, 1.

When the 'diffusion juice' leaves the battery the coarse particles of beet pulp are filtered out and from two to three pounds of lime added for each hundred pounds of beets used. Carbon dioxide is then forced through the liquid to precipitate the lime, together with certain impurities, after the removal of which the operations of liming, carbonizing, and filtering are repeated. If the final product is to be a white sugar, the clear juice is then bleached with sulphurous acid and again filtered. The subsequent treatment corresponds more or less closely with that employed in the factories using sugar-cane.

The United States Department of Agriculture and various experiment stations, by means of special appropriations, have assisted greatly in the development of the beet-sugar industry, which is established on a firm footing in America. Especially since 1897 (see table) has the growth been rapid, the capital invested being, in 1900, more than $25,000,000.

Maple Sugar. The manufacture of maple sugar is carried on more or less wherever sugar-maple trees are abundant, especially in the Northern Atlantic and Northern Central States, the leading producers, according to census returns, being Vermont and New York. In some cases the natural groves have been extended by planting. The busy period depends upon the locality and upon the season, sometimes commencing in February and sometimes lasting until the middle of May, the best flow of sap being when there is a diurnal alternation of thawing and slight freezing. See Maple.

The most popular modern method of tapping the trees is to bore a one-half inch hole not more than 1½ inches into the tree near the ground and to drive in a metal or wooden 'spile.' This conducts the sap and also serves to support the bucket, from which the sap is collected once or oftener each day and taken to a central plant to be boiled as soon after it arrives as possible, to avoid deterioration. All sorts of apparatus, including culinary utensils, are used for boiling the sap, but the most approved is a steam-heated evaporator, of which several makes are upon the market. In these the sap flows through a winding channel, emerging as the finished product, which, owing to its freedom from molasses, quickly solidifies if sufficiently evaporated.

On an average the sap contains about 3 per cent. of sugar, but occasionally exceeds 6 per cent., and at this average a yield of three pounds a year is considered profitable. Large trees and trees with rich sap often yield far more. The impurities of the sap as found in the sugar rarely exceed 5 per cent. There is, however, a small amount of insoluble material which is removed by skimming. Sometimes milk or white of egg is used as a clarifier, but usually no purifying agents are employed, reliance being placed on quick boiling and skimming to produce a light-colored and otherwise satisfactory sugar. The only impurity that causes trouble is the so-called 'sugar sand,' composed mainly of acid malate of lime, which collects on the bottom of the pans, interferes with the boiling, and makes the syrup cloudy and the sugar gritty.

Palm-Tree Sugar. The 'jaggery,' made principally in the East Indies from various species of palms (Phœnix, Borassus, Coccos, and other genera), is a dark-colored raw sugar made in a crude way by methods not essentially different from those described, except that a little lime is added as a clarifying agent. It plays a minor part in the world's markets.

Sugar Refining. Since all of the raw beet sugar and much of the raw cane sugar are unsuitable for table use, and since even the lighter grades of unrefined sugar are in small demand when compared to the snow-white granulated, loaf, and powdered sugars, the refining of raw sugars has become an important branch of the sugar industry. As usually conducted the process consists in dissolving the raw sugar in water, filtering through cloth to remove suspended matter, decolorizing by filtration through bone black (bone charcoal), and granulating in a vacuum pan as above described for sugar-cane sugar. For the manufacture of high-grade sugars with large, hard crystals, the process is sometimes modified, the raw sugar being washed with a dense syrup that removes the adhering molasses without perceptibly dissolving the crystals, which, when dissolved, form a syrup so light-colored as greatly to reduce or entirely obviate the necessity of filtering through bone black before the solution is placed in the strike pan for granulation.

Statistics of the Sugar Industry. The world's production of sugar in 1902-3, excepting that obtained from maple trees, is quoted below from the estimates given in Willett and Gray's *Weekly Statistical Sugar Trade Journal*, for September 17, 1903:

Sugar Crop of the World

Cane Sugar	Tons
Louisiana	300,000
Porto Rico	85,000
Hawaiian Islands	349,000
Cuba	975,000
West Indies (exports)	256,772
Mexico	115,000
Central America	23,500
British Guiana (exports)	105,000
Dutch Guiana	13,000
Venezuela	3,000
Peru	140,000
Argentina	130,000
Brazil	187,500
British India	15,000
Siam	7,000
Java	842,812
Philippine Islands (exports)	80,000
Queensland	76,626
New South Wales	21,000
Fiji Islands (exports)	35,500
Egypt	90,000
Mauritius	135,000
Réunion	35,000
Spain	28,000
Total cane-sugar production (Willett & Gray)	4,048,710
European beet-sugar production (Licht)	5,605,000
United States beet-sugar production (Willett & Gray)	195,463
Grand total cane and beet-sugar production	9,849,173

According to the reports of the Twelfth Census the maple sugar made on farms in the United States during the year 1899 amounted to 11,928,770 pounds, and the maple syrup to 2,056,611 gallons.

The annual per capita consumption of sugar in various countries is given in Willett, and Gray's *Weekly Statistical Sugar Trade Journal*, for March 14, 1901, as follows:

	Consumption per capita, 1899-1900
Germany	33.9 pounds
Austria	17.6 "
France	36.9 "
Russia	14.0 "
Holland	32.4 "
Belgium	23.3 "

	Consumption per capita, 1899-1900	
Denmark	54.8	pounds
Sweden and Norway	38.2	"
Italy	6.1	"
Rumania	7.8	"
Spain	10.6	"
Portugal	14.7	"
England	91.6	"
Bulgaria	7.7	"
Greece	7.2	"
Servia	6.2	"
Turkey	8.0	"
Switzerland	60.3	"
All Europe (Licht)	27.1	pounds
United States (W. and G.)	66.6	"

MOLASSES. Molasses is a viscid, usually dark-colored uncrystallizable liquid which seeps from the massecuite of sugar-cane or is thrown out by the centrifugal machine. The latter kind is reboiled as noted above; the former, however, being highly valued for its flavor and sweetness, is used as a food and for cooking. Since the introduction of the vacuum pan and the centrifugal machine it has become annually less plentiful in the market, the small quantities made being used in the regions where cane sugar is manufactured. Most of the so-called New Orleans molasses is composed of glucose flavored with some molasses from the sugar factories. Spurious maple syrup and sugar (see above) are made of cane sugar and glucose often flavored with an extract of hickory bark. No table molasses is made from the sugar beet, because the impurities cannot be removed by any known process. Processes have been patented for the manufacture of table syrup from beet roots, but they have hitherto been of little commercial importance.

Normally, cane molasses made by the open-kettle process contains about 30 per cent. cane sugar, 23 per cent. reducing sugar, and 47 per cent. water, ash, and impurities; that made in a large modern factory, 20 per cent. cane sugar, 25 per cent. reducing sugar, and 51 per cent. water, etc. Beet molasses contains 47 per cent. cane sugar, 5 per cent. reducing sugar, 20 per cent. water, 22 per cent. organic matter other than sugars, and 6 per cent. ash, etc. In sugar-manufacturing regions molasses is mixed with such bulky materials as cottonseed meal, cotton-seed hulls, etc., to be easily handled and fed to stock as a cheap source of carbohydrate food. In Europe several 'molasses feeds' have been proposed and one has been manufactured in commercial quantities from four parts bran, three parts beet-sugar molasses, and one part palm-nut cake. Another preparation composed of dried blood, peat, extracted beef pulp, and molasses has also been tried with favorable results.

MILK SUGAR OR LACTOSE. Sugar of milk, occurring only in the milk of mammals, is found to the extent of 4 or 5 per cent. in the milk of herbivorous animals. It is obtained by first curdling the milk with rennet or other agent to remove the casein and the fat, and then drawing off and evaporating the clear whey to a syrup in which, when cold and still, the milk sugar crystallizes and sinks. The deposit is recrystallized, after being dissolved in hot water, sometimes as hard cylindrical masses on strings. Sugar of milk is employed very largely for modifying cow's milk for the use of infants, in pharmacy, and as a food. See MILK; FOOD.

FOOD VALUE OF SUGAR. Since milk sugar and dextrose are used for human food to a far less extent than cane sugar, which they resemble somewhat closely in action, the statements in the following paragraphs are confined to cane sugar. In its food value sugar resembles starch, being considered a fat-former and a source of energy with a fuel value of 1860 calories a pound. Thus it is ranked as a more readily available heat-producer and force-conserver than starch (q.v.). From dietary statistics the conclusion is drawn that persons in well-to-do families in the United States consume about two pounds of sugar weekly, an amount that seems to be well utilized. The consumption of larger amounts is considered questionable economy both with respect to the purse and to the system. But excessive indulgence in food of any other sort is also wasteful and unwise. Thus the wholesomeness and utilization of sweetened foods is largely a matter of quantity or concentration, a simple dish flavored with sugar being considered easy to digest, but a heavily sweetened one eaten singly, more or less difficult because of its concentration. The bad effects popularly charged to sugar are misapplied.

BIBLIOGRAPHY. *Literature*—Roth, *Guide to the Literature of Sugar* (London, 1890); Barnett, "References to the Literature of Sugar Beet," in *Library Bulletin, No. 16, United States Department of Agriculture* (Washington, 1897). *History*—Lippmann, *Geschichte des Zuckers* (Leipzig, 1890); id., *Entwicklung der deutschen Zuckerindustrie von 1850 bis 1900* (ib., 1900); Boizard and Tardieu, *Histoire de la législation des sucres, 166½-1891* (Paris, 1891); Helot, *Le sucre de betterave en France de 1800 à 1900* (Cambrai, 1900). *Culture of Sugar-Producing Plants, Manufacture of Sugar*—Myrick, *American Sugar Industry* (New York, 1899); Stohmann, *Handbuch der Zuckerfabrikation* (Berlin, 1878, rev. ed. 1899); Horsin-Deon, *Traité theorique et pratique de la fabrication du sucre* (Paris, 1882, rev. ed. 1900); Beaudet, Pellet, and Saillard, *Traité de la fabrication du sucre de betterave et de canne* (ib., 1894); Stubbs, *Sugar-cane: A Treatise on the History, Botany, and Agriculture of Sugar-cane* (Louisiana Bureau of Agriculture, 1897); Krüger, *Das Zuckerrohr und seine Kultur* (Magdeburg, 1899); Rümpler, *Die Nichtzuckerstoffe der Rüben in ihrer Beziehung zur Zuckerfabrikation* (Brunswick, 1898); Bivort, *Etude sur la législation des sucres dans les divers pays d'Europe et aux Etats-Unis* (Paris, 1880); Lippmann, *Die Chemie der Zuckerarten* (2d ed., Brunswick, 1895); Maquenne, *Les sucres et leurs principaux dérivés* (Paris, 1900); Passche, *Zuckerindustrie und Zuckerhandel der Welt* (Jena, 1891); Spencer, *Handbook for Sugar Manufacturers and Their Chemists* (New York, 1897); Tollens, *Handbuch der Kohlenhydrate* (Breslau, 1895).

Numerous bulletins on the sugar industry and sugar manufacture have been published by the Division of Chemistry, United States Department of Agriculture. Some of the more recent of these are as follows: *Sugar-cane Culture*—Bulletins 70 and 75; *Sugar from Sorghum*—Bulletins 26, 29, 34, 37, and 40; *Sugar Beet Culture*—Bulletins 27, 30, 33, 36, 39, 52, 64, and 74. A series of publications on the progress of the beet-sugar industry in the United States has also been published. Those for 1900, 1901, and 1902 are issued as Reports Nos. 69, 72, and 74 respectively.

See SUGARS.

SUGAR BEET (*Beta vulgaris*). A vegetable of the natural order Chenopodiaceæ, botanically the same species as the garden beet, important commercially as the source of a very large part of the world's supply of sugar. (See SUGAR, section on *Beet Sugar.*) The sugar beet flourishes upon a rich, deep, loamy soil in a climate having a temperature of about 70° during the growing season. The seed is planted and the crop cultivated and harvested by the finest machinery. The rotation of the crop with others is carefully planned and the proper fertilization of the fields has been a subject of much study by the experiment stations. Since the sugar content and yield are influenced by many factors, the sugar companies employ field experts to instruct the farmers how to grow beets in the proper way. Being a product of intensive cultivation, the sugar beet is especially suited to a thickly settled population. The average cost of growing an acre of sugar beets in the United States is about $30. The average yield in the best districts is about 12 tons, with an average sugar content of 14.5 per cent. This represents a yield of about 3900 pounds of sugar per acre, though higher yields have been reported up to 4800 pounds.

SUGAR-BEET INSECTS. The recent introduction and rapid spread of the sugar beet have resulted in the attacks of several insects not before known as injurious and have given a new food to others. A leaf-miner (*Pegomyia vicina*), 30 or 40 larvæ of which may be found in a single leaf, has produced serious damage in California. Many leaf-hoppers (q.v.) feed upon the leaves; also several plant and leaf bugs, and plant-lice, notably the common melon aphis (*Aphis gossipii*). Various cutworms (q.v.) are troublesome while the beets are young. Considerable damage has been done by the greenhouse leaf-roller (*Phlyctænia ferrugalis*). The so-called garden webworms, however, especially in the West, have done the greatest damage of all. Certain leaf-beetles injure the leaves, and the larvæ of some of them feed upon the roots. Much damage has been done by grasshoppers, non-migratory locusts, and blister beetles (q.v.), the imbricated snout beetle, and the army worm (q.v.). Toward the close of the last century the so-called beet army worm (*Laphygma flavimaculata*) defoliated thousands of acres of sugar beets in Colorado. The purslane caterpillar (*Copidryas Gloveri*), the purslane sphinx (*Deilephila lineata*), and several of the woolly-bear caterpillars also feed upon the leaves. Great damage has been done in the State of Washington by a root-louse known as the beet aphis (*Pemphigus betæ*), and a root mealy-bug has been found on the crown of the plant in Colorado. Several of the wireworms (q.v.) and white grubs (q.v.) also damage the roots.

Consult: Forbes, *Twenty-first Annual Report State Entomologist of Illinois* (Chicago, 1900); Forbes and Hart, *Bulletin No. 60 Illinois Agricultural Experiment Station* (Urbana, 1900).

SUGAR-CANE (*Saccharum officinarum*). A tropical and subtropical grass, originally a native of the East Indies. It was brought to Europe by the Crusaders, and in the fifteenth and sixteenth centuries found its way into the European colonies in the tropics. In China it extends to latitude 30° N., and in North America to 32°; in the Southern Hemisphere only to latitude 22° S. The plant is a perennial with a creeping root, sending up a number of many-jointed diversely colored stems, generally 8 to 12 feet high, 1 to 2 inches thick, and filled for about two-thirds of their length with a loose, sweet, juicy pith. The leaves are ribbon-shaped, 4 to 5 feet long, with a strong midrib. The flowers are in great diffuse pyramidal panicles a yard long.

Sugar-cane requires a deep rich soil and abundant moisture during the growing season. Low alluvial soils near the sea are preferable. The land is prepared with very large plows. The plants are propagated by cuttings. For this purpose the top joints are planted in rows 5 to 7 feet apart. Usually two continuous lines of canes are planted in the row. The largest varieties, in rich, moist soils, attain a height of twenty feet; but in dry, poor soils the height is sometimes scarcely more than six feet. The plant tillers like wheat, but not to the same degree. The cane ground is kept clean by shallow cultivation. The best varieties are ready for cutting in about eight or ten months from the time of planting, but other varieties require from twelve to twenty months. When the canes are fully ripe they are cut a little above the ground, stripped of their leaves,



SUGAR-CANE.

and tied in bundles. Fresh canes, called *rattoons*, spring from the root, so that the plantation does not require to be renewed for several years; but the canes of the first crop are the largest, and a gradual decrease of size takes place. The ordinary practice on sugar estates is to renew a part of the plantation every year. The sugar content of the cane ordinarily grown has for some time averaged about 10 per cent. Sugar-cane production is usually carried on by large plantations. It is a business of great risks, but large profits. It requires a large and sure source

of labor, especially at harvest. The yield of sugar varies greatly. In regions with a fertile soil, irrigation, and improved methods of culture about five tons of sugar per acre is produced. Yields of over ten tons per acre are authenticated. In Hawaii, where sugar-cane production has reached its highest perfection, yields of even fourteen tons of sugar per acre are known. This is obtained only by frequent plantings and scientific fertilization and irrigation of the crop. The leaves are sometimes used for feeding cattle. Efforts made by the Louisiana Experiment Station to make silage from sugar-cane refuse were unsuccessful, owing to the alcoholic and acetic fermentation induced by the residual sugar. The pressed residue from the mill, known as *bagasse*, is used for fuel. It is also employed as a fertilizer. See SUGAR, MANUFACTURE OF.

SUGAR-CANE INSECTS. The principal enemies of the sugar-cane in the United States are the sugar-cane beetle (*Ligyrus rugiceps*) and the sugar-cane borer (*Diatræa saccharalis*). The former belongs to the family Scarabæidæ, and breeds in the ground. The adult beetles make their appearance in early spring, bore into the stubble or into the young cane, and also work into the seed cane; the top leaves wither and the stalk is finally destroyed. The borer is the larva of a crambid moth which lays its eggs upon the leaves of the young cane near the axils, and the young borer, hatching in the course of a few days, penetrates the stalk at or near the joint and tunnels, usually upward, through the soft pith. It matures in thirty days or less, and there are several generations each year. It hibernates in the larval state in the lower part of the stalk or in the tap root. Burning the tops and volunteer cane, and laying down the seed cane in trenches beneath the surface of the ground, keep this insect in check.

In Hawaii there is a weevil borer (*Sphenophorus obscurus*) which does considerable damage. Stalks of the cane are frequently riddled with the galleries of the larvæ, and the galleries are filled with macerated fibre which the larva apparently pushes behind itself. When ready to pupate the tunnel is somewhat enlarged and a cocoon is formed of coarse fibre in which transformation takes place. In Australia there is a noctuid larva which bores downward from the tips of the plants. Certain scarabæid larvæ feed upon the roots, and the young plants are destroyed by wireworms. In the West Indies a bark-boring beetle (*Xyleborus piceus*) sometimes riddles the canes by its minute burrows, the larva working into the young sprouts from the stumps of previously cut canes. In Java there are three lepidopterous borers and a mealy bug which do some damage, and in Mauritius a somewhat troublesome scale insect known as *Icerya sacchari*. Consult various volumes of *Insect Life* (Washington, 1888 to 1895); Comstock, *Report on Insects Injurious to Sugar-Cane* (ib., 1881); Morgan, "Sugar-Cane Borer," in *Bulletin 9, Louisiana Agricultural Experiment Station* (Baton Rouge, 1891).

SUGAR-HOUSE, THE. A brick building on Liberty Street, New York, used by the British as a military prison during the Revolution.

SUGAR OF LEAD. The common name for acetate of lead. See LEAD.

SUGARS (OF., Fr. *sucre*, from ML. *succarum*, *sacoharum*, from Gk. *σάκχαρ*, *sakchar*, *σάκχαρον*, *sakcharon*, sugar, from Ar. *sakkar*, from Pers. *shakar*, Hind. *shakkar*, from Prak. *sakkara*, sugar, from Skt. *śarkarā*, candied sugar, gravel, grit). A term applied to various substances composed of carbon, hydrogen, and oxygen (see CARBOHYDRATES), which are more or less sweet, are readily soluble in water, are colorless and odorless, and are usually crystallizable. They are widely distributed in nature as original products of vital processes in plants. They have an unparalleled importance in the organic world. In green plants they are formed from carbon dioxide and water by the chloroplasts (see PHOTOSYNTHESIS), and are transferred by diffusion to all parts of the plant body to be used directly in the metabolism of the plant for the manufacture of proteid substances, or to be stored for future use, sometimes as glucose (e.g. in the onion bulb), sometimes as saccharose (e.g. in the beet), and sometimes as other widely different substances into which they have been converted. (See STORAGE.) If formed more rapidly than they can diffuse away, sugars may be condensed into starch in the chloroplasts themselves. At times of renewed growth, as in the germination of seeds and the sprouting of tubers and bulbs, the plant draws upon these stores of carbohydrate. If the storage has been in the form of cellulose, starch, inulin, or cane sugar, the stored food must be converted by means of enzymes into a hexose sugar before it can be utilized. The stored sugars of plant tissues form one of the most valuable sources of animal food.

Sugars found in the bodies of animals or in the excreta therefrom are believed to be derived from substances of vegetable origin. The sugars have been variously classified according to their chemical and physical properties as fermentable and non-fermentable; reducing and non-reducing; and dextro-rotary, lævo-rotary, and inactive, according to their effect on polarized light.

FERMENTABLE AND UNFERMENTABLE SUGARS. These include the sugars that undergo change or decomposition under the influence of microörganisms; glucose, for example, and certain other sugars are thus changed into alcohol (q.v.) by the action of yeast. This term and method of classification have become unsatisfactory because of greatly increased knowledge of the action of the lower forms of life and enzymes on sugars and other substances. (See FERMENTATION; ENZYME.) Many sugars, however, that are not acted upon by one organism are readily decomposed by another, and so the subdivision of sugars into fermentable and unfermentable is of at least doubtful value. For example, milk sugar does not yield alcohol with yeast without first being hydrolyzed, but undergoes the lactic acid fermentation immediately.

REDUCING SUGARS. Certain sugars possess the property of reducing compounds of copper, silver, and other easily reducible metals in alkaline solution, the reduction being generally more rapid at the boiling point of the liquid. In some cases the compounds are reduced to lower oxides, which are precipitated, as in the case of copper; in other cases the reduction is complete, the free metal being precipitated. An alkaline solution of copper (see FEHLING'S SOLUTION) is the one usually employed for testing the reducing power of sugars. The amount of reduction depends

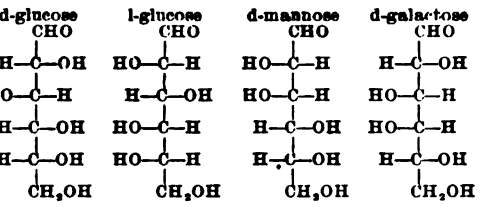
upon the amount of a given sugar present; the process is therefore used for the quantitative determination of reducing sugars. Among the important reducing sugars are d-glucose (dextrose or grape sugar), d-fructose (lævulose or fruit sugar), maltose, lactose (milk sugar), and 'invert sugar' (see below). Sucrose (cane sugar), raffinose, melicitose, and stachyose are the principal non-reducing sugars known.

OPTICALLY ACTIVE SUGARS. The property possessed by sugars of rotating the plane of polarized light to the right or left when passed through their solutions has long served as a basis for classification. Sugars possessing this property are said to be optically active, and those which do not are said to be inactive. Those that turn the plane of polarization to the right are called dextro-rotatory; those to the left, lævo-rotatory. The amount of rotation is proportional to the amount of the sugar in a given volume of the solution, and this is taken advantage of for the quantitative determination of sugars. A special form of the polariscope (q.v.), called a saccharimeter, is in common use for this purpose. For the polarimetric determination of sucrose (cane sugar), a weighed quantity of the sugar, syrup, or other material is dissolved in water; the solution is treated with lead acetate or other clarifying agent, diluted to 100 cubic centimeters, filtered, and placed in the observation tube of the polariscope. The observer then ascertains the percentage of sugar contained in the material under investigation by simply looking into the instrument, adjusting it to compensate for the change in the field of vision caused by the presence of the sugar solution, and by reading the percentage of sucrose directly from the scale of the instrument.

Since 1880 the sugars have formed the subject of numerous brilliant researches, notably those of H. Kiliani and Emil Fischer. In the early eighties Kiliani demonstrated that d-glucose (dextrose or grape sugar) and d-fructose (lævulose or fruit sugar) are aldehyde and ketone derivatives, respectively, of hexahydric alcohols, the former containing one aldehyde group and the latter one ketone group. (See ALCOHOLS; ALDEHYDES; KETONES.) He also showed that arabinose is an aldehyde of the pentahydric alcohol, arabite, and has the formula $C_5H_{10}O_5$. The molecules of all carbohydrates had been believed to contain six carbon atoms or some multiple thereof. But sugars containing three, four, five, six, seven, eight, and nine atoms of carbon in their molecules are now known; these are designated respectively by the class names trioses, tetroses, pentoses, hexoses, heptoses, octoses, and nonoses. According as the individual members of each of these classes contain aldehyde or ketone groups (see ALDEHYDES; KETONES), they are designated as aldoses or ketoses; for example, aldohexoses and ketohexoses. These classes together constitute the group of carbohydrates known as monosaccharides. Their molecules contain as many atoms of oxygen as atoms of carbon, except in the case of certain of their synthetic derivatives.

There are other groups of sugars, in the molecules of which there are fewer atoms of oxygen than of carbon. When the latter are treated with acids or enzymes they are hydrolyzed, i.e. each one of their molecules combines with one or more molecules of water and simultaneously splits up into two or more monosaccharide molecules. These more complex sugars are called disaccharides when each of their molecules yields two monosaccharide molecules; trisaccharides when one molecule yields three monosaccharide molecules; and polysaccharides when one molecule yields several monosaccharide molecules on hydrolysis; for examples, see descriptions of individual sugars below.

In the course of his work, Emil Fischer prepared a number of hitherto unknown sugars by purely synthetic processes. He showed that the monosaccharides furnish excellent examples of the necessity for the chemist to consider the space relations of the atoms in the molecule. (See STEREO-CHEMISTRY.) According to the theory of Le Bel and Van 't Hoff sixteen isomeric aldohexoses are possible, since their molecules contain each four asymmetric carbon atoms. Three of these occur in nature or are obtainable from natural carbohydrates by hydrolysis. Eight others have been produced in the laboratory. The aldopentose and ketohexose molecules each contain three asymmetric carbon atoms, therefore but eight stereo-isomers are possible in each case. No ketopentoses are known with certainty. Two aldopentoses are readily obtainable from natural sources; three or more others have been prepared in the laboratory. Only two natural ketohexoses are known; one or more others have been prepared in the laboratory. The character of the differences between the hexoses is illustrated by the following stereo-chemical formulæ:



Formic aldehyde and glycerin, both of which have been produced synthetically, are the substances from which certain sugars have been synthesized by Fischer and others. Formic aldehyde, CH_2O or H-COH, may be regarded as the simplest of the monosaccharides and be designated as monose. Bayer (1870) suggested that this substance is the first product of the reduction of carbon dioxide in the green parts of plants, and that starch and other carbohydrates are formed by its polymerization. Its formation in plants has never been satisfactorily demonstrated, but it is known readily to undergo polymerization or condensation to form paraform $(CH_2O)_n$ and trioxymethylene $(CH_2O)_3$. In 1861 Butleroff obtained by condensation of trioxymethylene a sweet, sugar-like body which he called 'methylenitan.' Loew (1885) obtained in a similar manner 'formose' from oxymethylene, and later 'methose.' The last named is more sugar-like than 'formose' in that it is fermented with yeast. Fischer regards these substances as mixtures of different hexoses, including among others d-acrose, which he also obtained from glycerose, which is a mixture of glyceraldehyde and dioxyacetone, obtained by the careful oxidation of glycerol (glycerin). From d-acrose [(d + l) fructose] Fischer prepared d-fructose, d-glucose, d-mannose, and the l- modifications, or optical antimeres, of each of these bodies.

The synthesis of each one of these bodies was accomplished by a series of complicated reactions which are fully described in text-books on chemistry. Fischer's work was greatly facilitated by the use of phenylhydrazine, which forms readily crystallizable compounds with the hexoses, called osazones. These compounds are insoluble in water and eminently suited for the separation and identification of the different sugars. By means of the cyanhydrine reaction he changed hexose sugars into heptoses, and these in turn into octoses and nonoses. The combination of monosaccharides to form disaccharides has only recently been accomplished by Fischer. Among a number of his synthetic disaccharides is one which he designates galactosidoglucose (because it is made by the union of one molecule of d-galactose with one molecule of d-glucose), and which closely resembles the natural sugar melibiose. In an article published in September, 1902, he says that if further investigations confirm his conclusion that the two sugars are identical, "melibiose is the first natural disaccharide to be produced synthetically."

The more important sugars are mentioned in the following table with brief descriptions of those of commercial importance:

I. MONOSACCHARIDES

1.	Monose, CH_2O.	Formic aldehyde.
2.	Biose, $C_2H_4O_2$.	Glycollic aldehyde.
3.	Triose, $C_3H_6O_3$.	Glycerose, obtained by oxidation of glycerin.
4.	Tetrose, $C_4H_8O_4$.	Erythrose, obtained by oxidation of erythrin, a tetrahydric alcohol found in lichens and algæ.
5.	Pentoses, $C_5H_{10}O_5$.	
	A. Aldopentoses.	l-arabinose (arabinose, arabose, pectinose, pectin-sugar) and xylose (wood-sugar), obtained alone or mixed with other sugars by hydrolysis of gums and other vegetable substances.
		d-arabinose, l-xylose, and ribose, obtained synthetically.
	B. Ketopentoses.	None known with certainty.
	C. Methyl pentoses, $CH_3C_5H_9O_5$.	Fucose, from seaweed; rhamnose, widely distributed in the vegetable kingdom in the form of glucosides: chinovose, obtained by the decomposition of chinovite, a constituent of cinchona bark.
6.	Hexoses. $C_6H_{12}O_6$.	
	A. Aldohexoses.	d-glucose (dextrose, grape sugar or starch sugar), see GLUCOSE; d-mannose (mannose, isomannose or seminose), obtained by the oxidation of mannite and by the hydrolysis of various vegetable materials; d-galactose (see below).
		l-glucose, l-mannose, l-galactose, d-gulose, l-gulose, d-idose, l-idose, d-talose, and l-talose, obtained synthetically.
	B. Ketohexoses.	d-fructose (levulose or fruit sugar; see below); scrbinose, from mountain ash berries.
		l-fructose, obtained synthetically.
	C. Hexoses of natural origin and of unknown nature.	Chondroglucose, crocose, eucalyn, hederose, indiglucin, locaose, paraglucose, phlorose, scammonose, skimminose, solanose, tewfikose (forms 5 to 6% of the milk of the Egyptian buffalo), and wine sugar.
	D. Methyl hexoses, $CH_3C_6H_{11}O_6$.	a-rhamno-hexose and β-rhamno-hexose, obtained synthetically.
7.	Heptoses, $C_7H_{14}O_7$.	Six heptoses and a methyl derivative have been prepared synthetically.
8.	Octoses, $C_8H_{16}O_8$.	Four octoses and a methyl derivative have been prepared in the laboratory.
9.	Nonoses, $C_9H_{18}O_9$.	Two have been produced artificially.

II. DISACCHARIDES

1.	Derivatives of pentoses, $C_{10}H_{18}O_9$.	Di-arabinose or arabinon, obtained from arabinic acid (metapectic acid).
2.	Derivatives of hexoses, $C_{12}H_{22}O_{11}$.	Sucrose (cane sugar, saccharose, saccharon, or saccharobiose), lactose (milk sugar, lactobiose, or lacton), and maltose (maltobiose, malt sugar, amylon, diglucon, ptyalose, or cerealose); see below).
		Trehalose (mycose, trehabiose) from ergot and other fungi; isomaltose from malted grain; melibiose, formed together with d-fructose by careful hydrolysis of raffinose; turanose, formed together with d-glucose by hydrolysis of melecitose; cyclamose, from cyclamen tubers; agavose, from the juice of the agava; and several produced synthetically by Fischer.

III. TRISACCHARIDES

All are derivatives of the hexoses, $C_{18}H_{32}O_{16}$.		Raffinose (melitriose, melitose, gossypose, or cotton sugar; see below); melecitose (melecitriose), from the manna of *Pinus larix*; stachyose, from the tubers of *Stachys tuberifera*; gentianose, from the roots of *Gentiana lutea*; lactosinose (lactosin), from the roots of certain plants of the order Caryophyllaceæ; and secalose, from unripe rye.

SUCROSE, CANE SUGAR, OR SACCHAROSE. This is commercially the most important sugar. It and the products of its hydrolysis, 'invert sugar,' and the sugars that compose 'invert sugar' (d-glucose and d-fructose) are the most important sugars, considered from the point of their wide distribution in fruits and vegetables used for food by man and the lower animals. (For the commercial sources of cane sugar, see SUGAR, MANUFACTURE OF.) White granulated sugar, whether made from sugar-cane or beet roots, contains between 99 and 100 per cent. of pure sucrose or cane sugar. In many plants it is found associated with 'invert sugar,' which seems to be changed to cane sugar during the process of ripening. When cane sugar is hydrolyzed by the action of acids or enzymes, each molecule yields one molecule of d-glucose and one molecule of d-fructose, a mixture called 'invert sugar,' as explained above.

Cane sugar is readily crystallized in the form of monoclinic hemihedral tables which contain no water of crystallization. These crystals are well exemplified in loaf sugar, rock candy, and granulated sugar, the coarseness of which depends upon the size of the crystals. It dissolves in about one-half of its weight of water and is much more soluble in hot water; it is dissolved with difficulty in strong alcohol. Its specific gravity is 1.606. It melts at 160° C. (320° F.), and with care may be cooled to a colorless glass-like mass; if the temperature is somewhat higher the solidified mass is colored and constitutes the so-called 'barley sugar.' At 200° C. (392° F.) decomposition and marked coloration begin, caramel is formed, and as the heat is continued gases are evolved and finally only a black char remains. Sucrose unites with the oxides of calcium and other metals to form saccharates, which are of importance as a means of separating sugar from beet-root molasses. While cane and other sugars in dilute solutions are very prone to undergo fermentation and change, they possess considerable antiseptic power in concentrated solution, which is utilized in dried fruits, preserves, etc.

LEVULOSE, d-FRUCTOSE, OR FRUIT SUGAR. This occurs in almost all sweet fruits with d-glucose.

It is crystallized with difficulty, and melts at 95° C. (203° F.). It is readily obtained by hydrolysis of inulin, a polysaccharide which occurs in many plants. It is less soluble than d-glucose, and is as sweet as cane sugar. Levulose is used as a substitute for sugar in the food of diabetic patients. Some of the commercial forms of levulose for this purpose are called 'diabetine.'

RAFFINOSE, MELITRIOSE, MELITOSE, OR COTTON SUGAR. This occurs in rather large quantity in Australian manna (from varieties of Eucalyptus), in cottonseed meal, and in small quantities in sugar beets, the manufactured sugar from which sometimes contains small amounts, but the molasses much the greater proportion. It forms characteristic crystals and is strongly dextro-rotatory. When hydrolyzed by acids each molecule yields one molecule of d-glucose, one of d-fructose, and one of d-galactose.

MALTOSE, MALTOBIOSE, MALT SUGAR, OR AMYLON. This is formed, together with dextrin and dextrose, when starch is hydrolyzed with enzymes or acids. It is present in malted grain, in commercial glucose, and in the mash of beer and whisky. It is usually obtained in the form of crystalline crusts. When hydrolyzed it is converted into d-glucose.

MILK SUGAR, OR LACTOSE. This occurs in the milk of mammals. It crystallizes in white hard rhombic prisms, with one molecule of water of crystallization, which is dissipated at 140° C. (284° F.); at 205° C. (400° F.) it melts with decomposition. It dissolves in six parts of water at the ordinary temperature and in 2½ parts of hot water; is insoluble in alcohol, and has a faint, sweet taste. When hydrolyzed by the action of acids it is converted into equal parts of d-glucose and d-galactose. See SUGAR, MANUFACTURE OF.

GALACTOSE. This is of interest as one of the inversion or hydrolysis products of raffinose and milk sugar. It is also obtained by the hydrolysis of a number of polysaccharides occurring in vegetable substances and called 'galactans.'

BIBLIOGRAPHY. Tollens, *Kurzes Handbuch der Kohlenhydrate* (Breslau, 1895); Lippmann, *Die Chemie der Zuckerarten* (Brunswick, 1895); Pavy, *Physiology of the Carbohydrates* (London, 1895).

SUG'DEN, EDWARD BURTENSHAW. A celebrated English jurist and author. See SAINT LEONARDS, EDWARD BURTENSHAW SUGDEN, BARON.

SUGER, sụ'zhâ', ABBÉ DE SAINT DENIS (1081-1151). A French churchman, statesman, and historian. He spent a large part of his youth in the Abbey of Saint Denis, and was for a time a student with Prince Louis, afterwards Louis the Fat, with whom he always remained on terms of close friendship. In 1122 he became abbé of Saint Denis, and he carried out many reforms and greatly increased the prosperity of his charge. He was frequently engaged in affairs of State, and when Louis VII. went on the Second Crusade Suger acted as Regent in his absence and administered the affairs of the kingdom with great ability. Shortly afterwards, although he had opposed the previous one, Suger preached another crusade, but died in 1151 before it could be carried out. He wrote in Latin a *Life of Louis VI.* (c.1140), which is one of the chief sources upon the history of the period. His complete works were published at Paris in 1867. Consult Meanult, *Suger* (Paris, 1884), and Cartellieri, *Abt Suger von Saint-Denis* (Berlin, 1898).

SUGGESTION (Lat. *suggestio*, intimation, suggestion, from *suggerere*, to suggest, supply, from *sub*, under + *gerere*, to carry). A term used in four different senses in psychology. (1) In its broadest significance suggestion is a hint, a prompting, the insinuation of an idea into consciousness. An orator may suggest, e.g. impatience to his audience by a shrug of his shoulders. (2) Suggestion is used more narrowly as a synonym for association (q.v.). The idea of Spain suggests (or 'associates with') war, war suggests Cuba, Cuba suggests sugar, etc. (3) Still more specifically, suggestion implies a peculiar mode of creating belief. One may, e.g. create by suggestion the belief that a piece of metal is hot by handling it as if it were burning one. (4) Finally, suggestion indicates a means of directing the consciousness and the movements of a hypnotized subject. The operator is said to 'suggest' to his subject that he see an object which is not in reality present, or that he react to an imaginary situation. The first two definitions contemplate suggestion simply as an incentive to 'reproduction' (see REPRODUCTION OF IDEAS); the last two as a determinant of belief, under usual or 'normal' and under unusual or 'abnormal' conditions. Between the third and the fourth uses of the word no strict line of demarcation can be drawn. (See HYPNOTISM.) The term is most accurately employed in one of these narrower senses, as an influence upon belief. Belief (q.v.) may appear either as a mood of acquiescence (one believes, e.g. when one is told that $2 + 3 = 5$), or as a conviction following upon deliberation (one believes the conclusion reached by a series of 'sound' arguments). Just how suggestion may occasion belief under unusual circumstances, as in hypnosis, psychologists are not entirely agreed, but two theories have been worked out in detail. (1) The first (Wundt's) maintains that in hypnotic suggestion there is a 'constriction' of consciousness. Few ideas enter at once; only those that are aroused directly by association. 'Foreign' ideas are barred out. The narrowing of the field of consciousness implies, according to the theory, an increased clearness and intensity in the ideas attended to. This fact is explained physiologically by hyperæsthesia of a limited cortical area and a corresponding anæsthesia in the other areas. The result is that whatever comes to mind is peculiarly vivid and forcible and stands free from contradicting ideas. This is synonymous with belief. (2) The other theory (Lipps's) sees the essence of suggestion in an unusual inhibition of experience which, if it could come before the mind, would destroy belief (e.g. a hypnotized person believes the operator's statement that he is a king or a cat, because his past experience is in abeyance: it is beyond his control: he is unable to criticise or to oppose any statement made). The theory rejects physiological explanations and substitutes 'unconscious ideas.' Both theories agree that lack of conflicting ideas is essential. There is no room in hypnotic suggestion for deliberation and choice. To this we must add a feeling element, in the mood of acquiescence.

BIBLIOGRAPHY. Baldwin, *Story of the Mind*

(New York, 1898); Moll, *Hypnotism* (London, 1891); Wundt, *Philosophische Studien* viii. (1893); Lipps, *Zur Psychologie der Suggestion* (Leipzig, 1897).

SUHL, zōōl. A town of the Prussian Province of Saxony, Germany, on the Lauter, 12½ miles north by east of Meiningen (Map: Prussia, D 3). Important for its manufactures of firearms since the fifteenth century, Suhl has been called the 'armory of Germany.' Population, in 1900, 12,617.

affords ground for forfeiture of a policy of life insurance.

The statistics of suicide are by no means satisfactory, as motives always exist for the concealment of the cause of death, and published figures are likely to be too low. This trouble is partly overcome when figures are used comparatively, as in the following table, showing the average annual number of suicides per million of population in various countries during the nineteenth century:

	1831-35	1841-45	1851-55	1861-65	1871-75	1887-91	Recent
England and Wales	62.8*	64	64	66	66	81	90
Ireland	10	.....	.....	.....	18	24	.....
Prussia	96	110	130	122	134	197	193
Saxony	158†	198	248	264	299	322	306
France	64	85	100	124	150	218	236
Belgium	39	62	.....	55‡	68	120	116
Italy	.....	.....	.....	28	35	52	.....
Denmark	213†	232	272	286	258	253	258
Sweden	69	66	71	76	81	119	.....
Norway	97	107	107	85	73	66	.....

* 1831-1840. † 1836-40. ‡ 1856-65.

SUICIDE (from Lat. *sui*, of one's self + *-cidium*, a killing, from *cædere*, to kill). The intentional taking of one's own life. Among uncivilized peoples suicide is by no means unknown, though it has generally been regarded as uncommon. It is favored by the teaching of some Oriental religions, but expressly forbidden by the Koran. Aristotle condemned suicide as unmanly, and early Greek custom accorded dishonorable burial to the perpetrator; but later practice, especially under influence of the Stoics, was much less severe. The Romans, also affected by Stoic doctrine, recognized many legitimate reasons for suicide and punished with confiscation of property only suicides committed to escape punishment for a grave crime. The Justinian code admitted seven excuses for suicide, ranging from madness to mere life-weariness. Under Christianity the spirit of law and custom was radically modified. To Saint Augustine suicide was essentially a sin, and several Church councils, from the fifth century, deprived the corpse of the ordinary rites of the Church. Mediæval law usually provided confiscation of the suicide's property, while custom decreed indignities to the corpse, such as dragging by the heels face downward, as in France, or burying at the cross-roads with a stake through the body, as in England. Later English law compelled forfeiture of lands and goods in all cases of suicide, but the requirement came to be frequently evaded through the granting of a coroner's verdict of insanity, and the law itself was abolished in 1870. A statute of 1823 made it legal to bury suicides in consecrated ground, but it was not till 1882 that religious services were expressly permitted. In France at the present time neither suicide nor attempt at suicide is punishable. In the United States suicide is not a crime, but it is unlawful, and an unintentional killing of another during an attempt at self-destruction is homicide. An attempt at suicide is a common-law misdemeanor, and in some States a felony by statute. Thus in New York, aiding a suicide is manslaughter in the first degree, aiding an attempt at suicide is felony, and the attempt itself by a sane person is felony, punishable by not over two years in State prison, or a fine of not over $1000, or by both. Suicide generally

The remarkable differences which appear between countries are due rather to race and national characteristics than to climate. This is well shown by suicide rates in the United States. In 1900 in the registration area persons with mothers born in France had a suicide rate (per million) of 220; Germany, 193; England and Wales, 104; Ireland, 61; Russia and Poland, 58; Italy, 51. In the registration area as a whole the rate was 103 in 1890 and 118 in 1900, being very much higher for white persons than for colored. The most notable difference of rate is that occasioned by sex, males usually constituting from four-fifths to three-quarters of the total suicides. Statistics of several States and of foreign countries indicate that the preponderance of males has been increasing during recent decades. When age is considered together with sex, it appears that while suicide in general increases with age, the ages at which women most tend to self-destruction are much under the corresponding ones for men. Thus in the United States (1900) there were out of 1000 suicides at known ages, 1.2 committed by males under 15 years, but 7.8 by females; for the age period 15 to 19 the rate was 18.8 for men, 100.5 for women; for 30 to 34 years it was 103.4 and 109.7 respectively; while for 40 to 44 the male rate was in excess, 117.3 to 90.1; and the men then continue to preponderate up to 85 years. Married people show a lower suicide rate than single, and single than widowed or divorced persons. Large cities have an unfavorable influence. The rate in Dresden is more than 500 per 1,000,000; in Paris, more than 400; in London, about 230; in Berlin, 260; in Saint Petersburg and Rome, less than 100. In 1890 the rate in Massachusetts was 84, but in Boston it was more than 120; in New York State (1890) it was 95, but 97 in Brooklyn and 150 in Manhattan (New York City).

Suicides among the young are especially prevalent in the great centres. The professional and commercial classes are more prone to suicide than are others; artisans evince higher rates than do laborers; while among soldiers and criminals the rates are extremely high. The rates for summer or late spring are always much above those for the other seasons, the maximum

usually occurring between April and July, the minimum in January or December. The early part of each month and the early days of the week show a relative preponderance. Other interesting correlations appear in the methods by which suicide is accomplished. In the aggregate the order of preference in method is: Hanging, drowning, shooting, cutting or stabbing, falling from a height, and asphyxiation or poison. In cold countries drowning is naturally less favored than in the south; the use of firearms is specially prominent in Italy; of cutting or stabbing in Prussia; of poison in England. As would be expected, female suicides employ firearms less than male. In England drowning is the recorded means for more than a quarter of the women committing suicide, and poison for about a seventh; but only 15 per cent. of male suicides drown themselves, and only a twelfth use poison.

The study of the motives to suicide can be more successfully pursued by psychologists and physicians than by the statistician. Definite mental disorders usually appear as the direct cause of a third of all suicides, but a very much larger proportion of cases show evidence of mental or physical abnormality. Suicidal tendency, like insanity, has been observed to be inherited. Alcoholism is a frequent cause. Emphasis upon biological influences has led some writers to regard suicide as always being, like certain diseases, a specific tendency of the individual. But the social causes of suicide are not to be underestimated. Imitation and the desire for notoriety undoubtedly affect suicides, and though perhaps too much stress has been laid upon the influence and the hurry and strain of modern business, there can be no doubt that many contemporary conditions which stimulate suicide, especially in great cities, are, like the predisposing causes of alcoholism, largely under social control.

Consult: Morselli, *Suicide*, International Scientific Series (New York, 1882), a standard work; Legoyt, *Le suicide ancien et moderne* (Paris, 1881); Geiger, *Der Selbstmord im klassischen Alterthum* (Augsburg, 1888); Motta, *Bibliografia del suicido* (Bellinzona, 1890); Dürkheim, *Le suicide* (Paris, 1897); *Twelfth United States Census* (vol. iii.); *Registration Reports* issued by all New England States and by several other States and cities; *American Statistical Association Publications; Reports of the Registrar-General of the United Kingdom; Statistisches Jahrbuch für das Deutsche Reich* (annual); *Annuaire statistique de la France.*

SUIDÆ. The swine family. See SWINE.

SU'IDAS (Lat., from Gk. Σουΐδας, *Souidas*). The author of a great Greek lexicon, which was compiled probably in the middle of the tenth century. The work which is current under his name is a compilation giving the result of grammatical, lexicographical, historical, and literary studies. It is especially valuable for its articles touching the latter field, and the information which they contain is indispensable for our knowledge of the writers of antiquity. It is clear that the lexicographical portions were drawn from the lexica of Harpocration and Helladius, and certain other lexica and grammatical works which cannot be absolutely determined. He further employed excellent scholia to Aristophanes, scholia to Sophocles similar to those now found in the codex Laurentianus, Homeric scholia similar to those found in the codex Venetus B, and the older scholia to Thucydides. In his historical and theological articles it is more difficult to determine his sources, but his chief authority seems to have been the work of Constantinus Porphyrogenitus and the chronicle of Georgius Monachos. His literary articles were probably drawn in large measure from the *Onomatologos* of Hesychius Milesius, which he possessed in an abridged form. He employed also the notices of the comic poets preserved in Athenæus; but he added much from his independent reading. The work is best edited by Bernhardy (1834-53). The edition by Bekker (1854) is far inferior.

SUI JURIS, sōō'ī jōō'rĭs (Lat., of his own right). A Latin phrase employed to describe a person competent to perform legal acts. (See CIVIL LAW; PATRIA POTESTAS.) The meaning of the phrase has been extended in modern times to denote a person who is capable of taking care of himself.

SUIR, shōōr. A river of Ireland. Rising in County Tipperary, it forms, in part, the boundary between that county and County Waterford and then the boundary between Waterford and County Kilkenny. It unites with the Barrow to form Waterford Harbor, after a course of about 100 miles. For boats of about 55 tons it is navigable to Clonmel in Tipperary.

SUITE (Fr., succession, following), or PARTITA. In music, one of the oldest of cyclical forms. It had its origin in the sixteenth century, when the Stadtpfeifer began to perform several national dances in succession, which were of contrasting tempi, but all in the same key. During the seventeenth century German composers for the pianoforte applied the name partita to their *doubles* (a series of variations). (See VARIATION.) The form reached its culmination in the suites of J. S. Bach. The style of the suite is not so much contrapuntal as 'elegant.' The four obligatory movements are: (1) allemande, (2) courante, (3) sarabande, (4) gigue. As a rule, however, there were more movements, which were inserted after the sarabande. Such additional movements were known as *intermezzo* (q.v.). In modern times composers have also written suites for orchestra, which, however, but slightly resemble their prototypes. Some of the movements are not dance forms, and the principle of contrasting keys is also introduced. See DANCING; SONATA; SYMPHONY.

SUITS AT LAW AND EQUITY. See ACTION; EQUITY.

ŚUKASAPTATI, shōō'kă-săp'tă-tē (Skt., seventy [stories] of a parrot). A collection of Sanskrit prose stories. These tales, seventy in number, are told by a parrot to the wife of a merchant who is away on his travels. She is inclined to be unfaithful to her husband, and consults the parrot regarding her plans. The bird cleverly pretends to approve of her intentions, but points out to her the dangers of detection, and induces her to promise not to meet any lover unless she can extricate herself as such and such a person did. This rouses her

curiosity, and the parrot tells the story as far as the dilemma, which he asks her to solve. Unable to do this, she promises to remain at home that night on condition that the parrot will tell her the answer the following evening. In this way she is kept faithful until her husband returns. The story is very popular in India and has been translated into Persian as the *Tūṭīnāmah*. The Śukasaptati exists in two recensions. The shorter one was edited (Leipzig, 1893) and translated (Kiel, 1894) by Schmidt, who also edited (Munich, 1898) and translated (Stuttgart, 1899) the longer version. Consult Schmidt, *Ueber die Śukasaptati* (Halle, 1898).

SUKHĀVATĪ, sōōk-hä'vȧ-tē' (Skt., blissful). The 'Land of Bliss' into which those Buddhists are reborn who put their trust for salvation in Amitabha Buddha, the Buddha of boundless light, life, and mercy, invented by the founders of the Northern or Mahayana (q.v.) School. It is situated in some far distant world in the western quarter of the universe, separated from this world by tens of millions of Buddha worlds, and is presided over by Amitabha. Here there is no difference between gods and men, and sexual distinctions are unknown. There is no more toil, no hunger, nor pain of any kind, no thirst, and neither summer nor winter, no day, no night; no heat to scorch, no cold to chill; no sin, no suffering, no distress of any kind; no torments, and no prisons for punishment. To attain to rebirth in this paradise the performance of good works in this life is not necessary. Simple trust in the mercy of Amitabha is sufficient. It may even be attained by repeating the name of Amitabha two, three, four, five, six, or more nights before death. Among the common people this doctrine of a pure land of practically unending bliss has superseded the doctrine of Nirvana (q.v.).

SULEIMAN, sōō'lā-mān. A Turkish sultan. See SOLYMAN II.

SULEIMANIEH, sụ-lā'mȧ-nē'ye. A town of the Vilayet of Mosul, Turkey in Asia, 93 miles south of Bagdad, east of the Euphrates River. It commands several trade routes to Persia. Population, about 15,000.

SULEIMAN PASHA, sōō'lā-mān' pȧ-shä' (c.1840-92). A Turkish general, born at Constantinople. He was trained at the military school in Constantinople, entered the army, and attained the rank of major in 1867, when he served in Crete. In 1873 he was a colonel and instructor in the military school, of which he later became sub-director, with the rank of general of brigade, in 1874. He took part in the deposition of Abdul Aziz, May 30, 1876, and was made general of division by Amurath V. In 1877 he was made marshal. In the early part of the Russo-Turkish War (q.v.) he fought against General Gurko, whom he defeated at Eski-Zaghra (July 31-August 1, 1877) and forced to retreat into the Balkans, failing, however, in his desperate attempts to make himself master of the Shipka Pass. From October to December he commanded the Turkish Army of the Danube and was then intrusted with the command of the Turkish forces south of the Balkans. At Philippopolis, January 15-17, 1878, he was decisively defeated. This misfortune led to a heavy sentence of imprisonment, but he was afterwards pardoned.

SULFONAL. See SULPHONAL.

SULIMAN (sōō'lē-mān') **MOUNTAINS.** A range of mountains in the northeastern part of Baluchistan, near the borders of the Punjab, India (Map: India, A 2). It forms part of the eastern boundary of the great Iranian Plateau, toward which it sends numerous spurs, while on the east it falls steeply into the Indus Valley. Its highest point, the Kaisargarh, has an altitude of 11,320 feet.

SULINA, sōō-lē'nȧ. The central arm of the delta of the Danube (Map: Balkan Peninsula, G 2). Though not the largest in volume, it is the principal channel for navigation and has been made navigable for the largest vessels by means of large jetties and other engineering works conducted since 1858 by the International Danube Commission. At the mouth of the channel lies the little town of Sulina, whose harbor is a free port from which 11,411 vessels, aggregating 1,830,000 tons, cleared in 1901.

SULIOTES, sōō'lē-ōts. A tribe of Turkish subjects of mixed Greek and Albanian blood, who derived their name from the Suli Mountains, near Parga, in Epirus, to which they fled from the Turks in the seventeenth century. Their persistent opposition to Turkish rule brought them into constant trouble and won for them a reputation for bravery and patriotism. Overcome in 1803 by Ali Pasha of Janina, they left their mountains and fled to the islands off their native shore. In 1820 Ali Pasha invoked their aid in his fight for the independence of Albania. The forces of the Sultan were victorious and drove some of the Suliotes to their old mountain retreats, but more to the island of Cephalonia. Later they are found warring on the side of Greek independence, their most celebrated leader being Marco Bozzaris (q.v.). Many of them have migrated into Greece. Consult: Perrhaebos, *History of Suli and Parga* (London, 1823); Lüdemann, *Der Suliotenkrieg* (Leipzig, 1825).

SULLA (*Hedysarum coronarium*). A perennial leguminous fodder plant, native of Southern Italy and similar Mediterranean regions, where it has been in cultivation since about 1766. It is a leafy plant four to six feet tall, bearing numerous clusters of showy flowers. In the United States the seed is usually sown with fall wheat or oats in well-prepared soil, and after the removal of the cereal crop in the spring the sulla develops rapidly and by June is ready to cut. Sulla ranks with alfalfa as a forage crop, but does not seem as well adapted to the South as alfalfa. It is said to be preferred to alfalfa in more tropical regions, since it is better adapted to tropical conditions, but because it is susceptible to frost it is adapted to few regions of the United States.

SUL'LA, LUCIUS CORNELIUS (surnamed FELIX) (B.C. 138-78). A celebrated Roman general and statesman, born at Rome of a family belonging to the clan Cornelia. In B.C. 107 he was elected quæstor, and sent to Africa with cavalry that the consul Marius (q.v.) required for prosecuting the Jugurthine war. He rapidly acquired a series of important services by inducing Bocchus, the Mauretanian King, to surrender Ju-

gurtha (B.C. 106). In the campaigns that followed (B.C. 104-101) against the Cimbri and Teutones, Sulla's reputation continued to rise. For several years after the destruction of the barbarians Sulla lived quietly, taking no part in public affairs; but in B.C. 93 he stood for the prætorship, and won it by a liberal distribution of money among the people. Next year he was sent to Cilicia as proprætor, to replace Ariobarzanes on the throne of Cappadocia, from which he had been driven by Mithridates. In the Social War (q.v.) the successes of Sulla threw those of Marius into the shade, and the mortification of the latter was deep and bitter. In B.C. 88 Sulla was elected consul along with Q. Pompeius Rufus, and the senate conferred on him the command of the Mithridatic War. At this Marius, who desired the command for himself, precipitated a civil war. Allying himself with the tribune P. Sulpicius Rufus, a political adventurer in difficulties, Marius placed himself at the head of the new Italian party, on whom the rights of Roman citizenship had been conferred, and Sulla was compelled to flee to his camp at Nola in Campania. There, finding the soldiers full of enthusiasm, he resolved to lead them against the pseudo-government at Rome. The Marian party was overthrown and Marius fled to Africa. Sulla embarked for the East B.C. 87 and was away four years, but finally forced Mithridates to sue for peace, and returned to Italy B.C. 83. Marius was now dead, but his party was strong in numbers and again in revolt; yet before the close of B.C. 82 the Marian party in Italy was utterly crushed. In Spain, however, it held out under Sertorius (q.v.). Sulla caused himself to be appointed dictator, an office which he held until B.C. 79. Then followed the fearful period of the *proscriptions* (B.C. 81)—a virtual 'reign of terror' throughout Italy, the object of which was to extirpate the Marian party. His dictatorship was signalized by the framing of a series of laws the design of which was to restore the ancient power of the senate and the aristocracy. Sulla spent his last years at his estate at Puteoli, his death being hastened by debaucheries. Consult: Beesly, *The Gracchi, Marius, and Sulla* (New York, 1878).

SULLIVAN, Alexander Martin (1830-84). An Irish nationalist, born at Bantry. In 1853 he went to Dublin to become an artist and afterwards took up journalism. As editor of the *Nation*, the exponent of constitutional agitation, he became a formidable opponent of the Fenian conspiracy. In 1874 he was returned to Parliament as a Home-Ruler from the County of Louth, and from Meath in 1880. He was called to the Irish bar in 1876, and to the English bar in the following year, whereupon he discontinued his work for the *Nation* and went to England to practice law. He published *The Story of Ireland* (1870), *New Ireland* (1877), *A Nutshell History of Ireland* (1883).

SULLIVAN, Sir Arthur Seymour (1842-1900). A distinguished English composer. He was born in London of Irish parents. Sir George Smart accepted him as one of the children of the Chapel Royal, and during the choristership he wrote several anthems. His earliest published composition was a song "O Israel" (1855). In 1856, at the age of fourteen, Sullivan succeeded in obtaining the Mendelssohn scholarship, then recently established, and while still holding this scholarship he entered the Royal Academy of Music. In 1858 he went to Leipzig, where he studied at the Conservatory. His famous incidental music to Shakespeare's *Tempest* was his last work at the Conservatory, and was first heard in England in 1862, a few days after his arrival in the country. After holding organ appointments at Saint Michael's and at Saint Peter's he was appointed professor of the pianoforte and ballad-singing at the Crystal Palace School of Art, after which he gave a course of lectures on the theory and practice of music at the South Kensington Museum. His first great success in composition was his "Orpheus with His Lute," which was soon followed by "The Lost Chord." He was meanwhile engaged on more serious work, and in 1864 the cantata *Kenilworth* was produced. Then came the *Symphony in E* (1866), the *Overture In Memoriam* (1866), *The Prodigal Son* (1869), *Light of the World* (1873), *The Martyr of Antioch* (1880), *The Golden Legend* (1886), and the grand opera *Ivanhoe* (1891). He is held in greatest repute, however, for his light opera compositions, a form of writing into which he stumbled by the merest accident. The financial difficulties of the widow and family of a well-known artist on the staff of *Punch* caused the friends of the deceased to organize a 'benefit' for which F. C. Burnand and Sullivan promised to collaborate in a musical piece. *Box and Cox* was the result, and in seven days it was written, learned, rehearsed, and performed. The *genre* thus created became the field in which he achieved greatest success in collaboration with W. S. Gilbert. Besides those mentioned his dramatic works are: *The Contrabandista* (1867), afterwards enlarged as *The Chieftain* (1894), *Thespis* (1871), *Trial by Jury* and *The Zoo* (1875), *The Sorcerer* (1877), *H. M. S. Pinafore* (1878), *Pirates of Penzance* (1880), *Patience* (1881), *Iolanthe* (1882), *Princess Ida* (1884), *The Mikado* (1885), *Ruddigore* (1887), *The Yeomen of the Guard* (1888), *The Gondoliers* (1889), *Haddon Hall* (1892), *Utopia* (1893), *The Grand Duke* (1896), *The Beauty Stone* (1898), *The Rose of Persia* (1899), and *The Emerald Isle* (1901). In 1883 he was knighted by Queen Victoria. His music is essentially lyric in quality, and he was exceptionally fluent in melody as well as a master of dainty orchestration, in which latter respect he perhaps has never been excelled. His early training in the school of English church music left its imprint on all his sacred compositions. His anthems are distinguished by their pure melody and dignified harmony. His hymn-tunes are sung universally, and of these not the least important is his fine martial setting of "Onward, Christian Soldiers." He died in London.

SULLIVAN, Francis Stoughton (1719-76). An Irish jurist, born at Galway. He was educated at Trinity College, Dublin, where he gained a fellowship at the very early age of nineteen. He remained at Dublin until in 1750 he was made regius professor of law in the university and in 1761 professor of feudal and English law. He was a jurist of great distinction and his one important work, *An Historical Treatise on the Feudal Law* (1772), was long held in high favor.

SULLIVAN, James (1744-1808). An American jurist and politician, born in Berwick, Me.

He was admitted to the bar, and in 1770 was appointed King's attorney. In 1775 he was a member of the Massachusetts Provincial Congress, and was one of three commissioners dispatched on a secret mission to Ticonderoga. From 1776 to 1782 he was a judge of the Superior Court, and in 1784-85 a Massachusetts delegate to the Continental Congress. For many terms he was a member of the State Legislature, in 1787 was a member of the executive council, a probate judge, and from 1790 to 1807 was Attorney-General. In 1807 and 1808 he was elected Republican Governor of Massachusetts. He published *Observations on the Government of the United States* (1791), *The Altar of Baal Thrown Down* (1795), *Impartial Review of the Causes of the French Revolution* (1795). Consult the *Life* by T. C. Amory (Boston, 1859).

SULLIVAN, JOHN (1740-95). An American soldier, prominent in the Revolutionary War. He was born at Berwick, Me., removed to Durham, N. H., and there practiced law. In June, 1775, he was appointed brigadier-general by Congress. During the siege of Boston, with General Greene, he commanded the left wing under General Lee, and on June 4, 1776, was placed in command of the army in Canada, whence, after being badly defeated at Three Rivers, he retreated with great skill to New York. On August 10th he became a major-general, and on the 27th served with distinction at the battle of Long Island (q.v.), during which he was taken prisoner. He was exchanged and served in the battles of Trenton, Princeton, Brandywine, and Germantown. In 1778 he was sent with a large force to act with D'Estaing against Newport, but the plan being abandoned, after decisively defeating the English at Butt's Hill on August 29th, he withdrew from Rhode Island. In 1779 he marched into western New York, and effectually chastised the Iroquois, defeating them and their Tory allies at Newton (Elmira) on August 29th. Resigning from active duty late in 1779, he served in Congress in 1780-81, was Attorney-General of New Hampshire from 1782 to 1786, was President of the State from 1786 to 1789, and was United States district judge from 1789 to 1795. Consult his *Life* by Peabody in Sparks, *American Biography* (series 2, vol. iii.); Amory, *The Military Services and Public Life of General John Sullivan* (Boston, 1868); and *Journals of the Military Expedition Against the Six Nations* (Auburn, N. Y., 1887).

SULLIVAN, JOHN LAWRENCE (1858—). An American prize-fighter, born in Boston, Mass. In 1880 he defeated George Rooke, and two years afterwards he beat Ryan in nine rounds. In 1887 he fought a draw with Cardiff; in 1888 fought a draw with Mitchell at Chantilly, near Paris; and in the next year, in Mississippi, in a seventy-five round fight, defeated Kilrain, winning the American championship and a diamond belt offered by a sporting paper. In 1892 he met Corbett at New Orleans and was defeated in the twenty-first round, thereby losing the championship title. In 1896 he was defeated by Sharkey in three rounds.

SULLIVAN, THOMAS BARRY (1820?-91). A British tragedian, born in Birmingham. He was brought up in Cork, where he made his appearance on the stage before 1840. He joined the company of the Theatre Royal, Edinburgh, and remained there several seasons, advancing rapidly in his profession. In 1852 he appeared at the Haymarket Theatre, London, in Hamlet, the part in which he was on the whole most successful, though his Beverley in *The Gamester* was very highly praised. Consult Lawrence, *Barry Sullivan: A Biographical Sketch* (1893).

SULLIVAN, THOMAS RUSSELL (1849—). An American novelist and dramatist, born in Boston. He was educated at the Boston Latin School, passed the years 1870-73 in Europe, was then for fifteen years connected with a firm of Boston bankers as clerk and cashier, and after 1888 devoted himself to literature. He wrote *Roses of Shadow* (1885); *Day and Night Stories* (two series, 1890 and 1893); *Tom Sylvester* (1893); *Ars et Vita* (1898); *The Courage of Conviction* (1902); and several plays, of which the more noteworthy are *The Catspaw* (1881), a dramatization of *Dr. Jekyll and Mr. Hyde* (1886), and *Merely Players* (1886).

SULLIVAN'S ISLAND. An island at the entrance to Charleston Harbor, the site of Fort Moultrie (q.v.).

SULLIVANT, WILLIAM STARLING (1803-73). An American botanist, the founder of American bryology. He was born in Franklinton, Ohio, near Columbus, studied in Kentucky and in Ohio University, and in 1823 graduated at Yale. In 1840 he published a *Catalogue of Plants in the Vicinity of Columbus, Ohio*, and thereafter specialized in the cryptogamous plants. *Musci Alleghanienses* (1845) was followed in 1846 and 1849 by contributions to the *Memoirs* of the American Academy of Sciences "On the Bryology and Hepaticology of North America," and by a valuable addition to Gray's *Manual* on the mosses of the Northern United States, published separately in 1856 as *The Musci and Hepaticæ of the United States East of the Mississippi River*. In the same year, with the help of Lesquereux, he published *Musci Boreali-Americani Exsiccati*. *Icones Muscorum*, containing 129 valuable copper plates, is probably Sullivant's greatest work. At the time of his death he was at work on a *Manual of Mosses*.

SULLY, JAMES (1842—). An English psychologist, born at Bridgewater, Somersetshire. He was educated at Independent College, Taunton, Regent's Park College, London, and at the universities of Göttingen and Berlin. Until 1892 he served as lecturer in the College of Preceptors, London, and in that year became professor of the philosophy of mind and logic in University College, London. Sully published both general treatises and special studies in psychology, the most important being: *Outlines of Psychology, with Special Reference to the Theory of Education* (1884; 2d ed. 1885); *Elements of Psychology* (1886); *The Human Mind: A Text-Book of Psychology* (1892); *Studies of Childhood* (1895); and *Essay on Laughter: Its Forms, Its Causes, Its Development, and Its Value* (1902). Sully became known as one of the most eminent of modern English psychologists; his work carries on the best traditions of the English school, but is characterized by its breadth and careful recognition of the development of psychological science on the Continent.

SULLY, sụ'lē', MAXIMILIEN DE BÉTHUNE, Duke de (1560-1641). The great Minister of

Henry IV. of France. He was born at Rosny, near Mantes, the second son of François, Baron de Rosny. He belonged to a Protestant family and was educated with the young Henry at the Court of Navarre. This was the beginning of a friendship and a loyal service that continued until Henry's death. He escaped the Massacre of Saint Bartholomew, accompanied Henry in his flight from the French Court (1576), shared in the campaigns against the Catholic League, distinguishing himself especially at Coutras (1587), and became Henry's wisest and most trusted adviser. He urged Henry's acceptance of Catholicism to save the crown. The misgovernment of the preceding years and the anarchy of the wars of religion had almost ruined France, and Sully, made Minister of Finance in 1597, and chief intendant in 1599, set himself thoroughly to reform the administration. He made a tour through the chief provincial districts, armed with absolute authority, personally examined the accounts, dismissed or suspended delinquents, and largely replenished the treasury with the ill-gotten wealth which he compelled them to disgorge. Little by little he brought the affairs of the country into an orderly state. From 1597 to 1609 he trebled the income of the State. His indefatigable activity was not confined to the department of finance; he practically was in supreme charge of the various other branches of the administration, promoted agriculture, encouraged export trade, and constructed roads, bridges, and causeways. He was made grand master of artillery in 1601, and in 1606 was created Duke de Sully. Sully was not popular. His single-minded service of the King made him disliked by the people for his supposed severity. The Catholics hated him for his religion; the Protestants for his invariable refusals to sacrifice the smallest jot of his master's or the country's interest for their sake. At Henry's death he was forced to resign his offices and lived in comparative retirement. Sully wrote *Mémoires des sages et royales économies d'état, domestiques, politiques et militaires, de Henri le Grand*, a wearisome and disorderly collection of writings in the form of a narrative addressed to himself by his secretaries. It is through these volumes that we are made acquainted with the 'great design' of Henry for the federation of Europe, a design the genuineness of which has been the subject of much controversy. The edition in Michaud and Poujoulat, *Nouvelle collection des mémoires pour servir à l'histoire de France*, is from the original. Consult Lavisse, *Sully* (Paris, 1880).

SULLY, Thomas (1783-1872). A portrait painter of the early American school. Born at Horncastle, Lincolnshire, England; he was brought by his parents, who were actors, to Charleston, S. C., in 1792. In 1806 he removed to New York, and in 1809 he went to London, where he completed his studies begun in America under Benjamin West. Two years later he returned to America and settled in Philadelphia. Among his best known portraits are those of Commodore Decatur in the City Hall, New York; General Lafayette at Independence Hall, and George Frederick Cooke at the Pennsylvania Academy of Fine Arts, Philadelphia; Thomas Jefferson (1821) at the Military Academy, West Point; and portraits of Charles Kemble, Frances Anne Kemble, and Rembrandt Peale, James Madison, Andrew Jackson, and John Marshall, in the Corcoran Gallery, Washington. Consult his "Recollections of an Old Painter," in *Hours at Home* (1869).

SULLY-PRUDHOMME, sụ'lē' prụ'dôm', René François Armand (1839—). A French poet, born in Paris. He was educated for the law, and was a student of science and philosophy. In 1865 he published *Stances et poèmes*, which won the praise of Sainte-Beuve for their delicate elegiac sentiment. Encouraged by this success, he devoted himself wholly to poetry. In 1866 appeared *Les épreuves*, a work in which the sadness of unbelief is poignantly expressed. *Les solitudes* (1869) and a rhymed translation of the first book of Lucretius (1869) foreshadow by their depth his great philosophical poems *La justice* (1878) and *Le bonheur* (1888). These two last-mentioned poems are among the greatest efforts of French poetry since Victor Hugo and Lamartine. *Impressions de guerre* (1870) deal with some of the phases of the Franco-German War. *Les destins* (1872), *Vaines tendresses* (1875), and *Le prisme* (1886) are less philosophic and more personal. Sully-Prudhomme entered the Academy in 1881, and in 1901 received one of the Nobel prizes in recognition of the lofty qualities of his poetry. He devoted a portion of this to establishing an annual award for excellence among the younger French poets. His verses are thoughtful and often melancholy. Sensitively open to all impressions, he is singularly temperate in expression. This quality of reserve is particularly noticeable in his expression of the sadness which is his usual mood.

Consult: Brunetière, *Poésie lyrique*, vol. ii. (ib., 1894); id., *Littérature contemporaine* (2d ed., ib., 1895); Lemaître, *Les contemporains*, vols. i., iv. (ib., 1896); Gaston Paris, *Penseurs et poètes* (ib., 1897).

SULPHOCYANIC ACID, or Thiocyanic Acid, HCNS. A powerful organic acid analogous in its composition to the well-known cyanic acid (q.v.), HCNO, from which it differs in containing sulphur instead of oxygen. *Sulphocyanates*, i.e. salts of sulphocyanic acid, may be obtained by the direct action of sulphur on cyanides (i.e. salts of hydrocyanic acid). Thus, potassium sulphocyanate may be obtained by boiling a solution of potassium cyanide with sulphur. Free sulphocyanic acid may be prepared by decomposing barium sulphocyanate with sulphuric acid, and distilling the aqueous acid thus obtained over warm anhydrous chloride of calcium. The acid is thus obtained in the form of a volatile liquid with a characteristic pungent odor. Pure sulphocyanic acid may be preserved for some time if kept in the cold. At ordinary temperatures it rapidly polymerizes, forming an amorphous yellow substance. Several of the sulphocyanates are extensively used as mordants in certain dyeing processes. The principal commercial source of the salts is found in the manufacture of coal gas. The products formed during the destructive distillation of coal include ammonia, cyanogen, a certain amount of ammonium cyanide, and certain compounds of sulphur. In course of the purification of the gas, these by-products are brought into contact with moist ferric oxide for the purpose of freeing the gas from deleterious sulphur compounds. The sul-

phur is thus retained partly in the free state, partly as iron sulphide, and by combination with the ammonium cyanide present yields *ammonium sulphocyanate*, which may be dissolved out of the reacting mixture with water. Ammonium sulphocyanate itself may be used for the preparation of hydrazine. Usually it is transformed into the sulphocyanate of copper, from which, in turn, the useful *sulphocyanate of barium* is obtained by the action of baryta. The *sulphocyanate of aluminum*, another useful salt of sulphocyanic acid, may be obtained by the action of aluminum sulphate on the sulphocyanate of barium. Most of the sulphocyanates are soluble in water. *Sulphocyanate of mercury* may be obtained by the action of mercuric nitrate on the sulphocyanate of ammonium. It decomposes on moderate heating, the resulting mass, externally yellow, but black within, assuming a large size and often a most fantastic shape. This sulphocyanate is the principal ingredient of the well-known toy known as 'Pharaoh's serpents.' Each serpent consists of a little cone of tinfoil, filled with the salt. On lighting the cone at the apex, there begins to issue from it a thick serpent-like coil, which continues twisting and increasing in length to an extraordinary degree.

Like cyanic acid (q.v.), sulphocyanic acid furnishes a simple example of the phenomenon known as *tautomerism*. The two constitutional formulas corresponding to the acid, as deduced from a study of its two different series of derivatives, are as follows:

$$N \equiv C - S - H \quad \text{and} \quad H - N = C = S$$

The two imaginary compounds corresponding to these formulas, but in reality represented by only one acid, are called, respectively, sulphocyanic acid and iso-sulphocyanic acid (or thiocyanic acid and iso-thiocyanic acid).

SULPHONAL $(CH_3)_2C(SO_2C_2H_5)_2$. A white crystalline compound used as a hypnotic. It is prepared by the action of acetone on mercaptan (q.v.) and the oxidation of the resulting product by permanganate of potassium. It is sparingly soluble in water and alcohol and is best administered with hot milk. It is employed as a substitute for chloral, over which it has the advantage of exercising no depressing action on the heart. It is, however, a poisonous substance and has been known to produce serious functional disturbances and eruptions on the skin. It is sometimes administered in conjunction with a similar compound, known as trional (q.v.).

SULPHOVINIC ACID. Same as ethyl hydrogen sulphate, or ethyl sulphuric acid. $C_2H_5.H.SO_4$. See ALCOHOL.

SULPHUR (Lat. *sulphur*, *sulfur*, sulphur; possibly connected with Goth. *swibls*, OHG. *swebal*, Ger. *Schwefel*, AS. *sweft*, sulphur). A non-metallic element that has been known since ancient times. Owing to the fact that it burns readily, it was called *brennestone* or *brimstone*, and was regarded by the alchemists as the principle of combustibility, representing the alterability of metals by fire. It occurs in the uncombined state, though usually contaminated with clay, bitumen, and other impurities, and sometimes with traces of arsenic, selenium, tellurium, etc., usually in the vicinity of volcanoes and hot springs. Its compounds, especially those with metals (sulphides), are of common occurrence, and include *chalcopyrite* or copper-iron sulphide, *cinnabar* or mercury sulphide, *galena* or lead sulphide, *pyrite* or iron sulphide, the arsenic sulphides or *realgar* and *orpiment*, *sphalerite* or zinc sulphide, *stibnite* or antimony sulphide. In combination with metals and oxygen (sulphates), sulphur occurs in such minerals as *anglesite* or lead sulphate, *barite* or barium sulphate, *celestite* or strontium sulphate, *chalcanthite* or copper sulphate, *gypsum* or calcium sulphate, and *kieserite* or magnesium sulphate. Volcanic gases generally contain sulphur in the forms of sulphur dioxide and sulphureted hydrogen, and compounds containing sulphur are found in certain organic materials, such as the volatile oils of mustard and garlic, hair, wool, bile, and albuminous substances. It is generally believed that native sulphur has been formed by the action of sulphur dioxide on hydrogen disulphide. Sulphur may also be obtained by decomposing certain mineral sulphides, such as pyrite. The commercial article is usually obtained by purifying native sulphur by fusion, or by distillation, and is produced largely in Sicily, where it occurs mixed with celestite, gypsum, limestone, and marl. The ore, after being carefully hand-picked, was formerly heated in heaps from which the liquid sulphur collected in a trough at the bottom, whence it was ladled out; but as this process was very wasteful, kilns came into use, in which the sulphur ore was piled and ignited at the bottom; the heat penetrated slowly into the mass, and as the sulphur gradually melted it ran to the bottom of the kiln, where it was collected and then cast into molds. Sulphur may also be extracted from ores by using a solvent such as carbon disulphide, from which it is then separated by distillation. Crude commercial sulphur usually contains about 3 per cent. of earthy impurities, which may be removed by distillation, in which case the sulphur is first melted and then heated to the boiling-point, the vapor of sulphur then passing into a large chamber, where it condenses and falls to the floor in the form of a light yellow crystalline powder commonly known as *flowers of sulphur*. This is cast into slightly conical wooden molds, when it is known as *roll sulphur* or *brimstone*, and sometimes it is allowed to cool in the chamber, when it is obtained in large crystalline masses called *block sulphur*.

Sulphur (symbol, S; atomic weight, 32.07) occurs in several allotropic modifications. One of these is a brittle solid that crystallizes in the rhombic system, but that on heating passes into transparent yellowish-brown needles of the monoclinic system. Both of these forms are soluble in carbon disulphide. The modifications of sulphur that are insoluble in carbon disulphide include plastic, amorphous, yellow, and black sulphur. There is a variety of sulphur that is soluble in water. This is known as *colloidal sulphur* and is obtained by passing hydrogen disulphide into an aqueous solution of sulphur dioxide. Sulphur has a specific gravity of about 2.03, and melts variously from 111° to 115° C. It is a poor conductor of heat and electricity. The element itself is extensively used in the arts and manufactures, as in making gunpowder and matches, and in medicine.

Sulphur combines with oxygen to form a dioxide (SO_2) and a trioxide (SO_3), which in turn combine with water to form sulphurous and sulphuric acids (H_2SO_3 and H_2SO_4 respectively).

It also forms a sesquioxide (S_2O_3) and a heptoxide (S_2O_7); but these are unimportant. Sulphur dioxide, or sulphurous anhydride, was known to the ancients, and Homer mentions the fact that the fumes from burning sulphur were used for fumigation, while Pliny says that such fumes were employed for purifying cloth. It is readily formed by burning sulphur in the air, and also by the action of certain metals, such as copper, on sulphuric acid. It is a colorless gas with a suffocating odor and is freely soluble in water, forming sulphurous acid. The gas is used as a bleaching agent, as a disinfectant, and as an antiseptic, serving to prevent the putrefaction of meat and to stop fermentation. It is also used in the sulphuring of wine. Its compound with water, known as sulphurous acid (H_2SO_3), combines with bases to form a series of salts which are known as sulphites. *Sulphur trioxide*, or sulphuric anhydride, is formed when a mixture of sulphur dioxide and oxygen is passed over platinum sponge, or by the distillation of fuming sulphuric acid. It is a colorless mobile liquid that solidifies in the form of long transparent prismatic crystals which melt at 14.8° C. The liquid boils at 46° C. It is very acrid and chars paper, wood, and organic matter generally. When thrown into water it dissolves with a hissing sound and evolves a large amount of heat, forming sulphuric acid (q.v.). Under the name of *crystallizable sulphuric acid*, it is used in the manufacture of coal-tar colors, such as alizarin, and in the purification of ozokerite. With hydrogen and oxygen sulphur forms a series of acids including, besides those already mentioned, the following: *thiosulphuric* or *hyposulphurous acid* ($H_2S_2O_3$), which is described elsewhere; *hydrosulphurous acid* (H_2SO_2), a powerful reducing agent discovered by Schützenberger and prepared by the action of metallic zinc on acid sodium sulphite; *persulphuric acid* (HSO_4), obtained in a combined form by the electrolysis of a strong solution of acid potassium sulphate; *pyrosulphurous acid* ($H_2S_2O_5$), whose potassium salt is formed when sulphur dioxide gas is passed into a hot aqueous solution of potassium carbonate; *pyrosulphuric acid* ($H_2S_2O_7$), formed by the direct union of sulphur trioxide and sulphuric acid; *dithionic acid* ($H_2S_2O_6$), whose manganese salt is formed by the action of sulphur dioxide on manganese dioxide; *trithionic acid* ($H_2S_3O_6$), whose potassium salt is formed by the action of flowers of sulphur on a warm solution of acid potassium sulphite; *tetrathionic acid* ($H_2S_4O_6$), whose sodium salt is formed by the action of iodine on sodium hyposulphite; *pentathionic acid* ($H_2S_5O_6$), formed, along with free sulphur, by the action of sulphur dioxide on aqueous sulphureted hydrogen.

Sulphur combines with hydrogen to form a disulphide (sulphureted hydrogen, q.v.) and a persulphide, of which the former is well known. The persulphide (probably H_2S_5) is an oily yellow liquid which is prepared by pouring an aqueous solution of an alkaline polysulphide into excess of a solution of about equal parts of concentrated hydrochloric acid and water. It has the property of bleaching organic coloring matters, and reduces the oxides of gold and silver with great rapidity. With carbon sulphur combines to form a disulphide (CS_2), which is described in a special article. (See CARBON DISULPHIDE.) With chlorine sulphur combines to form a monochloride (S_2Cl_2), a dichloride (SCl_2), and a tetrachloride (SCl_4), of which the most important is the monochloride. This is prepared by passing dry chlorine gas over melted sulphur and distilling off the chloride from the excess of sulphur. It is an amber-colored liquid that fumes strongly in the air, and possesses a penetrating odor. A saturated solution of sulphur in the monochloride is used in vulcanizing rubber goods.

SULPHUR, MEDICAL USES OF. Sulphur is used in medicine both internally and externally. It is prepared from crude sulphur by sublimation, washing, and precipitation. Taken by the mouth sulphur is in medicinal doses a mild laxative, producing a soft stool, which slips by strictures of the rectum, piles, and fissures with little discomfort. It is, therefore, used in these conditions. Sulphur is particularly valuable for chronic rheumatism, either taken in the form of mineral waters containing this element, or externally by means of sulphur baths. The latter are employed in various chronic skin diseases, of obstinate type, such as psoriasis, lichen, and eczema. (See BATH and MINERAL WATERS.) Calcium sulphide is of value in all cases where pus is about to form, as when successive crops of boils appear, or in acne pustulosa.

The external uses of sulphur are mostly confined to affections of the skin and as a parasiticide. It is only active when used in the form of an ointment. For the itch (q.v.) sulphur ointment is a specific. It is also a favorite remedy for ringworm (tinea, q.v.).

SULPHURETED HYDROGEN, HYDROGEN SULPHIDE, or HYDROSULPHURIC ACID, H_2S. A gaseous acid compound of sulphur and hydrogen, known since the sixteenth century, but first carefully investigated by Scheele in 1777. It occurs uncombined in certain mineral waters and is formed in the decomposition of albuminous substances containing sulphur. It also occurs as a product of transformation of gypsum (calcium sulphate) and other metallic sulphates and is a constituent of volcanic exhalations. But whatever its origin, it does not long remain unchanged in the air, being oxidized with the greatest ease. The usual method of preparing the gas consists in causing sulphuric or preferably hydrochloric acid to act on ferrous sulphide. The following rule usually holds good: Sulphureted hydrogen is formed by the action of acids on the sulphides of those metals (e.g. iron, zinc, manganese, calcium, magnesium, sodium, potassium, etc.) which can directly decompose the acids with liberation of hydrogen. Sulphureted hydrogen is a colorless gas, somewhat heavier than air, soluble in water and more so in alcohol, the solutions reddening blue litmus paper. Mixed with 1½ volumes of oxygen and ignited, it explodes, the products of the reaction being water vapor and sulphur dioxide (SO_2). Under the influence of cold and pressure, sulphureted hydrogen condenses to a colorless mobile liquid. Sulphureted hydrogen is very poisonous, and even small proportions of it in the air are dangerous. The presence of free sulphureted hydrogen may be demonstrated by means of a strip of filter-paper soaked with a solution of lead acetate, the paper turning brown or black, owing to the formation of lead sulphide. Chlorine and

iodine decompose sulphureted hydrogen, and this is why the odor of the latter is readily destroyed by bleaching-powder. Sulphureted hydrogen is used in the manufacture of certain metallic sulphides, for the purification of sulphuric acid, and extensively in analytical chemistry. The sulphureted hydrogen produced in certain industrial processes is utilized by burning it and transforming the resulting sulphur dioxide either into sulphuric acid or into free sulphur.

SULPHURIC ACID, H_2SO_4. A well-known acid compound of hydrogen, sulphur, and oxygen. When pure and free from water, it is a colorless, oily liquid of specific gravity 1.84 (approximately) at 0° C. While it may readily be undercooled, it solidifies normally at 6.79° C. (44.3° F.). At about 290° C. (554° F.) it begins to boil, breaking up into sulphur trioxide and water vapor, and as some of the latter is retained by the boiling acid, the temperature rapidly rises to about 338° C. (640° F.). It is highly hygroscopic, absorbing about 30 per cent. of its weight of water. It readily chars organic matter, and is poisonous, not only on account of its powerful corrosive action, but also on account of a specific effect on the blood. Chemically it is a dibasic acid, either one or both of its hydrogen atoms being replaced by metals, with the formation, respectively, of either acid or neutral salts (sulphates). Its chemical constitution is generally assumed to be represented by the formula H — O — S — O — O — O — H. By adding to it a little water, it may be caused to form the hydrate $H_2SO_4.H_2O$, which crystallizes out when the mixture is cooled and may then be readily isolated from the mother-liquor by suction. Glass bottles containing commercial sulphuric acid often burst in winter, owing to the separation of crystals of this hydrate, whose melting-point is about 8° C. (about 46° F.), and which decomposes into sulphuric acid and water above 205° C. (about 370° F.). If pure sulphuric acid is mixed with water in the proportion of 49 parts of the former to 18 parts of the latter, another well-defined hydrate is formed, having the composition $H_2SO_4.2H_2O$.

The term 'sulphuric acid,' however, as technically and commercially understood, seldom if ever refers to the actual monohydrate or to any of the other recognized hydrates of sulphur trioxide.

It refers either to a series of solutions of the monohydrate in water or to a series of solutions of sulphur trioxide in the monohydrate. ($H_2SO_4 + SO_3$.) The first series are known commercially as 'chamber acid'—'oil of vitriol'—'concentrated acid' or in terms of their specific gravity as indicated by a hydrometer scale, as 60° Baumé acid, 144° Twaddell acid and so forth. The second series are termed 'fuming' or Nordhausen acids, and are always estimated alkali-metrically according to the percentage of free sulphur trioxide contained.

Technically, therefore, 'sulphuric acid' might be considered to be the generic name of a series of solutions of sulphur trioxide (SO_3) in water, some of which solutions are distinguished by variations of properties which occur uniformly with uniform percentage mixtures of sulphur trioxide and water and are therefore chemical hydrates of sulphur trioxide—most of which are, however, merely solutions of convenient strength for use in the arts.

The manufacture of sulphuric acid is one of the greatest chemical industries. The processes involved include the production of sulphur dioxide, the transformation of this into sulphur trioxide, and the transformation of the trioxide into sulphuric acid. Of these, the oxidation of the dioxide is the most important, the dioxide itself being readily produced by burning sulphur, mineral sulphides, or sulphureted hydrogen, with free access of air, the resulting gases, technically termed 'burner-gas,' including from 5 to 8 per cent. of the dioxide (the remainder is constituted by the nitrogen and excessive oxygen of the air and by impurities). The two processes devised to effect the oxidation of the dioxide are alike catalytic in their action, in so far as the

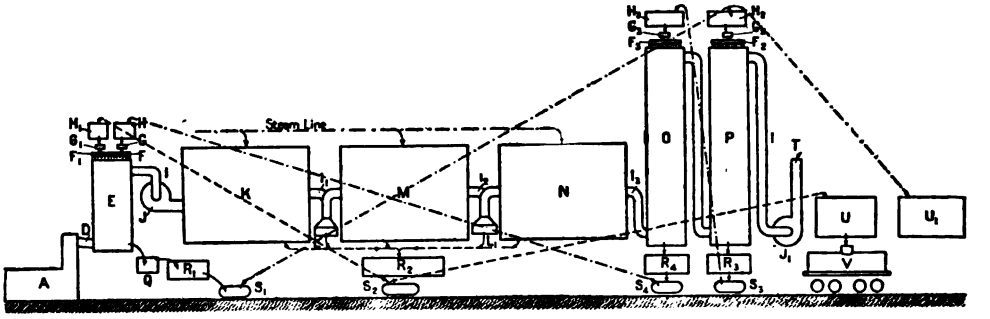


DIAGRAM SHOWING CHAMBER PROCESS FOR MAKING SULPHURIC ACID.

In the figure, A is a bench of pyrites burners, niter oven, etc. The burner-gas is conducted through pipe D to the Glover tower, E, where it meets the dilute acids and oxides of nitrogen. The fan J carries the gases through the pipe I to the first chamber, K, where oxidation of the sulphur dioxide takes place in presence of water vapor supplied by the steam-line shown above the chambers, thence to the second and third chambers, M and N, through the flues I_1 and I_2 and surface condensers L and L_1. The acid drained from the bottom of each chamber and the condensers is collected in the tank R_2.

The pump S_2 delivers this acid to the tank H_1, over the Glover tower, or to the storage tank U, whence it goes to the tank-car V. The strong acid coming from the Glover tower is collected in cooler Q and tank R_1 and is delivered by the pump S_1 to the tank H_2 over the second Gay-Lussac tower, P, and to the storage tank U_1. The gases from the last chamber, N, are conducted through the pipe I_3 to the first Gay-Lussac tower, O, and thence to the second Gay-Lussac tower, P, their flow being maintained by the fan J_1. The exhausted gases pass to the atmosphere at T. The nitrous vitriol from the first Gay-Lussac tower is collected in the tank R_4 and is delivered by the pump S_4 to tank H over the Glover tower. The nitrous vitriol from the second Gay-Lussac tower, containing but little N_2O_3, is collected in the tank R_3 and is delivered by the pump S_3 to the tank H_3 over the first Gay-Lussac tower. In different works this scheme varies somewhat in detail, but not in its essential points.

substances used, while producing the required chemical reaction, remain themselves in the end unchanged. These two processes are termed, respectively, the chamber process and the contact process.

THE CHAMBER PROCESS. In the chamber process the burner gas is mixed in large lead chambers (and with more or less auxiliary apparatus) with nitric acid, or with the products of the action of sulphuric acid on sodium nitrate, the catalytic agent being probably nitrogen trioxide, and the following reactions probably taking place:

$$2SO_2 + N_2O_3 + H_2O + O_2 = 2SO_2(OH)(NO_2);$$
$$2SO_2(OH)(NO_2) + H_2O = 2H_2SO_4 + N_2O_3.$$

The nitrogen trioxide is thus entirely reproduced. In addition to the above principal reactions there are further reactions set up in the so-called Guy-Lussac and Glover towers, in which apparatus, respectively, the catalytic agent is recovered and made available (in the form of nitric acid) for further use. The principle of the chamber process, therefore, is the production of a dilute sulphuric acid by oxidizing a burner gas containing say 5 per cent. to 8 per cent. of sulphur dioxide in presence of water vapor by the means of nitric acid in suitable apparatus in such a way that the nitric acid is practically recovered for further use. This recovery, however, is rarely complete—a certain mechanical loss being unavoidable. The strongest acid which can be produced by the chamber process will correspond to from 50 per cent. to 60 per cent. of sulphur trioxide. Stronger acids must be produced by driving off the contained water by heat or by isolating the acid by freezing. It is thus possible to produce the concentrated acid (oil of vitriol) of commerce, containing from 93.5 to 97 per cent. of pure sulphuric acid; also distilled acid, containing up to 95.5 per cent. of H_2SO_4; but the anhydrous can only be isolated by freezing.

THE CONTACT PROCESS. In the contact process the method of production is directly synthetical, and acids of any desired strength may be made in one operation. In this process the burner gas must be first rendered absolutely free from everything other than sulphur dioxide, oxygen, and inert nitrogen, the usual impurities of burner gas, such as dust, moisture, arsenic, selenium, etc., derived from the raw material used, seriously interfering with the process. After purification, the gas is passed through a substance possessing the faculty of causing sulphur dioxide to oxidize into sulphur trioxide, without apparently suffering any change whatever in its own condition. This contact must be brought about under conditions as to temperature according to the substance used. The contact substances used are finely divided platinum in various forms, such as platinized asbestos and pumice, etc., crusts formed of platinum and some soluble sulphate, ferric oxide, cupric sulphate, diatomaceous earth, etc. The transformation of sulphur dioxide into the trioxide takes place best between 200° and 450° C. (392°-842° F.). Above 450° C. the transformation grows incomplete, for at that temperature commences the dissociation of sulphur trioxide into dioxide and free oxygen—a dissociation which is complete at 900° C. The formation of sulphur trioxide having been attained, it simply remains either to condense it at the proper temperature in its crystalline condition or to absorb it in sulphuric acid or water until a solution of the required strength is obtained.

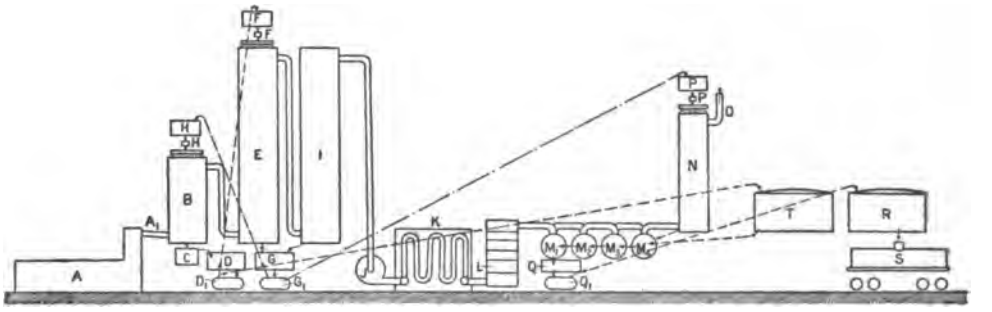


DIAGRAM SHOWING CONTACT PROCESS FOR MAKING SULPHURIC ACID.

A is a bench of pyrites burners. The burner gas passes through the flue A_1 to the first cleaning tower, B. Weak sulphuric acid is constantly flowing down this tower, becoming concentrated by the hot burner gas and absorption of the sulphur trioxide contained in the burner gas, and finally flows out at the bottom into the cooler C at a strength of from 62° to 64° Baumé. From the cooler C the strong acid passes to the tank D and is delivered by the pump D_1 to the storage tank T, or to the tank F over the second cleaning tower, E. A constant stream of strong sulphuric acid from the tank F is kept flowing down this tower. In this tower the burner gas coming from the top of B is further cleaned and dried by the action of the strong acid and then passes to the filter tower, I; the circulation of the gases through the train of apparatus is maintained by the fan J. Before entering the contact ovens, the mixed gases are reheated to the proper temperature for the combination of the sulphur dioxide and oxygen in the reheater, K.

The contact oven, L, consists of cast-iron rings with perforated shelves, or diaphragms, upon which is placed the contact mass.

The sulphur trioxide formed in the contact oven now passes through the absorption cylinders, M_1, M_2, M_3, M_4. These are cylindrical iron tanks connected in such a way that the gas passes from end to end, meeting the weak acid flowing in the opposite direction. Both the gas and the acid in M_1 are richest in sulphur trioxide, while in M_4 the gas and acid are weak. Sulphur trioxide is most readily absorbed by acid containing about 98% H_2SO_4. The strong acid, which is ready for the market as it comes from M_1, is collected in the tank Q and is delivered by the pump Q_1 to the storage tank, R.

The gases coming from the last absorption tank, M_4, contain still a small amount of unabsorbed sulphur trioxide. In order to recover this, the gases are passed through the tower N, which is supplied with strong acid which absorbs the last traces of sulphur trioxide. The nitrogen and oxygen remaining pass into the air through the pipe O. The tank car S receives acid for shipment from the storage tank, R.

USES OF SULPHURIC ACID. The uses of sulphuric acid in the arts are extremely varied and of the highest importance. It forms the basis of manufacture of nearly all the other acids and

salts. Nitric, hydrochloric, acetic, picric, phosphoric, oxalic, tartaric, citric, and stearic acids, chemical manures and fertilizers, are all prepared by the agency of sulphuric acid. It is also used in the metallurgy of copper, cobalt, nickel, silver, and platinum, as well as in the preparation of sheet iron and wire for galvanizing and tinning; in the preparation of phosphorus, bromine, iodine, potassium bichromate, ordinary ether, and various esters (q.v.), starch, glucose, sugar, and effervescent drinks; in the manufacture of parchment papers, cellulose, celluloid, high explosives, nitroglycerin, nitrobenzene, guncotton, smokeless powders, pyroxilene, etc.; in the manufacture of coal-tar colors and dyes; in dyeing, calico printing, and tanning; in refining mineral oils, tallow, benzene, and paraffin; in the preparation of the various sulphates, as those of ammonium, potassium, barium, magnesium, aluminum, iron, zinc, copper, mercury, atropine, hydroscyamine, morphine, quinidine, quinine, strychnine, and others, too numerous to mention and many of which have an extensive application in therapeutics.

HISTORY. Geber was the first to describe sulphuric acid as a spirit which can be produced from alum and which possesses solvent properties. From the year 1613 sulphuric acid was prepared by the apothecaries by burning sulphur with access of air in moist vessels. In 1666 the addition of a little saltpetre was introduced by Nicholas Lefèvre About 1740, at Richmond, near London, England, the first sulphuric acid works on a commercial scale were founded, producing oil of vitriol 'made by the bell' in contradistinction to that distilled from copperas. The birth of the modern method of sulphuric acid making, however, dates from Roebuck's installation of lead chambers in Birmingham in 1746, and his further installation at Prestonpans, in Scotland, in partnership with Garbett. As late, however, as 1800 the Prestonpans works only yielded 111 per cent. on the sulphur burned, with a consumption of 13 per cent. of nitrate of soda (modern practice would yield 300 per cent. of the acid on sulphur burned with a consumption of less than 3 per cent. nitrate of soda). The chambers at that time were about 14 feet long, 10 feet high, and 4 feet 10 inches wide. (They are now commonly 50 feet to 100 feet long, 20 feet to 25 feet high, and 20 feet to 30 feet wide.) In 1827 Gay-Lussac introduced his towers for the recovery of nitric acid. Another important step was the introduction, in 1859, by John Glover, of his denitrating and concentrating tower at the Washington Chemical Works, near Durham, in England. This completed the rational and economical method of manufacture known as 'the chamber process.' From that time on the history of the chamber process of manufacturing sulphuric acid has been largely one of minor improvements, economics, and investigations into the chemical reactions involved in the process.

In the meantime, however, as early as 1817, the catalytic action of platinum was discovered by Sir Humphry Davy, and this phenomenon was further investigated by Edmund Davy, Döbereiner, and others. In 1831 Peregrine Phillips, Jr., an acetic acid manufacturer, discovered and patented the application of the catalytic action of platinum to the production of sulphur trioxide. The matter remained dormant until 1848, when the Belgian Schneider claimed to have discovered in pumice stone a substance of great catalytic activity. From this time on the subject received the attention of many scientists in Europe. But it was not until the publication of the investigations of Clemens Winkler in Dingler's *Journal*, in 1875, that the foundation of a commercial contact process can be said to have been securely laid. Subsequent work by Hanisch and Schroeder, Messel and Lunge, and others, followed. Finally, about 1880, the matter was taken up by the Badische Anilin und Soda Fabrik in Germany, and this firm, after a long, costly, and obstinate struggle, brought the process to a commercial success. An output of 18,500 tons of sulphur trioxide by this firm in 1888 had been increased in 1890 to 116,000 tons. Other manufacturers also have made the contact process an established success, the different manufacturers working on slightly different methods or different contact materials. As yet, however, the only contact material of demonstrated commercial value is platinum in one or the other form or combination. In the United States the first contact plant was erected in 1899, at Mineral Point, Wis., by the New Jersey Zinc Company under the patents of Schroeder. This plant was almost immediately followed by others, all of which are in successful operation, and while this process cannot be said to have superseded the old chamber process, its advantages are such that its complete triumph is probably only a matter of time and improved methods.

BIBLIOGRAPHY. Until the publication of Georg Lunge's *Sulphuric Acid and Alkali* in 1879 (3d Eng. ed., London, 1903), the literature on this subject was confined entirely to the scientific journals and *Proceedings* of scientific societies. Consult also a lecture by Dr. Rudolf Kneitsch before the German Chemical Society, October 19, 1901, an English translation of which was published in the *Mineral Industry*, vol. x. Vols. vii., viii., ix., x. of the *Mineral Industry* also contain reports on "Progress in the Sulphuric Acid Industry."

SULPHURIC ETHER. See ETHER.

SULPHUROUS ACID (H_2SO_3). A colorless liquid containing about 6.4 per cent. of sulphurous anhydride (SO_2) and 93.6 per cent. of water. The gas is a valuable disinfectant and has been used for this purpose from the most ancient times. The gas is employed almost universally at the present day to disinfect buildings and rooms, although formaldehyde gas is gradually superseding it. Sulphurous acid is used as a spray or lotion in diphtheria and stomatitis, and is valuable as a wash for indolent ulcers and foul sores. It is an excellent remedy for ringworm. The acid is sometimes given internally to prevent abnormal fermentation in the stomach and intestines in certain varieties of dyspepsia, but its value is problematical, and there are many other drugs suitable for this condition whose action is certain. See DISINFECTANTS; FUMIGATION.

