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THE ENCYCLOPÆDIA BRITANNICA

A DICTIONARY OF ARTS, SCIENCES, LITERATURE AND GENERAL INFORMATION

ELEVENTH EDITION

VOLUME VI SLICE VII

Columbus to Condottiere

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COLUMBUS, a city and the county-seat of Muscogee county, Georgia, U.S.A., on the E. bank and at the head of navigation of the Chattahoochee river, about 100 m. S.S.W. of Atlanta. Pop. (1890) 17,303; (1900) 17,614, of whom 7267 were negroes; (1910, census) 20,554. There is also a considerable suburban population. Columbus is served by the Southern, the Central of Georgia, and the Seaboard Air Line railways, and three steamboat lines afford communication with Apalachicola, Florida. The city has a public library. A fall in the river of 115 ft. within a mile of the city furnishes a valuable water-power, which has been utilized for public and private enterprises. The most important industry is the manufacture of cotton goods; there are also cotton compresses, iron works, flour and woollen mills, wood-working establishments, &c. The value of the city's factory products increased from $5,061,485 in 1900 to $7,079,702 in 1905, or 39.9%; of the total value in 1905, $2,759,081, or 39%, was the value of the cotton goods manufactured. There are many large factories just outside the city limits. Columbus was one of the first cities in the United States to maintain, at public expense, a system of trade schools. It has a large wholesale and retail trade. The city was founded in 1827 and was incorporated in 1828. In the latter year Mirabeau Buonaparte Lamar (1798-1859) established here the Columbus *Independent*, a State's-Rights newspaper. For the first twenty years the city's leading industry was trade in cotton. As this trade was diverted by the railways to Savannah, the water-power was developed and manufactories were established. During the Civil War the city ranked next to Richmond in the manufacture of supplies for the Confederate army. On the 16th of April 1865 it was captured by a Union force under General James Harrison Wilson (b. 1837); 1200 Confederates were taken prisoners; large quantities of arms and stores were seized, and the principal manufactories and much other property were destroyed.

COLUMBUS, a city and the county-seat of Bartholomew county, Indiana, U.S.A., situated on the E. fork of White river, a little S. of the centre of the state. Pop. (1890) 6719; (1900) 8130, of whom 313 were foreign-born and 224 were of negro descent (1910 census) 8813. In 1900 the centre of population of the United States was 5 m. S.E. of Columbus. The city is served by the Cleveland, Cincinnati, Chicago & St Louis, and the Pittsburg, Cincinnati, Chicago & St Louis railways, and is connected with Indianapolis and with Louisville, Ky., by an electric interurban line. Columbus is situated in a fine farming region, and has extensive tanneries, threshing-machine and traction and automobile engine works, structural iron works, tool and machine shops, canneries and furniture factories. In 1905 the value of the city's factory product was $2,983,160, being 28.4% more than in 1900. The water-supply system and electric-lighting plant are owned and operated by the city.

COLUMBUS, a city and the county-seat of Lowndes county, Mississippi, U.S.A., on the E. bank of the Tombigbee river, at the head of steam navigation, 150. m. S.E. of Memphis,

Tennessee. Pop. (1890) 4559; (1900) 6484 (3366 negroes); (1910) 8988. It is served by the Mobile & Ohio and the Southern railways, and by passenger and freight steamboat lines. It has cotton and knitting mills, cotton-seed oil factories, machine shops, and wagon, stove, plough and fertilizer factories; and is a market and jobbing centre for a fertile agricultural region. It has a public library, and is the seat of the Mississippi Industrial Institute and College (1885) for women, the first state college for women—the successor of the Columbus Female Institute (1848)—of Franklin Academy (1821), and of the Union Academy (1873) for negroes. The site was first settled about 1818; the city was incorporated in 1821, and in 1830 it became the county-seat of the newly formed Lowndes county. During the Civil War the legislature met here in 1863 and 1865, and in the former year Governor Charles Clark (1810-1877) was inaugurated here.

COLUMBUS, a city, a port of entry, the capital of Ohio, U.S.A., and the county-seat of Franklin county, at the confluence of the Scioto and Olentangy rivers, near the geographical centre of the state, 120 m. N.E. of Cincinnati, and 138 m. S.S.W. of Cleveland. Pop. (1890) 88,150; (1900) 125,560, of whom 12,328 were foreign-born and 8201 were negroes; (1910) 181,511. Columbus is an important railway centre and is served by the Cleveland, Cincinnati, Chicago & St. Louis, the Pittsburg, Cincinnati, Chicago & St Louis (Pennsylvania system), the Baltimore & Ohio, the Ohio Central, the Norfolk & Western, the Hocking Valley, and the Cleveland, Akron & Columbus (Pennsylvania system) railways, and by nine interurban electric lines. It occupies a land area of about 17 sq. m., the principal portion being along the east side of the Scioto in the midst of an extensive plain. High Street, the principal business thoroughfare, is 100 ft. wide, and Broad Street, on which are many of the finest residences, is 120 ft. wide, has four rows of trees, a roadway for heavy vehicles in the middle, and a driveway for carriages on either side.