SULPHUR SPRINGS. The county-seat of Hopkins County, Texas, 79 miles east by north of Dallas, on White Oak Creek, and on the Saint Louis Southwestern and the Missouri, Kansas and Texas railroads (Map: Texas G 3). It has cotton gins, a cotton compress, cottonseed-oil mills, and manufactories of leather, brick and

tile, carriages and wagons, and lumber products. The water-works are owned by the municipality. Population, in 1890, 3038; in 1900, 3635.

SULPICIANS, sŭl-pĭsh'anz. A society of priests founded in 1641 by Jean Jacques Olier (q.v.) to educate candidates for the priesthood. It took its name from the parish of Saint-Sulpice in Paris, of which Olier was pastor. When the number of priests had increased beyond the needs of the parish, some took charge of a seminary; and this has since been their principal work. At the present time they have charge of the clerical seminaries in twenty-five dioceses of France. They came to Canada in 1642 and had a large share in the founding of the city of Montreal as a Christian colony; for a long time they did all the priestly work there, and still conduct the seminary. On the invitation of Bishop Carroll, they came to Baltimore in 1790 and took charge of the seminary founded there a year later; in 1808 they established another at Emmitsburg, the later Mount Saint Mary's College. They also have charge of the seminaries in the dioceses of New York, Boston, and San Francisco, and of the clerical students in the Catholic University at Washington.

SULPICIUS (sŭl-pĭsh'ĭ-ŭs) **SEVE'RUS** (c.363-c.410.) An ecclesiastical historian, born in Aquitaine. According to Paulinus (Ep. xxii.) he went to live at Primuliacum, a village near Toulouse, and about this time he seems to have taken monastic vows. He was a friend of Saint Martin, Bishop of Tours, whom he frequently visited, and whose life he wrote (*Vita S. Martini Turonensis*). His biography and his dialogues are of great historical value. The most important of Sulpicius's other writings is his *Historia Sacra*, composed about 403. This book was for a long time used as a text-book for history in the schools of Europe (till c.1656). There is an English version of his writings, by Alexander Roberts, in *Nicene and Post-Nicene Fathers* (vol. xi., 2d series, New York and Oxford, 1894).

SULTAN. A breed of small fowls, derived from Turkey, and kept for their beauty of plumage and docility as pets.



A SULTAN COCK.

SULTAN (Ar. *sulṭān*, emperor, empire, from *saliṭa*, to be imperious). A common title of Mohammedan princes since the time of the Ghaznivid Mahmud (997-1030). It is given, *par excellence*, to the ruler of Turkey, who takes the name *sultan khan*, 'reigning sultan,' or sultan of sultans. It is also given to the princesses of the royal house, and the Sultan's mother is called *valide sultan;* the mother of his first-born son is called *hasseki sultan*. In English a feminine form *sultana* is usually employed for women.

SULTE, sŭlt, BENJAMIN (1841—). A French-Canadian author, born at Three Rivers, in the Province of Quebec. Taken from school at the death of his father, who perished at sea, Sulte pushed his way through various employments into journalism and into the service of the Government as translator. His most solid prose work is the *Histoire des Canadiens-Français* (8 vols., 1882-84), which was followed by *Histoire de Saint François-du-Lac* (1886) and *Pages d'histoire du Canada* (1891). Sulte is also well known for his songs in *Les Laurentiennes* (1870) and *Les chants nouveaux* (1880).

SULU, sōō-lōō', or JOLÓ. The capital of the island and archipelago of the same name in the Philippines, situated on the northwest coast of the island of Sulu, 580 miles almost due south of Manila, and 99 miles southwest of Zamboanga, Mindanao (Map: Philippine Islands, F 13). The old town, destroyed during the Spanish occupation of 1876-78, was the residence of the sultans from the time of the traditional first leader, Xarib, or Charib, who is reported to have come from Mecca during the latter part of the seventeenth century. The new town, laid out on the hill by the Spaniards at the time of their permanent occupation, is well constructed and fortified. The harbor is provided with a long stone pier and a lighthouse, and the town is an important shipping place. Since the protocol of 1877 between England and the German Empire and Spain, it has been a free port. The population is but a few thousand.

SULU (Sp. JOLÓ) **ISLANDS,** or **SOOLOO ISLANDS.** The southernmost group of the Philippine Islands. It extends between the Sulu and Celebes Seas from the western extremity of Mindanao southwestward to the northeastern extremity of Borneo (Map: Philippine Islands, F 13). Its combined area, excluding the Basilan group, which properly belongs to Mindanao and forms a separate province, is estimated at 1029 square miles. The archipelago is arranged in two main parallel chains, and consists of several minor groups, each centred around a large island. Of the latter the two largest are Sulu Island in the north and Tawi-Tawi in the south, whose areas, respectively, are 380 and 187 square miles. The number of islands counted is 188. The larger islands are of volcanic formation, and consist of mountains from 1000 to 3000 feet high, with several extinct volcanoes. The mountains are generally surrounded by a coast zone of coral deposits, and most of the smaller islands are wholly of coral formation and very low, though all are built on the summits of a subterranean mountain range. The climate, being more tempered by the sea, is cooler and more equable than that of Mindanao. The soil, a mixture of volcanic and coral detritus, is extremely fertile, and the vegetation is luxuriant. The flora is more distinctly related to that of the Philippines, especially Mindanao, than to the Borneo flora; the forests produce teak and other valuable timbers, and cocoanut and nipa palms are abundant.

Considerable areas in Sulu Island are cleared and cultivated, the chief crop being rice, while coffee, cacao, corn, hemp, cotton, and indigo are also raised. The industries include weaving for domestic use, the manufacture of cordage and of knives and hatchets, and pearl and shell fishing, the last being probably the most important. Trade is almost wholly in the hands of Chinese merchants, and consists chiefly in the exportation of pearl shell to Singapore and Manila and the importation of manufactured goods. The dominant race among the inhabitants are the Moros, a tribe of Mohammedan Malays, who had invaded and conquered the islands before the arrival of the Europeans. They practice polygamy and a mild form of slavery, which the United States Government has agreed not to abolish, though it has insisted that hereafter no person shall be enslaved. The people are governed directly by local chieftains called datos, who are more or less nominally subject to the Sultan of Sulu. The latter was confirmed in his title and authority by the United States Government. The population of the archipelago is estimated at 22,630. The capital is Sulu (q.v.).

When the Sulu Archipelago was visited by Magellan in 1521 it was already occupied by the Moros, and formed, together with its possessions in North Borneo, an independent State. The Moros showed a warlike and independent spirit, and remained almost up to the present time among the most formidable pirates in the Malay Archipelago. Spain claimed sovereignty over the islands and their dependencies, but did not exercise it beyond sending occasional punitive expeditions against the pirates, and her sovereignty was disputed by England and Germany. By 1875, however, Spain had gradually gained a foothold and begun to assume actual control. In 1877 traffic was declared free in the archipelago, and Spain abandoned her claim to North Borneo in favor of England. Finally in 1885 England and Germany formally recognized Spanish sovereignty in the islands. It had already been acknowledged by the Sultan in 1878. With the Philippine Islands the Sulu Archipelago passed into the possession of the United States in 1898. In December, 1899, a treaty was definitely concluded between the Sultan and the United States by which American sovereignty over the islands was recognized. The rights and dignities of the Sultan were acknowledged and an annual stipend was conferred upon him. The Moros were guaranteed immunity in the practice of their religion. Toward the end of 1903 hostilities broke out between the Moro chiefs and the United States forces. The latter, under the command of General Leonard Wood, inflicted a severe defeat on the enemy in the last days of November.

SULZER, zụl'tsĕr, JOHANN GEORG (1720-79). A Swiss æsthetic philosopher, born at Winterthur. Educated in Zurich, he went in 1742 to Berlin, where he entertained friendly relations with Euler and Maupertuis, became professor of mathematics at the Joachimsthaler Gymnasium (1747), then at the Ritterakademie (1763), and was elected a member of the Academy. His principal work, in which he sought to reconcile the doctrines of Wolf with the tenets of the French and English philosophers, is the *Allgemeine Theorie der schönen Künste* (1771-74; new ed., with literary additions by Blankenburg, 1792-94), supplemented by *Nachträge, oder Charakteristik der vornehmsten Dichter aller Nationen*, ed. by Dyk and Schatz (1792-1808). With Ramler he edited *Kritische Nachrichten aus dem Reiche der Gelehrsamkeit* (1750). Consult his autobiography (Berlin, 1809).

SUMACH (OF. *sumac, sumach*, Fr. *sumac, sommac*, sumach, from Ar. *summāq*, sumach, from *samaqa*, to come of good stock), *Rhus*. A genus of about 100 species of shrubs and small trees of the natural order Anacardiaceæ, distributed over almost all the world, except its coldest regions. The following species are of commercial importance: Venetian sumach (*Rhus Cotinus*), known also as wig sumach or wig tree, is a native of Southern Europe and Western Asia, and is often planted under the name smoke tree as an ornamental shrub. It has simple leaves and hairy corymbs of fruit, which have a sort of resemblance to periwigs. The wood, which dyes yellow, and, with the addition of other substances, green and brown, is known in trade as young fustic. The leaves are astringent, and are used for dyeing Turkey red. The root is also used in dyeing, and the whole plant is used for tanning in Italy. The seed resembles the almond in flavor. The very acid fruit of the elm-leaved sumach (*Rhus Coriaria*), a native of the Mediterranean region, has been used from the earliest times as a condiment. Similar to this is the Virginian sumach, or stag-horn sumach (*Rhus typhina*), a native of almost all parts of North America, with curiously crooked



STAGHORN SUMACH (*Rhus typhina*).

branches, covered, when young, with a soft velvety down. The smooth-leaved sumach (*Rhus glabra*), a similar species, also North American, has acid leaves, which are used for domestic purposes. The collection of the leaves of the sumach, especially *Rhus typhina*, for tanning is an industry in parts of the South. The varnish sumach or Japan varnish tree (*Rhus vernicifera*), a native of Japan and Nepal, yields a varnish much used in Japan for lacquer-work. The expressed oil of the seeds becomes as hard as tallow, and is used for candles. In Australia

the wood of *Rhus rhodanthema* (or *Rhodasphæra rhodanthema*) is considered one of the most valuable cabinet woods. It is dark yellow with a satiny lustre, and takes an excellent polish. The leaves and bark are used in tanning. The name tanner's sumach is given to *Coriaria myrtifolia*, a European shrub of the natural order Coriariaceæ. The leaves are astringent, and are used for tanning and for dyeing black.

The popularly reputed poisonous American species are botanically confused. *Rhus Toxicodendron*, a low shrub, is believed to be common only at the South; *Rhus radicans*, the so-called poison oak or ivy, a low, trailing or climbing species, referred by some botanists to Toxicodendron, is more widely distributed. *Rhus vernix* (or *Rhus venenata*), the so-called poison alder, sumach, dogwood, or swamp sumach, has long been reputed to cause irritation of the skin in some people and to be inert in others, a reputation also pertaining to the preceding species. A saturated alcoholic solution of lead acetate is considered a specific.

SUMAROKOFF, sōō'mȧ-rō'kôf, Alexander Petrovitch (1718-77). A Russian poet. He was born in Finland, was well educated, entered the military service, became Count Rumyantseff's adjutant, and later reached a high rank. When the first permanent theatre was established at Saint Petersburg in 1756, he was made director, and also wrote plays for production at the theatre. Petty of character, quarrelsome, and overambitious, he left the capital, incensed at the insufficient recognition he had received, and began to stage his works at Moscow. After a time he got into disputes with the management of the theatre there, and in despair took to drink, dying in obscurity. Although clumsy and ineffective, his tragedies played an important part in the history of Russian morals. His comedies and satires have a great deal of genuine humor and wit. His works were published at Moscow (2d ed., 10 vols., 1787).

SUMATRA, sōō-mȧ'trȧ. One of the Sunda Islands, the most western, also the largest, not reckoning Borneo, of the Dutch East India Islands, separated from the Malay Peninsula by the Malacca Strait, and from Java by the Sunda Strait (Map: East India Islands, B 5). It extends in a northwest and southeast direction. Its length is 1050 miles; its breadth ranges from 90 to 240 miles. Area, 161,612 square miles.

The Bukit-Barisan mountain range, of primitive formation with a covering of eruptive rocks, lines the island along the whole western shore, and in the south and in the north diverges toward the east coast. The whole northern part of the island is in fact mountainous. The descent to the generally rocky shores on the west is comparatively short and results in numerous valleys and ports of safety. To the east, in all the central part, extend lower stretches of level and undulating country sloping eastward, where all the main rivers are found, flowing eastward, often through marshy flats at the coast. The greatest elevations in the island are in the north, the loftiest peak being 12,100 feet. Here in the vicinity of Lake Toba—the most important lake—are steppes averaging 4000 feet in elevation, and thinly wooded, but the contiguous lower plains are rich in forests and characterized by dry rice-fields. In the region next south are encountered volcanoes and deep river valleys. Further south, in the large middle belt of the island, are also volcanoes on the west, rising to about 10,000 feet. Here are Lake Maninju, covering nearly 50 square miles and occupying the sunken cone of a volcano, and Lake Singkara, of equal area. Out of the latter issues the Ombilin River, coursing over a high plain of Eocene formation, and rich in coal fields. This whole fertile region in the western part is thickly populated and forms the Padang section, at present the most valuable industrial and commercial part of Sumatra. The large, more or less alluvial, and plentifully watered southern part of the island is little known. Sumatra has eight active volcanoes. The western coast with its rich soil, timber, and mines has been much more favorable to development than the eastern. The main rivers are the Musi, Jambi, Indragiri, and Kampar. They are of little importance for navigation. Around a large part of the coast extend rows and groups of islands of more or less significance and once a portion of the mainland—Banka, Linga, Rupert, Simalu, Siberut, etc. As a whole, Sumatra geologically belongs to the neighboring continental regions; sandstone, limestone, and slate formations abound.

The equator passes nearly through the centre of the island; accordingly the even temperature is constantly high, the mean annual temperature ranging from 77° to 81° F. The annual rainfall varies from approximately 90 to 185 inches. The lower sections of the island are unhealthful, the higher are pleasant and habitable. Thunderstorms and waterspouts occur frequently, and earthquakes now and then. The flora is practically that of the Malay Peninsula and Borneo, containing a few remarkable special features, such as gigantic forms of arum. A large part of the island is overgrown with trees and foliage. The mountains are rich in tall timber. Oak, camphor, and teak trees abound. Sumatra is unsurpassed for fauna, nearly all the large equatorial types being present. Buffaloes are the leading live stock. The rhinoceros, elephant, tiger, tapir, panther, deer, and many species of the ape are also largely represented. The supply of minerals is large. The island yields coal abundantly, and large tin deposits on Singkap Island on the east coast are being worked. Petroleum wells flow in the Palembang region, and there is an important output of petroleum in Langkat.

Agriculture is the occupation of the natives. All the tropical crops are or can be grown. The native princes and the Government farm out land to cultivators. The natives skillfully manufacture filigree articles in gold and silver, fabrics, and household articles. The northeast coast, around Dili, is a rich and extensive tobacco country, which produced in 1899 about 53,000,000 pounds of tobacco. The pepper trade is important. Coffee, bamboo, rubber, copra, and gums are also exported.

Sumatra is called one of the outposts of the Dutch East Indies. Its government appears to be in a somewhat transitory state, but is patterned after that of Java. The Dutch control in the interior is as yet but nominal. The various portions are known as the West Coast, the East Coast, Benkulen, Lampongs, Palembang, and

Achin, the first containing one-half the people of the island. Sumatra has a Governor (under the Governor-General of the East Indies), a President, Comptroller, etc. The 8 administrative districts are called residences. The Residency of Rhio includes several hundred islands off the east coast. A Government railway extends from Padang to the great coal mines in the adjacent interior. There is a railway from Medan to the coast, and one will operate from Achin along the northern coast. In 1900 Sumatra had 200 miles of railway. There are many good roads in various coast districts, and there is now a fair roadway from Palembang to Benkulen. Padang, Achin, Dili, Benkulen, and Palembang are the leading towns.

The population of Sumatra exceeds 3,000,000. The Europeans number about 6000, and the Chinese about 100,000. The natives of Sumatra, exclusive of the intruding Hindus, Arabs, Tamils, Indo-Chinese, and Chinese, belong to the Malayan stock, linguistically and physically, although some authorities group as 'Indonesians' such peoples as the Battaks and a few others. Among the most important and most interesting tribes are the Achinese of the extreme northwest, noted for their long struggle against the Dutch, the Battaks of the northern interior and northwest coast, and their neighbors in the Nias and Batu Islands, the Kubus, a very primitive people of the forests and marshy regions of Palembang, the so-called Menangkabau Malays of the middle of the island and other parts east and west, the Palembangs, Redjargs, Passumahs, Lampongs, and other tribes to the south, and the Abongs. The Malayan people of Sumatra exhibit many varieties of culture, from that of the forest-dwelling Kubus and other tribes of a primitive sort to those who under Hindu, and centuries later under Mohammedan influences, reached a considerable degree of culture, with religious and commercial as well as political development and expansion. The first intrusions of Hindu life and culture into Sumatra began some time before the Christian Era. Traces of Hinduism are evident in architecture, religion, and language. It was in all probability from Java that Buddhism in the sixth century made its way into Sumatra, where, however, it never obtained general vogue. The Battaks, some of whose divinities bear corrupted Indian names, possess an alphabet of Hindu origin. Hindu influences were probably at their height in the eighth century. From the thirteenth to the fifteenth century Mohammedan influences prevailed and many of the tribes were converted to Islam, and a number of sultanates were established. The Mohammedan influence upon politics, religion, and language was great. Since then the various European conquerors and intruders (Portuguese, English, Dutch) have made themselves felt, but chiefly in the coast regions. A considerable portion of the interior is still only nominally subject to the rule of the Dutch. On the whole the native population of Sumatra, as is also the case in Java, is on the increase. Mohammedanism is generally professed in the coast districts and also to a great extent in the interior.

Marco Polo visited Sumatra in 1292, and the first Portuguese in 1508. In the seventeenth century the Dutch obtained a firm foothold, having forced out the Portuguese. From 1812 to 1819 the English held the island. In 1825 Benkulen, where the English had been established for nearly a century and a half, was transferred to the Dutch. The conquest of the natives has been in progress since the discovery of the island, and has not yet been entirely completed. The Sultan of Achin, in the northwest, with whom a war has been going on since 1873, has especially proved troublesome.

Consult: Verbeek, *Topographische en geologische beschrijving van een gedeelte van Sumatras westkust* (The Hague, 1886); Forbes, *A Naturalist's Wanderings in the Eastern Archipelago* (London, 1887); Carthaus, *Aus dem Reich von Insulinde. Sumatra und der Malaiische Archipel* (Leipzig, 1891); Keane, *Eastern Geography* (London, 1887); Brenner, *Besuch bei den Kannibalen Sumatras* (Würzburg, 1894); Miquel, *Flora Sumatrana* (London, n. d.); Werner, "Reptilien und Batrachier aus Sumatra," in *Zoologisches Jahrbuch*, vol. xiii. (Jena, 1900); Breitenstein, *Sumatra* (Leipzig, 1902); Giesenhagen, *Auf Java und Sumatra* (ib., 1902).

SUMBA, sōōm'bȧ, or SANDALWOOD ISLAND. One of the Sunda Islands (q.v.).

SUMBAWA, sụm-bī'wȧ. An island of the Dutch East Indies, one of the Sunda group, situated between Java and Flores. It is separated by Atlas Strait from Lombok on the west and by Sapi Strait from Komodo and Flores on the east (Map: East India Islands, E 6). Its area is given as 4300 square miles by some authorities, and as high as 5400 by others. Four mountain ranges traverse Sumbawa from west to east, the northern being volcanic, the southern containing a limestone formation. Mid-Sumbawa is a region of circular hills of lava and tufa, and the land is covered with a long silver-colored grass. The natives engage in agriculture. Sumbawa, with its four free States, is included, for the administrative purposes of the Dutch, under Residency No. XI. of Insulinde or Island India. The population is put as low as 75,000 and as high as 150,000, nearly all Mohammedan Malays. There are about 12,000 foreigners, who control the trade.

SUMERIAN LANGUAGE. The language supposed to have been spoken by the non-Semitic inhabitants of the Euphrates valley who were gradually absorbed by the invading Babylonians. This language, according to the view of a majority of Assyriologists, has been preserved in a number of inscriptions. The first successful decipherers of the cuneiform characters, Hincks, Rawlinson, and Oppert, observed that the wedge-shaped signs were employed in writing languages not akin to the Assyrian, that the inventors of this system of writing cannot have been Semites, since the signs have syllabic values and some characteristic Semitic sounds are not represented, and that one of these languages was used in Babylonia itself. Hincks thought that these languages were Aryan; Rawlinson regarded them as Scythian, meaning by this term Mongolian; Oppert considered the Babylonian non-Semitic tongue as Kasdo-Scythian. The term 'Accadian' was first used by Rawlinson in 1855, the term 'Sumerian' by Oppert in 1869. There was practical unanimity among all Assyriologists before 1874 as to the agglutinating and non-Semitic character of this language. In that year, however, Halévy began his protest against the very

assumption that the Sumerian language ever existed. He first attempted to prove that the Sumerian language did not belong to the Turanian family and that the Turanian people cannot be supposed to have lived in Babylonia, and then maintained that the texts claimed to be Sumerian could be regarded as composed in an ideographic writing invented by the Assyrians in addition to the phonetic system and having the same values in pronunciation. Of the Sumerian signs in the syllabary, he found Semitic values for 114. In 1876 Halévy modified his view by admitting that the Sumerian signs could not have been pronounced like the ordinary Assyrian words. In his opinion, the so-called Sumerian was only a hieratic or priestly system of writing used as a cryptography for purposes of concealment. It was made from the other not only by the peculiar choice of ideograms, but by the apocopation of the closing vowel or syllable, changes of vowels and consonants, transpositions of syllables, and transfers of rarer meanings to common forms. Consequently it was to be regarded not only as a priestly system of writing, but as an artificial language constructed for certain occult purposes. Against this theory especially Oppert and Lenormant, Sayce, and Schrader urged many arguments, such as the impossibility of finding real Semitic values for the Sumerian signs and the improbability of an artificial language having been created as a secret means of communication between priests and then used for inscriptions in which kings recount their victories and their building enterprises. In 1880 Haupt indicated the existence of two dialects, *Emeku* and *Emesal*, of the Sumerian as shown by certain differences observed by earlier scholars without full appreciation of their significance. Even in view of this fact, explained by Halévy as due to varieties of cryptography, the difficulty of classifying the Sumerian, the apparent silence of the monuments concerning a nation speaking this language and conquered by the Babylonians, and the manifest influence of the Semitic speech on the vocabulary, led some scholars to hesitate. Meanwhile the study of the Sumerian, on the assumption that it was a real language, continued. Lehmann's investigations rendered it probable that the native name of the people speaking this language was *Shumeri* and that their home was in South Babylonia, in distinction from the *Akkadi*, who were the Semites and had their centre in North Babylonia.

The Sumerian is found in bilingual syllabaries and word-lists, bilingual hymns and prayers, bilingual inscriptions of kings, and many unilingual inscriptions. Of these the earliest show the least evidence of a Semitic influence. These are in the *Emeku* dialect. Those in the *Emesal* dialect naturally reveal more traces of the Semitic vernacular. Even within the *Emeku* dialectical differences have been observed, and the *Ememalah* may represent a dialect spoken in Miluhha. (See MINÆANS.) Sumerian loan-words in the Assyrian—of which Leander has counted 217—are taken from the *Emeku* dialect. The Sumerian is made up of monosyllabic roots and shows a tendency to triliterality; it is fond of compounds, which are rarely found in the Semitic languages, and expands its nouns by many prefixes and suffixes; it has no gender. The plural is often formed by duplication, as *kur-kur*, 'lands,' and sometimes by *ini;* the genitive is sometimes expressed by the suffix *ge* or *gid;* instead of prepositions it has post-positions, such as *-shu*, 'to,' *-ta*, 'from,' *-da*, 'with;' the pronouns are either independent or pronominal suffixes, but altogether different from the Semitic; the numerals resemble the Semitic only in making the twenties, thirties, etc., in the plural while the forms are entirely different; the verb has practically the same derived stems as the Semitic and Hamitic, but has a greater variety of prefixes, infixes, and suffixes. The attempts to discover the affinities of this language have not yet been successful, but it is probably the oldest known language in the world. From the Sumerian vocabulary it is evident that the people who spoke this language had reached a comparatively high civilization. The sexagesimal system was in vogue, and the beginnings of astronomy and mathematics are with much plausibility ascribed to the race who spoke the *lishan Shumiri* or Sumerian language.

BIBLIOGRAPHY. Lenormant, *Lettres assyriologiques* (Paris, 1874); Halévy, *Recherches critiques sur l'origine de la civilisation babylonienne* (ib., 1876); Delitzsch, *Assyrische Grammatik* (Berlin, 1889); id., *Assyrisches Handwörterbuch* (Leipzig, 1896); id., *Entstehung des ältesten Schriftsystems* (ib., 1892); Haupt, *Akkadische und sumerische Keilschrifttexte* (ib., 1881-82); id., *Die sumerischen Familiengesetze* (ib., 1879); id., *Die akkadische Sprache* (Berlin, 1883); Guyard, *Bulletin critique de la religion assyro-babylonienne* (Paris, 1882); Zimmern, *Babylonische Busspsalmen* (Leipzig, 1885); Lehmann, *Shamash-shum-ukin* (ib., 1892); Hommel, *Sumerische Lesestücke* (Munich, 1894); Weissbach, *Die sumerische Frage* (Leipzig, 1898); Radau, *Early History of Babylonia* (Oxford, 1900); Hilprecht, *Old Babylonian Inscriptions* (Philadelphia, 1898); De Sarzec and Heuzy, *Découvertes en Chaldée* (Paris, 1890, et seq.); Rogers, *History of Babylonia* (New York, 1902); Barton, *A Sketch of Semitic Origins* (ib., 1902).

SUMIDA-GAWA, sōō'mē-dä-gä'wä. A river in the island of Hondo, Japan, rising northwest of Tokio on the border of the provinces of Musashi and Kai, and entering the Bay of Tokio, after a course of some 90 miles. It is navigable for small boats. In Tokio it is a place of popular resort. On its banks are tea-houses, temples, and the great avenue of cherry trees at Mukojima. It is crossed by numerous bridges. In July it is the scene of a great festival called 'river opening,' when the tea-houses are illuminated, a great display of fireworks is given, and the river is covered with gayly decorated boats filled with pleasure parties.

SUMMARY PROCEEDINGS (from Lat. *summa*, main thing, substance, sum, fem. sg. of *summus*, superlative assigned to *super*, above, over). Proceedings in the nature of trials which are conducted before judicial officers without juries, and in a speedy and peremptory manner. Such proceedings must be specially authorized by statute, as they are not sanctioned by the common law. The Federal Constitutional guaranty of the right to trial by jury does not extend to such civil and criminal cases as were not triable by jury at common law, thus leaving the States free to dispose of such cases by summary proceedings

if they deem it expedient to do so. Most of the State constitutions also secure the right to trial by jury in all important cases. However, for the speedy administration of justice in trivial cases, both civil and criminal, the statutes of nearly all the States provide for the determination by summary proceedings of such petty misdemeanors as the violation of municipal ordinances as to fast driving, etc., disorderly conduct, and other minor offenses.

Certain proceedings for the ejectment of tenants are also known as summary proceedings in some States. See JURY; TRIAL.

SUMMER. A principal horizontal beam. The term, which is found in old English architecture, applies to a chief beam of a floor, or what is ordinarily termed a girder. When a summer is used to support a wall or other superstructure, as in the front of a building, it is known as a breast summer (q.v.). Summer is also used to denote a stone at the top of a pier or of a wall where an arch, lintel, or other work is supported.

SUMMER DUCK. The wood duck (q.v.).

SUMMER REDBIRD, or TANAGER. See TANAGER.

SUM'MERS, THOMAS OSMUND (1812-82). A clerical author of the Southern Methodist Church. He was born at Corfe Castle, Isle of Purbeck, Dorsetshire, came to America in 1830, and joined the Baltimore Conference (1835). He was missionary to the Republic of Texas (1840), and was one of the nine preachers who formed the Texas Conference. He was transferred to the Alabama Conference (1843); was secretary of the Louisville convention where the Methodist Episcopal Church South was organized; subsequently he was secretary of every General Conference of his Church until his death. He was assistant editor of the *Southern Christian Advocate* (Charleston, 1846), removing to Nashville (1855); was elected general book editor (1845), serving until his death, and editing nearly all of the publications of the denomination. He founded the *Sunday School Visitor* and edited it for four years; he edited the *Quarterly Review* nine years. He was professor of systematic theology in Vanderbilt University and dean of the theological faculty (1872-82); and was chairman of the committee which prepared a revised edition of the hymn-book of his Church. He wrote numerous works, including a commentary in six volumes on the Gospels, Acts, and Romans (1868-74); *Baptism, a Treatise* (1853); *Biographical Sketches of Eminent Ministers* (1858); *Sunday Service of the M. E. Church South* (1867); *Systematic Theology*, edited by Tigert (1888). For his life, consult Fitzgerald (Nashville, 1884).

SUMMER SCHOOL. The name applied either to institutions the sole purpose of which is the giving of instruction during the summer months, or to the summer sessions of any institutions of learning. Some universities in the United States frequently select from their regular programmes such subjects as will be suitable, and offer courses during the summer months. The successful completion of summer school courses gives credit toward the degrees of the institution at which they are taken. Other summer schools exist independently, usually at some situation favorable for summer resort. Such are the schools at Chautauqua, N. Y., at Martha's Vineyard, etc. Conditions of admission are either not required or are not severe. Certificates are given for work done, and frequently such work is allowed to count toward college degrees.

SUM'MERSON, ESTHER. The heroine of Dickens's *Bleak House*, the natural daughter of Lady Dedlock and Captain Hawdon, and ward of Mr. Jarndyce. She marries Allan Woodcourt, a surgeon.

SUMMER YELLOWBIRD. See WARBLER.

SUMMIT. A city in Union County, N. J., 12 miles west of Newark; on the Morris and Essex division of the Delaware, Lackawanna and Western Railroad (Map: New Jersey, D 2). It is attractive because of its elevation and the beauty of its scenery and is largely inhabited by New York business men. It has a Fresh Air and Convalescent Home and the Arthur Home for Orphans. There is a silk factory with several hundred hands. Population, in 1890, 3502; in 1900, 5302.

SUMMONS (OF. *semonse*, Fr. *semonce*, summons, admonition, fem. sg. of p.p. of OF. *semoner*, *somoner*, *semondre*, Fr. *semondre*, to summon, from Lat. *submonere*, to remind secretly, from *sub*, under + *monere*, to warn). A writ or process by which a defendant is notified to appear in court and answer the cause of action alleged in the plaintiff's complaint or declaration. It has superseded the *original writs* for the purpose of beginning an action in England and most of the United States. In the absence of statutory provisions to the contrary, a summons must be signed by the clerk of the court in which the action is brought, but under the codes it is usually signed by the plaintiff's attorney. For method of service, see SERVICE OF PAPERS. See also PROCEDURE; WRIT.

SUMMUM BONUM. See ETHICS.

SUM'NER, CHARLES (1811-74). An American statesman. He was born in Boston, Jan. 6, 1811; graduated at Harvard in 1830; entered the Harvard Law School the following year, and was admitted to the bar in 1834. Throughout his early years he maintained an extraordinary literary activity, writing chiefly upon legal topics, and occasionally appearing on the platform. His strength becoming overtaxed from the labor of editing an American edition of *Vesey's Reports*, he sailed for Europe in 1837, where he traveled for three years, devoting much of his time to the study of languages, literature, and history. Returning to America in 1840, he began to take an active interest in the anti-slavery movement, and in 1845 he delivered a notable Fourth of July oration at Boston, on "The True Grandeur of Nations," which Cobden pronounced "the noblest contribution ever made by any modern writer to the cause of peace," but it gave offense to the leaders of the Whig Party and led eventually to his withdrawal from that party. This oration was soon followed by others of great force, mainly on anti-slavery topics. He was a leader of the 'Conscience Whigs' of Massachusetts, who helped to form the Free-Soil Party. In 1851, through a combination of Free-Soilers and Democrats, he was elected to the United States Senate, of which body he was a member until his death. Here he waged a vigorous and uncompromising war on slavery. His first important speech was entitled "Freedom National, Slavery Sectional." This was followed

in 1856 by another on "The Crime Against Kansas," in which he reflected severely upon Senator Butler of South Carolina. This arraignment led to an assault in the Senate Chamber upon Sumner by Preston Brooks (q.v.), a Southern Representative and a relative of Butler, with the result that Sumner was so injured that he was incapacitated for Senatorial service for nearly four years. The attack led, indeed, to the disease to which Sumner finally succumbed. In December, 1859, he resumed his seat, but took little part in the debates until the middle of 1860, when he delivered a speech on "The Barbarism of Slavery." From the beginning he was recognized as one of the leading men in the Republican Party. In 1861 he became chairman of the Senate Committee on Foreign Relations, and made a number of able speeches on questions of foreign concern during the war, notably on the Trent Affair (q.v.).

He held the chairmanship of this important committee during ten years of a critical period. He took an active part in the debates on reconstruction measures and allied questions, ably advocating what came to be known as the 'suicide theory' of the status of the Southern States at the close of the war. (See RECONSTRUCTION.) He supported the impeachment proceedings against President Johnson and secured the enactment of a civil rights law to secure equality of treatment to negroes in hotels, theatres, etc., which was subsequently declared unconstitutional by the Supreme Court. He broke with the Grant administration, and in 1872 joined the Liberal Republican movement in advocating the election of Greeley for President. Sumner's *Works* were published in 15 volumes (Boston, 1874-83). Consult an elaborate *Memoir* by his friend E. L. Pierce (4 vols., Boston, 1877-93), and a short biography by Moorfield Story (Boston, 1900), in the "American Statesmen Series."

SUMNER, EDWIN VOSE (1797-1863). An American soldier, born in Boston, Mass. He was educated at Milton Academy, entered the United States Army, distinguished himself in the Black Hawk War, and was engaged in fighting Indians on the Western frontier. In 1838 he was placed in command of the school of cavalry practice at Carlisle Barracks, Pa. In the Mexican War, before the outbreak of which he had attained the rank of major, he participated in all the engagements of Scott's army in the advance from Vera Cruz to the City of Mexico, was wounded while leading a cavalry charge at Cerro Gordo, and for gallantry in holding in check a body of 5000 Mexican lancers at Molino del Rey was brevetted colonel. In 1857 he conducted a successful campaign against a hostile band of Cheyennes. In March, 1861, he was promoted to the rank of brigadier-general, and relieved Albert Sidney Johnston (q.v.) of the command of the Department of the Pacific. In the following year he was recalled and placed in command of the First Corps of the Army of the Potomac. He distinguished himself in the Peninsular campaign, particularly in the battle of Seven Pines (q.v.); was twice wounded in the Seven Days' Battles before Richmond; was brevetted major-general in the Regular Army and was appointed major-general of volunteers; and took part in the battle of Antietam, in which he was again wounded. He commanded the right wing of Burnside's army at Fredericksburg. Relieved at his own request after the appointment of Hooker to succeed Burnside, he was assigned to the command of the Department of Missouri, and died suddenly while on his way thither.

SUMNER, INCREASE (1746-99). An American jurist, born at Roxbury, Mass. He was educated at Harvard College, where he graduated in 1767, and studied law in the office of Samuel Adams. He was admitted to the bar in 1770, and he was a member of the State Constitutional Convention of 1779. In 1782 he was elected to Congress, but at the same time was offered an associate justiceship of the Supreme Court, which he held till 1797. In 1789 he was a member of the convention which adopted the Constitution of the United States. In 1797 he was elected Governor of Massachusetts, and held that office during the remainder of his life.

SUMNER, WILLIAM GRAHAM (1840—). An American political economist and educator, born at Paterson, N. J. He graduated at Yale in 1863, studied at Göttingen and Oxford, and was tutor at Yale in 1866-69. Ordained in the Protestant Episcopal Church in 1867, for some time he was assistant at Calvary Church, New York, and rector at Morristown, N. J. After 1872 he was professor of political and social science at Yale, where he attracted public notice by his pungent and incisive advocacy of free trade in lectures, essays, and books. Among his chief publications are: *History of American Currency* (1874); *Lectures on the History of Protection in the United States* (1875); *Life of Andrew Jackson* ("American Statesmen Series") (1882); *What Social Classes Owe Each Other* (1882); *Essays in Political and Social Sciences* (1883); *Protectionism* (1885); *Robert Morris* (1891); *The Financier and Finances of the American Revolution* (1892); and *A History of Banking in the United States* (1896).

SUMO, sōō'mō. A Central American linguistic stock. See ULUA.

SUMPTUARY LAWS (Lat. *sumptuarius*, relating to expenditure, from *sumptus*, expenditure, expense, from *sumere*, to take up, choose, apply, spend, from *sub*, under + *emere*, to take, buy). Laws to prevent extravagance in private expenditure, and indirectly to prevent immorality and crime. The purposes of sumptuary legislation may be grouped under the following heads: (1) To prevent poverty and diminish the cost of supporting the poor; (2) to increase the possible revenue of the State by diminishing private expenditure; (3) to prevent luxury when considered an evil; (4) to favor certain commercial or political interests; (5) to enforce class distinctions; (6) to prevent the consumption of commodities, as liquors and tobacco, which are considered dangerous to health and morals. Sumptuary laws were common in ancient legislation. By means of them Greece endeavored to inculcate simple habits of life among her people. Women, except prostitutes, were forbidden to wear expensive attire, as gold or embroidered apparel. The laws of Solon forbade costly banquets and funerals. At an early period in Roman history the censors, to whom was intrusted the superintendence of public and private morality, punished all persons guilty of luxuri-

ous living; but as the love of luxury grew with the increase of wealth and foreign conquest, various legislative enactments were passed with the object of restraining it. The Twelve Tables limited expenditures for funerals. Other early laws of Rome limited the expenditures of women, specified the number of guests who might be entertained at a single time, and fixed the amount which could be spent on entertainments. A later law made guests, as well as those who entertained, liable for a violation of these regulations.

Sumptuary laws found favor in England from the time of Edward III. down to the Reformation. In the reign of Edward III. one act prohibited more than two courses at a meal or more than two kinds of food at a course, except in the principal festivals of the year, when three courses were allowed. Another act prescribed the kinds of clothing the various classes might wear, except the orders of the nobility above the knights. Similar legislation prevailed in Scotland, France, Spain, and Italy.

When the mercantilistic theories of government emerged nations endeavored to control consumption by prohibiting the use of commodities produced abroad. It was held that the luxury of a people enriched other nations and impoverished their own. An English law prohibited the wearing of silk in order to encourage the manufacture of woolen goods in England. In France a law at one time prohibited the wearing of gold and silver embroidery, silks, and fine linens.

Aside from protectionism sumptuary legislation to-day comes under the head of the police regulations and is aimed to preserve the public health and morals. Under the United States Federal and State constitutions no restriction can be placed on the consumption of commodities or traffic in them, save as the public health, protection, and safety require it. The chief restrictive legislation is directed against the traffic in intoxicating drinks, and takes the form of high license requirements for the privilege of selling liquors, or in the prohibition of the right to deal in liquors altogether.

SUMTER. The county-seat of Sumter County, S. C., 43 miles east by south of Columbia, on several divisions of the Atlantic Coast Line Railroad and the Southern Railway (Map: South Carolina, D 3). It is known for its large trade in cotton. There are a cotton compress, cotton and cottonseed-oil mills, lumber mills, telephone factories, coffin and casket factories, and a manufactory of golf sticks. Population, in 1890, 3865; in 1900, 5673.

SUMTER, FORT. See FORT SUMTER.

SUM'TER, THOMAS (1734-1832). An American soldier, born in Virginia. He early removed to South Carolina; accompanied several expeditions against the Cherokee Indians; served under Braddock in 1755, and in March, 1776, became lieutenant-colonel of the Second Regiment of South Carolina Riflemen. Until the capture of Charleston (1780), he served in the interior of the State against the Loyalists and Indians; but subsequently raised a regiment in North Carolina and engaged actively in partisan warfare. On July 12, 1780, he defeated a force of mounted infantry under Captain Huck, and soon afterwards was made a brigadier-general of State troops. On August 1st he made a spirited but unsuccessful attack on Rocky Mount, and on August 6th defeated 500 regulars and Tories at Hanging Rock, but, his men dispersing, he was subsequently driven back. He then by a brilliant movement cut Cornwallis's line of communications between Charleston and Camden, capturing a supply train with its convoy; but three days later his force was almost annihilated by Tarleton at Fishing Creek. Enlisting another regiment, he defeated Major Wemys at Broad River (November 9th), and on November 20th repulsed an attack of Tarleton at Blackstock Hill, the latter losing 200 in killed and wounded, while the Americans lost 3 killed and 4 wounded. Here Sumter was severely wounded, but he returned to the army in February, 1781, and continued to render the most efficient service as a partisan commander. After the war Sumter sat in the State convention of South Carolina which ratified the Federal Constitution, was a member of Congress in 1789-93 and 1797-1801, and of the United States Senate from 1801 to 1809 and again from 1811 to 1817, and was United States Minister to Brazil in 1809-11. He was the last surviving general officer of the Revolution.

SUMY, sōō'mē. The capital of a district in the Government of Kharkov, Russia, situated 125 miles northwest of Kharkov (Map: Russia, D 4). The chief manufactures are machinery, tobacco, and liqueurs. Population, in 1898, 26,355.

SUN (AS. *sunne*, Goth., OHG. *sunnō*, *sunna*, Ger. *Sonne;* connected with AS. *sōwil*, Lat. *sol*, Gk. ἥλιος, *hēlios*, Ir. *sul*, Lith., Lett., OPruss. *saule*, Skt. *svar*, *sūra*, Av. *hvarə*, sun). The central governing body of the solar system (q.v.), and the chief source of our light and heat. To us the sun is the most important of all the heavenly bodies, since upon it depends the possibility of life upon the earth. The sun's apparent angular diameter is 32′ 4″; diameter in miles, 866,500; density, 1.41, water being 1; mean distance from the earth, 92,800,000 miles. The sun's distance from the earth is the fundamental unit of linear measures in cosmic astronomy. The method of the determination of this distance is given under PARALLAX.

Successive generations of astronomers have been able to gather much information as to the appearance, constitution, and structure of the sun. The theory at present accepted is as follows: The visible light-giving surface, as we see it in the telescope, is called the *photosphere*. We suppose it to be a collection of luminous clouds, holding in suspension certain particles condensed out of the extremely hot gaseous material of which the innermost nucleus of the sun is probably composed. Just outside the photosphere is a thin shell of gaseous matter called the *reversing layer*. This is doubtless composed of many substances such as we find among the known chemical elements of our earth. It is observed and its very existence is demonstrated by the spectroscope. According to Kirchhoff's theory, when light coming from incandescent solids or liquids is passed through vaporized matter, the vapors absorb or cut off the light from certain definite parts of the spectrum. To each vaporized substance belongs its own series of such points in the spectrum; and these correspond exactly to the positions which would be occupied by bright lines in a spectrum derived

directly from such vaporized substances themselves, if rendered incandescent. Thus the ordinary solar spectrum is crossed by certain well-known dark lines corresponding to the absorption of certain parts of the photospheric light by the absorptive effect of the reversing layer. Now if it were possible in some way to get rid of the light of the photosphere and examine directly the light of the reversing layer, we ought to see the spectrum of ordinary incandescent gases. This observation can actually be made at the time of a total solar eclipse. If we watch the solar spectrum very carefully just before the beginning of totality, when the moon's advancing edge is on the point of obscuring the sun completely, there will come a moment when nothing remains in sight but the outer or reversing layer. At that instant the dark lines in the spectrum are suddenly reversed, becoming bright like the lines in the spectrum of a gas heated to incandescence artificially in the laboratory. This remarkable observation was made by Young (q.v.) at the Spanish eclipse of 1870, and repeated photographically in 1896 by Shackleton, at the Nova Zembla eclipse.

The so-called *chromosphere* is a great layer composed of very hot gases, principally hydrogen, and surrounding the sun chiefly outside the reversing layer. It is supposed, however, that both these strata are mixed together, except that the hottest and densest gases are in the lower or reversing layer. This chromospheric layer can be seen for an instant at the beginning or end of a total solar eclipse, and it is found to consist principally of a mass of red flames. The color is due to the preponderating presence of hydrogen, and it is this color that gives rise to the name chromosphere or colorsphere. The presence of flame does not, however, indicate a process of combustion in the usual sense of the word. For instance, coal burning in an ordinary stove is really being combined chemically with the oxygen of the air, and chemical combination of that character is certainly not going on in the sun.

The most interesting features of the chromosphere are the *prominences*. These are great eruptive jets of red hydrogen flame bursting outward from the solar surface, sometimes to a distance of hundreds of thousands of miles into space. They were first seen during total solar eclipses, when the bright light of the central solar disk had been obscured by the interposed moon. Under ordinary circumstances the central solar light illuminates our terrestrial atmosphere very strongly, and enough of this light is reflected from the air itself into our telescopes to mask completely the fainter light of the prominences. But it has been found possible to study the prominences spectroscopically during full sunlight, and without waiting for a solar eclipse. This was first done visually in 1868 by Janssen, Lockyer (q.v.), and Huggins (q.v.), and photographically by Hale (q.v.) and Deslandres in 1890. The two latter astronomers working independently of each other, the former in Chicago and the latter in Paris, devised certain instruments called photographic spectro-heliographs, by means of which it is possible to take pictures of the chromosphere and prominences over the entire solar surface at once and in full sunlight. It has thus become known that the velocity of motion in these prominence eruptions may be as great as several hundred miles per second, indicating real explosions of incalculable force.

Extending far out beyond the chromosphere and prominences, and usually recognized as the sun's outermost envelope, is the *corona*. It is visible only at the time of total eclipse, when the central part of the solar disk is completely obscured. The appearance of the corona at such times is very sudden; the advancing edge of the moon slowly and gradually covers more and more of the sun's surface, until finally only a sickle-shaped filament remains. Then suddenly this too disappears, and on the instant the superb corona bursts into view, truly one of the most magnificent objects in the whole range of nature's phenomena. The inner corona, close to the solar disk, is very bright, even dazzling; farther out it fades by insensible gradations into a beautiful crown of filmy light. There are thread-like streamers, interlacing with complex involutions, and extending often many millions of miles into space above the solar surface.

Although observed visually from the most ancient times, it was not until the application of photography to astronomical observation that we have been able to fix with some approach to certainty the details of the coronal structure. See ASTRO-PHOTOGRAPHY.

Spectroscopically the corona reveals the presence of luminous gases, possibly containing in suspension particles of solid or liquid matter. No existing theory will explain quite satisfactorily its mechanical construction, so difficult is it to reconcile with gravitational law so enormous an extension outward from the sun. Possibly magnetic forces are wholly or partly responsible for its existence and equilibrium; certain it is that we still have in the corona one of the 'pending problems' of astronomy.

The chemical constitution of the sun has been studied with great care spectroscopically. The spectroscope, when suitably arranged for the purpose, enables us to compare solar light with light obtained in the laboratory from vapors of terrestrial substances raised to incandescence by artificial heating. In this way many terrestrial chemical elements have been identified in the sun; and we may consider extremely probable the hypothesis that sun and earth are composed of the same kinds of matter. This, if true, is a fact of great importance in its bearing on the origin and evolution of the solar system. (See NEBULÆ; COSMOGONY.) The most conspicuous phenomenon of the solar surface is the *sun-spots*. These are apparently great holes or depressions in the photospheric surface, usually having a dark spot in the middle, surrounded by a sort of radial grating. They vary in diameter from 500 to 60,000 miles for the central black parts, and range up to 150.000 miles for the surrounding less dusky portions. At times they are large enough to be seen with the naked eye. Their depth is very uncertain, and has been variously estimated from a few miles up to 2500. The *faculæ* are bright streaks seen in various parts of the photospheric surface, but usually near spots, and most conspicuous when approaching the edge of the solar disk. The spots usually begin as mere dots, and then grow gradually or rapidly to the enormous dimensions already stated. At times they break into several pieces, giving rise to a group or

collection of several spots. They are by no means immovable upon the solar surface, but have a motion of their own, those near the sun's equator traveling farther from the poles, and those in higher solar latitudes increasing their distance from the equator. But no sun-spots are ever found farther from the solar equator than latitude 45°, and few are nearer the equator than latitude 5°. One of the most remarkable things about the spots is the fact that their frequency is periodic. Once in about eleven years they have a maximum frequency, and astronomers are able to record their occurrence in greater numbers than usual. The cause of this periodicity is unknown.

Very interesting questions are raised by a study of the sun's light and heat. The quantity of light given by the sun, as compared with a standard candle, can be measured, and the sun's 'candle power' thus made known. Experiments show that this candle power is represented by the number 1575 with twenty-four zeros attached. The quantity of solar heat is no less stupendous; it has been estimated that the heat given out each hour by the sun is equivalent to the burning of a quantity of coal sufficient to cover the entire solar surface to a depth of more than twenty feet. The source of this vast amount of light and heat has been for a long time a mystery. It cannot be a question of combustion, because in that case the sun would have been consumed long ago, even if made of solid coal. The theory at present accepted is due to Helmholtz. It assumes that the sun's bulk is slowly contracting, and that the energy thus produced is turned into heat. It has been computed that a diminution of 150 feet annually in the sun's radius would be sufficient to account for the heat developed. Such a contraction would remain invisible even in our most powerful telescopes until it had continued for at least 10,000 years, and the process would need to continue for ten million years before the sun would lose the power to give us heat enough to keep life on the earth.

The rotation of the sun on its axis occupies about 25 days, 8 hours. This period is determined by watching the spots go around with the sun; and it is somewhat uncertain, because, as we have seen, the spots are not themselves quiescent on the solar surface. The rotation axis is inclined to the ecliptic plane, like that of the earth; if continued to the celestial sphere, it would pierce it midway between the bright star Lyræ and the Pole star. And there is one very peculiar feature in the rotation due perhaps to the fact that the sun's vast bulk has not yet been completely transformed from the gaseous to the liquid or solid stage. The equatorial regions rotate faster than those in higher latitudes, showing the existence of strong rotary surface currents of different velocities. No thoroughly satisfactory explanation of this phenomenon has yet been obtained by astronomers. See ECLIPSE; PLANETS; PERTURBATIONS; ORBIT; SOLAR SYSTEM. Consult: *Astrophysical Journal* (Chicago); Kayer, *Handbuch der Spectroscopie* (Leipzig, 1902); Young, *The Sun* (New York, 1900); Lockyer, *Solar Physics* (London, 1874); Proctor, *Sun* (London, 1871).

SUN, TEMPLE OF THE. An immense temple of ancient Rome erected by Aurelian, after the taking of Palmyra, on the site of the early Pulvinar Solis on the Quirinal Hill. It was built in imitation of the Eastern sanctuaries of the sun, and stood on a platform 92 feet high, from which the temple rose to a height of 110 feet. It was approached by two staircases, the steps of which now form the approach to the Church of the Aracœli, to which they were removed in 1348. The temple was of massive proportions. The 44 pillars of its peristyle were 65 feet high and 7⅔ feet in diameter, and a single fragment of the cornice, now in the Colonna gardens, weighs 100 tons. The vaults in the substructure were utilized for the storage of wines. The last portion of the temple, which formed part of the fortifications of the Colonnas, was destroyed about 1595, and the only remains of the building are three blocks in the Villa Colonna. The material was used in the Pope's palace on the Quirinal, Santa Maria Maggiore, and other buildings.

SUN AND LION, ORDER OF THE. A Persian civil and military order of merit with five classes, founded in 1808 by Shah Feth Ali on the model of the French Legion of Honor. The decoration is a silver star, bearing a lion with a sword. See Plate of ORDERS.

SUN ANIMALCULE. See HELIOZOA.

SUNBIRD. A bird of the tropical passerine family Nectarinidæ, which may be regarded as occupying nearly the same place in the Old World as do the humming-birds in America. They are all of small size, although none are so small as the smallest humming-birds, which they rival in brilliancy of plumage. Like them, they feed partly on the nectar of flowers, which they suck by their long bill, but chiefly on the minute insects which the flowers attract; they do not, however, flutter on the wing when feeding, like humming-birds, but perch on or beside the flower into which the bill is to be inserted. The species are very numerous, and are natives of the southern parts of Asia, the Eastern Archipelago, and Africa. The resplendent metallic plumage belongs only to the male, and only to the breeding season. They have been described and depicted in a magnificently illustrated monograph by Shelley, *The Nectariniidæ* (London, 1876-80). See Plate of CREEPERS.

SUN-BITTERN (so called because of its brilliant ocellated plumage). A curious bird of South and Central America, about the size of a chicken, allied to the cranes and more closely to the kagu (q.v.), the two species of which constitute the genus Eurypyga and the family Eurypygidæ. It haunts river banks, feeds upon small fish, crustaceans, and insects, and utters a soft or plaintive, long-drawn whistle. In the mating season it executes a fantastic dance, with its wings spread about its head, showing a pattern comparable to the sun's rays. Its nest is a rude affair in a bush or on a low tree branch. The best-known species is *Eurypyga helias*, which is beautifully variegated with brown, black, and white tints. This bird is often domesticated by the Brazilians. Consult Newton, *Dictionary of Birds* (New York, 1896). See Plate of BUSTARDS.

SUNBURY. The county-seat of Northumberland County, Pa., 54 miles north of Harrisburg, on the Susquehanna River, and on the Pennsylvania and the Philadelphia and Reading railroads (Map: Pennsylvania, E 3). There are the

Mary M. Packer Hospital, the court-house, jail, and parish house. Sunbury has silk and woolen mills, coffin works, planing mills, a foundry and machine shops, and flour mills. The government, under the charter of 1896, is vested in a burgess, chosen every three years, and a council. Sunbury was founded in 1772 on the site of an old Indian village and of Fort Augusta, built in 1756, during the French and Indian War. It was first incorporated in 1797. Population, in 1890, 5930; in 1900, 9810.

SUNDA (sŭn'dȧ) **ISLANDS.** A name commonly applied to all the islands of the Malay Archipelago lying west of the Molucca and Banda seas, and separating the China Sea from the Indian Ocean (Map: East India Islands, B 6). They include the four large Sundas, Sumatra, Java, Borneo, and Celebes, with their dependent islands, and the Lesser Sundas, Bali, Lombok, Sumbawa, Flores, Sandalwood Island, Timor, and others extending in a chain eastward from Java. The Sunda Islands are named from the Sundanese, ethnographically a Malayan people of the western part of Java. They are shorter in stature than the Javanese proper, and somewhat more brachycephalic. They have also been less influenced by Hindu culture.

SUN DANCE. The great annual religious ceremony common to all the tribes of the Plains with the exception of the Comanche and perhaps one or two others. In purpose it is a thanksgiving and invocation to the sun god and his representative the buffalo. Although anticipated as a yearly tribal event, it is usually 'made' or organized on each occasion in fulfillment of a vow by some particular individual in gratitude for recovery from sickness or for some other blessing. The management of details is in charge of certain priests, together with the warrior societies. The dance usually takes place about the beginning of summer and with all its attendant ceremonies lasts more than a week, the dance proper continuing four days and nights. The entire tribe assemble for the occasion and pitch their tipis in a great circle, in the centre of which is erected the medicine lodge of leafy cottonwood saplings. The centre pole of the lodge is decorated with streamers and symbolic paints, besides which a sacred bundle, usually wrapped in a buffalo skin, is fastened near the top. The centre pole is cut down by the women with much ceremony. The dancers are stripped and painted, the paint design differing in symbolic character at each stage of the dance, and are prohibited from eating or drinking during the four days of the dance. Among the Sioux, Cheyenne, and some other tribes they formerly also subjected themselves to voluntary torture by leaning their weight upon ropes fastened to wooden skewers driven through the flesh of their breasts and shoulders. Among the Mandan this torture was carried to an almost incredible degree; the victim was lifted completely from the ground and permitted to swing from the roof pole in this condition, after which one or more fingers were chopped off as a further sacrifice. Among the Kiowa such torture was unknown.

The dancers form a half circle about the centre pole, each one looking steadfastly upon the sacred bundle at the top and constantly facing the sun in its course, with their arms swinging at their sides, and holding between their teeth whistles of eagle bone with which they keep up a continual shrill whistling. At the west end of the medicine lodge is an altar of bushes and variously decorated twigs within which are the sacred buffalo skull, the sacred pipe, and other ceremonial objects. On another side are the drummers, who sing the songs of the sun dance to the accompaniment of a powerful drum. Throughout the ceremony there is a rapid succession of ceremonial performances, including addresses, feasting, giving of presents, initiation of new members into the various societies, and the piercing of the ears of the children born during the past year. At night there are games, story-telling, and more feasting, winding up with various social dances after the grand performance is at an end. The dance is still kept up among nearly all the Plains tribes, varying but little in details.

SUNDARBANS, or **SUNDERBUNDS,** sŏŏn'dĕr-bŭnz. A number of low islands, forming the delta of the Ganges, British India, and extending from the mouth of the Hugli to the island of Rabanabad (Map: India, E 4). Area, 7500 square miles. Only the northern part is inhabited, the southern being mainly jungle, infested by tigers, leopards, buffaloes, crocodiles, and snakes. The only town worthy of mention is Port Canning, connected with Calcutta by rail.

SUNDAY (AS. *sunnandæg*, OHG. *sunnuntag*, Ger. *Sonntag*, Sunday, from AS. *sunnan*, OHG. *sunnun*, gen. sg. of AS. *sunna*, OHG. *sunno*, Ger. *Sonne*, sun + AS. *dæg*, Ger. *Tag*, day). The first day of the week, observed by Christians almost universally as a holy day in honor of the resurrection of Christ. For some time after the foundation of the Christian Church, the converts from Judaism still observed the Jewish Sabbath to a greater or less extent, at first, it would seem, concurrently with the celebration of the first day; but before the end of the apostolic period, Sunday, known as 'the Lord's day,' had thoroughly established itself as the special day to be sanctified by rest from secular labor and by public worship. The hallowing of Sunday appears incontestably as a definite law of the Church by the beginning of the fourth century; and the Emperor Constantine confirmed the custom by a law of the State. Throughout the mediæval period the authority of the Church was so universally recognized that secular legislation in this regard was almost unnecessary. The Catholic Church then required, and still requires, abstinence from servile work on that day, and the assistance at mass of all who are not lawfully hindered. While the devout have attempted to make it in all respects a holy day, yet the mass of the people in Roman Catholic countries see no harm in spending a part of the day in social intercourse and amusements of various kinds. The tendency of Protestantism, however, has been to recur to the stricter Jewish observance, and to forbid any practice of the ordinary occupations of other days.

In the mediæval period the courts were presided over or dominated by the clergy, and Sunday early became in the legal sense a *dies non* (q.v.), on which legal proceedings could not be conducted. By the common law, however, all other business might lawfully be transacted on Sunday. The first substantial limitation of this right was imposed by the statute 5 and 6 Edw.

V., ch. 3, which provided that all secular labor should be unlawful on Sunday, except in cases of necessity. This was supplemented by the sweeping act of 29 Car. II., ch. 7, which prohibited all 'worldly business' on the 'Lord's day,' except where absolutely necessary, or for charity. These statutes have been substantially followed in practically all of the United States. The New England States were the first to regulate the observance of Sunday by a series of statutes. The Constitution of the United States prohibits the restriction of religious liberty or the enforcement of religious observances, and therefore, in law, Sunday is regarded merely as a civil day, which is a convenient one for the suspension of business, because of its observance as a holy day by a great majority of the people. These statutes are constitutional as a valid exercise of the police power. Works of necessity and great public convenience are usually excepted. Thus, a physician may carry on his practice, making lawful charges for his services; drug stores may keep open; transportation lines may handle freight and passenger traffic; milk dealers are usually permitted to deliver their product; and all persons whose business conduces to the public health are permitted to continue their activities. Where a cessation of operations would cause great financial loss, an exception is commonly made.

Where a person is traveling on Sunday in violation of law, and is injured, he is not precluded from recovering damages if he is otherwise entitled thereto. Although contracts entered into on Sunday were valid at common law, the courts of many States have interpreted their Sunday statutes as including this kind of a business transaction. A payment of a debt on Sunday is generally held to discharge the obligation. Wills executed on Sunday may be probated in most jurisdictions. In most States the legal Sunday begins at midnight on Saturday night, and continues twenty-four hours. In a few New England States Sunday ends at sunset. Many States exempt Hebrews and others who observe Saturday or some day other than Sunday as a holy day from the operation of the Sunday laws, but if such persons do not keep sacred any other day, they must suspend business on Sunday.

The need of one day in seven for rest from labor has long been recognized from an economic standpoint also. Not only has it been found that man produces more and better work by resting one day in seven, but also that he is a better physical and social being for observing such a rule. Sunday labor in the United States is, however, increasing. It has been estimated that in Massachusetts alone 50,000 persons work on Sunday. That the increase is general is shown by the growing opposition of the labor unions, and their frequent demands for shorter hours throughout the week, on the ground that they have no assurance of the Sunday respite.

SUNDAY-SCHOOLS. An agency of the Church for giving religious instruction to learners of all ages. The method of instruction is generally interlocutory and the subject of study more particularly the Bible. In its essentials the Sunday-school or Bible-school was an important part of the early Jewish educational system. About B.C. 80-70 Simon ben Shetach established a system of religious schools in connection with synagogues in Palestine, making attendance obligatory. Historians like Edersheim and Schürer confirm the general existence of such schools then and later in the time of Christ.

Bunsen says that "the Apostolic Church made the school the connecting link between herself and the world." Her catechetical instruction (cf. Luke i. 4; Acts xviii. 25) grew so steadily in acknowledged importance that church buildings were designed to provide special accommodations for the Bible-school. These early catechumenical schools included children and adults, who were taught individually, by the interlocutory method, subject matter beginning with the Old Testament story of creation and proceeding to practical Christian living. Gregory the Illuminator Christianized Armenia at the beginning of the fourth century by a compulsory system of Bible-schools for children in every city, while at that period similar schools were to be found in Mesopotamia, Cappadocia, Egypt, and elsewhere. In all these schools the Bible text was the main subject. In the Middle Ages the Bible-school idea was adhered to among the Waldenses, Albigenses, Lollards, Wiclifites, etc. A notable example of the Bible-school, apparently in many ways like our modern institution, were the schools of Charles Borromeo, Archbishop of Milan, in the middle of the sixteenth century. During the seventeenth and eighteenth centuries the direct study of the Bible gave way to the rote memorizing of set answers in catechisms not intended for such uses, and genuine Bible teaching was thus largely displaced.

It is to Robert Raikes (q.v.) that the modern revival of the Sunday-school is justly accredited, although numerous isolated Bible-schools were to be found both in England and America prior to his time and pioneer efforts were made in America independent of his example. (Consult Trumbull, *Yale Lectures on the Sunday-school*, Philadelphia, 1889.) According to contemporary testimony Raikes gathered some street boys in July, 1780, into a room in Sooty Alley, Gloucester, England, under the temporary care of a Mrs. Meredith, but soon transferred the school to the house and care of Mrs. Mary Critchley, in Southgate Street, where the first permanent Raikes school was established. The pupils were instructed not only in the Bible, but in reading, and in catechisms of the day. Later the school was held in Saint Mary de Crypt Church, then in the Crypt Grammar School, then at the Corn Exchange, and thence was transferred to the church again. The school seems to have had as many as 100 scholars at a time, the teachers receiving a shilling a day from Raikes for their work. Raikes worked quietly and experimentally for three years, and then on November 3, 1783, began to publish his idea in his newspaper, the *Gloucester Journal*. He published as early as 1785 *The Sunday Scholar's Companion*. In the extension of the Sunday-school idea Raikes accords much credit to John Nichols, of *The Gentlemen's Magazine*. The cause was notably furthered by Hannah More, John and Charles Wesley, and Whitefield, and even the Queen expressed an interest in the movement by sending for Raikes in order to hear his plan described. In 1784 Rowland Hill started a Sunday-school in London at Surrey Chapel. William Fox and Jonas Hanway were instrumental in organizing a gen-

eral Sunday-School Society in 1785, of which on June 11, 1787, Raikes was elected an honorary member. In 1786 five schools were reported in or near London. In ten years from that date the society had distributed 91,915 spelling books, 24,232 Testaments, and 5360 Bibles, to 1012 Sunday-schools and 65,000 scholars. From 1788 to 1800 the society had paid more than $17,000 to teachers. Gratuitous teachers were utilized in a school in Stockport, England, toward the close of the eighteenth century, and paid teachers gradually ceased to be generally employed. Before Raikes died, in 1811, there were 400,000 children in the Sunday-schools of Great Britain alone. In Scotland, where the need was not so greatly felt, and in New England, the Sunday-school met with little favor at first, as seeming to endanger the sacredness of the Sabbath, and to relieve the home of some of its duties. The Archbishop of Canterbury summoned a council of bishops to consider means by which the movement might be stopped. Yet notwithstanding all opposition the Sunday-school idea constantly gained in favor.

On December 19, 1790, twelve Christian workers held a meeting in Philadelphia, which led to the organizing on January 11, 1791, of a Society for the Institution and Support of First Day or Sunday Schools in the city of Philadelphia, with Bishop William White as president and Matthew Carey as secretary. The Reverend Robert May, of London, gave a new impetus to Sunday-schools in Philadelphia in 1811, urging the need of a general union. On January 13, 1816, in New York City, was formed the Female Union Society for the Promotion of Sabbath-Schools, and on February 26, 1816, the New York (male) Sunday-School Union. In 1817 the Sunday and Adult School Union was formed in Philadelphia with Alexander Henry as the first president, and this developed on May 24, 1824, into the American Sunday-School Union. The records of this great agency, interdenominational and national in its scope and support, showed in 1899, on its seventy-fifth anniversary, that through its efforts 100,928 Sunday-schools had been organized, with 578,680 teachers and 4,070,346 scholars, and that the union had distributed publications amounting in value to over $9,000,000.

At an anniversary of the American Sunday-School Union in Philadelphia on May 23, 1832, fifteen States were represented. It was then decided to call a general national Sunday-school convention to meet in New York in the autumn of that year to consider 78 questions on Sunday-school work sent out to 2500 persons throughout the country. The first national convention, therefore, assembled on October 3, 1832, in Chatham Street Chapel, New York City, and chose the Hon. Theodore Frelinghuysen as president. The National Convention as an independent organization met subsequently in Philadelphia, May 22, 1833; Philadelphia, February 22-24, 1859; in Newark, N. J., April 29-30, 1869; and in Indianapolis, April 16-19, 1872, at which convention the uniform lesson system was inaugurated, after much discussion, by the appointment of the first lesson committee to select the lessons from 1873 to 1879. The united interest of Bible-students in selected portions of the Bible, in the progress of the uniform lesson plan, has given rise to a literature, both permanent and periodical, that has widely popularized Bible study. The international lesson system now includes a special beginners' course of Bible study for the youngest children, and still other modifications are under discussion. Other lesson systems are in use in some schools and in a few denominations, but in the vast majority of schools the international uniform lesson system is used.

At the next convention in Baltimore, May 11-13, 1875, the convention became international in scope and name. This convention has met every three years since that time. It is composed of delegates from auxiliary State, Territorial, and provincial Sunday-school associations in North America. Its work is conducted during the triennium by an executive committee; a lesson committee, international and interdenominational in its personnel; a primary department; and a field workers' department. A World's Convention, under the auspices of the London Sunday-School Union and the International Executive Committee, was held in London, July 1-4, 1889, thus establishing an institution comprising all the countries of the world, and meeting since then in Saint Louis, Mo., September 3-5, 1893, and in London, July 11-15, 1898. In the improvement of teacher-training and Bible study what is known as the 'Chautauqua movement' has been an important factor. See CHAUTAUQUA.

The Sunday-school is the pioneer religious agency in new communities, and the conserver of neighborhood religious instruction for the entire family in every community where it exists. It is extended to frontier or sparsely settled districts in America by the various denominational mission boards, and by the American Sunday-School Union. It is stimulated to better work, and is made acquainted with the most recent methods, by means of conventions and institutes, some 18,000 of which are held in North America yearly, under the auspices of the International Convention and its auxiliary State, provincial, county, township, and district Sunday-school associations.

At the tenth international Sunday-school convention, held at Denver, Colo., in 1902, the following statistics were presented as to the Sunday-schools in the United States, including Hawaii and Porto Rico: Number of Sunday-schools, 139,817; officers and teachers, 1,419,807; scholars, 11,493,591; total enrollment, 13,092,703. In 1898 the corresponding figures for the entire world were: Sunday-schools, 254,698; teachers, 2,410,818; scholars, 23,227,330; total, 25,810,861.

BIBLIOGRAPHY. (1) Historical: Pray, *History of Sunday-schools and of Religious Education from the Earliest Times* (Boston, 1847); Watson, *The History of the Sunday School Union* (London, 1853); id., *The First Fifty Years of the Sunday School* (ib., 1873); *Centenary Memorial of the Establishment of Sunday Schools* (ib., 1881), a collection of informing addresses and papers containing valuable historical material; Trumbull, *Yale Lectures on the Sunday School* (Philadelphia, 1888), the most comprehensive and thorough treatment of the whole subject; Harris, *Robert Raikes, the Man and His Work* (Bristol, 1899); Brown, *Sunday School Movements in America* (New York, 1901), deals with special phases of Sunday-school progress, and the general field in America; Hamill, *A Brief History of the International Lessons* (Chicago, 1901). (2) Practical: Trumbull,

Teaching and Teachers (Philadelphia, 1884), the standard manual for the thorough study of the work of the teacher; Vincent, *The Modern Sunday School* (New York, 1887), a comprehensive detailed outlining of the school itself; id., *The Church School and Normal Guide* (ib., 1889), deals with the character of the institution and methods of Bible study and teacher-training; Schauffler, *Ways of Working* (New York, 1895), practical hints out of a varied experience; Foster, *A Manual of Sunday School Methods* (Philadelphia, 1899); Peters, *Practical Handbook on Sunday School Work* (Philadelphia, 1900); Oxtill, *The Organized Sunday School* (Nashville, 1901); Hamill, *The Sunday School Teacher* (Nashville, 1901); Pattison, *The Ministry of the Sunday School* (Philadelphia, 1902); Blackall, *Our Sunday School Work and How to Do It* (rev. ed., Philadelphia, 1902); Schauffler, *Pastoral Leadership of Sunday School Forces* (Nashville, 1903).

SUNDERBUNDS, sōōn'dĕr-bŭnz. A name applied to the islands forming the delta of the Ganges. See SUNDARBANS.

SUN'DERLAND. A seaport in the County of Durham, England, 14 miles northeast of Durham, at the mouth of the Wear (Map: England, E 2). It is one of the great coal-shipping ports of the world. Shipbuilding is an important industry. Machinery, glass, earthenware, ropes and chains, anchors, and other iron wares are extensively manufactured, and fishing is carried on to a considerable extent. In the vicinity are rich coal mines, of which the Pemberton, 2286 feet deep, is said to be the deepest in existence. On both sides of the river are extensive wet docks, much of the area of which has been reclaimed from the sea. The harbor, defended by batteries, is formed by two great piers, one 650 yards and the other 590 yards in length. Sunderland is a well-built town with broad streets. There are a fine town hall, an assembly hall, handsome club houses, a large infirmary, and a spacious workmen's hall. The public park contains 70 acres. The town came under the Municipal Corporations Act in 1835. The borough was extended in 1867 and again in 1895; it includes the townships of Bishopwearmouth, Monkwearmouth, and Monkwearmouth Shore. The Monkwearmouth portion of the town dates from a monastery of the seventh century, in which the Venerable Bede spent most of his life. Population, in 1891, 131,686; in 1901, 146,565.

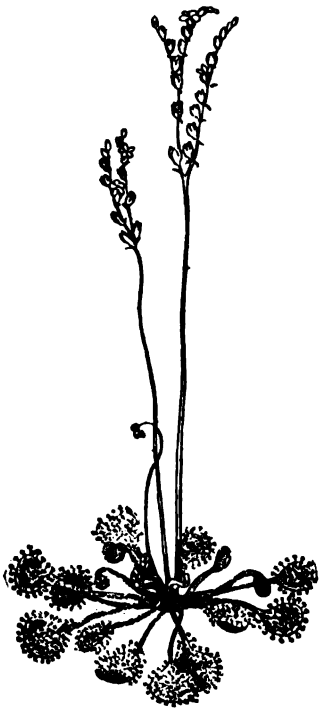
SUNDERLAND, CHARLES SPENCER, third Earl of (1674-1722). An English statesman. He was the second son of the second Earl of Sunderland, and became Lord Spencer on the death of his elder brother in 1688. In 1700 he married Lady Anne Churchill, second daughter of the Earl of Marlborough. In 1702, on the death of his father, Spencer succeeded to the title. Through the influence of Marlborough, Sunderland obtained several important posts, and became a member of the famous Whig Junta, which for a time controlled the whole Government. In 1720 Sunderland brought about the establishment of the notorious South Sea Company (q.v.). When the crash came it was found that Sunderland had received a bribe of £50,000 from the company, and though he was acquitted by a party vote, he had to resign his offices. He retained, however, considerable influence until his death. Sunderland seems to have been a disagreeable and treacherous politician. He was a collector of rare books, and a patron of Addison and other men of letters.

SUNDERLAND, JABEZ THOMAS (1842—). A Unitarian minister, born at Howarth, in Yorkshire, England. He was educated at Madison (now Colgate) University, Hamilton, N. Y., University of Chicago, and Union Baptist Theological Seminary of Chicago. From 1886 to 1895 he edited the *Unitarian Monthly*. He visited India in 1895-96. He is author of *A Rational Faith* (1878); *What is the Bible?* (1878); *The Liberal Christian Ministry* (1889); *Home Travel in Bible Lands* (1894); *The Bible: Its Origin, Growth, and Character, and Place Among the Sacred Books of the World* (1893); *The Spark in the Clod: A Study in Evolution* (1902).

SUNDERLAND, ROBERT SPENCER, second Earl of (1640-1702). An English statesman. He was the only son of Henry Spencer, who was raised to the peerage in 1643. After some diplomatic service abroad he was made a member of Temple's reformed Privy Council of thirty members, and was one of the smaller inner Cabinet with which King Charles II. habitually conferred. Sunderland at first supported the Duke of York and then labored for the Exclusion Bill, which was to exclude the Duke from the succession. Thereby he lost the favor of Charles and his position in the Privy Council (1680). In 1682 he was restored to royal favor through the influence of the Duchess of Portland, mistress of Charles II., and the French Ambassador Barillon, and unscrupulously advocated the disgraceful French connection. He remained in office until the accession of James II., when his influence in the Ministry became greater than ever. Although there is reason to believe he gave some encouragement to Monmouth in his rebellion, he managed, with consummate art, to obtain the entire confidence of James, and in 1685 became Lord President and principal Secretary of State. In 1687 he privately conformed to the Roman Catholic Church, and afterwards openly professed his conversion. Yet we find him about this time in correspondence with the Prince of Orange, afterwards William III. With profligate but masterly dexterity he contrived to deceive both his master and Barillon, and to keep them in ignorance of the events that were passing in Holland. When the Prince arrived in England, Sunderland and his wife went to Amsterdam, whence he wrote to the new monarch, claiming his favor and protection on the ground that he had all along been in his interest. In 1691 he was allowed to return to England, and in 1697 was made Lord Chamberlain. Popular indignation, however, compelled him to resign within a few months. He spent the rest of his days at Althorpe, where he died September 28, 1702.

SUNDEW (so called from the dew-like drops exuded, especially in the sunlight), *Drosera*. A beautiful and interesting genus of about seventy-five species of plants of the natural order Droseraceæ, several species of which are natives of American bogs, etc. A common species is the round-leaved sundew (*Drosera rotundifolia*). Its leaves all spring from the root, and spread out in a rosette, from the centre of which springs the flower-stem or scape with a raceme of flowers

all on one side. The leaves of this and the other species are fringed and beset in all parts with hairs, which bear at their extremity viscid



SUNDEW (*Drosera rotundifolia*).

glands, which fold up when irritated, imprisoning insects and digesting them through the action of enzymes secreted by the plant. Consult Darwin, *Insectivorous Plants* (1875).

SUN-DIAL. See DIAL.

SUN-DOGS. See HALO.

SUNDSVALL, sŭns'vâl. A seaport in the Län of Wester Norrland, Sweden, 28 miles south by west of Hernösand, on the Gulf of Bothnia (Map: Sweden, G 5). It is known for its extensive lumber interests, and is engaged in shipbuilding and the manufacture of iron and steel. Population, in 1901, 15,087.

SUNFISH. The name of a variety of fishes; also given by sailors to jellyfish. (1) In the United States a group of numerous and familiar fishes of streams and ponds, related to the bass, and forming several genera of the family Centrarchidæ (q.v.). All are of small size, six to ten inches long, oval in shape, and much compressed. All are excellent eating. They are brightly colored, especially in the breeding season, and may be known by the black flap to the posterior edge of the gill-cover. Their feeding and breeding habits are similar to those of the fresh-water bass (q.v.). See Plate of DARTERS AND SUNFISH; and consult Jordan and Everman, *Fishes of North and Middle America* (Washington, 1900), and the authorities there cited.

(2) One of the strange oceanic fishes of the family Molidæ, related to the Diodontidæ; especially *Mola mola,* which seems to be composed of a huge head with small fins attached. (See Plate of ROCKFISH, SUNFISH, ETC.) They reach a weight of 300 to 1500 pounds, are scaleless, dull in color, clumsy, and often lie inert like a huge gray blanket on the surface of the sea sunning themselves and bending with the movements of the waves. The young are more fish-like, and were long considered entirely separate. They are of no use as food. There are about six species, one of which (*Ranzania truncata*) is called 'king of the mackerels.' Consult Dean, *Fishes Living and Fossil* (New York, 1895).

(3) The threadfish (q.v.) (*Alectis ciliaris*).

SUNFLOWER (probably so called from its yellow radiate disk), *Helianthus.* A genus of large herbs of the order Compositæ, containing numerous, mostly perennial species, all natives of America. The common sunflower (*Helianthus annuus*), an annual, one of the most important species, is a native of the tropics, where it sometimes attains a height of 20 feet and produces flower heads from 1 to 2 feet in diameter. In temperate climates it grows from 5 to 8 feet high. This species has become widely distributed throughout the United States as a weed, especially in the West and the Southwest. It was introduced into Europe about the middle of the sixteenth century. In Egypt, India, and Southern Europe, especially in Russia, the plant is grown for its seeds, which are eaten like nuts, and their oil, which is used for culinary purposes. The oil is also used in the manufacture of varnishes on account of its drying properties, which, however, are inferior to those of linseed oil. It is also used in soap-making and other manufactures. Sunflowers are cultivated somewhat in the United States and Canada for ornament, for forage, and for seed. On light, well-drained, well-tilled, and fertile soil a yield of from 30 to 50 bushels of seed per acre may be obtained. The preparation of the soil and its subsequent cultivation is similar to that for corn, but the distance between plants in the row should be from 12 to 16 inches. From 10 to 15 pounds of seed is required per acre. The heads are harvested shortly before they are thoroughly ripe to prevent loss of seed. Before storing they are carefully dried to prevent molding. The seeds are threshed out with flails.

AVERAGE COMPOSITION OF SUNFLOWER PRODUCTS.

	Water	Protein	Fat	Nitrogen-free extract	Crude fibre	Ash
	per cent.	*per cent.*	*per cent.*	*per cent.*	*per cent.*	*per cent.*
Whole plant	85.2	1.7	1.0	6.2	4.0	1.9
Heads	86.1	1.9	1.5	5.6	3.8	1.1
Seed	8.6	16.3	21.2	21.4	29.9	2.6
Sunflower seed cake	10.8	32.8	9.1	27.1	13.5	6.7

The whole plant and the seeds have been used to a limited extent as a feeding stuff, especially mixed with horse beans and corn fodder for making silage. The seed is frequently fed to poultry. The oil cake is fed especially in Northern Europe to fatten animals.

Sunflower stalks are useful as fuel when other materials are not abundant.

SUNG, sōōng. One of the seven great Chinese dynasties. It was founded in 960 by Chao Kw'ang-yin, a descendant of a family of officials of the T'ang dynasty (618-907), who had risen to high military command. With the Empire rent with disorder, and the hordes of the Liao Tatars threatening on the north, the army concluded to raise their general, Chao, to the throne. He at once proceeded to repel the Liao and unify the Empire by reducing the petty States. He introduced many reforms, and for sixteen years ruled with great wisdom and ability. The Liao, however, continued to encroach on Chinese territory, and in 1126, during the reign of the ninth Emperor, established their authority over all of North China, styling their dynasty the *Kin* or 'Golden.' The Sung fled south to Hang-chow (q.v.), which continued to be the capital of the diminished empire of the Southern Sung. Nine emperors ruled here until 1279, when Kublai Khan and his Mongols overthrew both the Kin and the Sung, and established the Yuen dynasty in 1280. Notwithstanding the harassments and encroachments of invading armies, the Sung period was one of great prosperity and advance in civilization and culture.

SUNGA'RIA, or DZUNGARIA. A name vaguely applied to a region of undefined extent in Central Asia (Map: Asia, H 4). It belongs to the Chinese Empire, and the name is generally restricted to the region lying north of the Tarim Basin in East Turkestan, between the Tian-Shan and Altai Mountains, and west of Mongolia. It is chiefly of historical significance, deriving its name from the Sungarians, a Mongolian people who attained their greatest power about the middle of the seventeenth century, when their kingdom embraced the territory between the Kuen-lun and the Altai Mountains, extending westward to Lake Balkhash. About 1670 the ruler of Sungaria entered into conflict with the Chinese, who completely overran the country. The Chinese were driven out in 1710 and for a short time the rulers of Sungaria were masters of Tibet. In 1759 the Chinese, after long campaigns, destroyed the reestablished Sungarian kingdom and made the country a part of their empire, peopling it in large measure with colonists from China.

SUNKEN BELL, THE (Ger. *Die versunkene Glocke*). A poetic play in blank verse by Gerhart Hauptmann (1896). It is a fairy-drama, the chief human character of which is Heinrich, a master bell-founder who has completed his crowning work, a bell which is to be hung in a church on a mountain inhabited by sprites. Through their hostility the wagon bearing the bell is overthrown and the latter is sunk in a mountain brook. Heinrich is injured and is nursed by the chief personage of the drama, Rautendelein, half child, half fairy, whose love changes Heinrich's standards and brings about the death of his wife.

SUNN. A plant (*Crotalaria juncea*) grown in India and some other warm climates for its fibre. See HEMP, SUNN; CROTALARIA, and illustrations on Plate of CRANBERRY, ETC.

SUN'NA (Ar. *sunnah*, custom, legal usage, tradition, from *sanna*, to establish a usage or law). In the original meaning among Moslems, the sayings and the example of Mohammed and his community, provided they are in accordance with the Koran, the meaning of which, however, is itself explained by the Sunna. As embracing traditional law, Sunna is divided into three parts: (1) what Mohammed did; (2) what he enjoined; and (3) what was done in his presence and not forbidden by him. The term is therefore (though incorrectly) used for the collections of moral and legal traditions known as *Hadith* (q.v.) traced to the Prophet, which supplement the Koran, somewhat like the Mishna (q.v.), which supplements the laws of the Pentateuch. The Sunna not only comprises religious doctrines and practice, but also civil and criminal laws, and the usages of common life, the way to eat and to drink, to dress, and the like. For the credibility and canonicity of a tradition, it was originally necessary that it should have been *heard* by one truthful witness; but this law was much relaxed in later times. By the beginning of the ninth century a large number of individual collections known as *Musnads* had been produced by different theologians, but the first who sifted them critically, and without regard to any special theological system, was Buchari (810-887). His collection contains 7275 single traditions, 4000 of which, however, occur twice in the work. Muslim, a younger contemporary (817-873), supplemented Buchari with another collection, containing 12,000 traditions, again including 4000 repetitions. Besides these, there are 'canonical' collections by Abu Daud (817-888), by Tirmidhi (830-914), a pupil of Buchari, and by Abu Maja (824-886), besides others that also enjoyed some measure of authority. The Sunna, as we have it in these collections, contains, broadly speaking, more truth than it is generally supposed to contain, and, critically used, is, besides the Koran, the most authentic source of a knowledge of Islam. A selection from the different collections (both canonical and otherwise), called *Mishkat Al Masabih*, has been translated into English by Matthews (Calcutta, 1809). The Arabic text of Buchari has been published by Krehl, *Le recueil des traditions musulmanes* (Leyden, 1862-68), and fragments of this work in German translation were embodied by Hammer-Purgstall in his *Fundgruben des Orients* (Vienna, 1810-19). Goldziher has a valuable treatise on the Hadith literature in his *Mohammedanische Studien*, vol. ii., pp. 1-274 (Halle, 1890).

SUNNITES, sŭn'īts (from Ar. *sunnah*, custom, legal usage, tradition, from *sanna*, to establish a usage or law). The orthodox sect in Islam; politically it may be described as the Centre, in contrast to extreme theories concerning the headship of the Church. The term arose in distinction to several tendencies which early asserted themselves, but especially differentiates that section which denies the claim of the Shiites (q.v.) for the peculiar authority of Ali, as the sole legitimate successor of Mohammed. (See MOHAMMEDAN SECTS.) These Shiites fast developed their peculiar theological and constitutional theories, and so drove their opponents to an understanding of their own position; as they were content with tradition and with things as they were, they called themselves Sunnites, or Traditionalists. The differences rapidly developed into those of a political and

ethnic character, the Shiites being found in the lands which were opposed to the Ommiads (q.v.), as Arabia, where independence was characteristic, and in Persia, which only by force of arms had submitted to Islam. But the decision between the two parties was by no means immediately reached. The fall of the Ommiads was brought about by Persian Shiite influences (750), although the new Abbasside dynasty which was installed soon threw in its lot with the Sunnites. In general the geographic centre of the Arab power, Mesopotamia and Syria, remained in the control of this party. But the Shiites maintained the contest. The latter as liberalists and theosophists possessed a strong following, especially among the cultured, and they often enjoyed immunity under free-thinking caliphs. The Empire was honeycombed with Shiite secret societies like the Assassins (q.v.), and Shiite dynasties arose in Egypt and at Bagdad. (See SHIITES.) But by 1100 Sunnism was master in Southwestern Asia. This party was able to maintain itself during the Mongol invasions, and with the favor of the Ottoman Turks it remains as the predominant body in Islam. At the present time orthodoxy outnumbers all its opponents by ten to one, and commands not only the whole Turkish Empire, but the millions of Moslems in Africa, India, China, Malaysia and the Philippines, non-Turkish Arabia, and Northern Africa (Morocco being practically Sunnite).

Within this conservative and orthodox body, apart from outer foes, there early developed all kinds of theological strife. Rationalistic and liberal parties developed, which opposed, one after another, the original principles of Islam, such as its views of God, and of heaven and hell, its doctrines of predestination and of the literal authority of the Koran. On the other hand, the crass views of the fanatical mob opposed anything like philosophy, even though orthodox. Traditionalism was not fitted to meet the dialectic methods of its opponents, who had learned from the ancient schools of culture, and was ignorant of the use of philosophy in self-defense. But the champion of orthodoxy arose in Al-Ashari (born 882). A member originally of the Mutazilite sect, which had gone to the extreme of rationalizing upon the faith and the Koran (see MOHAMMEDAN SECTS), he was led to the consciousness of this inconsistency, and openly abjured that heresy, henceforth devoting himself to the formulation of a scholastic philosophy in support of orthodoxy. This school encountered for long the opposition of the liberals and the ignorant, but about 1050 Ashari's triumph became evident. His philosophy was continued and popularized by Al-Gazali (q.v.), who established the pietistic principle of Sufism, which may be compared to the Christian emotional principle of faith. Since Ashari and Gazali no commanding theologian has arisen and no further philosophic advance has been made in Islam.

With reference to the head of Islam, Sunnism still as ever lacks a definite principle. Since 1658 the Ottoman Sultan has claimed the caliphate, although he possesses but fictions of the traditional requirements, and he holds his power by force and through the agreement of the faithful. Hence Sunnism is not bound to the dynasty at Constantinople, and many of its thoughtful minds would regard the fall of the Ottoman power in the light of redemption for the Church. Contrary, therefore, to the original theocratic constitution of Mohammed there has arisen a division between the spiritual and the political forces. Political power is wielded by the Sultan, but the spiritual rule is in the hands of the Ulema (q.v.) of Constantinople, a close corporation of lawyer-theologians. Its chief, the Sheik-ul-Islam, is appointed by the Sultan, but only out of that body, and he possesses large independent powers which the Sultan dare not invade. He is the chief spiritual person in orthodox Islam.

Within the Sunnite body exist four different schools of law, those respectively of the Hanbalites, the Hanifites, the Shafiites, and the Malikites (so named after their respective founders). The first code is confined to the Wahabites (see WAHABIS); the second to Upper Egypt and North Africa; the third prevails in Lower Egypt, Southern India, and Malaysia; the fourth is followed by the Turks and by the Moslems of Central and Northern Asia. These schools arose in the second and third centuries of the Hejira and represent so many different compositions between tradition and progressive law. They are at peace with one another now, and divide orthodox Islam among themselves, each people being allowed to live by its law, and each lawyer electing his choice. But in the Ottoman Empire there exists the contrast between this canon law and the secular law. The latter proceeds from the authority of the Sultan or is the ancient secular law of the land; the other, the law of the Church, is confined mostly to domestic matters, and it is one of the grievances of the orthodox that the legal authority of the Church is thus put into abeyance by the secular arm. Here again the analogy may be drawn with the dispute which has prevailed in European Christendom between the canon and the civil law. Therefore, both in its past history and in its present condition, Sunnism is by no means to be regarded as a homogeneous body or practice. For literature, see MOHAMMEDANISM; MOHAMMEDAN SECTS.

SUNNYSIDE. A gabled stone house on the Hudson River near Irvington, three miles south of Tarrytown, noted as the home of Washington Irving, and described in Irving's sketch entitled *Wolfert's Roost*, the former name of the mansion. The house, in which the author's study has been preserved in its original condition, is overgrown with ivy from Abbotsford.

SUNSTONE, or HELIOLITE. A variety of aventurine, oligoclase, or feldspar, which when polished yields internal yellowish or reddish reflections emanating from crystals or flakes of iron oxide that are contained in the mass. The finest specimens, which show a brilliant play of colors, are found in Norway, although gem varieties occur in the United States at Crown Point, N. Y., and Media, Pa.

SUNSTROKE. See HEAT-STROKE.

SUN-WORSHIP. See NATURE-WORSHIP.

SUO'VETAURIL'IA (Lat., sacrifice of a boar, a sheep, and a bull, from *sus*, boar + *ovis*, sheep + *taurus*, bull). A Roman sacrifice, which was offered to Mars, in the lustrum, or purification of the people, on the Campus Martius at the Census, the Ambarvalia in May, the Amburbium in February, and other similar lustrations. It

derived its name from the three animals of which it consisted, a boar, a ram, and a bullock. In all cases the animals were led three times around the gathering or territory to be purified, and then sacrificed.

SUPAN, sōō'pän, ALEXANDER (1847—). An Austrian geographer, born at Innichen, Tyrol. Having studied at the universities of Gratz, Vienna, Halle, and Leipzig, and taught at Laibach, he qualified as privat-docent at Czernowitz, Bukowina, and was made professor in 1880, but removed to Gotha in 1884 to assume the redaction of *Petermanns Mitteilungen*. The publication of its geographical literary reports, since 1885, is due to his initiative. He wrote: *Lehrbuch der Geographie für oesterreichische Mittelschulen* (1874; 10th ed. 1901); *Grundzüge der physischen Erdkunde* (3d ed., 1903); *Geographie von Oesterreich-Ungarn* (1889); *Deutsche Schulgeographie* (6th ed. 1903); and numerous contributions to the *Mitteilungen*.

SUPEREROGATION, WORKS OF (Lat. *supererogatio*, payment in addition, from *supererogare*, to pay in addition, from *super*, above + *erogare*, to expend, especially after asking consent, from *e*, out + *rogare*, to ask). A class of good works which, in the Roman Catholic system, are described as not absolutely required of each individual as conditions to his eternal salvation. Roman Catholics found this definition on the distinction between what they believe to be commanded and what they hold to be only counseled. (See EVANGELICAL COUNSELS.) For works of supererogation, as for all supernaturally good works, they hold that the assistance of God's grace is indispensably necessary; and they do not ascribe to them any merit, except that which arises from God's own free and gratuitous promise. A further consequence of this doctrine is that God may accept the superabundant works of one in atonement for the defective service of another; and hence, in the Catholic theory of indulgences (q.v.), along with what they regard as the infinite and inexhaustible treasure of the merits of Christ, they also regard, although in a degree infinitely inferior, the superabundant merits of the saints as forming part of that 'treasure of the Church' which is applied in the form of indulgences.

The idea of such works is rejected by Protestants generally, and the Anglican Articles declare that they "cannot be taught without arrogancy and impiety."

SUPERFICIES (Lat., surface). At civil law, the hereditary and alienable right to maintain and use a building on land belonging to another. Unless a term be fixed in the contract, the right is perpetual. The owner of the land is technically owner of the building (*superficies solo cedit*); but practically the owner has no right except to an annual ground-rent (*solarium*). Even when the ground-rent has not been paid for several years, the right of the superficiary is not forfeited unless this be expressed in the contract. In the absence of such express agreement, the owner of the land can only attach and sell the superficiary right.

Historically, *superficies* was first established at Rome in public or municipal land. It was originally lease (*locatio conductio*), but it soon became a different thing, because the superficiary was recognized as having possessory right (see POSSESSION) and actions *in rem*.—advantages which the Roman lessee did not enjoy. In the later development of the Roman law superficiary right could be established on private land and also in a special story or floor of a building.

Superficies is analogous to *emphyteusis* (q.v.), but the rights of the superficiary are greater than those of the emphyteutist.

Mediæval jurists regarded superficies and emphyteusis as cases of divided ownership, analogous to the feudal tenures. The landlord had *dominium directum*, the tenant *dominium utile*. Some of the modern legislations recognize divided ownership in a different sense: the landlord is said to own the land, the superficiary the house or floor. See DOMINIUM; EMPHYTEUSIS; PROPERTY.

SUPERFŒTATION (from Lat. *superfœtare*, to conceive anew when already pregnant, from *super*, above, over + *fœtare*, to breed, from *fœtus*, offspring; connected with Gk. *φύειν*, *phyein*, to generate, Skt. *bhū*, to become, and ultimately with Eng. *be*), and SUPERFECUNDATION. The circumstance of two distinct conceptions occurring in the same woman at an interval of weeks or months, so that two fœtuses of different ages, and possibly the offspring of different fathers, may coexist in the uterus. True superfœtation takes place when a second ovule has been impregnated while the uterus already contains an ovum which has arrived at a considerable degree of development. By *superfecundation* is meant the impregnation, at or near the same period of time, of two separate ovules before the decidua lining of the uterus has been formed, which is believed by many to interpose an insuperable obstacle to subsequent impregnation. The possibility of this occurrence has been proved on numerous occasions by the birth of twins bearing the stamp of fathers of different races, i.e. white and black. The question of superfœtation has given rise to much discussion owing to its medico-legal importance. Against the possibility of this occurrence it is urged that ovulation is suspended when impregnation has taken place; that the decidua (afterbirth) so completely fills the uterine cavity that the passage of spermatozoa is impossible, and that their ascent is prevented by the plug of mucus filling the cervix. It is now believed that none of these obstacles is insuperable.

The medico-legal aspect of the question may be summed up as follows: A woman may be unjustly suspected of conjugal infidelity when, delivery of a mature or premature child having taken place, she is (without having meanwhile seen her husband, or submitted to coitus), in the course of one, two, or three months, delivered of another child, either mature or premature. Cases of this kind may be explained, as indicated above, by twin pregnancy with expulsion of the fœtuses at an interval of several weeks or months; by the existence of bilobed uterus, the two cavities expelling their contents at different times; or by true superfœtation. When the children are of different race or color the fidelity of the female may be justly questioned. See Bonner, in *Edinburgh Medical Journal* (1864-65); Witthaus and Becker, *Medical Jurisprudence* (New York, 1894); Playfair, *Midwifery* (Philadelphia, 1893).

SUPERIOR. A port of entry and the county-seat of Douglas County, Wis., adjacent to Duluth,

Minn.; at the mouth of the Saint Louis and Nemadji rivers, on three bays, inlets of Lake Superior, and on the Northern Pacific, the Eastern Minnesota, the Saint Paul and Duluth, the Duluth, South Shore and Atlantic, the Great Northern, and the Chicago, Saint Paul, Minneapolis and Omaha railroads (Map: Wisconsin, A 2). It is connected with Duluth by two railroad bridges and by ferry. The city is finely situated. It is the seat of a State Normal School, and among other features are a public library, with more than 13,000 volumes, and Saint Mary's Hospital. An excellent harbor, which has been enlarged and improved through national, State, and city appropriations, and good transportation facilities have contributed to Superior's commercial importance. In the year ending June 30, 1901, the total foreign trade was valued at $7,353,553, including exports to the amount of $6,946,547. Wheat, corn, flour, lard and other meat products, iron and steel, cement, and lumber compose the principal shipments. The various industries in the census year 1900 had an invested capital of $5,882,562, and a production valued at $7,527,703. There are lumber mills, foundries and machine shops, breweries, flour mills, boiler shops, iron works, manufactories of chairs and windmills, and shipbuilding interests.

The government is vested in a mayor, elected biennially, and a unicameral council; and in administrative officials, the majority of whom are appointed by the mayor, subject to the confirmation of the council. For maintenance and operation, the city spends annually about $409,000, the chief items being: schools, $120,000; fire department, $25,000; interest on debt, $23,000; and streets, $19,000. Population, in 1890, 11,983; in 1900, 31,091.

On the site of Superior Radisson and Grosseilliers are supposed to have made their headquarters in 1661. Here in 1680 the famous explorer Du L'Hut established a trading post. Superior was first laid out in 1855, and in 1885 the city was considerably enlarged, a company headed by Gen. J. H. Hammond having laid out an addition west of the original town. In 1881 the Northern Pacific Railroad Company built a branch hither.

SUPERIOR, LAKE. The largest and most northerly of the Great Lakes of North America, and the largest body of fresh water in the world (Map: America, North, K 5). It is situated a little to the northeast of the centre of the continent, and is bounded on the north and east by the Canadian Province of Ontario, and on the south by the State of Michigan and a part of Minnesota, the latter State forming also the western boundary. Its shape is nearly a crescent, the horns extending southwest and southeast, while the large Keweenaw Peninsula reaches nearly to the centre of the lake from the middle of the southern coast. Lake Superior has a coast line of 1500 miles; its extreme length from east to west is 412 miles; its extreme breadth is 167 miles. Area, 31,200 square miles. Its mean elevation above sea level is 602 feet, and it lies 20 feet above the level of Lake Huron, into which it discharges through the Saint Mary's River (q.v.). It receives a large number of streams, but they are all short, the lake being closely hemmed in by the watersheds of the Mississippi and of Hudson Bay. The principal stream entering it is the Saint Louis River, which falls into the extreme western end of the lake, and is considered as the farthest headstream of the Saint Lawrence.

The shores of Lake Superior, except in the southeast, where there are long lines of sand dunes, are generally bold and rocky. On the Michigan shore are the celebrated sandstone cliffs known as Pictured Rocks, which are streaked by the red and yellow deposits of ferruginous waters. In many places, especially along the Canadian shore, there are precipitous cliffs of basalt rising directly from the water to a sheer height of from 300 to over 1000 feet, such as Thunder Cape on the northwest shore. The north shore is also cut up into deep bays surrounded by high cliffs, and forming good harbors, and it is lined with a number of high, rocky islands with precipitous sides and capped by eruptive material. In the greater part of the lake, however, the islands are few, the largest being Isle Royal, 45 miles long and 8 miles wide, belonging to Michigan. In general the country surrounding the lake is covered with pine forests.

Lake Superior is deeper than any of the other Great Lakes, its maximum depth being 1008 feet, so that the bottom lies 400 feet below sea level. The water is very clear, and so fresh as to be almost chemically pure. It is cold throughout the year to within a few feet of the surface, and in the deeper portions maintains a nearly uniform temperature of 39°. The lake never freezes except in the shallow water along the shores. The level of the lake is subject to several sets of periodic changes, partly owing to changes in rainfall and evaporation and partly to the winds; a long continued storm will sometimes raise the leeward level seven feet above the normal. Violent storms occasionally sweep over the lake, when the waves may attain an amplitude of 15 or 18 feet.

The basin of Lake Superior is remarkable as being unrelated to those of the other Great Lakes. While the latter are river valleys scooped out of the softer strata of the ancient coastal plain lying northwest of the Appalachian Plateau and skirting the Archæan continent, Lake Superior lies almost wholly within the Archæan region. The most recent investigators are of the opinion that this basin is a primitive depression in the earth's crust antedating the Huronian period. The numerous intrusions of eruptive rocks which encircle the lake are arranged roughly in concentric circles, the most recent being found nearest the lake, and it has been suggested that the depression is an ancient and deep-seated centre of volcanic activity. The formation of the lakes themselves, however, is due to the obstruction of the valleys during the Glacial Period. The country surrounding the lake is rich in minerals, and large veins of copper and iron ore traverse its bottom from the southern shore. Consult Agassiz, *Lake Superior: Its Physical Character, Vegetation, and Animals* (Boston, 1850). For commerce and navigation on the lake, see GREAT LAKES.

SUPERPHOSPHATE. An orthophosphate in which only a portion of the hydrogen of the orthophosphoric acid has been replaced by a basic radical. The most important superphosphate, agricultural, that of lime, monocalcium phosphate ($CaH_4O_2.2H_2O.P_2O_5$), is prepared by treating trical[illegible] phosphate ($[CaO]_3.P_2O_5$) in the form

of mineral phosphate, bone ash, bone black, etc., with sulphuric acid. It is also called acid phosphate. See MANURES AND MANURING.

SUPERPOSITION. See CONGRUENCE.

SUPERSEDEAS (Lat., that you set aside). A common-law writ containing an order for a stay or suspension of legal proceedings. Under the common-law practice it is issued in a great variety of cases for the above purpose, and is sometimes used as a substitute for the common-law writ of *audita querela* (q.v.). Probably it is issued most frequently to stay execution, pending an appeal from a judgment. The person applying for the writ is required to give a bond, to secure the other party against loss by reason of the delay. Several writs are said to operate as a *supersedeas* by implication, as in effect they operate as a stay, viz.: habeas corpus, certiorari, and writ of error. The practice of granting a *stay* by an order of the court has superseded the above practice in many jurisdictions.

SUPERSTITION (Lat. *superstitio*, excessive religious belief, superstition, possibly originally a standing over a thing in amazement or awe, from *superstare*, to stand above or over, from *super*, above, over + *stare*, to stand). A term loosely used to include all false faith or belief, its distinguishing characteristic being its irrational estimate of something imperfectly understood. Since the answer to the question of truth or falsity varies with place and time, it follows that the accepted belief of one time or people may be superstition to another. Most of the popular superstitions of the present are survivals of earlier science or religion. At a time when there existed no system of recorded observations of natural phenomena conclusions were of necessity drawn from external characteristics, and objects and events were supposed to exercise influences corresponding to the impression produced upon the senses or imagination. This manner of interpretation, or sympathetic magic (see MAGIC), is responsible for a great mass of superstitions. It is a characteristic of popular credulity that such notions, once prevalent, do not yield to contrary experience. If observation shows the principle to be inaccurate, reasons are always at hand to explain the error, or at the most it is only necessary to introduce additional complexity into the rule. Hence the power of the ancestral habits, which we find arbitrary and call superstitious. With all savage peoples, such beliefs have an immense effect on action; the daily method of nutrition, attire, the chase, agriculture, and warfare are determined by an infinity of regulations which are religiously handed down from generation to generation. In some cases it is possible to discover the principle of expediency which gave birth to the requirement; thus, the discovery of the ill effect of in and in breeding causes to be established a religious necessity, limiting the relations of the sexes according to certain complicated and ingenious rules, of which the prohibited degrees are the modern ecclesiastical survival. But in multitudes of other cases no good reason can be offered for demands and abstentions which originally depend on inferences which it is impossible to reconstruct.

A considerable number of superstitions are connected with the heavenly bodies. From remote times the observation of the stars and their movements has been considered important, but it has been with the night, especially, that ancient religious ceremonies are associated. The most distinctive differences between the nights were formed by alterations in the growth of the lunar crescent; according to universal processes of thought, it was supposed that the time when the planet increases and becomes dominant the principle of growth must prevail, and on the other hand, that her wane must be a season of general decay. Hence it has been everywhere inferred that all operations designed to promote increase ought to be performed at the time of the new moon, and that then potatoes should be planted, hair cut, and so on. But if it is desired to cause shrinking, the work should be done when the moon is at the full according to the maxims of traditional agriculture, and at this time should be cut alders, spruce, and other undergrowth, because the roots will in this case wither without sprouting.

Not less important in popular usage is the part played by the course of the sun. As he moves in a particular direction, so it has been thought that in order to produce beneficial results, mankind should proceed in a corresponding manner; in worship it was thought necessary to adopt a processional movement in the sunwise direction. Even in the ordinary movements of daily life this order was followed, and traces of it survive to the present day. Thus in order to make good bread or butter, it is essential that the motion should be in the same uniform direction, for reversal of the direction in which the kneading or churning is performed will undo the work accomplished, and insure a failure. From household maxims still preserved, it appears that the hand must be moved in a sunwise circuit. As the route taken by the sun is holy, so the opposite path will be evil, and has been adopted in practices of witchcraft and magic, and in Roman worship the gods below were adored with this reverse circuit.

Among periods of human life, the terror which attaches to death has made it the centre of a vast body of superstitious habits. A great number of actions and experiences are still popularly regarded as signs of approaching departure. The principle on which the phenomena are interpreted is that of association of ideas. Thus ringing in the ears is a sign of dissolution, because the Church has usually rung a 'death-bell' over the departed; carrying a spade through the house has like significance, because a spade is used to dig graves; a blue flame in the candle is ominous, for the lowering of the light forecasts the decline of the life; a flower blooming out of season foreshows a decease; and so on indefinitely. In like manner, the unusual also is a fruitful source of superstition; if every child were born with a caul (that is, a membrane encompassing the head) it is doubtful if this would have been taken as an especial sign of good luck.

A considerable number of superstitions relate to times of the year, and revert to the practices of old religion. Thus Hallowe'en, or the evening before All Saints' Day, is attended with observances which seem to have been dependent on its original character as a feast of the dead, when departed spirits were invited to partake in the fruits of the harvest, and were conceived as present at the sacrifice and merry-making. On this

night it is usual to perform divinations, now reduced to mere jests, in which an unmarried person is expected to discover his or her companion for life. These practices must be regarded as the remainder of serious necromancy, in which the returning spirits were asked to reveal the future.

While the majority of superstitions are remains of antiquity, their invention has not altogether ceased in historical times. Of this we have examples in the prejudice against the number thirteen, and in objection to Friday as unlucky, since in Christian thought the day of the Crucifixion and the number involving the addition of Judas were of necessity regarded as ill-omened. The superstition of the evil eye, that is, the belief that certain individuals have the power to injure by a look, is still widespread in Eastern countries, where the belief yet lingers that the demoniac (q.v.) is divinely inspired. Nature worship (q.v.) lingers in such superstitions as those connected with the moon, the belief in its mysterious power to work good or ill, its influence on the weather, and the like. The belief in ghosts (q.v.) reflects the earlier ancestor worship. The common notion about the good luck brought by a horseshoe has been traced back to phallicism (q.v.).

The following list, prepared by Bolton (*The Counting-out Rhymes of Children*, London, 1888), gives the technical names for different forms of divination and the method followed in each:

Aëromancy	by appearances in the air.
Alectoromancy, or Alectryomancy	by a fowl picking up grains of wheat.
Aleuromancy	by wheat.
Alphitomancy	by barley flour.
Amniomancy	by the amnion.
Anagrammatism	by anagrams of a person's names.
Anthropomancy	by human entrails.
Anthroposcopy	by man's features.
Arithmancy	by the use of numbers.
Astragalomancy, or Astragiromancy	by little sticks, bones, tablets, or dice.
Astrology	by the heavenly bodies.
Austromancy	by winds.
Axinomancy	by the axe or hatchet.
Belomancy	by arrows.
Bibliomancy	by the Bible.
Bletonism	by subterranean springs.
Botanomancy	by herbs.
Cartomancy	by playing cards.
Capnomancy	by smoke from an altar.
Catoptromancy	by mirrors.
Ceromancy	by dropping melted wax into water.
Cephalomancy	by an ass's head.
Chalcomancy	by vessels of brass.
Chaomancy	by appearances in the air.
Chartomancy	by writings on paper.
Chiromancy	by the hand.
Cledonismancy	by certain lucky or unlucky words.
Cleromancy	by dice.
Clidomancy	by keys.
Coscinomancy	by sieves.
Crithomancy	by dough of cakes.
Cromniomancy	by onions.
Crystallomancy	by a magic lens.
Dactylomancy	by suspended rings.
Demonomancy	by evil spirits.
Daphnomancy	by the laurel.
Extispicium	by entrails of a victim.
Gastromancy	by ventriloquism, or by a vial of water.
Geloscopy	by the manner of laughing.
Geomancy	by geometrical figures.
Gyromancy	by walking in a circle.
Haruspicy	by sacrificial appearances.
Halomancy	by common salt.
Hieromancy	by the entrails of animals.
Hydromancy	by water.
Hydatoscopy	by rain water.
Ichthyomancy	by the entrails of fishes.
Idolomancy	by idols and images.
Judeomancy	by a Jewish art.
Keraunoscopy	by thunder.
Lampadomancy	by lamps.
Lecanomancy	by a basin of water.
Libanomancy	by incense.
Lithomancy	by precious stones, or pebbles.
Logarithmancy	by logarithms.
Lychnomancy	by lamps.
Margaritomancy	by pearls.
Macharomancy	by knives and by swords.
Meteoromancy	by meteors.
Metoposcopy	by men's features.
Molybdomancy	by melted lead.
Myomancy	by mice.
Necromancy	by the black art.
Oinomancy	by wine of libations.
Omphalomancy	by the navel of an infant.
Oneiromancy	by dreams.
Onomancy	by letters forming the name of a person.
Onyomancy, or Onychomancy	by the finger nails reflecting the sun's rays.
Oöscopy	by eggs.
Ophiomancy	by serpents.
Ornithomancy	by birds.
Palmistry	by the hands.
Palpitatio	by the pulsation of some member.
Pegomancy	by springs of water.
Pessomancy	by pebbles.
Physiognomy	by man's features.
Podomancy	by the feet.
Psephomancy	by pebbles drawn from a heap.
Psychomancy	by ghosts.
Pyromancy	by sacrificial fire.
Pyroscopy	by examining fire.
Rhabdomancy	by wands.
Rhapsodomancy	by poetical passages.
Salisatio	by the pulsation of some member.
Sciomancy	by shadows or manes.
Sideromancy	by straws on a red-hot iron.
Sortilege	by drawing lots.
Spatilomancy	by skin, bones, etc.
Stereomancy	by the elements.
Sternomancy	by marks on the breast.
Stichomancy	by poetical passages.
Tephramancy	by writing in ashes.
Theomancy	by oracles.
Theriomancy	by wild beasts.
Tyromancy	by cheese.

See also FOLKLORE; MAN, SCIENCE OF; MAGIC; MYTHOLOGY; RELIGION, COMPARATIVE.

SUPERTONIC. In music, the note which, in the diatonic scale, is next above the tonic or keynote, and forms with it the interval of the second, as, for example, D in the key of C major.

SUPERVISOR (ML. *supervisor*, overseer, from Lat. *supervidere*, to overlook, oversee, from *super*, above, over + *videre*, to see). A popularly elected officer of a township or other local district in the United States. The name first appeared in New York in 1691. This officer is still the chief administrator of the town organization in New York, while all the supervisors of the county assembled in a board meeting constitute the chief county authority. The New York supervisor system exists in several Western States. In Michigan and Illinois, as in New York, there is a single supervisor for each township, while in Wisconsin and Minnesota there are three for each township. In some States the supervisor is not a member of the county board and his duties vary, as, for example, in Michigan, where he is also tax assessor, and in Illinois, treasurer. See UNITED STATES, section on *Local Government*.

SUPPÉ, sōō-pā', FRANZ VON (1820-95). An Austrian composer of light opera, born at Spalato, Dalmatia. He studied at the Vienna Conservatory under Sechter and Seyfried. He was kapellmeister successively at the Josephstädter Theater, the Theater an der Wien, and from 1865 until the end of his career at the Leopoldstädter Theater. He was a prolific composer, the most important of his works being the operettas Flotte Bursche (1863), Die schöne Galathea (1865), Leichte Kavallerie (1866), Banditenstreiche (1867),

Fatinitza (Vienna, 1876), *Boccaccio* (1879), *Das Modell* (posth., 1895). He also composed considerable instrumental and sacred music. He was one of the most popular of the world's light opera composers, and a musician of no little genius.

SUPPLE JACK (*Berchemia volubilis*). An American twining shrub of the natural order Rhamnaceæ, which is found as far north as the Dismal Swamp in Virginia. It has oval leaves, small flowers, and violet-colored berries, and ascends to the top of the highest trees. The name is also given in the West Indies and tropical America to Serjania lucida and Serjania trachygona, shrubs of similar habit which belong to the natural order Sapindaceæ. The stems are used for walking-sticks.

SUPPLEMENTARY PROCEEDINGS. Certain proceedings under codes and practice acts designed to discover property of a judgment debtor and apply it to the satisfaction of the judgment. The order directs the debtor to appear and submit to an examination under oath as to his property. Most acts provide for the appointment of a receiver where property is found. Consult *New York Code of Civil Procedure*. See EXECUTION.

SUPPLIANTS, THE (Lat. *Supplices*, Gk. Ἱκέτιδες, *Hiketides*). (1) The earliest of the extant plays of Æschylus, of uncertain date. With but slight plot or dramatic action, it pictures the arrival of the fifty daughters of Danaüs on the shore near Argos, their prayer to the King of Argos for protection, the appearance of the ship bearing the fifty sons of Ægyptus, and their repulse by the King.

(2) A tragedy by Euripides, produced about B.C. 420. Theseus and the Athenians, entreated by the mothers of the dead chiefs, after defeating the Thebans, oblige them to surrender the bodies of the slain Polynices and his allies, to whom they had refused burial. The funeral of the chiefs, the burning of Evadne on the pyre of her husband, Capaneus, and the patriotic and political references provide the interest lacking in the simple plot.

SUPPORTERS (from *support*, OF., Fr. *supporter*, from Lat. *supportare*, *subportare*, to support, from *sub*, under + *portare*, to carry). In heraldry, figures placed on each side of an armorial shield. See HERALDRY.

SUPPOSITORY (Lat. *suppositorium*, from *supponere*, *subponere*, to put beneath, from *sub*, under + *ponere*, to put, place). A solid medicated compound intended to be introduced into the rectum, vagina, or urethra, either for the purpose of causing an evacuation of the bowels, or for its specific effect on inflamed mucous membrane. Suppositories are made in several shapes —conical, cylindrical, or spherical—and in sizes adapted to the orifice they are intended to enter. In consistency they are such that they remain solid at ordinary temperatures, but melt slowly at the temperature of the body. The basis of most suppositories is cocoa butter. With this are incorporated one or several ingredients, such as carbolic acid, tannic acid, belladonna, morphine, opium, cocaine, and lead.

SUPPURATION (Lat. *suppuratio*, *subpuratio*, from *suppurare*, *subpurare*, to form pus, from *sub*, under + *pus*, white viscous matter from a sore). A morbid process which takes place in animal tissues, resulting in the formation of pus. It is a frequent termination of inflammatory processes and is due to invasion of the inflamed tissues and their exudates by pyogenic organisms. (See PUS; INFLAMMATION.) White blood cells escape into the neighboring tissue after passing through the walls of the blood vessels, and become pus cells. If they escape to the surface and there is an open wound, the wound is said to suppurate. If they are confined to a circumscribed area below the surface, the collection of pus cells and broken down tissue is called an abscess (q.v.).

SUPRALAPSARIAN. See INFRALAPSARIAN.

SUPRARENAL (from Lat. *supra*, above + *renalis*, relating to the kidneys, from *renes*, kidneys) **CAPSULES AND THEIR DISEASES.** The suprarenal capsules are two small, flattened, glandular bodies of a yellowish color and crescentic shape, situated, as their name implies, immediately in front of the upper end of each kidney. In weight they vary from one to two drams. They belong to the class of ductless glands, and on making a perpendicular section each gland is seen (like the kidney) to consist of cortical and medullary substance. The blood-vessels and nerves of the glands are exceedingly numerous. The capsules are also called the suprarenal bodies or the adrenals.

The suprarenal bodies are subject to inflammation, to atrophy, and to invasion by malignant processes, but all of these occurrences are extremely rare. The only morbid process that occurs with any frequency is tuberculosis. This process is the causative factor in the production of Addison's disease (q.v.), a rather rare and usually fatal affection characterized by anæmia, general languor, feebleness of the heart's action, irritability of the stomach, and bronzing of the skin.

The dried and prepared suprarenal substance of animals constitutes a powerful and valuable astringent and hæmastatic. See ORGANOTHERAPY.

SUPREMACY, ROYAL (OF. *suprematie*, Fr. *suprématie*, from OF. *supreme*, Fr. *suprême*, supreme, from Lat. *supremus*, highest, superlative of *superus*, high, from *super*, Gk. ὑπέρ, *hyper*, Skt. *upari*, Goth. *ufar*, OHG. *ubar*, *uber*, *ubiri*, AS. *ofer*, Eng. *over*). A phrase specifically applied to the relation of the sovereign of England to the established Church of that country. During the Reformation the supremacy of the Pope was abolished in England, and the act passed in 1534 declared the King to be the "only supreme head on earth of the Church of England." The Government at the same time issued an explanation of this language to the effect that it was intended to recognize in the sovereign the authority of a governor without spiritual jurisdiction, and not to "take any power from the successors of the Apostles that was given them by God." Under Queen Mary this Act of Supremacy was repealed in 1554, but this repeal was itself repealed by Queen Elizabeth in 1559, who, however, did not make use of the words 'supreme head.' In her injunctions she explained the supremacy of the Crown to be "that which is and was of ancient time due to the Imperial Crown of this realm, that is, under God to have the sovereignty and rule over all manner of persons born within those her realms of what

estate either ecclesiastical or temporal soever they may be so as no other foreign power shall or ought to have any superiority over them." The governing and visitorial power of the sovereign, under the safeguard of an organized court of justice, has since been continuously recognized by the Church of England. By successive statutes an oath as to royal supremacy was appointed to be taken by the holders of public offices along with the oaths of allegiance and abjuration. A royal supremacy similar in character is a prerogative of the Czar of All the Russias, also of the Protestant princes of Germany, and of the sovereigns of Holland, Denmark, Norway, and Sweden.

SUPREME COURT. See COURT.

SUPREME COURT OF THE UNITED STATES, THE. The Supreme Court of the United States is the head of the national judiciary. In our system of government there are three coördinate departments—executive, legislative, and judicial. The latter is the last named in the national Constitution, was the last brought into being, but is by no means the least important. The existence of the Supreme Court is authorized by the Constitution. Section 1 of Article III. provides that "the judicial power of the United States shall be vested in one supreme court, and in such inferior courts as the Congress may from time to time ordain and establish." The Supreme Court is thus a constitutional court, while the other courts of the United States are statutory. Though the Constitution provides for a Supreme Court, it leaves its organization and membership for Congressional supervision. The first act in respect thereto was passed at the first session of the United States Congress, approved by Washington on September 24, 1789, and directed that the court should consist of a Chief Justice and five associate justices, any four of whom should make a quorum. This act not only made provision for the Supreme Court, but created the inferior courts of the United States and organized its entire judicial system. It was drafted by Oliver Ellsworth, afterwards a Chief Justice of the United States. It has remained in its main features unchanged, and one of Ellsworth's admirers has declared that the Federal judicial system, "the whole edifice, organization, jurisdiction, and process, was built by him as it now stands."

The Constitution in Section 2 of Article III. declares that "the judicial power shall extend to all cases, in law and equity, arising under this Constitution, the laws of the United States, and treaties made, or which shall be made, under their authority; to all cases affecting ambassadors, other public ministers, and consuls; to all cases of admiralty and maritime jurisdiction; to controversies to which the United States shall be a party; to controversies between two or more States; between a State and citizens of another State; between citizens of different States; between citizens of the same State claiming lands under grants of different States, and between a State, or the citizens thereof, and foreign citizens, or subjects." And also that "in all cases affecting ambassadors, other public ministers, and consuls, and those in which a State shall be party, the Supreme Court shall have original jurisdiction. In all the other cases before mentioned, the Supreme Court shall have appellate jurisdiction, both as to law and fact, with such exceptions and under such regulations as the Congress shall make." The original jurisdiction, being conferred by the Constitution, cannot be taken away by Congress, although that body may prescribe the procedure by which that jurisdiction is to be exercised; but in respect to the appellate jurisdiction both the procedure and its extent are matters of Congressional determination, and Congress has from time to time made changes in each.

The appellate jurisdiction may be separated into two divisions: one over State courts; the other over the inferior Federal courts. With respect to the former it reviews the final judgment rendered in any case by the highest court of the State to which the case under State practice can be carried, and this irrespective of the amount in controversy. With respect to the latter, up to 1891 it had, speaking generally, jurisdiction to review the proceedings in any case which had passed to final judgment in such inferior courts, with a limitation in some classes of cases to a certain amount in controversy. By the act of that year (1891) courts of appeal were established, one in each circuit, and were given final jurisdiction in certain cases, such as revenue, admiralty, patent cases, etc. But the Supreme Court may still by certiorari, if it sees fit, bring any of these cases from a court of appeals before it for review. This act did away with the limitation as to the amount in controversy requisite for review by the Supreme Court. In addition the Supreme Court is given power to issue writs of prohibition and all other writs which may be necessary for the exercise of its jurisdiction and agreeable to the principles and usages of law. So that it may be said that the Supreme Court has complete supervision and control over all the inferior courts of the United States.

The full significance of the Supreme Court as a factor in the new government was not at first appreciated by all; yet there were some who realized its great importance, like Washington, who, with prophetic visions of what the future was to disclose, wrote, in a letter inclosing the commission of James Wilson, one of the first associate justices: "Considering the judicial system as the chief pillar upon which our national government must rest, I have thought it my duty to nominate for the high offices in that department such men as I conceived would give dignity and lustre to our national character." Early there arose two parties in this country—one believing that the new government was but a continuance of the old confederacy, in effect a league of States, the States remaining the dominant powers, and the national Government serving only as a limited agency for the transaction of a few matters of general importance; the other that a new nation was created, supreme in control, possessing all the power of a nation, the States being simply parts of the one new nation. By the one party, the provisions of the Constitution were strictly construed; no power was vested in the national Government, except that which was expressly named. The other believed that the Constitution was to be so construed as to give vigor and efficiency to the new nation. Upon the solution of this question turned the future of the Republic. It was finally answered

and settled by the Supreme Court, which has always spoken for the nationality of the United States. A brief reference to some of the leading cases may indicate its action, and the effect thereof on our history. In Chisholm, executor, *v.* Georgia, 2 Dall. 419, decided February 18, 1793, the court (considering those provisions of the Constitution which extend the judicial power of the United States to controversies "between a State and citizens of another State," and give to the Supreme Court original jurisdiction of controversies to which a State is a party) held that an action might be maintained against a State by a citizen of another State. The national idea was not yet strong, and the proposition that a sovereign State could at the instance of an individual and without its consent be brought to the bar of a court and compelled to defend an action against it startled many. As a consequence the Eleventh Amendment was adopted, which in effect forbids an action in the Federal courts against a State by an individual.

John Marshall became Chief Justice in January, 1801, and remained in office for thirty-four years. He is often aptly called 'the great Chief Justice.' During his long term many questions of vital interest were considered and determined by the court. It was a great constructive period, and by those decisions which declared the relative powers of the nation and the State was disclosed the full significance of the Constitution as an instrument expressing the creating of a new nation and not a mere article of confederation between separate States. Not merely were these relative powers declared, but the peculiar work and value of the Supreme Court as the tribunal to determine the extent of such relative powers and to pass in judgment upon acts of State and nation were also made apparent. In Marbury *v.* Madison, 1 Cranch, 137, decided February 24, 1803, it was held that an act of Congress repugnant to the Constitution was void. True, this was not the first case in which such a judicial opinion had been announced, but Chief Justice Marshall presented the argument so fully and forcibly that since then the question has been at rest, and it is now undoubted that a legislative act repugnant to the Constitution is a nullity. Again, in M'Culloch *v.* Maryland, 4 Wheat. 316, the question was presented of the power of Congress to charter a national bank. The Constitution gives in terms no such power, or indeed any power to create corporations, and the advocates of a strict construction contended that in the absence of an express grant of such power Congress could not create a corporation for any purpose. The court, upon the authority of that clause which, following the clauses making express grants to Congress, empowers that body to "make all laws which shall be necessary and proper for carrying into execution the foregoing powers," held that, as a bank was a proper and convenient agency for carrying on the fiscal affairs of a government, there was power in Congress to create a banking corporation; that the word 'necessary' was not to be construed in a strict and narrow sense, but—viewing the Constitution as an organic instrument by which a government was established and which from the very necessities of the case used general terms in giving to that government the power essential for its being—to be taken broadly and liberally, and said in a phrase which has become axiomatic in constitutional law: "Let the end be legitimate, let it be within the scope of the Constitution, and all means which are appropriate, which are plainly adapted to that end, which are not prohibited, but consistent with the letter and spirit of the Constitution, are constitutional."

This decision laid the foundation of what is known as the doctrine of implied powers, the significance of which may be better appreciated when we recall the fact that under a grant of power stated in these few words "to establish post-offices and post roads" the great postal system of the United States has been built up. At the same term was decided the case of the Trustees of Dartmouth College *v.* Woodward, 4 Wheat. 518, in which it was held that the charter of a private corporation granted by a State created a contract whose obligations the State could not impair, because of that provision of the Federal Constitution which forbids a State to pass any law "impairing the obligation of contracts." (See DARTMOUTH COLLEGE CASE.) It is true the full effect of that decision has been avoided by constitutional enactments in the several States, reserving the power of repeal, alteration, and amendment of all corporate grants. Yet, notwithstanding these limitations, that decision stands as the great bulwark of the sanctity of contract rights created by the States.

Martin *v.* Hunter, 1 Wheat. 304, and Cohens *v.* Virginia, 6 Wheat. 264, the latter decided at the February term, 1821, settled the power of the Supreme Court to review, and if necessary set aside, the proceedings of a State court in a case in which a Federal right was asserted by the defeated party. Thus it is that all rights which are claimed under the Constitution of the United States may finally be adjudicated by the Supreme Court of the United States, and a unity is thereby established which pervades the nation in respect to such rights. Again, in Gibbons *v.* Ogden, 9 Wheat. 1, decided in 1824, the supreme power of the Federal Government over the navigable waters of the United States was affirmed. In that case Robert Fulton, the inventor of the steamboat, and his associate, Robert R. Livingston, obtained from the State of New York the grant of an exclusive right to navigate with steamboats the waters within the jurisdiction of that State. Gibbons claimed a right under national authority to navigate with his steamboats the same waters, and hence the litigation. The Constitution having granted to Congress the power to "regulate commerce with foreign nations and among the several States," it was held that that power could not be infringed upon by any action of a State and that a State could not interfere with such commerce even when carried upon waters wholly within its own territory. Upon that decision rests that freedom of commerce between the States which, perhaps more than any other thing, has wrought into the minds of the people the great thought of a single controlling nationality. In this connection the case of 'The Genesee Chief,' 12 How. 443, decided in 1851, may be noticed. In that case it was held that the English rule that the jurisdiction of admiralty ended with tide waters was inapplicable, and that in this country such jurisdiction, which by the Constitution is vested in the United States courts, extends to all the navigable waters of the Republic. Thus

the control of the Great Lakes and all the navigable rivers of the United States, whether within or without the limits of a State, is vested in the national Government. In Osborn *v.* United States Bank, 9 Wheat. 738, it was held that a State had no power to tax one of the branches of the United States Bank; that the bank was one of the agencies and instrumentalities of the national Government, and as such was removed from the sphere of State taxation. From that decision has sprung the settled rule exempting all the agencies and instrumentalities of the national Government from State taxation except so far as permitted by Congress. This is seen in respect to United States bonds, national banks, etc. Conversely, though at a later date, in The Collector *v.* Day, 11 Wall. 113, decided December, 1870, it was held that Congress could not impose an income tax on the salaries paid to State officials. By these two decisions neither State nor nation can impair the efficiency of the necessary governmental action of the other.

Chief Justice Marshall was succeeded by Chief Justice Taney. As he and a majority of his associates had belonged to the 'strict construction school,' many prophesied a complete reversal of prior rulings, but the court still affirmed the nationality of the United States. Thus in Pennsylvania *v.* Wheeling and Belmont Bridge Company, decided in 1849, 9 How. 647, and 1851, 13 How. 518, the jurisdiction of the Supreme Court was affirmed over a case brought by a State to restrain the obstruction of a navigable river within the limits of other States. In Ableman *v.* Booth, decided in 1858, 21 How. 506, a prisoner in custody of the United States authorities was held not to be subject to discharge by State process. And in the famous 'Dred Scott Case,' decided in 1856, 19 How. 393, the nationality of the United States was asserted, though in a way not satisfactory to the friends of human freedom, in that it decided that the recognition by the Constitution of slave property carried with it the protection of that property in all the territories of the nation.

When the Civil War ended and Chief Justice Taney had been succeeded by Chief Justice Chase a new series of cases arose. Naturally bitter feelings were excited by the war, and stringent laws were passed by Congress and by some of the States against those who had participated in the rebellion. Test oaths were prescribed which prevented ministers and lawyers who had taken part with the South from pursuing their respective professions, but in Cummings *v.* Missouri, and *ex parte* Garland, decided in 1866, 4 Wall. 277 and 333, such test oaths were adjudged invalid as *ex post facto* acts. At the same time, in *ex parte* Milligan, 4 Wall. 2, it was held that a military tribunal, sitting in Indiana, a State in which there had been no rebellion, had no jurisdiction to punish a citizen, in no way connected with the army, for an offense against the Government. In Texas *v.* White, 7 Wall. 700, decided in 1868, it was held that States in rebellion did not lose their existence or identity, and in the opinion Chief Justice Chase made the memorable declaration that this was "an indestructible union composed of indestructible States." Soon after the war the Fourteenth Amendment to the Federal Constitution was adopted, which prohibited the States from depriving any person of life, liberty, or property without due process of law, and from denying to any one the equal protection of the law. It was claimed by many that this operated to prevent the grant by a State of any special privileges, but in the Slaughter House Cases, 16 Wall. 36 (1872), a charter given by the State of Louisiana, which secured to the corporation a monopoly of the butchering business within certain limits of New Orleans, was held to be valid, and thus the right of each State to determine for itself, in the grant of privileges, that which was best for its citizens, was sustained. In 1890 came Leisy *v.* Hardin, 135 U. S., 100, in which it was held that the grant by the Federal Constitution to Congress of the power to regulate commerce between the States invalidated the legislation of one State which sought to prevent a citizen of another from selling and shipping liquors into it. In 1895, in the Income Tax Cases, 82 U. S., 429, it was held that the constitutional provision requiring direct taxes to be apportioned among the States according to their population rendered invalid a tax which was not so apportioned on incomes derived from real estate and as the direct product of personal property. And only recently were decided the Insular Cases, 128 U. S., 1, cases arising out of the conquest of Porto Rico and the Philippines, in which was considered the power of Congress to govern territories acquired by war or treaty, and in which was affirmed to the largest extent the national power of the Republic. This list might be greatly increased, but enough have been cited to show the general character of the cases considered and determined by that court in upholding the idea of nationality. It has always strongly upheld the powers given by the Constitution to the nation, and at the same time protected the States in the powers reserved by that instrument to them.

At first the amount of business in the Supreme Court was small; now it is large. In 1801, the first year of Chief Justice Marshall's term, only ten cases were filed; from 1875 to 1880 there were 1953, or an average of about 390 a year. While the act of 1891 diminished the number of cases that could come to the court, yet during the year 1900 401 cases were filed, and during the year 1901 383.

As heretofore stated, the court at first consisted of six members; it never has had at any time over ten, and now has but nine. The following is a list of the Chief Justices and also of the associate justices, as well as the States from which they were appointed: Chief Justices—John Jay, New York; John Rutledge, South Carolina; Oliver Ellsworth, Connecticut; John Marshall, Virginia; Roger B. Taney, Maryland; Salmon P. Chase, Ohio; Morrison R. Waite, Ohio; Melville W. Fuller, Illinois. Associate Justices—William Cushing, Massachusetts; James Wilson, Pennsylvania; John Blair, Virginia; James Iredell, North Carolina; Thomas Johnson, Maryland; William Paterson, New Jersey; Samuel Chase, Maryland; Bushrod Washington, Virginia; Alfred Moore, North Carolina; William Johnson, South Carolina; Brockholst Livingston, New York; Thomas Todd, Kentucky; Joseph Story, Massachusetts; Gabriel Duval, Maryland; Smith Thompson, New York; Robert Trimble, Kentucky; John McLean, Ohio; Henry Baldwin, Pennsylvania; James M. Wayne, Georgia; Philip P. Barbour, Virginia; John Catron,

Tennessee; John McKinley, Alabama; Peter V. Daniel, Virginia; Samuel Nelson, New York; Levi Woodbury, New Hampshire; Robert C. Grier, Pennsylvania; Benjamin R. Curtis, Massachusetts; John A. Campbell, Alabama; Nathan Clifford, Maine; Noah H. Swayne, Ohio; Samuel F. Miller, Iowa; David Davis, Illinois; Stephen J. Field, California; William Strong, Pennsylvania; Joseph P. Bradley, New Jersey; Ward Hunt, New York; John M. Harlan, Kentucky; William B. Woods, Georgia; Stanley Matthews, Ohio; Horace Gray, Massachusetts; Samuel Blatchford, New York; Lucius Q. C. Lamar, Mississippi; David J. Brewer, Kansas; Henry B. Brown, Michigan; George Shiras, Jr., Pennsylvania; Howell E. Jackson, Tennessee; Edward D. White, Louisiana; Rufus W. Peckham, New York; Joseph McKenna, California; Oliver W. Holmes, Massachusetts; William R. Day, Ohio. They hold office for life, and yet up to 1903 the average term of office of the Chief Justices had been 13 5-12 years, and of the associates 15 9-12 years.

That the work of the court has not only developed a national idea, but also has done much to give stability to republican institutions, is now conceded by all. See CONSTITUTION OF THE UNITED STATES; COURT; FEDERAL GOVERNMENT. Consult Curtis, *Jurisdiction of the United States Courts.*

SURABAYA, sōō'rä-bä'yȧ. The most populous residency in Java. Area, 2091 square miles. The soil is fertile and produces an abundance of rice, coffee, sugar-cane, indigo, and tobacco. Capital, Surabaya. Population, in 1897, 2,217,120.

SURABAYA, or **SOERABAYA.** The largest city in Java, and the capital of the Residency of Surabaya, situated in the eastern part of the north coast, at the mouth of the Kediri River, two days by rail from Batavia; latitude 7°12′ S., longitude 112°34′ E. (Map: East India Islands, D 6). It has regular steam communication with the other cities in the island and archipelago. It has a good harbor and strong fortifications and is the military and naval headquarters of the Dutch East Indies. The houses are generally separated by gardens. Simpang, the suburb, contains the home of the resident and a large hospital. The shipbuilding industry is important. The trade in rice, coffee, cotton, sugar, tobacco, and cocoanuts is very extensive. Population, in 1897, 142,080, of whom 6988 were Europeans, 121,075 natives, and 12,133 Chinese.

SURAKARTA, sōō'rä-kär'tȧ. A residency in the central part of Java, between Samarang and Surabaya. Area, 2404 square miles. The residency is one of the so-called independent States, and is governed by a native 'emperor,' who is subsidized by the Dutch and wholly under their control. Capital, Surakarta. Population, in 1897, 1,226,368.

SURAKARTA, or **SOERAKARTA.** The capital of the Residency of Surakarta, Java, on the left bank of the Solo River and on the railway between Samarang and Surabaya (Map: East India Islands, D 6). It is the residence of the native prince, whose palace is directly opposite the great fort called Vastenburg in the middle of the city. Population, in 1897, 86,074.

SURAT, sōō-rät'. The capital of a district of the same name, Bombay, British India, 150 miles by rail north of Bombay and about 15 miles from its port, Swalli, at the mouth of the Tapti, in the Gulf of Cambay (Map: India, B 4). The town is surrounded on the landward side by a brick wall. It has numerous mosques and several Hindu and Parsi temples and the palace of the former Nawab of Surat. The Tapti, owing to a sand-bar, affords entry only to small vessels, and the commerce of Surat, which from the sixteenth century to the eighteenth century was very extensive, has been steadily diverted to Bombay. Surat is a place of military importance, with a castle dating from 1540, centrally situated on the river front, and a cantonment, the residence of a British military commandant and other dignitaries. Surat rose into importance as the spot whence the Mohammedans of Hindustan embarked on their pilgrimage to Mecca. In 1612 the English East India Company established a factory here, which for some time was their principal trading station in India. In 1759 the castle was made over to the English and in 1800 they assumed the administration of the town. Population, in 1901, 118,364.

SURBITON. A town in Surrey, England, on the Thames, one mile south of Kingston, with which its industries are identified. Surbiton Common witnessed the last stand of the Royalists in the Civil War. Population, in 1891, 12,178; in 1901, 15,019.

SURDS. See IRRATIONAL NUMBERS.

SURESNES, sụ'rân'. A town of the Department of Seine, France, at the foot of Mont Valérien, on the left bank of the Seine, seven and a half miles west of Paris (Map: France, B 6). In 1593 a conference was held here which resulted in the adoption of Catholicism by Henry IV. Population, in 1901, 11,225.

SURETTE, sōō-rĕt', THOMAS WHITNEY (1862—). An American organist and composer. He was born in Concord, Mass., and studied music under Arthur Foote and J. K. Paine. In 1883 he became organist in his native town, and in 1894-96 was organist and choirmaster of Christ Church, Baltimore. In 1896 he became interested in the University Extension movement, and devoted most of his time to lecturing under its auspices on musical subjects. He also lectured on music at the University of the State of New York, Albany; at Oxford University, England; and at Mill Hill Abbey, London. As a composer he became known by his operetta *Priscilla* (1899), which has been frequently performed. In the same year he produced in Pittsburg a romantic opera named *Cascabel*, and also set Keats's *Eve of Saint Agnes* as a dramatic ballad.

SURETYSHIP (from *surety*, from OF. *surete*, *seurte*, Fr. *sûreté*, from Lat. *securitas*, freedom from care, from *securus*, free from care, from *se-*, apart + *cura*, care, anxiety). The engagement by which one person becomes legally bound to another for the liability of a third. It therefore involves three parties: the creditor, the principal debtor, and the surety. The distinction between this term and another which is often used interchangeably with it has been pointed out under GUARANTY (q.v.), and need not be repeated here.

It is generally held that surety agreements are subject to the ordinary rule of interpretation that a written contract is to be construed strong-

ly against the party executing it. This will always be enforced when it appears that the language was chosen by the signer, whether he enters into the contract for his own benefit or for the benefit of a third person. Another important rule is that such contracts shall be interpreted so as to give effect to all of their provisions if possible.

After the contract is made it is the duty of the creditor not to enter into any binding engagement with the principal, modifying that contract, without the assent of the surety. The law favors the surety and protects him with much jealousy. Accordingly, if the creditor varies the terms of the original contract or changes securities put into his hands by the principal debtor, or discharges a co-surety, or gives time to the principal debtor, or negligently causes a loss to the surety, the latter will be discharged unless he has assented to this conduct of the creditor. If, however, the principal debtor or a co-surety is discharged from liability by operation of law, as by a discharge in bankruptcy, the surety still remains bound.

The rights of the surety may be considered under three heads. First: Against the principal debtor. As soon as the debt becomes due, the surety is entitled to call on him for exoneration. This relief is obtainable in a court having equitable powers, it being unreasonable that the surety should have such a cloud hanging over him. If the surety has been compelled by the creditor to pay the debt he is entitled to call on the principal for reimbursement; for the money paid by him was paid for the principal's use. Second: Against the creditor. As soon as the debt becomes due the surety may compel the creditor to sue the principal and collect the debt from him. In some of our States the surety is discharged from liability if the creditor does not sue the principal upon the surety's request. One who is surety for the honesty or good conduct of an employee is entitled to have the employee discharged from service for serious defaults or breaches of duty, or to be freed from his suretyship. Another and very important right of the surety is to have the benefit of all securities which the creditor holds against the principal. This is known as the right of subrogation (q.v.). Third: Against co-sureties. It often happens that one surety is compelled by the creditor to pay the whole debt, and that the debtor is worthless. In such a case the unlucky surety is entitled to call upon his co-sureties for contribution. See SUBROGATION. Consult authorities cited under GUARANTY.

SURFACE (OF., Fr. *surface*, from Lat. *superficies*, upper side, surface, from *super*, above + *facies*, form, figure, face). The boundary between two portions of space. As a point in a plane is determined in general by two intersecting lines, so a point in space is in general determined by three intersecting surfaces. These surfaces may be plane, quadric, or of higher order according as their equations are of the first, second, or higher degree in the linear coördinates of the system. Thus in Cartesian coördinates (see COÖRDINATES) the general equation of the first degree in x, y, z, or $ax + by + cz + d = 0$, is represented by a *plane*. The general equation of the second degree in x, y, z, or $ax^2 + by^2 + cz^2 + 2fyz + 2gzx + 2hxy + 2kx + 2my + 2nz + d = 0$, is represented by a conoid, or surface of the second order, also called a *quadric* surface. By a suitable transformation of coördinates the general equation of the second degree may be transformed into one or the other of the forms (1) $Ax^2 + By^2 + Cz^2 = D$ or (2) $Ax^2 + By^2 = Cz$. Surfaces having the symmetric equation (1) are symmetric with respect to the origin as a centre and are called *central* quadrics. Non-central quadrics are included in equation (2). If $A = B = C$, equation (1) takes the form $x^2 + y^2 + z^2 = K$ $(= r^2)$, the equation of the sphere (q.v.). The general equation (1) represents either an ellipsoid (q.v.) or an hyperboloid. If $D = 0$, and A, B, C are not all positive, equation (1) represents a conical surface whose vertex is at the origin. Equation (2) is represented by the surface of a paraboloid (q.v.).

A surface through every point of which a straight line may be drawn so as to lie entirely in the surface is called a *ruled* surface. Any one of these lines which lies on the surface is called a generating line of the surface. The cylinder, cone, hyperboloid of one sheet, conoid (q.v.), and the hyperbolic paraboloid (see PARABOLOID) are ruled surfaces. There are two distinct classes of ruled surfaces, those on which the consecutive generators intersect and those on which they do not. The former are called *developable* and the latter *skew surfaces*.

If the degree of the equation $f(x, y, z) = 0$ is higher than the second, the surface representing it will be of an order higher than the second. In discussing the properties of such surfaces, especially the nature of the surface in the vicinity of any given point, the equation of the tangent plane at that point is necessary. This plane is the locus of all tangent lines through the given point, and will meet the surface of the nth order in a curve of the nth degree, since each straight line meets this curve in n points. The point of contact of the plane with the surface will be a singular point on the curve. (See CURVE.) The section of any surface by a plane parallel and indefinitely near to the tangent plane at any point is a conic and is called the *indicatrix* at the point. Thus points of a surface are called elliptic, parabolic, or hyperbolic, according as the indicatrix is an ellipse, parabola, or hyperbola. If every straight line through a point (x', y', z') of a surface meets the surface in two coincident points, the point (x', y', z') is called a *singular* point. If the tangent lines at any point form a cone the point is called a *conical* point; if they form two planes the point is called a *nodal* point. Similar to the envelope of a family of curves, the envelope of a family of surfaces is the locus of the ultimate intersections of a series of surfaces produced by varying one or more parameters (q.v.) of an equation. The curve in which any surface is met by the consecutive surface is called the *characteristic* of the envelope. Every characteristic will meet the next in one or more points, and the locus of these is called the *edge of regression* or cuspidal edge of the envelope. The conditions for convexity and concavity, different orders of contact, and various other properties are best obtained from works on analytic geometry.

Consult: Monge, *Application de l'analyse à la géométrie* (Paris, 1795); Dupin, *Développements de géométrie* (ib., 1813); Plücker, *Neue Geometrie des Raumes gegründet auf die Betrachtung der geraden Linie als Raumelement* (Leipzig,

1868); Salmon, *Analytic Geometry of Three Dimensions* (4th ed., Dublin, 1882); Smith, *An Elementary Treatise on Solid Geometry* (3d ed., New York, 1891); Gauss, "Allgemeine Flächentheorie," in Ostwald's *Klassiker der exakten Wissenschaften* (Leipzig, 1900); Knoblauch, *Einleitung in die allgemeine Theorie der krummen Flächen* (ib., 1888). For a brief sketch of the history of the subject, consult Smith, "History of Modern Mathematics," in Merriman and Woodward's *Higher Mathematics* (New York, 1896).

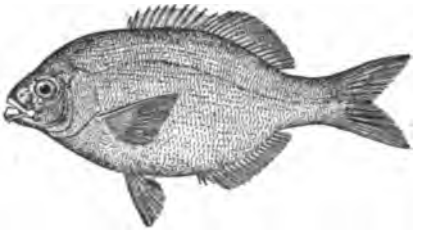
SURFACE, JOSEPH. A sentimental, plausible hypocrite in Sheridan's *School for Scandal*, Charles's elder brother, who pursued Maria for her fortune.

SURFACE TENSION. See CAPILLARITY.

SURF-BIRD. A remarkable plover-like bird (*Aphriza virgata*) widely distributed on the coasts and islands of the Pacific Ocean, and common along the entire west coast of North America. It is about nine and a half inches long, dark ashy brown above, white beneath, everywhere more or less spotted, streaked, or barred with black. The feet are like those of a sandpiper, but the bill is plover-like, short and thick. The wings are very long and acute, reaching beyond the end of the tail when folded. It is clearly related to the turnstone (q.v.).

SURF DUCK, or SURF SCOTER. See SCOTER.

SURF-FISH. A fish of the suborder Halconoti and family Embiotocidæ, related to the percoids. Many species occur on the Pacific Coast



A SURF-FISH, THE ALFIONA.

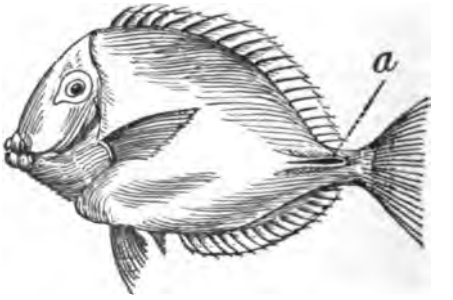
of the United States, where they inhabit bays and the surf on sandy beaches. They are small, oval-oblong, compressed, and often very handsome, with stripes, spots, and effusions of various colors. Their flesh is not very highly regarded. The fact of greatest interest connected with them is that they are viviparous. One of the largest and most useful of the family is the 'alfiona' (*Rhacochilus toxotes*).

SURF SMELT. A small, firm-fleshed, and fat smelt (*Hypomesus pretiosus*) of the coast of California and northward, valued as food. It spawns in the surf, and is netted in great quantities. See Plate of WHITEFISH, SMELTS, ETC.

SURGEON, MILITARY AND NAVAL. Appointments to the medical corps of the United States army or navy are made by the President of the United States upon recommendation of candidates by the surgeons-general of the army and navy, and after satisfactorily passing the examinations of the respective medical examining boards. Candidates for the army medical service must be between the ages of twenty-two and twenty-nine years; for the navy, between the ages of twenty-one and thirty. A candidate for either service must be a graduate of a regular medical school. Appointees are admitted to the service of the army and navy as assistant surgeons, with the rank of first lieutenant in the army and lieutenant (junior grade) in the navy. A surgeon in the army has the rank of major, and is required to have been an assistant surgeon at least five years. A surgeon in the navy has the rank of lieutenant and must have been an assistant surgeon for two years. Prior to regular assignment, United States army surgeons go through a five months' course at the Army Medical Museum, Washington, D. C.

The Royal Army Medical Corps of Great Britain differs from the United States in that it is a distinct branch of the service; the surgeons and enlisted men use the same distinguishing titles of rank as the combatant arms, and the officers prefix the word surgeon before the rank. They are under their own headquarters organization, and are rarely, even indirectly, subject to the authority of commanding officers of other branches. Members of the corps are armed and trained for military as well as medical emergencies. The Sanitary Corps of Germany and France are on similar lines to the United States, differing principally in the details due to general army organization. See SURGERY, MILITARY; ARMY ORGANIZATION; HOSPITAL; HOSPITAL CORPS.

SURGEON-FISH (so called from the lancet-shaped spine), or SEA-SURGEON. One of a family (Teuthididæ) of tropical Oriental fishes, of which about 80 species are recognized, and which feed upon seaweeds. Those best known are of the genus Teuthis, called 'barberos,' 'lancet-fishes,'



SURGEON-FISH.
a, position of the lancet and its sheath.

'tangs,' and so on, and characterized by the possession of a long, sharp, lancet-like spine on each side of the caudal peduncle. The spine is movable and shuts into a groove along the side of the tail.

SURGERY (OF. *cirurgerie, cirurgie, sirurgie*, Fr. *chirurgie*, surgery, from OF. *cirurgien, serurgien*, Fr. *chirurgien*, surgeon, from Lat. *chirurgus*, from Gk. χειρουργός, *cheirourgos*, surgeon, handicraftsman, from χείρ, *cheir*, hand + ἔργον, *ergon*, work). In contradistinction to medicine surgery embraces a consideration of those disease conditions that are treated chiefly by mechanical methods rather than by the administration of drugs. This classification is naturally arbitrary; and now that the dangers of surgical operations have so materially diminished, diseases formerly looked upon as hopeless or as suitable for medical treatment only are included among the surgical affections. It is

incorrect, however, to assume that surgery consists entirely or even in great part in the elaboration of methods of treatment; the pathological processes so treated demand and receive their proper degree of investigation and study.

Up to the time of Hunter (1728-93) surgery, and indeed medicine, were based in their practice almost entirely upon tradition and dogma. Hunter, by his labors in the direction of anatomy and physiology, lifted medicine from the obscurity of philosophical doctrine to the firm foundation of facts and imparted an impulse that is still felt and is still in evidence in the methods of research employed to-day in the fields of comparative pathology and experimental medicine which promise most for the advancement of the medical and allied sciences. With Hunter's death, however, ended the active prosecution of original investigation; and although the high position of English surgery at that time was preserved by the clinical and other work of Hunter's successors, notable among whom are Charles Bell, Astley Cooper, Abernethy, and Jenner, the laboratory methods employed by him were largely abandoned and have only within relatively few years been revived. From Hunter's period to the introduction of anæsthesia there is no remarkable fact in the development of surgery. During this time the efforts of surgeons seem to have been directed chiefly to the perfection of the bedside methods and the influence of the profession in America began to make itself felt. Ephraim McDowell, a native of Kentucky and trained under Bell in Scotland, in 1809 first successfully opened the abdominal cavity and removed an ovarian cyst, thus establishing forever one of the most beneficial of operations. A little later Valentine Mott of New York successfully applied ligatures to some of the largest arteries, for the relief of aneurism, and demonstrated the curability of this disease in positions in which it had previously been invariably fatal. The introduction of general anæsthesia (q.v.) in 1846 by Warren in the Massachusetts General Hospital marks the greatest stride in the progress of surgery up to that time. This property of ether was discovered independently by Long of Georgia and Morton of Boston, but it remained for Warren to popularize it by making use of it publicly, repeatedly and with success. A year later Simpson of Edinburgh introduced chloroform. The propulsion to the practice of surgery given by the employment of general anæsthesia during operations can hardly be exaggerated. Before that time operative treatment of disease was limited in its application to lesions correctible by coarse methods and in briefest time. Human beings, surgeons and patients, could not endure the pain of protracted operations, nor could sufficient freedom from struggling be secured to make refined dissections possible. Under the influence of anæsthesia quiet was obtained and the necessity for great speed was greatly diminished, so that new operations were soon planned, new regions invaded, and detailed procedures devised and new and better results achieved. Even after the introduction of anæsthesia, however, operations and all injuries continued to be looked upon with for they were almost invariably followed or the other of the infectious wound and deaths from septicæmia, pyæmia, hospital gangrene, etc., were so common

mortality after even trifling operations was not small.

Pasteur then began the series of observations and experiments that finally enabled him to indicate the causes first of fermentation and then of wound diseases, and to identify some of the agents as members of the class of beings known collectively as bacteria. Lister seized these facts and applied them in surgery. His notion was that the infectious wound diseases were due to the deposit upon the raw surface exposed in open injuries of the bacteria floating in the air, and he therefore aimed at the sterilization of the air in the neighborhood of wounds during the course of operations, and at the exclusion of air from wounds during healing. The first was attempted by saturating the air in contact with wound surfaces with the vapor of carbolic acid, and from time to time flooding wounds with solutions of the same substance or of corrosive sublimate; the second object was accomplished by covering wounds during repair with dressings impregnated with the same antiseptics.

The effect was apparent at once in the results of operations, in lowered mortality, and in recoveries with fewer complications. This plan of treatment, properly called antiseptic, was found, however, to possess serious dangers to both surgeon and patient in the risk of poisoning by the powerful germicides necessarily employed, and the idea began to develop that it was more logical to prevent the inoculation of wounds by bacteria from any source than to attempt their destruction after they had gained entrance. Meanwhile the rapid growth of the science of bacteriology had reached a development that led to the identification of the bacteria causing the common wound diseases and had made surgeons familiar with their distribution, the modes of growth within and outside of the body, and the means of destroying them. The adoption of methods of conducting operations and treating wounds whose purpose was absolutely to prevent the inoculation of denuded surfaces and tissues by bacteria followed naturally, and now has become universal; and the methods have become so perfect that wound diseases due to bacteria are rare except after accidental injuries, and some of the most serious of them have virtually ceased to exist. Few men of the present generation of surgeons have seen hospital gangrene, for example, a disease which has been the cause of thousands of deaths.

The possibilities suggested by the relative freedom from danger with which operations were carried out were quickly appreciated by the medical profession, and the cure of disease by operative measures was soon extended to regions in which, previously, operations had been undertaken with the greatest misgiving, or not at all. In consequence, to-day the surgeon opens the cranial and spinal cavities, the thorax, the abdomen, and the joints with perfect confidence that no ill will result from the operation itself; and the benefits that have thus been secured in the relief of lesions of the viscera contained in these cavities cannot be adequately estimated. While the attention of the surgeons during the last two or three decades has been in great part directed toward the perfection of operative technique, progress in other lines has also gone on, and during this period the knowledge of the pathology of many surgical affections has been great-

ly widened, with corresponding refinements in their treatment.

Not the least important factor in the great progress which has been made in surgery and in medicine also is the method by which the subject is now taught, and the candidate for the degree of doctor in medicine is now qualified to undertake the management of the cases he may be called upon to treat. Up to twenty years ago the instruction to medical students consisted very largely of didactic lectures on the various branches of medicine, supplemented by clinics at which various diseases were demonstrated and their treatment indicated or carried out by the professors. The student but rarely came into contact with the patient. With the better appreciation of the value of laboratory methods of instruction in the natural sciences which were originally adopted by Hunter and revived and insisted upon by Huxley, they began to be utilized in medical schools, and were gradually elaborated until at present in almost every department the student gains his information and experience in that way. The result is that didactic lectures have been greatly diminished in numbers. During the first year of instruction the medical student is introduced in this way to normal human anatomy and physiology; in the laboratories he studies the gross and minute structure of the body and the functions of the tissues of which it is composed. During the second year he is taught by the same means the general process of deviation from the normal that constitutes disease. During the third year he studies specific instances of deviations from the normal and learns to identify them as particular diseases. At this time he is brought into contact with patients suffering with the diseases with which he has more or less familiarized himself in the laboratory and concerning whose causation and pathology he is fully informed, but whose symptoms and treatments he has yet to learn. The laboratory method is still pursued, but the dispensary and the hospital have now become for the student his laboratory, and it is in them during his fourth year that he spends the major part of his time. Thus up to the point of gaining experience in performing operations the student is as well instructed as he can well be. This field is well covered by the performance of operations upon the cadaver where practically all of the major and minor operations can be as well practiced as upon the living; and for special purposes operations can be carried out upon the dog.

As time has progressed and the treatment of diseases peculiar to particular regions has become more refined, special divisions of surgery have naturally arisen; and this specialization has contributed in no small degree to the rapidity of the development of surgery. There are now the well-recognized departments of ophthalmology, treating of diseases of the eye; otology, treating of diseases of the ear; rhinology and laryngology, treating of diseases of the nose, throat, and larynx; gynecology, treating of diseases of the female; genito-urinary surgery, treating of the diseases of the male; dermatology, treating of diseases of the skin; orthopædic surgery, treating of deformities growing out of diseases of the bones and joints. In the case of all of these specialties the feature that makes them departments of surgery is the fact that the diseases peculiar to each are treated by mechanical means, either by the application of fixed apparatus to be continually worn through long periods or by bloody or non-bloody procedures whose duration is brief.

Operations. The purpose in view in designing operations is very variable and scarcely admits of formulation with any accuracy. They may be planned in case of injuries to close superficial or deep-seated wounds, to stop bleeding, to facilitate the adjustment of broken bones or the reduction of dislocated joints, to remove foreign bodies, or to make disinfection and drainage easier. In inflammations operations may be required to evacuate pus, to establish drainage, or to remove inflammatory tissue. In case of tumors, operations are done for their removal. In deformities, operations may be required to restore the normal contour of the region. In the contemplation of a typical operation to be performed under average circumstances several factors necessarily come up for consideration in detail: (1) The operating room, instruments, dressings. (2) Preparation of the patient. (3) Preparation of the surgeons. (4) The operation. (5) After-treatment.

(1) *The Operating Room.*—This should be of good size, well lighted, and of a temperature of between 70° and 80° F. All furniture, carpets, and hangings should be removed, the walls and ceiling rubbed over with moist bread crumbs, and the floor scrubbed. The operating table should be made especially for the purpose. On each side of the table and at its head there should be one or two small tables, those on the operator's side for the instrument trays, those on the assistant's side for the sponges, towels, dressings, etc., and that at the head for the anæsthetics, stimulants, etc. On each side of the table there should be a large basin in which the hands of the operator and his assistant may be rinsed from time to time. The *instruments* vary with the character of the operation to be performed. They should be made entirely of metal to withstand the heating necessary for sterilization, and as smooth as possible to avoid lodgment for bacteria. They are sterilized immediately before use by boiling for fifteen minutes in a 1 per cent. solution of sodium carbonate, and are then transferred to trays themselves sterilized by thorough washing in 0.2 per cent. solution of bichloride of mercury and lined by sterile towels. The *suture and ligature materials* are also sterilized, silk by being exposed to steam at about 250° F. for one hour, catgut by boiling in absolute alcohol under pressure for one hour. *Dressings* composed of absorbent material (usually cheese-cloth and cotton) and the pledgets of gauze with which the wound is kept free from blood during the progress of the operation are sterilized by being exposed to steam at 250° for one hour. The *basins, trays, and other receptacles* used during operations are sterilized by prolonged submersion in strong (0.2 per cent.) solutions of corrosive sublimate. The *solutions* used are 0.1 per cent. bichloride of mercury for the hands and towels; for douching wounds 0.6 per cent. solutions of sodium chloride are employed, sterilized by being boiled in cotton-plugged flasks for one hour on two occasions.

(2) *Preparation of the Patient.*—Twenty-four hours before operation the skin at the site

chosen for incision and for a wide area around it is thoroughly scrubbed and shaven and then covered by a soap poultice. Immediately before the operation the skin is again scrubbed, wiped off with spirits of turpentine, ether, and a 0.1 per cent. solution of corrosive sublimate in alcohol. If local anæsthesia is sufficient it is secured by the injection into the skin and subcutaneous tissues of dilute solutions of cocaine. If general anæsthesia is necessary, ether, chloroform, or nitrous oxide may be used, the choice depending upon the duration of the operation and upon the presence or absence of certain physical changes in the heart, blood-vessels, lungs, and kidneys. In any case the necessary restoratives must be at hand.

(3) *The Surgeons' Preparations.*—The surgeons' preparations consist in sterilization of their hands and forearms and in the assumption of gowns designed to prevent dust from settling from the clothing upon the wound, instruments, etc. Such gowns are of coarse cotton or linen, and extend from the neck to the feet; the sleeves only reach the elbow. They are sterilized by steam before using. The hands and forearms of all persons likely to handle the wound, instruments, dressings, etc., are thoroughly disinfected and the hands covered by thin rubber gloves previously sterilized by boiling.

(4) *The Operation.*—In addition to the procedures necessary to fulfill the purpose of the operation, the most painstaking care is exercised to exclude all bacteria from wounds, in aseptic operations; and to kill or remove the bacteria present, and to avoid the introduction of more bacteria, in antiseptic operations. Therefore, besides the elaborate preparations just described during the progress of an aseptic operation, much attention must be paid to cleanliness. (a) No substance—finger, instrument, sponge, or dressing—is allowed to come into contact with the wound unless previously sterilized. (b) Instruments, sponges, and the surgeons' and assistants' hands are rinsed in sterile solutions from time to time. (c) If, for any reason, hands or instruments become soiled, they must be resterilized before again coming into contact with the wound. (d) No antiseptic fluids are to be used in the wound. If any flushing at all is necessary, sterile salt solution only is allowable. For antiseptic operations, the same preparations are made, but here it is often advisable to use antiseptic rather than simple sterile solutions. Otherwise the precautions are the same.

The first step in so-called bloody operations is the division of the integument. This is done by cutting implements, as knives and scissors, or, sometimes, by the actual cautery, or the écraseur. Subsequent steps are accomplished in a variety of ways: To expose deep-seated tissues, retractors are used. To facilitate dissection, various forms of forceps are used. To puncture cavities, hollow needles and trocars are used. To scrape out tissue, sharp spoons are used. To divide bones, saws, chisels, and strong cutting forceps are used. The division of tissue involves more or less bleeding. To prevent bleeding, in operations upon the extremities digital or instrumental compression of the afferent arteries is practiced, or the afferent artery may be ligated as a preliminary step. During the progress of the operation the 'bleeding points'—ends of the vessels—are seized by clamps, and then ligated with catgut. General oozing is controlled by packing the wound with dry gauze, or by flushing it with very hot salt solution, or by touching the surface with the actual cautery, or by elevating the part. At the end of the operation it remains to treat the wound so as to secure healing in the shortest possible time, and with a minimum scar, i.e. to secure union by first intention. For this purpose every obstacle to such union is removed. (a) Bleeding is absolutely stopped. (b) Foreign bodies, including bacteria, are removed. (c) The walls of the wound are brought into close contact and no 'dead spaces' allowed to remain. (d) Drainage is provided for, i.e. vents established for the escape of wound secretions. (e) The wound is protected from possible bacterial invasion, and the wounded tissues supported and immobilized by dressings.

(5) *After-Treatment.*—After the dressing has been applied, the patient is moved to his bed and allowed to recover from the anæsthetic. Morphine is often given to diminish vomiting and to mitigate anticipated pain. General symptoms, as shock or acute anæmia, are treated if they exist. No food or drink is given by the mouth until the nausea and vomiting caused by the anæsthetic have ceased. Then small but increasing quantities of milk or beef-juice are given until the desired diet is taken. If there is retention of urine, the bladder is emptied with the catheter. The bowels are to be moved by the second or third day after operation. Drains are removed in two to five days. Sutures are removed in five to seven days. If suppuration, due of course to bacteria, develops, the particular inflammation excited is to be treated as indicated by its characteristics.

From what has just been outlined it is obvious enough that all of the conditions looking toward the successful issue of a serious operation can be secured only in hospitals of first-class equipment; and it is to be noted that this fact is becoming so generally known that hospitals of the first class are being established and operated not only in the larger cities of this country, but also in the smaller ones and even in villages. Institutions of this kind are of benefit to the communities in which they exist and by which they are supported in many ways. They furnish at a nominal cost, or very often without charge, care for the sick poor that could be supplied in no other way; and the well-to-do may find in them facilities for the treatment of disease and particularly for the conduct of operations that cannot be secured even in their own homes. For the community at large they are also of the greatest value, since they afford for the medical men who serve in the hospitals a field which amplifies their experience indefinitely. Again, in the larger cities where medicine is taught as before outlined the hospitals may be regarded as parts of the laboratory system. The wards are the places in which the student finally gains his practical experience in the recognition of particular disease forms and the treatment of them.

SURGERY, Military. The best civil have proved the best military surgeons, as is shown by the great names in surgical history, Ambroise Paré, Larrey, Pirogoff, Von Bergman, Von Esmarch, Billroth, and Lister. Not until the discovery of asepsis and antisepsis was the true foundation laid for the modern treatment of gunshot wounds. This discovery so radically changed

all former methods of treatment as to lead to the now thoroughly established maxim formulated by Senn in the recent war between the United States and Spain, "The fate of the wounded rests in the hands of the one who applies the first dressing." The lesson has only recently been learned that bullet wounds must never be touched on the field—much less explored by probing or otherwise—before the first aid (antiseptic) dressing is applied. Operative interference is justifiable on the battlefield only in cases of extreme urgency, where extensive hemorrhage exists, or where the wound is in the region of the throat and suffocation is imminent. As a rule gunshot wounds are bloodless. Primary hemorrhage, unless resulting from the very rare accident of cutting some large vessel, is usually absent altogether, or can readily be controlled by a compress or first aid bandage. Especially in wounds of the abdomen the law of non-interference applies with double force. In the Spanish-American War 50 per cent. of all the cases of abdominal wounds unoperated upon recovered, while all operated upon died. In the Russo-Turkish War, that great apostle of conservatism in military surgery, Von Bergman, by the use of occlusive dressings, immobilization of the limb, and antiseptic precautions, saved thirteen out of fourteen cases of severe gunshot wounds of the knee-joint complicated with extensive comminution of the bone, while of similar cases treated by the old method of exploration without antiseptic precaution 95 per cent. died.

Observations during the recent Spanish-American War and the Boer War have led to the following deductions: (1) Small-calibre bullet wounds are usually aseptic and heal promptly. (2) Jagged and extensive wounds, poisoned by such missiles, are due to the detachment of the jacket, the introduction into the bullet of foreign particles (such as cloth, buttons, etc.), lateral impingement of the bullet, or ricochet. (3) Owing to the small diameter of the bullet and its great velocity, the orifices at entrance and exit are minute, and it is almost impossible to distinguish one from the other. (4) The cardinal principle has been established that manipulation of such wounds and probing on the field (except in the rarest instances) is surgical malpractice.

To Esmarch is really due the latest conception of the axiom '*laissez aller*,' and his first aid package is a memorial to his practical grasp of the principles of wound infection. The first aid package has been modified by Senn, of Chicago, who emphasizes his conclusions as follows: (1) First aid packages are indispensable on the battlefield in modern warfare. (2) The first aid dressing must be sufficiently compact and light to be carried in the skirt of the uniform, or on the inner surface of the cartridge or sword belt, to be of no inconvenience to the soldier or in conflict with military regulations. (3) The Esmarch triangular bandage is of great value in the school of instruction, but as a component part of the first aid package it is inferior to the gauze bandage. (4) The first aid package must contain in a waxed aseptic envelope an antiseptic powder, such as boro-salicylic powder; two strips of aseptic lintine, each $2\frac{1}{2} \times 4$ inches; a triangular piece of gauze, the diagonal half of a square yard; sterilized pins wrapped in tin foil, and between this package and the outside impermeable cover, two strips of adhesive plaster an inch wide and eight inches long. (5) The first aid dressing must be applied as soon as possible after the receipt of the injury, a part of the field service which can be safely intrusted to competent hospital corps men. (6) The first aid dressing, if employed on the firing line, should be applied without removal of the clothing over the injured part, and fastened to the surface of the skin with strips of rubber adhesive plaster, the bandage being applied over and not under the clothing. (7) The first aid dressing must be dry and should remain so by dispensing with an impermeable cover of any kind over it, so as not to interfere with free evaporation of the wound secretion. (8) The first aid dressing should not be disturbed unnecessarily, but any defects should be corrected at the first dressing station.

Suppurating wounds from small-calibre bullets, having high velocity, heal with comparative promptness. Wounds from such bullets are necessarily more humane and less painful than those from the older missiles; but the relative percentage of deaths to wounded is but slightly reduced. Unless unusual complications call for immediate surgical interference, the injured should be removed as rapidly as possible to a well-equipped base or general hospital for treatment. Penetrating abdominal and thoracic wounds give a vastly larger percentage of recoveries where non-interference has been observed. Laparotomy, except under the most favorable conditions, such as hold in well-equipped hospitals, is attended with great peril. The Röntgen ray has been of utility in indicating where surgical interference is justified and in many cases has averted infection which would result from probing or similar surgical procedures. It has also thrown light on the pathology of wounds involving the solid structures, and shown that the severest lesions of bones will progress toward recovery, provided the wound is sterile. It proved an invaluable aid in the Spanish-American War, in the Boer War, and in the Philippines, where it was used in general hospitals at the base of operations and on hospital ships; but it is not a practical apparatus near the firing line, where its use in the detection of bullets could only prove an incentive to premature operations. The modern jacketed bullet is practically aseptic; there is never urgency for its removal except where aseptic technique is possible, otherwise infection of the wound is an inevitable consequence. The Röntgen ray was also of especial scientific value in gunshot fractures by showing the character of the bone lesions, the form of the fracture, and the amount of bone comminution by small-calibre bullets, fragments of shells or other missiles, conditions that could not have been otherwise determined in the living body, thus also proving an important factor in developing the principle of conservatism in surgery of war.

It is to Pasteur and Lister that military surgery owes its greatest debt. They have simplified its labors and taught the great lesson of non-interference. The soldier who falls on the battlefield from the effect of a ball passing through any but a vital part of his anatomy and who has a 'first-aid' dressing promptly applied and is then transported to a general hospital where the Röntgen ray and the principles of asepsis and antisepsis can be utilized, has a far greater chance of recovery than when his wounds are treated on the field. By following these conserva-

tive methods in the Spanish-American War the percentage of recoveries was 95.1 per cent., while 4.9 per cent. died, a ratio never before attained in the history of warfare.

The medical corps of different armies vary little in their personnel. There is one surgeon-general; a chief surgeon to each separate army corps, division, brigade, and general hospital; a surgeon and two assistants to each regiment; and a single surgeon with each battery or separate detachment. These are all commissioned officers. The hospital corps comprises the hospital stewards and their assistants, privates often selected to serve as pharmacists, orderlies, nurses, cooks, litter-bearers, and ambulance-drivers, and should equal four per cent. of the fighting force of the army. In addition to a canteen, the United States Hospital Corps men carry a corps pouch and an orderly pouch. The corps pouch contains aromatic spirits of ammonia, first dressing packets, wire gauze for splints, gauze bandages, rubber bandages, surgical plaster, scissors, pins, forceps, and knife. The orderly pouch contains chloroform, antiseptic tablets, pocket case, ligatures, hypodermic syringe, etc. Medical and surgical chests used on the march or at the front should contain, as stated by Surgeon-General Forward, United States Army, "surgical material mainly, and very little medicine, which may be for the most part in tablet form. The principal articles are splints and modern wound dressings, including plaster rollers, and rubber plaster for rapid fixation of splints; a light complete operating set, tin trays, basins, and cups in nests; chloroform and inhaler; rubber tubing, needle, and canula; and pure sodic chlorid for transfusion; mercuric bichlorid, tricresol, iodoform, soda, and green soap; rubber bandage and rubber gloves; hypodermic syringe and full sets of tablets; purgative pills, quinine, and a few other medicines; concentrated food and stimulants; small case of 'tools in the handle,' and a lantern. The dressings consist mostly of bichlorid and iodoform gauze, absorbent cotton, and gauze bandages. They should be in small parcels, compressed, and wrapped in strong waterproof paper, to save waste and contamination, and for convenience in transportation, handling, and distribution."

The same general directions—relative to (1) the operating room, covering instruments and dressings; (2) preparation of the patient; (3) preparation of the surgeons; (4) the operation; and (5) after-treatment—that apply in general surgery (as stated in the article SURGERY) apply also to military surgery at the base hospitals, and successful results will follow in exact proportion as these details are carried out. It is not therefore to any special training in surgical technique that the military surgeon will owe his triumphs. History has shown that more campaigns have been decided by disease than by the sword. Statistics of wars for the past hundred years, while varying in some particulars, have concurred to establish the fact that for every soldier killed in battle there are five wounded who recover. The introduction of modern weapons with the compound metal-jacketed small-calibre balls of high velocity and great range, has shown no perceptible change in the proportion of these figures, viz. one killed to five wounded. It is also an established fact that for every man killed in action or who dies from the results of wounds, at least five die from disease that is almost invariably of a preventable character. In the American Civil War (1861-65) 110,070 were killed, and over 249,458 died from disease. These proportions were higher in the war of the Crimea and also in the Mexican War; and in the Spanish-American War, although actual hostilities only lasted for a period of six weeks, the proportion of losses by disease was even higher still.

When these appalling figures are properly recognized, and the advantages of extreme conservation on the field is appreciated, the true field of the military surgeon will be found. He must possess executive ability and a certain amount of military training, so that in time of action he can quickly organize his assistants and hospital corps, seeing that the wounded are brought promptly from the firing line to the first dressing station. This should be located at the nearest protected spot to the firing line. Here the wounded man can receive such immediate attention by the surgeon or an assistant as is imperatively demanded; dressings if out of place can be readjusted; in case of fractures or joint injuries the limb can be immobilized in splints, and the soldier can rest until transported by ambulance or otherwise to the field hospital, which should be located well in the rear. Here the case can receive thorough attention, and later be transported to a general or base hospital, a hospital ship, or a civil hospital, as is deemed most advisable. The problem of rapid transportation of the wounded is one that should engage much attention. Splendid results in the development of this feature were attained in the war with Spain, by the hospital ships and fast railway train in charge of the surgeons of the American Army, and many valuable lives were saved in consequence.

But it is at times when the army is not in action that the responsibilities of the military surgeon are greatest. In order to prevent the invasion of that deadlier foe, whose fatalities in every year are never less than five times greater than those killed in battle, he must prove himself a keen sanitary engineer in the selection of camp sites, of camp drainage, of the location of latrines; in the inspection of all water supplies, the quality of food and its cooking, and of the soldier's clothing and his personal cleanliness. He must be an epidemiologist and a bacteriologist, as well as a student of dietetics and metabolism. Terrible epidemics of typhoid fever, cholera, dysentery, and diarrhœa have resulted from flies carrying disease germs from unsavory places to the mess-hall, or through the drinking of polluted water. The parasite of malaria and of yellow fever is transmitted through the medium of the mosquito, that of tuberculosis through the sputum. (See INSECTS, PROPAGATION OF DISEASE BY). The iron-clad ration of the soldier has at times led to starvation or scurvy, or has proved an excitant to intestinal disease. With all these problems the military surgeon must be prepared to wrestle, especially when he is with newly recruited troops, unaccustomed to the rigorous discipline of army life, or when stationed in tropical climes. The normal condition of the soldier is health; disease and premature death are to a large extent unnecessary. "They are to be overcome, however, not by the abrogation of the intellectual faculty, but by its exercise."

SURGICAL ASSOCIATION, AMERICAN. A society founded in 1880 for the primary purpose of cultivating and improving the science and art of surgery. The active membership is limited to 125 fellows; the honorary membership to 25 fellows. An applicant to be eligible for fellowship must be thirty years old, a graduate of five years' standing from a recognized medical college, and have an established reputation as a practitioner, author, or investigator. The meetings of the association are held annually. Every third year the association joins with the constituent associations of the Congress of American Physicians and Surgeons in a meeting held in Washington, D. C. An annual volume of *Transactions* is published containing the papers presented at each meeting.

SURICATE. The meerkat (q.v.).

SURIGAO, sōō'rē-gä'ō. A province of Mindanao, Philippine Islands, occupying the northeastern portion of the island, and bounded on the west and south by the provinces of Misamis and Dávao (Map: Philippine Islands, K 11). Area, 13,201 square miles. The greater part is covered with forests, and the river forms almost the only means of communication, most of the towns being situated on its banks. Cotton, hemp, rice, sugar, and tobacco are raised, and betelnuts and cocoanuts are exported. Population, estimated in 1901, at 85,125, largely Visayans. Capital, Surigao (q.v.).

SURIGAO, STRAIT OF. The strait connecting the Sulu Sea with the Pacific Ocean, extending between the island of Mindanao on the south and the islands of Negros, Cebu, Bohol, Leyte, and Samar on the north (Map: Philippine Islands, K 10).

SURINAM, sōō'rē-näm'. A river of Dutch Guiana. It rises in the south central part of the country, and flows northward, emptying into the Atlantic Ocean through an estuary three miles wide, on whose shore lies the town of Paramaribo. Length, 400 miles. It is navigable 40 miles for the largest vessels, and 100 miles for ships drawing 10 feet. Near its mouth it is joined by the Cottica River, a navigable channel running 100 miles parallel with the coast and connecting with the mouth of the Maroni.

SURINAM. A Dutch colony in South America. See GUIANA.

SURINAM TOAD. See PIPA.

SURMULLET (OF., Fr. *surmulet*, from *sur, sor, saur*, reddish + *mulet*, diminutive of *mulle*, from Lat. *mullus*, red mullet). One of certain species of mullets found for the most part in the tropical seas. The striped red surmullet (*Mullus surmuletus*), attaining a weight of six to eight pounds, is sometimes abundant on the coasts of Europe. A very similar species (*Mullus auratus*), about eight inches long, occurs along our Atlantic coast, particularly toward the south. See Plate of MULLETS AND ALLIES.

SURNAME (OF., Fr. *surnom*, from ML. *supernomen*, surname, additional name, from Lat. *super*, above, over + *nomen*, name). In modern usage, the family name, as distinguished from the given or individual name. Many are based on personal peculiarities, as William Rufus, John Lackland, and are consequently originally mere epithets. Another class is patronymic, indicating of whom the person bearing the name is a son. Here belong the numerous names like Johnson, Thompson, Williamson. This form of surname prevailed especially in Scandinavian countries, and survived in Denmark until the middle of the nineteenth century, when it was replaced by the system of family names. A third class is given by the occupation or place of residence. Surnames were not generally used as family names until the thirteenth century. See COGNOMEN.

SURPLICE (OF., Fr. *surplis*, from ML. *superpelliceum*, surplice, from Lat. *super*, above, over + ML. *pellicia*, fur garment, *pelisse*, from Lat. *pelliceus*, made of skin, from *pellis*, skin). A linen vestment worn in the Roman Catholic Church by all ecclesiastics in choir except the officiants of the mass, and by the clergy of the Anglican communion; also, in both churches, by laymen and boys who sing in the choir or assist at the altar. The shape of the vestment in mediæval days was long and flowing; the modern tendency has been to reduce its size so that it usually comes little below the waist. The Italian name *cotta* is frequently applied to the modern vestment.

SURRENDER. In law, the giving up or abandonment of an estate for life or years in real property to the person next entitled to the remainder or reversion, with intent to merge the lesser estate in the greater. This differs from *renunciation* (q.v.), which is practically the refusal to receive an estate to which one is legally entitled. A valid surrender can only be made by an adult person of sound mind. Under the Statute of Frauds in most States, a surrender *in fact*, that is, by agreement, can only be made in writing. Thus, the mere cancellation or destruction of the instrument creating the estate will not operate *ipso facto* as a surrender. However, a surrender may take place by operation of law. Thus, where the landlord accepts another person as tenant; where the landlord takes possession of the premises to his own use; or where the tenant accepts a new lease for the same premises, these acts will be construed as a surrender by operation of law. The legal effect of a surrender is to terminate the relation of landlord and tenant, and to discharge the latter from liability for future rent, though not for rent already accrued. See LANDLORD AND TENANT, and authorities there referred to.

SURREY. A southeastern inland county of England, bounded on the north by Middlesex, and on the east by Kent (Map: England, F 5). Area, 758 square miles; population, in 1891, 1,731,343; in 1901, 2,008,923. The surface is hilly and diversified, with a northern slope toward the Thames. The principal streams are the Mole and Wey, tributaries of the Thames. The northern half of the county along the valley of the Thames is fertile and largely cultivated, hops, wheat, and the ordinary crops being raised; market gardening constitutes a lucrative industry. In the west and southwest the land is to a great extent covered with heath. The numerous manufactures include silk, cloth, leather, paper, pottery, and beer. Lambeth, Southwark, and other portions of southern metropolitan London are in the county, which is a favorite suburban residential section of London business men.

SURREY, HENRY HOWARD, Earl of (c.1517-47). An English soldier and poet, son of

Lord Thomas Howard, affirmed third Duke of Norfolk. His youth was spent in France, and at the Court of Henry VIII., and he received a careful classical education. He was made a knight of the Garter in 1541, and in 1543 joined the English army in France, where by his gallantry and feats of arms he gained the title of field marshal. He captured Boulogne, was made its Governor, and gained other victories, but was recalled to England after some slight reverses at Saint-Etienne. His influence at Court was no longer so powerful as in the life of his youthful friend and companion the Duke of Richmond, Henry's natural son, and charges of treasonable ambition in aspiring to the royal succession were constantly urged against Surrey and his father by the Hertford faction. In 1546 the two were arrested; Norfolk was sent to the Tower, and Surrey, on the most trivial charge, was beheaded in 1547. Though not primarily a man of letters, his work in that field left a more abiding impression than his exploits as a soldier. He wrote many amatory verses and elegies in the Italian manner, but his chief service to English literature lay in the insight with which he enriched its poetry by the introduction of the verse forms which had already received a higher development in Italy. His translation of two books of the *Æneid* gave the language its most powerful and characteristic poetic form, blank verse; and the sonnet which Shakespeare used, consisting of three quatrains and a couplet, was also introduced by Surrey. The peculiar excellence of his work was in the insight with which he not only adopted but also adapted these forms, making them harmonize with the genius of the English language. The best known edition of his verse and that of Wyatt, including a memoir, is by Nott (London, 1815-16; new ed. 1871); there is also the Arber reprint of *Tottel's Miscellany*, in which the work of both of them first appeared. Consult also an essay in Hales, *Folia Literaria* (London, 1893).

SURROGATE (Lat. *surrogatus*, *subrogatus*, p.p. of *subrogare*, *surrogare*, to substitute, from *sub*, under + *rogare*, to ask). A judicial officer having jurisdiction over the probate of wills, the administration and settlement of decedents' estates, and in some States the power to appoint and supervise guardians of infants and other legally incompetent persons. As the derivation of the name indicates, a surrogate was formerly the substitute or representative of another official. Originally in England the ecclesiastical courts had jurisdiction of all the matters above mentioned, and as their business increased it became necessary for the bishops to delegate some one to act in their places. These substitutes were at first ecclesiastical, and at a later period lawyers, and were known as surrogates. In 1857 the probate jurisdiction of the surrogates was transferred to the Court of Probate and Divorce.

Prior to the Revolution the Governors of the various American colonies were accustomed to appoint surrogates to represent them in matters of probate and administration of estates. In New York and several other States to-day the surrogate of a county is an independent judicial officer. The jurisdiction of a surrogate is usually confined to the probate of wills, the administration of the estates of persons dying intestate, and the appointment of guardians for infants and other incompetent persons. Incidentally they must hear contests of wills, and controversies over the descent and distribution of property of decedents. They exercise a close supervision over the conduct of guardians' affairs, and the latter may apply to them for advice in case of doubt on any matter pertaining to their trusts. Proceedings before a surrogate are conducted with practically the same formality as in other courts. An appeal from the decisions of surrogates will lie to appellate courts. Surrogates correspond to probate judges and judges of widows' and orphans' courts in some States. See COURTS; PROBATE COURT; and consult the authorities there referred to.

SURTEES, sûr'tēz, ROBERT (1779-1834). An English antiquary, born at Durham. He graduated B.A. from Christ Church, Oxford, in 1800; then studied law at the Middle Temple. On the death of his father (1802) he gave up the law and settled on the family estate at Mainsforth, a small village in the County of Durham, where he lived in retirement. Surtees devoted his life to his *History of Durham* (vol. i. 1816; vol. ii. 1820; vol. iii. 1823; vol. iv., ed. by James Raine, 1840). This is a careful and exhaustive work, and is written in a readable style. Surtees was also an adept at composing ballads which were playfully palmed off as ancient. Scott himself was deceived by *The Death of Featherstonehaugh*, which was inserted in the *Minstrelsy of the Scottish Border*. As a memorial, the Surtees Society was established in 1834 at Durham for publishing unedited manuscripts bearing on the history of the northern counties of England from the earliest period to the Restoration. Consult the *Life of Surtees*, by G. Taylor (Surtees Society, Durham, 1852).

SURVEY. See SURVEYING; GEODESY; COAST AND GEODETIC SURVEY, UNITED STATES; GEOLOGICAL SURVEY, UNITED STATES.

SURVEYING (from *survey*, from AF. *surveer*, *survoir*, from Lat. *supervidere*, to overlook, oversee, from *super*, above + *videre*, to see). The art of ascertaining by measurement the shape and size of any portion of the earth's surface, and representing the same on a reduced scale on maps in a conventional manner. Surveying is supposed to have originated in Egypt, where property boundaries were annually obliterated by the inundations of the Nile. In Rome surveying was considered one of the liberal arts, and the measurement of lands was intrusted to public officers (*agrimensores*) who enjoyed certain privileges; and it is probable that the system of measurement practiced by them was similar to the cruder methods of plane surveying practiced at the present time. The higher development of surveying method is of comparatively recent date.

Surveys are broadly separated into two classes, determined by the extent of the area surveyed. Most surveys comprise the measurement of comparatively small areas in which all practical refinements are met if we consider the areas absolute planes, neglecting the curvature of the earth's surface. The methods of measuring such areas is usually denominated plane surveying. Certain surveys of modern times, however, include areas so large that it is necessary to take into account the curvature of the earth's surface, and the methods of measuring such areas are termed geodetic surveying or geodesy (q.v.).

Briefly summarized, plane surveying includes land surveying, topographic surveying, and hydrographic surveying (see HYDROGRAPHY), mining surveying, railway surveying, and city surveying. Geological surveying is a development of topographical surveying in which the outcrops of the earth's rock formation are located and denoted on topographical maps. Geodetic surveying is a class by itself, as is also photographic surveying (q.v.).

PLANE SURVEYING.

LAND SURVEYING. As at present practiced all surveys of land, properly so called, are made: (1) to establish certain monuments, corners, lines, and boundaries, so as to lay out and divide land; or (2) to identify and locate such monuments, lines, and boundaries after they have been established, as in all resurveys for location and area. In all cases of land surveying the boundaries and dividing lines are the traces of vertical planes on the surface of the ground, and the area is the area of the horizontal plane included between the bounding vertical planes. In other words, the area sought is not the real surface, but the horizontal projection of that surface. In laying out land, the work consists in running the bounding and dividing lines over all the irregularities of the surface, determining their bearings and horizontal distances and leaving temporary and permanent marks. The bearing of a line is the horizontal angle it makes with a meridian plane through one extremity, and it is determined by means of a surveyor's compass. The length of the line is usually determined by measurement with a surveyor's chain. (See ENGINEERING INSTRUMENTS.) The marks by which the line is physically denoted are various, such as stones, stakes, holes, mounds, or trees, specially marked and described. These marks, whatever their character, are called monuments, and should be of distinctive and permanent character.

The true meridian of a place may be obtained by astronomical observations and the deviation of the magnetic meridian determined. This deviation is called the declination, or variation, of the magnetic needle. The compass is usually provided with a vernier-scale (see VERNIER) for turning off the variation so that the needle may indicate the true meridian if desired. An instrument called the solar compass, invented by Burt (1836), determines the true meridian by a single observation, the sun being on the observer's meridian. This instrument has been adopted by the United States Government for use in surveying the public domain. The declination varies from year to year and is an essential element to be recorded in the field-notes so as to enable the surveyor at any future time to retrace the original survey.

The system of laying out the United States public lands furnishes a good example of the methods of laying out land on a large scale. This system probably was devised by Gen. Rufus Putnam, of Revolutionary War fame, and was first used in laying out the eastern portion of the State of Ohio in 1786-87. The reference lines employed in these public land surveys are in each case a principal meridian and a base line, the meridian running, of course, north and south, and the base line running east and west. From the principal meridian and its accompanying base line guide meridians are run north and south from the base line 24 miles apart, and standard parallels are run east and west from the principal meridian 24 miles apart. These lines are run with great care, the solar compass being employed. Every mile is marked by a monument and is called a 'section corner,' and every sixth mile has a different mark and is called a 'township corner.' From each township corner on any standard parallel, auxiliary meridians are run north to the next standard parallel. Since these meridians converge somewhat toward the principal meridian, they will not be quite six miles apart when they reach the next standard parallel, and, therefore, to run the next series of auxiliary meridians north, the start is made not at the points where the first series terminate, but at the six-mile points previously marked off. Where the auxiliary meridians have been lined out, the land is divided into a series of strips running north and south, and six miles wide. These are called 'ranges.' The next step is to cut these ranges transversely by running east and west lines at six-mile intervals. The land is thus divided into squares measuring six miles on each side. These squares are called 'townships,' and each contains 36 square miles, or 23,040 acres. The next step is to run meridians and parallels one mile apart to divide the township into 36 sections. Monuments are set at intervals of one-half mile on the lines to divide each section into quarter sections. The quarter section is the smallest primary division of the public land surveys.

The determination of areas between known boundaries is accomplished in several ways, but the one commonly used consists in determining the bearings and lengths of the outside boundary lines. This is done by beginning at one corner

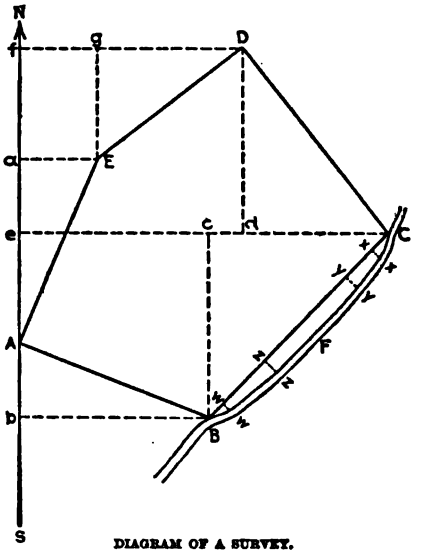


DIAGRAM OF A SURVEY.

and running around the area to the starting point, and observing the bearing and measuring the distance of each boundary line in the order in which it is encountered. To illustrate, reference will be made to the diagram, in which the lines A B C D E represent the boundary of a field of land whose area is required. Beginning

at A, the surveyor proceeds around the field, obtaining by his compass the bearings, and by measurement with a surveyor's chain, the lengths, of the lines A B, B C, C D, D E, and E A, one after the other in the order named. This being done he states these bearings and distances on paper, giving the figure A B C D E shown by the sketch. He next draws a meridian line NS through the westernmost corner of his boundary, and draws the various perpendiculars shown by the broken lines. These perpendiculars represent what are known as the latitudes of the several lines; thus for line DC, dD is the latitude, Dc is the departure, and (fD + dC) is the double meridian distance. Knowing the bearings and lengths of the various courses by simple trigonometrical calculation, the surveyor is enabled to calculate the latitudes, departures, and double meridian distances. This being known, the following rule is used for calculating the area: Twice the area of the figure is equal to the algebraic sum of the products of the double meridian distances of the several courses into the corresponding latitudes, north latitude being reckoned positively and south latitude negatively. Expressed symbolically, for the figure shown, this rule is as follows: 2A = (bB + eC) Bc + (eC + fD) Dd − (bB) Ab − (aE) Aa − (aE + fD) Eg. It may often happen that one boundary of a field is not a right line, but is an irregular curved line such as the course of a stream C F B instead of by the right line B C. The area of this field is then the area of A B C D E plus the area of C F B; the surveyor when measuring the line B C measures two or more perpendiculars such as xx, yy, zz, and ww, known as offsets and extending from the line B C to the stream. These perpendiculars divide the area C F B into a number of small areas each of which approximates closely a simple trapezoid or triangle whose area is easily determined and the sum of whose areas is the area of the total tract. There is of course a slight error in this method, but it can be made so small by an experienced surveyor as to be practically negligible. Systematic methods have been devised for making field notes so as to include a register of the topographical features incident to the chain lines, the relation of these lines one to another, and a description of monuments sufficient to identify the lines in the field. A column is usually taken in the centre of each page of the field-book to represent the chain line, and the necessary notes are entered on either side. These notes if properly kept enable the surveyor to execute a topographical map of the territory surveyed, and to calculate its area.

Topographical Surveying. The topographical surveying of a region includes not only the character and geographical distribution of the surface covering, but also the exact configuration of that surface with reference to its elevations and depressions. Thus any point is geographically located when its position with reference to any chosen point and a meridian through it is found, but to be topographically located its elevation above a chosen level must also be known. In making a topographical survey, therefore, the following processes are carried out. First, the or more reference points, according to the are geographically located; second, a series precise levels are run to establish marks tain intervals whose elevations are with reference to a common datum; these established points and elevations the locations and elevations of the surface points are established by one of several methods. The final process is to plat on a map by means of conventional symbols the location of all surface objects and the elevations and depressions of the general surface. See Topographical Map, accompanying Map.

In the topographic work of the Geological Survey, and in fact in the work of all the United States Government Surveys, the reference point for geographical location is astronomical position and the datum for all elevations is mean sea level. The various reference points are connected by means of a system of triangulation, by which intermediate points are geographically located. Elevations are established by means of lines of precise levels starting from datum. On these as a skeleton the topographical survey proper is hung. The operation of determining an astronomical position consists, first, in the measurement of zenith distances of stars by means of delicate transit instruments for the determination of latitude; second, the exchange of telegraphic time signals between a known astronomical position and an unknown one for the determination of time difference, and hence the difference of longitude; and, third, the determination by astronomic observations on close circumpolar stars of the azimuth of a line, presumably a base line or side of a triangle. The measurement of a base line consists, first, in the selection of a site, the extremities of which are so situated as to permit of easy expansion by primary triangulation; second, the laying out of a site by running a line of spirit levels over it and of setting plugs or other stable measuring marks at fixed intervals; third, the ranging out of a straight line by transit or theodolite; and finally, the measurement of the length of the base by means of base bars, iced bars or steel tapes. The expansion of a system of primary triangulation consists, first, in a reconnaissance to select stations from which others are intervisible in such manner as to permit of the formation of a series of quadrilateral, pentagonal, or similar figures composed of well-conditioned triangles; second, the erection of signals and the marking of station positions by monuments; and third, the measurement of the angles at any one station to the others which are intervisible therefrom, by means of theodolites of high power. Finally, there remains the office computation whereby the lengths of the sides of the various triangles are determined, and by the aid of this and their connection with a known astronomic position and azimuth the geodetic position and coördinates of the various triangulation stations are computed. These or equivalent coördinates at important points on a traverse line are then platted on the topographic map sheets, and this furnishes the primary control for the extension of the secondary detail of the map.

The datum on which all of the representation of the relief by contours is based is mean sea level. In order that pieces of work separated by distances of 100 or 1000 miles may ultimately meet on sheet lines with homogeneity of vertical location, it has been necessary, first, to plan out series of primary triangulation for the control of the whole. These precise levels are connected with tidal gauges referred to the mean level of the sea. With these primary data in ex-

istence it is possible to commence field work in widely scattered areas, lines of spirit leveling of lesser precision being run throughout the area to be mapped at distances not exceeding six miles apart. Between these, at distances of one to three miles apart, according to the scale and contour interval, lines of flying or secondary levels are run with only such accuracy as will enable them to close upon the better levels within limits of one or two feet, an amount imperceptible in contours of 10 to 50 feet interval.

The three surveying bureaus of the Government, viz. the Coast and Geodetic Survey, the Engineer Corps of the Army, and the Geological Survey, are all engaged in running lines of precise levels throughout the country, as they are extending the related work of triangulation and topographical mapping. The skeleton of the survey being completed, the next task is to perform the topographical mapping. Starting with two or more primary triangulation stations within the area of the quadrilateral to be surveyed, a secondary scheme of triangulation is extended by plane table (q.v.) by which tertiary points are located with such frequency as to give an average of from one to three good locations per square mile, equivalent to the same number per square inch of map. Elevations are determined of all triangulation points, which are chiefly hill summits, by vertical angulation depending on spirit leveling. Also of all the lower relief of the country by lines of spirit levels run from three to six miles apart. Where the lack of surface relief or the density of forests is unfavorable to the execution of triangulation, the primary and secondary control consists of a system of primary traverses checked by astronomical positions or primary triangulation locations. A second system of horizontal control consists of odometer traverses of all roads and trails, or, where these are not sufficient, of stadia or taped traverses across country and about the shores of lakes and streams. These traverse lines are run by compass and plane table, and are platted upon the board as the work progresses, and are adjusted upon the map, between the frequent locations resulting from the primary traverse or the plane-table triangulation. The distances between check points on such traverse are so relatively short, being one to four miles, that the error of location is hardly perceptible upon the scales of one or two miles to the inch, and an adjustment to the better positions becomes easily possible. The primary triangulation and precise leveling is executed a season in advance of the topographic mapping. The determination of secondary positions by plane-table triangulation, road and stadia traverse, and flying levels proceeds together a little in advance of the sketching of the map, but by members of the same party. The results of the adjustment and transfer of all traverse lines and level elevations to the secondary locations is a control or sketch sheet upon which are two to five trigonometric locations per square inch, from four to eight inches of road traverse per square inch, and an average of one to two instrumental elevations per square inch. Placing himself at a known position, the height of which is already determined, the topographer sketches, with the aid of hand level and by eye, the plan of the contour line passing through his position on the map, and it may be possible to locate this for a distance of half a mile, the equivalent of half an inch, in either direction. If the country be wooded it cannot be seen beyond his absolute position. Proceeding now over the road, preferably by vehicle, he stops at greater or lesser intervals, according to the amount of change of slope, carrying differences of elevation for short distances between check points by aneroid. When good elevations are insufficient more are procured by flying levels or by vertical angulation, as the work progresses. In this way a network of topographic contouring is built up everywhere along the lines of the roads, and these are frequently so near together that the contours meet and fill up the entire surface of the map. Otherwise the topographer walks in between roads, pacing distances if short, or runs stadia line, if necessary, and thus he fills in the interior of the road circuits and completes the map. This general method is necessarily much modified, according to the conditions.

MINING SURVEYING. Mining surveys are of two classes: (1) surveys to determine the surface location and boundaries of mining claims; and (2) underground surveys to determine connections, lay out work, establish the relations of the underground workings to the surface lines, points, and so on, and measure the ore removed or still in the mine. The surface methods employed are substantially land surveying methods as modified by the local and general mining laws. The underground surveys comprise carrying surface locations underground, lining on the galleries and shafts, running levels, etc., and laying out tramways and railroads. This work is ordinarily carried on much the same as it is on the surface.

CITY SURVEYING. The methods described in the section on land surveying are adequate to the needs of the city surveyor, except that, on account of the value of the land, greater accuracy should be secured. To this end, the transit instrument is used instead of the compass and the steel tape instead of the chain.

BIBLIOGRAPHY. The literature of surveying is extensive. A concise technical treatment of the whole subject is contained in Johnson, *Theory and Practice of Surveying* (New York, 1900). Other books of equal value in their particular field are: Wilson, *Topographic Surveying* (New York, 1900); Merriman, *Precise Surveying and Geodesy* (New York, 1899) and *Geodetic Surveying* (New York, 1892); and Gribble, *Preliminary Surveys and Work Estimates* (London, 1897). The voluminous reports of the Coast and Geodetic Survey, the Geological Survey, and the Engineer Corps, United States Army, contain an enormous mass of information relating to their surveys throughout the United States. Many important articles on surveys and surveying are also to be found in the proceedings of the engineering societies and in the volumes of the principal engineering journals. See GEODESY; MAP; ENGINEERING INSTRUMENTS; ENGINEERING, MILITARY; PHOTOGRAPHIC SURVEYING; LEVELING; COAST AND GEODETIC SURVEY; GEOLOGICAL SURVEY; PLANE TABLE; STADIA; etc.

SURVEYING, MARINE. See HYDROGRAPHY.

SURVEYS, NATIONAL. See GEOLOGICAL SURVEY, UNITED STATES; COAST AND GEODETIC SURVEY, UNITED STATES.

SURVIVORSHIP. A term commonly employed to describe a doctrine prevailing in some jurisdictions to the effect that where two or more

persons perish in the same accident or calamity there is a presumption of law that the stronger of them survived the others. This doctrine originated in the Roman and civil law, but generally no presumption exists in England or most of the United States, and a person seeking to establish the survivorship of one who lost his life with others in the same peril must do so by logical and relevant evidence as in any other case, or he will fail to sustain the burden of proof resting upon him. This proof need not be direct; the facts and circumstances may be shown if they furnish any reasonable basis for a conclusion. See PRESUMPTION; EVIDENCE.

SURVIVORSHIP, RIGHT OF. The right of a person holding a title jointly with another to succeed to the latter's rights upon his death, by operation of law. This right exists in case of joint tenancies, in the absence of statutes to the contrary; in a husband and wife where they hold real property as tenants by the entirety; and in surviving partners after the death of another for the purpose of winding up the business, and in some forms (tontine) of life insurance. See PROPERTY; JOINT TENANCY; PARTNERSHIP; INSURANCE.

SŪRYA, sōōr'yȧ (Skt., sun). In Hindu mythology, the god of the sun in its physical aspects. He is honored in the hymns of the Rig-Veda. (See VEDA.) All creatures depend on him, for he drives away disease and upholds the sky. He watches over mankind and beholds their deeds. His father is variously said to be Dyaus, the sky, or Indra (q.v.), or Soma (q.v.). On the other hand, he is the son of Aditi or of Ushas (q.v.), who is also regarded in other hymns as his wife, who bears the Asvins (q.v.). In later mythology Surya is the son of the sage Kasyapa and Aditi. He married Sanjna, who, overpowered by his radiance, left him, substituting for herself Chaya (Shadow). When he discovered this, he prevailed on his wife to return, and at his request his father-in-law, Tvashtar, the artificer of the gods, ground off one-eighth of his brightness, from which were made the disk of Vishnu (q.v.), the trident of Siva (q.v.), and other divine implements. He is still worshiped on the first Sunday of the month of Magha (January-February), although he has degenerated into a petty godling in modern times. Consult: Macdonell, *Vedic Mythology* (Strassburg, 1897); Wilkins, *Hindu Mythology* (London, 1900).