The principal building is the state capitol (completed in 1857) in a square of ten acres at the intersection of High and Broad streets. It is built in the simple Doric style, of grey limestone taken from a quarry owned by the state, near the city; is 304 ft. long and 184 ft. wide, and has a rotunda 158 ft. high, on the walls of which are the original painting, by William Henry Powell (1823-1879), of O. H. Perry’s victory on Lake Erie, and portraits of most of the governors of Ohio. Other prominent structures are the U.S. government and the judiciary buildings, the latter connected with the capitol by a stone terrace, the city hall, the county court house, the union station, the board of trade, the soldiers’ memorial hall (with a seating capacity of about 4500), and several office buildings. The city is a favourite meeting-place for conventions. Among the state institutions in Columbus are the university (see below), the penitentiary, a state hospital for the insane, the state school for the blind, and the state institutions for the education of the deaf and dumb and for feeble-minded youth. In the capitol grounds are monuments to the memory of Ulysses S. Grant, Rutherford B. Hayes, James A. Garfield, William T. Sherman, Philip H. Sheridan, Salmon P. Chase, and Edwin M. Stanton, and a beautiful memorial arch (with sculpture by H. A. M‘Neil) to William McKinley.

The city has several parks, including the Franklin of 90 acres, the Goodale of 44 acres, and the Schiller of 24 acres, besides the Olentangy, a well-equipped amusement resort on the banks of the river from which it is named, the Indianola, another amusement resort, and the United States military post and recruiting station, which occupies 80 acres laid out like a park. The state fair grounds of 115 acres adjoin the city, and there is also a beautiful cemetery of 220 acres.

The Ohio State University (non-sectarian and co-educational), opened as the Ohio Agricultural and Mechanical College in 1873, and reorganized under its present name in 1878, is 3 m. north of the capitol. It includes colleges of arts, philosophy and science, of education (for teachers), of engineering, of law, of pharmacy, of agriculture and domestic science, and of veterinary medicine. It occupies a campus of 110 acres, has an adjoining farm of 325 acres, and 18 buildings devoted to instruction, 2 dormitories, and a library containing (1906) 67,709 volumes, besides excellent museums of geology, zoology, botany and archaeology and history, the last being owned jointly by the university and by the state archaeological and historical society. In 1908 the faculty numbered 175, and the students 2277. The institution owed its origin to federal land grants; it is maintained by the state, the United States, and by small fees paid by the students; tuition is free in all colleges except

the college of law. The government of the university is vested in a board of trustees appointed by the governor of the state for a term of seven years. The first president of the institution (from 1873 to 1881) was the distinguished geologist, Edward Orton (1829-1899), who was professor of geology from 1873 to 1899.

Other institutions of learning are the Capital University and Evangelical Lutheran Theological Seminary (Theological Seminary opened in 1830; college opened as an academy in 1850), with buildings just east of the city limits; Starling Ohio Medical College, a law school, a dental school and an art institute. Besides the university library, there is the Ohio state library occupying a room in the capitol and containing in 1908 126,000 volumes, including a “travelling library” of about 36,000 volumes, from which various organizations in different parts of the state may borrow books; the law library of the supreme court of Ohio, containing complete sets of English, Scottish, Irish, Canadian, United States and state reports, statutes and digests; the public school library of about 68,000 volumes, and the public library (of about 55,000), which is housed in a marble and granite building completed in 1906.

Columbus is near the Ohio coal and iron-fields, and has an extensive trade in coal, but its largest industrial interests are in manufactures, among which the more important are foundry and machine-shop products (1905 value, $6,259,579); boots and shoes (1905 value, $5,425,087, being more than one-sixtieth of the total product value of the boot and shoe industry in the United States, and being an increase from $359,000 in 1890); patent medicines and compounds (1905 value, $3,214,096); carriages and wagons (1905 value, $2,197,960); malt liquors (1905 value, $2,133,955); iron and steel; regalia and society emblems; steam-railway cars, construction and repairing; and oleo-margarine. In 1905 the city’s factory products were valued at $40,435,531, an increase of 16.4% in five years. Immediately outside the city limits in 1905 were various large and important manufactories, including railway shops, foundries, slaughter-houses, ice factories and brick-yards. In Columbus there is a large market for imported horses. Several large quarries also are adjacent to the city.

The waterworks are owned by the municipality. In 1904-1905 the city built on the Scioto river a concrete storage dam, having a capacity of 5,000,000,000 gallons, and in 1908 it completed the construction of enormous works for filtering and softening the water-supply, and of works for purifying the flow of sewage—the two costing nearly $5,000,000. The filtering works include 6 lime saturators, 2 mixing or softening tanks, 6 settling basins, 10 mechanical filters and 2 clear-water reservoirs. A large municipal electric-lighting plant was completed in 1908.

The first permanent settlement within the present limits of the city was established in 1797 on the west bank of the Scioto, was named Franklinton, and in 1803 was made the county-seat. In 1810 four citizens of Franklinton formed an association to secure the location of the capital on the higher ground of the east bank; in 1812 they were successful and the place was laid out while still a forest. Four years later, when the legislature held its first session here, the settlement was incorporated as the Borough of Columbus. In 1824 the county-seat was removed here from Franklinton; in 1831 the Columbus branch of the Ohio Canal was completed; in 1834 the borough was made a city; by the close of the same decade the National Road extending from Wheeling to Indianapolis and passing through Columbus was completed; in 1871 most of Franklinton, which was never incorporated, was annexed, and several other annexations followed.