SŪRYASIDDHĀNTA, sōōr'yȧ-sĕd-hän'tȧ (Skt., text-book of the sun). The earliest Hindu astronomy that has been preserved. It is written in verse and contains fourteen chapters, furnishing a complete system which remains the chief authority in India for the adherents of the Hindu science of astronomy. The work has been considerably altered in content in course of time. It is probable that Greek astronomy exercised some influence over this as over the succeeding Hindu works on this science. The *Sūryasiddhānta* has been published repeatedly in India, the best edition being that by Hall and Deva Sastri (Calcutta, 1859). It has been translated into English by Deva Sastri (ib., 1860), and by Burgess and Whitney in the *Journal of the American Oriental Society*, vol. vi. (New Haven, 1860). Consult Thibaut, *Astronomie, Astrologie und Mathematik* (Strassburg, 1899).

SU'SA (Lat., from Gk. Σοῦσα, *Sousa*, Heb. *Shūshan*, Pers. *Shūs*). The capital of the Province of Susiana or Elam in Persia, a royal residence, and one of the most important cities of the ancient East. The site, 21 miles southwest of Dizful, in the modern Province of Khuzistan, is on a hilly plateau between the Ab-i-Kerkhah (the ancient Choaspes) and the Shaur (the ancient Eulæus) (Map: Persia, C 5). It is marked by the so-called tomb of Daniel, a pilgrimage shrine of repute, which in reality is a comparatively modern Mohammedan mausoleum, and by the Kaleh-i-Shus (fortress or acropolis of Susa) with ruins that cover a space of about three miles and consist of three spacious artificial platforms more than 100 feet high. The name of Susa occurs on Assyrian monuments of the time of Asshurbanipal (B.C. 668-626), who captured it. At first under Babylonian dominion, it came, at the time of Cyrus, under Persian rule; and the Achæmenian kings raised it to the dignity of a metropolis of the entire Persian Empire. When Babylon had risen again to importance under Alexander and his successors, Susa gradually declined. In the Arab conquest of Persia it held out bravely for a long time, defended by Hormuzan. During the Middle Ages it was still inhabited and known for its manufactures of sugar. Excavations by Williams, Loftus, Churchill, Dieulafoy, and others, have revealed a citadel of semicircular form, and the remains of the extensive colonnade, with a frontage of 343 feet and a depth of 244 feet, of the great palace built by Darius Hystaspis (B.C. 521-485), and restored by Artaxerxes Mnemon (B.C. 405-362), after having been ruined by fire in the reign of Artaxerxes Longimanus (B.C. 465-424). Cuneiform inscriptions, friezes of lions and archers, finely colored, now in the Museum of the Louvre at Paris, and numerous other relics have been recovered. Consult: Dieulafoy, *L'Acropole de Suse d'après les fouilles exécutées en 1884, 1885, 1886, etc.* (Paris, 1890-92); and Billerbeck, *Susa* (Berlin, 1892).

SUSA, sōō'zȧ (Lat. *Segusio*). A city in the Province of Turin, Italy, 32 miles by rail west of the city of Turin, on the Dora Riparia (Map: Italy, B 2). It has a triumphal arch 44 feet high, dedicated, the inscription reads, in A.D. 8 to Augustus. It was formerly of strategic importance, being regarded as the key to the Alpine roads over Mont Cenis and Mont Genèvre. Population (commune), in 1901, 4957.

SUSA. A port of Tunis, on the Gulf of Hammamet, in the Mediterranean Sea. It is 32 miles east-northeast of Kairwan, with which it is connected by rail, as also with Tunis (Map: Africa, F 1). It is surrounded by old walls, and its lofty, ancient, and restored citadel is used as the French military headquarters. In the neighborhood are large plantations of olives and grapes. The roadstead is bad. Susa is on the site of the Roman city of *Hadrumetum*. Population, about 12,000.

SUSAN'NA (Gk. Σούσαννα, *Sousanna*, from Heb. *shūshan*, lily), HISTORY OF, also known as THE JUDGMENT OF DANIEL, and as SUSANNA AND THE ELDERS. One of three apocryphal additions to the Book of Daniel in the Greek Bible, the others being *The Song of the Three Holy Children* and *The History of Bel and the Dragon* (q.v.). The story of Susanna is as follows: In

the early days of the Babylonian captivity there lived a woman, Susanna by name, who was celebrated for her beauty and her virtue. She was the wife of Joiachim, a wealthy and respected man, and daughter of a priest, Hilkiah. Two elders, who were also judges and held in high repute, were seized by desire for Susanna, and, meeting each other unexpectedly in Joiachim's garden, agreed to coerce her. Susanna refused to listen to them, and in revenge the elders accused her of adulterous relations with a young man who had fled when surprised by their sudden appearance. She was condemned to death on this evidence, but Daniel, then a very young man, appeared and undertook to prove Susanna's innocence. By questioning the witnesses apart and showing discrepancies in their testimony he succeeded. The people applauded Daniel and put Susanna's accusers to death. There is nothing to warrant the supposition that the story was originally written in Hebrew or Aramaic. In most manuscripts it precedes the first chapter of the Book of Daniel, and so we find it in the old Latin and Arabic versions; but the Septuagint, the Vulgate, the Complutensian Polyglot, and the Hexaplar Syriac place it at the end of the book, and reckon it as the thirteenth chapter. Consult: Ball, in the *Speaker's Apocrypha*, vol. ii. (London, 1888); Fritzsche, *Apokryphen* (Leipzig, 1871); Zöckler, *Apokryphen des Alten Testaments* (Munich, 1891); Kautzsch, *Apokryphen und Pseudepigraphen des Alten Testaments* (Tübingen, 1899 et seq.).

SUSEMIHL, zōō'ze-mēl, FRANZ (1826-1901). A German classical scholar, born at Laage, in Mecklenburg-Schwerin. He was appointed professor of classical philology at the University of Greifswald in 1856. Among his works the most valuable are: *Die genetische Entwickelung der Platonischen Philosophie* (1855-60); text editions of Aristotle's *Politics* (with German translation, 1879); the *Ethica Nicomachea* (1880); and a *Geschichte der griechischen Litteratur in der Alexandrinerzeit* (1891-92). The last work is regarded as one of the most popular and trustworthy treatises on the subject.

SUSO (zōō'zō), or **SEUSE,** HEINRICH (c.1295-1366). A German mystic. He was born at Ueberlingen, Baden. At the age of thirteen he entered the Dominican Order and spent most of his life in monasteries at Constance and Ulm. He was impulsive and an enthusiastic disciple of Eckhart (q.v.), but gives the master's speculative ideas a spiritual expression. He was truly called 'the sweet' Suso on account of his poetry and child-like religion. He was not a member of the Brethren of the Free Spirit, as has sometimes been supposed. His *Autobiography* and his *Book of Everlasting Wisdom* have been translated into many languages, and are both of unique importance for the study of the psychology of mysticism. He died at Ulm, and was beatified by Gregory XVI. in 1831. Consult Diepenbrock, *Heinrich Suso: Leben und Schriften* (Regensburg, 1829, 1837, and Vienna, 1863). A more critical edition of Suso's works is that by Denifle (Augsburg, 1878), and there is an English translation (London, 1865).

SUSPENSION (Lat. *suspensio*, from *suspendere*, to hang, from *sub*, under + *pendere*, to hang). A term in music. A note is said to be suspended when it is continued from one chord to another to which it does not properly belong, and to a proper interval of which it must eventually be resolved.

SUSPENSION BRIDGE. See BRIDGE.

SUSPENSOR (ML., that which suspends, from Lat. *suspendere*, to hang). A special, usually filamentous organ developed by and at the base of the embryo, which is thereby related more effectively to its food supply. The suspensor chiefly appears among seed-plants, its largest development occurring among the conifers. See EMBRYO.

SUSPICIOUS HUSBAND, THE. A comedy by Benjamin Hoadly, produced in 1747. Strickland, the husband, is made jealous by the intrigues of two attractive visitors in his home, in which he fancies his wife involved.

SUSQUEHANNA, sŭs'kwe-hăn'ȧ. A river draining the greater part of Pennsylvania (Map: Pennsylvania, E 4). It rises in Otsego Lake in central New York, and flows southward in three large zigzag bends across Pennsylvania and into Maryland, where it empties into the northern end of Chesapeake Bay at Havre de Grace after a total course of more than 400 miles. It is almost throughout a shallow, swift, and unnavigable stream, but its whole course is through very picturesque country as well as through some of the most populous industrial and mining regions. After flowing through the northern plateau it enters the anthracite districts of the Appalachian valley. First it follows one of the western longitudinal valleys, and then turning to the southeast it breaks through all the Appalachian ridges, after which it traverses the more open but still picturesque Piedmont plain. It receives its chief tributaries from the west, the Chemung, which joins it near the New York boundary, the large West Branch, 200 miles long, and the Juniata. Its lower and middle course is followed by a lateral canal, but its only importance as a waterway is for floating lumber. The traffic along its valley is carried chiefly by the railroads which follow its course throughout its length. The chief cities on its banks are Harrisburg and Wilkesbarre in Pennsylvania, Port Deposit in Maryland, and Binghamton in New York. The principal city on the West Branch is Williamsport.

SUS'SEX. A southeastern maritime county of England, bounded on the north by Surrey and Kent, on the south by the English Channel, and on the west by Hampshire (Map: England, F 6). Area, 1458 square miles. Population, in 1891, 550,446; in 1901, 605,052. The South Downs traverse the county from west to east, ending about 20 miles east of Brighton, in the lofty cliff of Beachy Head, and the northern escarpment of the Downs leads down to the fertile and richly wooded district of the Weald. The chief rivers are the Arun, Adur, and Ouse, which rise in the north of the county, and flow south into the Channel. A remarkably productive tract of land extends west from Brighton along the coast to the Hampshire border; and in the southeast of the county the rich marsh lands that line the coast make excellent pasture grounds. The Down-lands are covered with a fine, short, and delicate turf, on which the well-known breed of Southdown sheep are pastured. The principal industries of the county are agriculture and cat-

tle-raising. Thick beds of gypsum are worked at Netherfield. Capital, Chichester.

SUSSMANN-HELLBORN, zus'män hĕl'-bôrn, Louis (1828—). A German sculptor, born in Berlin, where he studied under Wredow and settled in 1857 after a sojourn in Rome (1852-56). Of his genre and mythological subjects, a "Drunken Faun" (1856) and "Sleeping Beauty" are in the National Gallery, while his monumental work is represented by statues of "Frederick the Great in Youth" (1862), City Hall, Breslau; "Frederick the Great in Mid-age" and Frederick William III. (both 1869), City Hall, Berlin; "Holbein" and "Peter Vischer," both in the Art-Industrial Museum, Berlin, which he helped to establish in 1867. He was artistic director of the Royal Porcelain Factory in 1882-87.

SUTECH, sōō'tĕk. An Egyptian deity. See Set.

SUTH'ERLAND. A northern county of Scotland, bounded on the east by Caithness and the North Sea, on the north and west by the Atlantic, and on the south by Ross and Cromarty (Map: Scotland, D 1). Area, 2028 square miles; population, in 1891, 21,896; in 1901, 21,440. The coast line is 60 miles in extent, and the shores, rugged on the north and west, where they are broken by the force of the Atlantic, are comparatively flat on the east. The southern and central regions of Sutherland are the most elevated; the principal mountain peaks are Ben More in Assynt (3273 feet) and Ben Clibrigg (3154 feet). The chief rivers are the Oikel and the Shin. Extensive moors stretch across the county; and the rivers and lakes, the chief of which is Loch Shin, form numerous low-lying valleys or straths. In the eastern districts the soil is very fertile, yielding all kinds of agricultural produce. Coal, granites of various colors, marble, limestone, etc., are found; there are good salmon, herring, and other fisheries. The capital is Dornoch.

SUT'LEJ, or **SATLEJ.** The chief tributary of the Indus. It rises in the southern part of Tibet near the sources of the Indus and the Brahmaputra, and, after breaking through the main range of the Himalayas, it flows southwest through the great arid plains of the Punjab, joining the Indus in the southwesten part of that province after a course of about 950 miles (Map: India, B 3). After passing through Lake Manasarowar (q.v.) the river, whose upper course is very rapid, flows through a series of lofty and highly picturesque mountain valleys. In the low 'doabs' of the Punjab its waters are largely used for irrigation, but its volume is nevertheless almost equal to that of the Indus. The Sutlej is the eastern and southernmost of the 'Five Rivers of the Punjab,' the other four being its two main tributaries, the Beas and the Chenab, together with two branches of the latter. Below the confluence of the Beas the river is known as the Ghara, and its lowest course, after receiving the Chenab, is called the Panjnad, or Five Rivers.

SŪTRA, sōō'trȧ (Skt., thread, string, clew). In Sanskrit literature, the technical name of more or less brief, aphoristic rules, and works consisting of such rules. The *sūtra* style of writing is preëminently the scientific style of India. The object of the *sūtras* is to supply a short survey of the facts of any given science in a form so brief that the whole theme may be memorized. In the later works of this class brevity and allusiveness are carried to such an excess that, but for the aid of commentaries which regularly accompany them, they would be obscure and sometimes absolutely unintelligible. Probably this peculiar style of writing originated with the methods of teaching which have prevailed in India from the earliest time. The school work is purely mnemonic; the teacher recites, and the pupil learns by heart piecemeal. It seems, therefore, likely that the *sūtras* were intended as memorial sentences which the pupil had to learn by heart, in order to obtain a grasp of the outline of his subject, as well as the fuller explanation which his teacher appended to it orally.

The importance of the *sūtras* will be understood from the fact that they form in very early times the standard medium of most of the ritual, legal, grammatical, metrical, and philosophical literature. The ritual *sūtras*, known as *Śrāuta Sūtras* and *Gṛhya Sūtras*, are systematic compendiums of the priestly sacrifices and the homelier religious practices of the householder respectively. The *Dharma Sūtras*, the oldest sources of Indian law, are also rooted in the Veda (q.v.). There is another class of Vedic *sūtras*, concerned with religious practice, the *Śulva Sūtras*, of which class the last chapter of the great Vedic *sūtra* collection of the school of Apastamba is an example. There are practical manuals giving the measurements of the altars, and so forth. They show quite an advanced knowledge of geometry, and constitute the oldest Indian mathematical works. In addition, the systematic study of the Vedas, which was prompted by the increasing difficulty of understanding and preserving the hymns, produced a series of ancillary Vedic sciences in *sūtra* style, the so-called six *Vēdāngas* or 'members of the Veda.' These are *śikṣā*, or phonetics, *chandas*, or metrics, *vyākaraṇa*, or grammar, *nirukta*, or etymology, *kalpa*, or religious practice, and *jyōtiṣa*, or astronomy. The most important class of these texts, belonging to the class *śikṣā*, phonetics, are the *Prātiśākhya Sūtras*, which deal with accentuation, pronunciation, and other matters, but are chiefly concerned with the phonetic changes undergone by Vedic words when combined in a sentence. Their observations are so minute and acute as to approach the best results of the modern science of phonetics, and they are unrivaled in their way in the whole history of antiquity. A still more important branch of *sūtra* literature is grammar, in which the Hindus again surpass all nations of antiquity. Little has been preserved of the preliminary stages of grammar. The student of native Sanskrit grammar, therefore, enters at once upon the intricate structure which bears the name of Panini (q.v.). His systematic analysis of words into roots, suffixes, and inflexional elements has been adopted with unimportant changes by modern European scientific grammar.

Later systematic philosophy, which has grown up on the basis of the theosophic hymns of the Veda and the *Upanishads* (q.v.), also adopts the *sūtra* style of presentation in the six systems of philosophy. Even so remote a theme as erotics is in the *Kāmasūtra*, or 'Love Sutra,' of Vatsyayana, naïvely treats this subject in the set form of *sūtra* rules. In one quarter, however, the *sūtra* has abandoned its typical style and has

become the reverse of brief, for the Buddhist *Sūtras*, or *Suttas* (see PITAKA), the sermons ascribed to Buddha, excel in prolixity almost every other type of literature in existence.

SUTRI, sōō'trē (anciently **SUTRIUM**). A town in the Province of Rome, Italy, 29 miles northwest of Rome. It is interesting for its ancient walls and gates, its Etruscan tombs, and the ruins of an amphitheatre dating from the time of Augustus. Sutri is known as the scene of the synod which in 1046 deposed Popes Gregory VI. and Sylvester III. Population (commune), in 1901, 2795.

SUTRO, sōō'trō, ADOLPH HEINRICH JOSEPH (1830-98). A German-American mining engineer, philanthropist, and Mayor of San Francisco. He was born at Aix-la-Chapelle, in Rhenish Prussia; came to the United States in 1850; and soon after went to the Pacific Coast. He was best known as the designer and constructor of the famous Sutro Tunnel, built to drain and ventilate the mines of the celebrated Comstock silver lode in Nevada. It is 20,500 feet long, and cost about $6,500,000. It did not prove so valuable as had been hoped, but by investing the returns which he got from it in San Francisco real estate Sutro became a millionaire. In 1880 he laid out in San Francisco the Sutro Heights Park, and he made numerous gifts to the city. He also founded the Sutro Library, containing about 250,000 volumes. In 1894 he was elected Mayor of the city by the Populists. By the terms of his will Sutro Heights was given to the city for a public park, the Sutro Library was to be opened to the public, and San Miguel ranch was given to support a scientific school. The will was, however, set aside by the courts on the ground that he was not mentally competent at the time he made it.

SUTTEE (from Skt. *satī*, virtuous wife). The practice which prevailed in India of a wife burning herself on the funeral pile, either with the body of her husband, or separately, if he died at a distance. Suttee for the orthodox Hindus is based on the injunctions of their sacred books, and there can be no doubt that various passages in the Puranas (q.v.) and codes of law countenance belief in its merit and efficacy. These, however, are all rather late texts. The custom is alluded to in Hindu literature, and classical authors refer to it as early as B.C. 316. It has even been referred to the Rig Veda as authority, and it was formerly thought that a Vedic verse had been falsified to give support to the practice. It has been shown, however, that this view is untenable. The Rig Veda does not recognize the custom. Manu (q.v.), the law-giver, does not sanction it, though it was known before his time. It appears at first to have been a royal custom and privilege, afterwards generalized and made legal. The custom was abolished by the British in 1829. Suttee is by no means confined to India. Under other names, and in other forms, the widow's death at the grave of her husband is known in many parts of the world, notably in the South Pacific, where a king's favorite wives were wont to let themselves be buried alive in his grave. Consult: Colebrook, *Digest of Hindu Law* (London, 1801); id., *Miscellaneous Essays*, vol. i. (new ed., ib., 1873); Grimm, *Kleinere Schriften*, vol. ii. (Berlin, 1849); Wilson, *Collected Works*, ed. by Rost, vol. ii. (London, 1862).

SUTTER, JOHN AUGUSTUS (1803-80). An American pioneer, born in Kandern, Baden. He was of Swiss parentage and was educated at the military college at Berne. He emigrated to America in 1834, and became a trader at Santa Fe, N. M. In 1838 he made his way to the Pacific Coast, thence to the Sandwich Islands, and finally to Alaska. Obtaining a grant of Mexican land, he established in 1841 a settlement called New Helvetia, where the city of Sacramento now stands. He was Governor of the north district of California under the Mexicans, and alcalde and Indian agent after it passed to the United States. In February, 1848, gold was discovered on his estate. The discovery, however, brought him nothing but disaster. Gold-diggers preëmpted his lands, and except an annual pension of $3000 granted him by the California Legislature he received nothing. He settled in Pennsylvania in 1873.

SUTTNER, zōōt'nĕr, BERTHA VON (1843—). An Austrian novelist, especially known for her efforts to promote peace. Born at Prague, the daughter of Count Franz Kinsky, she married, in 1876, Baron Arthur von Suttner (1850-1902), also known as a novelist, and lived with him for ten years in Tiflis. In 1891 she founded the Austrian Society of Peace-lovers, and, as its president, took a prominent part in the peace congresses at Rome (1891), Bern (1892), Antwerp (1894), and Hamburg (1897). Her novels include: *High Life* (1884; 3d ed. 1902); *Ein Manuskript* (1885); *Erzählte Lustspiele* (1889); *Die Waffen nieder* (1889; 14th ed. 1896), translated into most European languages; and its sequel *Marthas Kinder* (1902). She also wrote *Das Maschinenzeitalter* (3d ed. 1898) and *Die Haager Friedenskonferenz, Tagebuchblätter* (1900); and edits the monthly *Die Waffen nieder* (Dresden, 1892, et seq.), organ of the Peace Bureau at Bern.

SUTTON. A town in Surrey, England, four miles northeast of Epsom. Population, in 1891, 13,977; in 1901, 17,224.

SUTTON COLDFIELD. A municipal borough in Warwickshire, England, seven miles north-northeast of Birmingham (Map: England, E 4). The chief objects of interest are an ancient Early English church, the grammar school founded in 1543, and the celebrated Sutton Park, a recreation ground of 3500 acres, these two latter institutions due to the beneficence of Bishop Vesey of Henry VIII.'s reign, who also bequeathed real estate yielding an annual revenue of $15,000, which is applied to educational and charitable purposes. Population, in 1891, 8685; in 1901, 14,264.

SUTTON IN ASHFIELD. A town in Nottinghamshire, England, three miles southwest of Mansfield, known for its hosiery manufactures (Map: England, E 3). Population, in 1891, 10,562; in 1901, 14,862.

SU TUNG-P'O, or SOO TUNG-P'O, sōō'tûng'pō' (1036-1101). The name by which Su Shih, a Chinese statesman and poet, is best known. He entered public service in 1060, and soon attracted the attention of the Emperor. At his own request he was appointed Governor of Hangchow (q.v.). He opposed the reforms of Wang An-shih, then in favor at the Court, and was degraded in consequence and banished. On

the death of the Emperor in 1086 he was recalled to the capital, where he filled several high posts, becoming president of the Board of Rites in 1091. The sarcasm of his verse, however, continued to make him enemies, and, being accused of speaking ill of the Emperor, he was again banished. A new Emperor having come to the throne, he was recalled in 1101 and restored to honor, but died soon after at Ch'ang-chow, in Kiang-su. In the estimation of the Chinese, Su stands in the first rank as a poet. An edition of his works in 115 books was issued in his lifetime, and there have been many since then with commentaries and new arrangements. Copious translated extracts are to be found in Giles, *Gems of Chinese Literature* (London, 1884), and his *Chinese Literature* (New York, 1901).

SUTURE (from Lat. *sutura*, seam, from *suere*, to sew; connected with Skt. *siv*, Goth. *siujan*, OHG. *siuwan*, *siwan*, AS. *siwian*, Eng. *sew*). A term employed both in anatomy and surgery. In anatomy it is used to designate the modes of connection between the various bones of the cranium and face. A suture is said to be *serrated* when it is formed by the union of two edges of bone with projections and indentations (like the edge of a saw) fitting into one another. The coronal, sagittal, and lambdoidal sutures (see SKULL) are of this kind. A suture is termed *squamous* when it is formed by the overlapping of the beveled (or scale-like) edges of two contiguous bones. There are also the *harmonia* and *schindylesis* sutures, the former being the simple apposition of rough bony surfaces, and the latter being the reception of one bone into a fissure of another. See JOINT.

In surgery the word suture is employed to designate various modes of sewing up wounds. The term is also applied to a single stitch. Two main varieties of suture are recognized, the *continuous* and the *interrupted* suture, and from these two a great number of modifications have been made, of which the quill suture, button suture, the glover's suture, the quilt suture, and the intestinal sutures of Lembert and Duypuytren are examples. A buried suture is one which unites some deeper structure, such as a muscle or a layer of fascia, and which does not appear above the skin. It is often made of some absorbable material. Many materials are at present employed for sutures, such as silk, catgut, silkworm-gut, horse-hair, animal-tendon, and silver wire. Consult McGrath, *Surgical Anatomy and Operative Surgery* (Philadelphia, 1902).

SU'VA. The capital and chief port of the British colony of the Fiji Islands (q.v.). It is situated on the southwestern coast of Viti Levu, 1100 miles from Auckland and 1540 miles from Brisbane. There is good anchorage in a harbor accessible at all tides; wharf extension was made in 1901. There is a European population of over 1000.

SUVALKY, sōō-väl'kē. A government of Russian Poland, situated in the northeastern part. Area, 4852 square miles (Map: Russia, B 4). The surface is generally flat and interspersed with lakes. The principal river is the Niemen. The soil is mostly fertile. About one-fourth of the area is in forests, which belong chiefly to the State and are extensively exploited. The principal occupation is agriculture. Population, in 1899, 604,945, half of whom were Lithuanians.

SUVALKY. The capital of the Government of Suvalky in Russian Poland, situated on a small tributary of the Niemen, 606 miles southwest of Saint Petersburg (Map: Russia, B 4). Population, in 1899, 27,165.

SUVAROFF, sū-vä'rôf, or **SUVOROFF**, ALEXEI VASSILIEVITCH, Count (1729-1800). A Russian field-marshal. He was of Swedish descent and was born in Finland. He served in the campaigns of the Seven Years' War and was made a colonel after the battle of Kunersdorf (1759). His services in the Polish War (1768-72), in the war against the Turks (1773-74), in suppressing the uprising of Pugatcheff, and in subduing the Tatars of the Kuban (1783), gave him increased reputation and he rose to the rank of general. In the Turkish War of 1787-92 he was commander-in-chief, for the first time brought the bayonet prominently into use in the Russian army, and decided by it the battle of Kinburn (1787). At the siege of Otchakov (1788), the battle of Fokshany (1789), which he gained in conjunction with the Austrians, and the decisive victory of Rymnik (1789), his system of rapid and repeated attack by overwhelming numbers secured him complete success. For this last victory, which saved the Austrians under the Prince of Saxe-Coburg from annihilation or capture, Suvaroff was created by the Emperor Joseph II. a count of the Empire, and from his own sovereign received the title of Count Suvaroff-Rymnikski. One of his greatest successes was the storming, in 1790, of the fortress of Ismail, where the whole Turkish garrison was put to the sword. He was appointed (1791) Governor of the newly conquered provinces. In 1794 he was sent into Poland, where he completed the annihilation of the Polish monarchy by a victory won, in conjunction with Fersen, over the army of Kosciuszko, the capture of Praga, where a horrible massacre of the inhabitants took place, and the occupation of Warsaw. The grade of field-marshal rewarded these successes. Under Paul I. he fell into disgrace (1798), from his impatience of the Emperor's fantastic military regulations, and was deprived of his rank; but being restored through English influence, he commanded the army sent to coöperate with the Austrians in Italy against the French. He reached Verona in April, 1799; compelled Moreau to retire behind the Adda after defeating him at Cassano (April 27th); entered Milan (April 29th); again defeated the French under Macdonald at the Trebbia (June 17th-19th), and a third time under Joubert at Novi (August 15th), driving them out of the whole of Northern Italy. He next entered Switzerland in order to join Korsakoff and effected a toilsome march across the Saint Gotthard, in the course of which he lost one-third of his army. But Masséna defeated the army of Korsakoff at Zurich (September 25th), and Suvaroff was compelled to execute a retreat through the Grisons and Vorarlberg. For these remarkable services he received the title of Prince Italiski. In 1800 he was named commander-in-chief of the Russian armies and ordered home. He arrived in the capital, where he died May 18, 1800. He left an autobiography

in French, which was edited by Glinka (Moscow, 1819). Consult also: Smith, *Suworows Leben und Heerzüge* (Vilna, 1833-34); id., *Suworow und Polens Untergang* (Leipzig, 1858); Reding-Biberegg, *Der Zug Suworows durch die Schweiz* (Zurich, 1869); Macready, *A Sketch of Suwarrow and His Last Campaign* (London, 1851).

SUWANEE, sū-wą'nē. A river of Florida (Map: Florida, E 2). It rises in the Okefinokee Swamp in southern Georgia and flows southwest, emptying into the Gulf of Mexico, 12 miles north of Cedar Keys, after a course of 240 miles. The scenery along its banks is attractive, and the river has been celebrated throughout the country by the song, "Old Folks at Home."

SUYUTI, sōō-yōō'tē (Ar. *Abū al Faḍl 'Abd al-Raḥmān al-Suyūṭī*) (1445-1505). An encyclopædist and the most prolific writer in Arabic literature. His family was of Persian origin, but had emigrated to Egypt, where his father was a judge and professor at Cairo. Hither the son returned after the usual travels to Mecca and the centres of learning, and here he rose from one professorship to another. But at last his arrogant and dishonest conduct drove him from his position and he died in retirement. The production of great numbers of books seems to have been his affectation, and although they do not reveal genius, they are of value for the encyclopædic information they contain. About 315 titles of extant books of his are enumerated, touching upon every subject. Consult: Wüstenfeld, *Die Geschichtsschreiber der Araber* (Göttingen, 1882); Brockelmann, *Geschichte der arabischen Litteratur* (Berlin, 1899).

SVARGA, swŭr'gȧ (Skt., heaven). In Hindu mythology, the paradise of the god Indra (q.v.). It is the residence of some of the inferior gods and deified mortals, who there rest in the shade of the five wonderful trees, *Mandāra*, *Pārijāta*, *Santāna*, *Kalpavṛkṣa*, and *Harichandana*, drink *amṛta*, the beverage of immortality, and enjoy the music of the heavenly musicians, the *Gandharvas*, and the dancing of the celestial courtesans, the *Apsarasas*. Svarga is situated on Mount Meru (q.v.), and is 800 miles in circumference and 80 miles high. Its pillars are of diamonds and its palaces of gold. The inhabitants do not remain there forever, but after a lapse of years they descend to earth to be born and die according to the doctrine of metempsychosis (q.v.).

SVEABORG, svā'ȧ-bôr-y'. A fortress of Finland, Russia. See HELSINGFORS.

SVEARIKE, svā'ȧ-rē'ke. One of the three historical divisions of Sweden. It lies between Götarike and Norrland. Area, 32,589 square miles. Population, in 1900, 1,579,954.

SVENDBORG, svĕnd'bôrg. A seaport of Denmark, on the southeast coast of the island of Fünen, on the Svendborg Sound, 27 miles south of Odense (Map: Denmark, D 3). The town occupies a charming site in a hill-encircled valley. The chief industries are iron-founding, tanning, and shipbuilding. Population, in 1901, 11,531.

SVEND'SEN, JOHAN (1840—). A Norwegian violinist and composer, born at Christiania. He studied at the Leipzig Conservatory, toured extensively, later was appointed Concertmeister of the Leipzig 'Euterpe' concerts, and from 1872 to 1877 was conductor of the Christiania Musical Association. Afterwards he became Court conductor at Copenhagen, and in 1896 was appointed conductor of the Royal Theatre. His works include string quartets and quintets; symphony in D; violin concerto in A; overture to Björnson's drama *Sigurd Slembe; Carnaval à Paris*, for the orchestra; *Coronation March* (for Oscar II.); *Wedding Cantata*, for chorus and orchestra; *Carnaval des artistes norvégiens;* Norwegian rhapsodies for the orchestra; overture to *Romeo and Juliet;* Scandinavian airs for string quartet; and Romance in G, for the violin and orchestra.

SVERDRUP, svĕr'drụp, JOHAN (1816-92). A Norwegian politician, born at the Château of Jarisberg. He studied and practiced law, but from 1850, when he was elected to the Storthing, gave his entire attention to politics and became the leader of the radical peasant faction. As president of the Storthing since 1871, he violently fought against the royal prerogatives. He was called to preside over the Ministry in 1884, but did not satisfy the radical portion of his adherents, and, yielding to the combined attacks of the Conservatives and the extreme Left, resigned in 1889.

SVERDRUP, OTTO (1855—). A Norwegian Arctic explorer, born at Haarstad Farm, District of Helgeland. He followed the sea at the age of seventeen, was subsequently in command of a merchant vessel, and in 1888 joined Nansen's expedition to Greenland. In 1893 he started with Nansen for the North Pole as commander of the *Fram*, which had been built under his supervision, and when Nansen, in 1895, proceeded north on dog sledges, Sverdrup took the ship to the Arctic Sea and in 1896 back to Norway. In 1898 he led another expedition in the *Fram* as far as Cape Sable, was caught in the ice for a year, and, after advancing into Jones's Sound in the summer of 1899, was again icebound for three years. Having explored the southwest and western shores of Ellesmere Land and discovered islands north of the Peary Archipelago, he reached Goodhaven, Greenland, in August, 1902, and returned to Norway in the autumn.

SWA'BIA, or **SUABIA** (Ger. *Schwaben*, Lat. *Suevia*). A mediæval duchy in the southwest of Germany. It took its name from the Suevi, by which the Germanic people of the Alemanni (q.v.), who occupied Southwestern Germany in the third century, were also known. The name Suevia alternates with that of Alemannia as the designation of the country in the early part of the Middle Ages, but the former finally prevailed. The region occupied by the Alemanni embraced Western Bavaria, Württemberg, Baden, Alsace, and a great part of Switzerland. The bulk of the nation was subjected by the Franks at the close of the fifth century. As part of the Frankish realm, Alemannia was governed by native dukes, but the duchy was abolished before the dissolution of the Frankish Empire. The country from which Alsace and part of the Alpine territories had been detached, and which now came to be known as Swabia, was then placed under the rule of counts and *nuntii*

camera, and for a time it was nearly independent.

In 919 Swabia was constituted one of the great duchies of the German Kingdom. It comprised the region between the Rhine and the Lech and part of Switzerland. The office of duke was frequently kept in the royal family. In 1079 the duchy passed to the House of Hohenstaufen, being bestowed by the Emperor Henry IV. upon Frederick of Staufen. Under the rule of this house, which occupied the Imperial throne of Germany from 1138 to 1254, Swabia was the most wealthy and powerful of the German duchies. In 1096 Frederick of Staufen was compelled to give up to Berthold of Zähringen the Breisgau and the Imperial bailiffship in Zurich. On the extinction of the Hohenstaufen dynasty in 1268 disintegration took place and the ducal vassals (cities, prelates, counts, etc.) claimed independence except for their allegiance to the emperors. The Count of Württemberg occupied the leading place among the petty rulers. The numerous lesser lords were for the most part obliged to accept the overlordship of the House of Zähringen or of Austria. The cities, of which many had become wealthy and powerful, were striving for local independence. In 1376 some of them formed the first Swabian League, which extended beyond the bounds of Swabia. In 1405 Württemberg, Baden, and seventeen cities joined together in the League of Marbach. The two Leagues were of little importance as political powers, but they paved the way for the Great Swabian League, formed in 1488, which under the leadership of the Count of Württemberg exercised administrative and judicial authority over the whole country. During this long period of strife a considerable portion of old Swabia had passed into the power of Bavaria. In 1512 Swabia became one of the ten circles into which Germany was divided for administrative purposes by Maximilian I. The dissolution of the Great Swabian League took place in 1533. Among the many city commonwealths which arose in Swabia were Augsburg, Ulm, and Constance. The southwestern Government District of Bavaria bears the name of Swabia (or Swabia and Newburg). Its capital is Augsburg. The best general history is Stälin, *Geschichte Württembergs* (Gotha, 1882-87).

SWADLINCOTE, swŏd'lĭn-kot. A town in Derbyshire, England, 4 miles southeast of Burton-upon-Trent. Its industries comprise coal-mining and the various branches of earthenware manufacture. Population, in 1891, 13,889; in 1901, 18,014.

SWAHILI, swà-hē'lê. A Bantu people of the Kau District, Tana-Ozi Delta, British East Africa, mingled more or less in blood with Semites. They are Mohammedans and differ little from the Arabs in general culture. They number about one million. They are noted traders, and their language, the Kiswahili, is the great medium of intercourse throughout east Central Africa. Consult: Büttner, *Wörterbuch der Suaheli-sprache* (Berlin, 1890); Seidel, *Grammatik der Suaheli-sprache* (Vienna, 1891); Steere, *Handbook of the Swahili Language* (4th ed., London, 1894); Krapf, *Dictionary of the Suahili Language* (ib., 1882); Madan, *English-Swahili Dictionary* (Oxford, 1894); Delaunay, *Grammaire Kiswahili* (Paris, 1898).

SWAIN, Charles (1801-74). An English writer known as 'the Manchester poet.' He was born in Manchester, and lived all his life in England. For fourteen years he was a clerk in the dye house of his uncle; he afterwards carried on a business in engraving and lithographing. Between 1827 and 1867 he published several volumes of verse, among which are *Dryburgh Abbey* (1832), an elegy on Sir Walter Scott; *English Melodies* (1849); and the more ambitious *The Mind and Other Poems* (1832). Several of his songs, which have been set to music, are well known, as "Somebody's Waiting for Somebody" and "Tapping at the Window." Consult the edition of his poems, with portrait and introduction by C. C. Smith (Boston, 1857).

SWAIN, George Fillmore (1857—). An American civil engineer. He was born in San Francisco and was educated at the Massachusetts Institute of Technology, where he graduated in 1877. He then studied three years in the Government engineering school at Berlin, Germany. Upon his return he settled in Boston, where in 1887 he became professor of civil engineering at the Institute of Technology, and engineer to the Massachusetts Railroad Commission. In 1894 he was also made a member of the Boston Transit Commission. His most important publication is a "Report on the Water Power of the Atlantic Watershed" (vol. xvii. of *Tenth United States Census*).

SWAIN, Joseph (1857—). An American educator, born at Pendleton, Ind. He graduated at Indiana University in 1883; studied in the University of Edinburgh, and with the astronomer royal of Scotland in 1885-86; was professor of mathematics in his alma mater from 1886 till 1891; and in the latter year was called as professor of mathematics to Leland Stanford University. Two years afterwards he returned to Indiana University as president, and remained in that position until 1902, when he accepted the presidency of Swarthmore College in Pennsylvania.

SWAIN'SON, William (1789-1855). An English naturalist, born in Liverpool. He traveled in South America, and on his return to England began the publication of works on natural history. In 1841 he emigrated to New Zealand, where he became Attorney-General. Important among his works are: *Zoölogical Illustrations* (1820-23; 1829-33); *Exotic Conchology* (1821-22); *Ornithological Drawings* (1834-41); *Birds of Western Africa* (1837); *The Naturalist's Guide, etc.* (1840).

SWALLOW (AS. *swalewe*, OHG. *swalawa*, Ger. *Schwalbe*, swallow; perhaps connected with Gk. ἀλκυών, *alkyōn*, Lat. *alcedo*, kingfisher). A passerine bird of the family Hirundinidæ, a family represented by many similar species in almost all parts of the world. This family consists of birds which prey on insects, catching them in the air. They have remarkable powers of flight, now soaring to a great height, now skimming near the surface of the ground or of the water, and wheeling with great rapidity. The bill is short and weak, broad at the base, and deeply cleft, so that the gape is wide; the wings are very long, pointed, and more or less sickle-shaped when expanded, and have only nine primaries; the legs are short and weak. The tail is gener-

ally forked, and the plumage is close and glossy. The family is perhaps the most sharply defined and easily recognized of any in the order. The species are about eighty, widely diffused, being found in all countries except near the poles. Such of them as occur in the colder parts of the world are summer birds of passage, migrating to warmer regions when winter approaches and insects become scarce. Only seven species of swallow occur in North America, and all but one of these winter south of the United States, though in summer they range to the Arctic Ocean. The largest species is the purple martin, while the smallest is the bank swallow (q.v.). Perhaps the commonest of North American swallows is the barn-swallow (q.v.). Another swallow numerous about farmyards and barns is the cliff or eaves swallow (*Petrochelidon lunifrons*), whose nest is the remarkable flask-shaped structure of pellets of mud often seen attached in rows to the outside walls of barns, just under the eaves. Formerly, as in the case of other swallows (see BARN-SWALLOW), this species bred in rocky places and placed its nests in large companies against the faces of cliffs.

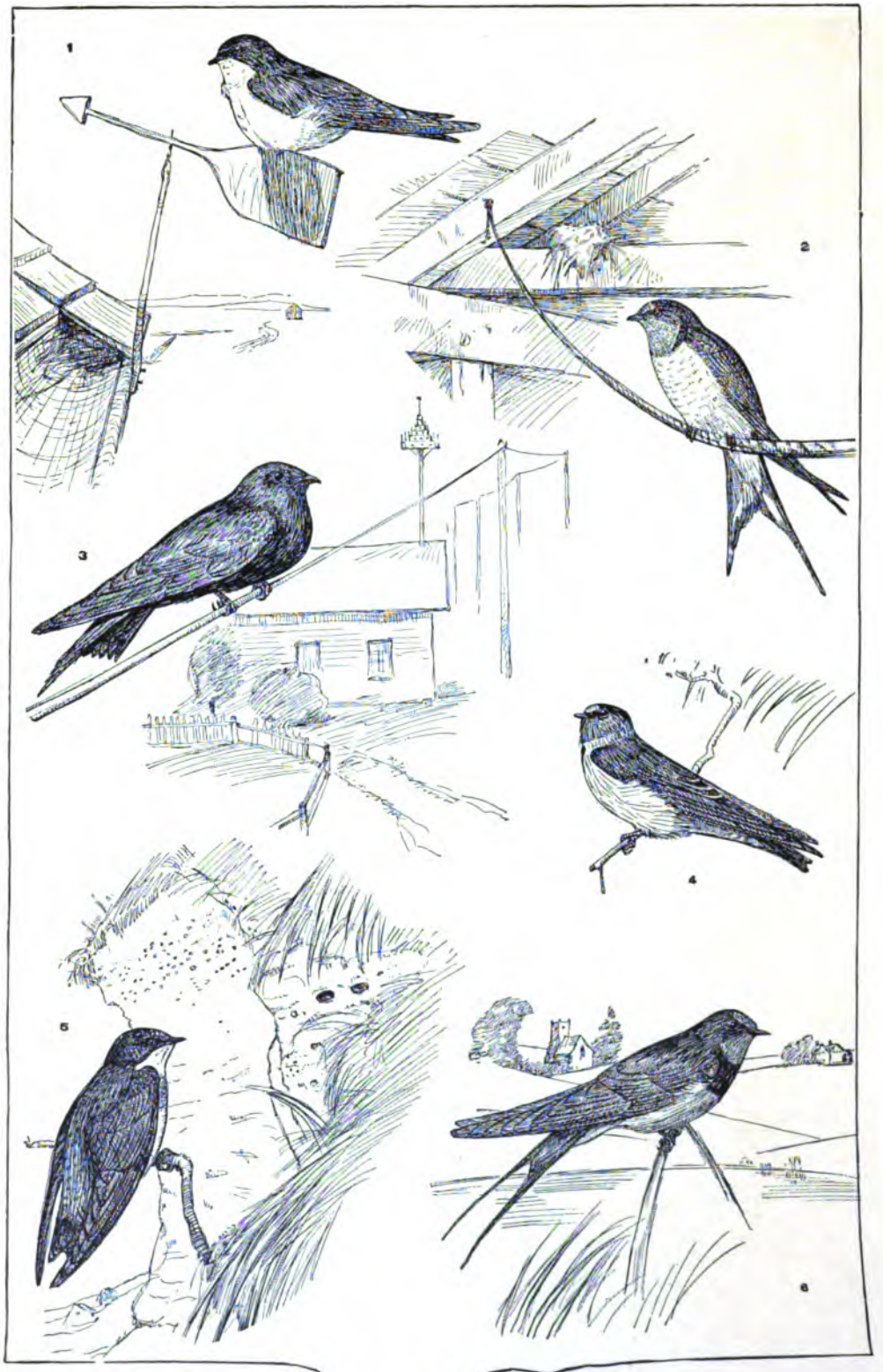
A large and handsome swallow common throughout North America is the white-bellied or tree swallow (*Tachycineta bicolor*), which is steel blue or green above and pure white beneath. Of the same genus is the exquisite little violet-green swallow (*Tachycineta thallasina*) of the Western United States, which is less than five inches long; the upper parts are velvety green and violet purple, while the under parts are pure white. The rough-winged swallow (q.v.) completes the list. South America has a large series of swallows very similar to those of the United States, and especially of that group of which the tree and violet-green swallows are a type. Some naturally breed in holes of rocks, others in hollow trees, or form nests of mud, straw, and feathers in some similar situation; but nearly all have abandoned their wild ways as fast as the country has been settled, and placed their abodes near or within buildings. The same pleasing habit characterizes the tribe in India, Africa, Australia, and everywhere else, and has led to the growth of much pleasant folk-lore, poetry, and sentiment. In Great Britain *Hirundo rustica*, the common or 'chimney swallow' (to be distinguished from the American chimney swift, q.v.), is much like our barn-swallow, and makes a similar nest, usually placed under a shed roof, in a half-ruined building, or often in a chimney. The geographical range of this species extends over a great part of Europe, Asia, and Africa. The window swallow, or house-martin (*Hirundo urbica*), is another very common European species, glossy black above, white below and on the rump; the feet covered with short downy white feathers, which is not the case in the chimney swallow.

Consult Sharpe and Wyatt, *Monograph of the Hirundinidæ* (London, 1885-94), which contains a description, with colored plates, of all the species of the world, and a full bibliography.

SWALLOWTAIL. Any member of a family of large butterflies, Papilionidæ, with tail-like prolongations of the hind wings. Black, yellow, blue, and green are the prevailing colors. About 25 species occur in the United States. South America is most rich in these butterflies. About 700 species have been described in all. The larvæ of the swallowtails possess a curious process on the thorax called an 'osmaterium,' which is usually retracted, but may be thrust forth at will. It is a Y-shaped process and contains a scent-gland which emits a strong odor when the organ is thrust out. The pupa is placed with the head upward, fastened by the tail to the supporting object, and is kept in place by a silk band around the middle of the body. (See BUTTERFLIES; also Plate under BUTTERFLIES, Fig. 5.) In certain species the males and females differ so much both in form and coloration that they might easily be mistaken for distinct species. In New Guinea there occurs a swallow-tail butterfly (*Ornithoptera paradisea*) the female of which is black, white, and gray, and the male is gold and green, with very long tails on the hind wings. The males of another species of the same genus are numerous and the female is rare; the proportion is said to be about 1000 to 15. Not only does the female show sexual dimorphism, but even considerable seasonal dimorphism. The tiger swallowtail (*Jasoniades glaucus*) is a North American species which shows a striking sexual dimorphism in a portion of its range. The form now known as *Turnus* is straw-colored above, banded and marked with black. In the South and West black forms of the female sex occur, and belong to the so-called '*glaucus*' form. The caterpillar of these two forms is dark green with two purple eye-spots, one on each side of the third thoracic segment, which are bordered with black, yellow, and black again in turn. When not feeding, this caterpillar rests on a bed of silk spun on a leaf. The zebra swallowtail (*Iphiclides Ajax*) presents one of the most striking cases of seasonal dimorphism known among butterflies, so that until the life-history of this form was known three different species had been described from it. There are several broods a season and the last brood winters in the chrysalis stage. The butterflies that appear in the early spring are known as the *Marcellus* form and those that appear later in the spring as the *Telamonides* form. The latter are larger butterflies with longer tails and more white than the *Marcellus* form. (See Colored Plate of AMERICAN BUTTERFLIES.) All the late spring broods produce a third form which is still larger and with longer tails. This summer brood is known as the *Ajax* form. See illustration at SKIPPER.

SWALLOWTHORN, or SEA-BUCKTHORN (*Hippophaë*). A genus of shrubs of the natural order Elæagnaceæ, natives of Europe. The commonest species (*Hippophaë rhamnoides*) is a spiny shrub often planted for ornament in sandy soil, especially near the sea. It is valued for its silvery leaves and yellow, acid, one-seeded berries, which, besides being attractive, are useful for sauces and jellies.

SWAMMERDAM, swäm'mĕr-dăm, JAN (1637-80). A Dutch naturalist, born in Amsterdam. He studied medicine at Leyden, but devoted most of his life to the study of insects and other animals. He was a skilled dissector of small animals, and was the father of the scientific study of the morphology and metamorphosis of insects. He first made a natural classification of insects by distinguishing between those which have a complete metamorphosis and those which have not. He wrote: *De Respiratione usuque Pulmonum* (1667); *Allgemeene verhandeling van*



1. WHITE-BELLIED or TREE SWALLOW (Iridoprocne bicolor).
2. BARN SWALLOW (Chelidon erythrogastra).
3. PURPLE MARTIN (Progne subis).
4. CLIFF or EAVES SWALLOW (Petrochelidon lunifrons).
5. BANK SWALLOW or SAND MARTIN (Clivicola riparia).
6. ENGLISH HOUSE SWALLOW (Hirundo urbica).

bloedeloose diertjes (1669); *Biblia Naturæ, sive Historia Insectorum in Certas Classes Redacta* (ed. Boerhaave, 1737-38).

SWAMP (AS. *swamm, swam*, swamp, Goth. *swamms*, sponge, *swumsl*, ditch, OHG. *swam*, MHG. *swam, swamp*, Ger. *Schwamm*, sponge; connected with OHG. *sumpft*, Ger. *Sumpf*, swamp, and with Gk. *σομφός, somphos*, spongy). An area of wet ground usually covered with certain coarse grasses, trees, and other plants peculiar to such land. While the direct cause for differences between typical swamps has not been fully worked out, drainage seems to be the principal controlling factor. It seems probable that in undrained swamps, such as peat bogs, the products of plant decay, including various acids, necessarily accumulate and that aëration is imperfect. Hence it seems reasonable to believe that only xerophytic plants can grow in such places. On the other hand, river swamps, which are comparatively well drained, may show reverse conditions. Since they are hydrophytic, as habitats they maintain plants whose structures are hydrophytic. (See HYDROPHYTES.) Thus undrained swamps are hydrophytic with respect to soil moisture, but xerophytic with respect to plant structures. See XEROPHYTES.

Perhaps no type of plant society better illustrates the order of succession or encroachment of one zone upon another than the most xerophytic swamps, the peat bogs or moors. A typical bog, for instance, may show a central pond with water lilies and other aquatics, surrounded by bulrushes, behind which may be a zone of sedges, and then grasses or swamp forests, e.g. of tamarack or arborvitæ. Since each of these zones in turn advances toward and encroaches upon the centre, the swamp gradually becomes filled and drained naturally in a few years.

Other characteristic xerophytic swamps are salt marshes, both the typical northern salt meadows and the mangrove swamps of the tropics. Plants of salt marshes (halophytes, q.v.) are very largely succulent. In many cases the coarse grasses resemble those of the prairies. In mangrove swamps xerophytic structures, represented typically by the mangrove leaf, are not the sole interesting features. Above the foul water many plants develop knee-like processes which supposedly are of advantage in aëration; and vivipary (q.v.) here reaches its highest expression. (See MANGROVE.) A closely allied type is the so-called cypress swamp of the Southern United States.

All swamps may be considered as ephemeral plant societies, developing either into prairies or mesophytic forests as they become better drained. Climate doubtless plays some part in this development, since the prairie rather than the forest is likely to develop in the prairie regions or in the forest regions adjoining the prairie, whereas in the heart of the forest regions most swamps eventually become covered with trees. This, is, however, not a universal explanation, since some swamps in forest regions never become sylvan.

SWAMP DEER, or BARASINGHA. A deer of Northern India, of rather large size, with smooth and somewhat flattened antlers, with a prominent brow-tine and sometimes 16 to 20 points. It is a grazer, keeps in the outskirts of the woods, and on grassy lands, and in winter gathers into small bands. Its scientific name is *Cervus Duvaucelli*. Consult Lydekker, *Deer of All Lands* (London, 1898).

SWAMP HARE, or SWAMP RABBIT. A hare of the swamps of the Lower Mississippi Valley (*Lepus aquaticus*), 24 inches long, finely mottled above with buff, rufous, and black, and more buffy than the 'cottontail;' belly and under side of tail pure white. Its habits are little known. Compare MARSH HARE.

SWAMP'SCOTT. A town, including several villages, in Essex County, Mass., adjoining Lynn and 13 miles from Boston; on Massachusetts Bay, and on the Boston and Maine Railroad (Map: Massachusetts, F 3). It is attractively situated and is known as a summer resort. There are two parks, a public library with 7500 volumes in the town hall, and the Phillips School, the most prominent building along the shore. Fishing is of some importance, but the community is engaged largely in the industries of Lynn (q.v.). The government is administered by town meetings. The water-works are owned and operated by the town. Population, in 1890, 3198; in 1900, 4548.

SWAMP WARBLER. A large genus (Helminthophila) of American warblers (q.v.), so called because of their fondness for low, swampy places. They are small, trim, insect-catching migratory birds prevailingly gray or green and yellow in color, and most of them breed north of the United States and winter in the tropics. A good example is the 'golden-wing' (*Helminthophila chrysoptera*), which is gray on the upper parts and white below, with the throat and auricular region black, and a conspicuous yellow patch on the wing.



GOLDENWING.

SWAN (AS., OHG. *swan*, Ger. *Schwan*, swan; probably connected with Lat. *sonus*, sound, Skt. *svan*, to resound). A water-bird of the duck family, the seven or eight species of which constitute the subfamily Cygninæ, composed mainly of the genera Cygnus and Olor, the latter distinguished by the great keel of the breast-bone being divided into two plates, between which lies the curvature of the windpipe—an organ greatly developed in this group. Swans are larger in body than geese, and are recognizable by their long arched necks, enabling them to reach food on the bottom of streams, and shallow ponds without diving. They nest mostly in high latitudes, constructing on the ground a rude receptacle of rushes and the like for the half a dozen greenish eggs. They feed chiefly on vegetable substances, as the seeds and roots of aquatic plants, but also on fish-spawn, of which they are great destroyers. They hiss like geese, and strike with their wings in attack or defense.

The typical and most familiar example of the tribe is the tame or 'mute' swan (*Cygnus olor*), which is about five feet in entire length, and weighs about thirty pounds. It is known to live for at least fifty years. The male is larger than the female. The adults of both sexes are pure white, with a reddish bill; the young (cygnets) have a dark bluish-gray plumage, and lead-colored bill, surmounted by a black knob at the base of

the upper mandible, and with a black nail. (See Colored Plate of WATER BIRDS.) In its wild state this species is found in Eastern Europe and in Asia; in a half-domesticated state it has long been a common ornament of ponds, lakes, and rivers. The ancients ascribed to it remarkable musical powers, which it was supposed to exercise particularly when its death approached. It has, in reality, a soft low voice, plaintive, and with little variety, to be heard chiefly when it is moving about with its young.

Swans, according to the law of England, are birds royal; those actually kept by the Crown had a mark, and the King's swan-herd once was an important person. The royal swans of the Thames are so marked to this day by notches and lines cut upon the beak, and the process of collecting and marking them annually is called 'upping.' Other Old World swans are the Polish, with an orange bill; the whistling swan or 'whooper;' Bewick's swan, and the aberrant black swan (*Chenopis atrata*) of Australia, which is comparatively small and deep black except the white wing-quills and the red bill.

The North American swans belong to the genus Olor. The most common species (*Olor Columbianus*) breeds in the far North and is seen in the United States only on its migrations, which extend to the Gulf of Mexico; and it is very rare east of the Alleghanies. The trumpeter swan (*Olor buccinator*), noted for its sonorous cry, breeds from Iowa and Dakota northward, and winters southward to the Gulf. It is one of the largest species, measuring 5½ feet in length. The black-necked and duck-billed swans are South American species. See DUCK, and authorities there cited.

SWAN, KNIGHT OF THE. A very old and popular myth found in French, German, and English mediæval romances, first mentioned by William of Tyre about 1180. Helias, Knight of the Swan, is one of eight children of Oriant of Lilefort. Seven are changed to swans, one drawing the hero in a boat to become champion for Clarissa of Bouillon, the ancestor of Godfrey, thus connecting the story with the Crusades. After marriage the knight departs when his wife breaks the taboo on his name, a Grail feature common to all variants, as *Lohengrin*, showing its partly Celtic origin. The scene is generally on the Lower Rhine, connecting it with the dukes of Brabant and Cleves, whose symbol was a swan.

SWAN, ORDER OF THE. A religious association of princes and nobles formed in 1440 by Elector Frederick II. of Brandenburg for benevolent purposes. It was extinguished during the Reformation, but was renewed in 1843 by Frederick William IV. of Prussia as an association, open to men and women of all creeds, for the amelioration of physical and moral ills.

SWAN, JOHN MACALLAN (1847—). An English painter and sculptor, born at Old Brentford. He studied in London and in Paris. In 1889 his "Prodigal Son" (bought by the Chantrey Fund) established his reputation. His sculptured works —in nearly every material—are usually studies of cats, and his modeling is broad, flexible, and naturalistic. "The Jaguar," "Puma and Macaw," "Wounded Leopard," and "Leopard Running," challenge comparison with Barye. His subjects in oil include animals, figures, and landscapes, and are distinguished by massive, simple treatment, and a strongly imaginative element. His color is delicate and discriminating, but nearly always low in tone. Notable paintings are: "Ocelot and Fish;" "Tigers;" "Tigers Drinking;" "Ceylon Leopards;" "Lioness Defending Her Cubs;" and "Polar Bear Swimming." He was elected an associate of the Royal Academy in 1894.

SWAN, JOSEPH WILSON (1828—). An English inventor, born at Sunderland, and there educated. He made several inventions of great value, among them the carbon process for making permanent photographs, called autotypes, a miner's electric safety lamp, improvements in electrometallurgical deposition, but most notable of all the incandescent electric lamp which bears his name, the forerunner of all the electric lamps now in use. These inventions brought him many honors, including a fellowship in the Royal Society.

SWANPAN. A Chinese calculating device. See CALCULATING MACHINES.

SWAN RIVER. A small river of Western Australia entering the Indian Ocean at the Fremantle, a few miles below Perth (Map: Australia, B 5). It is navigable for steamers to the latter city. On its banks was founded in 1829 the Swan River Colony, which formed the nucleus around which the colony of Western Australia was built up.

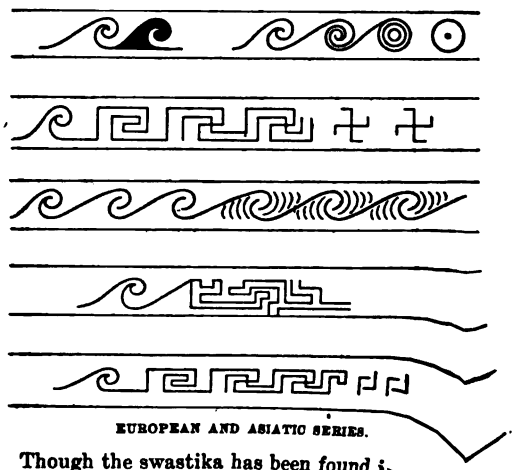
SWANSEA, swŏn'sĭ. A seaport in Glamorganshire, South Wales, at the mouth of the Tawe, 60 miles west-northwest of Bristol (Map: Wales, B 5). Swansea is the chief seat of the tin-plate trade of England, and one of the most important copper smelting and refining centres in the world. The vast resources of the surrounding coal field began to be exploited about 1830, and since that time the progress of Swansea has made it next to Cardiff the most important town in South Wales. The principal edifices, for the most part of modern construction, comprise a guild hall with the crown and law courts and municipal offices, the Royal Institution of South Wales, the grammar school founded in 1682, a good public hall, and a spacious and well-arranged infirmary. The harbor is formed by piers of masonry projecting from either side of the mouth of the Tawe into Swansea Bay, a wide inlet of the Bristol Channel. An average of 6000 vessels enter and clear nearly 4,000,000 tons of merchandise annually. In the immediate vicinity are smelting works, in which many thousands of tons of copper ores, silver ores, and zinc ores are smelted annually. About 20,000 tons of copper, valued at $15,000,000 to $20,000,000, are annually produced, and about 2,000,000 tons of tin plate, valued at $15,000,000, are exported annually. The annual value of exports and imports is estimated at $50,000,000 to $60,000,000. Swansea owes its origin to a castle erected in 1099. In 1260 the castle was burned down. It was twice rebuilt, but was finally dismantled by the Parliamentarians in 1647, and is now an interesting ruin. Population, in 1891, 90,349; in 1901, 94,514.

SWARTH, swärt, HELENE (1859—). A Dutch poet, born at Amsterdam and, since 1893, married to the poet Frits Lapidoth at The Hague. From

1865 to 1884 she lived at Brussels, and after publishing two volumes of poems in French, *Fleurs du rêve* (1879) and *Les Printanières* (1882), took high rank among the younger generation of poets in Holland with the lyrics, mostly in sonnet form, *Blauwe Bloemen* (1884), *Beelden en Stemmen* (1887), *Sneeuwvlokken* (1888), *Passiebloemen* (1891), and other collections. She also wrote sketches in prose, such as *Fronisch en tragisch* (1895), *Van Vromenleed* and *Van Vrouwenlot* (1896), *Ernst* (1902), and others.

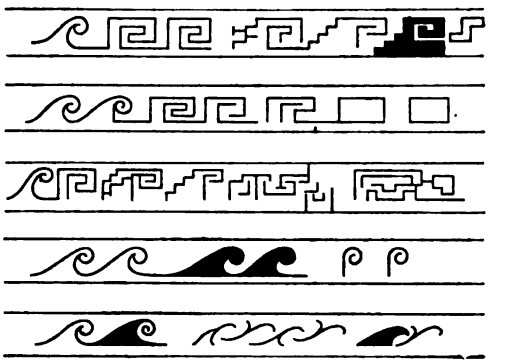
SWARTHMORE COLLEGE. A co-educational institution at Swarthmore, Pa., 12 miles west-southwest of Philadelphia. It was founded in 1864 by members of the Society of Friends, to secure to the youth of the Society higher educational training under instructors of their own faith. The college conferred the degrees of bachelor of letters and bachelor of science until 1903, when the degrees of bachelor of arts and bachelor of science in engineering were made the only ones given. The work is partially elective, and special courses of study are provided. The master's degree in arts, letters, and science and the degrees of civil, mechanical, and chemical engineers are given for advanced work. In 1903 there were 205 students in all departments, with 25 instructors. The college library contained 22,100 volumes. The productive funds amounted to $300,000, the income to $100,000, and the total valuation of the college property to $800,000.

SWASTIKA (Skt., weal-making). A fylfot or 'four-foot' cross, a monogrammatic sign having four branches, of which the ends are bent, generally at right angles, thus  or  . It is a sign of benediction or of good luck, and in one form or another has been used as a symbol of welfare from a very early time. The sign appears in a variety of modifications, often connected in a continuous scroll, of which there are two well-defined types, forming on the one hand the European and Asiatic series, and on the other hand the American series, as illustrated by the following diagrams:



EUROPEAN AND ASIATIC SERIES.

Though the swastika has been found in Asia, and America, yet it is unknown in Europe, races. There is, for example, no evidence that it was current as a native symbol in many Babylonia, Assyria, Phœnicia, or Egypt, (till a late period) in Persia. It was particularly adopted by Buddhism and its presence in China, Japan, and Tibet can easily be explained as due to that religion. The swastika is unknown in early India (all evidence to the contrary rests on false assumptions) and when (c.300 B.C.) it first appears, it is as a simple cross, as in crossed arms.



AMERICAN SERIES.

Many of the swastikas found at Hissarlik (Troy) are now acknowledged to be no true swastikas. They are not found before the third city. Its original place and significance are alike unknown, but it has been the object of endless speculation. Some scholars see in the swastika a solar symbol, which represents, in its so-called female and male forms,  and  respectively, the annual circuits of the sun to north and south. It has been derived from the *triskalion* or 'three-leg' symbol  , but this sign is of later origin. The swastika has also been interpreted in other ways, as a wind-symbol, an earth-symbol, an emblem of productivity, a phallic emblem, etc. Temple regards it as in origin merely decorative, and suggests that the running design may have been taken from a coil of string. In the opinion of d'Alviella, who calls it, from its shape, gammadion, the swastika was chiefly talismanic. The swastika has been derived by some from the cross; by others, from the circle; it has been regarded as an evolution from the lotus-petal in architecture; and as a mystic design it has been associated with fire and with water. The sun and fecundity are its most probable sources, if it had any meaning beyond that of an ornament becoming a mystic sign. The swastika appeared first in the Bronze Age, and occurs in the Swiss lake-dwellings. In the historic period it is found in Japan, Korea, China, Tibet, Armenia, Asia Minor, Greece and its islands (especially Cyprus and Rhodes), Italy, France, Germany, Scandinavia, Great Britain (perhaps only under Scandinavian influence), North America (e.g. Ohio, Tennessee, Mississippi, Alaska), Mexico, and South America (e.g. Brazil). In assigning its original home, it must be remembered that no case of Oriental swastikas precedes the period of Greek influence in India. It seems probable that d'Alviella may be right in ascribing an eastern emigration from a western centre, if not from Troy itself. It is said that there is in Tibet a sect of rationalists called Swastikas, but this is probably an error, and the sect meant is that of the Jains.

BIBLIOGRAPHY. The literature directly or indirectly relating to the swastika is very large (more than 100 works are mentioned by Wilson), but most of it is useless, being composed by theorists rather than by careful scholars. Besides the article by R. C. Temple (referred to above), which appeared in the first number of the *Journal of the Anthropological Society of Bombay*, and d'Alviella's great work, *La migration des symboles* (Paris, 1891), there is an exhaustive treatise in the *Report* of the United States National Museum (Washington, 1894), by Thomas Wilson, *The Swastika, the Earliest Known Symbol, and Its Migrations*, which, besides giving an account of the various theories of the symbol, has a complete bibliography of the subject.

SWATOW, swä'tou' (a local corruption of Chinese *Shan-t'ow*, fish-trap head). A treaty port in the Province of Kwang-tung, Southeastern China, situated in latitude 23° 21′ N., longitude 116° 39′ E., on the left bank and near the mouth of the river Han (Map: China, E 7). It is dependent on the departmental city of Ch'ao-chow fu, 35 miles farther up the river, where the consuls are supposed to reside. It was opened to foreign residence and trade by the Treaty of Tientsin (1858), and the British and United States consuls were appointed in 1860. The foreign community is small and isolated, partly in the vicinity of the native town and partly on the hilly ground on the opposite side of the river. The natives are noted for their turbulence and their hostility to foreigners. Sugar-making is the chief industry of the region served by Swatow. Sugar is the heaviest export, and bean-cake from Niu-chwang for use as manure in the sugar fields is one of the heaviest imports of native products. There are several large sugar refineries here, and a steam flour mill. Other products are tea, grasscloth, indigo, vegetable oils, paper, tobacco, joss-sticks, joss-paper, etc. The population in 1901 was 38,000.

SWATS, swäts. A people of the Indo-Afghan frontier belonging by race and language to the Aryan stock. Their country, called Swat, traversed by the river of the same name, an affluent of the Kabul, is included in the recently constituted Northwest Frontier Province of India. Formerly Buddhists, they were converted to Mohammedanism in the eleventh century. The lower Swat country was occupied by the Yusufzais in the middle of the fifteenth century, and at the end of the sixteenth the Swats were nearly exterminated.

SWAZILAND, swä'zé-länd. A small Kaffir country in South Africa under British rule, bounded by Portuguese East Africa (Lourenço Marques), Natal (Tongaland), and the Transvaal Colony (Map: Transvaal Colony, H 5). Area, about 8500 square miles. The region is mountainous. The Lebombo chain lies on the east, the Drakensberg on the west. The general elevation is given as about 5000 feet. Swaziland is well watered, and is a fine grazing country. It is considered also well adapted for farming. There is much rich soil and the climate is healthful. The forests are large and valuable, possessing rare varieties of woods. Its gold deposits are now being mined. Copper, coal, and tin are said to exist. The British resident commissioner has his seat at Bremersdorp. The population is about 70,000, the Europeans numbering 1600. Swaziland became an independent State in 1843, its people having thrown off the yoke of the Zulus. In 1894, by convention between the Boers and British, the region came under the rule of the South African Republic (Transvaal), with whose downfall the sovereignty passed to Great Britain.

SWEARING, PROFANE. See BLASPHEMY.

SWEAT (AS. *swāt*, OHG. *sweiz*, Ger. *Schweiss*, sweat; connected with Lat. *sudor*, Gk. *ἱδρώς*, *hidrōs*, Lith. *swidrs*, Skt. *svēda*, sweat). The fluid that is excreted through the pores of the skin; perspiration. The nature, composition, and uses of this fluid in the normal state have been noticed in the article on SKIN (q.v.). The sweat is diminished in amount in many febrile diseases, especially if the temperature is high and prolonged. *Anidrosis*, as this condition is called, accompanies diseases in which there is a profuse discharge of fluid from the kidneys, as in diabetes, or from the bowels or stomach. In anasarca or general œdema and myxœdema sweat is diminished from stretching of the skin. Certain drugs, as belladonna and strychnine, markedly diminish the amount of sweat; others, notably pilocarpine, increase it. Profuse sweating (*hyperidrosis*) occurs in acute rheumatism, Asiatic cholera, and certain adynamic fevers, the sweating stage of malaria, the advanced stages of pulmonary phthisis, and septicæmia. Certain ailments are characterized by localized sweats; for example, the hands and feet in conditions of general debility; the head in rickets; and unilateral or one-sided sweating of the head or face or body in some nervous diseases, or from pressure on the sympathetic nerves by thoracic aneurism. The composition and color of the sweat may in rare instances undergo remarkable alterations. When through disease the action of the kidneys has become impaired the sweat has sometimes a urinous odor and deposits white scales or urinary solids upon the skin. This is known as *uridrosis*. *Bromidrosis* is an affection of the sweat glands characterized by offensive-smelling perspiration.

SWEATING SICKNESS. An extremely fatal epidemic disease which prevailed in Europe, and especially England, during the fifteenth, sixteenth, and early part of the seventeenth centuries. From the fact that the English people both at home and abroad were chiefly attacked, the malady was known as the 'English sweat' or 'English ephemera.' It first appeared in August, 1485, in the army of Henry VII. shortly after his arrival in Wales from France to fight the battle of Bosworth, and in a few weeks it had spread to London. It was a violent inflammatory fever, attacking as a rule robust, vigorous men, and characterized by a short chill, painful oppression over the epigastrium, headache, stupor, and a profuse fetid sweat. The disease took its course in about twenty-four hours. The patient suffered profound prostration and intense internal fever, but refrigerants seemed only to do harm. This epidemic lasted about a month, but during this short period many thousands died. The disease returned to England in 1506, 1517, 1528, and 1551. The epidemic of 1528 was particularly severe and was long referred to as 'the great mortality.' It raged over Europe—Germany, the Netherlands, Denmark, Sweden, Norway, Poland, Lithuania, and Livonia were all attacked.

In Hanover alone 8000 persons died. After 1551 no further epidemic occurred until the beginning of the eighteenth century. Since that time numerous outbreaks have been noted, but in a milder form. The disease is nearly always prevalent in some part of the world, most frequently in France (Picardy) and Italy, under the more modern name of *miliary fever*. (See MILIARIA.) In Germany it is still known as the 'English sweat.' As now observed, the disease is characterized by fever, profuse sweats, and an eruption of miliary vesicles. As in influenza a large number of people are attacked, but the epidemic lasts sometimes not more than seven or eight days, and the mortality is not high. For full historical accounts of the epidemics of the Middle Ages, consult Dr. Cains, *A Boke Against the Sweatyng Sicknesse* (1552); Hecker, *Epidemics of the Middle Ages* (*Sydenham Society Transactions*); Hirsch, *Geographical and Historical Pathology* (*new Sydenham Society Transactions*, vol. i.); and Creighton's *History of Epidemics in Britain* (1891).

SWEATING SYSTEM. The practice pursued by certain manufacturers, particularly of clothing, of giving out piece work to individuals on which the work is to be done at home and at starvation wages.

The system is a survival of the household form of industry that still exists in certain trades in large cities. The term 'sweater' was used first by journeymen tailors in London, who worked long hours. As more work was given out, the home worker employed his family and outsiders, and thus a system of sub-contract developed in which the middleman was called the sweater. To-day 'the sweating system' designates the fag end of all industries where low wages and bad conditions prevail. The work is on a cheap grade of goods, principally cigars, bread made in cellars, candy, and garments. The people sweated belong to a low class of unskilled labor, generally foreign born. The sub-contractors usually are Jews.

Evils of the sweat shop are long hours—ten to eighteen hours a day, including Sunday; overcrowding in the shops and surrounding tenements; unsanitary conditions in the work rooms and tenement houses, lacking in light, air, and cleanliness; child labor, very young girls and boys often running the machines; disease and deformity brought on by confinement and dust; irregularity of the work; and poor pay. The chief causes of the sweating system are (1) the excessive supply of unskilled labor; (2) an economic advantage to large dealers, in having their work done in small shops, thereby saving rent and evading factory laws, in cheap labor, in the inability of isolated workers to combine, and in the irregularity of work; (3) finally, the irresponsibility of employers, and the indifference of the public.

Among proposed remedies may be mentioned (1) stringent legislation, backed by public opinion, to force these kinds of work into large shops and factories; (2) coöperative production; (3) trade unions for unskilled workers; (4) public workshops; (5) restriction of foreign immigration; (6) an eight-hour day; (7) consumers' league. Factory laws of Ohio, Massachusetts, Illinois, and New York require licenses, or permits, for tenement houses, and also require the registering and describing rooms in which work may be done. Massachusetts only enforces such laws successfully; and she cannot protect herself against sweatshop goods from elsewhere.

BIBLIOGRAPHY. Banks, *White Slaves* (Boston, 1892); Hobson, *Problem of Poverty* (London, 1891); *Hull House Maps and Papers* (New York, 1898); *American Social Science Association Journal*, 30, 57; *United States Labor Commission Bulletin IV.* (May, 1896); *Factory Inspectors' Report* (Illinois, 1895-96). See CONSUMERS' LEAGUE; LABOR PROBLEMS; FACTORIES AND THE FACTORY SYSTEM; FACTORY INSPECTION.

SWE'DEN (Sw. *Sverige*). The eastern and larger part of the Scandinavian peninsula. It is separated from Denmark on the southwest by the Cattegat and on the west, north, and east is bounded by Norway, Finland, and the Baltic Sea. It extends from latitude 55° 20′ N. to 69°, and from longitude 11° E. to 24°. Area, 172,876 square miles. In several physical aspects it differs much from Norway. It contains more level land and is more fertile and therefore adapted to support a larger population. Its coasts are not so deeply indented; its climate is continental instead of oceanic; and its harbors may be blocked with ice for five months, while those of Norway are unfrozen. Sweden comprises three main divisions. The northern half, which is very scantily inhabited, is called Norrland. The southern half comprises Svealand (Svearike), in the north, and Gotland (Götarike), in the south.

TOPOGRAPHY. The area of all the islands that are a part of Sweden is about 3000 square miles. A group of islands without mountains or vegetation skirt the Cattegat north of Göteborg; and north of Kalmar, on the Baltic side, are many islets, chiefly low rocks in shallow water, the continuation seaward of the Swedish plain. Two large islands in the Baltic lie off the southern or peninsular part of Sweden. The smaller, Öland, a narrow strip of land, 80 miles long, was once a part of the chalk shore of the mainland, from which it is separated by only two miles at the narrowest part of Kalmar Sound. The other, Gotland, is farther at sea, but connected with the mainland by a submarine bank. Only a comparatively small part of Sweden is very mountainous —the portion lying along the Norwegian border. The frontier region is not all mountains, but a part of it is a high and bleak plateau. (See *Topography* in NORWAY.) The greatest heights are in the northwest, Kebnekaisse being 7004 feet. In the south is a hilly district rising from a plateau that is several hundred feet above the surrounding plains of the coast, and is separated from the mountains of the north by the great depression occupied by the southern lakes. Most of the remainder of Sweden is a plateau sloping rapidly from the mountain fringe to a plain which stretches along the east coast to the southern extremity of the country, and which includes the fertile lowlands of Gotland, strewn with erratic boulders, where the largest and most productive farm lands are found.

HYDROGRAPHY. Sweden is well watered and is rich in lakes. Many rivers flow from the mountains southeast to the Gulf of Bothnia or the Baltic, affording much water power, but little navigation, on account of their rapid fall. They pass through many lakes, particu-

larly in the upper part of their courses, and the lakes have the effect of equalizing the floods so that the rivers are quite regular in their discharge. The numerous falls and rapids give picturesque charm to the rivers. The Klar Elf ('large stream'), the largest river, flows south into Lake Vener. The Göta Elf, which discharges the waters of Lake Vener into the Cattegat, is more important, because its falls and rapids have been circumvented by canals, making it a part of the waterway system of South Sweden. The principal river emptying into the Baltic is the Dal Elf. Many of the Swedish lakes are large and beautiful, and are distinguished by the clearness of their water and their picturesque surroundings. The four great lakes of the country lie in the depressed area north of the plateau of Southern Sweden. Lake Vener, the largest of them, is the third largest in Europe (over 2000 square miles). Lakes Vetter (about 700 square miles), Hjelmar, and Mälar (about 670 square miles) drain into the Baltic.

CLIMATE AND SOIL. As the western mountains shut off the tempering influence of the Atlantic, the climate is much colder than in Norway. The country being in the latitude of Labrador, the summer is short and the winter is cold and long. At Stockholm the mean temperature in January is about 25° F. and in July about 61°. The climate of Sweden is very healthy. The mountains prevent the greater part of the precipitation from reaching the eastern plateaus and plains, so that the mean rainfall in Sweden is only about 20 inches. The greatest rainfall is on the southwest coast, facing the Cattegat, where the average is 35 inches annually. The country is almost completely covered with snow in winter, when snow traveling on ski, or long wooden runners attached to the feet, is a favorite amusement. The splendid and extensive forests and the farms of Gotland and Scania, where the grain fields return as much to the acre as in England, show that the soils of the central and southern parts of the country are not deficient in fertility.

FLORA. Forests cover about two-fifths of the country, pines and firs predominating, and extend beyond the Arctic Circle. Over 2000 European plants have their northern limit in the Scandinavian peninsula. In Sweden beeches are found only in the extreme south, the oak disappears a little north of Stockholm, while the pine, fir, and alder extend nearly to the limit of arboreal vegetation. The forests of the southern plains differ little in appearance from those of the more temperate parts of Europe, but farther north, in the region of prevailing conifers, the labyrinth of moss-covered boulders, amid which the towering trees rise, where even a path is scarcely possible, gives a special character to the woodlands. The Dal Elf, north of Stockholm, is practically the northern limit of wheat, but barley is grown to the Arctic Circle.

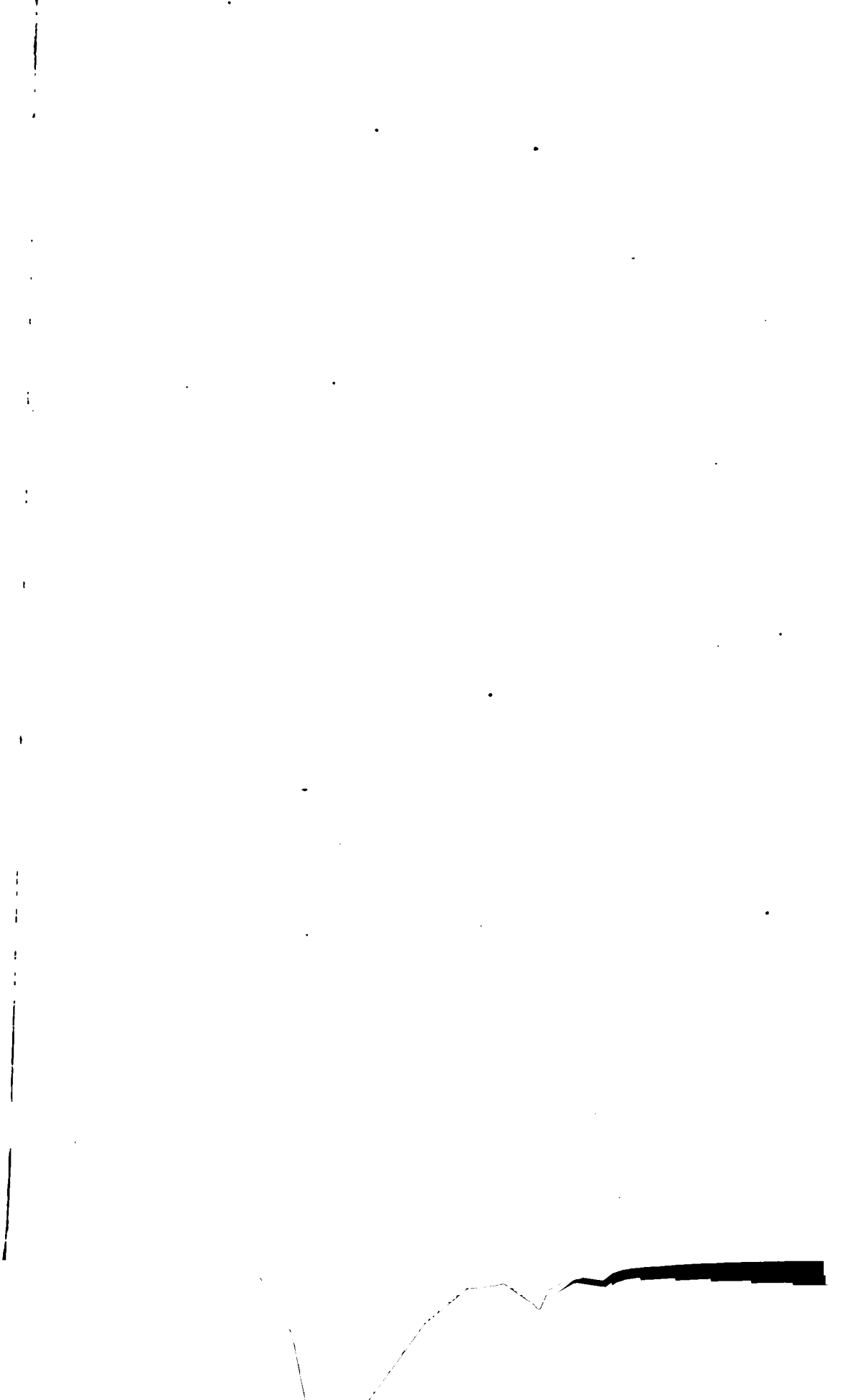
FAUNA. The bounties paid for bear, lynx, wolf, and fox skins and for birds of prey have resulted in nearly exterminating the leading wild animals. The beaver and hare survive, but the wild reindeer is no longer found. Fish are much less abundant in Swedish than in Norwegian waters.

GEOLOGY AND MINERAL RESOURCES. Archæan rocks are predominant, and in some districts, especially around the great lakes, they are overlaid by Cambrian and Silurian formations. In large areas also the ancient rocks are covered by extensive glacial deposits of clay, sand, gravel, and erratic boulders. Triassic, Jurassic, and Cretaceous rocks appear only in Scania, in the extreme south. Some time after the glacial epoch the Scandinavian peninsula subsided till the sea level, in relation to the land, stood 500, 700, and in some places 1000 feet higher than before, as is shown by marine deposits resting on rocks that had been scarred by glacial ice. Then the land began to rise again and the gradual upheaval is still in progress. The movement is best observed, of course, along the coasts. It is nowhere so rapid as on the Swedish side of the Gulf of Bothnia, and it is most rapid at the northern extremity of the Gulf, where the upheaval is estimated at about 5 feet in the past century. In the extreme south no change of level has been observed. Thus the Gulf of Bothnia appears to be slowly draining into the southern basin of the Baltic.

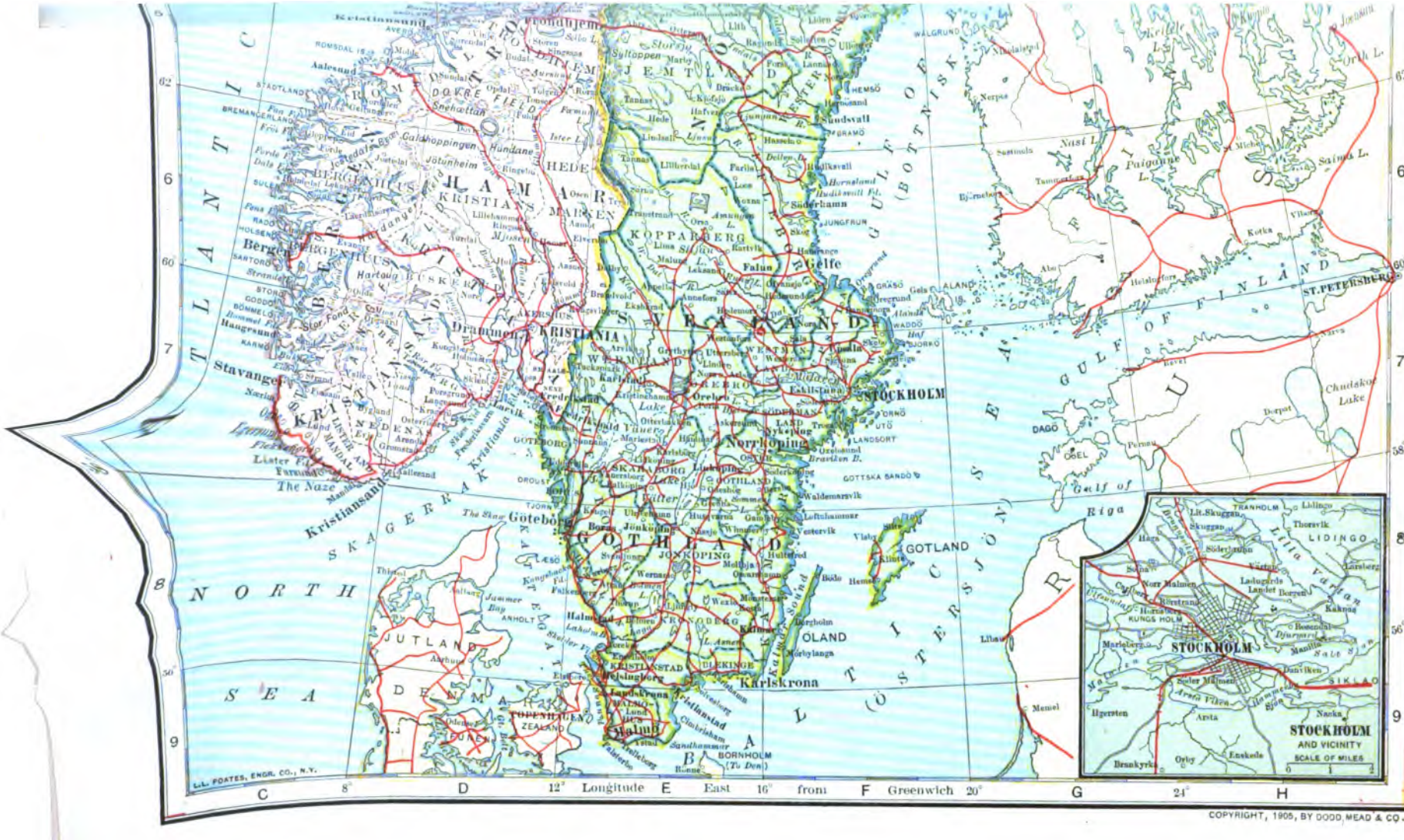
The mining industry competes with difficulty against the powerful rivalry of the leading European countries, although it is more important than that of Norway. Sweden is poorly supplied with coal (only 271,509 tons having been mined in South Sweden in 1901). Manufacturers are compelled to import coal or use charcoal. The most important and valuable mineral product is iron. In 1901 2,793,566 tons of iron ore were mined in the kingdom. While about 1,000,000 tons are mined every year near Gefle, Falun, and Dannemora, the largest supply comes from Gellivare (q.v.), 130 miles north of the Arctic Circle. Swedish iron is regarded as unsurpassed in the world, as it is almost entirely free from phosphorus (.05 per cent. or less), and is therefore of superior value for the manufacture of steel. For this reason it now rivals the ores of Spain in British and German markets, and large quantities are exported. Magnetite and manganese ores (2271 tons of manganese in 1901) used in steel-making also abound. The copper industry of Falun was long widely renowned, but the yield was formerly much larger than at present (23,660 tons of ore in 1901). Three-fourths of the total yield of zinc ore (48,630 tons in 1901) is produced at the Ammeberg mines, on the north side of Lake Vetter. The silver product in 1901 was 1557 kilograms, and the yield of lead was 988,396 kilograms. The number of persons engaged in mining declined from 35,000 in 1890 to 30,776 in 1901.

AGRICULTURE, LIVE STOCK, AND FISHERIES. Three-fourths of the population support themselves by agriculture, though only about 8 per cent. of the land area is under cultivation. Hay meadows and pastures cover 4 per cent. of the surface, forests 44.2 per cent., and 43.6 per cent. is unproductive. In 1900, 388,416 farms were

	Area	Yield
Wheat	192,413	4,726,700
Rye	1,015,417	21,447,900
Barley	537,225	12,954,425
Oats	2,037,503	55,210,375
Mixed grain	320,606	8,372,925
Pulse	114,114	1,612,325
Potatoes	381,862	44,841,775




NORWAY
AND
SWEDEN
SCALE OF STATUTE MILES
0 25 50 75 100 125 150
NORWEGIAN SEA
ARCTIC CIRCLE
NORTH SEA
Kristiansund
TRONDHEIM
NORRBOTTEN
WESTERBOTTEN
LAPLAND
Tromsö
Hammerfest
Sulitelma
Kebnekaise
Torneå
Luleå
Umeå
Piello L.
Enare L.
Uleå L.
Kemi L.
Kemijok
Muonio R.
Torne R.
Kalix R.
Lule R.
Ume R.
Pasvig R.
Pasvigvand L.
Paranger Fjord
Porsanger Fjord
North Cape
RIBACHI PEN
Alexandrovsk


NORTH SEA
ATLANTIC OCEAN
SKAGERRAK
KATTEGAT
GULF OF BOTHNIA
GULF OF FINLAND
BALTIC SEA
Kristiansand
Trondhjem
Aalesund
Bergen
Stavanger
Drammen
KRISTIANIA
Hamar
Lillehammer
Gjövik
Hartwig
Dovre Fjeld
Snehættan
Galdhoppingen
Hundane
Jötunheim
Jostedals Br.
Hardanger Fd.
Sognefjord
Fjærlandsfjord
Nordfjord
Romsdal Fjord
Storfjord
Sulen
Hjörundfjord
Geirangerfjord
Romsdal Is.
Stadtlandet
Bremangerland
Fruholmen
Utsire
Lister Fyr
Farsund
Mandal
Lindesnæs
The Naze
Kristiansand
Arendal
Risör
Langesund
Porsgrund
Skien
Brevik
Fredrikstad
Frederikshald
Lake Yttern
Lake Wener
Lake Wetter
Lake Hielmar
Lake Mälar
Lake Hornborga
Lake Roxen
Lake Asunden
Lake Tåkern
Lake Vettern
Lake Siljan
Lake Storsjö
Lake Malaren
Lake Ladoga
Lake Onega
Lake Saima
Lake Peipus
Lake Chudskoi
Lake Pskov
Lake Ilmen
Lake Enare
Lake Kitka
Lake Paiguine
Lake Nast
Lake Orlk
Lake Jeman
Lake Kemi
Lake Kuito
Lake Kuolajarvi
Lake Kitka
Lake Kemijarvi
Lake Kuolajarvi
Lake Kuito

under cultivation, of which about two-thirds were from 5 to 45 acres in extent. The preceding table shows the area (in acres) under the chief crops in 1900 and the yield (in bushels).

The largest and most productive area of farm lands is in East and West Gotland and Scania, in the south of the country. In spite of the improvement in farming in recent years, especially through the importation of modern farm machinery and implements, the country cannot produce wheat and rye enough for home consumption, and about 12,000 tons of breadstuffs more than the kingdom produces are brought in every year, chiefly from the Baltic countries. Nearly half the total grain raised is oats, which is an export crop. The sugar beet thrives in the extreme south, but the acreage given to it is not sufficient to supply the demand for sugar. Flax, tobacco, and hops are cultivated with much success. At the end of 1900 Sweden had 533,050 horses, 2,582,555 head of cattle, 1,261,436 sheep, and 805,805 hogs. Great quantities of butter are exported to Great Britain. The Government has done much to improve agriculture by founding schools of agriculture and by the appointment of peripatetic teachers. The fisheries are important, though much inferior to those of Norway. They do not suffice for the needs of the country. On the other hand, the timber trade is of much greater value than that of Norway.

MANUFACTURES. Although the manufacturing industries have been stimulated in every way by the Government and have made great progress, Sweden is still largely dependent upon foreign countries for most of these commodities. The kingdom lacks the coal, population, and capital for the most successful development in this respect. The industrial advance, however, has been most substantial, as is seen from the following comparisons: From 1896 to the close of 1901 the number of manufacturing establishments increased from 8812 to 10,904; the workpeople in them from 202,293 to 262,229; and the total value of the product from $192,487,400 to $285,010,200. The sawmills in 1901 contributed 13.53 per cent. of the total value of product; flour mills, 7.70 per cent.; textile mills, 5.22 per cent.; machine shops, 5.14 per cent.; and iron and steel manufactures and foundries, 5.01 per cent. The timber industry in all its branches, including wood pulp, is the leading manufacturing industry. The public forests (area, 18,830,000 acres) yielded in 1899 timber valued at $20,085,650. In 1900 43,312 work people in 1148 saw and planing mills produced lumber worth $43,589,544; furniture and other woodwork were also large products. Swedish matches, everywhere famous, are produced chiefly at Jönköping, where one factory employs 1500 hands. There are woolen and cotton factories at Norrköping, Stockholm, and Göteborg, but the manufacture of linen, a household industry, is the only branch of textile manufacture which meets the domestic demand. The most famous iron works are near Eskilstuna and the chief machine shops at Motala. Swedish bar iron, steel goods, blades, armor plates, cables, nails, and knives are highly esteemed.

COMMERCE. The average annual trade (in million dollars) is as follows:

	1881-85	1891-95	1898	1900
Imports	85.5	97.5	122.0	143.3
Exports	67.5	88.5	92.4	104.8

The kingdom sells abroad the abundant product of its forests, iron and zinc mines, dairies, and oat fields. Its home supplies of textiles, wool, machinery, railroad iron, and many other things are inadequate, and it must supplement them by foreign purchases. The following table gives the value in kronor of the leading imports and exports for two years (a krona equals in value 26 7-10 cents):

	Imports 1899	Imports, 1900	Exports, 1899	Exports, 1900
	Kronor	Kronor	Kronor	Kronor
Textile manufactures	46,738,248	41,958,659	1,579,218	1,544,852
Grain and flour	49,327,777	51,793,392	4,850,060	2,145,094
Groceries	38,634,760	45,584,093	135,289	336,180
Raw textile material and yarn	47,818,471	46,165,793	1,252,671	1,502,842
Minerals, of imports mostly coal	82,388,362	104,052,262	21,421,309	22,518,863
Metal goods, machinery, etc	74,605,197	65,009,836	22,585,054	25,316,543
Live animals and animal food	23,542,296	29,195,718	48,128,649	43,161,578
Hair, hides, and other animal products	24,459,229	20,438,630	4,300,564	5,370,750
Metals, raw and partly wrought	13,159,371	25,556,124	43,513,013	52,395,087
Timber, wrought and unwrought	4,751,465	5,925,996	178,553,581	200,559,375
Paper and paper manufactures	4,745,770	4,407,698	11,706,764	14,392,265
Other articles	94,617,737	94,846,909	20,158,575	22,090,583
Total	504,788,683	534,935,110	358,184,767	391,333,962

The trade of Sweden is chiefly with the countries bordering on the Baltic and North Seas. The value of its trade in two years with the leading countries in its commerce was:

COUNTRY	Imports from (1899)	Imports from (1900)	Exports to (1899)	Exports to (1900)
	Kronor	Kronor	Kronor	Kronor
Great Britain	154,563,118	176,504,553	157,198,342	169,248,313
Germany	124,113,227	137,897,874	54,960,864	65,244,540
Denmark	60,681,189	62,525,129	43,298,276	47,682,183
Norway	20,449,964	21,761,911	6,451,052	7,186,593
Russia (including Finland)	28,502,181	34,358,984	15,861,424	14,027,846
France	8,992,214	9,692,566	29,065,568	29,807,333
Spain	1,767,701	1,736,294	2,851,295	3,649,832
Netherlands	10,390,719	11,184,942	25,686,540	29,941,211
Belgium	16,804,527	18,186,404	13,783,461	14,839,185

The exports of the United States to Sweden and Norway in 1899 were $10,000,000, and the imports were $4,000,000; in 1901 the exports to Sweden and Norway were $11,000,000 and the imports were $3,600,000. Among the things that the United States sells to these countries are provisions, wheat, machinery, tools, and cotton.

TRANSPORTATION AND COMMUNICATION. Railroads are cheaply built because of the small cost of land, lumber, and iron. Uninterrupted rail communication extends between Gellivare in the north and Malmö in the south, over 1200 miles. A line has been constructed from Gellivare to Ofoten Fiord, Norway, giving the iron ore of North Sweden an outlet on the Atlantic coast. The total length of railroads in 1900 was 7023 miles. Southern Sweden has an excellent system of waterways by which a series of canals and canalized rivers unite the great lakes with both the North and Baltic seas, providing about 2500 miles of interior navigation. In 1900, 100,806 ships and boats passed through the canals. Swedish trade, like that of Norway, is predominantly maritime, and Swedish vessels are engaged both in the home and foreign trade. The mercantile fleet in 1901 comprised 2987 vessels, of 613,792 tons, including 911 steamers, of 325,105 tons. Göteborg is the principal port, with Stockholm, Malmö, and Helsingborg following.

BANKING. The National Bank of Sweden (Riksbank) belongs to the State, regulates financial relations with foreign countries, receives private accounts, and lends money on security to non-speculative enterprises. The bank is under the guarantee of the Diet, its capital and reserve are fixed, and its note circulation is limited by its metallic stock and its current accounts. Its actual circulation is kept far within the authorized limit. The assets and liabilities of the Swedish banks balanced (in kronor) on January 1, 1902, as follows: National Bank, 245,255,457; private banks, 874,039,400; joint-stock banks, 581,424,650.

GOVERNMENT. Since 1814 Sweden has been united with Norway under a common king, but each is in effect a separate kingdom with its own government. The fundamental laws of Sweden have never been embodied in any single written constitution, but consist of various enactments of the Diet from 1809 to 1866. By the fundamental laws a limited monarchy is constituted, at the head of which is a king, who is required to be a member of the Lutheran Church and who is bound by oath to observe the laws of the land. By the law of succession women are excluded from the throne. In case of failure of succession the King is to be chosen by the Swedish and Norwegian Diets acting separately. The King has the exclusive right of legislation as regards trade, commerce, manufacturing, mines, and forests. He is also empowered to issue police regulations and to make rules concerning vagrancy, sanitation, protection against fire, etc. In legislating on other matters he must act with the consent of the Diet. He possesses the right to declare war and make peace upon the advice of a Council of State representing both monarchies. He nominates higher officials, military and civil, negotiates treaties with foreign countries, and presides in the Supreme Court. He is advised and in some manner assisted by a Council of State consisting at present of eleven Ministers, at the head of which is the Minister of State. They have seats in the Diet with the privilege of debate and the right to initiate legislation. They sometimes resign in case of serious disagreement with the Diet, but the principle of Ministerial responsibility is not yet freely recognized.

The National Parliament or Diet (Riksdag) consists of two Chambers, both of which are representative in principle. The Upper Chamber consists at present of 150 members chosen for a term of nine years by the provincial legislatures (*Landstings*), 25 in number, and by the municipal governments of those towns which are not represented in the provincial assemblies. These towns are Stockholm, Göteborg, Malmö, Norrköping, and Gefle. The members are distributed on the basis of one to every 30,000 of the population, and are required to be 35 years of age and in the possession for at least three years prior to their election of property of the taxable value of about $22,000, or an annual income of about $1100. They receive no compensation for their services. The Lower Chamber consists at present of 230 members chosen for a term of three years. Of these, 80 are chosen by the towns and 150 by the rural districts. The rural members are distributed on the basis of one member to every 40,000 inhabitants, while the towns are allowed one member for every 10,000 of the population. All native Swedes 21 years of age possessing property of the taxable value of about $280, or who cultivate for a period of five years a certain amount of land, or who pay an annual income tax on an income of about $225 are qualified voters. Any elector twenty-five years of age is qualified for membership in the Lower Chamber. The number of electors in 1899 was 339,876, less than 7 per cent. of the population, and but 40 per cent. of these actually voted. The members of the Second Chamber receive compensation.

The union of Norway and Sweden under the same executive makes necessary some provision for the administration of those affairs which are common to both monarchies, such as the conduct of their foreign relations. In this domain the King is given power to act for both countries, but his action is subject to the approval of the joint Council of State. Thus he may declare war and make peace, send and recall ambassadors, use ships of war, etc., with the consent of the joint council. This does not, however, destroy the individuality of either nation as regards foreign affairs, since the King may conclude treaties which affect but one of his kingdoms. Matters of common interest not within the power of the King are regulated by concurrent action of the two Diets. For the purposes of local administration Sweden is divided into 24 läns or provinces, each under the supervision of a prefect nominated by the King. In each province there is a general council or *Landsting*, which regulates internal affairs. The city of Stockholm, the capital, constitutes a separate administrative division. In the communes there is almost complete local self-government, all taxpayers being voters. Some of the communes have primary assemblies very much like the town meetings of New England, while those which are larger and more populous have municipal councils. In the parishes there are local assemblies for regulating ecclesiastical affairs.

FINANCE. The sources and amount of revenue and the expenditures for 1902 and 1903 were as follows:

REVENUE	1902	1903
	Kronor	Kronor
Domains, railways, land taxes, etc.	21,578,000	26,546,000
Customs	49,000,000	48,500,000
Post	12,400,000	13,340,000
Stamps	6,500,000	6,500,000
Impost on spirits, beet sugar, etc.	30,000,000	32,000,000
Tax on incomes, etc.	10,500,000	26,950,000
Net profit of the National Bank	2,000,000	2,716,200
Surplus from the previous years	24,165,000	15,916,000
Total revenue	156,143,000	172,468,200

EXPENDITURE	1902	1903
	Kronor	Kronor
(a) Ordinary:		
Royal household	1,321,000	1,321,000
Justice	3,852,420	3,911,815
Foreign affairs	652,050	659,150
Army	33,775,094	37,204,600
Navy	10,461,982	11,865,917
Interior	19,319,100	25,015,315
Education and ecclesiastical affairs	13,721,011	14,115,333
Finance	7,299,821	7,338,705
Agriculture	4,680,915	4,859,600
Pensions	3,649,115	3,786,632
	98,732,508	110,078,067
(b) Extraordinary	43,872,492	40,466,033
(c) Expenditure through the Riksgäldskontor:		
Payment of loans and miscellaneous (diet, etc.)	11,888,000	13,774,100
Carried to floating capital	.....	6,500,000
Fund for insurance against invalidity of workmen	1,400,000	1,400,000
Fund for insurance against accidents of workmen, etc.	250,000	250,000
Total expenditure	156,143,000	172,468,200

On January 1, 1902, the public liabilities, contracted entirely for railroads, were 349,132,333 kronor, bearing interest at from 3 to 4 per cent. All loans are paid off gradually by means of sinking funds.