See J. H. Studer, *Columbus, Ohio; its History and Resources* (Columbus, 1873); A. E. Lee, *History of the City of Columbus, Ohio* (New York, 1892).

COLUMELLA, LUCIUS JUNIUS MODERATUS, of Gades, writer on agriculture, contemporary of Seneca the philosopher, flourished about the middle of the 1st century A.D. His extant works treat, with great fulness and in a diffuse but not inelegant style which well represents the silver age, of the cultivation of all kinds of corn and garden vegetables, trees, flowers, the vine, the olive and other fruits, and of the rearing of cattle, birds, fishes and bees. They consist of the twelve books of the *De re rustica* (the tenth, which treats of gardening, being in dactylic hexameters in imitation of Virgil), and of a book *De arboribus*, the second book of an earlier and less elaborate work on the same subject.

The best complete edition is by J. G. Schneider (1794). Of a new edition by K. J. Lundström, the tenth book appeared in 1902 and *De arboribus* in 1897. There are English translations by R. Bradley (1725), and anonymous (1745); and treatises, *De Columellae vita et scriptis*, by V. Barberet (1887), and G. R. Becher (1897), a compact dissertation with notes and references to authorities.

COLUMN (Lat. *columna*), in architecture, a vertical support consisting of capital, shaft and base, used to carry a horizontal beam or an arch. The earliest example in wood (2684 B.C.) was that found at Kahun in Egypt by Professor Flinders Petrie, which was fluted and stood on a raised base, and in stone the octagonal shafts of the early temple at Deir-el-Bahri (c. 2850). In the tombs at Beni Hasan (2723 B.C.) are columns of two kinds, the octagonal or polygonal shaft, and the reed or lotus column, the horizontal section of which is a quatrefoil. This became later the favourite type, but it was made circular on plan. In all these examples the column rests on a stone base. (See also CAPITAL and ORDER.)

The column was employed in Assyria in small structures only, such as pavilions or porticoes. In Persia the column, employed to carry timber superstructures only, was very lofty, being sometimes 12 diameters high; the shaft was fluted, the number of flutes varying from 30 to 52.

The earliest example of the Greek column is that represented in the temple fresco at Cnossus (c. 1600 B.C.), of which portions have been found. The columns were in cypress wood raised on a stone base and tapered downwards.[1] The same, though to a less degree, is found in the stone semi-detached columns which flank the doorway of the Tomb of Agamemnon at Mycenae; the shafts of these columns were carved with the chevron design.

The earliest Greek columns in stone as isolated features are those of the Temple of Apollo at Syracuse (early 7th century B.C.) the shafts of which were monoliths, but as a rule the Greek columns were all built of drums, sometimes as many as ten or twelve. There was no base to the Doric column, but the shafts were fluted, 20 flutes being the usual number. In the Archaic Temple of Diana at Ephesus there were 52 flutes. In the later examples of the Ionic order the shaft had 24 flutes. In the Roman temples the shafts were very often monoliths.

Columns were occasionally used as supports for figures or other features. The Naxian column at Delphi of the Ionic order carried a sphinx. The Romans employed columns in various ways: the Trajan and the Antonine columns carried figures of the two emperors; the columna rostrata (260 B.C.) in the Forum was decorated with the beaks of ships and was a votive column, the miliaria column marked the centre of Rome from which all distances were measured. In the same way the column in the Place Vendôme in Paris carries a statue of Napoleon I.; the monument of the Fire of London, a finial with flames sculptured on it; the duke of York's column (London), a statue of the duke of York.

With the exception of the Cretan and Mycenaean, all the shafts of the classic orders tapered from the bottom upwards, and about one-third up the column had an increment, known as the *entasis*, to correct an optical illusion which makes tapering shafts look concave; the proportions of diameter to height varied with the order employed. Thus, broadly speaking, a Roman Doric column will be eight, a Roman Ionic nine, a Corinthian ten diameters in height. Except in rare cases, the columns of the Romanesque and Gothic styles were of equal diameter at top and bottom, and had no definite dimensions as regards diameter and height. They were also grouped together round piers which are known as clustered piers. When of exceptional size, as in Gloucester and Durham cathedrals, Waltham Abbey and Tewkesbury, they are generally called "pillars," which was apparently the medieval term for column. The word *columna*, employed by Vitruvius, was introduced into England by the Italian writers of the Revival.

In the Renaissance period columns were frequently banded, the bands being concentric with the column as in France, and occasionally richly carved as in Philibert De L'Orme's work at the Tuileries. In England Inigo Jones introduced similar features, but with square blocks sometimes rusticated, a custom lately revived in England, but of which there are few examples either in Italy or Spain.

The word “column” is used, by analogy with architecture, for any upright body or mass, in chemistry, anatomy, typography, &c.

(R. P. S.)

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1 The tree-trunk used as a column was inverted to retain the sap; hence the shape.

COLURE (from Gr. κόλος, shortened, and οὐρά, tail), in astronomy, either of the two principal meridians of the celestial sphere, one of which passes through the poles and the two solstices, the other through the poles and the two equinoxes; hence designated as *solstitial colure* and *equinoxial colure*, respectively.