WEIGHTS, MEASURES, AND MONEY. Gold is the standard of value. The krona, the unit of coinage, is worth 26 7-10 cents. The metric system of weights and measures became obligatory in 1889.

ARMY AND NAVY. See articles ARMIES and NAVIES.

POPULATION. The population, according to the census of 1901, was 5,175,228. The density of population is 30 to the square mile. The growth of population has been as follows: in 1800, 2,347,303; in 1840, 3,138,887; in 1870, 4,168,525; and in 1890, 4,784,981. The emigration, chiefly to America, has been large for many years, and since 1894 has varied from 8000 to 19,000 a year.

RELIGION. The Lutheran Protestant Church is recognized as the State religion, and most of the people are professors of that faith, its adherents numbering 4,735.218 in 1890. Other Protestants numbered 44,375 and there were a few followers of the Roman Catholic and other faiths. In the State Church are 12 bishoprics and 2572 parishes.

EDUCATION. Education is maintained at a high level. It is under the control of the Government, is compulsory, and practically all the inhabitants of school age and over can read and write. The secondary schools and the universities are modeled on the German system. In 1902 there were 1434 students in the University at Upsala and 644 in the University at Lund. The schools included in 1901: 79 public high schools, 18,085 pupils; 29 people's high schools, 1510 pupils; 14 normal schools for elementary teachers, 1325 pupils; 2 high and 6 elementary technical schools; 10 navigation schools, 729 pupils; and besides schools for deaf-mutes and the blind, medical, military, agricultural, veterinary, forestry, weaving, mining, and other special schools. In 1900 the expenditure on elementary education was 23,097,746 kronor, of which about one-fourth came from the national treasury.

ETHNOLOGY. The Swedes belong to the Scandinavian branch of the Teutonic stock. Their average stature is 1.705 meters, classing them among the tall races; the average cephalic index is 78.2. The Swedes are blondes, sturdy and robust. Prehistoric culture came from the South. In the settlement of Sweden the Goths or Gotar were the first conquerors of whom history tells. They occupied the southern parts, and following them came the Svear, who overran the rest of the country and gave their name to the Svenskar or Swedes of to-day. The Dalecarlians are thought to preserve best the type of the Svear; they are described as tall, slender, and agile, with blue eyes and broad, open brow, courteous, cheerful, and firm, and with a wide reputation for honesty.

HISTORY. Tacitus in the *Germania* tells of the two great Germanic tribes in the Scandinavian peninsula, the Suiones, or Swedes, in the north, and the Gothones, or Goths, in the south. These two, like other rival Germanic tribes, seem to have been generally at war with each other, and it was not until about the fourteenth century that the country was really organized and unified through the cessation of jealousy between the two sections. The ancient Swedish people had a bond of union in their religion and a common sanctuary at Upsala, which was the early centre of Swedish nationality. The history of Sweden previous to the tenth century is wrapped in obscurity. In the first half of the ninth century Ansgar (q.v.), a Frankish missionary, came to Sweden from Denmark, and began the teaching of Christianity, which slowly became established in the country. Under Eric the Saint (1150-60) the Swedish power was strengthened and extended and Christianity with it. Churches were built and monasteries founded. Eric carried Christianity into Finland with the sword and established Swedish settlements in that country, whose subjugation, however, was not completed

until more than a century after his death. He was defeated and killed in 1160 by the Danish prince Magnus Henriksen, who made an unprovoked attack upon Sweden, the beginning of a long series of wars between Sweden and Denmark, productive of national hatred and bitterness. The reigns of the early Swedish kings were short and stormy. In 1389 the Swedish nobles, disgusted with the conduct of their King, Albert of Mecklenburg, offered the crown to Margaret, Queen of Denmark and Norway, daughter of Valdemar IV., who defeated and dethroned Albert, and in 1397 brought about the union of Kalmar, by which the three Scandinavian kingdoms were henceforth to remain united under a single sovereign. This union continued with interruptions for more than a century, but with constant dissensions and wars between Denmark and the Swedish people. The Swedes themselves were divided between the upholders of national sovereignty and the supporters of the pretensions of the Danish kings. In the latter part of the fifteenth century the family of Sture (q.v.) rose to eminence in the struggle for national independence, Sten Sture, the Elder, being proclaimed administrator of the kingdom in 1470. In 1520 Christian II. of Denmark invaded Sweden to enforce his claim to sovereignty. The administrator, Sten Sture, the Younger, was defeated and mortally wounded and Christian entered Stockholm, where he enacted a carnival of blood, executing a large number of the nobles. Sweden soon rose against the tyrant (1521) under the lead of Gustavus Vasa, who was made administrator. He shook off the hated yoke of Denmark and in 1523 became King of Sweden. In 1529 Lutheranism was formally established as the State religion of the kingdom. Gustavus Vasa organized the kingdom as a hereditary monarchy, in which the power of the nobles was circumscribed and that of the clergy subordinated to that of the State. He fostered trade, manufactures, art, learning, and science, and left a full exchequer, a standing army, and a well-appointed navy.

The great work of the first Vasa sovereign was almost undone by his son and successor, Eric XIV. (1560-68), who became insane and was deposed, being succeeded by his brother, John III. At the beginning of Eric's reign Esthonia, a fragment of the dominions of the Knights Swordbearers, submitted to Sweden. The reign of John III. (1568-92) was notable for a reaction toward Catholicism. He had married Catharine Jagellon, of the Polish royal house, and in 1587 secured the election of his son Sigismund to the throne of Poland. For this Sigismund had to profess Catholicism. The great majority of the Swedes were strong Protestants, and when Sigismund succeeded his father as King of Sweden and attempted to restore Catholicism he was compelled by the Diet to resign the throne in 1599. His uncle Charles, the only one of Gustavus Vasa's sons who inherited his talents as a ruler, was made administrator of the kingdom and in 1604 was crowned King as Charles IX. The policy of Charles IX. was to encourage the burgher classes at the expense of the nobility; and by his successful efforts to foster trade—in furtherance of which he laid the foundations of Göteborg and other trading ports—to develop the mineral resources of the country, and to reorganize the system of Swedish jurisprudence, he did much to retrieve the calamitous errors of his predecessors. (See CHARLES IX.) The deposition of Sigismund gave rise to a long war with Poland. Charles was succeeded by his son, Gustavus II. Adolphus (1611-32). This greatest of Swedish kings was confronted at the beginning of his reign by wars with Russia, Poland, and Denmark, which last-named power still owned Scania and other districts at the southern extremity of the Scandinavian Peninsula. These wars were concluded advantageously for Sweden, which acquired Ingria, Karelia, and Livonia (the last-named not formally renounced by Poland until 1660), and the King addressed himself to the task of making Sweden the dominant power on the Baltic. In 1630 Gustavus Adolphus came to the rescue of German Protestantism, which had succumbed to the arms of Tilly and Wallenstein. (For his victorious career in Germany, and the successes of the generals who were trained in his school, see the articles GUSTAVUS II. ADOLPHUS, and THIRTY YEARS' WAR.) The foreign policy of Gustavus Adolphus was continued after his death at Lützen in 1632 by his able chancellor, Oxenstierna (q.v.), who directed the government during the minority of Gustavus's gifted but eccentric daughter Christina (1632-54). As a result Sweden was for nearly a century the great power of the north. By the Peace of Westphalia (1648) Sweden received Hither Pomerania (west of the Oder), the island of Rügen, and other territories in Germany, and was admitted to representation in the German Diet.

Charles X. Gustavus (1654-60) waged a fierce war against the Polish King, John Casimir, in which the Swedish forces overran Poland. He conquered from Denmark the provinces of Scania, Halland, and Blekinge, which rounded out the Swedish boundaries. The war with Poland was closed at his death by the Peace of Oliva (1660). Misgovernment by a regency followed during the minority of Charles X.'s son and successor, Charles XI. (q.v.) (1660-97). This King was involved as the ally of Louis XIV. in European wars, which the regency had not left him the resources to carry on. In 1675 the Swedes suffered a great defeat at the hands of Frederick William, the "Great Elector" of Brandenburg, at Fehrbellin. Charles XI. reorganized the government and was declared an absolute sovereign by the estates in 1693. His son, Charles XII. (1697-1718), by his military genius raised Sweden to an extraordinary pitch of power. Not long after his accession he successfully met a joint attack by Russia, Poland, and Denmark, dealing blows that astonished the world. His inordinate ambition, however, finally brought ruin upon Sweden. Peter the Great wrested from her Karelia, Ingria, Esthonia, and Livonia. Charles met his death in an invasion of Norway, leaving the kingdom overwhelmed with debts and again disorganized. With him the male line of the House of Vasa expired. His sister Ulrica Eleonora, who succeeded him, and her husband, Frederick of Hesse-Cassel, who shared the throne, were mere puppets of the nobles, whose dissensions as the factions of the 'Hats,' or French party, and the 'Caps,' or Russian party, brought on the country calamitous wars and almost equally disastrous treaties of peace. The weak

Adolphus Frederick of Holstein-Gottorp, who was called to the throne on the death of Frederick in 1751 and died in 1771, did little to retrieve the evil fortunes of the State. (See STRUENSEE.) His son, Gustavus III. (q.v.) (1771-92), skillfully availed himself of the general dissatisfaction of the people with the nobles, to destroy the factions of the Hats and Caps, and under a new constitution to restore the power of the Crown and of the popular estates at the expense of the nobles. His extravagance and dissoluteness detracted, however, from his merits as a ruler. He was assassinated in 1792. His son and successor, Gustavus IV. Adolphus (q.v.), was but three years of age at his accession, and was forcibly deposed in 1809, and obliged to renounce the crown for himself and his direct heirs in favor of his uncle, Charles XIII. (1809-18), who was compelled at once to conclude a humiliating peace with Russia, by the terms of which Finland was severed from Sweden. The early part of the reign of Charles, who was childless, was troubled by domestic and foreign intrigues to regulate the choice of an heir to the throne. Finally, hoping to conciliate Napoleon, the dominant party in Sweden elected General Bernadotte to the rank of Crown Prince. Bernadotte led the Swedish forces in support of the Allies against the French Emperor in 1813-14. With the aid of England, Sweden compelled Denmark, in January, 1814, to cede Norway to her, the Swedish possessions in Pomerania being handed over to Denmark. The Congress of Vienna (1814-15) recognized the union of Norway with Sweden; Swedish Pomerania passed to Prussia. In 1818 Bernadotte mounted the throne as Charles XIV. John (q.v.). Under his able administration the united kingdoms of Sweden and Norway made great advances in material prosperity and political and intellectual progress; and although the nation at large entertained very little personal regard for their alien sovereign, his son and successor, Oscar I. (1844-59), and his grandsons, Charles XV. and the present King, Oscar II., who came to the throne in 1872, won a large share of the affections of the Swedes. The great problem of the dual kingdom under the present sovereign has been to satisfy the demands of the Norwegians, who are more democratic than the Swedes and are restive under the union. See NORWAY.

BIBLIOGRAPHY. Höjer, *Konungariket Sverige* (Stockholm, 1872-84); Rosenberg, *Geografiskt-statistiskt handlexikon öfver Sverige* (ib., 1883); Nystrom, *Handbok i Sveriges geografi* (ib., 1895); id., *Sveriges rike* (ib., 1902); Du Chaillu, *The Land of the Midnight Sun* (New York, 1882); Hahn, "Schweden," in Kirchhoff's *Länderkunde von Europa* (Leipzig, 1890); Passage, *Schweden* (Berlin, 1897); Thomas, *Sweden and the Swedes* (Chicago, 1893); Healey, *Educational Systems of Sweden, Norway, and Denmark* (London, 1893); Gandolphe, *La vie et l'art des Scandinaves* (Paris, 1899); Nathorst, *Sveriges geologi* (Stockholm, 1894); Andersson, *Geschichte der Vegetation Schwedens* (Leipzig, 1896); Nordenström, *L'industrie minière de la Suède* (Stockholm, 1897); Strindberg and Sjögren, *Sveriges natur* (ib., 1901); Sundbärg, *La Suède; son peuple et son industrie* (ib., 1900; English trans., ib., 1903). HISTORY. Dunham, *History of Denmark, Sweden, and Norway* (London, 1840), a standard small work; Geijer and Carlson, *Geschichte Schwedens* (Gotha, 1844-75), the German edition of the principal Swedish History; Otté, *Scandinavian History* (London, 1874), is the chief work in English on this field; Geffroy, *Histoire des états scandinaves* (Paris), one of the useful series edited by V. Duruy; Save, *Sveriges historia under den nyaste tiden* (1890), popular; Cronholm, *A History of Sweden* (Chicago, 1902); and the standard works of Fryxell, Strinnholm, Malmström, Montelius, and Hildebrand.

SWE'DENBORG, *Sw. pron.* svā'den-bŏry', EMANUEL (1688-1772). A Swedish scientist and theologian. He was born in Stockholm and died in London. His father was Jesper Svedberg, subsequently Bishop of Skara. He was educated at Upsala, and traveled for four years in England, Holland, France, and Germany. On his return to Sweden he was appointed by Charles XII. to an assessorship of mines. Swedenborg was ennobled in 1719, and the family name changed from Svedberg to Swedenborg. Swedenborg published short treatises on various topics in the fields of mathematics, astronomy, physics, and chemistry. He devoted himself for eleven years to the duties of his assessorship and to a systematic description of mining and smelting, and the construction of a theory of the origin of creation. The result appeared at Leipzig in 1734, in three massive folios, entitled *Opera Philosophica et Mineralia*. This was followed in the same year by a treatise on *The Infinite, and the Final Cause of Creation; and the Mechanism of the Operation of the Soul and the Body*, carrying the doctrine of the *Principia* into higher regions. Dissatisfied with his conclusions, he determined to track the soul to its inmost recesses in the body. His studies in human anatomy and physiology, with this end in view, appeared as *Œconomia Regni Animalis*, in two volumes, 1741, and as *Regnum Animale*, in three volumes, unfinished, 1744-45.

At this point his course as scientist was arrested, and he entered on his career as seer, by which he is known in history. After 1745 he professed to have had his spiritual senses opened. His recorded experience was unique in this respect, that it did not consist in having communication with spirits, as is the claim in modern spiritualism; nor did it consist in having visions merely, and receiving communications, as was the case with the prophets; but it consisted in being himself consciously an inhabitant of the spiritual world as if he had died, and thence in associating with the people of that world as one of them. In 1749 he made his first public appearance in his new character in the issue in London of the *Arcana Cœlestia*, completed in 1756 in eight quartos. It is a revelation of the internal, or spiritual, sense of Genesis and Exodus. Adam signifies the Most Ancient Church, and the flood its dissolution; Noah, the Ancient Church, which, falling into idolatry, was superseded by the Jewish. The spiritual sense pervades the Scriptures, with the exception of Ruth, Chronicles, Ezra, Nehemiah, Esther, Job, Proverbs, Ecclesiastes, the Song of Solomon, the Acts of the Apostles, and the Epistles. By reason of its symbolism of the inward sense, the letter of Scripture is holy in every jot and tittle,

and has been preserved in immaculate perfection since the hour of its divine dictation. The Jewish dispensation having reached its period, God appeared in Jesus Christ. He assumed human nature in its lowest condition in the Virgin, wrought it into conformity with himself, "glorified and made it divine." There is a Trinity, not of Persons, but of Divine Essentials, consisting of the Father, or God as He is in himself, and thus incomprehensible to man; the Son, or God as revealed to man in Jesus Christ; and the Holy Spirit, or divine operation thence. It is imaged in man by his soul, his body, and their operation. Swedenborg acknowledged God in Jesus Christ, and regarded Him as the sole object of Christian worship. The Church which Christ established at His advent in the flesh came to an end in 1757, and Swedenborg witnessed the last General Judgment at that time effected in the world of spirits. Then commenced a new dispensation, and a New Church, signified by the New Jerusalem in the Revelation, of which the writings of Swedenborg contained the doctrines.

The grand and distinctive principle of Swedenborgian theology, next to the doctrine of the divine humanity, is the doctrine of life. God alone lives. Creation is dead—man is dead; and their apparent life is the divine presence. God is everywhere the same. It fallaciously appears as if He were different in one man and in another. The difference is in the recipients; by one He is not received in the same degree as another. There is an inmost, or highest, degree, or plane, of man's reception of the divine life, called the celestial or love plane; there is a second, or lower degree of receptivity called the spiritual or wisdom plane, and there is a third called the natural or plane of obedience. The life of evil is the perversion of divine life into disorderly forms. These degrees of man's reception of God's life are entirely separate from each other, and can never be commingled. They are related by correspondence, by which each lower degree derives its existence and its life from the plane above. The relation of correspondence is plenary, there being nothing in a higher plane which is not represented by something corresponding to it in the plane below; and there is nothing in the lower plane which does not exist from some corresponding thing in the plane above; and all this to the most minute detail, even to the things on this earth. Earthly things beautiful and useful manifest spiritual good; and earthly things ugly and hurtful, spiritual evil. The Scriptures are written according to correspondences, and by the aid of that science their mysteries are unlocked. By it, too, the constitution of heaven and of hell is revealed. There are three heavens in which there live three orders of angels, the first, the second, and the third, or the natural, the spiritual, and the celestial; they are three planes, or degrees, of man's receptivity of divine life described above. All angels were once men, and have lived on this or some other planet. They marry and live in societies, in cities and countries as in the world, in outer appearance differing only in the vast superiority and glory of these things there. But the similarity between the life of angels in heaven and that of men on earth is of the outer appearance only, while the differences between them are internal and radical; for it is not in degrees of outer perfection and glory that the life in heaven and the life on earth may be compared truly, but in their capacity to supply a field for the realization of the inner life of the soul. To the angels the images presented to their senses are the expressions of ideas and emotions which are by this means revealed to them; and so concerned are they in these meanings, that they are unconscious of the objects of their senses, or of their own bodily life, as such. To them their sense-life therefore is made only a visible, audible, and tangible—a concrete spiritual life. There is no denominational favoritism with God; all in whom the love for God and man prevails in any degree whatever, and whatever may have been their Church, or religious connection, go to heaven after the death of their bodies. Between heaven and hell, there is an intermediate state called the world of spirits, where all those who pass into the spiritual world are prepared for their final states. Hell is not merely a place of punishment for the sins done in the body, but is a provision of divine love, and the necessary state and condition of the unregenerated natural man. No one is sent there, but the unregenerated seek a place there of their own accord. Hell as a whole is called the devil, or Satan; there is no supreme individual bearing that name. There are three hells opposite the three heavens.

All of Swedenborg's works were written in Latin and received little attention from contemporaries. The American Swedenborg Printing and Publishing Society of New York issued complete editions of the theological works in English, a nearly complete edition in Latin, certain of the works in Latin-English, and some in other languages. Most of the original manuscripts have been reproduced by photolithographic processes. Complete editions have been issued in English by the Swedenborg Society of London, which has also issued a concordance to the works by Potts (6 vols. 1888 et seq.). The *Rotch Edition* of Swedenborg's works in small volume is published by the Massachusetts New-Church Union. About forty biographies of Swedenborg have been published. The most important of those now in print are by Wilkinson (London, 1849), White (ib., 1856), Swift (ib., 1883), and Worcester (Boston, 1883). Consult also *Documents Concerning the Life and Character of Emanuel Swedenborg, Collected, Translated, and Annotated* by R. L. Tafel (London, 1875-77), a very scholarly work, compiled with great labor.

SWEDENBORGIANS. The name popularly applied to those who accept the doctrines of Christianity and of philosophy as set forth in the writings of Emanuel Swedenborg (q.v.). They do not call themselves Swedenborgians, but members of the New Church. Swedenborg formed no ecclesiastical organization, and many of his followers do not sever themselves from their previous Church connections; but the majority have organized a Church which they have named 'The Church of the New Jerusalem,' after the New Jerusalem of Apocalyptic vision (Rev. xxi.). The first movement toward organization began in Great Britain in 1782, when Robert Hindmarsh, a printer of London, and certain associates formed a class for reading and studying

the writings of Swedenborg. This grew into a society for worship and preaching. Public services were first held in 1788. The General Conference of the New Jerusalem Church in that country began its sessions in 1789, and since 1815 has met annually. In 1902 the Conference consisted of 73 societies, with an aggregate membership of 6337. There were twelve societies, with a membership of 193, which do not belong to the Conference, and also 996 believers not connected with any society, enrolled as 'isolated receivers,' making a grand total of 7526 enrolled Swedenborgians in Great Britain. On the Continent of Europe there is a society of Swedenborgians in each of the cities of Paris, Zurich, Florence, Budapest, Vienna, Stuttgart, Copenhagen, Stockholm, and Gothenburg. In the United States the first society of Swedenborgians was organized in Baltimore in 1792. The General Convention of the New Jerusalem in the United States and Canada held its first meeting in Philadelphia in 1817. With little interruption this body has held annual sessions ever since. In this country the Swedenborgian societies are grouped into State organizations, called associations. The General Convention is composed of twelve of these associations, and of nine separate societies. The individual membership of the bodies composing the Convention as reported in 1902 was 6812. There is a smaller organization of the Swedenborgians called *The General Church of the New Jerusalem*. Its headquarters are in the United States, though it has members in other countries. It is an offshoot from the Convention, having withdrawn from that body in 1891. It reports a membership of 600. In Australia there are four societies of Swedenborgians, with an aggregate membership of about 350; and there is a society in New Zealand; one on the island of Mauritius, in the Indian Ocean; and one at Durban, South Africa. There are also circles of readers and students of Swedenborg of sufficient importance to be reported in the journals of the organization in British India, China, Japan, and South America. Taken all together there are not far from 16,000 registered adult members of the Swedenborgian faith in the world.

The ministry of the Swedenborgians is patterned after the Episcopal order. In the General Conference of Great Britain there are 7 ordaining ministers, 35 ordained ministers, and 12 recognized leaders and missionaries, making a total ministerial force of 54. In the General Convention of the United States there are 6 general pastors, 102 pastors and ministers, and 16 authorized candidates and preachers, making a total of 124 in its ministerial force. The General Church of the New Jerusalem reports one bishop, 16 pastors, 4 ministers, and 2 candidates, making a ministerial force of 23. The pastors and ministers of the societies scattered throughout the world for the most part act under the authority of some one of these three general bodies, and their ministerial force of about 200 as reported above may be considered as constituting the entire clergy of the Swedenborgians in the world. In this classification the ordaining ministers of the General Conference, the general pastors of the General Convention, and the bishop of the General Church hold among Swedenborgians a position similar to that of a bishop of the Episcopal Church, though with the exception of the bishop of the General Church they do not exercise such authority.

A number of Swedenborgian societies in England conduct secular schools in connection with their religious societies. There are ten such institutions, with an aggregate enrollment (in 1902) of 4375 scholars. There is also a New Church College, London, concerned for the most part in preparing young men for the ministry. In the United States there are The Waltham New Church School, at Waltham, Mass.; The Urbana University, at Urbana, Ohio; The New Church Theological School, at Cambridge, Mass.; and The Academy of the New Church, at Bryn Athyn, Pa., conducted by the General Church, which has also several parochial schools in the United States and Canada. The sect publishes many journals.

SWEDISH LANGUAGE AND LITERATURE. Swedish belongs to the northern branch of the Germanic family, within which it is an eastern development of the old *donsk tunga*, or Danish tongue, a name anciently applied to the language spoken not in Denmark only, but in the rest of Scandinavia as well. It was very much the same in the entire Northland down to about A.D. 900, or a little later, when it began to differentiate into an eastern type, ramifying into Danish and Swedish, and a western type, giving rise to Norwegian and Icelandic. From 900 to 1500 the Swedish branch is called Old Swedish. Until after 1200 the only records are runic inscriptions, cut for the most part on gravestones. The use of the Latin alphabet began in the thirteenth century. In the fourteenth century, when a literary language began to develop out of the Södermanland dialect, the differentiation from Danish proceeded slowly; after this came a period of extensive approximation to Danish, to be followed in time by an archaizing period, which restored original forms. Aside from divergencies of vocabulary, Swedish now differs from Danish especially in its retention, after a vowel, of the old voiceless consonants, *k*, *t*, *p*, which in Danish changed to *g*, *d*, *b*, and in its retention of the vowels *a* and *o* in unstressed syllables, where Danish has *e* or no vowel at all; thus Swedish *bok*, 'book,' *mat*, 'meat,' *apa*, 'ape,' are in Danish *bog*, *mad*, *abe*. Swedish *talar ni svenska* 'do you speak Swedish?' is in Danish *taler de svensk;* and Swedish *flickan liknar sin mor*, 'the girl resembles her mother,' is in Danish *pigen ligner moderen*. Under this head it may be added that Swedish has not the 'glottal catch' of Danish, and that Danish has not the delicately modulated musical accent of Swedish.

The main body of the Swedish vocabulary is old Germanic stock, the principal foreign ingredients being (1) Latin and Greek words that came in with Christianity or with the growth of scholarship; (2) Low German words dating from the time of the Hanseatic League, as *arbeta*, 'to work,' *stövel*, 'boot,' *smaka*, 'taste;' (3) German words from the time of the Thirty Years' War, as *tapper*, 'brave,' *prakt*, 'splendor;' (4) French words borrowed in the seventeenth and eighteenth centuries, as *affär*, 'business.' *talang*, 'talent,' *charmant*, 'charming.' Like the other North-Germanic tongues, Swedish has the postpositive definite article (originally a pronominal

affix); thus *flicka*, 'girl,' *flickan*, 'the girl.' As in English, nouns have but one case (the genitive), which is now distinguished by inflection. The genitive ending is *-s*, which is appended after the article; thus *flickans mor*, 'the girl's mother.' The plural of nouns is formed by means of the endings *-or*, *-ar*, *-er*, *-en*, to which the definite article is appended in the forms *-na*, *-ne*, according to a feeling for vowel-balance which shows itself as early as the fourteenth century; thus *flickorna*, 'the girls,' but *dalarne*, 'the dales.' A new pronoun of address, *ni*, taking the place of *I*, came into the language in the seventeenth century and is now commonly used in books; but in conversation Swedish politeness prefers to avoid it and substitute the title of the person addressed, putting the verb in the third person; thus, *är frun sjuk*, 'is the lady sick?' = 'are you sick, madam?' The verb still retains the old Scandinavian passive in *-s*, which was originally an affixed reflexive pronoun; thus, *kalla*, 'call,' *kallas*, 'to be called.' A more peculiar feature of conjugation is the differentiation of the perfect passive participle into two forms, one of which, called the supine, is used to inflect the perfect tenses, while the other is declinable and serves as a true participle; thus *jag har älskat*, 'I have loved,' but *jag är alskad*, 'I am loved,' and *vi äro älskade*, 'we are loved.'

In the printing of Swedish the Roman letters have long since prevailed. Speaking somewhat roughly, the written language of to-day represents the pronunciation of about two hundred years ago; and as phonetic change has been at work during the interval, it is the case, just as in English, that the written form is often a bad index to colloquial utterance. Swedish print teems with 'silent' letters; thus, *jag skal vara i staden*, 'I shall be in the city,' is pronounced *ja ska vara i stän;* and *hvad är det*, 'what is it?' becomes *va ä de*. For the learner of Swedish one of the greatest difficulties is presented by its peculiar accent, which involves both stress and variations of musical pitch. Every word has either the simple or the compound tone. The simple tone is a rising modulation, while the compound (to quote from Sweet) "consists of a falling tone on the stress-syllable, with an upward leap of the voice and a slight secondary stress on a succeeding syllable." Not only the correct pronunciation, but the very meaning of a word often depends on the exact modulation of its musical accent.

BIBLIOGRAPHY. For Old Swedish the leading authority is Noreen, *Altschwedische Grammatik* (Halle, 1897). He has also treated the subject in his *Geschichte der nordischen Sprachen* (Strassburg, 1898), a reprint of his article in the second edition of Paul's *Grundriss*. The great work on Swedish grammar is Rydqvist, *Svenska sprdkets lagar* (6 vols., Stockholm, 1850-83). A good small grammar is Schwarz and Noreen's *Svensk sprdklara* (ib., 1881). There is no good grammar in English. The best Swedish-English dictionary is that of Björkman (Stockholm, 1886). The great dictionary of the Swedish Academy, *Ordbook öfver svenska spräket* (Lund, 1894 et seq.), is only in the initial stages. On the subject of the dialects consult Lundell, *Nyare bidrag till kännedom om de svenska landsmalen*, etc. (Stockholm, 1879 et seq.). An excellent account of Swedish pronunciation by Sweet is given in *Transactions of the Philological Society* (London, 1877-79).

THE LITERATURE. About 160 of the runic inscriptions of Sweden, the oldest dating from the tenth century, contain alliterating verses evidently quoted from preëxisting sagas. This and other lines of evidence show that the poetic art was widely cultivated in the Viking Age. But this 'literature,' which may have been comparable to that preserved in Old Icelandic, is lost. By the middle of the twelfth century Christianity was firmly established, and the old pagan songs and sagas fell under the ban of the Church. From that time on for five hundred years the national literature was dominated, rather more than elsewhere in Western Europe, by the religious spirit. The earliest writings that have come down in the Latin alphabet are certain codes of provincial laws (*landskapslagar*). The most important is the "Elder West Göta Law," dating from the thirteenth century. Magnus Eriksson's *Landslag* (about 1350) is that King's attempt to provide a common law for all the provinces he had brought under his rule. It was probably a scholar from the entourage of this same King Magnus who wrote the celebrated *Um styrilsi konunga ok höfþinga* ("On the Conduct of Kings and Magnates"). To the fourteenth century belong the writings ascribed to Saint Birgitta, a pious nun and mystic revealer of heavenly things. There are nine books of her "Revelations." Saint Birgitta is the most eminent personage in the annals of Catholic Sweden. She made the Convent of Vadstena a literary centre, where many Latin writings, chiefly mystical and hagiographic, but including a part of the Bible, were translated into Swedish for the benefit of the nuns. In poetry the mediæval period is not very rich, though its aggregate of metrical production is considerable. The romances of chivalry are represented in the so-called *Eufemiavisor*, certain tales of knighthood done into Swedish verse by a gleeman living at the court of Queen Euphemia of Norway (1303-12). They are *Herra Iwan*, *Hertig Fredrik af Normandie*, and *Flores och Blanzaflor*, *all* in rhyming couplets with four accents to the line. Besides these metrical romances, there are several rhymed chronicles, the oldest being the *Erikskrönika* (about 1320), and the ballads. It is agreed that the ballad-making period in Sweden was in the thirteenth and fourteenth centuries, but the extant collections are of the sixteenth and seventeenth. None of the known specimens are of indisputable antiquity, but the best compare very well in form and matter with the better *Kæmpeviser* of Denmark. From the fifteenth century we have a few good poems by Bishop Thomas of Strengnäs (died in 1443).

The Reformation transferred the literary centre from Vadstena to Upsala. The literature of the sixteenth century is almost exclusively religious, the two chief writers being the brothers Petri, Carmelite monks who had been converted to Lutheranism at Wittenberg. They stand out as the leading Swedish apostles of the new faith. The elder, Olavus ('Master Olof'), wrote psalms, devotional poems, a prose chronicle of Swedish history, and (probably) the mystery-play *Tobie Comedia*. With his brother Laurentius he directed the publication of the first Swedish Bible

(Upsala, 1541). The first secular author of any note in the new era is the historian Messenius, who also wrote six 'school comedies' on subjects from Swedish history. The best known is *Disa*, which was played by Upsala students in 1611.

The period of Swedish expansion (1630-1730) is marked by the widening of the literary horizon through the introduction of new ideas and forms from Germany, France, Italy, and Holland. The prominent figure is Stjernhjelm (1598-1672), the 'father of Swedish poetry.' He did a work like that of Opitz in Germany, by whom he was influenced; that is, he sought to give his country a worthy poetic literature by imitating good models, old and new. He laid great stress on metrical regularity and ornateness of diction. His poem *Hercules*, a didactic allegory on the conflict of Pleasure and Duty, may fairly be said to have nationalized the dactylic hexameter. It is metrically elegant, but rather florid. Stjernhjelm also experimented with alexandrines, the *ottava rima*, the sonnet, and the ballad. His most noteworthy disciple was the poet-scholar Columbus (1642-79). An opponent of Stjernhjelm, Rosenhane (1619-84), won fame especially as a sonneteer. A jovial and facile rhymester who stood apart from the schools was Johansson, called Lucidor (died in 1684). The eccentric polyhistor Rudbeck (1630-1702), with his amazing *Atlantika*, belongs to the history of literary curiosities rather than of literature.

In the ensuing epoch (1730-1772) the great Swedish names are Swedenborg and Linnæus; but they belong, respectively, to the history of religion and of science. In belles lettres the ideals of Sweden were substantially those of contemporary France and England. The presiding genius is Dalin (1708-63), whose *Swedish Argus*, started in 1732 in imitation of the *Spectator*, became the rallying-point of the dominant ideas. Dalin had something of Voltaire's versatility and cleverness. He wrote much poetry, but is best remembered as an elegant stylist in prose, the first in Swedish annals. Opposed to Dalin in some of his tendencies was the coterie of Fru Nordenflycht (1718-63), the 'Northern Aspasia.' Her salon in Stockholm was not unworthy of its Parisian models. To her circle belonged Creutz (1729-85), best known for his pleasant pastoral *Atis och Camilla*, and Gyllenborg (1731-1808), author of many ratiocinative poems. All these mid-century writers were strongly influenced by their contemporaries in England.

The Gustavian epoch (1772-1809) is marked by royal patronage of letters on a large scale. Gustavus III., himself a playwright and a prize orator, assembled an academic court of talent, which continued the French tradition of the Old Régime. The leading Gustavians were Kellgren (1751-95), Leopold (1756-1829), and Oxenstjerna (1750-1818), all poets of considerable talent and devoted to the ideals and sentiments of the expiring Age of Enlightenment. Here belongs also the name of the gifted poetess Fru Lenngren (1754-1817), famed for her idyls and satires and her literary salon. Quite untouched by academic influence was the much admired Bellman (1740-95), a genial humorist of Anacreontic tendencies, who turned his observations of Stockholm low life into tuneful verse. To the Gustavian period finally, though not of its spirit and distinctly prophetic of a new era, the best work of the eminent lyric poet Franzén (1772-1847).

The great Romantic movement of the nineteenth century, with the concomitant renaissance of national feeling, affected Swedish literature profoundly. The new ideas, coming from Germany by way of Denmark, precipitated at first a wordy war of various schools and tendencies, after which came a season of really brilliant production. In the soulful verse of Wallin (1779-1839); in the best work of the arch-Romanticist Atterbom (1790-1855); in the fine spirituality and exquisite workmanship of Stagnelius (1793-1823); in the stirring Northern poems of Geijer (1783-1847), who was destined to become, next to Fryxell, perhaps, his country's greatest historian; in the productions of the brilliantly endowed but erratic and uneven Almqvist (1793-1866); and of several minor poets like Sjöberg (1794-1828) and Nicander (1799-1839); but above all in the splendid talent of Tegnér (1782-1846), who won world-wide fame with his romanticized *Frithiof's Saga*—the national genius found a richer expression than at any time before or since.

In the mid-century period the prominent names are Fredrika Bremer (1801-65), once widely read at home and abroad, and Runeberg (1804-77), a strong rival of Tegnér for the first place of honor in the whole Swedish Parnassus. Somewhat later come Topelius (1818-98), best known for his novels of Finnish history, and Rydberg (1829-95), eminent as poet, novelist, and translator of Goethe's *Faust*. The newer realism is most conspicuously represented by Strindberg (1849—), and recent poetry by Count Snoilsky (1841-1903).

BIBLIOGRAPHY. A good anthology of Old Swedish will be found in Noreen's *Altschwedisches Lesebuch* (Halle, 1892-94), and of the entire literature (to 1830) in the *Läsebok i svensk litteratur* of Hildebrand, Bergstadt, and Bendixson (Stockholm, 1897-98). The old laws have been edited by Schlyter, much of the religious mediæval literature by Klemming. See also the publications of the *Svenska Fornskriftssällskapet*. Of older works on the history of literature the best are Wieselgren, *Sveriges sköna litteratur* (Lund, 1833-49); and Malmström, *Grunddragen af svenska vitterhetens historia* (Örebo, 1866-69). The best work up to date is the *Illustrated svensk litteratur-historia* of Schück and Warburg (Stockholm, 1896 et seq.).

SWEDISH MOVEMENT. See MOVEMENT CURE.

SWEDISH MUSIC. See SCANDINAVIAN MUSIC.

SWEDISH NIGHTINGALE. A popular name given to the Swedish singer Jenny Lind.

SWEENY, THOMAS WILLIAM (1820-92). An American soldier, born at Cork, Ireland. He came to the United States in his boyhood; in 1846 enlisted as second lieutenant in Burnett's New York Volunteers, and fought under General Scott in Mexico. At the outbreak of the Civil War he was in command of the arsenal at Saint Louis, Mo. In reply to efforts of Confederate sympathizers to induce him to surrender that important post he declared that before he would do so he would blow it up. As second in com-

mand he participated in the capture of Camp Jackson in May, 1861; assisted in organizing the Home Guards, and was chosen brigadier-general of that organization, and commanded the Fifty-second Illinois at Fort Donelson. At Shiloh he successfully defended a gap in the Union line. He commanded the second division of the 16th army corps in the Atlanta campaign. In 1866 he took a prominent part in the Fenian invasion of Canada. He retired from the army in 1870 with the rank of brigadier.

SWEET, BENJAMIN JEFFREY (1832-74). An American soldier, born at Kirkland, Oneida County, N. Y. At the age of sixteen he moved with his father to Wisconsin. At the outbreak of the Civil War he helped to raise two regiments, and became colonel of one of them, the Twenty-first Wisconsin. At the battle of Perryville he received a wound that incapacitated him from further service in the field. In the spring of 1864 he was put in command of Camp Douglas at Chicago. In the following July and again in November he defeated plots of the Knights of the Golden Circle (q.v.) to capture Chicago and release the 10,000 Confederate prisoners confined in Camp Douglas. For these services he was promoted brigadier-general of volunteers. From 1869 till 1870 he was United States pension agent at Chicago, and from 1870 till his death was First Deputy Commissioner of Internal Revenue at Washington.

SWEET, HENRY (1845—). An English philologist, born in London. He was educated at King's College and Balliol College, Oxford. He devoted himself to Anglo-Saxon and phonetics. Of his editions of Anglo-Saxon texts the most important are King Alfred's version of Gregory's *Cura Pastoralis* (1871); *Anglo-Saxon Reader* (7th ed. 1894); *Anglo-Saxon Primer* (3d ed. 1883); *Alfred's Translation of Orosius* (1883); *Epinal Glossary* (1883); *Oldest English Texts* (1885). Among his contributions to Anglo-Saxon philology are his *Dialects and Prehistoric Forms of Old English* (1876), and *A Sketch of Anglo-Saxon Poetry*, in Wharton's *History of English Poetry*, vol. iv. (London, 1871). His work in phonetics includes his *Handbook of Phonetics* (1877); *History of English Sounds* (2d ed. 1888); and *Primer of Phonetics* (1890). He is likewise the author of *Words, Logic, and Grammar* (1876); *Elementarbuch des gesprochenen Englisch* (2d ed. 1886); *New English Grammar* (1892); *Current Shorthand, Orthographic and Phonetic* (1892); and a literary study on *Shelley's Nature-Poetry* (1891), of primers of Middle English (1884-86) and of Icelandic (1886), and *The Practical Study of Languages* (1899).

SWEETBRIER. See EGLANTINE.

SWEET CALABASH. See GRANADILLA.

SWEET FERN. A popular name for Myrica asplenifolia and Myrrhis odorata, also known as sweet cicely, both of which have fern-like foliage. The former, being rich in tannin, has been employed as an astringent in domestic medicine; the latter is employed in cooking, for its agreeable flavor.

SWEET FLAG. See ACORUS.

SWEET GALE. See CANDLEBERRY.

SWEET GUM. See LIQUIDAMBAR.

SWEET PEA (*Lathyrus odoratus*). An old-fashioned papilionaceous garden flower which has been brought into prominence and greatly improved in form and color during the closing quarter of the nineteenth century. The plant is a free random grower like other peas, but has perfumed flowers of greater beauty. Sweet peas should be planted as early in spring as the ground can be worked. A rich, deeply prepared clay loam suits them best. Thin, dry soils are not satisfactory. Sweet peas should be sown



SWEET PEA (*Lathyrus odoratus*).

thinly, 2 to 3 inches deep in trenches 4 to 5 inches broad and as deep, 3 to 3½ feet apart. Brush or trellis should be provided when the plants are two inches high, and shallow cultivation should be given all through the growing season and blooming period, gradually filling up the trench. No pods should be allowed to ripen as long as flowers are wanted, as growth ceases with the ripening of the pods. More than 100 named varieties are in cultivation. Two other closely related peas are also cultivated for their flowers—the sweet tangier pea (*Lathyrus tingitanus*) and the perennial or everlasting pea (*Lathyrus latifolius*). Both have long been in cultivation in Europe. The latter, which is very hardy, has many-flowered clusters, large standard, scentless flowers, strongly veined leaflets, and broad, hairless pods. Consult: Hutchins, *All About Sweet Peas* (1894); id., *Sweet Peas Up to Date* (Philadelphia, 1897); New York Cornell Agricultural Experiment Station Bulletins 111, 127.

SWEET POTATO, or BATATAS (*Ipomœa Batatas*). A perennial plant of the natural order Convolvulaceæ, with long creeping stems, heart-shaped leaves on long stalks, and variously lobed, large purple flowers much resembling those of the best known species of Convolvulus, and large oblong or elongated roots. Authorities differ as to whether it owes its origin to East India or America, but it is now cultivated in all tropical and sub-tropical countries for its sweet, wholesome roots, which are highly esteemed as an article of food.

The sweet potato is propagated by sets obtained from the tubers sprouted in a specially

prepared bed and when about four inches tall planted 18 inches asunder in rows 3½ feet apart in the field; the later vine cuttings, which are commonly used in the Gulf States and as far north as Virginia, require from 90 to 105 days to mature their roots. The crop grows best in a warm, sandy, well-drained soil. It requires clean cultivation. Early digging yields only one-half to two-thirds as much as may be obtained from the matured crop, which averages from 250 to 275 bushels per acre. The roots should be harvested before frost and when the ground is dry. The roots must be stored in a rather warm, dry place, as otherwise heavy losses are almost sure to occur from rotting. The so-called 'yams' grown in the United States are all sweet potatoes.

The most serious diseases of the sweet potato destroy the fleshy roots. The black rot (*Ceratocystis fimbriata*), which appears as greenish black, irregular spots which increase in size and eventually destroy the whole root, may be spread through planting diseased tubers in the seed bed or through the presence of the fungus in the soil. At the New Jersey Experiment Station sulphur in the soil has been used with success as a preventive. Dry rot (*Phoma batatæ*) dries, wrinkles, and fills the roots with powder. It attacks the whole root in the field. Rotation of crops and destruction of diseased material are recommended as preventives. A soft rot (*Rhizopus nigricans*) attacks stored roots, usually commencing at places where the skin has been broken. Since moisture favors its spread, sweet potatoes should be stored in well-ventilated, dry rooms. A leaf spot (*Phyllosticta bataticola*) often attacks and turns the foliage white, and a leaf mold (*Cystopus ipomœæ-panduranæ*) turns the leaves, especially the older ones, brown. Spraying with Bordeaux mixture or other fungicide (q.v.) is recommended for these last two and the first disease.

As ordinarily prepared for the table the skin constitutes on an average 20 per cent. and the edible portion 80 per cent. of the root. The edible portion has the following percentage composition: water, 69.0; protein, 1.8; fat, 0.7; nitrogen-free extract, 27.4; and ash, 1.1 per cent., the fuel value being 570 calories per pound. Like ordinary potatoes, sweet potatoes are a succulent food, the chief nutrient being carbohydrates, the principal of which is starch. Sugars are also found, 2.5 per cent. cane sugar and 3.4 per cent. invert sugar being the average amount found in a large number of analyses. In addition to the quantities consumed in the fresh state, sweet potatoes are also canned and evaporated. They are sometimes fed to farm animals, especially pigs. To secure the greatest profit the pigs should harvest the crop and some nitrogenous feed like cowpeas should also be fed. See Plate of YAM, SWEET POTATO, ETC.

SWEET-POTATO INSECTS. The leaves of the sweet potato are punctured by a small bronzed flea-beetle (*Chætocnema confinis*), which eats channels along the veins soon after the plants have been set out and causes the leaves to shrivel. The most serious of the insect enemies of the crop are several species of tortoise-beetles. (See TORTOISE-BEETLE.) The commonest species are the two-striped tortoise-beetle (*Cassida bivittata*), which is about one third of an inch long, the tortoise-shell yellow and has two black stripes on each wing-cover. The larva is dirty yellowish white and covers itself with cast skins and excrement. It gnaws irregular holes in the leaves underneath which it transforms to pupa. The golden tortoise-beetle (*Coptocycla aurichalcea*), which is more abundant, resembles gold tinsel and is beautifully resplendent. The larva is dark brown and feeds like the previous species. Arsenical sprays have been recommended.

SWEET-SCENTED SHRUB. See CALYCANTHUS.

SWEET SOP (*Anona squamosa*). A bush or small tree of the natural order Anonaceæ, a native of tropical America and introduced in other warm countries. The scaly greenish fruit has a soft, somewhat mealy, sweet, and luscious pulp with a musky aromatic odor and flavor. It is much used, generally raw, but sometimes cooked, and has proved valuable during famines in Hindustan.

SWEET SULTAN. A garden plant. See CENTAUREA.

SWEET VERNAL GRASS. A slender European grass (*Anthoxanthum odoratum*), about 18 inches tall and bearing a loose cylindrical spike of flowers. It is noted for its pleasing odor due to coumarin, which is most noticeable when the plant is in flower. It is often mixed with other grasses to give flavor to hay, but is not considered equal in feeding value to timothy, orchard grass, etc. See Plate of GRASSES.

SWEET WILLIAM, WILD. See PHLOX.

SWELL (AS., OHG. *swellan*, Ger. *schwellen*, to swell; possibly connected with Gk. σαλεύειν, *saleuein*, to toss, Lat. *salum*, open sea). A term applied to a local thickening of a mineral deposit. The phenomenon is not uncommon in many metalliferous veins, and is caused by local expansions of the ore-bearing fissure, due to dynamic action or solution. In coal seams a similar phenomenon is often met with, but the swell here is caused by movements of the floor and roof of the coal bed.

SWELL. In music, a set of pipes in an organ, forming a separate department, which are capable of being increased or diminished in intensity of sound by the action of a pedal, or by a series of shades or shutters overlapping each other like Venetian window-blinds, within which the pipes in question are inclosed. The first recorded swell organ was made in 1712 by Jordan, and in 1763 Shudi introduced the so-called Venetia swell, but the compass of all the early swells was very incomplete. See ORGAN.

SWELLFISH. One of the many names applied to plectognath fishes, especially of the family Tetraodontidæ, which inflate their bodies with air until they become globe-like and the spines of their skin rigid, making them unpleasant morsels for an enemy to swallow. A familiar example is *Tetraodon turgidus*, of the Eastern American coast-waters, also called 'swell-toad' and 'puffer.' Compare GLOBEFISH. See Plate of PLECTOGNATH FISHES.

SWELL SHARK. A small, voracious gray shark (*Catullus uter*) of the family Scylliidæ, common on the Pacific Coast from central California to Chile, and often taken in lobster-pots. When caught it will inflate its stomach with air,

until its thickness is equal to a third of its length, and will float belly upward until it supposes the danger past; hence its vernacular name. See Plate of LAMPREYS AND DOGFISH.

SWETCHINE, svĕch-ĕn', ANNE SOPHIE SOYMANOFF (1782-1857). A Russian-French author, born in Moscow. Her father was Soymanoff, the founder of the Moscow Academy. She married in 1799 General Swetchine and established at Saint Petersburg a *salon* of much distinction, frequented by émigrés. Thus she came into touch with Joseph de Maistre in 1815, and was by him converted to Roman Catholicism. In the next year she moved to Paris, where her equally famous *salon* took on a distinctly religious tone. Her writings, all of a religious or contemplative character, are edited with a *Life* by Falloux (Paris, 1860); her *Lettres* by the same editor (ib., 1862; 5th ed. 1881), who added a journal of her *Conversation* (ib., 1863), and *Lettres inédites* (ib., 1866). Her letters have been translated by H. W. Preston (Boston, 1867). Consult: Sainte-Beuve, *Nouveaux lundis* (vol. i., Paris, 1863-72), and Scherer, *Etudes critiques sur la littérature contemporaine*, vol. i. (ib., 1863).

SWETE, swēt, HENRY BARCLAY (1835—). An Anglican clergyman, especially distinguished for his work in textual criticism. He was born at Redlands, Bristol, and was educated at King's College, London, and at Caius College, Cambridge. In 1877-90 he was rector of Ashdon, Essex; in 1882-90 professor of pastoral theology at King's College, London, and in 1890 was made regius professor of divinity in Cambridge. Among his published works are two essays on the *History of the Doctrine of the Holy Spirit* (1873, 1876), an edition of *Theodore of Mopsuestia's Commentary on the Epistles of Saint Paul* (1880-82), *The Old Testament in Greek* (1887-94; 2d ed. 1895-99), *The Akhmîn Fragment of the Gospel of Saint Peter* (1893), *The Psalms in Greek According to the Septuagint, with the Canticles* (1889; 2d ed. 1896), *The Apostles' Creed in Relation to Primitive Christianity* (1894; 3d ed. 1899), *Church Services and Service Books Before the Reformation* (1896), and *An Introduction to the Old Testament in Greek* (1900).

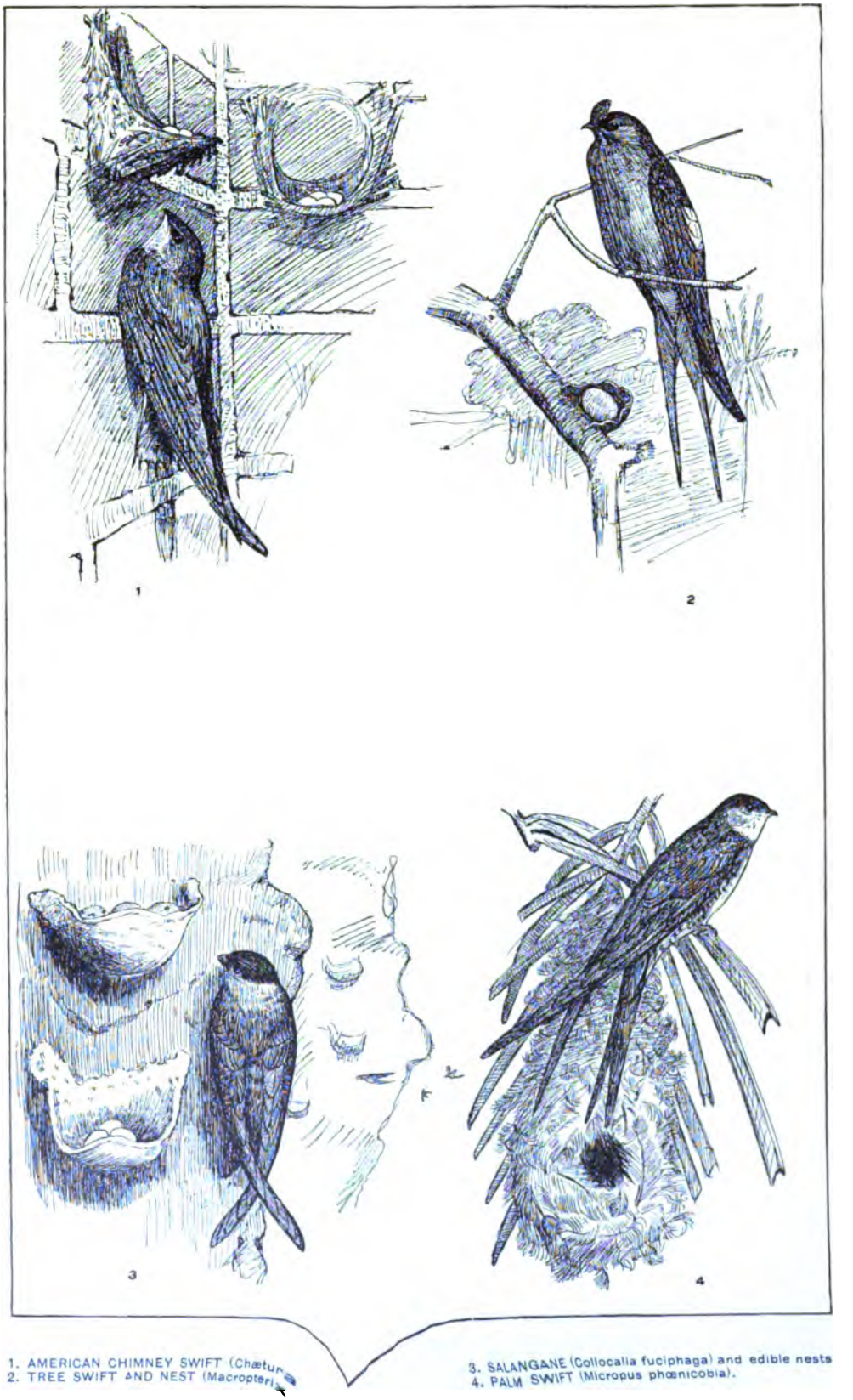
SWEYN, swān, **SWEGEN**, svā'gen, or **SWEND**, svĕnd. A King of Denmark, father of Canute (q.v.). See DENMARK.

SWIETEN, svē'ten, GERARD VAN (1700-72). A celebrated Dutch physician and scholar, born at Leyden, where, after studying philosophy at Louvain, he pursued medicine under Boerhaave, whose most distinguished pupil he became. Called to Vienna in 1745 as physician in ordinary to Maria Theresa, he instilled new life into every branch of science, but especially promoted reforms in the study of medicine, which, as director of the faculty, he raised to a high standard through his own teachings as well as by the appointment of famous specialists to chairs at the university. Reforms in the other faculties presently followed, and although greatly hampered by the intrigues of the Jesuits, Van Swieten held his own against them here as well as in the supervision of censorship, in which considerable authority was accorded him as custodian of the Imperial library, and of which he was finally appointed chairman in 1759. In science he sought his fame as an expositor of his teacher Boerhaave. His *Commentaria in Hermanni Boerhaave Aphorismos de Cognoscendis et Curandis Morbis* (new ed. 1787-92) hold a permanent place in medical literature. In 1758 Van Swieten, having saved the life of the Empress, was created a baron.

His son GOTTFRIED (1733-1803) succeeded him as custodian of the Imperial library and was an intimate friend of Haydn and Mozart. For the former he adapted the text of the *Creation* from the English and wrote the text of *The Seasons*.

SWIFT (AS. *swift*, fleet, rapid; connected with *swāpan*, Eng. *swoop*, *sweep*, OHG. *sweifan*, Ger. *schweifen*, to rove). A bird of the family Cypselidæ, nearly related to the humming-birds. The swifts are widely distributed, and some are only found in tropical countries; others are birds of passage, and spend the summer in colder parts of the world. Many are popularly called swallows, as, for example, the chimney-swift of the United States, almost always called 'chimney-swallow.' This confusion is due to a resemblance in the long, pointed wings, the small, widely gaping bill, the weak feet, and to the habit of capturing their insect prey by untiring hunting in the air. About seventy-five species of swift are known, half of which are American, although only four occur in the United States. Swifts are mostly dull-colored birds, black, brown, gray, and white, and are seldom over seven inches in length or more than twice that across the wings. They are remarkable for the development of the salivary glands, the secretion of which is used in building the nest. The latter may be nearly pure saliva, as in the edible nests of the salangane (q.v.), or, as is more commonly the case, may be composed of grass, twigs, or other vegetable matter, glued together and to the support by saliva. The nests are attached to cliffs, the interior of chimneys, or hollow trees, the spathes of palm blossoms, or the leaves of palms, etc. The eggs are pure white, unspotted. The only swift common in the United States is the well-known chimney-swift (q.v.). Along the Pacific Coast occurs also the great black swift (*Cypseloides niger*), whose range includes the West Indies and Mexico and extends north to British Columbia. It breeds on inaccessible cliffs, and is still little known. Another large swift (*Cypselus melanoleucus*), which has the chin, throat, and breast white, occurs in the Southwestern United States, north to Wyoming and Utah, and it also breeds on practically inaccessible cliffs. To the same genus as the last-named species belong the best-known European forms. In this genus, which contains about twenty-five species, three-fourths belonging to the Old World, the tail is usually forked, the legs and toes are feathered, and all the toes are directed forward. The common and widespread European swift is *Cypselus apus*. Another notable species is the alpine swift of the mountainous parts of South Europe. To this same genus belong the palm swifts of the West Indies, of which a Jamaican species (*Micropus phœnicobia*) is noteworthy on account of its nest, which when placed in a palmetto is glued to the surface of one of the great fronds and formed of silk-cotton in the shape of a bag or watch-pocket open at the side. Some of the most curious and interesting swifts dwell in the Orient. One genus

SWIFTS AND THEIR NESTS



1. AMERICAN CHIMNEY SWIFT (Chætura
2. TREE SWIFT AND NEST (Macroptery
3. SALANGANE (Collocalia fuciphaga) and edible nests
4. PALM SWIFT (Micropus phœnicobia).

(Macropteryx) contains the tree-swifts, whose plumage is peculiarly soft, the tails deeply forked and the head crested. They are shy and breed in rocky jungles, forming a little cup-shaped nest of flakes of bark glued together with saliva and attached to the side of the branch of a tree. There is only one egg, which (as is the case with all the family) is pure white. Five species are found in the Indo-Chinese region and eastward to the Solomon Islands.

SWIFT, BENJAMIN. The pseudonym of the English novelist William Romaine Paterson (q.v.).

SWIFT, GUSTAVUS FRANKLIN (1839-1903). An American merchant, born at Cape Cod, Mass. After various business experiences he engaged in meat-packing in Chicago, and was the first to ship meat long distances successfully. He founded and was president of the corporation of Swift and Company, one of the largest packing firms in the United States, and was a prominent member of many other similar concerns. His business enterprise did much for the trade development of Chicago.

SWIFT, JONATHAN (1667-1745). The greatest of English satirists, born in Dublin, November 30, 1667. He was of Yorkshire origin. His father had been attracted to Ireland by the prospect of political preferment, but died before Jonathan's birth. When he was six years old, his uncle Godwin sent him to Kilkenny School, the Eton of Ireland, where Congreve and Berkeley were his contemporaries. At fifteen he was sent to Trinity College, Dublin. At Trinity the lad read much history and poetry, but was so disdainful of the ordinary curriculum and of college regulations that his degree was only granted to him by a special grace. The disturbances of the Revolution of 1688 drove him to England, and in the following year he obtained employment as secretary to Sir William Temple (q.v.) at Moor Park, in Surrey. Swift found the position trying, though he calls Temple "a man of sense and virtue." In 1694 he quarreled with his employer and returned to Ireland to seek ordination, obtaining the small living of Kilroot, near Belfast. But he soon wearied of rural isolation and in 1696 he went back to Moor Park. Perhaps the impelling motive was the presence there of Esther Johnson, subsequently immortalized as "Stella," a poor relation of Temple's. Swift had a hand in her education; she was now, at fifteen, growing into a beautiful woman, with "hair blacker than the raven and every feature of her face in perfection." Swift remained at Moor Park until Temple's death in 1699. His sojourn there, however galling some incidents of it may have been to his pride, was of inestimable value to him. Besides the daily association with a statesman and a man of culture, he had time for an enormous amount of reading and for practice in writing. His only relics, however, of this period are some Pindaric odes, a species of composition for which he was little qualified and which Dryden characterized frankly with the judgment, "Cousin Swift, you will never be a poet."

His first prose composition betrayed his resentment. This was *The Battle of the Books*, a burlesque of the controversy then raging over the relative merits of the ancients and moderns, in which for the first and last time his satire recoiled on himself. He returned once more to Ireland, as secretary and chaplain to Lord Berkeley, but lost the secretaryship and did not get the deanery of Derry, which he had expected. He was, however, appointed to the rectory of Agher, with the vicarages of Laracor and Rathbeggan. For the first time his own master, Swift showed that stern regard for duty which characterized him, and gained the respect, if he failed to influence the convictions, of his Catholic neighbors. He realized himself that he was a poor preacher, calling his sermons 'pamphlets.' He soon began his career as a political pamphleteer, which was to be so epoch-making, with *A Discourse on the Dissensions in Athens and Rome* (1700), really a defense of Somers and the other Whig lords threatened with impeachment. In 1704 he published the *Tale of a Tub*, the most amusing of his satirical works, the most strikingly original, and the one in which the full compass of his powers was most perfectly displayed. With matchless irony he ridiculed many forms of pretentious pedantry, mainly in literature and religion. The book led to many doubts of his orthodoxy and injured his chances of ecclesiastical preferment.

Though nominally a Whig, Swift differed from his party on important questions. He hated its war policy and its alliance with dissent. These differences, along with the failure to gain anything from the connection, made it easy for him to break from his former allies. In 1710 the Tories came into power with Harley and St. John at their head and Swift was easily won over to their side. He turned upon the Whigs with a series of brilliant squibs, assumed the editorship of the *Examiner*, the Tory organ, November 2, 1710-June 14, 1711, and produced several independent pamphlets, in all of which he ably defended the policy of the Tories. Of these particular papers the most powerful was the *Conduct of the Allies* (November, 1711), in which the position was maintained that the Whigs had prolonged the Continental War out of self-interest. Swift certainly led the way to the dismissal of Marlborough and the Peace of Utrecht (1713). For three years Swift was among the most conspicuous men in politics and society. His advent marks a new era in English politics, with the accession of public opinion, fostered by him more than by any other man, to supreme power.

He comes into full light in September, 1710, with the beginning of his *Journal to Stella*. He had invited her in 1701 to Ireland, with her friend Mrs. Dingley. They lived in his house at Laracor and Dublin when he was absent, and in lodgings near by when he was present. The diary letters which he sent to Stella and Mrs. Dingley, ending with April, 1713, compose one of the most interesting documents that ever threw light on the history of a man of genius. In London he lodged close to Mrs. Vanhomrigh, whose daughter Hester (called Vanessa by him) fell in love with Swift, and hugged the chains to which Stella merely submitted. In 1714 the Tory Ministry fell, Queen Anne died, and Swift's power was gone. In spite of the Queen's distrust of him, he had been appointed to the deanery of Saint Patrick's in Dublin, in 1713, and thither he now retired, no doubt hoping that the move would settle his complications for him. But, as luck would have it, Vanessa's mother died and she followed him to

Celbridge, in the near neighborhood. It is possible that in 1716 Swift may have married Stella. He undoubtedly loved her and shows a tenderness for her such as he never displays in any other case. From 1717 to 1720 he and Vanessa remained apart, but in the latter year he began to pay her regular visits. In 1723 Vanessa took the desperate step of writing to Stella. Swift rode down to Marley Abbey, where she was staying, with a terrible countenance, petrified her with a frown, and departed, flinging on the table a packet containing her letter to Stella. Vanessa died within a few weeks, leaving behind her the poem he had written for her, *Cadenus and Vanessa*, and their correspondence.

Five years afterwards Stella followed Vanessa, and the wretched lover sat down the same night to record her virtues in language of unsurpassed simplicity. A lock of her hair is preserved with the inscription in Swift's handwriting, most affecting in its apparent cynicism,"Only a woman's hair." Between the death of Vanessa and that of Stella, as though withheld by an evil fate until he could no longer enjoy it, came the greatest political and literary triumph of Swift's life. He had fled to Dublin a broken man, politically extinct; a few years raised him to the summit of popularity, though power was denied him. In 1724 he took Ireland by storm with the *Drapier Letters*, a series of wonderfully effective pamphlets, directed against the patent granted to one Wood, a hanger-on of the Court, for coining copper halfpence in Ireland.

The noise of this success had hardly died away when Swift acquired more lasting glory by the publication of *Gulliver's Travels*. Few books have added so much to the innocent mirth of mankind as the first two parts of *Gulliver*. With the omission of certain passages, it is one of the most delightful children's books ever written. Yet it has been equally valued, as Swift meant it to be, for an unrivaled satire on mankind. He seems to have solaced himself with its composition in the early years of what he called his exile; and if the later books show his most savage temper, it is well to remember that they were written during the years when he was attacking political corruption and when his private happiness was being destroyed. In 1726 he brought the completed manuscript to England with him and it was published anonymously in the winter of that year, meeting with instantaneous success.

His last years, however, were clouded by constantly increasing torture from disease. He governed his cathedral with great strictness and conscientiousness, and for years after Stella's death held a sort of miniature court at the deanery. But death was becoming more and more real and welcome to him. His regular farewell to a friend in these latter years was, "Good night—I hope I shall never see you again." A period of absolute mental decay closed with his death on October 19, 1745. He was buried in his cathedral in the same coffin with Stella, with the epitaph written by himself, "Here lies the body of Jonathan Swift, D.D., dean of this cathedral, where burning indignation can no longer tear at his heart. Go, traveler, and imitate if you can a man who was an undaunted champion of liberty."

Swift's character, as a whole, forms a fascinating psychological study. From some passages of his life he would appear a heartless egotist; and yet he was capable of the sincerest friendship, and could never dispense with human sympathy. Thus an object of pity, as well as awe, he is the most tragic figure in the literature of the eighteenth century—the only man of his age who could be conceived as affording a groundwork for the creations of Shakespeare. "To think of him," says Thackeray, "is like thinking of the ruins of a great empire." Nothing finer or truer could be said.

Consult his *Works*, edited by Sir Walter Scott (19 vols., Edinburgh, 1814 and 1824); *Prose Works* (the best edition) edited by T. Scott, with introduction by W. E. H. Lecky (Bohn's Library, 8 vols., London, 1897-99); various selections, by S. Lane-Poole (ib., 1884-85), by W. Lewin (Camelot Series, ib., 1886), by H. Morley (Carisbrooke Library, ib., 1889), and by H. Craik (Oxford, 1892-93); *Unpublished Letters* (edited by G. B. Hill, London, 1899). The best recent lives of Swift are by H. Craik (London, 1882), Leslie Stephen (ib., 1882), and Churton Collins (ib., 1893). Consult also Forster's incomplete *Life* (1875); Wilde, *Closing Years of Swift's Life* (Dublin, 1849); Lane-Poole's *Notes for a Bibliography of Swift*, reprinted from *The Bibliographer* (London, 1884).

SWIFT, Joseph Gardner (1783-1865). An American soldier, born at Nantucket, Mass. He graduated at the United States Military Academy in 1802, being the first graduate of that institution; became a captain in 1806 and a major in 1808, and in July, 1812, was promoted to be colonel and chief engineer of the United States Army. In the War of 1812 he served as chief engineer of the army under General Wilkinson, in the Saint Lawrence campaign of 1813; later had charge of the construction of the fortifications of New York harbor; was brevetted a brigadier-general in February, 1814; and was superintendent of the United States Military Academy by virtue of his office as chief of engineers from 1812 to 1817. He resigned from the army in November, 1818; superintended the construction of the New Orleans and Lake Pontchartrain Railroad in 1830-31; was for many years in charge of harbor improvements on the Great Lakes; and was engaged in numerous other engineering enterprises.

SWIFT, Lewis (1820—). An American astronomer, born at Clarkson, N. Y. He was educated at Clarkson Academy and about 1854 took up the study of astronomy. He was noted for his numerous discoveries of comets and nebulæ previously uncatalogued. He became director of the Warner Observatory, Rochester, N. Y., 1882. His 16-inch telescope at that institution was presented to him as a gift by the citizens of Rochester and was subsequently removed by him to his present observatory on Echo Mountain, Pasadena, California.

SWIFT, Lindsay (1856—). An American librarian, bibliographer, and literary historian, born in Boston. A graduate of Harvard (1877), he became associated in various bibliographical capacities with the Boston Public Library, and made valuable contributions, editorial and original, to the study of early American literature and history. The most noteworthy of his books is *Brook Farm* (1900), an essay on New Eng-

land transcendentalism. Noteworthy also is a monograph on *Massachusetts Election Sermons.*

SWIMMING (from *swim*, AS., OHG. *swimman*, Ger. *schwimmen*, to swim; connected with Goth. *swumsl*, pond, and ultimately with Eng. *swamp*). The act by which an animal progresses in the water. Man is the only animal who does not swim naturally, yet keeping the head above the water is an act which most human beings may easily learn.

The swimming of quadrupeds amounts simply to walking in the water, whereas man has adopted many kinds of stroke besides the dog-paddle method by which most land animals propel themselves. These methods involve swimming on the breast, with a broad sweep of the arms and a frog-like motion of the legs; swimming on the side, and swimming on the back. He has also learned to float and to tread water. In the latter case the body is held in a perpendicular position and the hands and feet beat downward. The old side stroke is the favorite style for long-distance racing. It consists of three alternate motions, an under-arm and an over-arm stroke, and a scissors leg stroke, coming between the two arm strokes. The Trudgeon stroke is a form of swimming introduced into England a few years ago from the South Pacific. This is now very popular among all civilized swimmers, and is one of the fastest of all strokes for short distances. It consists of alternate overhead strokes, with a frog kick simultaneous with one of the arm strokes, the body swimming on the belly. A modification of this stroke was introduced a few years ago by Alexander Meffert, the famous American amateur mile-champion, in which the head and forearm are kept submerged as the body is pushed forward, the body being turned from the waist and the face brought above the water as the body checks between strokes. This style of swimming admits of freer animation and obviates any cramped position of the head. It is used by some of the best American swimmers.

The home of organized swimming is England. International swimming races between the various parts of the United Kingdom are held annually, the universities of Oxford and Cambridge include swimming on the list of inter-university sports, and inter-collegiate competitions take place within the universities themselves. An amalgamation of clubs in 1869 first brought swimming under organized control, and this association developed, under several successive names, into the Amateur Swimming Association in 1886. England and the Australian colonies easily head the world in feat swimmers. In addition to the Amateur Swimming Association, great practical good has come to the art by the establishment of classes of already good swimmers to be further instructed in the methods of rescuing drowning persons, and resuscitating those apparently exhausted. Diving has been carried to a greater degree of perfection in Sweden than in any other country. Usually the English practice has been confined to the standing or running dive with the succeeding underwater swim, a very useful accomplishment where life-saving is the object, as the body thereby enters the water with a strong impulse in the line of the desired direction: but in Sweden the dive from platforms from forty to sixty feet above the surface, singly and in groups, and either directly or horizontally, or with intermediate somersaults, has been developed.

In the United States, the West is ahead of the East both in general interest and participation, especially beyond the Rockies, where several world's records have been approached. The first championship races were held in 1877 by the New York Athletic Club, and were annual thereafter up to 1888, excepting the years 1879-82. In 1888 the management was ceded to the Amateur Athletic Union. In 1896 an indoor meet was added. The development in time made is shown in the record of the first meet in 1877, when R. Weissenborn won the mile in 45.44¼, a quarter of a minute slower than the present American record. The 100-yard event was established at the third meet, 1883, when A. F. Camacho won in 1.28¼.

Water polo is a department of swimming that has become very popular since it was first recognized as a sport, and there are leagues and national and international championships in Ireland, England, and Scotland (where the game is called water football), Wales, the United States, Canada, India, Australia, and New Zealand. It is played with an Association football (the round ball) in a bath or open water by seven swimmers on each side. The goals are from 19 to 30 yards apart with goal posts at each end. The game is started by the referee throwing the ball into the centre between the line of teams. The ball can be hit or thrown by any player providing he is not standing and only uses one hand. Fouls are awarded for various breaches of rules, the penalty being a free throw for the opposing party. The duration of the game is 14 minutes, 7 each way; a goal is scored when the ball passes through the goal posts and under the cross bar.

SWIN'BURNE, ALGERNON CHARLES (1837—). An English poet, son of Admiral Charles Henry Swinburne and Lady Henrietta Jane, daughter of the third Earl of Ashburnham. He was born in London, April 5, 1837, and was educated at Eton and at Balliol College, Oxford. There he contributed prose and verse to *Undergraduate Papers*, ed. by John Nichol. After three years he left Oxford (1860) without a degree and traveled on the Continent, visiting Landor at Florence (1864). Returning to England, he became closely associated with his brother romantics, Dante Gabriel Rossetti and William Morris. Having written *The Queen Mother* and *Rosamond* (1860), two dramas recalling the fire of the Elizabethan age, he published *Atalanta in Calydon* (1865), a beautiful lyric drama cast in the mold of ancient tragedy. The next year he awakened violent criticism with *Poems and Ballads*. To his assailants Swinburne replied with unmeasured scorn in *Notes on Poems and Reviews* (1866). Besides the few pieces that reasonably disturbed the moralists, the volume contained melodious lyrics covering a wide range of motives, Hebrew, Greek, and mediæval. Swinburne now composed a series of eloquent odes, which won universal attention and again exposed him to censure. Beginning with "A Song of Italy" (1867), they reach a point where "the heights flash" in *Songs Before Sunrise* (1871), celebrating the conflict between darkness and dawn, tyranny and freedom in revolutionary Europe. In the meantime had appeared several lyrics on other themes, of which the finest was

"Ave atque Vale" (1868), in memory of Baudelaire. In 1865 Swinburne published *Chastelard*, a romantic tragedy on the first period in the career of Mary Queen of Scots. He continued her history in *Bothwell* (1874) and afterwards completed it in *Mary Stuart* (1881). The imposing trilogy is a chronicle history cast in dramatic form with no view to the stage. The poems thus far enumerated fairly represent Swinburne, his originality, his extraordinary command over hitherto unsuspected sources of melody, his passion and vehemence.

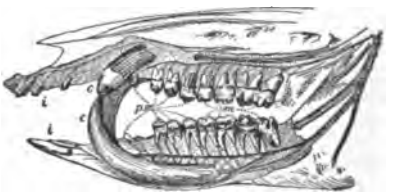
With occasional fall in power, Swinburne produced *Erechtheus* (1876), a second and more restrained classical drama; a second series of *Poems and Ballads* (1878); the grand odes to Victor Hugo; various beautiful sonnets; translations from Villon; *Songs of Two Nations* (1875); *Songs of the Springtides* (1880); *Studies in Song* (1880); *Tristram of Lyonesse and Other Poems* (1882), passionate verse haunted by the rhythm of the sea; *A Century of Roundels* (1883); *A Midsummer Holiday and Other Poems* (1884); *Marino Faliero*, a tragedy (1885); *Locrine*, a tragedy (1887); a third series of *Poems and Ballads* (1889); *The Sisters*, a tragedy (1892); *Astrophel and Other Poems* (1894); *The Tale of Balen* (1896); and *Rosamund, Queen of the Lombards*, a tragedy (1899).

The earlier attitude of defiant revolt against the conventional social order, against kings and priests, prevented his appointment as laureate on the death of Tennyson in 1892, though he was acknowledged as the greatest surviving English poet. In his later years, however, the note of rebellion was less violently sounded, and other feelings, characteristically English, the love of the sea and of little children, held a large place in his poems. As an artist in verse, by his unsurpassed command of all the resources of metrical technique, he takes a unique position. He invented a number of new rhythmic forms, and used none of the old without developing new beauties in them. His chief defect was the natural outcome of his exceptional facility of utterance and impatience of restraint, which allows him frequently to pour forth long sequences of sonorous strains with but little regard to sense. In criticism Swinburne's attention is paid chiefly to the Elizabethan dramatists, though he has indeed made excursions elsewhere, not sparing contemporary singers. These essays have been partially collected in *Essays and Studies* (1875), *A Study of Shakespeare* (1880), and *Miscellanies* (1886). Into his prose Swinburne carried something of the passion of his verse. Notwithstanding the occasional exaggeration into which this leads him, and much faulty reasoning, his conclusions are likely to be true. With wonderful insight he sees the truth, but deceives himself when he comes to state the way in which he arrived at it. His prose, too, has caught the alliteration, resonance, and undulating rhythm of his verse. Consult: Stedman, *Victorian Poets* (rev. ed., Boston, 1887); Theodore Wratislaw, *Algernon Charles Swinburne: a Study* (London, 1901); and Shepherd, *The Bibliography of Swinburne* (ib., 1887). Also *The Fleshly School of Poetry* (1871)—a pamphlet in which Robert Buchanan attacked Rossetti and Swinburne—and Swinburne's reply in *Under the Microscope* (1872).

SWINDLING. See FRAUD.

SWIN'DON. A municipal borough in Wiltshire, England, 77 miles west of London (Map: England, E 5). The old market town, the *Svindune* of Domesday, is built on an eminence commanding fine views of the surrounding country; its urban boundaries were enlarged between 1890 and 1900 to include New Swindon on the marshy plain below. The old town, which received a charter for a fair from Charles I., still maintains the characteristics of an agricultural centre with corn and cattle markets. Population, in 1891, 90,350; in 1901, 94,500.

SWINE (AS. *swīn*, Goth. *swein*, OHG. *swīn*, Ger. *Schwein*, swine; connected with Lat. *suinus*, relating to swine, from *sus*, Gk. *ὗς*, *hys*, Av. *hu*, pig, OHG. *sū*, Ger. *Sau*, AS. *sugu*, *sū*, Eng. *sow*, and ultimately connected with Skt. *sū*, to generate, produce, or with Skt. *sūkara*, swine, lit. *sū*, maker). The family Suidæ, containing those cloven-hoofed ungulate mammals whose domesticated races are called hogs or pigs. The swine are closely allied to the Hippopotomidæ, on the one hand, and to the Dicotylidæ on the other; the latter (peccaries, q.v.), indeed, are sometimes included in the term in popular usage. The three families form a group, Suina. Swine differ from hippopotamuses in their smaller size, in the terminal nostrils, and mobile, gristly snouts with which they obtain their food (largely roots and herbs) by grubbing in the ground. Each foot has four digits, two of which are functional, while the others, although elevated, are often useful in preventing the foot from too readily sinking into marshy ground. They are generally hairy, the babirussa (q.v.) being an exception. The dentition is complete and of the character exhibited by the accompanying illustration of a hog's teeth. The great canines form



DENTITION OF SWINE.

i, incisors; *c*, canines (tusks); *pm*, premolars; *m*, molars; the nervous system of the teeth is also shown.

tusks, which in the males (boars) become formidable weapons; and in some cases (as the babirussa) are doubly developed. The food consists largely of vegetable matter, but may include tough roots, nuts, etc., and also flesh, fish, shellfish, etc.; the stomach is simple, and there is no cæcum (except in the peccaries). These animals are somewhat gregarious, often gathering into small bands, and some peccaries form large herds. The boars fight terrifically in competition for the favor of the females (sows), and valorously defend their young (which are usually striped); they are also courageous in resisting all foes, so that the hunting of certain species affords exciting sport. The pork is usually nutritious and palatable. The family is not large, and is mainly tropical in its distribution. The Suidæ are confined to the Old World; the Dicotylidæ to the warm latitudes of Ameri-

ca. The type-genus is Sus, of which the wild boar (see BOAR) of Europe and Asia is the most prominent species. India and the Malayan region have together three other species, and Western Africa possibly a fifth. The African warthogs (q.v.) include two species of the genus Phacochœrus, distinguished from Sus principally by the huge tusks and great protuberances on the face. The Celebesian babirussa (q.v.) represents alone another genus; and the African river-hogs close the list with two species. One genus and two species enumerate the peccaries. See HOG for an account of domestic races.

Fossil forms of the genus Sus are known in rocks of Middle Miocene to Pleistocene time in Europe, India, and Africa. The earliest representatives of the hog family appear in the Eocene of both North America and Europe, and the group reached an important stage of evolution in late Tertiary time. One notable genus, not, however, in the direct line of pig ancestry, is Elotherium of the Miocene, which was about the size of a rhinoceros, with large heavy head, massive shoulders, and small hindbody and narrow chest, and the body supported on stilted legs that terminated in two-toed feet.

SWINEMÜNDE, svē'ne-mụn'de. A strongly fortified port and fashionable resort on the Baltic Sea, in the Province of Pomerania, Prussia, on the island of Usedom, 37 miles north-northwest of Stettin (Map: Germany, F 2). The Swine here connects the Stettiner Haff with the sea. The harbor is fine. Nearly 5000 vessels of 1,700,000 tons cleared the port in 1899. The town has valuable fisheries. Population, in 1900, 10,251.

SWINE PLAGUE. A reputed contagious disease of hogs attributed to the action of a specific organism. For remedial, preventive, and sanitary measures, see HOG CHOLERA.

SWING, DAVID (1830-94). An American preacher, born in Cincinnati. He graduated at Miami University, Oxford, Ohio, in 1852, and began to study theology, but for twelve years, beginning in 1853, he filled the position of professor of languages in his college. In 1866 he was called to the Fourth Presbyterian Church in Chicago and soon became one of the prominent clergymen of that city. In 1874 he was tried for heresy and acquitted, but, as a consequence, he resigned his pastorate and withdrew from the Presbyterian ministry. Many of his congregation sympathized with him and a new church was organized, meeting at first in a theatre and later in the Central Music Hall, where Dr. Swing continued to preach to one of the largest congregations in Chicago till his death. His preaching, though diverging from the verbal standards of 'orthodoxy,' was essentially evangelical and spiritual, as well as marked by intellectual power.

SWIN'TON. A manufacturing town in Yorkshire, England, 4 miles north-northeast of Rotherham (Map: England, E 3). It has railway, iron, glass, and pottery works. Population, in 1891, 9705; in 1901, 12,217.

SWINTON, WILLIAM (1833-92). A Scotch-American author, born near Edinburgh. He came to America in 1843 and studied at Knox College, Toronto, and at Amherst College, with a view to the Presbyterian ministry. Giving up this intention, he became professor in a woman's seminary at Greensboro, N. C., and subsequently in Mount Washington College, New York. On the outbreak of the Civil War he was sent to the front as war correspondent for the New York *Times*, and served principally with the Army of the Potomac, of whose career he was afterwards a historian. In 1869 he was appointed professor of belles-lettres in the University of California. Among his publications are: *Rambles Among Words* (1859); *Campaigns of the Army of the Potomac* (1864, rev. 1886); *The Twelve Decisive Battles of the War* (1867); and several textbooks, including a *Condensed History of the United States* (1871) and *Outlines of the World's History* (1874).

SWINTON AND PENDLEBURY, pĕn'd'l-bĕr-ĭ. A town in Lancashire, England, five miles northwest of Manchester. Cotton manufacture and brickmaking are its chief industries. Population, in 1891, 21,637; in 1901, 27,001.

SWISS FAMILY ROBINSON. A story by the Swiss writer J. R. Wyss, begun by his father and published by him under the title *Der Schweizerische Robinson.* It is the account of a family wrecked on an uninhabited island, whose wants are provided for by the most remarkable resources of the island. The tale is based on the idea of *Robinson Crusoe,* and has been widely popular in many languages.

SWISS GUARD. A famous regiment of royal body-guards in France, composed exclusively of Swiss. This regiment was first constituted by royal decree in 1616. Their fidelity was absolute and on the outbreak of the Revolution of 1789 they were the object of special animosity on the part of the Parisian mob. On August 10, 1792, the Swiss Guards were called on to defend the palace of the Tuileries against the revolutionary mob. After a gallant resistance in the face of overwhelming numbers, the Swiss were ordered to lay down their arms, whereupon most of them were massacred by the infuriated assailants and those who escaped did so with the greatest difficulty. It is estimated that nearly 800 Swiss Guards were slain on that day. It is in memory of their heroic conduct and brave death that the famous Lion of Lucerne (q.v.), designed by Thorwaldsen, was carved in the face of a cliff at Lucerne, Switzerland. A feeble effort to reconstitute the Swiss Guards was made in 1815, and a body bearing that name was organized. But it was a poor imitation of the old corps and was easily dispersed by the revolutionists in 1830. Consult: Pollio et Marcel, *Le bataillon du 10 août* (Paris, 1881); Ternaux, *Histoire de la Terreur* (8 vols., Paris, 1863-81); Morse Stephens, *The French Revolution* (2 vols., London, 1886-91).

SWITCHBACK. See RAILWAYS.

SWITCHMEN'S UNION OF NORTH AMERICA. See RAILWAY BROTHERHOODS.

SWITHIN, swĭTH'ĭn (or, more correctly, SWITHUN), SAINT (?-862). An English ecclesiastic of the ninth century, who was chaplain to King Egbert, and tutor to his son Ethelwulf. In 852 he was consecrated Bishop of Winchester and made one of Ethelwulf's chief councilors. The origin of the tribute called 'Peter's Pence' (q.v.) has been often assigned to him, and he is said to have procured an act of the Witenagemot enforcing for the fist time the universal

obligation of paying tithes. Swithin was buried, according to his own desire, in a place outside of his church at Winchester, where passersby might tread upon his grave and the rain drop on it from the eaves. A century later he was canonized and his body exhumed and buried inside the church. According to the legend this translation, which was to have taken place on July 15, was delayed in consequence of violent rains, which continued without intermission for forty days. Out of this circumstance arose the still current belief that if rain falls on July 15 it will continue to rain for forty days.

SWITZERLAND (Fr. *Suisse*, Ger. *Schweiz*). A country of Europe extending between latitudes 45° 50′ and 47° 45′ N. and longitudes 6° and 10° 25′ E. It is bounded on the west by France, on the north by Germany and the Lake of Constance, on the east by Austria-Hungary (Tyrol and Vorarlberg) and Liechtenstein, and on the south by Italy and the French Department of Haute-Savoie, from which it is separated by the Lake of Geneva. Area, 15,975 square miles. It stretches over 200 miles east and west and 120 miles north and south. The boundaries are complicated and do not follow natural features, excepting that the Jura Mountains form the natural border between Switzerland and France, and the main crest of the Alps is mainly the border on the south side.

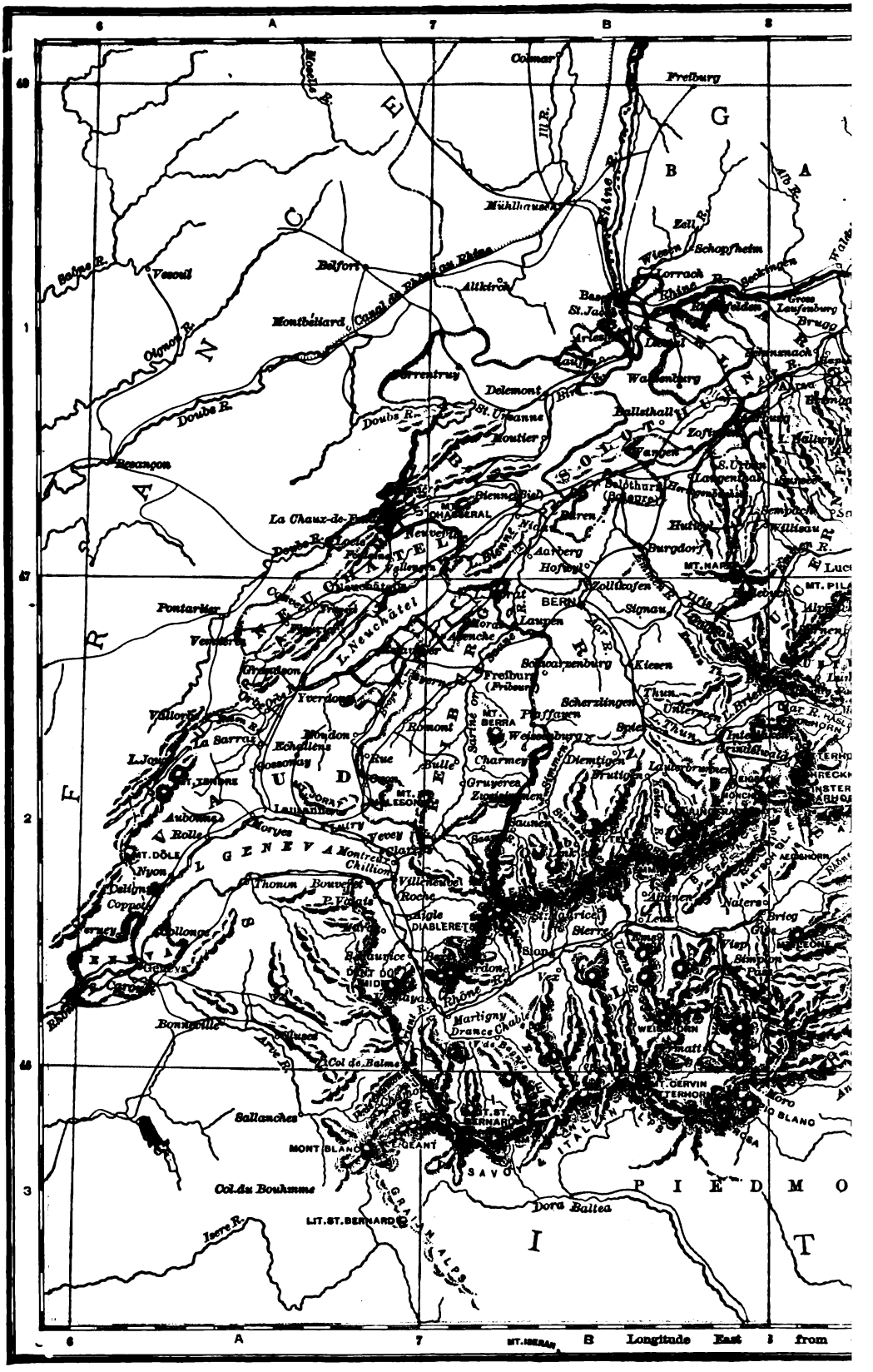
Topography. Switzerland is the most mountainous country of Europe, three-fourths of its area being covered with mountains. The central and southern parts are occupied by the Swiss Alps, which spread over nearly three-fifths of the entire area. The Jura Mountains cover the northwestern portion of the country. Between the Jura Mountains and the Alps is the Swiss high plain, where most of the inhabitants live surrounded by these great natural ramparts. The Jura Mountains form a generally southwest-northeast curve. Their summits do not ordinarily exceed 5000 feet, the loftiest in Switzerland being the Dôle, 5505 feet. The folded Juras have fifteen main folds, nearly parallel with one another, none of them extending the whole length of the district. Between the ranges are long valleys, transverse gorges connecting one valley with another; and these features produce scenery of great beauty and variety. Many fine forests of firs cover the upper slopes and an abundance of rich pastures is spread below them, mingling with the fields and vineyards which extend down to the margin of the small lakes that occupy some of the valley bottoms.

The central plain is steeply walled in between the Juras and the Alps. It is about 1300 feet in general elevation. It is a plain chiefly in contrast with the mountains around it and in other countries would be called an elevated region, thickly studded with picturesque hills. It extends in a southwest and northeast direction from the Lake of Geneva across Lake Constance to Württemberg, and has an average width of about thirty miles. Its hills are due chiefly to unequal erosion, the coarse gravel brought down from the Alps (known as 'Nagelflue,' often cemented into a hard conglomerate) having been able especially to resist the destructive action of time and weather. The débris from the Alps, with which it is covered to a great depth, forms its soil, but the disintegrated granites and gneisses contribute too large a proportion of sand and pebbles to make the soil very rich in plant food, though the conditions are more favorable where there is a considerable admixture from the limestone mountains.

The Alps rising from this central plateau are three times as high as the Juras. The utmost complexity appears to mark the arrangement of the towering ranges, masses, spurs, and precipices of the Swiss Alps. The group of Saint Gotthard, however, is the central knot of this mountain world. It is the middle point from which radiate on almost every side the mighty Alpine ranges that fill the centre and the south of Switzerland. The ranges of Ticino from the south, the mountain masses extending from the Simplon in the southwest, the Bernese Oberland from the west, the Titlis group from the north, the Tödi chains (the Alps of Glarus and Schwyz) from the northeast, and the mighty complex of the Grisons from the southeast, all converge upon Saint Gotthard. This group is also a great hydrographic centre. The headwaters of the Rhine flow from its eastern and of the Rhone from its western sides, cutting the Swiss Alps into a northern and a southern half. The Reuss rises from its northern and the Ticino from its southern slopes.

The Swiss Alps are the middle part of the great highland region of South Europe, which extends in the form of a bow from the Gulf of Genoa to the plain of Hungary. The southern Swiss Alps (south of the Rhine and Rhone) begin in the west in the splendid glacier-covered chain of the Pennine Alps, which have their culmination in Monte Rosa (15,217 feet), inferior in height only to Mont Blanc in France. The Mischabelhörner, the Weisshorn, the Breithorn, and the incomparable pinnacle of the Matterhorn are among the Pennines which extend eastward to the Simplon. Over thirty summits exceed 12,000 feet. East of the Simplon extend the Lepontine Alps, the water parting between the Rhine, the Rhone, and the Po, with many valleys deeply excavated by torrents and crossed by a number of important passes to Italy. East of the Ticino Valley and between the Rhine and the Inn are the Alps of the Grisons, whose snows chiefly feed tributaries of the Rhine, many summits exceeding 10,000 feet. Lastly, south of the Inn and the most eastern group of the southern Swiss Alps are the magnificent peaks of Bernina, whose culminating point is 13,288 feet above the sea. These southern Alps are formed of crystalline rocks, while the northern Swiss Alps are chiefly of limestone stupendously folded.

The chains of the northern Swiss Alps are separated one from another by three deep valleys: (1) that of the Aar with the lakes of Brienz and Thun, which carries nearly all the drainage of North Switzerland to the Rhine; (2) the valley of the Reuss with Lake Lucerne; and (3) the Walensee and Lake Zurich. Thus separated the four great groups of the northern Alps are: First, the Bernese Alps (Oberland), the water parting between the Aar and the Upper Rhone, which include the greatest snow mountains of the Alps; first among them the crystalline summits of the Finsteraarhorn (14,026 feet), the Jungfrau (13,672), Mönch (13,440), Eiger, Wetterhorn, Schreckhorn, and others, a compact mass of snowy and rugged peaks with the Aletsch glacier, 16 miles long, the largest of


Colmar
Freiburg
Mulhouse
Rhine R.
Ill R.
Moselle R.
Saône R.
Vesoul
Belfort
Altkirch
Basel
St. Jacob
Arlesheim
Liestal
Laufen
Delémont
Porrentruy
Doubs R.
Montbéliard
Canal du Rhône au Rhin
Ognon R.
Besançon
St. Ursanne
Moutier
Wangen
Solothurn (Soleure)
Langenthal
Huttwil
Burgdorf
Aarberg
Hofwyl
Zollikofen
BERN
Signau
Lauzen
Schwarzenburg
Kiesen
Thun
Interlaken
Grindelwald
Fribourg
Pontarlier
Neuchâtel
Yverdon
Romont
Bulle
Charmey
Gruyères
Diemtigen
Scherzligen
Spiez
Oberhofen
Brienz
Meiringen
Lausanne
Vevey
Montreux
Chillon
Aigle
DIABLERETS
Martigny
Sion
Sierre
St. Maurice
Visp
Brieg
Naters
Aletsch Glacier
Bonneville
Col de Balme
Sallanches
MONT BLANC
LE GEANT
Col du Boukmme
LIT. ST. BERNARD
Dora Baltea
Isère R.
Rhône R.
Arve R.
Aar R.
Reuss R.
Limmat R.
Zürich
Winterthur
Schaffhausen
Basel
Lake of Geneva
Lake of Neuchâtel
Lake of Thun
Lake of Brienz
Lake of Constance
Longitude East from
6
7
8
A
B


SWITZERLAND
AND LIECHTENSTEIN
SCALE OF MILES
5 0 5 10 15 20 25 30
Railroads
Greenwich
C
9
D
10
E
48
47
46
GERMANY
AUSTRIA
ITALY
Bodensee or L. Constance
Rhine R.
Inn R.
Adda R.
Lake Como
Lugano
Bellinzona
Locarno
Chur
Davos
St. Moritz
Zurich
Basel
Geneva
Lucerne
Bern
Interlaken
Brig
Simplon Pass
Julier Pass
Splügen
Bernardino
Mt. Bernina
Mt. Disgrazia
Mt. Masuccio
Mt. Braulio
Mt. Sentis
Mt. Rigi
Mt. Pilatus
Lake Maggiore
Lake Lugano
Lake Como
Lake Orta
Lake Constance
Lake Zurich
Lake Lucerne
Lake Thun
Lake Brienz
Lake Wallen
Lake Zug
Lake Neuchâtel
Lake Geneva
Lake Silvaplana
Lake Sils
Lake Poschiavo
Lake Iseo
Lake Garda
Lake Varese
Lake Lecco
Lake Como
Lake Orta
Lake Maggiore
Lake Lugano

Switzerland's 600 glaciers. More than 20 of these summits rise over 12,000 feet above sea level. Second, the Titlis Alps, to the east of the Bernese Oberland. Third, the Alps of Glarus and Schwyz, also known by the name of their highest summit in the centre, Tödi (11,887 feet). The Rigi (5906 feet), commanding one of the magnificent views of the Alps, stands in the northwest corner of this group on the shores of Lake Lucerne. Fourth, the lower Alps, between lakes Constance and Zurich, which nowhere reach the snow line. On the whole the southern slopes of the Swiss Alps are steep, but the northern slopes are more gradual. Glaciers and perpetual snow are spread over 800 square miles, or about one-twentieth of the area of Switzerland. See ALPS.

HYDROGRAPHY. Owing to the Alps, the country is especially well supplied with water. Nearly every valley is traversed by a larger or smaller stream, often interrupted by picturesque waterfalls. The country possesses the headwaters of some of the important rivers of Europe—the Rhine, the Rhone, and the Po. The Rhine and its tributaries flowing to the North Sea form the principal system of rivers, but all the rivers in Switzerland are so rapid that they are almost useless for navigation, though their impetuous character fits them for industrial purposes. The only navigable stream of importance is the Aar tributary of the Rhine, which carries a larger volume of water to that river than the Rhine itself supplies above their point of junction. The Rhone, flowing to the southwest and to the Mediterranean, reaches Lake Geneva as a muddy stream and leaves it to enter France as a clear blue river. The Ticino is the largest river sent down by Switzerland to the Po. It has a larger catchment basin than any other Swiss river and is the least fed by glaciers. The Inn flows east through the deep, narrow valley called the Engadine, and falls into the Danube at Passau, where it is much larger than the Danube itself. The glaciers are a source of perennial water supply, and since they melt most rapidly in summer, the Swiss rivers are larger in summer than in winter.

The Alps are the Lake Country of Southwestern Europe. The lakes are remarkable for size, depth, and the grandeur and beauty of the scenery which surrounds them. Among the fifteen important lakes in Switzerland, eleven are in the basin of the Aar and none in the basin of the Inn. Lakes Geneva and Constance, the largest lakes, balance each other at the opposite ends of the country. Lake Geneva, partly in France, is over 200 square miles in area and has a maximum depth of 1000 feet, its bottom extending almost to the level of the Mediterranean. Lake Constance is a little smaller than Geneva, not quite so deep, lies partly in German territory, and is the filter of the Rhine. Lake Neuchâtel, the largest lake entirely in Swiss territory, lies on the tableland, and hence is not so deep as the lakes in the longitudinal mountain valleys. Lucerne, Zurich, Brienz, Thun, and Bienne are also important lakes. Lake Lugano lies partly in Italy, and only nine miles of Lake Maggiore belongs to Switzerland. The Ticino flows through the latter on its way to the Po.

CLIMATE. The distribution of climate is vertical rather than horizontal. On the central plain and in the lower mountain valleys a temperate climate prevails, the mean annual temperature being about 50° F. The mean temperature diminishes on an average by 3° for every thousand feet of elevation, so that the climate in the higher valleys is very severe. Ticino, Vaud, and Geneva enjoy an almost Italian climate, with a mean temperature of 51° to 53.5° F., in which southern fruits ripen. The snow line on the southern side of the Alps is about 10,170 feet above sea level; on the north side the limit of perpetual snow is about 8530 feet. The growth of grain ceases at about 4000 feet. On the higher Alps, which are wrapped in clouds much of the time, the annual precipitation is from 78 to 97 inches; on the central plain it is 33 inches. The Föhn, a warm south wind, causes some destruction by rapidly melting the snow and so producing avalanches and inundations. The climate of Switzerland, on the whole, is not favorable to agriculture, but is stimulating and healthful.

FLORA AND FAUNA. The vertical zones of vegetation in the Alps correspond to the horizontal zones of Europe between latitude 46° and the Arctic Circle. Olives in a few of the low valleys are succeeded by vines and the plants of middle Europe; then come in succession deciduous trees and grains, conifers, the high pastures, and shrubs and mosses, above which rises the region of perpetual snow. Oaks and chestnut trees are abundant only in the more southern valleys, beech trees are numerous up to 4000 feet above the sea, and pines, larches, and fir trees thrive between 4000 and 6500 feet. Agriculture is mainly confined to the regions not above 2500 feet, but the high pastures extend far above the region of tillage.

The wolf, ibex, and chamois are found in the mountains, but all wild animals are becoming very scarce.

GEOLOGY AND MINERAL RESOURCES. The backbone of Switzerland consists of gneiss and granite with outlying strata of the Carboniferous, Triassic, Jurassic, Cretaceous, and Tertiary formations. These strata are all thrown into a succession of gigantic folds, giving rise to great geologic complexity. Four distinct geologic zones, extending across Switzerland from southwest to northeast, are recognized. The limestone Jura region of roughly parallel folds is the first zone. The second is the plain whose rocks are chiefly sandstone covered, to a great extent, by the deposits of the ice invasions. The other zones cover the Alps, the more northern being that of the limestone Alps whose strata are greatly distorted and piled up over one another. The fourth zone consists of the great crystalline masses of the southern Swiss Alps formed of gneiss, granite, and other crystalline rocks and schists. Denudation has reduced the height of the mountains and deepened and lengthened the valleys, the larger rivers having pushed their sources back to the very heart of the mountain groups. The mining industry is of little importance. Building stone, particularly sand and limestone and rock salt, found in three cantons, are the chief mineral products. A little iron ore is mined in the Jura ranges, but the iron industries depend upon imports of material. A small amount of anthracite is mined near Bern of Fribourg, but Germany sends nearly a million tons of coal to Switzerland every year, and France, Austria, and England also contribute important quantities. Asphalt in the Val des

Travers, marble in Uri, Schwyz, and Ticino, slate in Glarus, and rock-crystals of great beauty, are other mineral products.