COLUTHUS, or Colluthus, of Lycopolis in the Egyptian Thebaid, Greek epic poet, flourished during the reign of Anastasius I. (491-518). According to Suidas, he was the author of *Calydoniaca* (probably an account of the Calydonian boar hunt), *Persica* (an account of the Persian wars), and *Encomia* (laudatory poems). These are all lost, but his poem in some 400 hexameters on *The Rape of Helen* (Ἁρπαγὴ Ἑλένης) is still extant, having been discovered by Cardinal Bessarion in Calabria. The poem is dull and tasteless, devoid of imagination, a poor imitation of Homer, and has little to recommend it except its harmonious versification, based upon the technical rules of Nonnus. It related the history of Paris and Helen from the wedding of Peleus and Thetis down to the elopement and arrival at Troy.

The best editions are by Van Lennep (1747), G. F. Schäfer (1825), E. Abel (1880).

COLVILLE, JOHN (c. 1540-1605), Scottish divine and author, was the son of Robert Colville of Cleish, in the county of Kinross. Educated at St Andrews University, he became a Presbyterian minister, but occupied himself chiefly with political intrigue, sending secret information to the English government concerning Scottish affairs. He joined the party of the earl of Gowrie, and took part in the Raid of Ruthven in 1582. In 1587 he for a short time occupied a seat on the judicial bench, and was commissioner for Stirling in the Scottish parliament. In December 1591 he was implicated in the earl of Bothwell’s attack on Holyrood Palace, and was outlawed with the earl. He retired abroad, and is said to have joined the Roman Church. He died in Paris in 1605. Colville was the author of several works, including an *Oratio Funebris* on Queen Elizabeth, and some political and religious controversial essays. He is said to be the author also of *The Historie and Life of King James the Sext* (edited by T. Thompson for the Bannatyne Club, Edinburgh, 1825).

Colville’s *Original Letters*, 1582-1603, published by the Bannatyne Club in 1858, contains a biographical memoir by the editor, David Laing.

COLVIN, JOHN RUSSELL (1807-1857), lieutenant-governor of the North-West Provinces of India during the mutiny of 1857, belonged to an Anglo-Indian family of Scottish descent, and was born in Calcutta on the 29th of May 1807. Passing through Haileybury he entered the service of the East India Company in 1826. In 1836 he became private secretary to Lord Auckland, and his influence over the viceroy has been held partly responsible for the first Afghan war of 1837; but it has since been shown that Lord Auckland’s policy was dictated by

the secret committee of the company at home. In 1853 Mr Colvin was appointed lieutenant-governor of the North-West Provinces by Lord Dalhousie. On the outbreak of the mutiny in 1857 he had with him at Agra only a weak British regiment and a native battery, too small a force to make head against the mutineers; and a proclamation which he issued to the natives was censured at the time for its clemency, but it followed the same lines as those adopted by Sir Henry Lawrence and subsequently followed by Lord Canning. Exhausted by anxiety and misrepresentation he died on the 9th of September, his death shortly preceding the fall of Delhi.

His son, Sir Auckland Colvin (1838-1908), followed him in a distinguished career in the same service, from 1858 to 1879. He was comptroller-general in Egypt (1880 to 1882), and financial adviser to the khedive (1883 to 1887), and from 1883 till 1892 was back again in India, first as financial member of council, and then, from 1887, as lieutenant-governor of the North-West Provinces and Oudh. He was created K.C.M.G. in 1881, and K.C.S.I. in 1892, when he retired. He published *The Making of Modern Egypt* in 1906, and a biography of his father, in the "Rulers of India" series, in 1895. He died at Surbiton on the 24th of March 1908.

COLVIN, SIDNEY (1845-), English literary and art critic, was born at Norwood, London, on the 18th of June 1845. A scholar of Trinity College, Cambridge, he became a fellow of his college in 1868. In 1873 he was Slade professor of fine art, and was appointed in the next year to the directorship of the Fitzwilliam Museum. In 1884 he removed to London on his appointment as keeper of prints and drawings in the British Museum. His chief publications are lives of Landor (1881) and Keats (1887), in the English Men of Letters series; the Edinburgh edition of R. L. Stevenson's works (1894-1897); editions of the letters of Keats (1887), and of the *Vailima Letters* (1899), which R. L. Stevenson chiefly addressed to him; *A Florentine Picture-Chronicle* (1898), and *Early History of Engraving in England* (1905). But in the field both of art and of literature, Mr Colvin's fine taste, wide knowledge and high ideals made his authority and influence extend far beyond his published work.

COLWYN BAY, a watering-place of Denbighshire, N. Wales, on the Irish Sea, 40½ m. from Chester by the London & North-Western railway. Pop. of urban district of Colwyn Bay and Colwyn (1901) 8689. Colwyn Bay has become a favourite bathing-place, being near to, and cheaper than, the fashionable Llandudno, and being a centre for picturesque excursions. Near it is Llaneilian village, famous for its "cursing well" (St Eilian's, perhaps Aelianus'). The stream Colwyn joins the Gwynnant. The name Colwyn is that of lords of Ardudwy; a Lord Colwyn of Ardudwy, in the 10th century, is believed to have repaired Harlech castle, and is considered the founder of one of the fifteen tribes of North Wales. Nant Colwyn is on the road from Carnarvon to Beddgelert, beyond Llyn y gader (gadair), "chair pool," and what tourists have fancifully called Pitt's head, a roadside rock resembling, or thought to resemble, the great statesman's profile. Near this is Llyn y dywarchen (sod pool), with a floating island.

COLZA OIL, a non-drying oil obtained from the seeds of *Brassica campestris*, var. *oleifera*, a variety of the plant which produces Swedish turnips. Colza is extensively cultivated in France, Belgium, Holland and Germany; and, especially in the first-named country, the expression of the oil is an important industry. In commerce colza is classed with rape oil, to which both in source and properties it is very closely allied. It is a comparatively inodorous oil of a yellow colour, having a specific gravity varying from 0.912 to 0.920. The cake left after expression of the oil is a valuable feeding substance for cattle. Colza oil is

extensively used as a lubricant for machinery, and for burning in lamps.

COMA (Gr. κῶμα, from κοιμᾶν, to put to sleep), a deep sleep; the term is, however, used in medicine to imply something more than its Greek origin denotes, namely, a complete and prolonged loss of consciousness from which a patient cannot be roused. There are various degrees of coma: in the slighter forms the patient can be partially roused only to relapse again into a state of insensibility; in the deeper states, the patient cannot be roused at all, and such are met with in apoplexy, already described. Coma may arise abruptly in a patient who has presented no pre-existent indication of such a state occurring. Such a condition is called *primary coma*, and may result from the following causes:—(1) concussion, compression or laceration of the brain from head injuries, especially fracture of the skull; (2) from alcoholic and narcotic poisoning; (3) from cerebral haemorrhage, embolism and thrombosis, such being the causes of apoplexy. *Secondary coma* may arise as a complication in the following diseases:—diabetes, uraemia, general paralysis, meningitis, cerebral tumour and acute yellow atrophy of the liver; in such diseases it is anticipated, for it is a frequent cause of the fatal termination. The depth of insensibility to stimulus is a measure of the gravity of the symptom; thus the conjunctival reflex and even the spinal reflexes may be abolished, the only sign of life being the respiration and heart-beat, the muscles of the limbs being sometimes perfectly flaccid. A characteristic change in the respiration, known as Cheyne-Stokes breathing occurs prior to death in some cases; it indicates that the respiratory centre in the medulla is becoming exhausted, and is stimulated to action only when the venosity of the blood has increased sufficiently to excite it. The breathing consequently loses its natural rhythm, and each successive breath becomes deeper until a maximum is reached; it then diminishes in depth by successive steps until it dies away completely. The condition of apnoea, or cessation of breathing, follows, and as soon as the venosity of the blood again affords sufficient stimulus, the signs of air-hunger commence; this altered rhythm continues until the respiratory centre becomes exhausted and death ensues.

Coma Vigil is a state of unconsciousness met with in the algide stage of cholera and some other exhausting diseases. The patient’s eyes remain open, and he may be in a state of low muttering delirium; he is entirely insensible to his surroundings, and neither knows nor can indicate his wants.

There is a distinct word “coma” (Gr. κόμη, hair), which is used in astronomy for the envelope of a comet, and in botany for a tuft.

COMA BERENICES (“Berenice’s Hair”), in astronomy, a constellation of the northern hemisphere; it was first mentioned by Callimachus, and Eratosthenes (3rd century B.C.), but is not included in the 48 asterisms of Ptolemy. It is said to have been named by Conon, in order to console Berenice, queen of Ptolemy Euergetes, for the loss of a lock of her hair, which had been stolen from a temple to Venus. This constellation is sometimes, but wrongly, attributed to Tycho Brahe. The most interesting member of this group is *24 Comae*, a fine, wide double star, consisting of an orange star of magnitude 5½, and a blue star, magnitude 7.

COMACCHIO, a town of Emilia, Italy, in the province of Ferrara, 30 m. E.S.E. by road from the town of Ferrara, on the level of the sea, in the centre of the lagoon of Valli di Comacchio, just N. of the present mouth of the Reno. Pop. (1901) 7944 (town), 10,745 (commune). It is built on no less than thirteen different islets, joined by bridges, and its

industries are the fishery, which belongs to the commune, and the salt-works. The seaport of Magnavacca lies 4 m. to the east. Comacchio appears as a city in the 6th century, and, owing to its position in the centre of the lagoons, was an important fortress. It was included in the “donation of Pippin”; it was taken by the Venetians in 854, but afterwards came under the government of the archbishops of Ravenna; in 1299 it came under the dominion of the house of Este. In 1508 it became Venetian, but in 1597 was claimed by Clement VIII. as a vacant fief.

COMANA, a city of Cappadocia [frequently called Chryse or Aurea, *i.e.* the golden, to distinguish it from Comana in Pontus; mod. *Shahr*], celebrated in ancient times as the place where the rites of Mā-Enyo, a variety of the great west Asian Nature-goddess, were celebrated with much solemnity. The service was carried on in a sumptuous temple with great magnificence by many thousands of *hieroduli* (temple-servants). To defray expenses, large estates had been set apart, which yielded a more than royal revenue. The city, a mere apanage of the temple, was governed immediately by the chief priest, who was always a member of the reigning Cappadocian family, and took rank next to the king. The number of persons engaged in the service of the temple, even in Strabo’s time, was upwards of 6000, and among these, to judge by the names common on local tombstones, were many of Persian race. Under Caracalla, Comana became a Roman colony, and it received honours from later emperors down to the official recognition of Christianity. The site lies at Shahr, a village in the Anti-Taurus on the upper course of the Sarus (Sihun), mainly Armenian, but surrounded by new settlements of Avshar Turkomans and Circassians. The place has derived importance both in antiquity and now from its position at the eastern end of the main pass of the western Anti-Taurus range, the Kuru Chai, through which passed the road from Caesarea-Mazaca (mod. *Kaisarieh*) to Melitene (Malatia), converted by Septimius Severus into the chief military road to the eastern frontier of the empire. The extant remains at Shahr include a theatre on the left bank of the river, a fine Roman doorway and many inscriptions; but the exact site of the great temple has not been satisfactorily identified. There are many traces of Severus’ road, including a bridge at Kemer, and an immense number of milestones, some in their original positions, others in cemeteries.