AGRICULTURE AND STOCK-RAISING. The soil is distributed among nearly 300,000 peasant proprietors representing nearly two-thirds of the population. More than 28 per cent. of the area is unproductive, chiefly the regions above the zone of tillage. Hay and pasturage lands, more important than the cultivated lands, cover 36 per cent. of the surface; the area under forests is 18.4 per cent., while only 16.5 per cent. of the surface is arable. Switzerland derives less support from its agricultural resources than any country of the Continent, excepting Norway. Only Solothurn, Lucerne, Schaffhausen, and Fribourg, among the cantons, produce nearly enough plant food for their own consumption. Wheat is grown up to 2500 feet above sea level, but the crop averages only about 3,500,000 bushels, while over 11,000,000 bushels are imported from other countries, chiefly Russia and Hungary. Rye, oats, and potatoes are the chief crops, but potatoes are imported in large quantities. During the tourist season of 1901 the amount of vegetables brought into the country was about 20,000 tons, of which nearly two-thirds came from Germany, France and Italy contributing most of the remainder. The cultivation of fruit is in a flourishing condition and nearly all the cantons manufacture wine or spirits from it, such as the cherry brandy produced at Basel. In 1901, 78,931 acres were in grapes, the cultivation of the vine commanding careful attention in most of the cantons. The best wine is made in Geneva, Neuchâtel, and Valais. The wine produced (35,800,000 gallons in 1901) does not cover the domestic demand. Orchards are planted everywhere in sheltered places and grapes thrive especially in the warmer soils around Lake Geneva and some other lakes and on the southern slopes of the mountains. The warmer cantons of the south also produce chestnuts, almonds, walnuts in abundance, olives, and even lemons. Switzerland is no longer so rich in timber as formerly, for unscientific forestry has thinned the woods to a large extent. The entire forest area is about 3300 square miles, of which a large portion is now under Government supervision. Every effort is being made to restore this source of wealth to its former magnitude, and in 1901 there were planted 23,731,376 trees.

As the climate and soil are especially favorable for hay and pasturage, the animal industries are more important than tillage. In comparison with cattle (1,340,375 in 1901) the other domestic animals are much inferior in number and importance. Cattle-breeding is carried on in all the cantons, and in the higher regions it is the chief and sometimes the only resource of the inhabitants. Switzerland is famous for its cheese, and the chief agricultural industries are the manufacture of cheese and condensed milk. The annual production of cheese amounts to about 500,000 cwts., of which three-fifths is exported to all quarters of the globe. The best cheeses are made in the Emmenthal, Maderanthal, Ufernthal, and in Gruyères. Many Swiss cattle are exported for breeding purposes, while, on the other hand, the great influx of tourists in summer makes it necessary to import an average of about 50,000 beef cattle a year, chiefly from Austria and Italy, to make up for the local deficiency in beef. Next in number are goats (354,634), which abound in the higher Alpine cantons and are reared for their skins, flesh, and milk. In 1901 the horses numbered 124,896; mules and asses, 4866; sheep, 219,438; and hogs, 555,261. The lakes abound in fish, and pisciculture is promoted by 155 establishments that produce enormous quantities of fry.

MANUFACTURES. Switzerland is a great manufacturing country, though it lacks coal, iron, and seaports. Its advantages are abundant water power, markets in the adjoining countries in which to buy raw materials and sell manufactured products, good connections with seaports, and the diligence, perseverance, and skill of the people. Nearly as many persons are engaged in manufactures as in agriculture. Large quantities of the manufacturing output are produced in the homes. The textile and metal industries are of greatest importance. The cotton industry, which competes even with English manufactures, is centred chiefly in the cantons of Zurich, Glarus, Saint Gall, and Appenzell. Swiss cotton cloths noted for fineness of texture and excellence of dyes and prints are sent all over the world. The well-known machine-made lace and embroidery industry of Switzerland employs about 10,000 machines and 17,000 workers in Saint Gall, Appenzell, and Neuchâtel. The great centres of the silk industry are Basel, where all kinds of silk ribbons are produced, and Zurich, where dress goods are woven. Watchmaking and machinery lead in the metal industries. The most important centres of watchmaking are Geneva, Chaux-de-Fonds, and Locle. The industry was once very prosperous, but it has suffered severely of late years from the competition of the machine-made watches of the United States. The Swiss, however, have regained a large part of their export trade by the introduction of machinery and the manufacture of the cheaper grades of watches, which they produce by the hundreds of thousands every year, five-sixths of them being sold in foreign countries. The manufacture of jewelry and musical boxes, wood-carving, straw-plaiting, leather-making, and tanning are also very important industries. The well-known machine works of Zurich, Winterthur, and Geneva export a considerable part of their output.

COMMERCE. The average annual foreign trade of Switzerland is:

	1885-86	1891-96	1901
Imports	$149,000,000	$189,500,000	$223,700,000
Exports	134,000,000	140,000,000	172,600,000

The largest imports are grain, cattle, and other foodstuffs, cotton, coal, iron, petroleum, and groceries. Nearly all the exports are manufactures, such as cheese, wine, silk and cotton goods, watches, fine steel and iron goods (instruments, etc.), machinery, jewelry, lace, embroideries, and straw-plaiting. Manufacturers do not aim to produce large quantities of cheap stuffs, except that cheap watches have, to a great extent, replaced the finer grades. They aim to make a reputation for the excellence and fineness of their goods. Nine-tenths of the import trade and three-fourths of the export trade are with Europe, chiefly with Germany, France, Italy, Great Brit-

ain, and Austria-Hungary. The United States sells very little to Switzerland, but its purchases of cotton embroideries, silk goods, cheese, and other Swiss products are important. Switzerland's trade with the United States in three years amounted to:

	1900	1901	1902
Imports from.....	$250,477	$255,360	$217,515
Exports to.....	17,393,268	15,799,400	17,784,855

TRANSPORTATION AND COMMUNICATION. In the absence of navigable rivers, the international traffic is carried by the railroads. The main arteries are the lines from Lake Constance to Geneva and Basel, and from the north via the Saint Gotthard tunnel to Italy. There are 2490 miles of railroad, and under the law of 1898 the State is acquiring the ownership of the entire system. Switzerland is noted for its admirable wagon roads. Navigation is important on the lakes, where 112 steamboats belonging to fifteen companies were plying in 1901.

BANKING. The 36 banks had, at the close of 1901, paid up capital amounting to $39,155,000; note circulation, $47,610,000; and cash on hand, $23,995,000. Banks of issue are under Government inspection; the notes of the 22 cantonal banks are secured by the cantons, and 10 of other banks by the deposit of securities.

GOVERNMENT. The Constitution of 1848, with the important revision of 1874 and subsequent amendments of lesser importance, constitutes the present fundamental law of Switzerland. (For the methods of amending the Constitution, see REFERENDUM.) The Swiss State is composed of twenty-two cantons, with Bern as the capital. The Constitution vests the executive power in a Federal Council of seven members elected for a term of three years by the two Houses of the Federal Legislature. Any Swiss citizen who is eligible to either branch of the Federal Legislature may be chosen to the Federal Council, except that not more than one member may be chosen from the same canton. It is the custom to choose members of the Council from the membership of the Federal Legislature and to reëlect them continually for a long period of time. The work of administration is divided into seven departments, and one member of the Council is put in charge of each department, but the act of any Councilor is considered to be the act of the Council as a whole. The Council is organized under a president (President of the confederation) and a vice-president chosen by the Federal Legislature from among the Councilors to serve for a term of one year.

The powers and duties of the Federal Council are many and varied. In the domain of legislation it plays an important part, although it has no veto upon the acts of the legislature. In this domain the Council sustains a relation to the legislature somewhat like that of the Cabinet in the parliamentary system of government. It makes an elaborate report to the legislature, and although its members cannot at the same time be members of the legislature, they have access to its sessions, take an active part in the deliberations, introduce legislative proposals, give their opinions upon various measures, and exert a great influence upon the work of legislation. It prepares the budget and advocates its adoption by the legislature, and takes the lead in the discussion of all important measures introduced by the Government. The Federal Council also has a wide power of action in judicial affairs. It has, for instance, the settlement of a large class of administrative controversies which in other Continental countries is intrusted to special administrative courts. It has a large supervisory power over the cantonal administration, particularly when the cantons are engaged in administering federal law. In addition to the above mentioned functions the Council has the other powers usually exercised by a nation's executive.

The strictly legislative powers of the Government are vested in a Federal Assembly (*Bundesversammlung*), consisting of two Houses, viz. the National Council (*Nationalrat*) and the Council of Estates (*Ständerat*). The two Houses hold separate sessions in all legislative matters and joint sessions for the exercise of certain electoral and judicial functions. There is full equality between the two Houses in all matters whatsoever. The Council of Estates is composed of 44 members, or two from each canton. In three cantons which are divided, each half canton chooses one member. The tenure, amount of compensation, qualifications, mode of election, and the relations which they bear to their constituents are matters which the Federal Constitution does not regulate, but are left to the determination of each canton according to its own ideas with the result that the greatest variety of provisions prevails. The terms of members vary from one to four years. The Council of Estates elects its own president and vice-president under the limitation that neither office can be filled from a canton which furnished the president for the session preceding. The National Council, or popular chamber of the legislature, consists of members chosen by direct universal suffrage for a term of three years. The Federal Constitution apportions the members of the National Council according to population on the basis of one representative for every 20,000 inhabitants. In those districts which choose more than one representative the members are chosen on a general ticket. The Council elects its own officers subject to the limitation that the president and vice-president must be chosen from the body of the Council and are ineligible to succeed themselves for an ensuing term. The president, in addition to his vote as a member, has a casting vote in case of a tie. The members of the National Council receive a compensation from the Federal treasury. The Federal Assembly holds two regular sessions annually, beginning in June and December, each lasting about one month. The discussions take place in French, German, or Italian, according to the convenience of the speakers, while all formal readings occur in both French and German. The two Chambers meet jointly to settle conflicts of jurisdiction between the Federal authorities; to grant pardons; and to elect the Federal Council, the Supreme Court, the Chancellor, and the commander of the army. The ordinary legislative power of the Federal Assembly is very wide and extends to many subjects which in the United States are left to the regulation of the States.

The judicial power of the Confederation is vested in a Supreme Court or Federal Tri-

bunal consisting of fourteen judges and a number of supernumeraries elected for a term of six years by the Federal Assembly, which also designates a president and a vice-president of the court for two years. The court is divided into three sections, each of which holds a session in one of the five judicial districts into which Switzerland is divided. The seat of the court is at Lausanne, in the Canton of Vaud. The jurisdiction of the Federal Court in the domain of public law extends to conflicts of authority between the Confederation and the cantons, to disputes between cantons of a public-law nature, and to complaints of the violation of individual constitutional rights. In civil matters of private law its jurisdiction extends to suits between the Confederation and the cantons or between the cantons themselves, or suits against the Confederation or between the cantons and private individuals or corporations. The Federal Tribunal is also a court of appeal from the decisions of the cantonal courts where the amount in dispute exceeds 3000 francs (about $600). Its criminal jurisdiction extends to cases of high treason against the Confederation or violence against the Federal authorities, to offenses against the law of nations, to political offenses which cause disorder and lead to armed intervention, and to certain minor offenses.

For the purposes of local government the political divisions and subdivisions of Switzerland are cantons, districts, and communes. Each canton has its own constitution and local government. With a few exceptions there is a unicameral legislative body called the Great Council, whose members are elected by popular suffrage, as a rule, for a term of three or four years. It enacts laws, votes the taxes, and supervises the administration. In the four cantons of Uri, Unterwalden, Glarus, and Appenzell primary assemblies of all the voters, in many respects like the New England town meeting, take the place of a legislative body. Such assemblies are known as the *Landsgemeinden*. The chief executive authority in all the cantons is a council whose membership varies in number from 5 to 9 in the different cantons. The same may be said of the term of service and the mode of election. At present the members are chosen by popular vote in a majority of the cantons; in the others they are chosen by the local legislatures. In all the cantonal constitutions except that of Fribourg the referendum (q.v.) as a means of legislation has a prominent place. The initiative likewise plays an important part in local legislation. In all the cantons except Geneva constitutional amendments may be initiated by popular petition; and in all except Fribourg, Lucerne, and Valais the same right exists in the case of ordinary statutes.

The cantons are divided into districts. The chief executive and administrative authority in the district is a sort of prefect either popularly elected or chosen by the cantonal Council. A subdivision of the district is called the commune (*Gemeinde*). In some of these the popular town meeting is the chief organ of government; in the others there is a local legislative assembly popularly elected. In all of them the chief executive authority is a small council consisting of a president or mayor and not less than four members.

FINANCE. The Confederation derives most of its revenue from the customs, though considerable income is yielded by the post-office and telegraphs. The alcohol monopoly, amounting in 1901 to about $1,120,000, is divided among the cantons, one-tenth of the amount being used to combat the spread and evil effects of alcoholism. The revenue of the Confederation in 1901 was $20,384,936, and the expenditure was $21,110,618. The public debt amounted on January 1, 1902, to approximately $17,500,000, most of it bearing 3½ per cent. interest. The monetary standard is gold and silver, with the franc as the unit of coinage. Metric weights and measures are used.

DEFENSE. See under ARMIES.

POPULATION. The population, according to the census of December 1, 1900, was 3,315,443. In 1900, 2,319,105 inhabitants spoke German, 733,220 French, 222,247 Italian, and 38,677 Romansh. The total number of foreigners living in the country in 1900 was 392,896. The chief towns, with their populations, in 1901, were: Zurich, 152,942; Basel, 111,009; Geneva, 105.139; Bern, 64,864. The list of the cantons of Switzerland, with areas and populations for 1888 and 1900, is as follows:

CANTONS	Area, sq. miles	Population	
		1888	1900
Aargau	542	193,580	206,498
Appenzell... Ausserrhoden	101	54,109	55,281
Appenzell... Innerrhoden	61	12,888	13,499
Basel... Stadt	14	73,749	112,227
Basel... Land	163	61,941	68,497
Bern	2,657	536,679	589,433
Fribourg	644	119,155	127,951
Geneva	108	105,509	132,609
Glarus	267	33,925	32,349
Grisons	2,773	94,810	104,520
Lucerne	579	135,360	146,159
Neuchâtel	312	108,153	126,279
Saint Gall	779	228,174	250,285
Schaffhausen	114	37,783	41,514
Schwyz	351	50,307	55,385
Solothurn	302	85,621	100,762
Thurgau	381	104,678	113,221
Ticino	1,088	126,751	138,638
Unterwalden... Upper	183	15,043	15,260
Unterwalden... Lower	112	12,538	13,070
Uri	415	17,249	19,700
Valais	2,027	101,985	114,438
Vaud	1,244	247,655	281,379
Zug	92	23,029	25,093
Zurich	666	337,183	431,036
Total	15,975	2,917,754	3,315,443

EDUCATION AND RELIGION. Instruction is compulsory and is rigidly enforced in the Protestant but not in the Roman Catholic cantons. The pupils number nearly 600,000, of whom 471,713 were in the primary schools in 1900. Among the famous institutions are the Universities of Zurich, Bern, Geneva, and Fribourg, the Academies of Geneva and Lausanne, and the "Federal Polytechnic" at Zurich, which attracts pupils from all parts of Europe. In religion there is complete liberty of conscience. About three-fifths of the inhabitants are Protestants, nearly all the remainder being Roman Catholics.

ETHNOLOGY. Such human remains of the prehistoric Swiss as have been found in their lake-dwellings (q.v.) ally the ancient people with the short-headed Celtic or Alpine race. Racially Switzerland is now overwhelmingly Alpine or Celtic (index, 83.8; Romansh 85), especially

in isolated portions, with local invasions of northern and southern types. Great confusion is caused by the conflict between racial characters and environmental influences. Especially in stature is this true, the Teutonic element being shorter instead of taller.

HISTORY. In Roman times the country was inhabited by two races—the Helvetii, supposed to have been Celts, in the northwest; and the Rhætii, who were said to be of common stock with the Etruscans, in the southeast. The Helvetii, having migrated into Gaul, were conquered by Julius Cæsar in B.C. 58, who forced the remnant of them to return to their homes, and before the close of the century the Rhætians were subdued by the armies of Augustus. When the German invasions took place, the Alemanni took possession of the country east of the Aar, while the Burgundians settled in Western Switzerland. About the close of the fifth century the Alemanni were conquered by the Franks and their territory became a part of the Frankish dominion. Another Teutonic people, the Ostrogoths, took possession of the part of the country occupied by the Rhætii, which nearly corresponded to Grisons, but their rule was of short duration. The Burgundians embraced Christianity about the end of the fifth century; the Alemanni retained their old pagan creed until the seventh century, when the band of Irish monks which had entered Gaul under Saint Columban (q.v.) came among them, converted the people in vigorous fashion, and founded abbeys and churches, which survive to our own time. Switzerland made great progress under the rule of the Franks. After the dissolution of the great Carolingian realm the bulk of Switzerland was included in the Duchy of Alemannia, which became part of the German Kingdom, while the southwestern portion of the country was included in the Kingdom of Transjurane, Burgundy. In 1033-34 this Burgundian portion passed under the rule of the German emperors, so that from this time the whole of Switzerland belonged to the Holy Roman Empire. In the early part of the Middle Ages feudalism flourished in the Swiss highlands even more than elsewhere. In the twelfth century the dukes of Zähringen rose to great power in Switzerland. They did much to check civil wars and to promote the prosperity of the towns. In 1178 they founded Fribourg and in 1191 Bern. On the extinction of the line of Zähringen (1218) their allodial possessions passed to the counts of Kyburg, while a number of cities were released from feudal overlordship. In the latter part of the thirteenth century the counts of Savoy extended their domination into Western Switzerland. At this time the counts of Hapsburg became a great power in the land, and in 1264 the house succeeded to the bulk of the possession of the counts of Kyburg. At this time there were a large number of petty sovereignties in Switzerland. Prominent among the ecclesiastical princes were the bishops of Basel and Geneva and the Abbot of Saint Gall. The great towns were united in self-defense, and many of them obtained charters as free Imperial cities. The Hapsburg rule soon became burdensome and tyrannical, and the resistance which opened the long struggle that was to end in Swiss independence began in the three Forest Cantons—Uri, Schwyz, and Unterwalden. Uri received a special charter of liberties from the Emperor Frederick II. in 1231 and Schwyz in 1240. They had leagued themselves together in behalf of the Emperor somewhat later. Thus they were accustomed to the idea of a mutual league when after the death of the Emperor Rudolph they sought to resist the Hapsburgs. In 1291 they allied themselves into a 'perpetual league,' which came to be known as the Eidgenossenschaft. Subsequently they entered into an alliance with Zurich and the coalition of which it was the centre. Unterwalden received a charter similar to that of its associates from the Emperor Henry VII. In 1315 hostilities opened between Frederick of Hapsburg and the Eidgenossen, and the latter won the decisive battle of Morgarten (q.v.). To the period preceding this victory belongs the legend of William Tell. The Forest Cantons then renewed their pact by a fundamental agreement which was for five centuries the basis of the political life of independent Switzerland. Lucerne (1332), Zurich (1351), Glarus and Zug (1352), and Bern (1353) entered the confederation. Fresh wars followed with Austria, whose power in Switzerland was shattered by the victories of the confederates in 1386 at Sempach and in 1388 at Näfels. In 1415 the people of the cantons became the aggressors, invading Aargau and wresting it from Austria. Half a century later they made themselves masters of Thurgau. Swiss independence clashed with the ambitions of Charles the Bold of Burgundy, and the invincible prowess of the Swiss mountaineers shone forth when they were assailed by that powerful monarch. In 1476 they overthrew his armies at Granson and Morat, and it was with the aid of Swiss mercenaries that René of Lorraine overwhelmed Charles the Bold at Nancy in 1477. In 1481 the towns of Fribourg and Solothurn were admitted into the confederacy. In 1499 the Emperor Maximilian I. made a final attempt to bring Switzerland once more within the bounds of the Holy Roman Empire. He sought to draw men and supplies from the inhabitants for his Turkish war, but in vain. He was defeated in six desperate engagements. Basel and Schaffhausen (1501) and Appenzell (1513) were then received into the confederation, and its true independence began. The abbacy of Saint Gall and the cities of Saint Gall, Mülhausen, and Bienne became associated States with a vote in the Diet. Geneva, Neuchâtel, Valais, and Grisons also became associated States, but without a vote. In the early part of the sixteenth century the Swiss soldiers, who had become the most famous infantry in Europe, played a great, if not glorious, rôle as mercenaries in the Italian wars. After fighting successfully on the side of Milan against the French they suffered a terrible defeat at the hands of Francis I. at Melegnano in 1515. In 1516 they concluded the so-called Perpetual Peace with France, after which they fought on the French side. In the course of these wars a number of Italian towns and districts (in the present Canton of Ticino) were annexed to Switzerland.

The Reformation (q.v.), which was inaugurated by Zwingli in 1519, brought dissension among the confederates. Zurich in 1523 adopted Zwingli's opinions, and was followed by Bern and other cantons of the north. The Forest Cantons remained attached to the Church of Rome. War

broke out in 1531 between the Catholics and Protestants, and a small body of Zurichers was defeated at Kappel. Zwingli, who was with them as their chaplain, was slain. In 1536 Bern wrested the Pays de Vaud from the dukes of Savoy and annexed it to its own territory. In the same year Calvin settled at Geneva, which had succeeded in emancipating itself completely from the jurisdiction of Savoy and of its bishop, and the reformed doctrines spread throughout Western Switzerland. During the Thirty Years' War Bern, which had become, since the conquest of Vaud, the leading canton, and Zurich, contrived to maintain the neutrality of Switzerland; and in the Peace of Westphalia, in 1648, the country was formally declared to be wholly independent of the German Empire.

The complex fabric of the Swiss Confederation, with the division into two hostile religious camps, the relation between governing cantons and subjected districts, the selfish assertion of local and class interests, and the absence of any firm bond of union, was not conducive to a healthy political development. The constitution of the larger cantons became more and more aristocratic. In Zurich, Schaffhausen, and Basel the governing councils were elected by the corporations; and in Bern, Fribourg, Solothurn, and Lucerne a few families had acquired permanent rule. The French Revolution had its effect in Switzerland as elsewhere. In 1798 the country was occupied by the French, who were aided by the dissensions between the democrats and aristocrats. The old cantonal system was abolished and the Helvetic Republic was organized. In 1803, at the dictation of Napoleon and under the Act of Mediation, the cantonal system was reestablished, with nineteen cantons, six new ones being constituted—Saint Gall, Grisons, Aargau, Thurgau, Ticino, and Vaud. After this Switzerland enjoyed peace under an orderly government and began to recover prosperity. The Congress of Vienna (1814-15) recognized the independence of Switzerland and her perpetual neutrality and the inviolability of her territory were guaranteed by the great Powers. The new Confederation was divided into twenty-two cantons (three new cantons, Geneva, Valais, and Neuchâtel, being constituted), each of which was represented in a diet, which was appointed to hold its annual meetings alternately at Bern, Zurich, and Lucerne. The old abuses, however, which had crept into the constitutions of the cantons were revived, and representation in most of them became based on property qualifications. Officials, the aristocracy, and the clergy joined to oppose innovations, and succeeded in doing so until the Revolution of 1830 in France. From that year until 1848 Switzerland passed through a long crisis. There was strife between the democratic and aristocratic elements, and then between the Catholics, who in some of the cantons retained ancient special privileges, and the Protestants, who formed a majority of the Swiss people. In Aargau a struggle took place between the Liberals and the Ultramontane Party, which was settled by an unsatisfactory compromise. In Valais, where universal suffrage had put power into the hands of the reactionary party, a war took place, in which this party was victorious. It then ruled with a strong hand, and forbade Protestant worship within the canton. In Lucerne the Ultramontane Party so persecuted its political opponents that the latter were compelled to leave the canton. In 1844 a proposal was made in the Diet to expel the Jesuits, the chief object of Protestant attack; but that body declined to act. The Radical Party then determined to resort to force; they organized bodies of armed men, called "free corps," which invaded the Catholic cantons, but were defeated. The Catholic cantons then formed a league, named the Sonderbund, for defense against the free corps. There was a general clamor for its suppression, but in the Diet only 10½ votes out of 22 were in favor of that measure. The ruling party in Geneva had been with the majority, and this conduct led to a revolution in that city. One vote was thus gained against the Sonderbund. Saint Gall added another; and a majority in the Diet in 1847 declared the illegality of the Sonderbund, and decreed the expulsion of the Jesuits. The Federal forces under General Dufour defeated those of the Sonderbund; the leagued cantons were made liable for all the expenses of the war, the Jesuits were expelled, and the monasteries were suppressed. An attempt was made by diplomatic notes to intimidate the Swiss Government, but the revolutions of 1848 prevented further interference. This same period of civil strife was also one of intellectual and material development. The results of these stormy but profitable years were seen in part in the Constitution of 1848, which bound the Confederation more firmly together and gave it at last an efficient government. This Constitution subsisted until 1874, when the believers in a stronger federal government won a step in that direction. The Constitution of 1874 has been since amended in some of its details. In 1891 the six hundredth anniversary of the 'Perpetual League' was celebrated by the Swiss with great enthusiasm. The history of Switzerland for the past quarter of a century has been very uneventful, though marked by a steady material, intellectual, and political growth.

BIBLIOGRAPHY. GENERAL: DESCRIPTIVE. Reclus, *Nouvelle géographie universelle*, vol. iii. (Paris, 1878); Gourdault, *La Suisse études et voyages à travers les 22 cantons* (ib., 1879); Robida, *Les vieilles villes de la Suisse* (ib., 1879); Sowerby, *The Forest Cantons of Switzerland* (London, 1892); Stephen, *The Playground of Europe* (ib., 1894); Dixon, *The Switzers* (London, 1872); Osenbrüggen, *Die Schweizer daheim und in der Fremde* (Berlin, 1874); Story, *Swiss Life in Town and Country* (London, 1902). FLORA; FAUNA. Morthier, *Flore analytique de la Suisse* (Neuchâtel, 1879); Schröter, *Die Flora der Eiszeit* (Zurich, 1882); Heer, *Die Urwelt der Schweiz* (ib., 1883); F. von Tschudi, *Tierleben der Alpenwelt* (11th ed., Leipzig, 1890); Schinz and Keller, *Flora der Schweiz* (Zurich, 1900). GEOLOGY. Studer, *Geologie der Schweiz* (Bern, 1851-53); Schmidt, *Zur Geologie der Schweizeralpen* (Basel, 1889); Lubbock, *The Scenery of Switzerland* (London, 1896); and the authorities referred to under ALPS.

ECONOMICS. Farrer, *Volkswirtschaftslexikon der Schweiz* (Bern, 1885-92); Jay, *Etudes sur la question ouvrière en Suisse* (Paris, 1893); Dawson, *Social Switzerland* (London, 1897); Geering, *Wirtschaftskunde der Schweiz* (Zurich, 1902); and with special reference to industries

and resources, Wirth, *Allgemeine Beschreibung und Statistik der Schweiz* (Zurich, 1871-75); Geering and Holtz, *Die Handelspolitik der Schweiz am Ausgang des 19. Jahrhunderts* (Berlin, 1902). GOVERNMENT. Reymond, *Etudes sur les institutions civiles de la Suisse* (Geneva, 1885); Adams and Cunningham, *The Swiss Confederation* (London, 1889); Moses, *Federal Government of Switzerland* (Oakland, Cal., 1889); Vincent, *State and Federal Government in Switzerland* (Baltimore, 1891); Winchester, *The Swiss Republic* (Philadelphia, 1891); Salis, *Le droit fédéral suisse* (2d ed., Berne, 1902).

HISTORY. Hug and Stead, *Switzerland* (New York, 1890); Daguet, *Histoire de la confédération suisse depuis les temps anciens jusqu'en 1864* (7th ed., Paris, 1880); Muydin, *Histoire de la nation suisse* (Lausanne, 1896-97); Müller, Monnard and Vulliemin, *Histoire de la Suisse* (19 vols., Paris, 1837-51), indispensable as a reference work; Morin, *Précis de l'histoire politique de la Suisse* (Geneva, 1855-75); Dändliker, *Geschichte der Schweiz* (Zurich, 1892-1902); Vulliéty, *La Suisse à travers les âges* (Paris, 1902).

SWIV'ELLER, DICK. A lively young man in Dickens's *Old Curiosity Shop*, very flowery in language and untidy in dress. He finally marries 'the Marchioness.'

SWORD (AS. *sweord*, OHG. *swert*, Ger. *Schwert*, sword; of uncertain etymology). In its general sense, every steel weapon of offense or defense larger than the dagger or poniard; in modern military usage the term *sword* is used to describe the infantry or straight weapon, and *sabre* for the slightly curved weapon of the cavalryman. Although the distinction is clearly marked in Germany by the employment of *Degen* for the straight sword and *Säbel* for the curved weapon, the custom with other nations is to employ a single word for both varieties. The sword always has been, and is at present, a personal weapon; so much so that in the prose and poetry of all nations it is often endowed with human as well as superhuman qualities. To surrender the sword has always been a token of submission, and the breaking of it a most impressive ceremony of degradation, while to kiss the sword is even to-day with Orientals the highest form of oath and homage. The first sword was undoubtedly of hard wood, and judging from the widely scattered area in which it has been proved to have been known, its employment must have been practically spontaneous among all the peoples whose stage of civilization rendered possible its use. Wooden swords were part of the equipment of the Indians of Virginia, according to the statement of Captain John Smith. Greek literature refers more frequently to the spear and bow than to the sword, as is the case with the Roman and Hebrew writings. According to the testimony of the Greek works of art, the leaf-shaped blade sword was the one used by the Greeks in historical times, although the Greeks, almost alone of the ancient peoples, held the sword in but slight estimation. The ancient sword was usually worn on the left side suspended by a belt from the shoulder, although it was sometimes slung more forward, bringing the hilt in the front, or else suspended from a girdle around the waist. With the Egyptians the sword of bronze was carried in its leather scabbard in front of the body, and thrust in the sword belt in a sloping direction from right to left. The Assyrians seem to have possessed the weapon most nearly approaching the sword of to-day. It was straight and narrow and apparently designed for thrusting as much as for cutting. The pointed sword of the Roman legionaries was invariably successful when opposed to the pointless weapons of their enemies. On the other hand, most Asiatic nations to this day continue to use the sword as a cutting weapon, its curved shape usually preventing any use of the point. Thus the swords, military and civil, of to-day may be said to be descended from the European straight sword and the Eastern *scimitar* or *tulwar*. Under FENCING will be found the history of the sword up to the present day.

Asia has been more prolific in the matter of variety of blades than has Europe; for instance, the *yataghan* of the Mohammedan races with its double curve is a compact and formidable weapon, as also is the *kukri* of the Gurkhas, which resembles the *yataghan* except that it is considerably broader in the blade. The *pată*, a long straight-hilted sword, is found in the south of India, while in the north the *katár*, a broad-bladed weapon with a cross-bar handle, was for a long time in favor. The Japanese swords are many in number and characteristic to a degree of the Japanese people. They may be classified as two-edged swords called *tsurugi*, and one-edged swords called in general *katana*. The *tsurugi* is the primitive weapon of Japan, and is now rarely met with except as an ornament in temples. It was from 28 to 40 inches long and about 2½ or 3 inches wide, and in the middle up to ⅜ of an inch thick. It ended in a sharp point and often thickened and broadened toward the point. It was evidently designed more for cutting than for thrusting. The *katana* or one-edged sword is also a cutting rather than a thrusting weapon, but is a much more handy sword than the *tsurugi*. The various varieties of the *katana* are named according to their length, which is measured from the guard (at the inner end) to the hilt of the point, as: *Lachi; katana proper; wakizashi; tautô;* and many others. The *katana* proper is from 2 feet 6 inches to 2 feet 9 inches long, and is the common straight sword of the Japanese military class. The *tautô* or short sword was the weapon allowed to be worn by the tradesmen, and all others not allowed to wear the *katana*. The *kuwaiken* is a small sword worn by the ladies of the military class.

The modern military sword of all civilized nations is so constructed as to combine all the advantages of cutting and thrusting. The thrust is regarded as by far the most effective attack, but as it demands considerable skill and coolness, and as the average soldier (who in modern campaigns will in the majority of instances have been hastily taken from civil life) cannot be always counted upon to remember his training and will very naturally use the cut, it has led to the compromise above described. A good sword is required to be sufficiently elastic to permit of its being bent, or to resist a heavy blow without breaking or other injury, and also to be strong enough to deliver a thrust without bend-

ing too much. Equally important is the requirement that it be as light as possible, consistent with the strength required, and that it be well balanced. The military blades of to-day are all closely similar in design. They are nearly straight, but sufficiently heavy toward the point to enable the soldier to deliver a very effective cut. The only exception is the sword adopted by the French Government in 1899, which is a long sword designed only for thrusting. It is 35 inches in length of blade from hilt to point, and weighs 2 pounds 6 ounces without the scabbard, which latter is made of steel, with a wood lining. The German cavalry sword is 32½ inches long from hilt to point, and weighs 2 pounds 8½ ounces without the scabbard. The scabbard, like that of the French and British, is of steel with wood lining. The British cavalry officer's sword measures 35 inches from hilt to point, and weighs without the scabbard 2 pounds; while the sword of the trooper measures 33½ inches, and is 2 pounds 10¼ ounces in weight. The British infantry sword (officer's) measures 32½ inches from hilt to point, and weighs, without scabbard, 2 pounds 3 ounces. In the United States Army the sword proper has been abolished and a single form of sabre is now worn by all officers. These are issued in lengths of 30, 32, and 34 inches. The troopers of the United States cavalry have a sabre which is designed for both cutting and thrusting, and differs from the light artillery sabre, which is intended for cutting only and is more curved. In addition to the article FENCING, already mentioned, the reader is referred to the articles CAVALRY; TACTICS, MILITARY.

SWORD, ORDER OF THE. A Swedish military order of merit, with seven classes, founded in 1522 and renewed by Frederick I. in 1748. The decoration is a white cross of eight points, the arms separated by golden crowns. The blue medallion shows a bared sword surrounded by three crowns. The reverse bears a sword with a laurel wreath and the legend *Pro Patria.*

SWORD DANCE. A dance in which the use of a sword plays the characteristic part. Such dances, held in military attire, and serving as exercises of youth, were probably a feature in the life of all ancient peoples. In Greece a dance of this character was known under the name of Pyrrhic, and in Athens such a performance was said to have been instituted by Athena. Tacitus describes the youths of Germany as dancing naked over a bare blade, and fifteen centuries later a particular form of the sword dance was described by Olaus Magnus as belonging to Denmark. This special dance was widely diffused, and has survived in Germany, England, and Scotland. In it the number of performers was commonly six, with a leader; the movements were various, consisting of a march with weapons erect, directing them toward the centre of the ring, grasping the neighbor's blade by the hilt and point, forming the swords into a shield or rose and dancing with them in that form, leaping over and under the brands, and the like.

SWORDFISH. One of several fishes having an elongated snout, serviceable as a weapon; specifically, the single representative of the family Xiphiidæ, related to the mackerels and common in the warmer parts of the Atlantic and occasional in the Pacific Ocean. This fish has a round, very muscular body (see Plate of SPEARFISH AND SWORDFISH), with large fins and a crescentic tail of extraordinary size and power, so that it is able to move with extreme speed and force. As the young grow, the fore part of the body and the head increase steadily in girth in proportion to the posterior parts, and the upper jaw grows more and more elongated until it finally forms a flattened, sharp-edged 'sword' composed of the consolidated vomer, ethmoid and premaxillary bones, and coated with a finely granulated hide. This weapon is about half as long as the body, and becomes so strong that it may be driven far through the planking of a rowboat or even a sailing vessel, as has repeatedly happened, probably by accident. The swordfish reaches its largest size off the coast of New England, where in midsummer it comes near shore in pursuit of the schools of herring, mackerel, menhaden, and other gregarious fishes upon which it mainly feeds. A swordfish finding such a school pushes into its midst from beneath, and, striking right and left with its sword, kills or disables dozens of victims. The average size in the Atlantic is about seven feet in total length and 250 pounds in weight, but there are authentic records of fish more than twice that size. The flesh is of excellent flavor, and the capture of a swordfish is reckoned fine sport. Their spawning habits are little understood; and where they spend the winter, when they disappear from the American coast, is unknown.

Several other large related fishes are called 'swordfish,' among them the 'sailfish' and 'spearfish' (qq.v.) of the family Istiophoridæ; the large handsome 'papagallo' (*Nematistius pectoralis*) of the Pacific coast of tropical America; and the cutlass-fish (q.v.). The best general account of the swordfish and swordfishing is by Goode, *Fishery Industries*, sec. i. (Washington, 1884).

SWORDFISHING. The catching of swordfish is pursued in summer both for profit and sport off the coast of New England, and especially in the neighborhood of Nantucket, and is often the occasion of exciting incidents. Small swift vessels are employed, provided with a short bowsprit, at the outer end of which is set a small platform and a strong iron stanchion surmounted by a circular horizontal band at the height of a man's waist. The fisherman, standing within this contrivance, with a connecting strap buckled behind him, is held safely in spite of the pitching of the vessel, while both his arms are left free. A swordfish having been sighted at the surface, where it is feeding upon menhaden or some similar prey, the schooner bears down upon it until the fisherman is able to hurl a barbed spear, or a heavy grain, into its body. To this spear a line is attached, fastened inboard; and if a successful strike is made the crew gradually haul the struggling fish near enough to be knocked on the head and disabled. As the swordfish is big and strong, and is armed with formidable weapons in his 'sword' and his powerful tail, much strength, skill, and agility are required to overcome and secure it; and the sport is justly regarded as exhilarating and courageous in the extreme. Consult: Goode, *Fishing*

Industries, sec. i. (Washington, 1884); Halder, *Marvels of Animal Life* (New York, 1885).

SYB'ARIS (Lat., from Gk. Σύβαρις). A celebrated Greek colony in Magna Græcia (q.v.). It was situated in northeastern Bruttium, between the river Crathis (*Crati*) and Sybaris (*Coscile*), about three miles from the Tarentine gulf. It was founded by Achæans and Trœzenians at an early period in the colonization of Magna Græcia, and it soon acquired control of territory extending entirely across the peninsula. Sybaris was a great mercantile city, with strong democratic tendencies. The wealth and luxury of the inhabitants became proverbial. Of the history of the city almost nothing is known, but during the sixth century B.C. it had attained a circumference of more than five miles, and ranked with Miletus as one of the most powerful and wealthy of Grecian cities. The party strife which disturbed so many of the Greek mercantile communities raged here also, and toward the end of the century we find the city in the hands of a tyrant, Telys, supported by the popular party. A Crotonian noble who married Telys's daughter was exiled by his townsmen, and they also gave asylum to a large body of the banished nobles of Sybaris. The refusal of a demand for their surrender led to a war between the two cities, in which the Crotonians, in spite of inferior numbers, won a great victory, which was followed by internal strife in Sybaris, leading to the easy capture of the city (c.510 B.C.). The victors razed it to the ground and turned the bed of the Crathis over the site. The few survivors withdrew to their colonies, Scidros and Laos, on the west coast. Excavations in 1879 and 1888 have determined the site of the ancient city, but yielded little else of interest.

SYBEL, zē'bĕl, Heinrich von (1817-95). A German historian, born at Düsseldorf, December 2, 1817. He studied four years at Berlin and at Bonn, and in 1841 published his first work, the *Geschichte des ersten Kreuzzugs*. In 1844 he was made professor extraordinary at Bonn and two years later went to Marburg as professor in ordinary. It was there that he wrote his *Geschichte der Revolutionszeit von 1789 bis 1795* (1853-58), the most important of his works with one exception. In 1856 he became professor at Munich, where he instituted the historical commission of the Royal Bavarian Academy and founded the *Historische Zeitschrift*, and in 1861 was appointed professor at Bonn. He was made director of Prussian archives in 1875 and thus had access to the most valuable material for his chief work, *Die Begründung des deutschen Reichs* (Munich, 1889-94; trans. by Perrin, New York, 1890-97). Sybel was from 1862 to 1864 and from 1874 to 1880 a member of the Prussian Diet, and in 1867 was elected to the Constituent Reichstag of the North German Confederation. He died at Marburg, August 1, 1895. —His son Ludwig (1846—) is an archæologist, professor at Marburg since 1877, and author of: *Die Mythologie der Ilias* (1877); *Kritik des ägyptischen Ornaments* (1883); *Weltgeschichte der Kunst im Altertum* (2d ed. 1902), and others.

SYC'AMORE. The county-seat of Dekalb County, Ill., 52 miles west by north of Chicago; on the Chicago Great Western and the Chicago and Northwestern railroads (Map: Illinois, D 2). It is in a farming section, but is important rather for its manufactures, which include farm implements, gray iron castings, insulated wire, canned goods, etc. The water works are owned by the municipality. Population, in 1890, 2987; in 1900, 3653.

SYCAMORE, or **SYCOMORE** (OF., Fr. *sycomore*, from Lat. *sycomorus*, from Gk. συκόμορος, *sykomoros*, mulberry-tree, from σῦκον, *sykon*, fig + μόρον, *moron*, μώρον, *mōron*, black mulberry), *Ficus*. A genus of generally large, long-lived trees of the natural order Moraceæ, mostly natives of Africa and Asia. The Egyptian sycamore (*Ficus sycomorus*), supposed to be the sycamore of the Bible, is a large spreading tree often planted for shade in Egypt and Western Asia, where it is abundant in forests. The figs are top-shaped, and grow in clustered racemes on the trunk and oldest branches. They are sweet, well-flavored, and somewhat aromatic. The sycamore of Western Europe is a species of maple (q.v.); those of North America are various species of plane (q.v.).

SYCAMORE INSECTS. The sycamore or plane tree is comparatively free from insect attack, for although several caterpillars feed upon the leaves of the tree, none seems specifically confined to it. The leaves sometimes turn brown and fall from the attacks of colonies of one of the lace-bugs (*Corythuca fimbriata*), and the seed-balls are attacked by a true bug (*Melanochilus numideus*), which punctures the leaves and passes the winter in a half-grown condition thrust down between the seeds in the ball. Only one borer seems specifically confined to this tree, but *Chalcophora campestris* is found burrowing into dead limbs and trunks, and may hasten the death of an otherwise diseased tree. Consult Packard, *Insects Injurious to Forest Trees* (Washington, 1890).

SYCOSIS (Neo-Lat., from Gk. σῦκωσις, *sykōsis*, fig-like excrescence on the flesh, from σῦκον, *sykon*, fig). A skin disease characterized by an eruption of pustules or papules, each one pierced by a hair, generally limited to the bearded face. It is, in common with *impetigo faciei* and *tinea barbæ*, called 'barber's itch.' It is caused by the entrance into the hair follicles of a variety of staphylococcus, either albus, aureus, or citreus. Acne or eczema may be mistaken for it. Zinc, oil of cade, carbolic acid, ichthyol, sulphur, and betanaphthol are all recommended for its relief.

SYDENHAM, sĭd'en-am. A residential section and Parliamentary sub-district of Lewisham Borough, metropolitan London, 8 miles southeast of Saint Paul's Cathedral (Map: London and vicinity, F 8). It is of world-wide celebrity in connection with the Crystal Palace (q.v.), which was reërected here in 1854. Population, in 1891, 34,100; in 1901, 43,630.

SYDENHAM, Thomas (1624-89). A great English physician, born at Winford Eagle, educated at Magdalen Hall, Oxford, at All Souls' College, and at Montpellier, France. He received his degree in medicine from Cambridge, and in about 1650 established himself in practice in London, and soon became the foremost physician of his time. Although his name is inseparably con-

nected with our present knowledge of many diseases, he is especially to be remembered as the one who introduced cinchona in the treatment of malaria, and who first differentiated scarlatina, classified chorea, and expounded gout. A collection of his works was published in English (1785); and the Sydenham Society of London, founded for the purpose of printing meritorious medical works, put forth as its first issue his complete works in Latin in 1846, and in English in 1848. Consult Latham's *Memoir* (London, 1848).

SYDNEY. The capital of New South Wales and the oldest city in Australia, on the southern shores of Port Jackson; latitude 33° 52′ S., longitude 151° 13′ E. (Map: New South Wales, F 3). It is situated about 8 miles from the sea, and the whole bay round which the city is built forms a fine harbor, where the largest vessels can safely anchor. Its bold and rocky shores present a succession of picturesque and beautiful landscapes. The narrow entrance is called the 'Heads,' and is marked by a lighthouse. The Fitzroy dry-dock, originally intended for vessels of the royal navy, can accommodate vessels of the largest size. The city is defended by modern forts and batteries, and is the chief station of the Australian navy. The neighborhood of Sydney is surrounded by park-like grounds, and gardens of orange trees, bananas, and numberless semi-tropical plants. The suburbs include 41 municipalities, the chief of which are Balmain in the west; Newton, Redfern, Marrickville, and Waterloo in the south; Paddington, Randwick, Woolhara, and Waverley in the east.

The climate of Sydney is, upon the whole, temperate and healthful. The sandstone rock upon which the city is built affords a valuable material for building. The streets in the older parts of the town are narrow and irregular; in the newer portions they are modern, and the size and style of the buildings are not behind those of the principal towns of Europe. The University of Sydney stands on a commanding height. There are two suffragan colleges in connection with the university—that of Saint Paul's, belonging to the Church of England, and Saint John's, erected under the auspices of the Roman Catholic community. The metropolitan Cathedral of Saint Andrew is a handsome building in the later Perpendicular style of architecture, and the Roman Catholic Cathedral of Saint Mary is also a fine structure. Noteworthy are the residence of the Governor, the museum, the National Art Gallery, the exchange, the custom-house, the town hall, the new post-office, the public grammar school, and the theatres. Sydney has several mechanics' institutes.

There are fine botanical gardens, and a number of public parks, of which Hyde Park is the chief. Water is brought from a point on the Nepean River, 63 miles distant, and stored in a large reservoir at Parramatta. The water-works, abattoirs, and street railways are municipal property. The manufactures comprise wagons, glass, pottery, boots and shoes, carriages, stoves, and tobacco, and there are car-shops, distilleries, and breweries. At various points within a radius of from 30 to 100 miles large quantities of coal are mined for colonial consumption as well as for export. Its central position makes Sydney the permanent emporium of the British dependencies in the Southern Hemisphere. It maintains its position as the exclusive outlet for the productions and commerce of extensive pastoral and mineral districts on the northwest, west, and southwest.

The first party of British settlers (convicts) that reached Australia were landed at Botany Bay on January 20, 1788. The spot which had been selected being found unsuitable, it was abandoned a few days afterwards, and the infant settlement was transferred to a point about 7 miles farther to the north, the place where Sydney now stands. The choice of the new locality was chiefly determined by the circumstance of a stream of fresh water found there, flowing into the deep inlet known as Sydney Cove, one of the numerous bays into which the basin of Port Jackson is divided. After the abolition of convict transportation the growth of Sydney was rapid. The installation here, on January 1, 1901, of Earl Hopetoun as first Governor-General of the Australian Commonwealth consummated the federation of Australia. The population of municipal Sydney in 1901 was 111,801; of the city with its suburbs, 488,968.

SYDNEY, ALGERNON. An English statesman. See SIDNEY, ALGERNON.

SYDOW, zē'dō, EMIL VON (1812-73). A distinguished German cartographer, born at Freiberg, Saxony. He entered the Prussian army in 1829, taught geography, and in 1838 began to publish his excellent school-room maps. Detailed to Berlin in 1843 as a member of the Military Examination Committee, he was subsequently intrusted with the geographical lectures at the Military Academy, which he resumed in 1860, having in the meanwhile lived retired at Gotha since 1855. Attached to the great general staff, he was made director of the geographic-statistical department in 1867 and colonel in 1870. His cartographic work, nearly all translated also into foreign languages, comprises: *Methodischer Handatlas für das wissenschaftliche Studium der Erdkunde*, 30 maps (4th ed. 1870); *Schulatlas in 42 Blättern* (32d ed. 1880); new ed. by Wagner, entitled *Sydow-Wagner, Methodischer Schulatlas*, 63 main and 50 accessory maps (10th ed. 1902); *Oro-hydrographischer Atlas*, 25 maps; and others. He also contributed many articles to various periodicals, notably the reports "Ueber den kartographischen Standpunkt Europas," to *Petermanns Mitteilungen* (1857-72), and created the valuable book of reference *Registrande der geographisch-statistischen Abteilung des Grossen Generalstabs* (Berlin, 1870-83).

SYENE, sī-ē'nē. The ancient name of Assuan (q.v.), a town of Egypt.

SYENITE (Lat. *syenites*, from *Syene*, from Gk. Συήνη, a locality in Upper Egypt). An igneous rock of granitic texture, composed essentially of alkali feldspar and mica, hornblende, or augite (mica syenite, hornblende syenite, augite syenite). Its average composition is: silica, 59 per cent.; alumina, 17 per cent.; oxides of iron, 7 per cent.; magnesia, 37 per cent.; oxide of lime, 5 per cent.; oxide of sodium, 4 per cent.; oxide of potassium, 5 per cent. From granite syenite differs in containing little or no free silica (quartz).

SYKES, sīks, GEORGE (1822-80). An American soldier, born at Dover, Del. He graduated at West Point in 1842, served in the Seminole and Mexican wars, and was brevetted captain for gallant conduct at Cerro Gordo. He fought in the first battle of Bull Run, as a major in the Federal army; was commissioned brigadier-general of volunteers in September, 1861, took part in the Peninsular, in the second Bull Run, and in the Antietam campaigns; was commissioned major-general of volunteers in November, 1862; fought at Fredericksburg and Chancellorsville; and commanded the Fifth Corps at Gettysburg. In March, 1865, he was brevetted brigadier-general in the Regular Army for his services in the battle of Gettysburg and major-general in the Regular Army for his services during the war. He was mustered out of the volunteer army in January, 1866, but remained in the Regular Army first as lieutenant-colonel and then as colonel until his death in 1880. A monument has been erected in his honor at West Point.

SYKES, OLIVE (LOGAN) (1839—). An American actress and author, born in New York. In 1864 she appeared at Wallack's Theatre, New York, in *Evelcen*, a play of her own composition; but retired from the stage in 1868, and devoted herself principally to lecturing and writing in behalf of the woman's rights movement. Her later publications include *Women and Theatres* (1869); *Before the Footlights and Behind the Scenes* (1870); and the comedy *Surf, or Life at Long Branch*.

SYL'LABUS ERRO'RUM (Lat., catalogue of errors). A document published by Pius IX. in 1864, appended to the encyclical *Quanta cura*, condemning eighty doctrines which it calls "the principal errors of our times." They are classed under various heads: pantheism, naturalism, and absolute rationalism; moderate rationalism; indifferentism and latitudinarianism; socialism, communism, secret societies, Bible societies (considered from the point of view as Protestant proselytizing organizations), and clerico-liberal societies; errors concerning the Church and her rights; concerning civil society; concerning natural and Christian ethics; concerning Christian marriage; concerning the temporal power of the Pope; and errors connected with modern liberalism. The text of the document and an English translation are given in Schaff, *Creeds of Christendom* (New York, 1877-78). The Syllabus gave rise in England to a famous controversy between Gladstone and Newman. Consult Gladstone, *Vaticanism* (London, 1875); Newman, *Letters to the Duke of Norfolk* (ib., 1875).

SYLLOGISM (Lat. *syllogismus*, from Gk. *συλλογισμός*, reasoning, conclusion, from *συλλογίζεσθαι*, *syllogizesthaĭ*, to infer, conclude, from *σύν*, *syn*, together + *λογίζεσθαι*, *logizesthai*, to reason, from *λόγος*, *logos*, word, reason). The name of a logical operation when expressed in a certain form in accordance with the principles of formal logic. When we reason, or get at truth by means of inference, we are said to proceed either inductively (see INDUCTION) or deductively. Deductive reasoning, when fully and methodically expressed, takes the form called the syllogism. 'This thing will sink in water, for it is a stone,' is a deductive argument, but not fully stated; this is called an enthymeme (q.v.). The complete form is, "Stones sink in water; this is a stone; therefore, this sinks in water'—which form is called a syllogism.

To a perfect syllogism it is necessary (1) that there should be three, and no more than three, propositions (see PROPOSITION); these are the conclusion, or the matter to be proved, and two others that are the means of proving it, called the premises. It is also necessary (2) that there should be three, and no more than three, *terms*, namely, the subject and the predicate of the conclusion, and one, called the middle term, which must occur in both premises, being the connecting link for bringing the two other terms together in the conclusion. The *predicate* of the conclusion is called the major term, because it is in its extension (q.v.) the largest of the three; the *subject* of the conclusion is the minor term, as being the smallest in extension. The major and minor terms are called extremes. The three terms appear in the premises in this manner: the major term and the middle term appear in one premise, called the major premise; the middle term and the minor term in the minor premise. In the syllogism above stated, the terms are '(a thing that will) sink in water' (major), 'this thing' (minor), 'stone' (middle); the premises are, 'stones sink in water' (major), 'this thing is a stone' (minor); the conclusion is, 'this thing sinks in water'; (3) one premise at least must be affirmative; (4) if one premise be negative, the conclusion must be negative; (5) the middle term must be distributed (= taken in the whole of its extension) in at least one premise; (6) an extreme, if undistributed in a premise, may not be distributed in the conclusion. Any syllogism which violates any one or more of these six syllogistic rules is invalid. There are two other rules which are derivative: (7) one premise at least must be universal; (8) if one premise be particular, the conclusion must be particular also. Any syllogism which violates either of these rules violates also one or more of the first six rules given above. For the discussion of the question as to the evidence of these canons, see LOGIC.

Categorical syllogistic forms are divided into *figures*, and each figure into *moods*, which are the distinct syllogistic forms, the principle of division being as follows: The figure is determined by the function of the middle term, in the two premises; it may be the *subject* of the major premise, and the *predicate* of the minor (1st figure); the *predicate* in both (2d figure), the *subject* in both (3d figure), the *predicate* of the major and the *subject* of the minor (4th figure). The 4th figure did not belong to the original scheme of Aristotle, and it is usually considered as both unnatural and unnecessary, being only an awkward inversion of the first. The syllogisms of each figure are said to differ in *mood*, or according to the *quality* and the *quantity* of the propositions—that is, according as these are affirmative or negative (quality), universal or particular (quantity).

A conditional syllogism whose conditional major premise presents some sort of alternative is called a *dilemma*. We may have these cases: Either (*a*) alternative consequences may be as-

serted to follow upon a single condition (or combination of conditions) or (*b*) alternative conditions may be asserted to determine a single consequence (or combination of consequences); or (*c*) an alternative may be presented between a condition with its consequence and another condition with its separate consequence. If alternative consequences are asserted to follow upon a single condition, then it is possible to have a valid conditional syllogism either when a minor premise affirms the condition, warranting as conclusion the affirmation of the alternative consequence; or when a minor premise denies conjunctively ('neither—nor') the alternative consequences, warranting as conclusion the denial of the antecedent. If alternative conditions are asserted to determine a single consequence, it is possible to have a valid syllogism when a minor premise either categorically affirms one of the conditions or disjunctively affirms both conditions, in either case justifying as conclusion the affirmation of the consequent; or when the minor premise categorically denies the consequent, justifying as conclusion the conjunctive denial of the conditions. If the major premise presents an alternative between a condition with its consequence and another condition with its separate consequence, a valid syllogism obtains when the minor premise either disjunctively affirms the two conditions, justifying the disjunctive affirmation of the two consequences, or when the minor premise conjunctively or disjunctively denies both consequences, justifying a conjunctive or disjunctive denial respectively of the two antecedents. For bibliography, see books mentioned under LOGIC. See also FALLACY; DILEMMA; CONVERSION; OBVERSION.

SYLPHS (Neo-Lat. *sylpha*, probably from Gk. *σίλφη*, *silphē*, sort of beetle; so called as being a spirit flying in the air). In the fantastic system of the Paracelsists, the elemental spirits of the air, who, like the other elemental spirits, hold an intermediate place between immaterial and material beings. They eat, drink, speak, move about, beget children, and are subject to infirmities like men; but, on the other hand, they resemble spirits in being more nimble and swift in their motions, while their bodies are more diaphanous than those of the human race. They also surpass the latter in their knowledge, both of the present and the future, but have no soul; and when they die, nothing is left.

In common usage, the term 'sylph' has a feminine signification, and is applied to a graceful maiden. How this curious change of meaning occurred is not quite certain; but it is possibly owing to the popularity of Pope's *Rape of the Lock*, which introduced the term into the world of fashion and literature. Consult: Paracelsus's *Liber de Nymphis, Sylphis, Pygmæis et Salamandris et Cæteris Spiritibus* (Basel ed. of Paracelsus's works, 1590).

SYLVANITE. See TELLURIUM.

SYLVESTER. The name of two popes. SYLVESTER I., Pope 314-335. His reign was the first in the new period of Church freedom under Constantine. In his pontificate the Council of Nicæa was held, which he did not himself attend, but sent two legates to represent him. Numerous unhistorical legends, especially concerning his relations to Constantine, have clustered about him; concerning them, consult Döllinger, *Fables Respecting the Popes in the Middle Ages* (Eng. trans., New York, 1872); and see DONATION OF CONSTANTINE. His works are in Migne, *Patrologia Latina*, viii.—SYLVESTER II., Pope 999-1003, Gerbert by name. He was born at Aurillac, in Auvergne, about 935, and at an early age went to Spain, where he made remarkable progress in scientific studies. He became head of the cathedral school at Rheims, which grew to eminence under his direction. In 982 he was made Abbot of Bobbio on the nomination of Otho II., but returned to Rheims, of which, by Hugh Capet's wish, he was chosen Archbishop in 991. Four years later, the deposition of his predecessor having been declared invalid, he went to Magdeburg on Otho III.'s invitation, and accompanied him to Italy, where he remained, becoming Archbishop of Ravenna in 998, and reaching the Papal throne in the following year. He was a strict reformer, and acquired the reputation of the most learned man of his age; he was an adept in mathematics, and in practical mechanics and astronomy, in which his attainments were so amazing to his contemporaries as to arouse a suspicion that he was in league with the devil. The Gubar numerals, the ancestors of our modern numerals and due to the Western Arabs, owe much of their prominence, if not their introduction into Europe, to Sylvester. His writings are reprinted in Migne, *Patrologia Latina*, cxxxix.; also by Olleris (Paris, 1867); his letters, which throw much light upon an obscure period, have been translated into French (Riom, 1847). Consult studies of his life and times by Hock (Vienna, 1837), Axinger (Paris, 1842), Tappe (Berlin, 1869), and Schultess (Hamburg, 1891); also Schultess, *Die Sagen über Silvester II.* (ib., 1893), and the book of Döllinger referred to above.—The name was also borne by two antipopes, SYLVESTER III., who contested the Papal throne with Benedict IX. in 1044, and SYLVESTER IV., who was put up by the Imperial party to oppose Paschal II. in 1105.

SYLVESTER, JAMES JOSEPH (1814-97). One of the foremost English mathematicians of the nineteenth century. He was born in London, of Jewish parents, and received his early education in a Jewish school. He then attended the Royal Institution school in Liverpool, and thence proceeded to Saint John's, Cambridge (1831). As a Jew he was barred from taking a degree, and it was not until the passing of the Tests Act that he obtained his B.A. at Cambridge (1872). He studied at the Inner Temple after leaving Cambridge, and was called to the bar in 1850. Sylvester was appointed professor of natural philosophy at University College, London, in 1837, and was elected fellow of the Royal Society in 1839. In 1841 he was appointed professor of mathematics in the University of Virginia, but soon after (1845) returned to England, where he took up the work of an actuary. In 1855 he became professor of mathematics at the Royal Military Academy at Woolwich, where he remained for 15 years. In 1877 he became the first professor of mathematics at Johns Hopkins University, which position he held for seven years, returning to England to accept the Savilian professorship of geometry at Oxford. He founded

the *American Journal of Mathematics* and was for some years its editor.

Sylvester's contributions were almost exclusively in the form of memoirs, scattered through various scientific journals and the proceedings of various societies. They are devoted chiefly to the theories of algebraic forms (see FORMS), in which he was the recognized leader of the mathematical world. He and Cayley (q.v.) contributed more than any of their contemporaries to the theory of invariants, and he may be said to have practically created the vocabulary of the subject. He also published a work on *Laws of Verse* (1870), a subject in which he always showed an interest. Consult obituary notices in various scientific journals in 1897; and Franklin, *Address Commemorative of Sylvester* (Baltimore, 1897).

SYLVESTER, JOSHUA (1563-1618). An English poet, born in the north of Kent. His life was divided between poetry and trade. He is mainly known for a translation, or rather paraphrase, of the *Semaines* (Weeks), a sacred epic written by the French poet Du Bartas (q.v.). The translation had considerable influence upon Milton. Of Sylvester's original verse, all is forgotten except the beautiful sonnet beginning "Were I as base as is the lowly plaine" (in Palgrave's *Golden Treasury*). Consult his *Works*, ed. A. B. Grosart, "Chertsey Worthies Library" (2 vols., London, 1878).

SYLVESTER DAGGERWOOD. A one-act play by George Colman the younger, produced in 1795, a shorter form of *New Hay at the Old Market*, brought out in the same year. There were only two characters in it, the strolling player whose name is the title, and Fustian, a playwright.

SYLVICULTURE. See FORESTRY.

SYLVIUS. The Latinized name of Jacques Dubois (1478-1555), a French anatomist, born near Amiens. He studied in Paris, and afterwards was a lecturer on anatomy there. His anatomical discoveries and his invention of injection for use in dissection cause him to be remembered. The Sylvian fissure, the Sylvian aqueduct, and the Sylvian artery were named in his honor. His *Opera Medica* were published at Geneva in 1630.

SYMBIOSIS (Neo-Lat., from Gk. *συμβίωσις*, life together, from *σύν*, *syn*, together + *βίος*, *bios*, life.) That condition in which two or more dissimilar organisms live together in an intimate life relation. Various types of symbiosis depend upon the type of relation existing between the organisms, the so-called symbionts.

(1) Mutualistic symbiosis, or mutualism, is that condition in which each party to the symbiosis seems to derive advantage therefrom. This relation has perhaps not been proved to exist in plants, though it seems likely that mutualism exists between the legumes and the bacteria of their root tubercles. Many believe that lichens show true mutualism, the fungus symbiont supplying nitrogenous substances or other materials absorbed from the substratum, and the alga symbiont the carbohydrates.

(2) Antagonistic symbiosis, or parasitism, is that condition where one symbiont gains at the expense of the other. There are many illustrations of this in nature. For example, the parasitic fungi and seed plants may be regarded as securing food from their host plants, but not giving an equivalent in return, as is the case in perfect mutualism.

(3) A somewhat intermediate condition is illustrated by contingent symbiosis, or helotism (q.v.). Some writers hold that lichens illustrate this type, the idea being that there is not a mutual exchange between the alga and the fungus symbiont. The fungus is supposed to gain, but the alga is supposed neither to lose nor gain.

Symbiosis may be more or less intimate. In conjunctive symbiosis the symbionts are blended together so as to form a single body, as best illustrated by the lichens. In disjunctive symbiosis the symbiosis is more temporary, or the symbionts are less completely blended, as illustrated by ectotropic mycorrhizas.

Relations which are, perhaps, not to be regarded as symbiosis, but which nevertheless bear a close similarity to it, are frequently found. Saprophytism differs from parasitism only in that the host plant, so to speak, is dead. Recently a new life relation has been recognized, such as is found in the Indian pipe (Monotropa); in which case there is a root fungus which derives its food materials saprophytically from the soil. Monotropa, not being a green plant, gets nearly all of its food material from the fungus. Hence the relation of the two organisms taken together is saprophytism. The mutual relation of the pair is, however, symbiosis, and the whole relation may be called symbiotic saprophytism. This term may be applied to all of the mycorrhiza plants. By some authors lianas and epiphytes have been regarded as having symbiotic relations with the supporting plants, but the relation is not at all intimate, since they probably get only mechanical support. Kerner held a still broader view of symbiosis, applying this term, for instance, to the herbaceous shade plants of the woods, which are unable to grow unless shaded by the trees.

Among animals forms of symbiosis are to be found. An example of social symbiosis is the case of a polyp (Epizoanthus) or a sea-anemone (Adamsia), which grows on the shell inhabited by a hermit-crab. Klebs states that when the crab changes its shell it seizes the anemone and carries it off to its new home. The term *physiological symbiosis* may be applied to cases among the lowest organisms where certain algæ (Zoöxanthellæ) often live in Radiolaria (q.v.), while similar green and yellow plants inhabit the stomach epithelium of many actinians, corals, and worms. As Hertwig says, the Zoöxanthellæ are nourished by the carbon dioxide which is formed by the animal tissues, and breathe out oxygen, which in turn serves as food for the animal. They also form starch and other carbohydrates, and there is nothing to prevent any surplus thus formed from becoming food for the animal. A remarkable case of symbiosis, involving a structural modification, is that of a carpenter bee (of the Oriental genus Koptorthosoma) and a certain mite. A special chamber, with a small orifice for entry, exists in the abdomen of the bee, in which the Acari are lodged. Here it is a little difficult to draw the

line between symbiosis and the parasitism, for instance, of the itch mite which burrows under the skin between the fingers.

SOCIAL SYMBIOSIS. Wheeler applies this term to the relations between ants and the various beetles, crickets, cockroaches, etc., which live at their expense. Of those beetles (Claviger, Paussus, etc.) that live in ant and termite nests certain ones seem to be tolerated or ignored by the ants. So completely agreeable to the ants is the presence of certain of the Staphylinidæ that the ants regurgitate food which they give to the beetles, and the beetles in the same manner share their supply with hungry ants. The ants feed the larval beetles with as much care as they do their own larvæ. They even clean the young beetles by licking them. See ANT; BEE; COMMENSALISM; EPIPHYTE; INSECT; LICHEN; MUTUALISM; PARASITE; ROVE-BEETLE; TERMITE.

Consult: O. Hertwig, *Die Symbiosis* (Jena, 1883); Geddes, *Nature*, vol. XXV. (1882); Brandt, *Archiv für Anatomie und Physiologie* (1882), and *Mittheilungen der zoologischen Station, Naples*, iv. (1883); Lankester, *Nature*, vol. XXVII. (1882). For symbiosis in insects, see the papers of Forel, Wasmann, Wheeler, etc.

SYMBOLISM (from *symbol*, from Lat. *symbolus*, *symbolum*, from Gk. *σύμβολος*, *σύμβολον*, mark, token, signal, sign, confession of faith, from *συμβάλλειν*, *symballein*, to compare, put together, from *σύν*, *syn*, together + *βάλλειν*, *ballein*, to throw). In its broadest sense, the representation of one thing by another, as of a sound by a letter, of a word or a concrete idea by a hieroglyph. Symbolism is most important in the history of art, especially of Christian art. Obviously no doctrine of religion can take form in outward act without some kind of symbolism; and accordingly every detail of the ancient Roman Catholic or Eastern rites is so planned as to suggest to the worshiper one or another aspect of abstract truth. In the plan and construction of the older churches the same idea is carried out as in their cruciform shape. Early Christian art represented Jesus under numerous symbols, among the commonest being the lamb, the fish, and the Greek letters Alpha and Omega (the beginning and the end). Similarly, the Holy Ghost was represented by a dove; and the olive branch denoted peace; the palm, triumph; and the anchor, faith or hope. In later art each one of the saints depicted may be recognized by some appropriate symbol, e.g. Saint Andrew by a cross in the shape of an X, or Saint Dominic by the lily and the star above his forehead. Consult: Clement, *Handbook of Legendary and Mythological Art* (2d ed., Boston, 1881); Knight, *The Symbolic Language of Ancient Art and Mythology* (2d ed., New York, 1876). See DÉCADENTS.

SYMBOLISTS. The name of a class of writers which sprang up after 1880 notably in France and in connection with verse. The symbolists regard symbolism as the expression of an idea by the introduction of a being or an object merely for the purposes of such expression. The characteristic means are the allegory, transposition, and allusion. The symbolists were in effect reactionists against realism. They concern themselves with general truths in contrast with actualities. They court erudition, adore the metaphysical and mysterious, and especially exalt the magic power and charm of music. Identified with the influence of Wagner, they seek music in language and accordingly the sonorousness of words; they suggest but do not name. Dreams, visions, and mythological tales are their proper subjects, and lyricism their favorite form of poetic expression. In their aim to unify and blend the arts and the functions of the senses, the extremists among them, like Arthur Rimbaud, associated the vowels with colors, etc. The metrical reforms of the French Symbolists have resulted in making French verse more free and large in its possibilities of effect, more subtle, intimate, and musical. The Symbolists, despite the vagaries which attend all new schools of literature and art, have left a permanent and desirable mark. Their general influence has been for the exclusive, the refined, the delicate, and the mystic beauties of the supranatural. Their verse has represented idealism, religious sentiment, a return to the ancient, and an inherent preference for solemn or fatalistic themes. Verlaine, Mallarmé, and Maeterlinck are the most noteworthy of the French and Belgian Symbolists. Among Symbolist plays those of De Curel may be noted. Symbolism reaches also into the domain of contemporary painting. For a statement of certain particular phases or developments of Symbolism, see DÉCADENTS.

SYMBOLS, MATHEMATICAL. The various signs and abbreviations used to facilitate mathematical expression. They are of the following kinds:

Of value.
  Hindu and other numerals. See NUMERALS.
Of operation.
  Addition, $+$, Σ.
  Subtraction, $-$.
  Multiplication, as in $a \times b$, $a \cdot b$, $(a + b)$, $\lfloor\underline{a}$ or $a!$
  Division, as in $a \div b$, $a:b$, a/b, x^{-n} $\left(=\frac{1}{x^n}\right)$.
  % (as in $6\% = \frac{6}{100}$).
  Involution, as in x^n.
  Evolution, as in $x^{\frac{1}{n}}$ or $\sqrt[n]{x}$.
  Differentation, d, δ, D.
  Integration, $\int$.
Of function.
  $f(x)$, $F(x)$, for f — function of x, F — function of x; ϕ $(x, y, \ldots)$, for phi-function of x, y, ...
Of quality.
  Positive number, $+a$.
  Negative number, $-a$.
  Absolute value, $|a|$.
  Imaginary, ai for $a\sqrt{-1}$.
Decimal, as in 3.2.
Of relation.
  Equality, $=$, ::.
  Indentity, $\equiv$.
  Inequality, as in $a < b$ (a less than b), $a > b$ (a greater than b), $a \not< b$ (a not less than b), $a \not> b$ (a not greater than b), $a \neq b$ (a not equal to b).
Of continuation.
  ....., as in a, a^2, a^3, ...

Of deduction.
∵ (since).
∴ (therefore).
Of aggregation.
( ), [ ], { }, ——
Of denominate numbers, as in $10, 3° 4′ 15″ (degrees, minutes, seconds), £20 3s. 2d. (pounds, shillings, pence), cwt. (100 lbs.), and various abbreviations.
Of geometry.
∠, ∠s (angle, angles).
⊥ (perpendicular to).
∥ (parallel to).
≅ (congruent to).
∼ (similar to).
= (approaches as a limit).
△, △s (triangle, triangles).
⊙, ⊙s (circle, circles).
□, □s (square, squares).
▭, ▭s (rectangle, rectangles).
▱, ▱s (parallelogram, parallelograms).
⌒ (arc).
a (radians).

The question of the origin and development of mathematical symbols is a large one, and science has not yet given satisfactory answers at many points. The probable origin of the remarkable digits 1 . . 9, is discussed in the article on NUMERALS. The origin of zero is unknown, there being no authentic record of its history before A.D. 400. The extension of the position system below unity is attributed to Stevin (1585), who called tenths, hundredths, thousandths, . . . *primes, sekondes, terzes,* and wrote subscripts to denote the orders, thus 4.628 was written $4_{(0)}\ 6_{(1)}\ 2_{(2)}\ 8_{(3)}$. But Rudolff (1525) and Kepler (1571-1630) used the comma to set off the decimal orders, and Bürgi (1552-1632) and Pitiscus (1612) in their tables used the decimal fraction in the form 0.32, 3.2. Although the early Egyptians had symbols for addition and equality, and the Greeks, Hindus, and Arabs symbols for equality and for the unknown quantity, from earliest times mathematical processes were cumbersome for lack of proper symbols of operation. The expressions for such processes were either written out in full or denoted by word abbreviations. The later Greeks, the Hindus, and Jordanus indicated addition by juxtaposition; the Italians usually denoted it by the letter P or p with a line drawn through it to distinguish it as an operation, but their symbols were not uniform. Pacioli, for example, sometimes used p and sometimes e, and Tartaglia commonly expressed the operation by φ. The German and English algebraists introduced the sign +, but spoke of it as *signum additorum* and first employed it only to indicate excess. Subtraction was indicated by Diophantus by the symbol ↓. The Hindus used a dot, while the Italian algebraists denoted it by M or m with a line drawn through the letter. The symbols $\bar{m}$ and *de* were, however, used by Pacioli. The German and English algebraists were the first to use the present symbol and described it as *signum subtractorum.* The symbols + and − appeared first in print in an arithmetic of Widmann (1489). The symbol × for 'times' is due to Oughtred (1631). To Rahn (1659) is due the present sign ÷ for division; Harriot (1631) used a period to indicate multiplication, and Descartes (1637) used juxtaposition. Leibnitz in 1688 employed the sign ∽ to denote multiplication and ∽ to denote division. Division among the Arabs was designated variously by $a - b$, a/b, $\frac{a}{b}$, but Clairaut (1760) made familiar the form $a : b$. Descartes made popular the notation a^n for involution and Wallis defined the negative exponent. The symbol of equality, =, is due to Recorde (1557), and the symbols >, <, for greater than and less than, originated with Harriot (1631). Viète (1591) and Girard (1629) introduced various symbols of aggregation. The symbol ∞ for infinity was first employed by Wallis in 1655. The symbols of differentiation dx and of integration $\int$ as used in calculus, are due to Leibnitz, as is also the symbol ∽ for similarity, as used in geometry. The symbolism ϕ, f, F, as used in theory of functions, is due to Abel.

Consult Cantor, *Vorlesungen über Geschichte der Mathematik* (2d ed., Leipzig, 1900).

SYME, sīm, JAMES (1799-1870). A noted Scotch surgeon, born in Fife, and educated at the University of Edinburgh. He was lecturer (1823-32) and professor (1833-48) of surgery at his alma mater, after having served as demonstrator under Liston. He was the inventor of the mackintosh waterproof cloth. He was clinical professor from 1829 to 1833 in Minto House Hospital, which he founded at his own expense. He was one of the ablest teachers and operative surgeons of the age. He devised resection of the joints, Syme's amputation of the foot, and excision of the lower jaw. He was the author of many valuable works, including *The Excision of Diseased Joints* (1831); *Principles of Surgery* (1832); the same, to which is added *Diseases of the Rectum* (1866); *Pathology and Practice of Surgery* (1848); *Stricture of the Urethra and Fistula in Perineo* (1849). Consult Paterson, *Memoir* (Edinburgh, 1874).

SYMINGTON, sīm'ĭng-tŏn, WILLIAM (1763-1831). A British inventor, born at Leadhills. In 1786 he constructed a working model of a steam road-carriage, and afterwards patented a steam-engine in which he obtained rotary motion by chains and ratchet wheels. In 1788 he and Patrick Miller used an engine constructed on the lines of this patent to propel a small pleasure boat on Dalswinton Loch. In the following year they experimented on a larger scale on the Forth and Clyde Canal and succeeded in attaining a speed of seven miles an hour. As the type of engine used was imperfect, however, Symington in 1801 patented another in which a piston rod guided by rollers was connected by a rod to a crank attached to the paddle-wheel shaft. In the following year he fitted out a boat called the *Charlotte Dundas,* which proved able to tow two barges a distance of 19½ miles in six hours. The Duke of Bridgewater, Symington's patron, was so well pleased with the boat that he ordered eight others to be constructed. Unfortunately for the inventor, however, the Duke died shortly afterwards, the order was canceled, and Symington was unable to find another patron.

SYMMACHUS, sĭm'mȧ-kŭs. Pope, 498-514. He was born in Sardinia, and was chosen to fill the vacancy left by the death of Anastasius II. A minority, however, of the Byzantine faction, set up as a rival the archipresbyter Laurentius. As a result of the schism, bloody encounters took

place, and the Ostrogothic King Theodoric, although an Arian, was appealed to, and gave his voice for Symmachus. Theodoric, being again appealed to, caused the Bishop of Altinum to administer the affairs of the Church for a time, and left the decision to a synod. In its fourth session the synod (502) finally decided in favor of Symmachus. In vindication of the action of the synod the deacon Ennodius, afterwards Bishop of Ticinium (Pavia), gave clear expression to the principle that the Pope (Ennodius is among the first to limit this title to the Bishop of Rome) is above every human tribunal and is responsible only to God himself. Later councils during Symmachus's pontificate condemned all interference of laymen in the election of popes and regulated the disposition of goods belonging to the Church.

SYMMACHUS, GREEK VERSION OF. See BIBLE, section on *Versions*.

SYMMACHUS, QUINTUS AURELIUS. A distinguished Roman orator, scholar, and statesman, who was born probably not long after A.D. 340, was educated in Gaul, and after holding several lesser offices, became prefect of Rome (A.D. 384). Seven years later he was raised to the consulship. The date of his death is unknown, but we know that he was alive in A.D. 404. A sincere pagan in an age when classic paganism was almost extinct, he proved in his own person a pattern of its choicest virtues, and manfully, if in vain, strove to regain for it a place of honor in the State. Symmachus's extant writings consist of ten books of letters (*Epistolarum Libri X.*) and the fragments of nine orations. The best editions of Symmachus's entire works are by Seeck (Berlin, 1883) and Kroll (Leipzig, 1893). Consult: Morin, *Etude sur la vie et les écrits de Symmaque, préfet de Rome* (Paris, 1847); Dill, *Roman Society in the Last Century of the Western Empire* (London, 1899).

SYMMES, simz, JOHN CLEVES (c.1780-1829). An American soldier and author, born in Sussex County, N. J. He entered the United States Army as ensign in 1802, became captain January 20, 1813, and served through the War of 1812, distinguishing himself particularly at Niagara and in the sortie from Fort Erie. He subsequently lived in Newport, Ky., and gave his entire time to developing and advocating his theory that the earth and all the other planetary bodies are composed of a number of hollow concentric spheres, open at their poles. He believed the inside of the earth to be habitable, and in 1822 and again in 1823 petitioned Congress to fit out an expedition to test the theory. In support of his contention he published many pamphlets and a volume entitled *Theory of Concentric Spheres* (1826). Consult an article on "Symmes's Theory of the Earth," in the *Atlantic Monthly* for April, 1873.

SYMMETRY (Lat. *symmetria*, from Gk. *συμμετρία*, from *σύμμετρος*, *symmetros*, having a common measure, from *σύν*, *syn*, together + *μέτρον*, *metron*, measure, from *μετρεῖν*, *metrein*, to measure). A term used in geometry to express a characteristic property of two congruent or quasi-congruent figures which have a certain relation with respect to a point, line, or plane. Two systems of points, A_1, B_1, C_1, ..., A_2, B_2, C_2, ..., are said to be symmetric with respect to an axis when all lines $A_1 A_2$, $B_1 B_2$, ... are bisected at right angles by that axis. Two figures are said to be symmetric with respect to an axis when their systems of points are symmetric with respect to that axis. A figure is

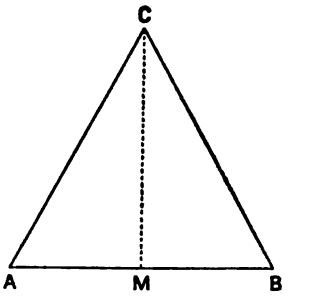
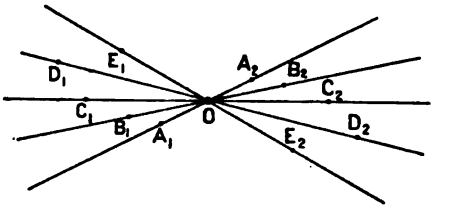
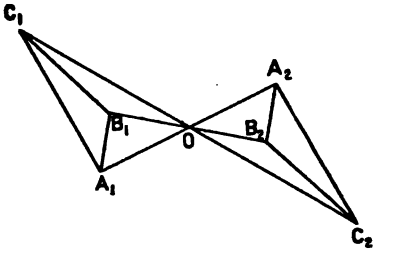


FIGURE SYMMETRIC WITH RESPECT TO AN AXIS.

said to be symmetric with respect to an axis when the axis divides it into two symmetric figures. Two systems of points A_1, B_1, C_1, ..., and A_2, B_2, C_2, ..., are said to be *symmetric with respect to a centre O* when all lines $A_1 A_2$, $B_1 B_2$, $C_1 C_2$, ..., are bisected by O.



POINTS SYMMETRIC WITH RESPECT TO A CENTRE.



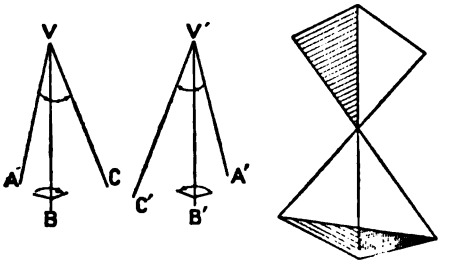
SYMMETRICAL TRIANGLES.

Two figures are said to be symmetric with respect to a centre when their systems of points are symmetric with respect to that centre. E.g. in the figure triangles $A_1 B_1 C_1$, $A_2 B_2 C_2$ are symmetric with respect to O.

Figures of three dimensions besides being symmetric with respect to an axis or a centre may be symmetric with respect to a plane. E.g. the sphere is symmetric with respect to its centre, with respect to any diameter as axis, and with respect to any diametrical plane as a plane of symmetry. Symmetric polyhedral angles may be considered as quasi-congruent, and are such as have their dihedral angles equal, and the plane angles of their faces also equal, but arranged in reverse order.

Thus, in the following figure, V and V′ are symmetric trihedral angles, the letters showing the reverse arrangement. Opposite polyhedral angles are such that each is formed by producing the edges and faces of the other through the vertex,

and are symmetric. The theory of symmetric figures is closely related to that of similarity (q.v.).



SYMMETRIC POLYHEDRAL ANGLES. OPPOSITE POLYHEDRAL ANGLES.

In algebra, an algebraic function is said to be *symmetric* with respect to certain letters when these letters can be interchanged without changing the form of the expression. E.g. $x^2 + 2xy + y^2$ is symmetric as to x and y, because if x and y are interchanged it becomes $y^2 + 2yx + x^2$, which is the same as the original expression.

A knowledge of symmetry and homogeneity (q.v.) is of great value in factoring. E.g. to factor $f(x,y,z) = x(y^2-z^2) + y(z^2-x^2) + z(x^2-y^2)$. The expression vanishes for $x = y$, hence $x-y$ is a factor by the remainder theorem (q.v.). But $f(x,y,z)$ is symmetric with respect to x,y,z, therefore $y-z$, $z-x$, are also factors. And $f(x, y, z)$ being homogeneous of the fourth degree, it must contain another factor of the first degree; but such a homogeneous symmetric factor can be $x+y+z$ only. Whence the literal factors are $x-y$, $y-z$, $z-x$, $x+y+z$. On algebraic symmetry consult Beman and Smith, *Elements of Algebra* (Boston, 1900).

SYMMETRY. The general tendency in animals toward a symmetrical arrangement of parts. Thus man is bilaterally symmetrical, i.e. the external parts or limbs are arranged in pairs on each side of his body. So with the annelid worms, the lobster, centipede, and scorpion. On the other hand, this symmetry is wanting in some of the internal organs—those which are single. Haeckel has elaborated a scheme of fundamental forms of which the following is a summary.

(1) *Anaxial or symmetrical* forms, with no fixed central point or definite axis (many Protozoa and most sponges).

(2) *Homaxial or spherical* animals have the fundamental shape of a sphere, the parts of the body being arranged concentrically around a fixed central point (a few spherical Protozoa, chiefly Radiolaria).

(3) *Monaxial or Radial Symmetry.* In polyps, owing to their becoming fixed in larval life, the digestive canal opens upward, the parts being arranged around the single or main axis, radiating from it. In cross-section the radial symmetry is seen to be very marked. The parts are like reëntering wedges and were called by Agassiz spheromeres (cœlenterates and echinoderms).

(4) *Bilateral Symmetry.* Here the parts are symmetrically arranged on each side of the main or sagittal axis (annelid worms, arthropods, vertebrates).

INTERNAL AND EXTERNAL SEGMENTATION. This is due to the division of the body into segments, indicated externally by infoldings of the integument (annelids, tapeworms, arthropods). The external signs of segmentation may be effaced or wanting. Thus in man the body is segmented only internally; in the lancelet the muscles are arranged segmentally and can be seen on the outside of the body. In the annelid worms (earthworm, etc.) not only is the body segmented externally, bearing setæ or parapodia on each segment, but the nerve-ganglia, nephridia or segmental organs, the vascular arches or transverse arteries, and the septa of the body, i.e. the partitions between the segments, are repeated metamerically.

HOMONOMOUS AND HETEROMEROUS SEGMENTATION. The earthworm, the galley-worm (Julus), and the centipedes afford examples where the trunk-segments are for the most part alike in size and appearance, and bear similar locomotive setæ or jointed appendages. In most crustacea and insects, as well as in the higher vertebrates, 'heteronomy' prevails. Homonomy is characteristic of the more primitive forms, heteronomy of later more specialized types. Thus the transfer of parts headwards in crabs (cephalization), due to the excessive development of certain of the head segments and the atrophy of those behind, brings about a decided irregularity in the size and shape of the segments. Heteronomy is thus accompanied by a division of physiological labor due to the specialization of the segments and their appendages. It is owing to the hypertrophy of certain segments and partial or total reduction and even in some cases loss of segments or portions of segments, with their appendages, that the varied forms of arthropods are produced. Consult Haeckel, *Generelle Morphologie* (Berlin, 1866).

SYMONDS, sīm'ondz *or* sī'mondz, JOHN ADDINGTON (1840-93). An English critic and literary historian, born at Bristol. From Harrow he passed to Balliol College, Oxford, where he graduated with distinction, winning the Newdigate prize, with a poem on *The Escorial* (1860), and a fellowship at Magdalen College (1862). He began the study of law, which ill health compelled him to abandon. He settled at Clifton and began literary work in earnest. Subsequently he passed much time on the Continent, and for several years lived at Davos, in Switzerland. *Our Life in the Swiss Highlands* (1891) tells charmingly of his mountain home. He died in Rome. Symonds's reputation rests mainly on *The History of the Italian Renaissance* (7 vols., 1875-86), and the excellent translations of the *Vita di Benvenuto Cellini* (1887) and the *Sonnets of Michelangelo and Campanella* (1878). Other striking books are the *Introduction to the Study of Dante* (1872), *Essays, Speculative and Suggestive* (1890), *In the Key of Blue* (1893), and *Walt Whitman* (1893). Symonds also contributed to the "English Men of Letters" good lives of Shelley (1878) and of Sir Philip Sidney (1886). Besides all these and much other miscellaneous work, he composed a considerable body of verse, admirable in technique, but wanting in inspiration. This includes *Many Moods* (1878); *New and Old* (1880); *Animi Figura* (1882); and *Vagabunduli Libellus* (1884). Both his verse and his prose show the thorough interpenetration of his

nature by the culture and the ideals of the Renaissance period with which he was so familiar. He was celebrated as a fascinating conversationalist; Stevenson, who passed some time at Davos with him, has commemorated him in the essay on "Talk and Talkers" in *Memories and Portraits*, under the name of Opalstein. Consult also the biography by Brown (London, 1895).

SYMONS, sĭm'onz, ARTHUR (1865—). An English essayist and verse writer, born in Wales. He attended several private schools and traveled in France and in Italy. He has written for the *Athenæum* and the *Saturday Review*, and was editor of the short-lived *Savoy* (1896). As a literary critic, Symons is seen at his best in *Studies in Two Literatures* (1897), dealing with contemporary English and French writers. These essays possess a charm and finish recalling Walter Pater. Symons has published *An Introduction to the Study of Browning* (1886) and *The Symbolist Movement in Literature* (1899). He has produced a body of graceful and tender verse in *Days and Nights* (1889); *Silhouettes* (1892); *London Nights* (1895); *Amoris Victima* (1897); and *Images of Good and Evil* (1900)—all showing a marked influence of the recent school of French Symbolists. Two volumes of poems (1902) contain, with some new verses, all he wished to preserve from earlier volumes.

SYMPATHY (Lat. *sympathia*, from Gk. *συμπάθεια*, *sympatheia*, fellow-feeling, sympathy, from *συμπαθής*, *sympathēs*, having like feeling, sympathetic, from *σύν*, *syn*, together + *πάθος*, *pathos*, feeling). In its broadest sense, the reproduction in one's self of a particular condition (physiological, psychophysical, or psychological) presented by other living creatures in one's perceptual or ideal environment. In genetic psychology, sympathy is a form of ejective or social consciousness, based ultimately upon a group of organic sensations (q.v.). The motor attitude assumed by gregarious animals in defense of their kind is different from the attitude adopted under the influence of personal fear. When consciousness becomes representative, and free ideas are formed (see IDEA), the sense-basis of the former attitude is associated with ideas of others' suffering and rescue, that of the latter with ideas of one's own danger, safety, escape, etc. This is the stage of sympathetic consciousness proper. In general psychology, sympathy is one of the great emotional types, covering such different individual emotions as love, anger, contempt, aversion, chagrin, resentment, etc. (See EMOTION; ANGER.) For the ethical importance of sympathy, see ALTRUISM, and the references there given. See also ANTIPATHY.

SYMPETALÆ. One of the two great groups of dicotyledons (q.v.).

SYMPHONY (Lat. *symphonia*, from Gk. *συμφωνία*, unison of sound, harmony, from *σύμφωνος*, *symphōnos*, agreeing in sound, harmonious, from *σύν*, *syn*, together + *φωνή*, *phōnē*, sound, voice). In music, a word used in two different senses: (1) The instrumental introduction and termination of a vocal composition, sometimes called *ritornello;* (2) a composition for a full orchestra, consisting generally of four movements. The most usual though not unvarying order of movements is a brilliant allegro, ushered in by a slow introduction, an adagio or andante, a scherzo with its trio, and the finale, again an allegro. For the origin of the modern symphony we must go back to the beginnings of opera early in the seventeenth century, when the name *Sinfonia* was given to the short instrumental prelude which preceded the opera. The early history of the symphony is, therefore, that of the overture (q.v.). About the middle of the eighteenth century composers began to write separate *sinfonie* exclusively for concert performance. The three parts of the older overture, which had then only a loose connection, were entirely detached and became separate movements. Haydn introduced a fourth movement, the minuet (q.v.), which he inserted before the finale. He also adopted for the first movement the sonata form (q.v.). By individualizing the separate instruments and grouping them in families Haydn also established the symphony orchestra and thus made the symphony what it is to-day. Beethoven extended the form considerably, particularly the development section of the first movement, and also replaced the minuet by the more elaborate scherzo (q.v.). Beethoven also increased the orchestra considerably. (See ORCHESTRA.)

SYMPLEGADES, sĭm-plĕg'ă-dēz (Lat., from Gk. *Συμπληγάδες*, that strike together, from *συμπλήσσειν*, *symplēssein*, to strike together, from *σύν*, *syn*, together + *πλήσσειν*, *plēssein*, to strike). Two mythical floating islands in the Pontus Euxinus, which dashed against each other until they became fixed when the Argo made its way between them. See ARGONAUTS.

SYMPOSIUM (Lat., from Gk. *Συμπόσιον*, banquet). (1) A philosophical treatise by Xenophon, discussing the nature of love and friendship, and depicting the character of Socrates, who is one of the speakers. The meeting place is the house of the Athenian Callias. The work conveys a good idea of the conduct of an Athenian drinking party. (2) A dialogue by Plato, intended probably as a corrective of the similar work of Xenophon. Its subject is the nature of love. Its scene is the house of the poet Agathon, and Socrates and Alcibiades are among the speakers.

SYMPTOM (from Gk. *σύμπτωμα*, *symptōma*, chance, mischance, symptom, from *συμπίπτειν* *sympiptein*, to fall in with, happen, coincide, from *σύν*, *syn*, together + *πίπτειν*, *piptein*, to fall). A medical term denoting a phenomenon by which a physician judges of the presence of disease. A group, or syndrome, of symptoms enables the physician to judge directly of the nature of and to identify the disease, or to decide upon the lesions or morbid tissue changes, and then determine what disease is present. This decision is called a diagnosis. (See PATHOLOGY.) Symptoms are *objective*, including those perceived by the physician and found upon examination, such as heart murmurs, rise of temperature, etc.; or *subjective*, including those perceived only by the patient, as pain, ringing in the ears, etc. Symptoms are termed *pathognomonic* when they are sure signs of a certain disease; e.g. the syndrome of occipital headache, severe pain in the orbits, acute nasal catarrh, rheumatoid pains in joints and muscles, and great prostration is almost always pathognomonic of the grippe.

SYNAGOGUE (Gk. *συναγωγή, synagōgē*, assembly, collection, from *συνάγειν, synagein*, to bring together, from *σύν, syn*, together + *ἄγειν, agein*, to lead; translation of Heb. *bēth-hakkeneseth*, the house of assembly). The name applied to the place of assembly used by Jewish communities primarily for public worship. The origin of this institution is probably to be traced to the period of the Babylonian captivity, when religious needs in the absence of an official cult could only be satisfied by private assemblies for religious communion. The example set during the Babylonian Exile led to the establishment of synagogues in Palestine after the days of Ezra, and with the impetus then given to the study of the law a further factor was introduced which encouraged the institution of assembly-houses for prayer and study. Although express notices of the synagogues are not found in the literature till the last century B.C., all indications point to their existence in the towns and even villages of Palestine at the time of the Maccabees.

Synagogues were erected from the common funds or free gifts of the community and supported by taxes and donations. Regarding their architecture it would appear that in Palestine the Græco-Roman model of public buildings was followed, though with some essential modifications. Abundant ornamentation was a feature both of the exterior and interior. The larger synagogues were divided by rows of pillars into several aisles and some had porticoes in front. In later times in Europe the Romanesque style was adopted, and in more modern times Moorish architecture is frequently chosen as a model. Little is known of any special law respecting the construction of these buildings, save that the faces of the worshipers should be directed toward Jerusalem; that, in accordance with the verse in the Psalms, there should be a slight descent of a step or two on entering the edifice; that the building should stand, if feasible, on a slightly elevated ground, or be somehow or other made visible from afar. Within at the extreme eastern end was the holy ark, or chest (*tēbāh*) containing several copies of the Pentateuch, from which the periodical readings were chanted. In front of this was the stand of the public reader of the prayers, not far from which was suspended the everlasting lamp. On a raised platform in the middle of the synagogue was the place of the reader or preacher. The women, who were not counted as members of the congregation, sat separated from the men.

The affairs of the synagogue were administered by a board of 'ancients' or 'elders,' at whose head stood a chief or principal (*Rōsh hakkeneseth, archisynagogos*). The 'chief' was not a scribe, though taking rank immediately after the scribes. The officiating minister, whose office it was to recite the prayers aloud, was called *shĕliaḥṣibbūr*, messenger of the community. The *chazzān* had general charge of the sacred place and its books and implements. He had to present the scroll to the reader, received it back after the reading was finished, rolled up the scroll and deposited it in the chest, and it was he who announced the advent of the Sabbath or of a holy day from the roof of the synagogue with a thrice repeated trumpet-blast. During the week-days he had to teach the children of the town or village. He had to be initiated by a solemn imposition of hands. The name of *chazzān*, however, at a later period, came to designate the officiating minister, and it has retained that meaning until this day. Almoners or deacons, who collected or distributed the alms, possibly the same as the *baṭlanim* or 'idle men,' whose office in relation to the synagogue cannot be exactly determined now, but who had always to be ready for the purpose of making up the requisite number of ten worshipers, were further attached to the general body of officials. The third, sixth, and ninth hours of the day were the times appointed for daily worship; the more special days were Monday and Thursday, when the judges sat, and the villagers came to town, and Saturday, on which the forms of some of the prayers were altered according to the occasion.

The reading from the Scriptures, though in Hebrew, was coupled in the synagogues of Palestine and Babylonia with a translation or paraphrase in the current Aramaic idiom, and presumably in the synagogues of Egypt a Greek translation was employed, but the chief prayers were always pronounced in Hebrew, though the Talmud admits the use of other languages in worship. Besides the prayers and the readings, a feature of early synagogue worship was the exposition of the law or of the lesson of the day by a competent person. In course of time a more elaborate liturgy developed. The oldest complete ritual, known as *siddur* ('arrangement'), dates from the year A.D. 880, and was compiled by a Rabbi Amram. In the liturgy as finally evolved two distinct elements are discernible: the *Shema'* ('Hear, O Israel,' etc.), being a collection of the three passages, Deuteronomy vi. 4-9, xi. 13-21, and Numbers xv. 37-41, expressive of the unity of God and of His government over Israel, put together without any extraneous addition; and the *Tĕphillāh* or prayer, consisting of a certain number of supplications, with a hymnal introduction and conclusion, followed by the priestly blessing. The single portions of this prayer gradually increased to eighteen and the prayer itself received the name of *Shĕmōnāh 'eshĕh* (eighteen). For a long time the prayers were recited only by the reader, the people joining in silent responses and amens. These readers by degrees—chiefly from the tenth century—introduced occasional prayers of their own, and ultimately religious doctrine, history, saga, angelology, and mysticism, interspersed with biblical verses, are found put together in a mosaic of the most original and fantastic, often grand and brilliant, often obscure and feeble kind. The ritual differed in different countries. At the beginning of the nineteenth century a movement began in Germany for the reform of the ritual and gradually spread to other countries. At first the changes consisted in the shortening of certain prayers, the omission of others and the introduction of German, English, or French by the side of the Hebrew.

The synagogues contributed more than anything else to the steadfast adherence of the people to their religion and liberty as long as there was any possibility of keeping both intact. At the same time they gradually undermined the priestly and aristocratic element that gathered around the temple, its gorgeous worship and kingly revenues. Their importance as a place of

instruction as well as a place of worship was of profound influence on the development of Judaism. Both primary and advanced instruction in the Scriptures and subsequently in Talmudic literature was given in the synagogue, and in the early centuries of the Christian Era legal decisions were likewise announced there. The synagogue could also be used as the place of mourning for prominent members of the community, and there are instances on record of the use of synagogues for political gatherings. In Babylonia travelers were accommodated in the synagogue and ate their Sabbath meals there. In view of these various uses to which the synagogue was put, it is not surprising that it became in the Middle Ages the centre of the religious and intellectual life of the Jews and in a measure of their social life as well. The 'reform' movement within Judaism as well as the extension of the intellectual interests of the Jews has resulted in narrowing the influence and scope of the synagogue to purely religious affairs, though in orthodox Jewish communities in Eastern Europe and in the Orient the former status of the synagogue is still in large measure maintained.
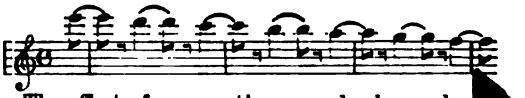
BIBLIOGRAPHY. Schürer, *History of the Jewish People in the Time of Jesus Christ* (Eng. trans., London, 1886-90); Abrahams, *Jewish Life in the Middle Ages* (Philadelphia, 1896); Grätz, *History of the Jews*, vol. i. (Eng. trans., ib., 1893). For the ritual, Leopold Löw, *Der synagogale Ritus* (*Gesammelte Schriften*, vol. iv., Szegedin, 1889); Dembitz, *Jewish Services in Synagogue and Home* (Philadelphia, 1899); Zunz, *Der Ritus synagogalen Gottesdienstes, geschichtlich entwickelt* (Berlin, 1855-59); a complete English translation of the Portuguese ritual may be found in Lesser's Prayer-book (Philadelphia, 1845); and a translation of the German ritual in Sachs's *Machsor* (Berlin, 1866).

SYNAGOGUE, THE GREAT (Heb. *hakkeneseth haggĕdōlāh*). An alleged assembly or synod, said to have been founded and presided over by Ezra and to have controlled the national and religious fortunes of the Jews after the return from Babylon, c.450-200 B.C. Its membership is generally given as 120, but sometimes as 80. The palpable chronological discrepancies that occur in the early accounts about this synod, together with other doubtful points, have led modern scholars to deny its existence. It is not mentioned by Josephus or the Apocrypha and is only twice referred to in the Mishna (*Pirke Aboth* I., 1 and 2). Even according to the Talmudical notices the 'great synagogue' continued only for a single generation. According to these notices the men of the great synagogue secured the acceptance of certain books of the Old Testament (Proverbs, Canticles, Ecclesiastes); they promoted the work of copying the Torah, devoted themselves to the perfection of a daily ritual, and introduced certain changes into the Old Testament text in order to avoid misunderstandings. The notion that they collected the books of the Old Testament and fixed the canon had no authority in the Talmud, and indeed does not arise till the sixteenth century. Kuenen has traced the origin of the name to the 'great assembly' which is described in Nehemiah viii.-x. This assembly was of a popular character, and no doubt marked an epoch in the history of post-exilic Judaism. An uncritical age made of this 'assembly' a permanent institution and attributed to it the various steps taken in the natural unfolding of that phase of Rabbinical Judaism which came to a temporary close when the canon of the Old Testament was definitely established. While some scholars (notably D. Hoffmann of Berlin) still cling to the traditional view, Kuenen's results have been accepted by the great majority. Consult his essay in *Gesammelte Abhandlungen*, pp. 125-160 (Freiburg, 1894); Hoffmann's reply will be found in the *Magazin für die Wissenschaft des Judenthums*, vol. x. (1883), pp. 45-63. See also L. Krauss, "The Great Synod," in the *Jewish Quarterly Review*, vol. x. (1898), pp. 347-377.
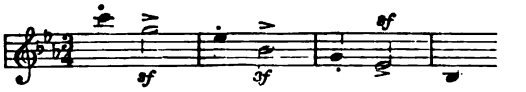
SYNCHRONOUS MOTORS. See DYNAMO-ELECTRIC MACHINERY.