See P. H. H. Massy in *Geog. Journ.* (Sept. 1905); E. Chantre, *Mission en Cappadocie* (1898).

(D. G. H.)

COMANA (mod. *Gumenek*), an ancient city of Pontus, said to have been colonized from Comana in Cappadocia. It stood on the river Iris (Tozanli Su or Yeshil Irmak), and from its central position was a favourite emporium of Armenian and other merchants. The moon-goddess was worshipped in the city with a pomp and ceremony in all respects analogous to those employed in the Cappadocian city. The slaves attached to the temple alone numbered not less than 6000. St John Chrysostom died there on the way to Constantinople from his exile at Cocysus in the Anti-Taurus. Remains of Comana are still to be seen near a village called Gumenek on the Tozanli Su, 7 m. from Tokat, but they are of the slightest description. There is a mound; and a few inscriptions are built into a bridge, which here spans the river, carrying the road from Niksar to Tokat.

(D. G. H.)

COMANCHES, a tribe of North American Indians of Shoshonean stock, so called by the Spaniards, but known to the French as Padoucas, an adaptation of their Sioux name, and among themselves *nimenim* (people). They number some 1400, attached to the Kiowa

agency, Oklahoma. When first met by Europeans, they occupied the regions between the upper waters of the Brazos and Colorado on the one hand, and the Arkansas and Missouri on the other. Until their final surrender in 1875 the Comanches were the terror of the Mexican and Texan frontiers, and were always famed for their bravery. They were brought to nominal submission in 1783 by the Spanish general Anza, who killed thirty of their chiefs. During the 19th century they were always raiding and fighting, but in 1867, to the number of 2500, they agreed to go on a reservation. In 1872 a portion of the tribe, the Quanhada or Staked Plain Comanches, had again to be reduced by military measures.

COMAYAGUA, the capital of the department of Comayagua in central Honduras, on the right bank of the river Ulua, and on the interoceanic railway from Puerto Cortes to Fonseca Bay. Pop. (1900) about 8000. Comayagua occupies part of a fertile valley, enclosed by mountain ranges. Under Spanish rule it was a city of considerable size and beauty, and in 1827 its inhabitants numbered more than 18,000. A fine cathedral, dating from 1715, is the chief monument of its former prosperity, for most of the handsome public buildings erected in the colonial period have fallen into disrepair. The present city chiefly consists of low adobe houses and cane huts, tenanted by Indians. The university founded in 1678 has ceased to exist, but there is a school of jurisprudence. In the neighbourhood are many ancient Indian ruins (see CENTRAL AMERICA: *Archaeology*).

Founded in 1540 by Alonzo Caceres, who had been instructed by the Spanish government to find a site for a city midway between the two oceans, Valladolid la Nueva, as the town was first named, soon became the capital of Honduras. It received the privileges of a city in 1557, and was made an episcopal see in 1561. Its decline dates from 1827, when it was burned by revolutionaries; and in 1854 its population had dwindled to 2000. It afterwards suffered through war and rebellion, notably in 1872 and 1873, when it was besieged by the Guatemalans. In 1880 Tegucigalpa (*q.v.*), a city 37 m. east-south-east, superseded it as the capital of Honduras.

COMB (a word common in various forms to Teut. languages, cf. Ger. *Kamm*, the Indo-Europ. origin of which is seen in γόμφος, a peg or pin, and Sanskrit, *gambhas*, a tooth), a toothed article of the toilet used for cleaning and arranging the hair, and also for holding it in place after it has been arranged; the word is also applied, from resemblance in form or in use, to various appliances employed for dressing wool and other fibrous substances, to the indented fleshy crest of a cock, and to the ridged series of cells of wax filled with honey in a beehive. Hair combs are of great antiquity, and specimens made of wood, bone and horn have been found in Swiss lake-dwellings. Among the Greeks and Romans they were made of boxwood, and in Egypt also of ivory. For modern combs the same materials are used, together with others such as tortoise-shell, metal, india-rubber and celluloid. There are two chief methods of manufacture. A plate of the selected material is taken of the size and thickness required for the comb, and on one side of it, occasionally on both sides, a series of fine slits are cut with a circular saw. This method involves the loss of the material cut out between the teeth. The second method, known as “twinning” or “parting,” avoids this loss and is also more rapid. The plate of material is rather wider than before, and is formed into two combs simultaneously, by the aid of a twinning machine. Two pairs of chisels, the cutting edges of which are as long as the teeth are required to be and are set at an angle converging towards the sides of the plate, are brought down alternately in such a way that the wedges removed from one comb form the teeth of the other, and that when the cutting is complete the plate presents the appearance of two combs with their teeth exactly inosculating or dovetailing into each other. In india-rubber combs the teeth are moulded to shape and the whole hardened by vulcanization.

COMBACONUM, or KUMBAKONAM, a city of British India, in the Tanjore district of Madras, in the delta of the Cauvery, on the South Indian railway, 194 m. from Madras. Pop. (1901) 59,623, showing an increase of 10% in the decade. It is a large town with wide and airy streets, and is adorned with pagodas, gateways and other buildings of considerable pretension. The great *gopuram*, or gate-pyramid, is one of the most imposing buildings of the kind, rising in twelve stories to a height of upwards of 100 ft., and ornamented with a profusion of figures of men and animals formed in stucco. One of the water-tanks in the town is popularly reputed to be filled with water admitted from the Ganges every twelve years by a subterranean passage 1200 m. long; and it consequently forms a centre of attraction for large numbers of devotees. The city is historically interesting as the capital of the Chola race, one of the oldest Hindu dynasties of which any traces remain, and from which the whole coast of Coromandel, or more properly Cholamandal, derives its name. It contains a government college. Brass and other metal wares, silk and cotton cloth and sugar are among the manufactures.

COMBE, ANDREW (1797-1847), Scottish physiologist, was born in Edinburgh on the 27th of October 1797, and was a younger brother of George Combe. He served an apprenticeship in a surgery, and in 1817 passed at Surgeons' Hall. He proceeded to Paris to complete his medical studies, and whilst there he investigated phrenology on anatomical principles. He became convinced of the truth of the new science, and, as he acquired much skill in the dissection of the brain, he subsequently gave additional interest to the lectures of his brother George, by his practical demonstrations of the convolutions. He returned to Edinburgh in 1819 with the intention of beginning practice; but being attacked by the first symptoms of pulmonary disease, he was obliged to seek health in the south of France and in Italy during the two following winters. He began to practise in 1823, and by careful adherence to the laws of health he was enabled to fulfil the duties of his profession for nine years. During that period he assisted in editing the *Phrenological Journal* and contributed a number of articles to it, defended phrenology before the Royal Medical Society of Edinburgh, published his *Observations on Mental Derangement* (1831), and prepared the greater portion of his *Principles of Physiology Applied to Health and Education*, which was issued in 1834, and immediately obtained extensive public favour. In 1836 he was appointed physician to Leopold I., king of the Belgians, and removed to Brussels, but he speedily found the climate unsuitable and returned to Edinburgh, where he resumed his practice. In 1836 he published his *Physiology of Digestion*, and in 1838 he was appointed one of the physicians extraordinary to the queen in Scotland. Two years later he completed his *Physiological and Moral Management of Infancy*, which he believed to be his best work and it was his last. His latter years were mostly occupied in seeking at various health resorts some alleviation of his disease; he spent two winters in Madeira, and tried a voyage to the United States, but was compelled to return within a few weeks of the date of his landing at New York. He died at Gorgie, near Edinburgh, on the 9th of August 1847.

His biography, written by George Combe, was published in 1850.

COMBE, GEORGE (1788-1858), Scottish phrenologist, elder brother of the above, was born in Edinburgh on the 21st of October 1788. After attending Edinburgh high school and university he entered a lawyer's office in 1804, and in 1812 began to practise on his own account. In 1815 the *Edinburgh Review* contained an article on the system of "craniology" of F. J. Gall and K. Spurzheim, which was denounced as "a piece of thorough quackery from beginning to end." Combe laughed like others at the absurdities of this so-called new theory of the brain, and thought that it must be finally exploded after such an exposure; and when Spurzheim delivered lectures in Edinburgh, in refutation of the statements of his critic, Combe considered the subject unworthy of serious attention. He was, however, invited to a friend's house where he saw Spurzheim dissect the brain, and he was so far impressed by the demonstration that he attended the second course of lectures. Investigating the subject for himself, he became satisfied that the fundamental principles of phrenology were true—

namely “that the brain is the organ of mind; that the brain is an aggregate of several parts, each subserving a distinct mental faculty; and that the size of the cerebral organ is, *caeteris paribus*, an index of power or energy of function.” In 1817 his first essay on phrenology was published in the *Scots Magazine*; and a series of papers on the same subject appeared soon afterwards in the *Literary and Statistical Magazine*; these were collected and published in 1819 in book form as *Essays on Phrenology*, which in later editions became *A System of Phrenology*. In 1820 he helped to found the Phrenological Society, which in 1823 began to publish a *Phrenological Journal*. By his lectures and writings he attracted public attention to the subject on the continent of Europe and in America, as well as at home; and a long discussion with Sir William Hamilton in 1827-1828 excited general interest.