SYNCLINE (from Gk. *συνκλινειν*, *synklinein*, to lean together, from *σύν*, *syn*, together + *κλινειν*, *klinein*, to lean). A term used in geology for the structure formed by the bending of strata into a basin of downward fold, the limbs of the fold dipping toward each other and meeting at a line called the synclinal axis. Where the strata dip downward from all sides a peculiar type of syncline arises, known as a geologic basin; in this case the synclinal axis is reduced to a point. The syncline, structurally, is the complement of the anticline (q.v.). See GEOLOGY.

SYNCOPATION (from Lat. *syncopatus*, p.p. of *syncopare*, to syncopate, from *syncope*, from Gk. *συγκοπή*, *synkopē*, a cutting short, from *συγκόπτειν*, *synkoptein*, to abridge, from *σύν*, *syn*, together + *κόπτειν*, *koptein*, to cut). In music, the joining together of two similar notes by means of a tie, so that the accent intended to fall on the second (strong beat) comes on the first (weak beat). The effect produced is that of contra-tempo. The following example is from Beethoven's overture "Lenora No. 3:"



The effect of syncopation can also be produc by merely shifting the accent by means of marks (*Eroica Symphony*, Scherzo):



The North American Indians made extensive use of syncopation, and in this were followed by the Southern negroes. In fact, the music of nearly every savage or semi-civilized nation shows traces of syncopated rhythm.

SYNCOPE. See FAINTING.

SYNCRETISM (from Gk. *συγκρητισμός*, *synkrētismos*, combination against a common enemy, from *συγκρητίζειν*, *synkrētizein*, to combine against a common enemy, apparently from *σύν*, *syn*, together + *κρητίζειν*, *krētizein*, to act like a Cretan, from *Κρής*, *Krēs*, Cretan). A term used: (1) in ancient times, politically, to designate the Cretan custom of disregarding all internal dissensions whenever a controversy with a for-

eign country occurred; (2) in the sixteenth century, philosophically, to denote the efforts made to reconcile opposing systems; (3) in the seventeenth century, theologically, first by Pereus in his *Irenicon*, and afterwards to describe the views of Calixtus and his followers, who sought to heal the schism in the Church by making the traditions of the first five centuries of equal authority with the Bible, and by adopting the Apostles' Creed as the common basis of all Christian denominations and a sufficient definition of true Christianity.

SYNDIC (from Lat. *syndicus*, from Gk. *σύνδικος*, *syndikos*, advocate, public officer, from *σύν*, *syn*, together + *δίκη*, *dikē*, justice, law, right). A name which has at different times and in different countries been given to various municipal and other officers. In Geneva the chief magistrate was formerly called the syndic. The syndics of cities in France, under the old régime, were officers delegated by the municipality as agents or mandatories; the various trading companies in Paris and the university had also their syndics; and in the University of Cambridge the same name is applied to members of special committees of members of the senate appointed by grace from time to time for specific duties. In Italy the mayors of towns are called syndics.

SYNERGISM (from Gk. *συνεργία*, *synergia*, coöperation, from *συνεργός*, *synergos*, coöperative, from *σύν*, *syn*, together + *ἔργον*, *ergon*, work). The name given to a doctrine of theology which teaches that in the work of conversion the will of man is not wholly passive, but can coöperate, through consent, with the Divine Spirit. In the time of the Reformation Melanchthon and his school were inclined to this view, while the strict Lutherans opposed it and charged its advocates with favoring Pelagianism (q.v.). In 1557 and later the question was hotly discussed, Pfeffinger and Strigel taking the lead on the Synergistic side, Flacius and Amsdorf (qq.v.) on the opposite. The Wittenberg divines in general favored the doctrine, the Mansfield divines opposed it. Finally it was condemned in 1580 in the third article of the Formula of Concord. See CONCORD, BOOK OF.

SYNE'SIUS (Lat., from Gk. *Συνέσιος*) (370-?). A Neo-Platonic philosopher and Christian bishop. He studied philosophy in Alexandria, under Hypatia, to whom he was ever warmly devoted, and his life well illustrates the combination of Neo-Platonism and Christianity so characteristic of the fourth century. For three years (397-400) he served as envoy at the court of Arcadius, in Constantinople, where he won popularity and influence. His famous speech *On Kingship* was delivered in the Emperor's presence, and was a bold discussion of the duties and frailties of monarchs. Synesius was made Bishop of Ptolemais in 410, against his own desire, and with the apparent stipulation that he should not be obliged to give up his wife or his philosophy. He administered his see with conscientious fidelity, notwithstanding the fact that his personal tastes were far from ecclesiastical. Neither the time nor the place of his death is known. Synesius's writings include about 150 letters; *Egyptian Tales, or on Providence*, a sort of historical allegory defending the idea of a providential government of the world; a defense of the philosophic life, entitled *Dio* (after Dio Chrysostom); a humorous work, called *Praise of Baldness*, suggested by Dio's *Praise of Hair;* and ten *Hymns*, which are partly pagan and partly Christian. His general theological point of view and his distinctive characteristics are well brought out in Charles Kingsley's novel, *Hypatia*, in which Synesius figures. For his works, consult: Migne, *Patrologia Græca*, lxvi. In general, consult: Glover, *Life and Letters in the Fourth Century* (Cambridge, 1901); Druon, *Etudes sur la vie et les œuvres de Synésius* (Paris, 1859); Volkmann, *Synesius von Cyrene* (Berlin, 1869).

SYNOD (Lat. *synodus*, from Gk. *σύνοδος*, assembly, meeting, coming together, from *σύν*, *syn*, together + *ὁδός*, *hodos*, way, road). A term applied almost exclusively to ecclesiastical assemblies convoked for the discussion and decision of ecclesiastical affairs. Synods or church councils are of five kinds: Ecumenical, general, national, provincial, and diocesan or local. By the law of the Roman Catholic Church the decrees of a national or provincial synod must be submitted to the Pope, and unless confirmed by him, or at least suffered to pass for two years without condemnation, are not held to be valid. The term synod has been preserved to describe courts in the Presbyterian system of church government which rank above the presbytery and the synod either is subordinate to a General Assembly or is itself the supreme court of the Church. The courts above the classes in the Dutch and German Reformed churches are called synods. In the organization of the Lutheran churches the synod is the highest representative body. Two of the Eastern churches have preserved the synod. The Holy Governing Synod of All the Russias is the highest ecclesiastical authority for the established Church of the Russian Empire. It consists of several metropolitans and other prelates and officials—the Chief Procurator of the synod representing the Czar. It was instituted by Peter the Great in 1721, to take over the jurisdiction formerly exercised by the Patriarch of Moscow. The orthodox national Church of the Kingdom of Greece is also governed by a synod of archbishops and bishops independent of the jurisdiction of any patriarch. For other conciliar organizations, see COUNCIL.

SYNODIC (Lat. *synodicus*, from Gk. *συνοδικός*, *synodikos*, relating to a conjunction, from *σύνοδος*, *synodos*, assembly, meeting, coming together). In astronomy, the epithet applied to the period of time which elapses between two successive conjunctions (q.v.) of a planet with the sun, as seen from the earth. In the case of the moon, the synodic period is therefore the time elapsing between two successive new moons. See MOON.

SYNONYM (Lat. *synonymum*, from Gk. *συνώνυμον*, *synōnymon*, neu. sg. of *συνώνυμος*, *synōnymos*, having the same name or meaning, from *σύν*, *syn*, together + *ὄνομα*, *onoma*, name). A word which nearly coincides in meaning with another, as clear, transparent; bright, limpid; fair, cloudless; serene, plain; lucid, perspicuous; patent, obvious; visible, evident. There is, however, in nearly every case a slight individual shade of meaning in each synonym. The development of synonyms is one first of convergence and then of divergence. That is, the meanings are originally quite distinct.

In the course of semasiological evolution, however (see SEMASIOLOGY), the particular words which tend to become synonymous overlap in meaning. This process may then continue till the words become identical in meaning. In this case the result is suppression of one of the terms, either complete, or, less usually, partial. The latter process gives the so-called suppletive or composite inflection, illustrated in such English verbs as *am, be, was*, or *go, went*, in which verb-roots originally distinct have coalesced. If, on the other hand, synonyms do not become identical, they tend to become so specialized in meaning with respect to each other that they not only retain for the most part their original distinctions, but frequently develop others. The main stylistic use of synonyms is to give variety and accuracy of diction. One of the criteria of excellence of a language is its synonyms, and herein English ranks as one of the foremost tongues. Consult, for English synonyms: Roget, *Thesaurus of English Words* (new ed., London, 1883); Soule, *Dictionary of English Synonyms* (new ed., Philadelphia, 1895); Crabbe, *English Synonyms* (new ed., New York, 1891); Smith, *Synonyms Discriminated* (4th ed., London, 1890).

SYNOVIAL MEMBRANE and **FLUID** (from Neo-Lat. *synovialis*, from *synovia*, lubricating fluid secreted by a synovial membrane, so called because it resembles the white of an egg, from Gk. *σύν, syn*, together + Lat. *ovum*, egg). In every joint in which a considerable range of motion is required, the osseous segments (or contiguous extremities of bones) are separated by a space, which is called the cavity of the joint. The end of each of the bones entering into the composition of the joint is incrusted by a layer of articular cartilage adapted to its form, and the entire cavity of the joint is lined by a delicate membrane, which is termed the *synovial membrane*, which secretes a peculiar viscid matter, termed *synovia*, or *synovial fluid*, for the purpose of lubricating the inner surface. Being a serous membrane, a synovial membrane is always a closed bag, like the pleura, for example, with an attached and a free surface, the latter being smooth and moist. The minute structure of a synovial membrane is much the same as that of serous membranes elsewhere. (See HISTOLOGY.) A very simple form of synovial membrane—anatomically known as a *bursa*—is employed to facilitate the gliding of a tendon of a muscle or of the integument over a projection of bone. It consists of a bag connected by areolar tissue with the neighboring parts, and secreting a fluid in its interior. These bags are sometimes prolonged into *synovial sheaths*, which surround long tendons, such as those of the flexor and extensor muscles of the fingers and toes. In felon (q.v.), when inflammation extends to one of the sheaths, and gives rise to the formation of adhesions, the motion of the inclosed tendon is destroyed, and a permanently stiff finger is the result. See SYNOVITIS.

The *synovial fluid*, or *synovia*, consists of water holding in solution mucin, albumen, fat, and inorganic salts. Excessive movement diminishes its amount, makes it more inspissated, and increases the mucin, but diminishes the salts.

SYNOVITIS (Neo-Lat., from *synovia*, lubricating fluid secreted by a synovial membrane). Inflammation of a synovial membrane. Although inflammatory processes involving joints frequently start in an inflammation of the synovial membrane, they rarely confine themselves to this membrane, but spread to and involve the surrounding tissues. It is for this reason that, especially in discussing the pathology of joints, the term synovitis, which properly means inflammation of the synovial membrane only, has been displaced by the term arthritis, which signifies inflammation of the joint in general, including the synovial membrane.

ACUTE ARTHRITIS is usually an exudative inflammation and may be serous, sero-fibrinous, or suppurative in character. In serous arthritis there is congestion of the synovial membrane with a serous exudate into the joint cavity. With the subsidence of the inflammation the serum may be absorbed and the joint return to its normal condition, or, becoming infected, may pass on to suppuration. The acuteness of the condition may pass off and the joint go on to a chronic inflammation. In sero-fibrinous arthritis there is in addition to the serum more or less fibrin in the joint cavity. Suppurative arthritis is an infectious condition due to the presence of bacteria. The exudate is purulent, while the synovial membrane is usually thickened, dull, and infiltrated with pus cells. Suppurative arthritis is apt to accompany or follow some one of the infectious diseases, as e.g. pyæmia, puerperal fever, pneumonia, gonorrhœa, diphtheria, and scarlet fever. Acute rheumatic arthritis or acute articular rheumatism is usually an exudative inflammation in which the exudate is serous in character and in which there is a successive involvement of different joints.

CHRONIC ARTHRITIS. The most important forms of chronic arthritis are simple chronic arthritis, arthritis deformans, rheumatic arthritis, gouty arthritis, and tubercular arthritis. In simple chronic arthritis there is a serous exudation into the joint cavity; the synovial membrane is thickened, pale, and rough. The exudate may be clear, thin, and watery, or may be cloudy and thick from the presence of minute particles of fibrin, or of lymphoid or endothelial cells. The amount of fluid is sometimes large and may result in rupture of the joint capsule or in so separating the joint surfaces that dislocations occur. In that peculiar form of chronic inflammation of the joints known as arthritis deformans there is a combination of destruction of parts of the joint with new bone formation which leads to extensive deformities. The joints most commonly involved are those of the fingers, hips, knees, and feet. In gouty arthritis there is a deposit of urates in and about the joints. These deposits take place in the cartilages and in the connective tissue and in the ligaments around the joints or even in the subcutaneous tissue. The deposit may be in the form of crystals or of whitish concretions. In tubercular arthritis the lesion is that of a tubercular inflammation modified by the nature of the tissues in which the inflammation occurs. The process may originate in the joint, but more frequently represents an extension to the joint of tubercular inflammation of the bones. Tubercular arthritis is always characterized by the growth of tubercle tissue in and about the joint. Like tubercle tissue in other parts of the body, this tissue may vary in character; and, dependent upon these variations, several types of tubercular arthritis are recognized.

In some cases the most marked feature of the tubercular process is the degeneration of the tubercle tissue and of the adjacent joint structures with the formation of ulcers. This is known as the ulcerative form of the disease. In other cases the growth of granulation tissue is very extensive, and the name 'fungous' is applied to this form of the disease. In still others extensive suppuration occurs, pus being present in the joint cavity and in the surrounding tissues. This is designated suppurative tubercular arthritis. The tubercular process frequently spreads to and involves the bone, resulting in extensive changes in the bones themselves. Tubercular arthritis is usually slow in its progress. The large joints are most frequently affected. The amount of stiffness is dependent upon the extent of the process. Tubercular arthritis may occur as part of a general tubercular infection, as secondary to other tubercular lesions, or, not infrequently, is confined to a single joint with no evidence of any tubercular condition in other parts of the body.

Treatment of synovitis or arthritis depends upon the cause. In the acute serous or serofibrinous varieties, rest, alternate hot and cold affusion, extension of the limb so as to separate the surfaces, and exercise with the joint immovable, may be all that is necessary. In some cases passive motion is desirable, to break up adhesions, after prolonged rest in a splint. In some exudative, especially in suppurative cases, the joint is aspirated and the fluid drawn off. Rheumatic and gouty arthritis yields to the salicylates, alkalies, lithia salts, or other internal medicine used in rheumatism or gout. In tubercular cases the joint is opened and the tubercular nidus scooped out, or the joint is resected in some instances. Deforming arthritis usually leaves permanent deformities. Sometimes operative procedures, undertaken after the inflammation has ceased, will correct these deformities in part. Consult Marsh, *Diseases of the Joints and Spine* (London, 1895); "Joints, Diseases of," in *Encyclopædia Medica*, vol. vi. (Edinburgh, 1900).

SYNTÁX. A division of philology (q.v.).

SYNTAX, FIGURES OF. Intentional deviations from the ordinary construction of words. The principal figures of syntax are as follows: Anaphora is the repetition of the same word or grammatical form at the beginning of several successive clauses, as '*without* tumult, *without* arms, *without* harm or injury the insurrection was quelled.' Anastrophe consists of a transposition of words, as *rolled the thunder* for *the thunder rolled*, or 'he travels earth *around*.' Asyndeton is the ellipsis of a conjunction or connecting particle, as *veni, vidi, vici*, 'I came, I saw, I conquered.' Brachylogy is the use of a concise or pregnant mode of expression, as 'the eye of a horse is bigger than an elephant,' i.e. than (the eye of) an elephant. Chiasmus is a cross-wise arrangement of words, where the words of a second and corresponding set are stated in inverse order to those of the first set, as 'Begot by butchers, but by bishops bred.' Ellipsis is the omission of a word or words necessary for the construction of the sentence, but not essential to its meaning. By means of ellipsis conciseness and impressiveness are gained, and accordingly it prevails in proverbs, as 'More haste, less speed,' or *Ex pede Herculem*. Asyndeton is a special form of ellipsis. Enallage is the substitution of one part of speech, or of one inflectional form of a word, for another, as 'they fall *successive* and *successive* rise.' Epanastrophe is the repetition of the end of a clause at the beginning of the next, as 'The mouse ran up *the clock, the clock* struck one.' Epiphora is the repetition of a word or words at the end of successive clauses and hence is the reverse of anaphora, as *Lælius navus erat, doctus erat*. Epizeuxis is the emphatic repetition of a word, as

> "*Alone, alone*, all, all *alone*,
> *Alone* on a *wide, wide* sea."

Hendiadys or hendiadyoin is the use of two coördinate words or phrases instead of an expression in which one qualifies the other grammatically, or, in other words, it is the presentation of one idea by means of two coördinate words or phrases, as a 'couch strewn with *purple and tapestry*,' i.e. with purple tapestry, or *armis virisque*, 'with arms and men' (i.e. armed men). Hypallage is the use of one case for another, the transference of an epithet from its proper subject to another, as *Tyrrhenus tubæ clangor*, 'the Tyrrhenian clang of the trumpet,' for *Tyrrhenæ tubæ clangor*, 'the clang of the Tyrrhenian trumpet.' Hyperbaton is the transposition of words or clauses. An example of hyperbaton of clauses is *valet atque vivit*, 'he is well and alive,' for *vivit atque valet*, 'he is alive and well.' Pleonasm is the use of superfluous words, sometimes, however, arising from a desire to secure strength, as in the excessive use of the negative in conversation, especially by uneducated persons or by children. Polysyndeton is pleonasm in the use of conjunctions and is the reverse of asyndeton. Prolepsis consists in introducing a word in advance of its proper place, as 'I know *thee*, who thou art.' Prolepsis also denotes the use of an epithet before it is logically applicable, as *Scuta latentia condum*, 'they conceal their hiding (or hidden) shields.' Syllepsis is the agreement of an adjective or verb with only one of two or more subjects with which it is linked, as *rex et regina beati*. Synesis is a construction of words according to the sense conveyed by them rather than by the strict requirements of grammatical rules, as 'Philip went down to Samaria and preached Christ unto *them*.' Tmesis is the separation of the parts of a word, as in Ennius's famous line, *saxo cere comminuit brum*, or, in 'the love of God *to* us *ward*.' Zeugma is the use of a word in two or more connections, though, strictly speaking, it is applicable to only one of them.

SYNTHESIS (Lat. *synthesis*, from Gk. *σύνθεσις*, composition, combination, a putting together, from *συντιθέναι*, *syntithenai*, to combine, put together, from *σύν*, *syn*, together + *τιθέναι*, *tithenai*, to put, place). In philosophy, a term applied to the organic unity of different elements, or to the process whereby such a unity is constituted. See ANALYSIS.

SYNTHESIS, CHEMICAL. The building up of compounds from their elements. The synthetic methods of chemistry are of the greatest importance in several respects. First, they may serve to test the correctness of analyses, or even, in certain cases, replace analytical methods altogether. For example, if there were any doubt as to water being composed of eight parts of

oxygen and one of hydrogen, or if water could not be analyzed at all, its exact composition could be demonstrated by causing oxygen and hydrogen to combine. In fact, it was the synthesis of water by Cavendish that first indicated its chemical nature and exact composition. (See CHEMISTRY, historical section.) Secondly, synthetic methods may, and very often do, serve to reveal the complex chemical constitution of compounds of carbon. It is explained under CARBON COMPOUNDS (q.v.) that one of the basal principles employed in determining the constitution of compounds is the assumption, itself well founded on facts, that when a given compound undergoes a moderate chemical change, the greater part of each of its molecules remains unaffected: an atom, or a group of atoms, may be replaced by another, but the linking of the remaining atoms is not changed. Thus, by the action of chlorine on acetic acid, the latter may be gradually transformed into mono-chloracetic acid, di-chloracetic acid, and tri-chloracetic acid, one, two, or three atoms of hydrogen in the molecule of acetic acid being replaced by one, two, or three atoms of chlorine; but the remaining atoms (carbon, hydrogen, and oxygen) are linked in the chloracetic acids in the same manner as in acetic acid itself. On this principle, the constitution of a compound becomes known if it is produced by synthesis from compounds of known constitution. In this connection it may be well to observe that the definition of the term synthesis must not be taken to mean the production of compounds from their elements directly. Thus, when it is said that ordinary alcohol can be produced synthetically, it does not mean that alcohol can be made by the direct union of carbon, hydrogen, and oxygen. The synthesis of alcohol consists of the following steps: carbon and hydrogen are caused to unite into acetylene (q.v.); acetylene is caused to unite with hydrogen into ethylene; ethylene is caused to unite with sulphuric acid to form ethyl-sulphuric acid; and the latter by reaction with water yields alcohol. The two compounds employed, viz. water and sulphuric acid, can also be made by starting with their elements; and so it may be said that ordinary alcohol can be made with nothing to start with but elementary substances, and this is what is meant by 'the synthesis of alcohol from its elements.' Finally, many synthetic processes have acquired great importance industrially. In 1868 Graebe and Liebermann built up by synthetical processes the substance called alizarin (q.v.), which occurs naturally in madder root, and which gives the latter its chief value as a dye-stuff. This artificial alizarin is now made on an enormous scale and has almost entirely displaced madder in dyeing and calico-printing. In 1880 Adolf Baeyer accomplished the synthesis of indigo. In 1887 Ladenburg succeeded in the synthesis of coniine, $C_8H_{17}N$, the poisonous alkaloid found in hemlock. Vanillin, the aromatic flavoring principle of the vanilla bean, has been made artificially by several chemists. Antipyrin, a substance much used in medicine, and saccharin, a substance several hundred times sweeter than sugar, are entirely the products of synthesis.

Yet while most of the known carbon compounds can be produced synthetically, some of the most important organic substances, including the proteins and many carbohydrates, still remain unsynthesized, and hence but imperfectly understood, and must still be obtained ready-made from nature. The synthetic methods employed in the preparation of a large number of carbon compounds are mentioned under the special names of those compounds. For further information, consult: Berthelot, *La synthèse chimique* (Paris, 1876; Ger. trans., Leipzig, 1877); Louise, *Synthèse d'hydrocarbures, d'acétones, d'acides, d'alcools, d'éthers et de quinones dans la série aromatique* (Paris, 1885); Lellmann, *Principien der organischen Synthese* (Berlin, 1887); and especially the excellent work of Elbs, *Die synthetischen Darstellungsmethoden der Kohlenstoff-Verbindungen* (Leipzig, 1889-91). See CHEMISTRY (historical section) and CARBON COMPOUNDS.

SYNTHETIC GEOMETRY. See GEOMETRY.

SYNTONIN (from Gk. *σύντονος, syntonos,* stretched tight, from *συντείνειν, synteinein,* to stretch tight, from *σύν, syn,* together + *τείνειν, teinein,* to stretch). A protein substance prepared by the action of dilute acids on the myosin of the muscles. The acid solution thus obtained is neutralized with alkali and the precipitated syntonin is washed with a small quantity of water. Syntonin may be converted into a globulin probably identical with myosin, by dissolving in lime-water, adding ammonium chloride, then neutralizing with acetic acid; from the solution thus obtained the globulin may be precipitated by adding the solution slowly to a large amount of distilled water. Syntonin is soluble in lime-water and in dilute solutions of sodium carbonate, but not in acid sodium phosphate. It may be classed with the so-called acid albumins, and it is distinguished from other substances of the same class of proteids by its insolubility in acid sodium phosphate solution.

SYPHAX, sī'fāks (Lat., from Gk. *Σίφαξ*). A Numidian prince, who played a part in the Second Punic War, an enemy of Masinissa (q.v.).

SYPHILIS (from *Syphilus,* in the Latin poem entitled *Syphilus, sive Morbi Gallici libri tres,* by the Italian physician and poet Hieronimo Fracastoria (1483-1553), a shepherd who was afflicted with the disease by Apollo as a punishment for offering homage to his king instead of to the god; of uncertain etymology, popularly explained as from Gk. *σῦς, sys,* hog + *φίλος, philos,* loving, or, less plausibly, from *σύν, syn,* with + *φίλος, philos,* loving), or LUES, or THE POX. A specific contagious disease peculiar to the human species, chronic in its course, and generally acquired during sexual congress. It is always due to contact with a syphilitic individual or with his secretions or discharges. Descriptions of syphilis are found in the earliest writings, and traces of it are discovered in the bones of prehistoric people. Chinese accounts of it date back to the writings of Hoan-Ti, who lived about 2637 B.C. The earliest Indian record is found in the Ajwe Veda of Suśrutas, A.D. 400. The Japanese historians described the disease several thousand years ago. The Hebrews were familiar with it and it is probable that many cases called leprosy were really syphilis. Hippocrates and his successors describe it as it existed among the ancient Greeks, and Celsus speaks of it among the Romans. Although the malady is known to have existed in Europe at least as early as A.D. 1250, when Theodoric, a Dominican monk, wrote of the *malum mortuum*

and recommended inunctions of mercury for its cure, its authentic and general recognition dates from a severe outbreak of the disease in the army of Charles VIII. of France during the siege of Naples. It was known as 'the Neapolitan disease' and as the *morbus Gallicus*. The disease spread with frightful rapidity and virulence, and during the following years was so widely disseminated as to be considered a form of plague. The armies of the various countries were nearly decimated, and no class of society escaped its ravages.

It was not at first recognized as a venereal disease. Its true nature appears to have been unsuspected at this time, as it was again a little previous to the time of John Hunter (q.v.), after whom was named the Hunterian or hard venereal sore. Hunter, although the greatest surgical philosopher of the eighteenth century, believed that there was but one venereal disease; that gonorrhœa, chancroid, and syphilitic chancre were merely variations of the same constitutional affection. Nearly half a century later (1831) Ricord established the identity of gonorrhœa, but failed to distinguish between chancroid and chancre. This was left to one of his pupils, Bassereau, to accomplish in 1856. The severe epidemics of the fifteenth century have never been repeated, although syphilis has since prevailed with continually decreasing virulence. This is due in part to improved personal hygiene, better understanding of the disease, and rational treatment, but also doubtless to the fact that successive generations have transmitted a certain degree of immunity to their descendants. See IMMUNITY.

The nature of the morbific principle—the *materies morbi*—of syphilis has not been determined. No specific microörganism has been discovered. Syphilis is peculiar to man. Attempts to inoculate the lower animals, with the possible exception of the monkey, have been uniformly unsuccessful. A disease somewhat resembling syphilis is observed in the horse. This is known as *maladie du coit* or equine syphilis. The negro race is believed to be more susceptible to syphilis and to have it in a severer form than the Caucasian. This may be explainable on the ground that the disease is a comparatively new one to the darker race, which has not had time to acquire immunity.

Syphilis requires for its transmission contact of the specific poison existent in the secretions or discharges of a syphilitic patient with an abraded surface of skin or with a mucous membrane. The blood is also capable of transmitting syphilis. Although the disease is as a rule acquired through sexual intercourse, *syphilis insontium*, or syphilis of the innocent, is of frequent occurrence. Physicians may become inoculated by contact with syphilitic patients, and innocent patients, on the other hand, may be infected, though rarely, by surgical and dental instruments. The saliva of syphilitic individuals contains the specific virus, and in this way inoculation may occur by kissing, and the use of pipes, spoons, cups, pencils, sticks of candy, plugs of tobacco, etc. Great care is necessary when one member of a family is affected to prevent transmission of the disease to others, since in the familiar intercourse of relations great danger exists.

After the poison of syphilis has been absorbed a certain time elapses before its effects become manifest. The abrasion heals over and there are no visible signs of danger. This is the period of incubation and lasts on the average three weeks, but may vary from ten to seventy days. At the end of this period a hard thickening appears at the site of inoculation, and this soon breaks down into a discharging sore or ulcer, the discharge from which is extremely contagious. This ulcer is situated on an indurated base and is surrounded by dense tissue, and from this fact is known as the 'hard' chancre. It is the characteristic initial lesion of syphilis, and is usually single. Another period of apparent quiescence now ensues, during which the patient is conscious of no trouble besides the sore. This is the so-called secondary incubation period, lasting from four to six weeks or perhaps longer. A characteristic set of symptoms now appears. The poison has been absorbed by the lymphatics, and upon examination the glands of the groin, axilla, neck, and in fact of the entire body will be found enlarged and indurated. A rash, somewhat resembling that of measles, breaks out upon the chest and abdomen, spreading thence to the face, extremities, and back. The rash may vary widely in character, presenting in different cases macules, papules, nodules, scabs, vesicles, or pustules. The eruption is usually superficial and fades gradually without scarring, differing in this respect from the tertiary rashes or 'late syphilides.' The rash marks the secondary stage of syphilis, and is attended with constitutional disturbances. There is slight fever, with severe nocturnal headache, pains in the bones, and general malaise. The tonsils, soft palate, and lymphatic tissues of the pharynx become swollen, and together with the gums, tongue, and inner side of the cheeks are the seat of 'mucous patches.' These are small grayish or whitish papules or shallow ulcers which discharge a most infectious material. It is through them that by far the greater number of cases of 'innocent' syphilis occur. Mucous patches are also apt to appear on the inner surface of the nose, the eyelids, about the genitals and arms. The throat is sometimes so sore and painful that eating solid food becomes impossible. Coincident with these changes in the skin and mucous membranes, several other tissues are affected. The periosteum covering the tibiæ, skull, clavicles, or sternum becomes the seat of inflammatory thickenings or nodules (see NODE), tender to the touch, but soon disappearing. The joints may swell. The hair may come off in considerable quantities, either in patches, or as a general thinning. The finger-nails are dry, brittle, and lustreless. The lymph glands continue swollen during the secondary period of the disease. They may be felt in chains along the neck and groins. A small gland just above the inside of the elbow, the epitrochlear, is almost invariably affected in syphilis and rarely in other diseases, and is therefore a valuable aid in the diagnosis of doubtful cases. Syphilitic iritis is apt to occur during this stage. It usually affects one eye at a time, and is manifested by photophobia, irregularity of the pupil from adhesions of the iris, swelling, and congestion. Later in the disease other eye tissues—the choroid and retina—may suffer seriously. Deafness may result from infiltration of the labyrinth of the ear.

The period of the active manifestations of syphilis, embracing the primary and secondary stages, extends over a year or more. In many cases all symptoms disappear, and no further evidence of the disease is felt. Patients rarely die during the second stage. After an interval of months or years, in a certain proportion of cases, the so-called 'tertiary' or third stage of syphilis sets in. Insidious degenerative changes may have been going on during the interval and now become manifest, suddenly or gradually. The characteristic lesion of this stage is the gumma, which consists of a soft elastic tumor composed of cells and fibrous tissue. Gummata may develop in any situation, skin, bones, liver, testes, kidneys, lungs, or brain, and vary in size from a hemp-seed to a walnut. They are very prone to break down and ulcerate, often resulting in great loss of tissue and hideous scars and deformities. The bony framework of the nose is frequently destroyed in this manner. The skin is apt to be the seat of a variety of deposits which tend to form sluggish ulcerations, slow in healing, and leaving scars surrounded by deeply pigmented skin. Several disorders of the nervous system are referable to syphilis; some, like hemiplegia, due to syphilitic degeneration of the arterial walls; others, like localized paralysis and convulsions, to gummata on the surface of the brain or the roots of the nerves; others again, like locomotor ataxia, are only indirectly traceable to syphilis.

Congenital syphilis shows itself in many and curious ways. Children born of parents suffering from syphilis in the first or second stage may be infected with the disease. The infection may be derived from the father alone, the mother being healthy; or from the mother alone, the father being healthy; or from both father and mother. Or the mother may acquire syphilis after conception and convey it to the child *in utero*. A curious law, to which there seems to be no exception, is that if a child inherits syphilis from its father, the mother being originally healthy, the infant may infect a wet nurse, but not its own mother, who is in some way protected against infection although she may have shown no evidences of the disease. As a rule the effect of syphilis in the parents is to cut pregnancy short, with resulting miscarriages, premature or still birth. Children may be born alive, presenting lesions of any stage of the disease. In many cases the child is at birth apparently healthy, fat and plump, but in a few weeks develops a characteristic catarrh, vulgarly termed the 'snuffles,' shows a rash, with ulcerations about the lips, genitals, and anus, and gradually wastes away until the face acquires a typical withered, shrunken, and aged appearance. Most of these children die in infancy.

The treatment and prophylaxis of syphilis is a matter of great importance, since there is no disease so widespread in its dissemination nor so potent in its influence upon the human species. Prevention depends on education in matters of sexual hygiene on the part of the public, elevation of the moral tone of the individual, and in segregation and inspection of prostitutes. The latter is practiced with good results in many cities of the Old World, and attempts are constantly making toward the same end in the United States. Great ignorance prevails among the laity as to the nature, effects, and treatment of syphilis. The only remedies of any value are mercury and iodides; but these must be given with care and under close observation, and should be combined with tonic remedies, according to the needs of the particular case. Lay medication is apt to be ineffectual, if not dangerous. Mercury may be given by inunction, fumigation, hypodermically or by the mouth. Excessive doses of mercury are likely to produce a series of very unpleasant symptoms (see MERCURY; SALIVATION), and its unwise use in the hands of the ancient practitioners has resulted in a popular distrust of the drug. As a rule mercury is of greatest value in the first stages of syphilis, a combination of iodine and mercury in the second stage, and iodine alone, usually in the form of potassium iodide, in the tertiary period. When these drugs are given skillfully and for proper periods of time, there is every reasonable prospect of a permanent cure. The time of treatment should extend over at least two and one-half years after all visible signs of the disease have disappeared and marriage should be prohibited during this interval. The general health must be watched, and exercise in the open air, full diet, and appropriate tonics administered. In the syphilis of infants mercury is best given by inunction. Children somewhat older may take mercury in the form of gray powder in small doses. The two other drugs that seem to exert almost a specific effect in children are cod-liver oil and the iodide of iron. For a fuller description of this disease, consult: Lydston, *A Text-book on the Genito-Urinary, Venereal, and Sexual Diseases* (Philadelphia, 1900); Fournier, *Syphilis and Marriage* (trans. by Morrow, New York, 1881); id., *Danger social de la syphilis* (Paris, 1901).

SY'RA (Lat. *Syrus*, from Gk. Σῦρος). An island in the Ægean Sea, belonging to the Cyclades, and situated nearly in the centre of the group, 10 miles southwest of Tinos. Area, 31 square miles (Map: Greece, F 4). It is for the most part barren and rocky, and its natural products are insufficient to support its population. Its importance is due to its being the site of Hermopolis (q.v.), the capital of the nomarchy of the Cyclades and one of the chief commercial ports of Greece. Population of the island in 1896, 26,856.

SYR'ACUSE (Lat. *Syracusæ*, from Gk. Συράκουσαι, *Surakousai*). Anciently the most famous and powerful city of Sicily, situated on the southeastern coast of the island, 33 miles south-southeast of Catania. It was founded by a body of Corinthian settlers under Archias, one of the Bacchiadæ, near the end of the eighth century B.C. The traditional date, B.C. 734, rests on uncertain evidence. The original colonists seem at first to have occupied nothing more than the little isle of Ortygia, about one mile long and half a mile broad, which lies near the shore, but with the growth of the city the population soon passed over to the mainland. This settlement was on Achradina, at the eastern end of a high triangular plateau, which lies north of the island. To the north of the island lay the small harbor, while to the west was the great harbor, one of the best in Sicily. Later the greater part of the city was on the mainland, with which Ortygia was connected by bridges or a causeway. It consisted of Achradina, occupying the

eastern end of the tableland and the adjacent coast, Tyche and Neapolis to the west of Achradina and of Epipolæ, still farther west, with the strong fort of Euryalus at the apex of the triangle. The colony rapidly rose to prosperity, and was enabled to establish sub-colonies of its own, Acræ (B.C. 664), Casmenæ (B.C. 644), and Camarina (B.C. 599). Nothing definite is known of the early political state of Syracuse, but the government seems to have been in the hands of the descendants of the Dorian colonists, who were land-owners employing a large body of serfs, seemingly Sicels. The commerce of the city brought, however, a large 'Demos' of Greeks, who about B.C. 486 expelled the 'Gamori,' or ruling oligarchy, and established a democracy. The 'Gamori' were brought back in the following year by Gelon (q.v.), tyrant of Gela, who at the same time made himself master of Syracuse. He was a great ruler, and under him the city increased in size and wealth. He was succeeded by his brother, Hiero I. (q.v.) (B.C. 478-467), whose court became a literary centre. In B.C. 465 the democracy expelled his brother and successor Thrasybulus, and for sixty years a free and popular government was enjoyed under which Syracuse prospered greatly. The Sicels were reduced, and war was waged with neighboring States, till the island attracted Athenian intervention, only closed by the Peace of Hermocrates (B.C. 424). Renewed hostilities with Segesta led to the great struggle with Athens (B.C. 415-413), in which Syracuse, aided by the Spartan Gylippus, annihilated the invading army, and contributed not a little to the outcome of the Peloponnesian War. But a new power appeared on the stage—the Carthaginian, whose conquests in Sicily toward the close of the fifth century threatened the existence of Syracuse. The successful leadership of Dionysius the Elder (q.v.) enabled him to become tyrant of the city and make it the chief power of Magna Græcia and Sicily. It was he who constructed the docks in the greater and lesser harbors, and surrounded the city with fortifications. His fierce and victorious war with Carthage (B.C. 397) raised the renown of Syracuse still higher. The reigns of Dionysius the Younger (q.v.) and of Dion (q.v.) were unsettled; but after the restoration of public liberty by Timoleon (B.C. 343) a brief season of tranquillity ensued, during which the prosperity of the city rapidly revived. Under Agathocles (q.v.), however, the despotic form of government was again established (B.C. 317). This reign was marked by a war with Carthage, including an invasion of Africa, conducted with very doubtful success. In B.C. 275 Hiero II. (q.v.) was chosen general, and about B.C. 270 he assumed the title of King. He adopted the policy of loyal alliance with Rome, and preserved the independence of the State until his death in B.C. 216. His grandson, Hieronymus, joined the Carthaginians, and in consequence the city suffered a long siege, rendered famous by the devices of Archimedes, and was finally stormed and plundered in B.C. 212 by Marcellus.

Under the Romans Syracuse slowly but steadily declined, though it always continued to be the capital and first city of Sicily, and was made a colony by Augustus. Captured, pillaged, and burned by the Saracens (878), it sank into complete decay, and is at present confined to its original limits, Ortygia, which, however, is no longer an island, but a peninsula. The population of Syracuse, which is the capital of a province of the same name, was about 32,000 in 1900. The mainland contains the chief remains of antiquity, which include a fine rock-cut theatre, a Roman amphitheatre, the great altar of Hiero II., the remains of the ancient fortifications, and the great Latomiæ or quarries. The cathedral on Ortygia has been built around an ancient Doric temple, and the columns of the temple form part of the church. The museum contains many interesting remains of the pre-Hellenic population, found in graves and caves in the neighborhood. In the southern part of the town is the famous fountain of Arethusa. Consult: Freeman, *History of Sicily* (Oxford, 1891-94); Holm, *Geschichte Siciliens* (Leipzig, 1870-98); Cavallari and Holm, *Topografia archeologica di Siracusa* (Palermo, 1883), and *Appendice* (1891).

SYRACUSE. The fourth city in population of the State of New York, and the county-seat of Onondaga County, 148 miles west of Albany and 149 miles east of Buffalo (Map: New York, D 2). It is situated at the mouth of Onondaga Valley, 35 miles south of Lake Ontario, in an amphitheatre of hills.

Syracuse has superior facilities for transportation, steam railroads entering the city from ten directions, and canals from three. The Erie Canal, which pierces the heart of the city, gives water communication with Lake Erie and the Hudson River, and thence with tidewater, and the Oswego Canal with Lake Ontario and the Saint Lawrence. All the steam railroad lines centring here are of two systems, the New York Central and Hudson River and the Lackawanna. The street railway system comprises 65 miles of track, and reaches all sections of the city. It is practically under one management.

The chief residential streets are profusely shaded, presenting a park-like appearance. Syracuse has forty-five public parks, ranging from small plots at street intersections to Burnet Park, on a hillside to the west, with more than 100 acres. Lincoln Park, a wooded height of 20 acres on the eastern border, commands the most extensive and picturesque view of the city and its surroundings. The State Fair, under the auspices of the State Agricultural Society, is permanently located in Syracuse. The State annually appropriates a large sum for the support of the fair.

The buildings of Syracuse University (q.v.) crown a commanding elevation and are among the most imposing edifices in the city. Other prominent public buildings are the city hall, the new high school, costing $400,000, the Carnegie Library, the county court-house, the Federal Government building, the State Asylum for Feeble-Minded Children, the County Orphan Asylum, the Old Ladies' Home, and the four hospitals. The Carnegie (public) Library contains 60,000 volumes, and the Court of Appeals Law Library, belonging to the State, 10,000 volumes. The city also maintains a Museum of Fine Arts. The Onondaga Historical Society is (1904) to erect a building for its own use.

Industrially, Syracuse is fourth among the cities of the State, its establishments in the census year 1900 having $31,358,000 invested capital, and a production valued at $31,948,000.

The leading manufactures are men's clothing, foundry and machine shop products, iron and steel, malt liquors, iron and steel pipe, typewriters and supplies, boots and shoes, agricultural implements, flouring and grist mill products, and furniture. The city is noted for the manufacture of typewriters. The Onondaga Salt Springs, belonging to the State, are on the borders of Onondaga Lake. The manufacture of salt, from the brine pumped out of the springs, was formerly the main industry, and is still of importance. The Solvay Process Works, manufacturing soda ash and other products, and employing some 3000 men, are just outside of the city limits on the west. With its many and varied manufactures, the city has a large wholesale and export trade.

The government is vested in a mayor and common council, elected every two years. The comptroller and treasurer are chosen at the same time. The mayor appoints the heads of departments, including the city engineer, corporation counsel, and commissioners of public works, public safety, and charities. The schools are under the control of a board of education elected on a general ticket. In maintenance and operation the city annually expends about $2,000,000, the principal items being: schools, $350,000; police department, $140,000; fire department, $180,000; and lighting, $122,000. There are 45 miles of paved streets, principally of asphalt; 100 miles of sewers; and 161 miles of water mains. The water system is under municipal ownership and control. The water is obtained from Skaneateles Lake, 18 miles distant, and is conveyed by gravity to the city through 36-inch pipes. The plant cost $5,000,000. The water department in 1902 netted the city a profit of $40,000.

Population, in 1850, 22,271; in 1860, 28,119; in 1870, 43,051; in 1880, 51,792; in 1890, 88,143; in 1900, 108,374.

The territory in which Syracuse is situated originally belonged to the Onondaga Indians. It was visited by the Jesuit missionary Father Isaac Jogues as early as 1642. By treaties in 1778 and 1795 the State bought a large tract containing the salt springs and formed from it the 'Onondaga Salt Springs Reservation,' parts of which were subsequently sold to individuals. Syracuse proper was first settled about 1805 and was of little importance until after the completion of the Erie Canal, its population in 1820 being only 250. Until named Syracuse in 1819 it was known successively as South Salina, Bogardus's Corners, Cassitt's Corners, and Milan. It was incorporated as a village in 1825, and in 1847 absorbed Salina and was chartered as a city. It was prominent for its abolitionist sentiment preceding the Civil War, and was one of the chief stations on the 'Underground Railroad' (q.v.). Here on October 1, 1849, occurred the famous 'Jerry Rescue,' which did much to crystallize abolitionist sentiment in the North and arouse the animosity of the Southern planters. In 1887 the villages of Geddes and Danforth became a part of Syracuse, and in 1892 some further additions were authorized by the Legislature. Consult Bruce, *Memorial History of Syracuse* (Syracuse, 1891).

SYRACUSE UNIVERSITY. A coeducational institution of higher learning at Syracuse, N. Y., founded in 1870. In its academic department it is a continuation of Genesee College, which was conducted at Lima, N. Y., from 1849 to 1871, and in its medical department of the Geneva Medical College (1835-72), which was in part successor of the Fairfield Medical College (1812-39). The university at present comprises five colleges: (1) the College of Liberal Arts with classical, philosophical, scientific, and library courses, leading to the degrees of B.A., Ph.B., and B.S.; (2) the College of Fine Arts, with courses in architecture, belles-lettres, music, painting, art, and decorative design, as well as normal courses, leading to the bachelor's degree in architecture, letters, music, and painting; (3) the College of Medicine, with a four years' course and leading to the degree of M.D.; (4) the College of Law, with a three years' course leading to the degree of LL.B.; and (5) the College of Applied Science with courses in civil, electrical, and mining engineering, leading to the corresponding engineer's degrees. In the graduate department the master's and doctor's degrees are conferred. In addition to the regular departments, the university maintains a summer session of six weeks, and a table at the Marine Biological Laboratory at Woods Hole, Mass. In 1902 an observing station of the United States Weather Bureau was established, in connection with which lectures are given on meteorology and climatology. The attendance in 1903, allowing for duplications, was 2009, distributed as follows: Liberal Arts, 905; Fine Arts, 706; Medicine, 140; Law, 123; Applied Science, 183; Summer School, 39. The endowment was $1,625,600, the income $765,936, and the estimated value of the college property $3,169,361, the grounds and buildings being valued at $1,169,500. The general library contained 50,842 volumes and 21,500 pamphlets.

SYR-DARYA, sēr-där'yȧ, or **SIR-DARIA** (ancient *Jaxartes*). A large river of Russian Turkestan, Central Asia (Map: Asia, F 4). It rises on the north slope of the Tian Shan on the boundary of Chinese Turkestan, and flows in a general northwest direction till it enters the northeastern part of the Aral Sea after a course of over 1700 miles. Its upper course, known as the Nȧrin, descends through a series of romantic gorges as a tumultuous mountain torrent, the fall being more than 3000 feet in less than 50 miles. It receives here numerous tributaries, but after making a long detour to the southwest around the highlands north of Ferghana, it enters upon the great arid lowland steppes, in which it receives no more affluents, but decreases in volume by evaporation. Its course becomes here very sluggish. In the rainy season it overflows the surrounding country, and its low banks are in some places lined with extensive marshes. In these lowland regions, also, a considerable amount of water is drawn from the river through numerous irrigation canals, and the discharge into the Aral Sea is less than half of the volume of the river in its middle course. The delta is marshy and shifting, and the depth on the bar is generally not more than three feet. From its lower middle course the river sends an arm across the desert to the southeastern end of the Aral Sea. This channel is now nearly dry, but probably indicates the former bed of the main river. The river is practically unnavigable in its lower course, though

small Russian gunboats have crossed the bar. It is now little used as an avenue of commerce.

SYR-DARYA, or **SIR-DARIA.** A territory in the northwest of Russian Turkestan. Area, about 195,000 square miles (Map: Asia, F 4). The larger part consists of extensive steppes and deserts. The southeastern part belongs to the region of the Tian-Shan Mountains and rises in some of its snow-covered peaks to an altitude of over 15,000 feet. The flat part of the territory is very scantily watered by the Syr-Darya and Amu-Darya (qq.v.). The lakes are mostly salty. The settlements are found largely at the foot of the mountains, where the streams are utilized for irrigation. Wheat, barley, rice, and cotton are the principal products, the cotton crop being valued at over $3,500,000 in 1900. The nomadic inhabitants have extensive herds of cattle and sheep, and utilize the wool for the manufacturing of woolen products, besides exporting large quantities of the raw material to Russia and other parts of Europe. The Central Asiatic Railway is the principal means of transportation. Population, in 1897, 1,479,848, consisting principally of Kirghizes and Sarts, the Russians forming only about 4 per cent. of the total. Capital, Tashkend (q.v.).

SYRIA. Traditionally, the region lying between the Euphrates River and the Syrian Desert on the east and the Mediterranean on the west, and between the Alma Dagh (the ancient Amanus) in the north and Egypt in the south. This region now forms a part of Asiatic Turkey (Map: Turkey in Asia, G 6). Mesopotamia, or at least a portion of it, is frequently designated as East Syria. Syria proper is now a distinct part of the Turkish Empire and is divided into six provinces—Jerusalem, Lebanon, Beirut, Aleppo, Syria, and Zor. It occupies approximately the area within the above boundaries. It, therefore, includes Palestine. Its area is 109,509 square miles.

Syria proper is traversed from north to south by a system of mountains connected with the Taurus in the north and in the south with Mount Sinai as well as with the important mountain chain of Western Arabia. The loftiest section is the Lebanon district, comprising the range of the Lebanon proper, skirting the middle part of the Mediterranean coast, and the parallel Anti-Libanus, with the valley of Cœle-Syria, between them. The Lebanon reaches an elevation of about 10,000 feet, the highest peak of the Anti-Libanus, Mount Hermon, being about 9000 feet. Syria is in general a plateau of chalk and Tertiary formation, with sandstone in evidence, and varied in places by eruptive stone. The plateau dips steeply to the Mediterranean. It is traversed north and south by the important and remarkable inter-mountain depression which, beginning at the Gulf of Akabah (of the Red Sea) in the south, extends under the name of Wadi el-Araba to the Dead Sea, thence north through the region of the Jordan to its sources, and beyond this through the Lebanon region, becoming narrower but widening again farther north, and finally reaches the sea at Antioch. This depression is over 400 miles long, and generally averages about 12 miles in width. It divides Syria (except in the north and northeast) into two long comparatively narrow stretches of tableland—the eastern and western. For the full description of the western, adjacent to the Mediterranean, see PALESTINE. The eastern strip merges into the Syrian desert, and is sandy and bare, its elevated levels being dominated by the basaltic Jebel Hauran (6000 feet) situated east of Lake Tiberias. The Nahr-el-Asi (ancient Orontes), the Litany (Leontes), and many short streams flow into the sea on the west. The Jordan is the main feeder of the Dead Sea, whose surface is nearly 1300 feet below that of the ocean. The principal affluents of the Jordan are the Yarmuk and Jabbok. In the east are a number of streams that die in the sands of the desert. There are several lakes besides the Dead Sea, the best known being Lake Tiberias (Gennesaret). The climate is that of the Mediterranean basin. At Beirut the mean annual temperature is 68° F.; at Jerusalem, 62.6° F. The rainfall is scanty, being heaviest in the north and west. The springs are short, the summers long, dry, and hot. Snow falls in winter and there is often almost severe cold. The flora is that of the Mediterranean region, the olive being prominent. Forests of conifers clothe portions of the western slope of the Lebanon. But small remnants survive of the famous cedars of Lebanon. In the east and south, however, the plant growth partakes of the scanty desert species. In the extreme north the date palm thrives. Of the wild fauna the lion has nearly disappeared, hyenas exist in some mountainous regions, and jackals abound. Gazelles are still met with. There are several species of venomous serpents, including the cobra. Formerly a land rich and highly productive, Syria is in modern times of very inferior agricultural and industrial significance. Fruits, grain, and vegetables are grown. The principal ports are Beirut and Jaffa. The Syrian Railroad has afforded an impetus to trade since 1895. The population in 1900 was 3,317,600. It is mainly Semitic in race. Mohammedans predominate, and Arabic is generally spoken. Bedouins and Arabs roam in the south and east. The Turks are few. The Christian population is considerable, the Maronites of the Lebanon region alone numbering over 100,000. There are many Jews, especially in Palestine, where they form agricultural communities. The Mohammedan sect of the Druses (in the Lebanon region and the Hauran) has been prominent through its fierce hatred of the Maronites. The chief towns are Damascus, Aleppo, Beirut, and Jerusalem.

HISTORY. About B.C. 1500 the kings of Egypt brought the greater part of Syria under their dominion. Their advance was opposed by the Hittites (q.v.), who were long dominant in northern Syria, and who spread also into the southern part of the country. The non-Semitic people were gradually amalgamated with the Semites among whom they dwelt, their speech becoming Semitic. About B.C. 1000 the Phœnicians were at the height of their power and prosperity and the Hebrew kingdom was firmly established. By this time the Hittites, whose State had become disintegrated into a number of principalities, had begun to feel the power of Assyria. Under David and Solomon the Israelites extended their sway over a great part of Syria, subduing the southern Hittites, the Amorites, and other peoples and subjecting Damascus and other important cities. On the southern part of the

coast the Philistine cities were united in a powerful confederacy. After the disruption of the Hebrew realm Damascus became the seat of a powerful independent kingdom. This was destroyed in the second half of the eighth century B.C. by the Assyrians, who imposed their yoke upon the Philistine cities, and put an end to the kingdom of Israel, while the Phœnician cities paid them tribute. About this time the last of the Hittite principalities were swallowed up by the same enemy. At the beginning of the sixth century B.C. Syria came under the rule of Babylon, which was succeeded in B.C. 538 by that of Persia. In B.C. 333-332 Alexander of Macedon established his sway. At the close of the century Upper Syria was appropriated by Seleucus, one of Alexander's generals, who founded Antioch as the seat of his kingdom. The Ptolemies and the Seleucidæ (q.v.) contended for the possession of the rest of the country, which finally passed to the latter, whose realm, which embraced a large part of Western Asia, came to be known as the Kingdom of Syria. A number of Greek cities were founded by this dynasty. In B.C. 167-141 Palestine threw off the yoke of the Seleucidæ. In B.C. 64 Syria was made a Roman province and in the following year Judea was made tributary to the Romans.

In the third century A.D. the Kingdom of Palmyra, on the eastern borders of Syria, enjoyed a short-lived splendor. After the close of the fourth century Syria formed part of the Byzantine Empire, from which it was wrested in 634-36 by the Saracens. In 661 Damascus became the seat of the caliphs, but about a century later it was supplanted by Bagdad. In the second half of the eleventh century the Seljuks occupied the country. In 1099 the Crusaders took Jerusalem, which was made the capital of a kingdom. At the same time was founded the Principality of Antioch. In the middle of the next century the Christian power in Syra was shattered by the assaults of Sultan Nureddin, whose seat was at Aleppo. In 1174-87 Saladin, Sultan of Egypt, wrested Syria from the successors of Nureddin and overthrew the Kingdom of Jerusalem. In the thirteenth century Khwaresmians and Mongols swept over Syria. In 1291 Acre, the last stronghold of the Christians on the Syrian coast, was taken by the Mameluke ruler of Egypt and Syria. In 1516 Syria was conquered by the Ottoman Turks. In 1831-32 Mehemet Ali of Egypt made himself master of the country, but was forced to relinquish it to the Sultan in 1841. In 1860 there were massacres of the Maronites by the Druses and a frightful slaughter of Christians at Damascus.

BIBLIOGRAPHY. De Vogüé, *Syrie, Palestine, Mont Athos* (Paris, 1879); Sachu, *Reise in Syrien und Mesopotamien* (Leipzig, 1883); Hull, *Memoir of the Geology and Geography of Arabia Petræa, Palestine, and the Adjoining Districts* (London, 1886); Post, *Essays on the Sects and Nationalities of Syria and Palestine* (ib., 1890); Miller, *Alone Through Syria* (ib., 1891); Charmes, *Voyage en Syrie* (Paris, 1891); Post, *Flora of Syria, Palestine, and Sinai* (Beirut, 1896); Petrie, *Syria and Egypt from the Tel-el-Amarna Letters* (New York, 1898); Deverell, *My Tour in Palestine and Syria* (London, 1899); Burton and Drake, *Unexplored Syria* (ib., 1872); Lady Burton, *Inner Life of Syria* (ib., 1875); Salverte, *La Syrie avant 1860* (Paris, 1861).

SYRIAC LANGUAGE AND LITERATURE. The Aramaic dialect anciently spoken in Edessa and Western Mesopotamia (see ARAMAIC), in which many literary productions have been preserved. This name is derived from the Greek Συρία, which is either an abbreviation of Ἀσσυρία, or a survival of the old designation *Suri* found in cuneiform inscriptions. Before the introduction of Christianity the natives of Mesopotamia called themselves Aramæans. Subsequently this term was used especially for the pagans, while the Christians were designated by Greeks and Persians as 'Syrians' and seem to some extent to have adopted the name themselves. The Syriac language shows in its earliest documents a remarkably fixed type, and must therefore have been long spoken in Mesopotamia. Characteristic of this dialect are the *n* of the preformative in the imperfect of the verb and the loss of the determinative force of the emphatic ending *a* in the noun.

There was probably an extensive pagan literature both in Edessa and in Harran; but no specimen of it has yet been recovered. The earliest document in this language is the translation of the Old Testament, which was probably made by Jews. It may belong to the first Christian century, though it was subsequently revised in some books with the aid of the Greek version. Two recensions of the oldest translation of the New Testament have been preserved in part in a Sinaitic manuscript of the Gospels and a Nitrian manuscript published by Cureton, containing fragments of the Gospels. This latter version may have been made in the middle of the second century. A compilation of the four Gospels, called the *Diatessaron*, was made by Tatian (q.v.), or translated by him from a Greek work of the same kind about 180. This *Diatessaron* is lost and is known chiefly through Ephraem Syrus (q.v.); the Arabic translation of this work published by Ciasca seems to belong to the eleventh century, and has manifestly been made conformable to the standard text. This compilation of the Gospels, after being long in use in the Mesopotamian churches, was finally supplanted by the Syriac Vulgate or *Peshitto* (see BIBLE, heading *Versions*), apparently in the fifth century. The shorter Catholic Epistles (II. Peter, II. and III. John, Jude) and the Apocalypse, which were not found in the old Syriac Bible, were later supplied from the versions of Philoxenus (508) and Thomas of Heraclea (616). In addition to the canonical books, Ecclesiasticus (q.v.) was also translated from the Hebrew and the other Apocrypha, including IV. Maccabees and a part of Josephus's Jewish War called V. Maccabees, were translated from the Greek, as well as several Pseudepigrapha, such as the Apocalypses of Baruch and Ezra. A translation of the Greek text adopted by Origen called the Syro-Hexaplaric version was made by Paul of Tella in 617; and a revision of the New Testament was made by Jacob of Edessa at the end of the seventeenth century.

As early as any of the New Testament translations are the works of Bardesanes, the Gnostic (q.v.), who flourished in the second century and was a poet, philosopher, astronomer, and his-

torian. His *Dialogue on Destiny* is extant; his 150 hymns are lost. A number of Gnostic hymns have, however, been preserved in the *Acts of Thomas*, written in the third century. In the fourth century Aphraates (q.v.) wrote his homilies, and the famous Ephraem (died 373) his commentaries on the Bible and on Tatian's *Diatessaron*, his exegetical discourses, and his hymns. Among the disciples of Ephraem were such writers as Aba, Zenobius, Balai, and Cyrillona. The most flourishing period of Syriac literature extended from c.400 to the Arabic conquest. In the course of the fifth century the great schism occurred which divided the Mesopotamian Church between Nestorians and Monophysites (qq.v.) and severed both from the Catholic Church. Much of the early Nestorian literature is lost; but some works of Hamana (died 607), Babai (died 610), and Elias of Merv remain. Among the Monophysites, Philoxenus of Mabug, Jacob of Serug (died 521), Jacob Baradæus, after whom the party was called 'Jacobites,' and Jacob of Edessa (died 708) were perhaps the most influential writers. In addition to the strictly theological works, there grew up an historical literature, including the *Chronicle of Edessa*, the very excellent chronicle of Dionysius of Tell Mahre, many histories dealing exclusively with the Church, such as that of John of Ephesus (sixth century), martyrologies and legends such as those of King Abgar and the Apostle Addai. Not only theological works, such as the *Clementine Recognitions*, the Apology of Aristides, the ecclesiastical history of Eusebius, and the commentaries of Theodore of Mopsuestia, were translated from the Greek, but also secular works like those of Homer, Æsop, Aristotle, Galen, and Hippocrates. Mana, Moses, Probus, Sergius, and Jacob of Edessa were especially active as translators. After the Moslem conquest the Arabic language gradually gained on the vernacular. But Syriac still continued to be spoken in many localities and to be cultivated as a learned language. The use of two languages led to philological studies, and many works on grammar and lexicography were written. Among these may be mentioned the grammar of Elias of Tirhan and the lexicons composed by Bar Ali Honain (died 873) and Bar Bahlul (963). Many books were translated from the Arabic in the tenth century, such as the *Kalilah wa Dimnah*, *Sindbad*, and Pseudo-Callisthenes's life of Alexander. Classical Syriac was written with great elegance by the Sabian Thabit ben Korrah (died 901) and his sons. (See SABIANS.) With the decline of the caliphate, the Syriac gained a more vigorous life, and numerous theological writers used it. The most important of these are Abulfaraj Gregory, called Bar Ebhraya or Bar-Hebræus (1226-86), who wrote a grammar, a commentary on the Bible, a history of the world, a commentary on Galen, translations from the Greek, essays on ethics and religion, astronomy, and other physical sciences (see BAR-HEBRÆUS); and Abhdisho (died 1318), a learned Nestorian who wrote the history of Syriac literature and many other works. After the fourteenth century there were no noteworthy writers.

The system of writing used by the Edessene Christians before the fifth century was a modification of the Aramaic script then in use in Syria, resembling most the Palmyrene. From the tenth century this writing was known as *Estrangelo*, or 'the writing of the gospel.' The Nestorians continued to use it, while the Jacobites adopted for distinction a cursive form. At first vowels were not indicated at all. Subsequently vowel-letters were used. But in the seventh century the Nestorians began to employ vowel points, and about 700 the Jacobites adopted some of the Greek vowels, which they wrote above or below the consonants to show the proper pronunciation.

The modern Syriac spoken with dialectical differences by the Nestorians in the West, those of Lake Urumiah, in the Kurdish mountains, and on the plain of Mosul, and by the Jacobites of Tur Abdin, exhibits, in addition to numerous Turkish, Kurdish, and Arabic loan-words, certain peculiarities rendering it probable that it is a descendant of the Aramaic, once spoken in Assyria, rather than of the classical Edessene. In the dialect of Urumiah a considerable literature has been developed by American missionaries.

BIBLIOGRAPHY. Nöldeke, *Syrische Grammatik* (2d ed., Leipzig, 1898); Duval, *Grammaire syriaque* (Paris, 1881); Nestle, *Syrische Grammatik* (2d ed., Berlin, 1888); Wilson, *Syriac Grammar* (New York, 1891); Brockelmann, *Syrische Grammatik* (Leipzig, 1900); Michaelis, *Castelli Lexicon Syriacum* (Göttingen, 1788); Payne Smith, *Thesaurus Syriacus* (Oxford, 1868-1903); Brockelmann, *Lexicon Syriacum* (Berlin, 1895); Wright, *History of Syriac Literature* (London, 1895); Stoddard, *Grammar of the Modern Syriac Language* (New Haven, 1855); Nöldeke, *Grammatik der neusyrischen Sprache* (Leipzig, 1868); Prym and Socin, *Der neuaramäische Dialekt des Tur Abdin* (Göttingen, 1881); Socin, *Die neuaramäischen Dialekte von Urmia bis Mosul* (Tübingen, 1882).

SYRIAC VERSIONS. See BIBLE.

SYRINGA (Neo-Lat., from Gk. σῦριγξ, *syrinx*, pipe, tube; name first given to the mock-orange, because its stems, after removal of the pith, were used as pipes). A genus of plants of the natural order Oleaceæ. The English name of the genus is lilac (q.v.). Syringa is also a name very commonly applied to the mock-orange or Philadelphus.

SYRINGOMYELIA (Neo-Lat., from Gk. σῦριγξ, *syrinx*, a pipe + μυελός, *myelos*, marrow). A disease of the spinal cord characterized by the formation of cavities and the growth of new tissue resembling glioma in its central parts. Its cause is not accurately known, though it may depend upon anomalous embryonic development and it apparently follows infectious diseases as well as wounds upon the hands. It is not caused by alcohol or syphilis, nor is it hereditary. It often appears after childbirth. It is rare, as probably less than 300 cases have been reported. The disease appears between the eleventh and the thirtieth year, and is more frequent in males than in females, in the proportion of 2.2 to 1. The symptoms are pains in neck and arms with reduced sensation in the hands, atrophy of the muscles of the hands, arms, and shoulders, with twitchings, followed by the same wasting in muscles of back, thighs, and legs. The hands become clawed, the feet deformed; and the spine

becomes curved, in extreme cases. Loss of sensation to temperature and pain, while not to touch, occurs, and is considered pathognomonic. Eruptions and ulcerations appear on hands and face, and many other changes occur. The disease runs for from five to twenty years, and the prognosis for checking it is not good. It is incurable. Rest and general tonic treatment, hydrotherapy, and massage, as well as silver and arsenic, are measures tried. Consult: Dana, *Text-book of Nervous Diseases* (New York, 1902).

SYR'INGOP'ORA (Neo-Lat. nom. pl., from Gk. *σῦριγξ, syrinx*, pipe, tube + *πόρος, poros*, passage, pore). A genus of fossil tabulate corals in which the coral mass consists of a bundle of slender cylindrical tubes that rise from a common base and that are connected at intervals by slender hollow horizontal processes or plates. The genus ranges through the Upper Silurian, Devonian, and Lower Carboniferous formations.

SYRINX (Neo-Lat., from Gk. *σῦριγξ*, pipe, tube). A simple instrument of reeds, probably the most ancient of all musical instruments. It is thought to be identical with the Hebrew *Ugab*, mentioned in the Bible. The Greeks supposed it to have been made by the god Pan out of reeds, and hence its secondary name, Pandean pipes. It was formed of seven, eight, or nine short hollow reeds cut in graduated lengths, so as to produce a musical scale, and then fixed together by wax. The lower ends were closed and the upper ones open and on a level, so that the lips could easily pass from one pipe to another.

SYRLIN, zēr'lĕn, JÖRG, the Elder (?-1491). A famous German wood-carver and sculptor, active at Ulm from about 1458, one of the most remarkable masters of his time. The three-seated stool of 1468 at the entrance of the choir in the cathedral, and his chief production, the stately double row of "Choir Stalls" (1469-74) there, the first of their kind in richness and artistic merit, exhibit a plastic beauty unequaled by any contemporary effort. His earliest known work is a "Singing Desk" (1458) in the Museum of Antiquities, and as an isolated production in stone is to be mentioned the fountain in the market square, known as the "Fischkasten" (1482). His son and pupil, JÖRG, the Younger (1455-c.1521), was a worthy inheritor of his art and executed the "Choir Stalls" (1493) and the "Celebrants' Stool" (1496), in the church at Blaubeuren, also a similar stool (1505) in the Neithardt Chapel of Ulm Cathedral, and in the latter the sounding-board of the pulpit (1510), more important architecturally than as a work of sculpture.

SYRPHUS FLY (Neo-Lat., from Gk. *σύρφος, syrphos, σέρφος, serphos*, gnat). A fly of the family Syrphidæ, many species of which are of much economic importance. More than 300 species occur in the United States. They are stout-bodied flies and vary greatly in color. Many species closely resemble bees and wasps. Nearly all of them are flower flies, and carry pollen from one plant to another. Very many syrphus flies in the larval state feed upon plant-lice and other soft-bodied insects. Others live in decaying wood or in manure or soft mud, in the sap of trees or in the stems of plants, or in fungi, or as guests of ants and bumblebees. The rat-tailed maggot (q.v.) is an example of the forms found in soft mud or in manure. Those which live in ants' nests belong to the genus Microdon and are among the strangest insect larvæ known. Those which live in the nests of bumblebees belong to the genus Volucella, and the adult flies resemble bumblebees.

SYR'TIS MA'JOR and **SYR'TIS MI'NOR.** The ancient names of two gulfs on the north coast of Africa. See SIDRA and CABES.

SYRUP. See SUGAR, MANUFACTURE OF.

SYSTOLE. See HEART.

SYSTYLE. An arrangement of classic columns in which the intercolumniation is equal to only twice the diameter of the column.

SYZRAN, sĭz-rän'y'. A river port in the Government of Simbirsk, Russia, on the River Syzran, near the right bank of the Volga (Map: Russia, G 4). It lies in a low district, submerged during the annual rise of the Volga. The town is known as a grain exporting centre. Population, in 1897, 32,377.

SZABADKA, sŏ'bŏt-kŏ. See THERESIOPEL.

SZABÓ, sŏ'bō, JÓZSEF (1822-94). An Hungarian geologist, born in Kalocsa, near Pest, and educated in Pest, and at the School of Mines in Schemnitz. In 1860 he was appointed professor of mineralogy and geology in the university of Pest. Szabó wrote, mostly in Hungarian, on geology, and in 1883 published a valuable text-book of that science, with especial stress on petrography.

SZARVAS, sŏr'vŏsh. A town of Hungary, in the County of Békés, 85 miles southeast of Budapest, on the left bank of the Körös (Map: Hungary, G 3). Population, in 1900, 25,773.

SZÁSZ, säs, KÁROLY (1829—). An Hungarian poet and translator, born in Nagy-Enyed, Transylvania. During the revolution of 1848-49 he fought in the Honvéd army, then studied theology; was engaged in teaching and pastoral work until 1867, when appointed councilor in the Ministry of Public Worship and Instruction. In 1884 he became reformed bishop at Budapest. He was elected to the Hungarian Academy in 1858. Besides numerous lyrics he wrote the epic poems *Almos* and *Salamon*, several dramas, and the tragedy *The Death of Attila* (1888), but won wide reputation especially through his masterly translations of many of the world's great poets, the *Nibelungenlied* and Dante's *Divina Commedia*, also through those embodied in *A világirodalom nagy eposzai* (The Great Epics of the World's Literature, 1882).

SZATMÁR-NÉMETI, sŏt'mär-nā'mĕ-tē. A town in the County of Szatmár, Hungary, 63 miles northeast of Debreczin, on the right bank of the Szamos (Map: Hungary, H 3). It contains a beautiful cathedral. Szatmár-Németi was founded by the Germans in the eleventh century. Its population in 1890 was 21,218; in 1900, 26,881, chiefly Magyars.

SZÉCHÉNYI, sā'chā-nyē, BÉLA, Count (1837—). An Hungarian traveler and explorer, born in Budapest. He traveled in North America in 1863 and in Algeria in 1865, and described the former trip in *Amerikai útam* (1865). In 1877-80 he explored the East Indies, Japan, China, Java, Borneo, Western Mongolia, and the frontiers of Tibet. An Hungarian description of this expedition was published in 1890 and a German version, *Die wissenschaftlichen Ergebnisse der*

Reise des Grafen Béla Széchényi in Ostasien, in 1893.

SZÉCHÉNYI, ISTVÁN (Stephen), Count (1792-1860). An Hungarian statesman, born in Vienna. As a youth he served in the Austrian Army in the wars with Napoleon, and afterwards traveled through Europe. In 1825 he took his seat in the Upper House of the Hungarian Parliament. As a leader of the National Party he endowed the Hungarian Academy of Science, a conservatory of music, and a theatre, and founded a society for effecting improvements in horse-breeding. To his exertions were due the erection of the great suspension bridge between Pest and Buda, the removal of obstacles to navigation at the Iron Gate, the regulation of the Theiss, and the introduction of steamboats on the Danube. In 1847-48 he at first opposed the extreme measures of Kossuth, but later fell in with the popular movement and became a member of the Ministry under Batthyányi and Kossuth in 1848. Becoming insane soon after, he was taken to the asylum at Döbling, near Vienna, where, though he partly regained his health, he spent his remaining years. In March, 1860, his papers were searched by the police, and in a fit of excitement he shot himself. Consult Lónyay, *Graf Stephan Széchényi und seine hinterlassenen Schriften* (Pest, 1875).

SZE-CHUEN, or **SZE-CHUAN,** sĕ'chwän' (Chin., Four Rivers). The largest of the eighteen provinces of China. It is bounded on the north by Kan-su and Shen-si, on the east by Hu-peh, on the south by Kwei-chow and Yun-nan, and on the west by Tibet (Map: China, B 5). Area, 220,000 square miles. With the exception of the elevated plain of Ching-tu (q.v.), 2400 square miles in area, and 1800 feet above the level of the sea, the province is entirely covered with mountains, many of them rising above the snow-line. The eastern portion, east of the Min River, may be regarded as Sze-chuen proper, the western and more inaccessible part being inhabited chiefly by non-Chinese tribes—Man-tse, Si-fan, and Lolos (q.v.). The province is well watered by the Yang-tse and its numerous tributaries—the Yalung, the Min, the T'o, and the Kia-ling from the north, and the Ta-kwan, the Nan-kwang, the Yung-ning, the Chih-shui, the K'i-kiang, and the Kung-t'an from the south. Nearly all of these are obstructed in parts by rapids, but they nevertheless form most valuable avenues of communication in an otherwise difficult country. The climate is not extreme, but changes are sudden. From October to February the country is generally enveloped in deep fogs and the sun is seldom seen. The rainy season begins in May and is at its height in July.

Sze-chuen is rich in minerals, especially in coal and iron, which occur together. Coal is found everywhere, but the seams are thin and the quality does not compare with the coal of Kan-su, Shan-si, Ho-nan, or even Hu-nan. It has not as yet been mined by modern methods. Copper, silver, gold, and lead occur in small quantities. Notwithstanding the mountainous character of the country, agriculture has been brought to a high state of perfection, and the province produces everything needed for home consumption except cotton and wool. The hillsides in many places have been terraced with much industry and skill. Wheat is a winter crop, but it has been largely encroached on by poppy culture, which is more remunerative. Rice, the staple article of diet, is very extensively grown. Other crops are barley, maize, millet, buckwheat, pulse, potatoes, tobacco of very fine quality, tea, sugar, indigo, and sesamum, rape and other oil-producing plants. Hemp is the only textile plant grown, except that used in the manufacture of grass-cloth.

Other important products are silk, white wax, vegetable tallow, tung-oil, rhubarb, medicines, musk, and hides. Wool is imported from Shen-si, Tibet, Kokonor, and other regions. Cotton, both raw and manufactured, comes chiefly from Hupeh. Cotton spinning and weaving are important home industries, and the cloth is exported to Tibet and Yun-nan, along with tea and silk. Iron manufacture from the ores of the province is one of the most extensive industries. Enormous quantities of salt are obtained from brine-springs from 500 to 2000 or more feet in depth, the brine being evaporated by natural gas or coal. It is a Government monopoly, and brings in a large revenue to both the provincial and the Imperial governments. Large numbers of people are also employed in paper-making and the production of fans, umbrellas, crape, gauze, and beautiful silk embroideries, etc.

Sze-chuen can be entered from the east by only two routes: either overland through Shan-si and Shen-si, along difficult mountain paths infested by robbers, or up the Yang-tse by steam to I-chang (q.v.) and thence by native, specially constructed, junks which are hauled slowly and at great expense and risk up formidable rapids and through deep gorges. Within the province itself there are many pack-roads paved with flags, and with steps cut in the rocks at very steep places. For travelers sedans and ponies are used, and for goods coolie carriers. Capital, Ching-tu (q.v.), where resides the Governor-General, who also has charge of East Tibet (q.v.). The only port opened to foreign trade is Ch'ung-k'ing (q.v.). Population, about 70,000,000. The province buys more foreign goods than any other. See Baber, *Travels and Researches in Western China* (London, 1882); Hosie, *Three Years in Western China* (London and New York, 1890); and Bishop, *The Yang-tse Valley and Beyond* (London and New York, 1901).

SZEGEDIN, sĕg'ĕd-ĕn (Hung. *Szeged*). A royal free city of Hungary, next in size to Budapest, in the County of Csongrád, on the right bank of the Theiss a little below the confluence of the Maros, 96 miles southeast of Budapest (Map: Hungary, G 3). The town has been largely and handsomely rebuilt since the terrible inundation of 1879, when 2000 persons lost their lives. A high dike has been constructed to protect the city from another such disaster. The modern streets are wide and there are several attractive squares. Szegedin has a fine rococo town hall, a Gothic cathedral, a handsome theatre, and other stately edifices. The Franciscan monastery contains an excellent library (80,000 volumes) and a museum of antiquities. There are also a Minorite and a Piarist monastery. The principal manufactures are paper, salt, cloth, and the famous Szegedin soap. As the commercial centre of the great Hungarian Alföld it has a brisk

trade in grain, wool, tobacco, lumber, etc., both by rail and river, the Theiss being lined with quays. Boat-building is extensively carried on. New Szegedin lies on the opposite bank. Szegedin was fortified by the Turks, who held it from 1526 for 160 years. Population, in 1890, 87,410; in 1900, 102,991, mostly Catholic Magyars.

SZEGSZÁRD, sĕk'sărd. A town of Hungary, capital of the County of Tolna, on the right bank of the Danube, 84 miles south of Budapest (Map: Hungary, F 3). The town produces an exceptionally fine red wine. Population, in 1900, 13,895, mostly Catholic Magyars.

SZEKLERS. See TRANSYLVANIA.

SZÉLL, sāl, KOLOMAN (1843—). An Hungarian statesman, born in Gosstony, and educated at Budapest and Vienna. Entering local politics in 1867 and Parliament the next year, he so distinguished himself by his financial interpellations that in 1875 he was offered the portfolio of finance by Wenckheim. He retained it until 1878, when he retired because of his disapproval of the Bosnian occupation. He then became president of a great financial institution in Budapest, refusing every inducement to reënter the Cabinet until the fall of Bánffy in 1899, when he rose to the head of the Government as Minister of the Interior and president of the Council. He retired in June, 1903.

SZE-MA KWANG, sĕ'mä'kwäng', or **SSŬ-MA KUANG** (1019-86). A distinguished Chinese statesman and historian, born in Hia, a district of Ho-nan. At nineteen he entered the public service, rose rapidly, became president of the Hanlin Yuan (q.v.), and a Minister of State. He is specially noted for the persistency and the vigor of his opposition to Wang An-shih (q.v.), 'the innovator.' Failing to induce the Emperor to dismiss Wang and repeal his reform, Sze-ma retired to private life, and devoted himself to literature and especially to the preparation of his *History of China* (B.C. 403 to A.D. 960), in 294 books, called the *Comprehensive Mirror for the Aid of Those Who Govern*. In 1085, on the death of the Emperor, he was taken into favor by the Empress Regent, was reinstated in office, and at once set about the repeal of the reforms of Wang, but he died in the following year. Besides the *Comprehensive Mirror*, he was the author of the *Ki-ku-lu*, or Investigations into Antiquity, in 20 books, which extends to A.D. 1067, an etymological dictionary, and many miscellaneous essays. See Rémusat, *Nouveaux Mélanges asiatiques* (2 vols., Paris, 1829), and Giles, *Chinese Literature* (New York, 1901).

SZE-MAO, sĕ'mou'. A town in the southwestern part of the Province of Yun-nan, China, situated 185 miles southwest by west of Yun-nan-fu. The trade of Sze-mao is almost entirely with Burma and Tibet. The town was opened to foreign residence and trade in 1897. Population, estimated at 14,000.

SZE-MA TS'IEN, sĕ'mä' chĕn', or **SSŬ-MA CH'IEN** (c.145-c.85 B.C.). The first great historian of China. He was born in Lung-mŭn, in Ho-nan, made great progress in learning while still a child, and at twenty began a great tour of the Empire. On his return he entered the public service, and was commissioned to inspect and report upon the regions now known as Sze-chuen and Yun-nan, then recently conquered. On the death of his father in B.C. 110 he succeeded him as historiographer, and entered upon the task of completing the great historical work which had been begun by his father. This he accomplished B.C. 91, but the work did not appear until some years after his death. It is entitled *Shih Ki*, or "Historical Records," and in 130 books gives the history of the country from B.C. 2697 to B.C. 104. For specimens of his style, see Giles, *Chinese Literature* (New York, 1901).

SZENTES, sĕn'tĕsh. A market-town of the County of Csongrád, Hungary, on a tributary of the Theiss, 28 miles north by east of Szegedin (Map: Hungary, G 3). The town formerly suffered from inundations, but is now protected by a number of large dikes. Agriculture and fishing are the principal pursuits, and wine is exported. Population, in 1890, 30,797; in 1900, 31,308, mostly Lutheran Magyars.

SZIGLIGETI, sĭg'lĭ-gĕ'tĭ, EDUARD (1814-78). An Hungarian dramatist, whose real name was Joseph Szatmáry. Born at Grosswardein, he studied engineering, but in 1834 went on the stage at Buda and in 1837 became secretary and stage manager of the newly erected national theatre at Pest. Of his numerous dramas several were crowned with prizes by the Academy, among them *Rózsa*, *Vándor színészek* (Itinerant Actors), *Béldi Pál*, *Laczfi Imre*, and *Béla IV.*, but the greatest success attended his popular plays drawn from national life, many of which found their way also to the German stage, notably *The Deserter*, *Two Pistols*, *The Csikós*, *The Foundling*, and others. Besides his excellent *A dráma és válfajai* (The Drama and its Species, 1874), he published biographies of Hungarian actors (1878). He was a member of the Academy and of the Kisfaludy Society, and, since 1874, director of the National Theatre.

SZILÁGYI, sē'lăd-yē, SÁNDOR (1827-99). An Hungarian historian, born at Klausenburg, and educated there and at Maros-Vásárhely. In 1867 he was appointed secretary in the Ministry of Public Instruction, and in 1879 was made librarian of the University Library at Budapest. He founded the Hungarian Historical Society, of which he was secretary until his death, and of whose organ, *Századok* ("The Centuries"), he was editor. He was the moving spirit in the revival of historical interest which took place in Hungary after 1849, published many monographs himself, and edited or projected works of importance. Of these may be mentioned the *Monumenta Comitialia Regni Transylvaniæ*, in twenty-one volumes; a collection of papers from Hungaro-Turkish sources in nine volumes; and a national history in ten volumes (1895-98).

SZOLNOK, sōl'nôk. A town of Hungary, the capital of the County of Jazygia—Great Cumania—Szolnok, 67 miles southeast of Budapest, on the right bank of the Theiss, at the mouth of the Zagyva (Map: Hungary, G 3). On March 5, 1849, the Austrian General Karger was defeated here by the Hungarians. Population, in 1890, 21,094; in 1900, 25,379, mostly Catholic Magyars.

SZUJSKI, shwĭs'kĭ, JÓZEF (1835-83). A Polish historian and dramatist, born at Tarnov, Galicia. He studied in Cracow and Vienna, became associated with Tarnovski in the establishment and redaction of the *Przeglad Polski* in

1867 and was appointed professor of Polish history at the University of Cracow in 1869, subsequently also secretary-general of the Academy of Sciences. In 1881 he was called to a seat in the Austrian House of Lords. He published many mediæval documents and chronicles bearing upon Polish history and in his excellent *Dzieje Polski* (1862-66; new ed. 1896) presented a history of Poland based upon the most recent researches. In German he wrote *Die Polen und Ruthenen in Galizien* (1882). Besides poems and tales he produced a number of historical dramas, remarkable for spirited characterization, such as *Halszka z Ostroga* (1858); *Jerzy Lubomirski* (1863); *Maryna Mniszchovna* (1876); *Jadviga, Kopernikus,* and others.

T

T The twentieth letter of the English alphabet. Its Semitic original *tau*, the last letter of the Phœnician alphabet, meant cross, and was so called on account of the early shape of the character. The various forms which it has assumed are as follows:



Phœnician. Early Greek and Latin. Later Greek and Latin.

As a phonetic character *t* is the voiceless alveolar explosive. To form this sound the tongue-tip is brought into contact with the sockets of the upper front teeth, and the breath is made to escape explosively.

English *t* represents in general an original Indo-Germanic *d*, as Sanskrit *dam*, 'to tame,' Greek *δαμάω*, Latin *domare*, English *tame*. It may also represent an original Indo-Germanic *t*, as in Sanskrit *stigh*, 'to step,' Greek *στείχω*, Anglo-Saxon *stīgan*, English *stile*. An excrescent *t* occurs especially between *s* and *r*, as a glide-sound between the median and lateral positions of the tongue, as in English *stream*, compared with Sanskrit *sravas*. An inorganic *t* has also been developed in some modern English words after a final *s*, as *amidst* from *amiddes*, *amongst* from *amonges*, *whilst* from *whiles*, and in the dialectic *oncet*, *twicet*.

The digraph *th* represents both the voiced and the voiceless spirant, as *then*, *thorough*. It may be pronounced *t*, as *Thames*, *thyme*, as may also the *-ed* of the preterite and perfect participle, as *dressed*. In several words *t* is silent, as in *chasten*, *moisten*, *christen*, *castle*, *gristle*, *hustle*. In *action*, *nation*, *portion*, *ti* has the sound of *-sh*.

As a mediæval numeral T = 160; $\overline{\text{T}}$ = 160,000. In music *t* = tenor, tempo.

TAAFFE, tä'fe, Eduard, Count (1833-95). An Austrian statesman of Irish extraction. He was born at Prague, and was educated in companionship with the Emperor Francis Joseph. He entered the public service in 1857 and was appointed Governor of Salzburg in 1863. He was Minister of the Interior in 1867 and Minister of National Defense in 1868, becoming president of the Council after Prince Auersperg's retirement in September, 1868. He resigned in January, 1870, but three months later became again Minister of the Interior and remained in office until February, 1871, when he was made Governor of Tyrol and Vorarlberg. In February, 1879, Taaffe was once more appointed Minister of the Interior and in August he formed a new Cabinet, over which he presided until 1893. The distinguishing feature of his administration was the greater weight given to the Slav nationalities, especially the Czechs and the Poles, as well as to the clericals, in the public affairs of the Empire and his vain effort to conciliate the divergent nationalities comprised in the Empire. He finally attempted to sustain his Government by a radical electoral reform measure, which displeased all parties, and was compelled to retire in November, 1893. He died November 29, 1895.

TAAL, täl. A town of Luzon, Philippines, in the Province of Batangas. It is on the Transipit River near its fall into the Gulf of Balayán, and is connected by a bridge with Lemeri on the opposite bank (Map: Luzon, E 11). It carries on a large trade in coffee, sugar, and cotton goods in addition to the local industries of agriculture, fishing, and stock-raising. The old town of Taal was situated on the bank of the lake of the same name near the volcano Taal (q.v.), and was destroyed in 1754. Population, in 1897, 22,000, now estimated at about 33,400, of whom a considerable number are of Chinese origin.

TAAL, or Bombón. A volcano in Central Luzon, Philippines. It forms a small island in the middle of Lake Taal, which lies 10 miles southwest of the Bay Lagoon. Its height is only a little over 1000 feet, but it has a crater over a mile in diameter. A number of eruptions have been recorded since the discovery of the islands, the last occurring in 1873.

TAALIBI, tä-lē'bē (Ar. *Abū Manṣūr Abd al-Malik ibn Muḥammad ibn Ismā'il al-Ṭa'ālibī*) (961-1038). A prolific writer upon philological and literary subjects. He was a native of Persia, his birthplace being Nisabur, and he represented the Persian-Arabic school of literature. Arabic philology was now passing from the ancient schools of Basra and Kufa to Persian soil. Portions of Taalibi's works have been edited in Europe and translated, for example: Seligman, *Proœmium et Specimen Lexici Synonymici Arabici Atthalibi* (Upsala, 1863); Cool, *Selecta ex Thaalebii Libro Facetiarum* (Leyden, 1835); Valeton, *Talibii Syntagma Dictorum Brevium et Acutorum* (Leyden, 1844). Consult Brockelmann, *Geschichte der arabischen Litteratur* (Weimar, 1898).

TABAGO, tȧ-bā'gō. An island of the West Indies. See TOBAGO.

TABANIDÆ (Neo-Lat. nom. pl., from Lat. *tabanus*, gad-fly). A numerous family of dipterous insects which live by sucking the blood of horses, cattle, and other animals, and are popularly known as gad-flies, horse-flies, or deer-flies. See GAD-FLY.

TABARD, THE. A famous inn of old London. It was situated on High Street, Southwark, near Kent Road, and must have been in existence as early as the fourteenth century, for Chaucer starts his pilgrims from it on their journey to the shrine of Thomas à Becket. Its sign was a tabard or sleeveless jacket. At the end of the sixteenth century it was in high repute. In the seventeenth century it was damaged by the Great Fire, and in the process of restoration the sign was changed to a 'Talbot.' It was condemned in 1866 and its site is at present occupied by the freight depot of the Midland Railway.

TABARI, tȧ-bā'rē (Ar. *Abū Ja 'far Muhammad ibn Jarīr al-Tabarī*) (838-923). Author of the first universal history in Arabic. A Persian, born in Tabaristan, he studied at Bagdad and visited the other schools in Syria and Egypt. He settled at last in Bagdad, and gave himself to teaching and incessant literary labors. His great historical work is the *Annals*, a history of the world from the creation to A.H. 302. This has been published at Leyden by de Goeje (1879 sqq.). Nöldeke's *Geschichte der Perser und Araber zur Zeit der Sassaniden* (Leyden, 1879) is a translation of portions of the *Annals*. His commentary on the Koran stands superior to all other commentaries. Consult Brockelmann, *Geschichte der arabischen Litteratur* (Weimar, 1898).

TABASCO, tȧ-bȧs'kō. A maritime State of Mexico, bounded by the Gulf of Mexico on the north, the State of Campeche and the Republic of Guatemala on the east, Chiapas on the south, and Vera Cruz on the west (Map: Mexico, M 8). Area, 10,072 square miles. Tabasco is well watered and some of its rivers, as the Usumacinta, are navigable to some extent. The climate is hot and unhealthful and the rainfall very abundant. The fertile soil yields good crops of cacao, sugar, coffee, tobacco, rice, and fruit. Stock-raising is of secondary importance. Population, in 1900, 158,107. Capital, San Juan Bautista.

TABASHEER (Hind. *tabāshir*, Skt. *tavakṣira*, *trakṣira*, bamboo-manna). A substance sometimes found in the cavities or tubular parts of the stems of bamboos and other large grasses. It consists chiefly of silica, with a little lime and vegetable matter, or sometimes of silica and potash. It appears to be formed by extravasation of the juices of the plant, in consequence of some diseased condition of the nodes or joints. It is in high repute among the Hindus as a tonic, and is prepared by imperfect calcination and trituration. Tabasheer has a beautiful veined structure and is remarkable as having the lowest refracting power of any known substance.

TABB, JOHN BANISTER (1845—). An American poet, born in Virginia. He was a Roman Catholic priest and professor of English literature at Saint Charles College, Ellicott City, Md. The verse of Father Tabb is scant, comprising *Poems* (1883), *An Octave to Mary* (1893), *Lyrics* (1897), *Poems Grave and Gay* (1899), and *Two Lyrics* (1900), but it is distinguished for its sympathy with whatever subjects it treats from nature, literature, or religion, for the delicacy and refinement of its sentiment, and for the precision of its verse. *The Sisters*, *To Shelley*, *Clover*, *Indian Summer*, *The Child*, and *The Druid* are examples of his exquisite lyric quality, and of his choice of subject. His thought is generally compressed into a few stanzas, often a quatrain.

TABERNACLE (Lat. *tabernaculum*, diminutive of *taberna*, hut, booth; connected with *tabula*, plank, board, table, tablet, Umbrian *tafle*, on a table). A portable sanctuary which, according to the traditional view, was carried about by the Israelites in the wilderness. The command to build this structure is found in Exodus xxv. 10-xxvii. 19, and the account of its construction in almost identical terms in Exodus xxxvi. 8-xxxviii. 31. While it is called a tent, it was in reality a house, having upright walls made of thick boards on three sides, and a curtain on the fourth. The wooden framework had four coverings, one of linen, one of black goats' hair, one of rams' skins dyed red, and one of the skins of wethers. In front the curtain was fastened to pillars made of acacia wood, with copper bases and capitals covered with gold. This structure was divided into two parts, separated by an inner curtain, supported by four pillars with bases of silver and wholly overlaid with gold. The outer and larger apartment was 'the Holy Place,' accessible to priests only; the inner, 'the Holy of Holies,' was entered only once a year by the high priest. Around the sanctuary was a court inclosed by curtains supported by sixty pillars of wood with bases of bronze and capitals overlaid with silver. In the Holy of Holies stood the Ark of the Covenant; in the Holy Place the table of shewbread, the golden candlestick, and the altar of incense; in the court stood the brazen altar of burnt-offering and around it were ash-pans, shovels, bowls, forks, and fire-pans of brass, while in the middle was the great brazen laver. The tabernacle is described as being of extraordinary splendor and of the costliest materials. It stood in the centre of the camp, and was carried by a large retinue of men when the camp moved. Modern scholars generally regard the description as wholly imaginary and devoid of historical value. It is considered as having been drawn on the basis of Solomon's temple and projected into the Mosaic period. This is indicated not only by the impossibility of such a house being constructed and carried about in the wilderness, but also by the fact that the earlier records know nothing of a tabernacle of this kind, while an Ephraemitish narrative has preserved the picture of a much simpler tent where Yahweh revealed Himself to Moses (Ex. xxxiii. 7 et seq.; Num. xi. 25; xii. 5; xiv. 10). This 'tent of meeting' (*'ōhel mō'ēd*) stood outside the camp and was only a small tent with a single custodian, and Yahweh revealed Himself there in a cloud at the door. It is not impossible that the memory of such a portable shrine, common to many nations, carried about while they were still nomads, survived among some of the tribes that afterwards formed the people of Israel. Apparently the ark

has its own history, and was not originally connected with this tent. The tent plays no part in the early history of Israel in Canaan, while the ark is of great importance.

In the Roman Catholic Church tabernacle is the name given to the receptacle in which the consecrated elements of the Eucharist are retained. By the present discipline, the tabernacle is commonly a small structure of marble, metal, or wood, placed above the altar, and of costly material and workmanship. Even when the exterior structure is of marble or metal, there is commonly an inner receptacle of wood (properly cedar), lined with silk. The tabernacle is appropriated exclusively to the reservation of the Eucharist, and it is prohibited to keep within it any other object. A red lamp is kept constantly burning before the tabernacle.

Consult: Colenso, *The Pentateuch and the Book of Joshua Critically Examined* (London, 1862-79); Kuenen, *De Godsdienst van Israël* (Haarlem, 1869); Wellhausen, *Prolegomena zur Geschichte Israels* (4th ed., Berlin, 1895); Carpenter and Battersby, *The Hexateuch* (London, 1900); Kennedy, article "Tabernacle," in the Hastings *Bible Dictionary* (New York, 1902); Benzinger, article "Tabernacle," in *Encyclopædia Biblica* (London, 1903).

TABERNACLES, Feast of (Heb. *Khag hasukkōth*). The name given in the Old Testament codes to a festival which marked the close of the harvest of fruit, oil, and wine in Palestine. As a harvest festival it is also known as the Feast of Ingathering (Ex. xxiii. 16; xxxiv. 22) and can be traced back to the Canaanites. The festival was marked by general jubilation and by a visit to some sanctuary, accompanied by sacrifices for the purpose of testifying gratitude to the giver of fertility. Among the popular customs observed by the Canaanites was the erection of booths in the vineyards, in which the people dwelt during the vintage. Hence the name Festival of Booths (or Tabernacles) in the four passages besides those already mentioned in which the ritual is set forth (Deut. xvi. 13-15; xxxi. 10-13; Lev. xxiii. 34-36; 39-44; Num. xxix. 12-40). This Canaanitish agricultural festival was adopted by the Hebrews and in the Deuteronomic and Priestly codes was given an historical aspect by interpreting the custom of dwelling in booths as a reminiscence of the nomadic stage in the life of the people, and more particularly of the traditional forty years' sojourn in the wilderness when the tent formed the only habitation. The pristine importance of the festival may be gathered from the fact that it was called 'the festival' *par excellence* and that originally it was the single occasion in the year on which a pilgrimage to a sanctuary was prescribed. As finally shaped in the Hebrew ritual, it extended over the seven days from the fifteenth to the twenty-second day of Tishri (the seventh month), and in addition the eighth day was observed as a 'solemn assembly,' which in Rabbinical Judaism developed into the festival of 'Rejoicing of the Law.' Booths were erected on the roofs of houses or in the courts and streets, made of olive, pine, myrtle, and palm branches (cf. Neh. viii. 15). The sacrifices prescribed for this feast were more numerous than for any other, sin-offerings (one kid daily) and burnt-offerings (two rams and 14 lambs daily), being prescribed for each day, besides 70 bullocks during the seven days (13 on the first day, 12 on the second, and so on in a diminishing scale). Besides these distinctly biblical enactments, we find in the days of the second temple daily processions around the temple altar, the priestly procession to Siloam to fetch water and its libation in connection with the morning sacrifice (cf. John vii. 37), the singing of the Hallel psalms (Ps. cxiii.-cxviii.), the lighting of the four great golden candelabra in the Court of the Women (John viii. 12), and the carrying of palm branches entwined with myrtle and willow together with a specimen of the *ethrog* (or citron) fruit by the worshipers into the synagogues. The erection of booths and the waving of the palm branches with the ethrog are customs still observed in orthodox Jewish communities. Consult the Hebrew archæologies of Nowack and Benzinger.

TABES DORSALIS, tā'bēz dôr-sā'lis. See Locomotor Ataxia.

TABLATURE (Fr. *tablature,* from Lat. *tabula,* plank, board, table, tablet). A method of musical notation used in the fifteenth and sixteenth centuries. At first it was chiefly employed for the lutes and viols. The lines and spaces of the staff did not represent the pitch of the notes, but the frets of the instrument. Either the lines or the spaces were used, but not both. These lines or spaces varied according to the number of the strings of each instrument. The French and English tablatures denoted the tones by letters, the Italian by numerals. But the German or organ tablatures employed a regular staff and musical notation for the melody or highest part, while the tones completing the harmony were written by letters vertically below each note of the melody. All tablatures had three points in common: (1) All letters or figures belonging to the same chord were written vertically one above the other; (2) all employed lines for the division of the separate bars or measures; (3) all made use of a uniform system to denote the time-value of notes and rests. These signs were written either above or below the numbers or letters. Rests were denoted by a horizontal line placed below the note sign.

TABLELAND. See Plateau.

TABLE MOUNTAIN, or **TAFELBERG,** tā'fel-bērg. A mountain of Cape Colony overlooking Cape Town and Table Bay. It is 3540 feet high and is named for its peculiar shape and level top. It is often covered with a white cloud, which is called the 'Tablecloth.'

TABLES, Lunar. Tabular lists of numerical data based on the elements (q.v.) of the moon's orbit and used for calculating the moon's position on the sky. See Nautical Almanac.

TABLET OF ABYDOS. See Abydos.

TABLEWARE, Silver-Plated. The manufacture of silver-plated tableware originated in England, and the centre of its manufacture was at Sheffield and Birmingham. The industry now flourishes in Germany and also in the United States, where the Rogers Brothers were the first to apply the process of electro-plating with silver to table utensils. This they did in 1846, and in 1851 a company was formed in Hartford, Conn., for the manufacture of electro-plated ware. At the close of the century the silver-plated and

britannia ware industry had spread into seven States, in which were located about 50 factories. Connecticut, however, still led, about one-half the total number of factories being in that State, with an annual product valued at $9,538,397.

Before the introduction of electro-plating, all ware was plated by the application of a thin sheet of silver to the object. Bits of solder were placed here and there between the plating and the body material, and, on subjecting the object to moderate but continued heat, the solder was melted and firmly united the metals. In this process it was always difficult to finish the sharp edges so they had the appearance of a continuous silver surface. The art of fashioning materials by stamping them out with dies (see DIES AND DIE-SINKING) has greatly facilitated and cheapened the manufacture of plated ware. In the modern factory three methods are employed for shaping the body material before the plating is applied—spinning, stamping, and casting, and special parts are sometimes hammered into shape. (See REPOUSSÉ.) The body material used in a standard factory is the composite metal called German silver, which consists of 53 per cent. copper, 31¼ per cent. zinc, and 15¾ per cent. of nickel. Stamping is the method usually employed when a large number of objects after the same pattern are to be made. When only one or a few pieces are to be made according to a given design, they are usually spun. In this process the object is shaped over a rapidly revolving wooden mold, known as a chuck, frequent annealing being required to keep the metal flexible. Spinning requires considerable manual dexterity, while stamping is a purely mechanical process. But the preliminary making of the wooden mold is much easier and cheaper than that of the metal die. Of course only objects which are somewhat spherical in shape can be spun, and the flat metal which is thus molded into shape is stamped out of the sheet. Often the chucks are sectional and hinged, so that they can be removed from the finished object, when this object is narrower at the top than at other portions; but oftener a dish, whether stamped or spun, is fashioned in several sections, which are soldered together before plating. Ornamental borders and similar decorations are stamped separately and soldered on. The final preparation for plating is to remove all roughnesses and scratches from each article and render it perfectly smooth, which is done by sand-finishing.

In applying the process of electro-plating (q.v.) to produce silver-plated ware, the objects are first washed in caustic soda and then in a strong solution of nitric, sulphuric, and hydrochloric acids. The trade terms 'single,' 'triple,' and 'quadruple,' which are commonly applied to plated ware to denote its quality, are somewhat misleading, for the heaviness of the plate usually depends upon the length of time during which the object remains in the electric bath, and not on the number of times the dip is repeated. The ware is carefully weighed before and after immersion and is allowed to remain in the bath until the desired number of pennyweights of silver have been added to its weight, an operation which, in thoroughly good ware, requires several hours, although the vessel is quite as attractive in appearance after a bath of a few minutes. It is sometimes stated that danger of poison is incurred in using certain forms of cheaply made plated ware, but in all but the poorest quality the silver is subjected to so many cleansing processes after it is plated that not a vestige of the deadly poison, cyanide of potassium, in which it has been immersed can remain upon its surface. Standard ware, after it is plated, is finished by a succession of processes of hand polishing and burnishing.

TABOO' (Samoan *tapu*, Hawaiian *kapu*, forbidden). An object or act religiously interdicted, and the religious system based upon such interdiction. Under various names and in one form or another, the practice of taboo is found all over the earth; but it has nowhere else been so systematized as in Polynesia. Primarily, taboo is something forbidden because the tabooed object is regarded as potent to injure owing to its *mana*, or mysterious (spiritual) power, which may be either holy, as a priest's possession, or unclean, as a corpse. There is at first no moral significance in taboo, and in many cases the interdict is due merely to fear of spirits. Thus in New Zealand there are a *mana* taboo and an *atua* taboo, the latter arising from a belief in spirits, *atua*, or a more personal embodiment of *mana*. Even in rites of purification the object is simply to keep off evil spirits. Taboo in many cases reverts to another phase of primitive philosophy, which sees retained in blood, nails, hair, etc., though severed from the body, the spiritual power of the individual. But in some cases taboo is merely the expression of conservatism, which may be religious or social. An instance of the former is the taboo of iron in religious ceremonies. Thus in such ceremonies both the ancient Romans and the modern Pawnee Indians put a taboo on iron, since the gods dislike innovations. Even without the fear of divinities, the same religious conservatism prevents the Australians from using stone implements in circumcision, for which they employ the still more antique burnt-wood knife. But there is also a social conservatism resulting in taboo. Foreigners and new things generally are dangerous and are regularly tabooed by many wild tribes (as in Africa), though the taboo is easily removed except in the case of chiefs. In such cases the foreign person, thing, or act is tabooed because of the unknown and dreaded *mana*. But, on the other hand, there are taboos which are simply in the interest of old practices. Thus the Hindu laws give the bed-hours of kings, and it needs only the right environment of superstition and antiquity to make such laws seem to be the effect of taboo, as in Egypt, though there can be no question that this is not the case in India.

Taboo may be permanent or temporary, private or public. Especially stringent are all royal and priestly taboos, because kings and priests control the weal of the people and must, for the people's sake, be guarded against danger in food and the like. In some cases a king becomes a mere slave bound by the rules thus laid upon him. In others he makes taboos for his own interest. The king is guarded from tabooed acts and objects; but the people too must guard themselves from the mysterious divine *mana* of the king, and it is this latter aspect of taboo which king and priest alike find it for their interest to maintain.

What is not taboo is *noa*, common, and in this antithesis lies the germ of the conception of per-

sonal property as applied to many persons and things. Thus taboo became in many cases merely an assertion of proprietary rights, as may be seen from the fact that a lesser chief's taboo was disregarded in New Zealand by a stronger chief, but a stronger chief's taboo was feared and respected by one weaker. Isolation was the object of taboo and this was the first stage to ownership. Food-taboos are often totemistic or hygienic, and the taboo of knots, which is very common, is a temporary taboo imposed because of the belief in mimetic magic. But it is not necessary that the imitative act be due to a wish to injure. Thus in Africa, Greece, and elsewhere there is a taboo on knots, locks, crossed arms and legs—in short, on all that suggests an impediment. Another common taboo is the *klonipa* or name-taboo of the Kafirs, with the woman-language found among the Kafirs (as also among the Semites and the Caribs), certain names and words being tabooed, for example, the names of fearful beasts in India, of kings in Africa, and of the dead in Australia and elsewhere, as well as words used only by women. Sex-taboo is very common. Thus the belief that a woman's blood is fatal to a man leads at stated periods to a temporary taboo of women even among civilized Hindus, and in many countries men may not eat with women. Other common examples of taboo are as follows: To be ill, or to touch a corpse or grave, a king or a priest, or anything divine (such as royal blood) renders one taboo. A priest's or a king's clothes are so filled with *mana* that it would kill any one else to wear them, and to enter a chief's house or even in some cases to look at a great chief would be destructive. A priest's house is taboo even to himself, so far as eating in it goes. The taboo of part of one's self is often recognized. Thus, when a person is under taboo he may not touch his own head and has to be fed by another or eat with chopsticks. Such a person may not touch a drinking vessel lest he render it also taboo and dangerous. For whatever comes in contact with a tabooed object becomes itself tabooed. The private or public taboo of places for certain practical reasons is also noteworthy. A river is tabooed by a king until the fishing-season is over; a wood, till the game is caught; a field, till the harvest is gathered. A public taboo is where, as in New Zealand, a whole community is made taboo while getting in their crops. This renders it impossible for any member of the tribe to do anything else till the taboo is removed, and prevents any stranger from approaching the tabooed ground. The removal of a public taboo is made by a priest who repeats a spell and performs certain rites over the tabooed people. If a chief wants anything for himself he taboos it by calling it part of himself. Women, if of high rank, may taboo an object as effectively as do chiefs of the tribe.

Taboo has been explained either as a priestly trick or as a religious observance, required by the chief for political reasons. But neither explanation will suffice, though many taboos may be referred to the arbitrary enactment of priest or king, and again some taboos are not religious at all. Others explain taboo as due to a categorical imperative, and deduce from it all moral laws as well as most of the practices of civilized communities, such as caste, the wearing of ornaments, the carrying of umbrellas, the washing of new-born babes, etc. On the other hand, oaths, the punishment of murderers and thieves, and marriage restrictions may be developed out of a taboo system, which recognizes no moral sin, only the danger of 'breaking taboo.' But in that case we have to do not with a categorical imperative, but with a belief in a mysterious spiritual potency and the fear of its effect. An extension of this belief results in its becoming purely formal. Taboo itself then may be divided into purely religious and formal taboo; while, if everything 'forbidden' is to be called taboo, there must be added a mass of detailed regulations arising from different sources, some of them having no connection with what is strictly called taboo; and it is evident that for such a combination of effects there can be no one explanation. Consult: Taylor, *Te Ika A Maui, or New Zealand and Its Inhabitants* (2d ed., London, 1870); Robertson Smith, *Religion of the Semites* (2d ed., ib., 1894); Jevons, *Introduction to the History of Religion* (ib., 1896); Frazer, *The Golden Bough* (2d ed., ib., 1900).

TABOR (Heb. *Thābōr*, lofty place). The most conspicuous and famous mountain in Galilee (Map: Palestine, C 2). Its summit is 1843 feet above sea level. As a typical mountain of the Holy Land it impressed itself upon the language of poetry. It seems to have been the natural site for a sanctuary, and upon it from early times lay a town of the same name. Here Barak assembled his forces to attack Sisera (Judges iv.); twice the Jews held it, though unsuccessfully, against the Romans (B.C. 53; A.D. 67). It is the traditional scene of the Transfiguration of Christ, although most unreasonably, and so it became the site of churches and monasteries, and was an object of pious pilgrimage. Consult: *The Palestine Exploration Fund Memoirs*, vol. i. (London, 1881); Robinson, *Biblical Researches* (Boston, 1841).

TABOR (OF. *tabour*, Fr. *tambour*, Sp. *tambor*, from Ar. *tambūr*, sort of lute with a long neck and six brass strings, drum). A small drum, played with one stick, generally in combination with a galoubet or three-holed fife.

TABOR COLLEGE. An undenominational institution of learning for both sexes at Tabor, Iowa, founded by a company of missionaries in 1857 as an academy, and incorporated as a college in 1866. The courses after the freshman year are arranged in the group system and include instruction in music and art. The attendance in 1903 was 181; the faculty numbered 15, and the library contained 12,000 volumes. The productive funds of the college in the same year amounted to $104,000.

TABORITES. The most radical party of the Hussites in Bohemia. They derived their name from their fortress of Tabor, near the river Lužnič. They asserted the right of individual judgment, rejected all ordinances of the Church not expressly appointed in the Bible, and had democratic tendencies. Their leaders were John Ziska (q.v.), Nicholas of Pistna (Husinec), Procopius the Great, and Procopius the Lesser. (See PROCOPIUS, ANDREW.) At first, in the face of common danger, all parties of the Hussites held together and inflicted repeated defeats upon the Imperial troops. After the Calixtines (q.v.) had made terms with Sigismund and the Church

(1433), the Taborites continued the war, but were overthrown in the battle of Böhmischbrod, May 30, 1434. The remnant of them was absorbed in the Bohemian Brethren (q.v.). See HUSSITES.

TABRIZ, tȧ-brēz', TAVRIS, or TEBRIS. The second largest town of Persia, capital of the Province of Azerbaijan, situated in a wide valley, on the Aji, a tributary of Lake Urumiah, 35 miles east of the lake, in about latitude 38° 4′ N., longitude 46° 18′ E., over 4000 feet above the sea (Map: Persia, B 2). Owing to the many earthquakes, large sections of the town are in ruins. The place is healthful, although the weather is bitterly cold a third of the year. In spite of the altitude, the bare rocks rising on the northeast and east and the peak of Sahand standing on the south give Tabriz the appearance of being shut in by mountains. The squalor of the native huts and the poor sanitary precautions are counteracted by the abundance of water and the numerous refreshing orchards and gardens. The town, in addition to its hundred public baths, numerous caravansaries, and five Christian (Armenian) churches, has over 300 mosques. Among these, the 'Blue Mosque,' incrusted within and without with blue faïence tiles, is especially worthy of mention. The 'Ark' in the centre of the town, the residence of the heir apparent, is a large, somewhat imposing brick building. Its cracked walls bear witness to the frequency and violence of earthquakes in this region. The 'Great Maidan' square and the ample barracks are examples of modern progress. There is an international telegraph. Before the Caucasus Railroad and the Caspian Sea became important mediums of transportation and the Russian trade was diverted to Astara and Resht, Tabriz was the emporium of Western trade.

In 1898-99, according to the books of the custom-house, the exports amounted to £219,930 and imports to £682,330, but it is likely that these figures are much less than the total trade. Dried fruits, silk, and various kinds of manufactures are exported from Tabriz. There are lead mines in the vicinity, and copper and cobalt are found in the Sahand. The population is estimated at from 165,000 to 200,000. It was formerly much larger.

Tabriz is said to have been founded by the wife of Harun al-Rashid in 791, but is mentioned before that date. In 858, 1041, 1721, and 1780 it was devastated by earthquakes. In that of 1721 80,000 persons lost their lives. It was held in turn by the Arabs, Seljuks, Mongols, and Turkomans, from whom it was taken by the Persians. It was several times in the possession of the Turks and was finally taken from them by Nadir Shah in 1730. Tabriz is essentially a Turkish city and Turkish is the prevalent language.

TAB'ULA BANTI'NA. The chief source of knowledge of the Oscan tongue; a bronze tablet in the Naples Museum, containing on one side an Oscan inscription of 33 lines referring to affairs of Bantia, and on the other a portion of a law in Latin. It was found near Bantia in 1793.

TABULA ILI'ACA (Lat., Ilian Tablet). A small relief in soft marble found near the ancient Bovillæ in 1683, and now in the Capitoline Museum at Rome. The slab, 10 × 11½ inches, is covered with scenes from the Trojan War, taken from the *Iliad* and the poems of the Trojan Cycle (see CYCLIC POETS), with explanatory Greek inscriptions. It is generally supposed to have been intended for school instruction, but was probably an ornamental panel of a bookcase.

TAB'ULA'RIUM. A large building on the slope of the Capitoline Hill facing the Roman Forum, built by Quintus Lutatius Catulus in B.C. 78 for the preservation of State records. It rested on massive substructures and consisted of a series of vaults with an upper portico of Doric half columns, some of which are still to be seen. Its extent corresponded with the present Palazzo del Senatore, which is built on the ancient walls. The structure is in good preservation, although the masonry of the vaults is corroded by the action of salt stored in them during the Middle Ages.

TABULAR STANDARD. A proposed standard of value which should obviate difficulties due to changes in the purchasing power of money. The proposal involves the preparation, by public authority, of a table of relative values of certain selected commodities after the fashion of an index number, and the permissive use of this table as a legal standard in contracts involving deferred payments. A tabular standard has been briefly defined as an official index number. Its compilation would require a commission or other body with power and facilities to collect price statistics. Having decided what commodities should be employed as basis for the standard, the commission would then calculate a yearly or monthly index number according to some accepted method. (See article INDEX NUMBERS.) The statistics would of course be public, and any one who chose could verify the calculation. The rise and fall of prices would either be expressed in percentages, or an arbitrary unit would be adopted, whose changing values, expressed in money, would indicate the same thing.

The practical operation of the tabular standard is simple. When a person makes a loan of say $100 for one year, the contract entitles him to receive the same number of dollars (usually with interest) at the end of the specified time, but it does not insure that the $100 which he lent and the $100 he receives will have the same purchasing power. If prices have risen in the interval, his $100 will buy less, if prices have fallen it will buy more. In so far as changed purchasing power is not compensated by a change in rates of interest, debtors are likely to be burdened by an appreciation, creditors by a depreciation, of the value of money. Suppose, however, the tabular standard to be employed, and that A sells a piece of property to B for $12,000, of which ¼ is to be paid at once, and ¼ more at the end of each succeeding year. The $3000 cash is of course paid as such. But after a year the tabular standard might show the purchasing power of money to have fallen 10 per cent. Expressed in tabular units, if at the time of sale a unit was worth $10, it would now be worth $11.11, giving the proportion 10.00 : 11.11 : : $3000 : $3333.33, which last figure is what B will have to pay. If at the end of the second year a unit of the tabular standard was worth $9, B would be called on for only $2,700. Whether he pays more or less in money, the sum will always have a uniform value in terms

of the commodities on which the standard is based.

That many advantages would be gained from the use of a tabular standard has generally been admitted. Two serious practical difficulties stand in the way of its introduction. First, the conservative attitude of business men toward any change of this sort; second, the difficulty of agreeing upon the precise mode of calculating the standard, and especially upon the precise commodities which should be selected as basis. Gen. F. A. Walker and others have questioned with good reason the practicability of the standard for the frequent short-time transactions of ordinary business, but for contracts of long duration, and for correcting injustice to recipients of fixed salaries, there seems no ground to question its suitableness.

The first conception of a general index number, or tabular standard, however, appears to date from 1798, when Sir George S. Evelyn read before the Royal Society a paper on "Endeavors to Ascertain a Standard of Weights and Measures" (*Philosophical Translations*, vol. lxxxviii., pp. 175 et seq.). Evelyn's selection of articles is open to criticism, as was pointed out by Arthur Young in 1811. Joseph Lowe (*The Present State of England*, London, 1822), referring to both Young and Evelyn, proposes the actual introduction of a tabular standard, and discusses the modes of calculating it. (New York edition, 1824, p. 287, and Appendix.) His is the first practical treatment of the subject in English. In Germany the principle of the tabular standard had been suggested about 1805, in application to rent payments. (Horton, *Silver and Gold*, 1877, pp. 39, 157.) G. P. Scrope, in a pamphlet of 1833, and in *Principles of Political Economy* (London, 1833, pp. 405, 424), again proposed the standard. G. R. Porter also treated the subject, and gave a table, in his well-known *Progress of the Nation* (London, 1838 and 1847). The matter was finally brought to prominence by W. S. Jevons, in an essay of 1865, and more forcibly in his *Money and the Mechanism of Exchange* (1875, chap. 25).

BIBLIOGRAPHY. Consult the *Reports of the Committee of the British Association on Measuring Variations in the Value of the Monetary Standard* (*British Association Reports*, 1887, 1888, 1889, 1890; the most important material in English); also Price, *Money and Its Relation to Prices* (London, 1896); Walker, *Money* (New York, 1878); *Report of the Monetary Commission of the Indianapolis Convention*, 1898.

TABULATA (Lat. nom. pl., tabulate, floored, table-shaped). A suborder of fossil corals characterized by the development of distinct horizontal septa or tabulæ across the visceral chambers of the corallites. It includes such genera as Favosites, Pleurodictyum, Michelinia, Aulopora, Syringopora, and others which are important members of the Paleozoic faunas. See CŒLENTERATA; CORAL; and articles on genera mentioned above.

TABULATING MACHINES, ELECTRIC. See CALCULATING MACHINES.

TACAHOUT, tä'kȧ-hōōt' (native name). The small gall formed on the tamarisk tree, *Tamariscus Indica*. Tacahout is one of the sources of gallic acid, of which it contains a large proportion.

TAC'AMAHAC' (South American name), or TACAMAHACA. A name applied to several different resins. One variety of tacamahac is yielded by the balsam-poplar (*Populus balsamifera*) growing in the United States. Another variety is obtained from certain tropical American trees (*Elaphrium tomentosum* and *Elaphrium tacamahaca*). East Indian tacamahac is obtained from the *Calophyllum calaba*, *Calophyllum inophyllum*, and *Calophyllum tacamahaca*. These and certain other varieties are used in making varnishes and to some extent also in medicine. See CALOPHYLLUM.

TACANA, tȧ-kȧ'nȧ. A group of tribes, constituting a distinct linguistic stock, inhabiting the banks of the Upper Beni and Mamore rivers, Northeastern Bolivia. They are remarkable for their light complexion, fine features, and independent expression.

TACCA (Neo-Lat., from the Malay name). A genus of large perennial tuberous-rooted plants of the natural order Taccaceæ. The few species are found in maritime places and woods in the South Sea Islands, tropical Asia and Africa. Some of them (*Tacca pinnatifida*, etc.) are much cultivated for the sake of their starchy tubers, which are used, generally with an acid, as food, although their acridity must be removed by maceration with water. They yield tahiti arrowroot, which is used as a substitute for West Indian arrowroot. The leafstalks of various species are boiled in China and Cochin-China and used as food. Hats, brooms, and other articles of value are made from them.

TACCHINI, tȧ-kē'nē, PIETRO (1838-1905). An Italian astronomer, born at Modena. He was appointed director of the observatory there in 1859, and was transferred to a similar post at Palermo in 1863. In 1879 he became director of the observatory in the *Collegio Romano*. He became known for his observations of eclipses and for his work with the spectroscope. His publications include *Il passaggio di Venere sul sole dell' 8-9 dicembre 1874, osservato a Muddapur* (1875), *Ecclissi totali di sole del 1870, 1882, 1883, 1886, e 1887* (1888).

TACHÉ, tȧ'shȧ', ALEXANDRE ANTOINE (1823-94). A Canadian Catholic archbishop, born in the Rivière-de-Loup, Lower Canada. He joined the Order of the Oblate Fathers, traveled great distances toward the northwest and became known for his mission work among the Indians. In 1871 his see, that of Saint Boniface, was erected into an archbishopric. Archbishop Taché was the founder of the Saint Boniface Theological College, and wrote *Vingt années de missions dans le nord-ouest de l'Amérique* (1866), and *Esquisse sur le nord-ouest de l'Amérique* (1869), which has been translated into English and is one of the most valuable works of reference on the region.

TACHINA-FLY, tȧ-kī'nȧ (Neo-Lat., from Gk. *ταχύς*, *tachys*, swift). A parasitic fly of the family Tachinidæ. These insects resemble in general the common house-fly and as a rule are gray, sometimes striped. They are usually parasitic upon caterpillars, upon the backs of which the females lay their eggs. The maggots penetrate

the body of the victim and feed upon its soft internal organs. Frequently, however, caterpillars cast their skins before the eggs hatch. The tachina-flies are considered beneficial to man.

TACHYGENESIS, tăk'ĭ-jĕn'ĕ-sĭs (Neo-Lat., from Gk. *ταχύς, tachys*, swift + *γένεσις, genesis*, origin, production, generation). A term proposed by Hyatt for rapid evolution, or evolution by leaps, i.e. without the vast series of intermediate forms postulated by Darwin. In his own words Hyatt defines tachygenesis as "the law of acceleration in the inheritance of characters." It has been found, for example, that characteristics are inherited in a series of species in a given stock at earlier and earlier stages in the ontogeny of each member of the series. These characteristics, as a rule, altogether disappear from the ontogeny, through lapse of heredity in the last members of a series, and thus the terminal forms become very distinct in their development. Rapid evolution was also very marked at the beginning of the evolution of any stock. In the dawn of geological history, as soon as divergent evolution set in, each type had a more or less free field, and its first steps in evolution were obviously not affected by natural selection. Afterwards evolution became much slower. On the other hand, when the type began to decline there was a sensible quickening of evolution. Dall suggested the term 'saltatorial evolution'; Galton, De Vries, and others, and especially the paleontologists, have all supposed that evolution has often been by leaps or spurts. Consult: Hyatt, "Cycle in the Life of the Individual (ontogeny) and in the Evolution of Its Own Group (phylogeny)," in *Proceedings of the American Academy of Arts and Sciences*, vol. xxxii. (Boston, 1897); Dall, "On a Hypothesis of Saltatory Evolution," in *American Naturalist*, vol. xi. (Boston, 1877).

TACITUS, tăs'ĭ-tŭs, Marcus Claudius (c. 200-276). Roman Emperor (275-276). He was born at Interamna (modern Terni), in Umbria, and was elected Emperor by the senate after the death of Aurelian and an interregnum of seven months (275). He began his brief reign of 200 days at the advanced age of seventy-five years. He instituted needful reforms and favored the restoration of the power of the senate. His victory over the Alani and Goths, for which he took the title *Gothicus Maximus*, is recorded on his coins. He was murdered by the soldiers in Asia about April 12, 276.

TACITUS, Publius Cornelius (c.55-c.117). A Roman historical writer. Information as to his life is exceedingly meagre. Tradition, however, designates Interamna as his birthplace. His training and career certainly indicate that he belonged to a Roman family of good standing. He was prætor in the reign of Domitian and consul suffectus under Nerva. In the year 78 he married the daughter of Gnæus Julius Agricola, a man prominent as a soldier and statesman. This event had great influence on his subsequent career. After his prætorship he was absent from Rome for at least four years until after 93, the year after the death of his father-in-law. The intimacy of Tacitus and Pliny the Younger is proved by references in the letters of the latter, and the two were associated in the successful prosecution of Marius Priscus, proconsul of Africa, charged with extortion. Tacitus's annals were published in 116 or 117, so that we may believe that he lived to the reign of Hadrian. Apparently he looked forward to writing a history of the reign of Domitian and of that of Trajan, but he must have changed his plan, for he began his *Histories* with Galba and continued the work through the reign of Domitian. In the *Annals* he declares his purpose of writing the history of Augustus and in the *Histories* of narrating the reigns of Nerva and Trajan, but we have no indication that he ever carried out this contemplated task. He wrote, however, the history of the Empire from the death of Augustus down to the beginning of his earlier work, i.e. through the reign of Nero.

The earliest extant work of Tacitus is the *Dialogus de Oratoribus*, published about 75 or somewhat later, but not later than the reign of Titus. The *Agricola* followed in the year 98, and even when engaged upon these books the historian was preparing for some greater work. It is possible that his *Germania*, or more fully *De Origine, Situ, Moribus, ac Populis Germaniæ*, represents some of the material accumulated in preparation for some more extensive history. The *Histories* belong to the reign of Trajan and the date of completion may be set in 108. The *Annals* are the last work of the historian and are plainly the production of the fully developed writer. As we have references to the *Annals* in the *Histories*, the date must be later than 108, and as there is apparently a reference in the second book to Trajan's conquest in the East (115-116), the publication may have been just prior to the reign of Hadrian. The *Dialogue on Oratory* belongs to the writer's early manhood, and gives evidence of the influence of Cicero and Quintilian, in so marked a degree that some scholars have attempted to assign it to Quintilian or to some other author not identified. The best opinion of the present day is in favor of the genuineness of the work. The subject is an investigation into the causes of the decline of eloquence, and the discussion is carried on by two celebrated orators of the Flavian period who are respectively supporters of the old and new oratory. After an eloquent silence—eloquent because we know the depth of feeling from the bitter words as to the reign of Domitian found in the introduction—Tacitus wrote the *Agricola*. This work is a gem, a most carefully prepared piece of biographical composition. The rhetorical power of the writer is plainly felt in the closing chapters, which are unexcelled in Latin literature. His *Germania* is a most important work because of the descriptions of political institutions and of the customs of various tribes. As the writer brings into vivid contrast the life of the Germans and that of the Romans, it has been thought by some that he was endeavoring to instruct his countrymen, either pointing out their evil ways, or startling them and warning them against the dangers threatening on their northern frontier. Tacitus shows an exact knowledge of those Germans near to the Rhine, but is uncertain as to the interior and more remote tribes. The greatest work of Tacitus has not come down to us entire, for of the *Histories* there are extant only the first four books and a part of the fifth, so that we have

merely the year 69 and a part of 70. Of the *Annals* there is extant only about one-half, and this does not give a continuous narrative. After the fifth chapter of the fifth book there is a lacuna which marks the loss of the events of 29-31. Tacitus probably ended this book with the death of Sejanus, so that the beginning of the sixth book is also lacking. The seventh to the tenth, the beginning of the eleventh, and the close of the sixteenth are also missing, and we thus lose all of the reign of Caligula, the first five years of Claudius, and the last two years of Nero.

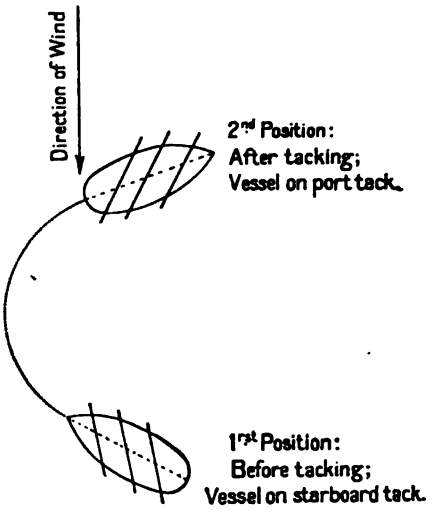
In the *Annals* Rome and the Princeps form the centre about which are grouped the events of a history which is not that alone of Rome, but of the associated provinces. The Medicean manuscript designates the work *Ab Excessu Divi Augusti*, and this is no doubt the original title. In the *Histories* Tacitus writes as a contemporary, and therefore with a surer touch, and he gives full play to his dramatic powers in his description of what is quite familiar to him. The *Annals* represent the culminating task of his lifetime and are the work of the period of his full development as a writer.

The great power of Tacitus as an historian is due to his skill in discerning the motives which lead men to act, and his 'deep psychological insight' is very marked. He studies men, not things, and hence he is skilled in character painting. A marked feature of the Tacitean spirit is the tendency to impute a base or unworthy motive to all the actions of those men whom he describes. This is particularly true of his treatment of Tiberius. Certain it is that Tacitus writes of Roman society as a pessimist, and we may obtain a juster view by turning to the more attractive picture presented by his friend and contemporary Pliny the Younger.

Tacitus early recognized that the style taught in the schools of rhetoric was not adequate for his history, and he thereupon evolved one of his own. There are three distinguishing features of Tacitus's style—conciseness, variety, and poetical coloring. There is not a superfluous word, and his condensation sometimes causes obscurity. We may say that his conciseness corresponds to his thought, for there is nothing artificial in it, and the style is characteristic of the writer. Tacitus's fondness for variety is found in his word positions, and in his variation in forms and constructions. The poetical coloring came from his study of the Augustan poets, particularly Vergil. Many words and expressions may be traced to Vergil, and this is true particularly of the minor writings and the *Histories*.

The manuscripts of Tacitus are the Codex Mediceus (I.), dating from the ninth century and containing a part of the *Annals;* and the Codex Mediceus (II.) of the eleventh or twelfth centuries containing what remains of the other books of the *Annals* and *Histories*. The *Germania* and *Dialogus* are obtained from a manuscript in the Vatican based on an earlier one of the ninth century and again from a manuscript at Leyden, dating from the fifteenth century. The *Agricola* is found in two transcriptions of the fifteenth century now in the Vatican. The *editio princeps* is by Puteolanus of Milan, about 1476. The best text is that of C. Halm in the "Teubner Series" (Leipzig, 1886). Important editions are the *Annals*, with English notes by H. Furneaux (Oxford, 1891-92; vol. i., 2d ed. 1896); Allen, *The Annals of Tacitus*, i.-vi. (Boston, 1890); Nipperdey and Andresen, *Ab Excessu Divi Augusti* (Berlin, 1892); Codley, *The Histories* (New York, 1891); Spooner (London, 1891); Frost, *Agricola* and *Germania* (ib., 1861); Hopkins (Boston, 1893); Furneaux, *The Agricola* (Oxford, 1896); Gudeman (Boston, 1899); id., *Dialogus* (ib., 1894); and Peterson (Oxford, 1893). The lexicons for Tacitus are Boetticher's (1832) and the great work of Gerber and Greef (completed 1903). An excellent English translation is that by Church and Brodribb (London, 1876-77).

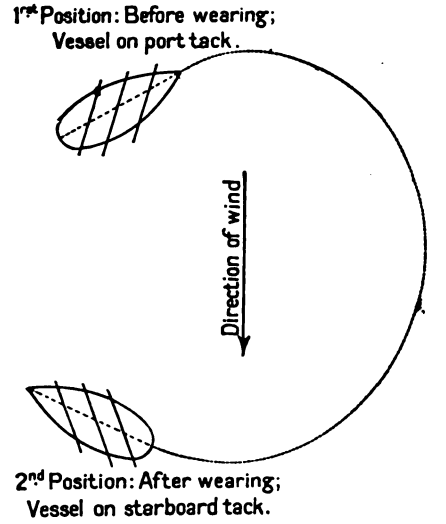
TACKING (from *tack*, from OF. *taque, tache*, dialectic Fr. *tache*, nail, tack; so called because of the part of the sail to which the rope is attached) AND **WEARING** (from *wear*, AS. *werian*, Goth. *wasjan*, OHG. *werjan*, to clothe; connected with Lat. *vestis*, Gk. *ἑσθής, esthēs*, clothing, Skt. *vas*, to put on clothing). A vessel is said to be *on the starboard tack* when she is sailing with the wind on her starboard side, and *on the port tack* when the wind is on her port side. She is *close-hauled* on either tack when she is sailing as near to the wind as the set of her sails permits. The operation of changing from one tack to the other is called *tacking* if the vessel comes up head to wind and then falls off on the other tack, and *wearing* or *gybing* if she falls off—bringing the wind astern—and then comes up to the wind on the new tack.



TACKING.

It is evident from the sketches that in tacking there is a gain to windward—if the vessel is a weatherly one and well managed—while in wearing there is a loss, because part of the time the ship is running away from the wind. Therefore, tacking is always preferred when practicable. While all properly built vessels will tack under ordinary conditions of sea and wind, there are times when the sea is very rough and the wind so strong that little sail can be carried; or the wind may be too light to give sufficient headway for tacking; or the vessel may be improperly sparred or ballasted. In these cases *wearing* is necessarily resorted to. In vessels carrying fore-and-aft sails only the operation of

tacking requires little labor, but in square-rigged ships the yards must be swung and the sails adjusted on the new tack. *Wearing* is called *gybing* when the vessel is fore-and-aft rigged and carries a boom mainsail which is not taken in or lowered during the operation. It



WEARING.

is evident that when the wind, in wearing, passes from one side to the other of such a sail it will give a thrust of considerable violence, and this thrust must be carefully watched in small vessels—and in large ones if the wind is strong—or it may cause them to capsize.

Tacking is frequently called *going about*. While the operation is in progress a vessel is *in stays;* if she fails to tack and falls back on the same tack as before, she is said to *miss stays*. A lively, fast-moving vessel, particularly if deeply loaded, will, before losing way, shoot some distance directly up into the wind after it is out of her sails. Advantage is frequently taken of this fact to avoid some slight obstruction, when tacking is undesirable or otherwise unnecessary, and the operation is called making a *half board*. To make a *good board* is to lose nothing to leeward; to make *short boards* is to tack frequently; to make *sternboard* is to go astern.

TACKING OF MORTGAGES. The act, permitted by a doctrine in English equity practice, of one who takes a mortgage or lien on real property subsequent to a second or later mortgage and in ignorance of its existence, to purchase the first mortgage and merges or 'tacks' his security in it. The effect of this is to compel the intermediate incumbrancers to redeem the first mortgage, including the one thus merged with it, before they can enforce their liens. This doctrine has been repudiated in most of the United States.

TACKLE (MDutch, Dutch, LG. *takel;* possibly connected with Goth. *taujan*, to do, or with Goth. *tēkan*, Icel. *taka*, AS. *tacan*, to take, Lat. *tangere*, to touch). A combination of blocks and ropes designed to increase the capacity of the available power to move heavy weights or decrease the time required to move an object with a power capable of moving only at a certain speed. The block consists of a *shell* or frame

containing one or more *sheaves* or pulleys and a *strap* to attach the block to the weight or support. It is evident that in all cases one block of a tackle, or one end of the rope—if there is a

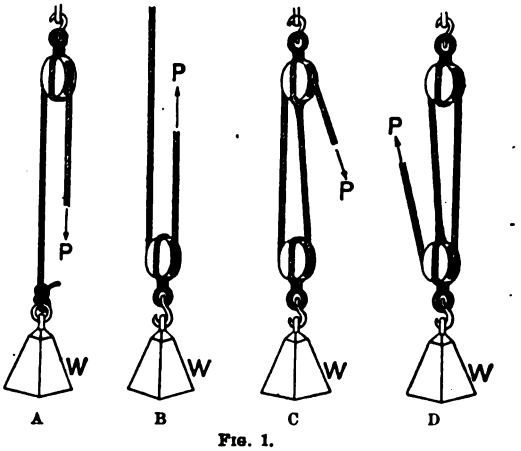


FIG. 1.
A, single whip; B, runner; C and D, gun-tackles.

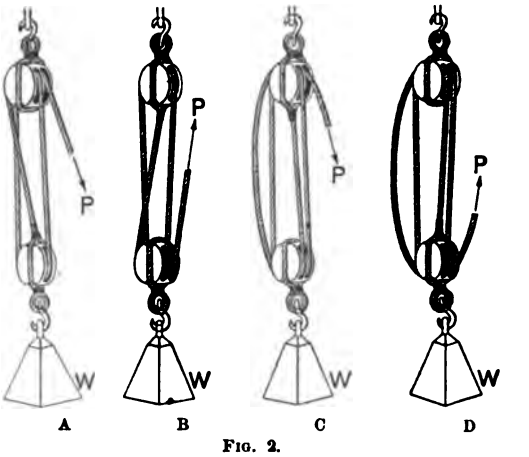


FIG. 2.
A and B, luff or watch tackle; C and D, two-fold purchases.

single movable block—must be fixed. This being the case, in simple purchases and neglecting friction we have $P = \frac{W}{N}$, in which P is the power,

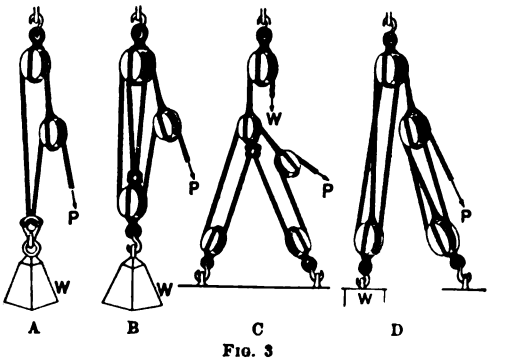


FIG. 3
A, single Spanish burton; B, double Spanish burton; C, Bell's purchase; D, luff upon luff.

W the weight, and N the number of parts of rope at the movable block. The amount of power lost by friction depends upon many things, such as: the character of the rope; its size with reference to the diameter of the pulley and the weight to be raised; the condition of the atmosphere; the bearings of the pulleys, etc. But in ordinary tackles, with the usual type of pulleys, rope, etc., the loss by friction is estimated at about one-sixth the gain effected by each pulley or sheave. The different classes of tackles, or *purchases* as they are frequently called, are shown in the accompanying figures.

TACKLETON, Mr. A toy-maker with a virulent dislike of toys and children, in Dickens's *Cricket on the Hearth.*

TACLOBAN, tä-klō'-bän. Capital of the Province of Leyte (q.v.), Philippine Islands, in latitude 11° 15′ N. and longitude 124° 59′ 30″ E. The town, which is on the eastern coast, is well built and has an important trade. The port is well protected and has four different wharves. Population, about 11,000.

TACNA, täk'nä. The northernmost province of Chile, bounded by Peru on the north, Bolivia on the east, the Chilean Province of Tarapacá on the south, and the Pacific on the west (Map: Bolivia, C 7). Area, 8688 square miles. Its level and arid interior is inclosed by the slopes of the Andes on the east and the coast range on the west. The rainfall is very scanty, and with the exception of the river valleys, the interior is an arid desert. The climate is unhealthful and earthquakes are not infrequent. There are deposits of nitrate, silver, and copper, which are mined to a limited extent. Population, in 1895, 24,160; in 1900 (estimated), 25,031, concentrated chiefly in the capital, Tacna (q.v.), and the port Arica. The province formerly belonged to Peru and was ceded to Chile for a period of ten years in 1884. At the expiration of that period, according to the provisions of the treaty, the ownership of the province was to have been determined by a plebiscite of the inhabitants. The political state of Peru, however, made it impossible to carry out the provisions of the treaty, and Chile still exercises control.

TACNA. The capital of the Province of Tacna, Chile, in the northwestern part of the province, about 40 miles by rail from Arica (Map: Bolivia, C 7). It was formerly a place of considerable commercial importance with notable municipal and industrial establishments, but the construction of railway lines in the Province of Antofagasta diverted the trade southward. Population, in 1895, 9418, as against 14,000 in 1885. In the vicinity a battle took place on May 26, 1880, betwen the Chilean and the allied Peruvian and Bolivian forces, in which the former were victorious.

TACO'MA. The county-seat of Pierce County, Wash., 140 miles north of Portland, Ore., at the head of Commencement Bay, Puget Sound (Map: Washington, C 2). It is a terminus of the Northern Pacific Railway, and is on the Great Northern, the Canadian Pacific, and other railroads. Many steamship lines, of which several are trans-Pacific, sail from Tacoma. The harbor is spacious and secure, and is admirably provided with shipping facilities, the railroad and steamship terminals being among the best on the Pacific Coast.

Tacoma has a picturesque site, rising from the bay to an altitude of 320 feet, with high mountains in the vicinity, Mount Rainier (q.v.), locally known by the old Indian name, Tacoma, to the southeast, being 14,526 feet in height. There are some 700 acres in public parks, of which Point Defiance is by far the largest. The city hall, court-house, Chamber of Commerce, Northern Pacific Railway headquarters, Tacoma Hotel, and Tacoma Theatre are among the prominent buildings. The city has a public library (Carnegie) containing some 25,000 volumes, the Ferry Museum of Art, and the State Historical Society. The educational institutions include Whitworth College (Presbyterian) and the University of Puget Sound (Methodist Episcopal), both opened in 1890; Annie Wright Seminary (Protestant Episcopal), the Pacific Lutheran University, and an Indian school. The State Insane Asylum is a few miles to the south, and there are in the city a number of charitable institutions, the more important of which are the City and County Hospital, Saint Joseph's Hospital, and the Fanny Paddock Memorial Hospital.

Superior transportation facilities, and a vast and highly productive tributary region have made Tacoma one of the leading business centres on the Pacific Coast. Coal is mined extensively in the vicinity, and the city has also advantages of rich agricultural and timber lands. It carries on a large wholesale trade and is largely interested in manufacturing, but derives its chief importance from an extensive coastwise and foreign commerce, particularly with the Orient. The principal articles of commerce are wheat, flour, lumber, coal, coke, fish, and fruit. In the census year 1900 the various industrial establishments had $8,147,000 capital, and an output valued at $12,029,000. The manufacture of lumber, shingles, furniture, carriages and wagons, woodenware, flour, foundry and machine shop products, cars, car wheels, and engines, ship and boat-building, smelting, and brewing are the chief industries.

Under the revised charter of 1896 the government is vested in a mayor, elected for two years, and a unicameral council. Most of the administrative officials are appointed by the mayor, the comptroller, treasurer, and board of education, however, being chosen by popular vote. The city spends annually for maintenance and operation about $698,000, the largest items being: interest on debt, $228.000; schools, $164,000; electric light plant, $69,000; fire department, $47,000; police department, $35,000. The water-works and the electric light plant are owned and operated by the municipality. Tacoma was formed in 1883 by the consolidation of Old Tacoma (founded in 1868) and New Tacoma. New Tacoma, founded about 1869, was made the western terminus of the Northern Pacific Railway in 1873, was organized as a city in 1874, and became the county-seat in 1880. Population, in 1890, 36,006; in 1900, 37,714.

TACOMA, Mount. A peak of the Cascade Range. See Rainier, Mount.

TACONIC MOUNTAINS, or TAGHKANIC MOUNTAINS. A low mountain range on the eastern boundary of New York State and occupy-

ing a small area in Massachusetts and Vermont (Map: Massachusetts, A 3). It extends from the Highlands east of the Hudson in a north-northeast direction, becoming gradually higher as it enters the northwestern corner of Massachusetts, and passes into southwestern Vermont, where it connects with the Green Mountains. Its highest peaks are Mount Equinox in Vermont, 3816 feet, and Greylock in Massachusetts, 3535 feet. It consists chiefly of metamorphosed Cambrian and Silurian rocks to which it has given the name Taconic System (q.v.).

TACONIC SYSTEM. A name applied by Emmons in 1842 to a series of rocks found in eastern New York, western Massachusetts, and Vermont, and considered by him to be of pre-Potsdam age because of their metamorphosed character and the supposed absence of fossils. It has been suggested by some that the term Taconic should be substituted for Cambrian. Consult: Emmons, *Geology of New York*, part ii. (Albany, 1842); Dana, "A Brief History of Taconic Ideas," in *American Journal of Science*, third series, vol. xxxvi. (New Haven).

TACTICS (from Gk. *τακτικός, taktikos*, relating to arrangement, especially in war, from *τακτός, taktos*, arranged, from *τάσσειν, tassein*, to arrange), MILITARY. The art of conducting and arranging troops on the battlefield, or in its immediate vicinity. Strategy (q.v.) strives to make all the conditions for the coming battle favorable, while tactics endeavors to realize what strategy has prepared for. The same principles apply in both, but tactics is more dependent on actual practice, while strategy is more of an art, derived from study, reflection, and genius.

Tactics not only demands from the individual officer understanding, comprehension, and genius, but in addition the masters of the art must be men of iron constitution and iron will. War alone can develop great soldiers—they are born, not made. But even they need preparation, education, and training—not to acquire theoretical knowledge, but to learn how to handle the tools of their art. Moreover, the great leaders need assistants, and these can be developed from the men of average ability, by the careful study of the use of the tools required, and practice with them and by the lessons of military history, bearing in mind that every case arising in war is an exception, and will never arise again, and not a general rule which may be used as a model.

TACTICS OF INFANTRY.

Infantry, except during a single period, namely, the Era of Knights or the Age of Chivalry, has always been the *principal* arm, that is to say numerically the strongest, and in its action the most decisive, and ever since the introduction of firearms the infantry has been gaining in importance. It is the only arm which can act *independently*, that is without the assistance of the other arms, under all conditions of ground, weather, and other circumstances, in attack or defense, while in motion or when at rest, in closed or open order, with fire action or shock action; it can operate on all kinds of ground; it is more independent of circumstances than the other arms; in it movement and effective firing may be combined to a far greater extent than in the other arms; it can come into action more easily and readily; it is equally effective in attack and defense; it is more easily and cheaply equipped and maintained than the other arms; and it can be more quickly made efficient. But it is limited in its rate of movement, hence the advantage of combining cavalry with it; and in the range of its effective action, hence the advantage of combining artillery with it for battle, and cavalry for reconnaissance.

Infantry holds its high position mainly on account of its great fire-action combined with its capacity to utilize fully the configuration of the ground.

The fire of the present breech-loading rifle begins to make itself felt at 2500 yards, but does not become effective as aimed fire until about 1000 yards from the enemy; at 500 yards it is decisive, and at 300 practically annihilating. Constant improvement gradually increases these distances, and in the Boer War it was noticed that the British attack usually came to a standstill at 900 yards.

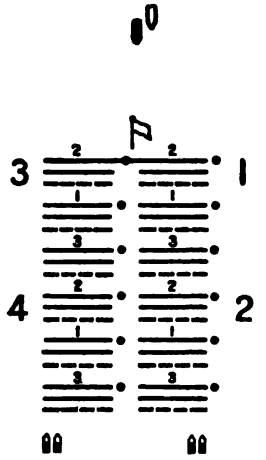
The perfection of firearms and the more extended utilization of the configuration of the ground have greatly increased the power and significance of fire-action. The introduction of an automatic firearm is now only a question of a comparatively short time, and this will still further increase fire effect. The bayonet attack, as an independent act, has ceased to exist; it can no longer overcome fire-action, but can only win the results of previous fire-action. The latter takes by far the longer time and makes the highest demands on the strength and endurance of the troops; moreover, its annihilating effect punishes promptly any rash resort to the bayonet. Nevertheless the necessity for the bayonet remains; not indeed in hand to hand conflict, but as a threatening measure in the assault of a position, and because of the confidence it inspires and the power of the initiative which it confers. According to the great German tactician Meckel, "The laurel of victory still hangs on the point of the bayonet."

The power of infantry fire necessitates cover, and the utilization of the natural configuration of the ground to secure this has acquired vital importance. The crossing of open spaces is avoided as much as possible, or postponed to decisive moments; hence, the battle usually crystallizes around woods, villages, and groups of buildings. But in broad open fields, as in the United States, or where troops are opposed to each other in strong natural or artificial positions for a considerable time, artificial cover must be obtained, consequently intrenchment is resorted to, and an intrenching tool has become a necessary part of the soldier's equipment.

The formations in which infantry moves and fights are not the result of haphazard theory, but have grown out of the conditions of warfare, and their importance is attested by the fact that, in spite of the improvement in firearms, the losses in battle have become gradually smaller. Infantry can fight only when the distance from the enemy, or the available natural or artificial cover, permits it to fire, and effective fire can only be obtained when the soldier has room to use his arm freely, consequently this arm fights in open or dispersed order, the closed order being used only for troops in rear of the firing line. The greatest difficulty in leading infantry is the loss of control by the officers due to this dispersed order, and this can only be overcome by

training, discipline, drill, and the example of the officers.

The tactics of infantry are designed to facilitate, as far as in them lies, that great object of every commander, namely, to make himself stronger than the enemy at the time and place of actual combat, and this can only be done by preserving unity of command, concerted action and mobility, combined with the least exposure of the men to loss. The formations in use attempt to fulfill these conditions, and the main principles governing in modern **infantry tactics are: an individual** training and instruction to develop a high degree of initiative combined with perfect subordination; the greatest development of fire in the firing line; a subdivision into fire units of such strength as to insure complete fire control by commanders; in the attack, pressure against the flank combined with a frontal attack; the reinforcement of the firing line by a succession of lines gradually closing to the front; and, if possible, the accumulation of a greater depth of forces opposite the portions of the enemy where the attack is to be concentrated.

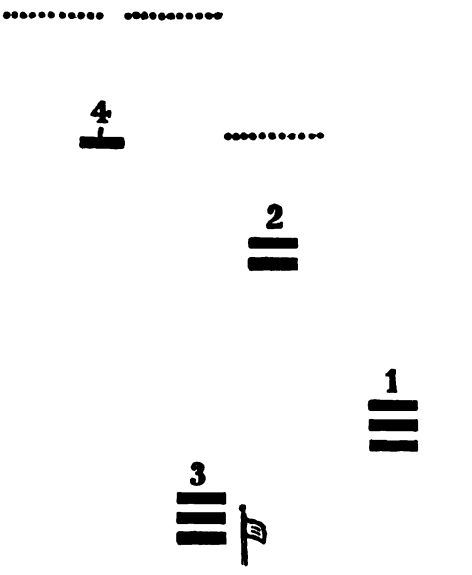


BATTALION DOUBLE COLUMN.

Colors; Battalion Commander; Adjutant; Company Commander; Platoon Commander.

The double column of the battalion (from which the column of march is usually deployed for battle). The larger numbers indicate the companies, the smaller the platoons.

The front line in the attack is composed of the *fighting line* and its *reserve*, and the former is subdivided into the actual *firing line* and its *supports*. The battalion is the tactical unit and the front it covers, as well as the particular nature of the action, determines the number of companies it places in the fighting line. The battalion covers normally about 400 yards of front and a company about 100 yards. The progress of the attack will proceed in general outline somewhat as follows: Before entering the zone of artillery fire (or at about 3000 yards) each regiment forms from column of march into line; the battalions then designate the companies to form the fighting line and those to form the reserve; the companies of the fighting line then designate the sections for the firing line and for the supports. The best form of advance of the companies is in column of sections (half platoons). This line of columns is kept up as long as possible, because in this formation the men are under the perfect control of their officers. Within effective infantry fire the column must deploy, since the bullet from the modern firearm can pass through two men at 1500 yards, and at 400 yards it can go through four men, so that the column, if preserved here, must expect heavy losses. In the attack closed columns cannot appear in open country within a range of 2100 yards. The successive lines, deployed in open order, or in company column of sections, depend-



A BATTALION ON THE RIGHT FLANK OF A GENERAL LINE DEPLOYED FOR BATTLE.

On a war footing the companies have three platoons each. The numbers indicate the companies, the fourth having two platoons deployed.

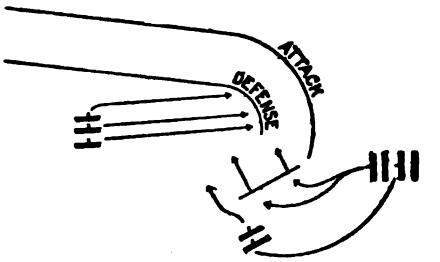
ing on the effect of the enemy's fire, continue to advance. When within effective range, fire is opened, by volleys, or a designated number of rounds at will, the skirmishers halting to deliver their fire, then advancing again. In open country, within 1100 yards skirmishers can no longer remain standing. The supports gradually close on the firing line, deploy as skirmishers and begin to reënforce the firing line. Then begins the advance by rushes, by alternate subdivisions, and portions of the reserve are added to the firing line, the rest still held in reserve in rear of the point of main attack. The final act is the charge, the reserves being brought up to insure victory and hold the position. The engagement is in general decided at about 900 yards' distance.

This is the general picture, but the details are very various. Long lines of skirmishers can only advance or retire on lines perpendicular to the front, and changes of front are no longer possible after the open order is adopted; moreover, throwing out a skirmish line oblique to the front is dangerous, consequently the companies must first be placed on the front to be formed before deploying as skirmishers. The skirmish line, to avoid losses, is often compelled to advance at a run, and systematic rushes are possible only on the drill ground; in the field these rapid advances depend on the local conditions, especially the effect of the enemy's fire. The long line, at three or four thousand yards from the enemy, will pass over varied ground, part covered, part open; on the latter artillery fire will make itself felt here and there, and at such points the men will advance at a run, then halt under cover, or out of the zone of fire, to await the other parts of the

line. These conditions will constantly change in all the different parts of the field.

The infantry attack is decided by fire-action, and to determine the number of skirmishers in the firing line, it must be remembered that there should be at least enough to prevent surprises, and not so many as to interfere with the commander's freedom of action, in case, for example, it should turn out that a considerable portion of the forces had been placed where they were not really needed. The further development of the fire-action will be determined by the points selected for decisive action, which cannot usually be determined beforehand.

One of the principal conditions for the success of the attack is that fire once opened should be kept up to about the same strength, and this again indicates the necessity for comparatively weak lines at first; on the other hand, the enemy should be met with superior forces from the beginning, and this superiority kept up. Between these two limits the commander must decide.



THE FLANK ATTACK.

The attack covers the entire front of the defense and has in addition sufficient troops for outflanking the right wing of the latter, and attacking him in a direction perpendicular to his front.

Decisive action is usually sought on a flank, but not necessarily an extreme outer flank of the line, for a modern skirmish line, from various causes, is very apt to have a number of inner flanks, which are also points of weakness. In the early part of the engagement the enemy must be forced to unveil his position, and then these interior flanks can be determined, and the commander may decide where to concentrate his forces, for superiority is desired only at the decisive points. The rest of the front can be held by comparatively weak forces. This also indicates the necessity for keeping as many troops as possible in reserve, but it must be borne in mind that the requisite number to insure superiority must be put in the firing line from the beginning, and this aside from all other considerations. The reserves must be added to the firing line in dispersed order, for the commander who hopes to force a decisive action by means of reserves in closed order disregards the effects of modern firearms. In an ideal action all the rifles are in use at the decisive moment, but this is not possible in long lines. Still, the troops remaining in close formation will find other uses. To cover a retiring skirmish line only those reserves can be used that stand far enough to the rear to be readily placed in a defensive position to which the line may fall back; if they are already on the way to the front they had better be thrown into the skirmish line, to turn the tide, if possible.

Breaking through the front of a line is a very difficult undertaking and hardly possible to-day. Consequently, the reserves should not be in rear of the centre, because they are of no use there, and would have to be kept so far in rear, to avoid the effects of the enemy's fire, that they might not enter the action in time. Their place is on one or both flanks, and so far beyond the flanks that they can enter the fight by a simple, direct forward movement, without any lateral gaining of ground. A regiment held in reserve, for example, should be placed in rear of the flank and about 600 yards beyond it. The main reserve is always behind the flank where the decisive action is expected to be brought about.

The regimental commander can only assign to each battalion its general duty; the execution must be left to the battalion commanders. On the defensive he assigns to each his section of ground, on the offensive his point of attack; and he lets go his control as fast as the circumstances require. The battalion commander, in the same way, gradually gives up control of his companies, and when once the battalion is deployed, he can only aid by caring for the supply of ammunition. A skirmish line fires only when at a halt, and the position taken depends on the range, but lying prone is now regarded as best because it gives the enemy's artillery no opportunity to get the range. Before opening fire the distance must be estimated, a difficult matter even for those well trained in it in time of peace. The skillful designation of the target also requires much practice. The firing may be by volley or at will, the former being advantageous when the range has been determined and the ground is suitable for observation of the fire, but in general is merely a drill-ground exercise of little practical use. The conduct of the fire and all fire control is in the hands of the company and subordinate commanders, and one of the most difficult duties of these officers is the observation of the effects of the fire.

These are the generally accepted principles of infantry tactics, but in the different States of Europe there are still considerable variations. The fighting front of a battalion, for example, varies from 200 yards in the Italian Army to 400 in the French, and the latter has practically abolished the supports for the firing line. In France and Russia fire is opened at great ranges, over 1900 yards; all the nations except Germany lay great stress on volley firing. Again, in France (and in the United States, as set forth in Wagner's *Tactics and Organization*, New York, 1895, officially approved), great attention is given to successive regular lines of attack, the first to introduce the action, the second to carry it out, and the third as a reserve: an indication of a love for theoretical forms, types, and systems in matters that are too elusive for such treatment, and which experience on the battlefield has shown to be very different in practice.

TACTICS OF CAVALRY.

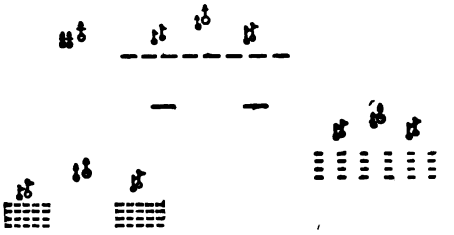
The prominent characteristic of cavalry is *rapidity* of movement, and its greatest duty is the service of security and information: a cavalry which is superior to the enemy's in screening its own army and clearing up that of its adversary will more than pay for itself. Its duty next in importance is pursuit, as it alone is capable

of overtaking and holding a retreating enemy till the arrival of the infantry. On the battlefield its use is important, but limited.

Cavalry is the arm of surprise, of sudden and vigorous attack; but its power of defense is comparatively poor, consequently it cannot hold for any length of time the ground it has gained. It is dependent to a great extent on the configuration and character of the ground, and its use in conjunction with the other arms is limited to favorable moments. Cavalry for its best and most effective action requires a broad, open country, and this is available only rarely on modern battlefields. For this reason, and on account of the increased range, rapidity of fire, and accuracy of firearms, cavalry can seldom decide battles.

Surprise is to-day absolutely essential for the success of a cavalry attack, but to seize the proper moment is very difficult, and requires constant watching of the progress of the battle, and even anticipation of the enemy's movements in order to place the cavalry in readiness to grasp the fleeting moment, ere it be too late; consequently the cavalry must often wait for hours, and even under fire, but of course this has its limits, and after a certain percentage of losses the cavalry must retire out of range, and thus give up temporarily any opportunities for attack that may possibly arise.

The true action of cavalry in battle has been shock action, its fire-action being quite subordinate, and employed mainly on the defensive. Under present conditions the precise sphere of activity for the arm in battle is a subject of much debate. Positions seized by an advancing cavalry may sometimes be held by its means until the infantry comes up, or it may be used to check the advance of the enemy; occasionally it may serve to support infantry. As a rule, fire-action of cavalry is delivered dismounted, but mounted fire-action, although rare, has been used with advantage in covering a retreat when the pursuit was very active. The formation of



CAVALRY DIVISION DEPLOYED.

Division Commander; Regiment Commander; Battalion Commander;
Division Staff Officers; Regiment Adjutant; Battalion Adjutant.

The division represented is composed of three regiments, one of which is deployed in line; the regiment on the right flank is in line of squadrons in column of troops with extended intervals ready to deploy; the other regiment is massed in close column.

cavalry used in the attack is the line, composed of two ranks in Europe. At other times the cavalry is generally kept in columns. The line allows of the simultaneous use of the greatest number of weapons, but because of its unwieldiness the squadron front is not exceeded for any formations other than the attack. Columns serve to assemble the troops in a narrow space, and render movement up to the moment of attack easy; they must be open to facilitate forming line, with comparatively narrow front and full distances.

In the attack of *cavalry against cavalry*, victory can be gained only by the rapid assault of closed lines. In the advance of two opposed lines toward each other the respective lines will necessarily be more or less broken, the closed portions of the line still remaining on either side will penetrate the open places, both fronts will thus be broken through, and a hand to hand conflict begins. The extent to which either side retains closed lines up to the last will be of great effect on the result, hence the necessity of keeping closed and advancing with determination. The squadron commander can always take personal part in the attack, and the regimental commander can generally do so, but the brigade commander very rarely. The enemy should be kept uncertain as to the direction of the proposed attack as long as possible, so that he cannot prepare to meet the attack on his flank or rear, where it is usually directed. The principles applying to the subdivision of the forces are the same as for infantry. Enough men must be put into action at the beginning to insure success, and the first contact should decide the affair, consequently the forces directed against the flanks must be so directed from the beginning, and therefore must have an entirely different base from those directed against the front. In the front it will hardly be possible to put more men than the enemy has, and overlapping flanks will charge against nothing. More than necessary for decisive action should not be put in at first, because a reserve will be necessary to meet other approaching troops while the attack is going on. However, if all the troops are needed for the first effect then there can be no reserve, but one should be formed as soon as possible out of the reassembled squadrons. After the attack the action gradually changes into flight on one side and pursuit on the other, and the latter should be kept up till new infantry or artillery stops it, or the horses are exhausted.

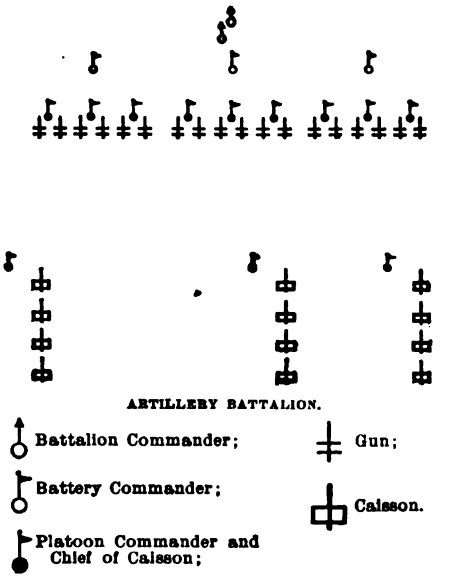
In the attack of *cavalry against infantry* victory can only result when the attack is so sudden that the infantry has no time to fire at all, or when the latter is badly demoralized by previous losses. *Cavalry against artillery* has a better chance for success, because a firing artillery line cannot protect itself toward the flanks, and in the early part of an engagement such unprotected lines will often be found. *Fighting on foot* enables cavalry to act for a time independently of the other arms, especially when it is supported by horse artillery, and is the only means by which cavalry can continue its advance through defiles, woods, or villages occupied by weak forces of the enemy. The action of dismounted cavalry is limited in general to holding particular points, such as defiles or villages, until the arrival of stronger forces. There are, however, instances where cavalry on account of their extreme mobility can be used advantageously in foot fighting, and modern tacticians are paying increased attention to this point. Such cavalry, however, must be distinguished from mere mounted infantry as they have a far wider tactical use.

The principal duty of the horse artillery attached to the cavalry is to support the latter, since it can clear out the enemy from positions which a cavalry force would have hard work to take. In the attack of cavalry against cavalry horse artillery cannot always find application, but it can aid when its cavalry is deploying from a defile. While the opposed cavalries are still manœuvring the artillery takes the enemy's cavalry as its target, and pays no attention to its artillery unless its fire is masked by its own cavalry or to facilitate the deployment of its own cavalry. The artillery should be massed, but artillery duels to prepare the action would be absurd. There will probably be no time for any change of position until after the cavalry attack is decided, when the artillery takes part in the pursuit. In case of defeat it will not have time to take up a new position, but must remain firing in its previous position.

These are in outline the principles involved in cavalry tactics, though they are constantly undergoing modifications and the discussion of the true sphere and use of cavalry is a favorite topic for military authorities. In France more attention is given to theoretical forms, and the French tactics prescribe three lines for the division, the third being a reserve in the hands of the division commander, which is put into action only by squadrons and never entirely, except as a last resort; and the horse batteries are directed to form about 900 yards on the flank of the field of attack.

TACTICS OF FIELD ARTILLERY.

The artillery is the arm of destruction, and, on account of its great moral effect and the fact that it can reach troops in every part of the field, in all kinds of ground, and behind all artificial field cover, it is essentially the arm for preparing for the attack, demoralizing the enemy, and facilitating the work of the other arms. The use of artillery in masses is the great feature of a modern battle, and this use results from the long range of the guns, which enables them to do in one position that which formerly required a number. Its mass action begins the battle, prepares it, supports the action of the other arms, and ends it, and as an arm of pursuit artillery ranks with cavalry. The disadvantages of artillery are that it is tied for a considerable period to a particular position, and cannot act alone, consequently it is always an auxiliary arm. Moreover, it is cumbersome in its movement and defenseless when moving. It is also expensive and difficult to train. Leaving out of consideration the artillery of the seacoast and that used in the attack and defense of land fortifications, which have a tactics of their own, that is treated elsewhere (see COAST DEFENSE and FORTIFICATIONS, ATTACK AND DEFENSE OF), the artillery taken along by the field army may be divided into light artillery and heavy artillery, the former comprising field, horse, and mountain batteries, the latter guns of position. The field batteries include howitzer and mortar batteries for curved or high-angle fire. The formations of the artillery of practical use in the field are simply a formation for going into battery, and the formation *in battery*, ready for firing. To train the cannoneer for his arduous work under enormous strain, the greatest precision in accuracy in drill must be insisted upon, for the numerous duties of a cannoneer (setting the fuze accurately, also the sight for the range as well as deviation ordered, and the use of the trail in pointing), under a fire, which may burst shells near the battery as often as one a second from each of the enemy's batteries, require the highest order of discipline. Moreover, to regulate the fire properly, each shot must be observed, in order to correct fuze-setting and sight. All this demands a formation of the battery in a small space, so that the men may be directly under the eyes of their superiors, and the batteries must be able to move easily, under cover if possible, to their positions. Beyond the range of firearms the artillery can move in column of platoons, but within that zone it apears only in the open order (in line at full intervals) or in column of sections. Firing artillery always stands in the open order (*in battery*), and this formation in open order is also the best for advancing into position, where it can be used, but the column of sections will be more generally applicable in coming into position.



This illustrates the manner in which an artillery battalion of three batteries (of six pieces and four caissons each) comes into action. The rest of the caissons are concealed further to the rear.

The greater range of artillery naturally makes it the arm to open the battle, and the desire to rapidly overpower the enemy's artillery, in order that it may take under fire the point selected for attack by the infantry, or, on the defensive, the enemy's infantry during the attack (the real duty of the artillery), as naturally leads to the accumulation of the artillery in masses. The support of the infantry attack is the true purpose and the real duty of the artillery, and everything else is only a means to this end. Consequently, the object which the commander-in-chief has in view determines the time, place, and strength in which the artillery is first placed in position, and he also must give the orders therefor. The artillery should, of course, endeavor to utilize its long range, and if possible come into position beyond the range of the enemy's infantry fire, but since its main duty

is to support the infantry, then, in order to give the latter prompt and effective aid, it must not hesitate to enter the zone of infantry fire, if required, because only when the *infantry* is beaten is the battle lost. On the other hand, it is the duty of the neighboring troops of other arms to protect the artillery against infantry fire. This does not, however, relieve the artillery from the duty of reconnoitring the ground, especially on the flanks, and artillery scouts or patrols (under energetic officers or non-commissioned officers) have become a necessity on the battlefield. The artillery, once in position, remains there, the losses being made good from the reserve, the ammunition train, and finally the drivers, while ammunition when exhausted can only be awaited. The battery is never relieved, but constantly strengthened and supported from the rear. Before occupying a position the ground must be carefully reconnoitred, and in selecting positions the principal condition is effective action, hence the target should be plainly visible; but more than that, a clear field of view is desirable because other targets may appear from time to time. This indicates that a line of heights is most suitable. Of course, in many cases some of the batteries will not be able to see the target, and when the enemy's artillery is superior a hidden position may be preferred; in these cases indirect fire must be used, but the problem of overpowering the enemy's artillery is thereby rendered very difficult. As to the distance from the enemy, it can only be stated "as near as possible," remembering that beyond 3200 yards shrapnel is not always effective, and observation of fire extremely difficult; moreover, the enemy's fire determines the inferior limit of a position. Nevertheless, *effect* is more important than *cover;* consequently, if artillery finds that its fire from a good covered position is not effective, it must enter the danger zone. The great masses accumulated on battlefields to-day limit the choice of position very much, and in most cases the problem will be less the selection of a position than making the best use of a given position.

The brigade commander rides over the ground, considers the available space, and with due regard to the targets to be taken under fire, decides what front will be occupied. The regimental and battalion commanders are then given their orders, and the latter indicate to the batteries their respective positions. The batteries then enter their position, keeping the roads as long as possible, and after that utilizing cover when practicable. On a line of heights the guns are placed in position close behind the crest, then moved up so that a man standing can just see the target. No battery opens fire until its guns are ready. In large masses it may be necessary to take up first a preparatory position under cover, so that, moved to the front, the batteries may open fire simultaneously, but this is rarely practicable. The direction of the fire is so arranged that brigade and regimental commanders merely indicate the target in general, while battalion commanders designate the special target for each battery and also decide on a change of targets; the ranging, selection of kind of firing, and the actual firing is left to the battery commanders. Changes of position are, in general, ordered only by the commander-in-chief, but in special cases the artillery must act on its own responsibility. In large masses this change of position takes place by echelons, portions of the line remaining in position and continuing the fire while others advance to the new position.

The attack of the infantry must be supported by the artillery in such wise that the former may overcome the enemy's infantry, consequently the artillery of the attack should be superior to the enemy's from the very first. This does not mean necessarily in numbers, because a smaller force by greater rapidity of movement into position and subsequent ranging may gain the upper hand of a large force. If a weaker artillery fears being overpowered it can await in a preparatory position the arrival of reinforcements, but this will not always be possible, because the circumstances may demand its coming into action at once. In this case the artillery endeavors to utilize the ground to the best advantage. In the attack on a prepared defensive front the entire artillery must be in position before opening fire. By superiority of fire is not meant the complete silencing of the enemy's artillery, but such an effect that, after the artillery duel, which first takes place, the enemy's artillery is no longer able to direct a destructive fire on the attacking infantry. As soon as the attacking infantry approaches too near the enemy the artillery must direct its fire on the ground beyond the objective, to prevent the advance of subdivisions from the rear. The principal duty of the artillery of the defense is to take the attacking infantry, even though it may have overcome by its fire the infantry of the defense, under such a hail of shrapnel as to cause its attack to break down. But in the beginning it will have to take up the artillery duel, and here it has the advantage of selecting and strengthening its positions. It will not do, however, to occupy its positions at the beginning, because if it should be forced to change it will lose all its advantages. Consequently, it takes up at first a preparatory position, until the direction of the attack becomes known, and this has the additional advantage of preventing the attacker from getting an insight into the defender's plans before the battle opens. The artillery of the defense, however, cannot devote all its attention to the attacker's artillery. Wherever the infantry of the attacker gains a strong foothold it must be taken under fire. As soon as the attacking infantry prepares for the final assault the entire situation changes, and the defender's artillery takes up its true rôle. The main effort is directed against the enemy's infantry, and his artillery is only kept occupied by a few guns. During the artillery duel the guns of the defense were kept under cover; now they must come out for their proper work. If the artillery of the defense is overpowered it may retire to be placed in position again during the infantry assault, but this will rarely be possible or effective. It is better to keep it in position, the men lying down for better protection, entering into action again at the decisive moment. Should the enemy's attack be successful, the batteries of the defense remain in position firing to the last, for the loss of the guns is no longer a disgrace on the battlefield, provided the situation demands it.

Every army will hereafter take into the field *batteries of position*, heavy batteries, for breaking down obstacles which the ordinary field ar-

TACTICS, NAVAL. The science of arranging combinations, groupings, movements, and methods of handling of ships and other naval weapons, and the art of carrying these plans into effect. Roughly speaking, tactics may be said to solve the question 'how' a certain operation may be performed; strategy to furnish the reason 'why' it is likely to be desirable. They are necessarily mutually dependent; tactics only provides for effecting conditions found desirable by strategy; and strategy is confined to operations which are tactically practicable. In its broad sense naval tactics includes the manipulation of all naval weapons—the movements of a ship or of a fleet, the methods of mounting and placing guns and of handling them, the placing of torpedo tubes and their handling, etc. In a narrower and more usual sense it is understood to mean the handling of a ship and her weapons or of several ships, leaving the tactics of the gun *per se* to be included in *gunnery*, and those of the torpedo to be studied under *torpedo tactics*.

Of the abstract principles of strategy the most important is to oppose to the enemy at the point of contact a superior force. This may mean more powerful ships, numerical superiority, or a better arrangement for attack and receiving attack. The first point must be secured by superior design; the vessel's guns must be more powerful, better mounted, better protected, or she must carry more of them; or her protection or speed must be superior. Numerical superiority where the opposing ships are equal in number and supposedly equal in power may be attained only by good manœuvring and is likely to be only temporary; but a clever tactician and strategist would be likely to reproduce the inequality whenever opportunity offered. The best disposition of the fleet for attacking and receiving attack must depend upon many circumstances; advantage should be taken of the strong points of your own vessels and the weaknesses of the enemy's. For instance, the better protected ships should seek close action, the others avoid it; ships having heavy bow and stern fire should seek action compelling bow and stern fighting if the enemy is particularly weak in bow and stern guns but relatively strong in broadside fire, etc.

The battle tactics of to-day resemble more nearly those of the galley period than those of the epoch of sail, because steam, like manual power, enables any sort of combination of ships to be made and kept with reasonable precision. And the development of signaling has added to the facility of effecting these combinations, though the most experienced naval officers believe that after a fleet action has begun the changes of formation should be simple and few in number.

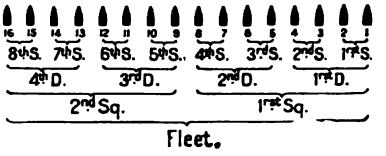


FIG. 1. FLEET IN LINE, NATURAL ORDER.
Showing numbers of section (S), division (D), and squadron (Sq.).

There are three principal formations, *line* (Fig. 1), *column* (Fig. 2), and *echelon* (Fig. 3). In England line is frequently called 'line abreast' and column styled 'line ahead.' In Figs. 1 and 2 a fleet of 16 ships is shown divided into two

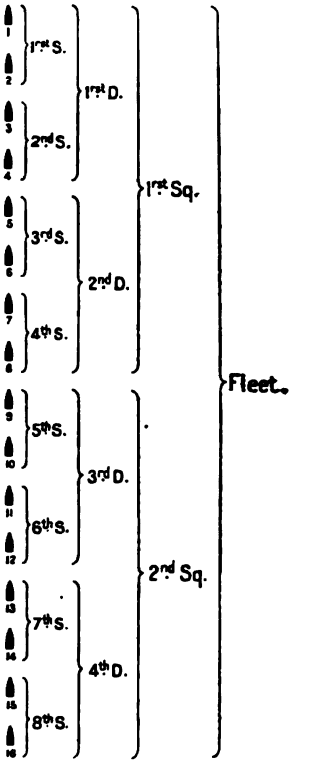


FIG. 2. FLEET IN COLUMN, NATURAL ORDER.
Showing numbers of sections (S), divisions (D), and squadrons (Sq.).

squadrons of eight ships each. If the fleet consisted of 12 ships it might be divided into three squadrons of four ships each, or two squadrons of six. In the various navies of the world the subdivisions of a fleet are different. Some have

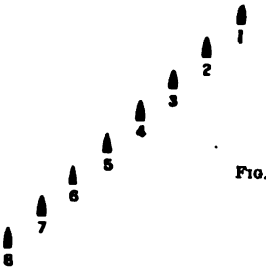


FIG. 3. SQUADRON IN ECHELON, NATURAL ORDER.

units of two, others of three. In the United States Navy a *fleet* consists of two or more *squadrons;* a *squadron*, of two to eight ships; a *division* is half of a squadron which consists of more than five ships; a *section* is a pair of ships



FIG. 4. SQUADRON IN INDENTED LINE, NATURAL ORDER.

forming part of a division or squadron. Vessels, sections, divisions, and squadrons are numbered from van to rear when in column and from right to left when in line. When vessel No. 1 is lead-

ing in column or is on the right when in line the fleet is said to be in *natural order;* if vessel No. 16 is leading or on the right the fleet is said to be in *inverted order.* Vessels not intended for the line of battle are separately formed and manœuvred and constitute the reserve and auxiliary

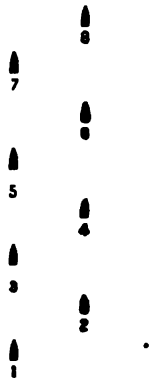


FIG. 5. SQUADRON IN INDENTED COLUMN, INVERTED ORDER.

squadrons, according to their character or the circumstances of the case. Vessels which have a distinct fighting value but are not fast enough or powerful enough to join the fighting line would form the reserve; supply ships, colliers, repair

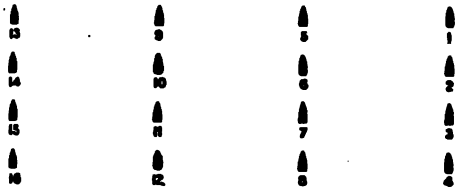


FIG. 6. FLEET IN LINE OF DIVISION COLUMNS, NATURAL ORDER.

ships, etc., would form the auxiliary squadron. The following terms are used:

About. A change of course of 180 degrees. *Advance.* Distance gained to the front in turning. *Alignment.* The direction of the line. *Arc of train or fire.* The angle through which guns may be trained or fired. *Column.* A formation in which vessels are in a line which is in the direction in which they are steering. *Double column* is a similar formation except that there are

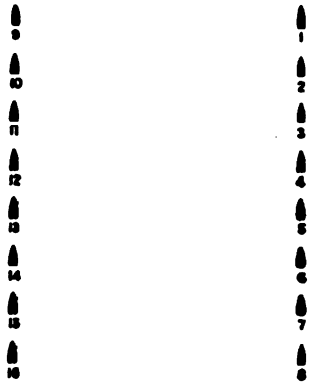


FIG. 7. FLEET IN DOUBLE COLUMN AT SQUADRON DISTANCE, OR LINE OF DOUBLE COLUMN.

two parallel lines. In *indented column* the even-numbered ships are moved slightly to one side instead of being directly in rear of the odd-num-

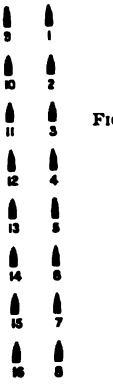


FIG. 8. FLEET IN CLOSE DOUBLE COLUMN.

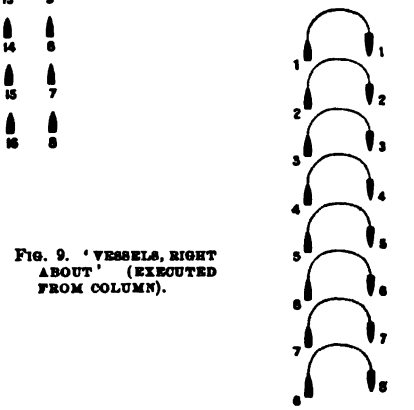


FIG. 9. 'VESSELS, RIGHT ABOUT' (EXECUTED FROM COLUMN).

bered ones. *Distance.* The linear distance (in yards) between the centres or foremasts of ships when in ordinary formation. *Half distance* is

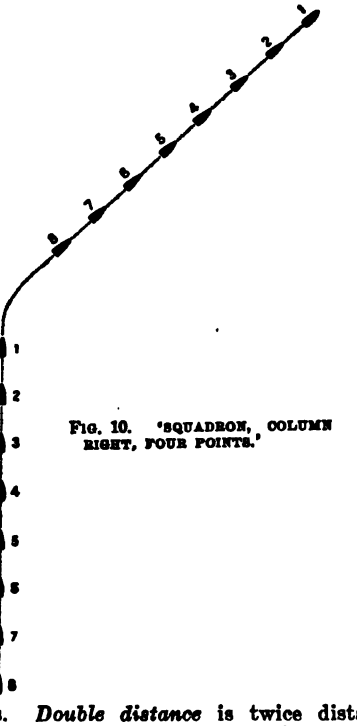


FIG. 10. 'SQUADRON, COLUMN RIGHT, FOUR POINTS.'

half this. *Double distance* is twice distance. *Echelon.* A formation in which the line of bearing of the ships makes an angle of about 45 de-

grees with the direction in which they are steering as in Fig. 3. *Evolution.* The combination of movements by which a fleet is changed from one formation to another. *Flank.* The sea to the

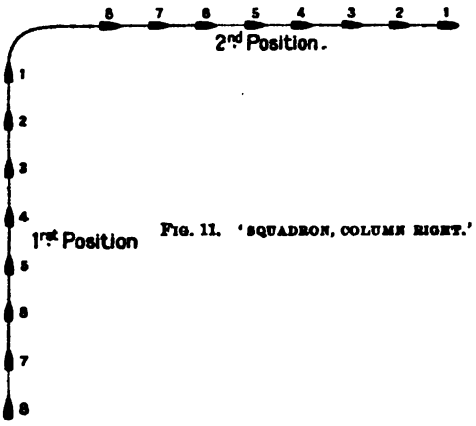


FIG. 11. 'SQUADRON, COLUMN RIGHT.'

right of the fleet is called the right flank; that to the left is called the left flank. *Formation.* The particular arrangement of the fleet. Simple formations are column, line,

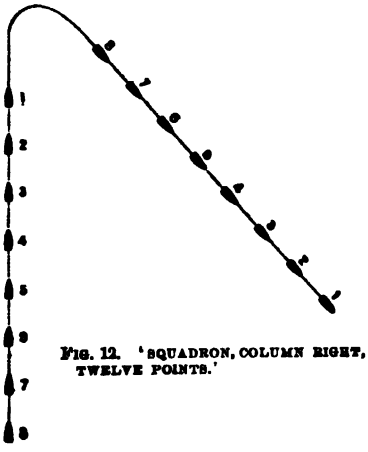


FIG. 12. 'SQUADRON, COLUMN RIGHT, TWELVE POINTS.'

echelon, etc. Compound formations are double column, line of division columns, etc. *Front.* The direction in which the fleet is steaming except when obliquing. The battle front is the

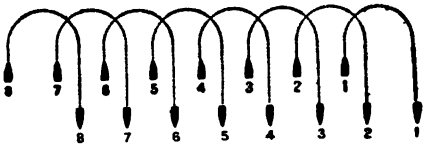


FIG. 13. 'VESSELS, RIGHT ABOUT' (EXECUTED FROM LINE).

direction of the enemy. *Guide.* The ship designated as the one upon which the formation is arranged for alignment and distance. *Interval.* The distance between divisions or squadrons when in compound formation. *Line.* A formation in which the line of bearing of the ships is at right angles to the direction in which they are steaming. *Line of bearing.* An imaginary line passsing through the centres or foremasts of ships when in a particular formation. In compound formations each part has its own line of bearing. *Movement.* One of the component

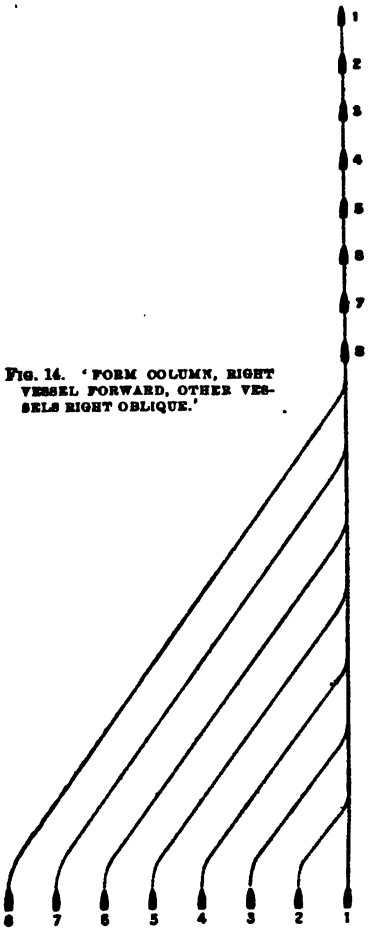


FIG. 14. 'FORM COLUMN, RIGHT VESSEL FORWARD, OTHER VESSELS RIGHT OBLIQUE.'

parts of an evolution. A movement is *simultaneous* when all ships execute it together, and *successive* when executed by each ship or group



FIG. 15. 'SQUADRON, COUNTER-MARCH.'

of ships in turn. *Oblique.* A change of course of less than 90 degrees. The ordinary oblique is three or four points. *Order.* The arrangement

of the fleet (see preceding pages). *Point.* One thirty-second of a circle or 11¼ degrees. *Rear.* The direction opposite to the front. *Speed. Standard* or *battle speed* is that designated for battle or

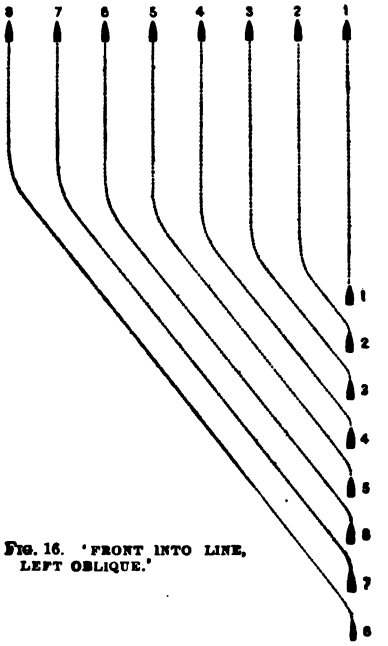


FIG. 16. 'FRONT INTO LINE, LEFT OBLIQUE.'

manœuvres. *Full speed* is a designated speed greater than standard; *half speed* is a designated speed less than standard; and *slow speed* is still less. *Tactical diameter.* The perpen-

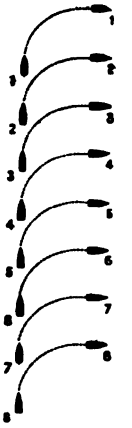


FIG. 17. 'VESSELS, RIGHT TURN.'
The manœuvre changes column to line in this instance.

dicular distance between the course at the beginning of a turn of 180 degrees and the course after the completion of the turn. *Transfer.* Dis-

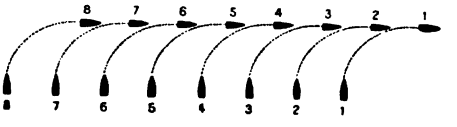


FIG. 18. 'VESSELS, RIGHT TURN.'
In this manœuvre line is changed to column.

tance gained to the right or left (i.e. toward the flank) in turning. *Turn.* A *turn* is a change of course of 90 degrees; a *half turn* is a change of 45 degrees. *Van.* The leading unit of a formation. *Wheel.* A movement in line in which the

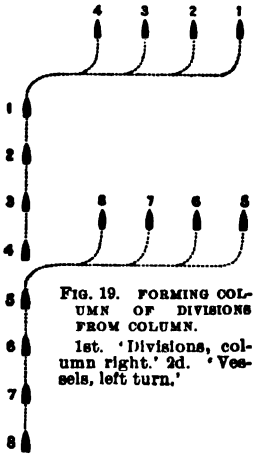


FIG. 19. FORMING COLUMN OF DIVISIONS FROM COLUMN.
1st. 'Divisions, column right.' 2d. 'Vessels, left turn.'

vessels preserve their relative positions but the line of bearing is revolved.

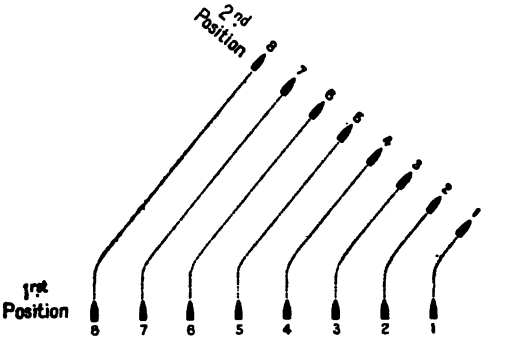


FIG. 20. 'SQUADRON, RIGHT WHEEL, FOUR POINTS.'
Executed similarly for any given number of points.

In performing evolutions there are two principal methods, by *rectangular movements* and by

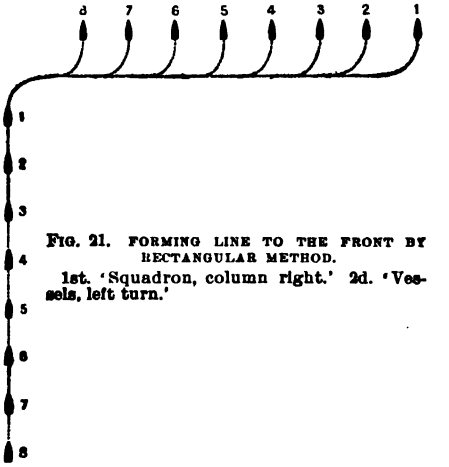


FIG. 21. FORMING LINE TO THE FRONT BY RECTANGULAR METHOD.
1st. 'Squadron, column right.' 2d. 'Vessels, left turn.'

direct or *oblique movements.* Certain evolutions also admit of movement by *isodrome* and others by *conversion* or *wheel.* The ease of movement

attainable with bodies of men is not possible with ships. There can be no turning with fixed pivots, because ships must continue in motion or they cannot be kept under control; nor are sudden halts possible, for a heavy ship moving at high speed cannot be stopped in a less distance than several times her length. These and other considerations have led to the general acceptance of certain rules.

First.—Movements during battle should be as simple as possible.

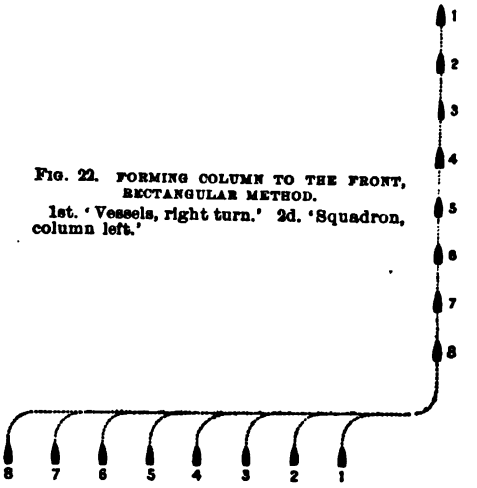


FIG. 22. FORMING COLUMN TO THE FRONT, RECTANGULAR METHOD.
1st. 'Vessels, right turn.' 2d. 'Squadron, column left.'

Second.—Changes in speed, particularly during evolutions, should be avoided as far as possible.

Third.—Evolutions should be performed by the method which requires the least time and the least space.

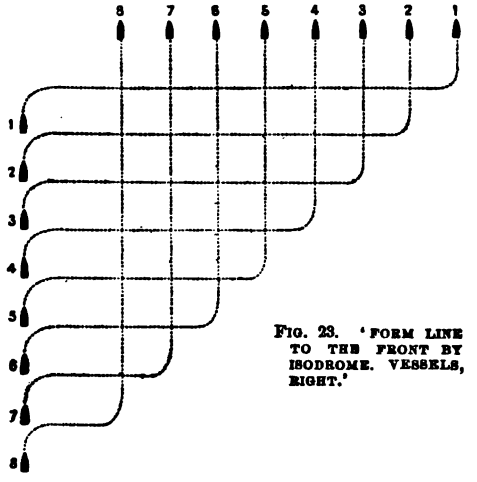


FIG. 23. 'FORM LINE TO THE FRONT BY ISODROME. VESSELS, RIGHT.'

Fourth.—Ships of like characteristics should be separately grouped as far as possible; this is particularly true as regards speed and hardly less so as regards power and arrangement of battery and armor.

Fifth.—When approaching the enemy and until in position to deliver attack the fleet must be kept concentrated and in condition to assume any desired formation.

The accompanying figures show the various formations commonly used and the method of passing from one to the other. With the exceptions of Figs. 1, 2, 6, and 7, the plans show the movements of a squadron of eight ships; the evolutions would be similar for a fleet of sixteen ships.

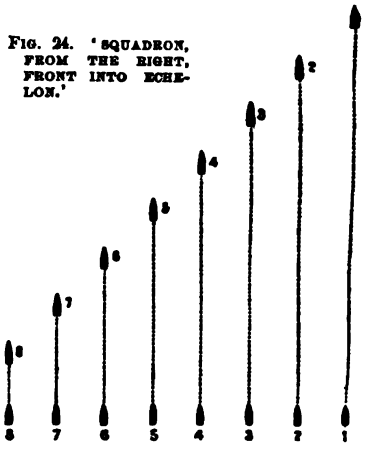


FIG. 24. 'SQUADRON, FROM THE RIGHT, FRONT INTO ECHELON.'

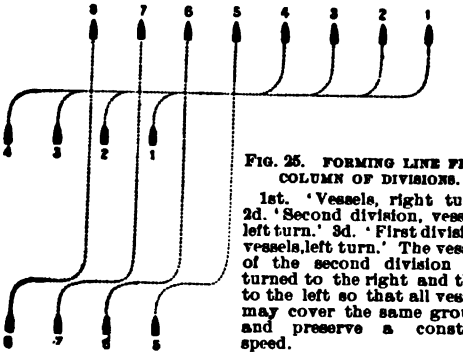


FIG. 25. FORMING LINE FROM COLUMN OF DIVISIONS.
1st. 'Vessels, right turn.' 2d. 'Second division, vessels, left turn.' 3d. 'First division, vessels, left turn.' The vessels of the second division are turned to the right and then to the left so that all vessels may cover the same ground and preserve a constant speed.

BIBLIOGRAPHY. For further information in regard to naval tactics and strategy, see: Captain W. B. Hoff, U. S. N., *Examples, Conclusions, and Maxims of Modern Naval Tactics* (Washington, 1884); Captain F. A. Parker, U. S. N., *Steam Fleet Tactics* (New York, 1863); Admiral Sir G. Elliot, R. N., *A Treatise on Future Naval Battles, etc.* (London, 1885); Saint Farret, French Navy, *Etudes comparatives de tactique navale* (Paris, 1883); also numerous articles in the *Proceedings of the United States Naval Institute*, and in the *Proceedings of the Royal United Service Institution* (London).

TACUBAYA, tȧ'kōō-bä'yȧ. A Mexican town in the Federal District, the head of the prefecture of that name, three miles southwest of the City of Mexico (Map: Mexico, C 9). It is a fashionable suburb and is famous for its gaming establishments and handsome villas. It is pleasantly situated partly on a plain and partly on a hillside which is crowned by an ancient episcopal palace, now used as one of the national observatories. The population, in 1895, was 15,259.

TACUL'LI (Carriers). A tribe of Athapascan stock (q.v.) residing about Stuart and McLeod lakes, on the headwaters of the Peace and

Fraser rivers, in Central British Columbia. Their social organization was based on the clan system. Their canoes were neatly made from birch bark; they hunted during the winter season on snowshoes; and their women spun yarn from the hair of the mountain goat and also made a coarse pottery. They are all now Christianized through the efforts of French Catholic missionaries, who devised for their language a syllabic alphabet in which nearly all have learned to read and write, although they have no schools. They are gathered on small reservations, and they numbered about 750 in 1903.

The Déné syllabary, as it is called, is the invention of the Rev. Adrien Morice, who began his mission work among the Athapascan tribes of British Columbia in 1880. It consists of thirty characters, which by inversion of position and the use of accompanying dots or dashes can be made to indicate nearly two hundred distinct syllables or sounds common to the Taculli, Chilcotin, and other neighboring cognate languages. Its printed literature consists of text-books, religious works, and the *Carrier Review*, a monthly journal published by Father Morice at Stuart Lake.

TADEMA, tā'dĕ-mȧ, ALMA-. An English painter. See ALMA-TADEMA.

TAD'MOR. Another name for Palmyra (q.v.).

TADPOLE (ME. *tadpolle, taddepol*, from *tadde, tade*, toad, AS. *tādige, tādie*, toad + *polle*, head, poll). The larval form of anurous amphibians. For its metamorphosis see TOAD.

TAEL, tāl (Port. *tael*, from Malay *taïl, tahil*, weight, tael, from Hind. *tōla*, weight, from Skt. *tulā*, balance). The name commonly given to the Chinese *liang*, a money of account in China, and worth from .724 to .806 of an American dollar, but varying in value in different parts of the Empire.

TÆNIA. An animal parasite developed in the intestines of man and some animals. See TAPEWORM.

TÆ'NIOP'TERIS (Neo-Lat., from Gk. *ταινία, tainia*, band, ribbon + *πτερίς, pteris*, fern). A genus of fossil ferns found in rocks of late Paleozoic and Triassic age. They have long leathery fronds of linguate form with entire margins, a strong central rib, and numerous closely parallel veins that run at right angles from the midrib to the margins. The fruiting frond is not known. See FERN.

TAENSA, tä-ĕn'sȧ, or **TENSA.** An historic American Indian tribe living, when first known to the French, about the year 1700, in seven villages between the Tensas River and the Mississippi, in the present Tensas Parish of Louisiana, about 20 miles from Natchez. Like the neighboring Natchez (q.v.), with whom they seem to have been closely connected, they were sun-worshipers and kept a sacred fire constantly burning in a temple. A part of the tribe, driven out by the Chickasaw (q.v.), was afterwards colonized by the French on the west side of Mobile Bay, in the neighborhood of Mobile, Ala., where the local name still remains. The settlement contained one hundred cabins about 1750. At a later period they removed higher up the Alabama River near the site of the present Tensaw. They were probably merged finally into the Choctaw or the Creek Confederacy. Nothing is known positively of their language, the *Grammaire et vocabulaire de la langue Taensa* by Haumonte, published in Paris in 1882, having been proved to be a transparent fraud. According to contemporary French testimony, however, the language was cognate with that of the Natchez.

TAFFETA (OF., Fr. *taffetas*, from Pers. *tāftah*, taffeta, woven, p.p. of *tāftan*, to weave). A term of somewhat general application in silk manufacture. It was formerly applied to all plain silks simply woven by regular alternations of the warp and filling (see WEAVING), and is by some writers supposed to be the first kind of silk-weaving known even to the Chinese, from whom it came to us. Modifications have, however, been introduced, by varying the quality of the warp and filling, and by the substitution of various colors for the single one of the original taffeta. It has therefore become a sort of generic term for *plain silk*, and other silk fabrics, and even for some combinations of silk, wool, and other materials.

TAFFY. See NATIONAL NICKNAMES.

TAFILET'. A large oasis in the northwestern part of the Sahara, belonging to Morocco, and situated at the southern base of the Atlas Range, 200 miles south of Fez (Map: Africa, D 1). Area, about 500 square miles. The chief product is dates, but the oasis is mainly important as one of the principal trading stations between Morocco and the Sudan. The oasis includes about 150 towns and villages, the largest and the most important commercial centre being Abuam. Population of the oasis, about 100,000.

TAFT, LORADO (1860—). An American sculptor, born at Elmwood, Ill. He was educated at the University of Illinois (Champaign, Ill.) and at the Ecole des Beaux-Arts in Paris (1880-83). In 1886 he became an instructor at the Art Institute of Chicago, and in 1893 a lecturer in the university extension department of the Chicago University. His works include statues of Schuyler Colfax (Indianapolis) and of General Grant (Fort Leavenworth, Kan.), and the sculptural decorations for the Horticultural Building of the World's Columbian Exhibition (1893).

TAFT, WILLIAM HOWARD (1857—). An American jurist and administrator, son of Alphonso Taft, born in Cincinnati. He graduated at Yale in 1878, and at the Law School of Cincinnati College two years later. In 1881-82 he was prosecutor of Hamilton County, and later for a time was a collector of internal revenue. From 1887 to 1890 he was a judge of the Superior Court of Ohio, was Solicitor-General of the United States in 1890-92, and was a judge of the United States Circuit Court (sixth circuit) from 1892 to 1900, when at the request of President McKinley he resigned to become chairman of the commission appointed to establish civil government in the Philippines. The following year, on June 5th, he was appointed the first civil Governor of the islands. In 1903 Taft resigned this position to accept the appointment of Secretary of War, as successor of Elihu Root. Consult: *American Monthly Review of Reviews*, vol. xxiv. (1901); and *The Outlook*, vols. lxiv., lxix., and lxx. See PHILIPPINE ISLANDS.

TAGABALOYE, tä'gä-bä-lō'yĕ. A tribe of eastern Mindanao. See PHILIPPINE ISLANDS.

TAGABAWA, tä'gä-bä'wä. A mixed people in Davao Province, southern Mindanao. See PHILIPPINE ISLANDS.

TAGABELIE, tä'gä-bā'lē-ā. A wild Malay people in southern Mindanao. See PHILIPPINE ISLANDS.

TAGAL, tä-gäl', **TAGALA**, tä-gä'lä, **TAGALOG**, or **TAGALO**, tä-gä'lō. A Malay people of the Philippine Islands, having an alphabet and considerable culture in pre-Spanish times. They inhabit many provinces in middle Luzon, and form with the Ilocano (q.v.) and Visaya (q.v.) the bulk of the Filipino population. Their language and culture have spread among the other tribes. See PHILIPPINE ISLANDS; PHILIPPINE LANGUAGES.

TAGANROG, täg'an-rôg'. A seaport in the Province of the Don Cossacks, Russia, on the northern coast of the Sea of Azov, 18 miles northwest of the mouth of the Don (Map: Russia, E 5). The harbor has now become very shallow and the trade of the town is decreasing. The principal export is grain. The total trade in 1899 was about $1,800,000. The manufacturing industries are well developed and the principal products are flour and tobacco. Population, in 1900, 60,678.

TAGBÁNUA, täg-bä'nōō-ä. A Malay-Negrito people in Palawan Island and the Calamianes Archipelago. See PHILIPPINE ISLANDS.

TAGHKANIC (tä-kä'nĭk) **MOUNTAINS.** See TACONIC MOUNTAINS.

TAGLIACOZZO, täl'yä-kôt'sô. A town in the Province of Aquila, Italy, 24 miles east by north of Tivoli, near which, on August 23, 1268, Charles of Anjou decisively defeated Conradin of Swabia (q.v.), the last of the Hohenstaufen.

TAGLIONI, tä-lyō'nē. An Italian family of ballet-dancers, of whom FILIPPO (1777-1871) was the first to attain prominence. He was born in Milan, became ballet-master, successively, at Stockholm, Cassel, Vienna, and Warsaw, and composed many ballets, of which *Sylphide* is the most noteworthy. His daughter MARIA (1804-84), born at Stockholm, was connected successively from 1822 with the opera houses in Vienna, Paris, and Berlin, appeared with enormous success also on all the other principal stages of Europe, and in 1832 married Count Gilbert de Voisins. After her last appearance in London, 1847, she retired to Italy. Her brother PAUL (1808-84), born in Vienna, performed successfully at Stuttgart, Vienna, and Paris, and in 1829 secured a permanent engagement in Berlin, where he was appointed ballet-director of the Royal Theatre in 1869. As a composer of ballets he earned world-wide reputation, especially with *Flick und Flock* and *Fantasca*. His daughter MARIA (1833-91), born in Berlin, made her début (1847) in London, was for some time a great favorite at the Royal Theatre in Berlin, then at San Carlo in Naples, and married Prince Joseph Windischgrätz in 1866.

TAGOSATI, or **TOGASASTI**. A shrub (*Cytisus proleferus albus*) of the natural order Leguminosæ. It is a native of the Madeira and the Canary islands, where it is an important fodder plant and from whence it has been introduced into southern Australia. It is well adapted to dry soils and climates, but cannot be depended upon where there is danger of frost.

TAGUAN (East Indian name). A large Old World flying squirrel (*Pteromys petaurista*). See FLYING PHALANGER.

TA'GUS (Sp. *Tajo*, Port. *Tejo*). The largest river of the Iberian Peninsula. It rises in the Sierra de Albarracin on the western boundary of the Spanish Province of Teruel, 88 miles east of Madrid, and flows in a general west-southwest direction through Spain and Portugal, emptying into the Atlantic Ocean shortly after passing the city of Lisbon (Map: Spain, D 2). Its length is 565 miles. In its upper course it traverses the arid plains of New Castile, but at Toledo it plunges through a wild gorge between high granite cliffs. Farther west it again flows through sandy, level country, bordered by oak forests. About 40 miles above Lisbon it divides into two branches, which inclose a low, marshy island, and which reunite in the Bay of Lisbon, an expansion of the river about 18 miles long and 5 miles wide. This bay is deep and sheltered, and forms one of the best harbors in the world. At Lisbon the river again contracts, and enters the ocean through a narrow and deep channel, which, but for the bar at the mouth, would be accessible for the largest ships. The river is regularly navigated 105 miles to Abrantes, but in Spanish territory navigation is impeded by rapids.