His most popular work, *The Constitution of Man*, was published in 1828, and in some quarters brought upon him denunciations as a materialist and atheist. From that time he saw everything by the light of phrenology. He gave time, labour and money to help forward the education of the poorer classes; he established the first infant school in Edinburgh; and he originated a series of evening lectures on chemistry, physiology, history and moral philosophy. He studied the criminal classes, and tried to solve the problem how to reform as well as to punish them; and he strove to introduce into lunatic asylums a humane system of treatment. In 1836 he offered himself as a candidate for the chair of logic at Edinburgh, but was rejected in favour of Sir William Hamilton. In 1838 he visited America and spent about two years lecturing on phrenology, education and the treatment of the criminal classes. On his return in 1840 he published his *Moral Philosophy*, and in the following year his *Notes on the United States of North America*. In 1842 he delivered, in German, a course of twenty-two lectures on phrenology in the university of Heidelberg, and he travelled much in Europe, inquiring into the management of schools, prisons and asylums. The commercial crisis of 1855 elicited his remarkable pamphlet on *The Currency Question* (1858). The culmination of the religious thought and experience of his life is contained in his work *On the Relation between Science and Religion*, first publicly issued in 1857. He was engaged in revising the ninth edition of the *Constitution of Man* when he died at Moor Park, Farnham, on the 14th of August 1858. He married in 1833 Cecilia Siddons, a daughter of the great actress.

COMBE, WILLIAM (1741-1823), English writer, the creator of “Dr Syntax,” was born at Bristol in 1741. The circumstances of his birth and parentage are somewhat doubtful, and it is questioned whether his father was a rich Bristol merchant, or a certain William Alexander, a London alderman, who died in 1762. He was educated at Eton, where he was contemporary with Charles James Fox, the 2nd Baron Lyttelton and William Beckford. Alexander bequeathed him some £2000—a little fortune that soon disappeared in a course of splendid extravagance, which gained him the nickname of Count Combe; and after a chequered career as private soldier, cook and waiter, he finally settled in London (about 1771), as a law student and bookseller’s hack. In 1776 he made his first success in London with *The Diaboliad*, a satire full of bitter personalities. Four years afterwards (1780) his debts brought him into the King’s Bench; and much of his subsequent life was spent in prison. His spurious *Letters of the Late Lord Lyttelton*[1] (1780) imposed on many of his contemporaries, and a writer in the *Quarterly Review*, so late as 1851, regarded these letters as authentic, basing upon them a claim that Lyttelton was “Junius.” An early acquaintance with Lawrence Sterne resulted in his *Letters supposed to have been written by Yorick and Eliza* (1779). Periodical literature of all sorts—pamphlets, satires, burlesques, “two thousand columns for the papers,” “two hundred biographies”—filled up the next years, and about 1789 Combe was receiving £200 yearly from Pitt, as a pamphleteer. Six volumes of a *Devil on Two Sticks in England* won for him the title of “the English le Sage”; in 1794-1796 he wrote the text for Boydell’s *History of the River Thames*; in 1803 he began to write for *The Times*. In 1809-1811 he wrote for Ackermann’s *Political Magazine* the famous *Tour of Dr Syntax in search of the Picturesque* (descriptive and moralizing verse of a somewhat doggerel type), which, owing greatly to Thomas Rowlandson’s designs, had an immense success. It was published separately in 1812 and was followed by two similar *Tours*, “in search of Consolation,” and “in search of a Wife,” the first Mrs Syntax having died at the end of the first *Tour*. Then came *Six Poems* in illustration of drawings by Princess Elizabeth (1813), *The English Dance of Death* (1815-1816), *The Dance of Life* (1816-1817), *The Adventures of Johnny Quae Genus* (1822)—all written for Rowlandson’s caricatures; together with *Histories* of Oxford and Cambridge, and of Westminster Abbey for Ackermann;

Picturesque Tours along the Rhine and other rivers, *Histories of Madeira*, *Antiquities of York*, texts for *Turner's Southern Coast Views*, and contributions innumerable to the *Literary Repository*. In his later years, notwithstanding a by no means unsullied character, Combe was courted for the sake of his charming conversation and inexhaustible stock of anecdote. He died in London on the 19th of June 1823.

Brief obituary memoirs of Combe appeared in Ackermann's *Literary Repository* and in the *Gentleman's Magazine* for August 1823; and in May 1859 a list of his works, drawn up by his own hand, was printed in the latter periodical. See also *Diary of H. Crabb Robinson*, *Notes and Queries for 1869*.

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1 Thomas, 2nd Baron Lyttelton (1744-1779), commonly known as the "wicked Lord Lyttelton," was famous for his abilities and his libertinism, also for the mystery attached to his death, of which it was alleged he was warned in a dream three days before the event.

COMBE, or Coomb, a term particularly in use in south-western England for a short closed-in valley, either on the side of a down or running up from the sea. It appears in place-names as a termination, *e.g.* Wiveliscombe, Ilfracombe, and as a prefix, *e.g.* Combemartin. The etymology of the word is obscure, but "hollow" seems a common meaning to similar forms in many languages. In English "combe" or "cumb" is an obsolete word for a "hollow vessel," and the like meaning attached to Teutonic forms *kumm* and *kumme*. The Welsh *cwm*, in place-names, means hollow or valley, with which may be compared *cum* in many Scots place-names. The Greek κύμβη also means a hollow vessel, and there is a French dialect word *combe* meaning a little valley.

COMBERMERE, STAPLETON COTTON, 1st Viscount (1773-1865), British field-marshal and colonel of the 1st Life Guards, was the second son of Sir Robert Salusbury Cotton of Combermere Abbey, Cheshire, and was born on the 14th of November 1773, at Llewenny Hall in Denbighshire. He was educated at Westminster School, and when only sixteen obtained a second lieutenancy in the 23rd regiment (Royal Welsh Fusiliers). A few years afterwards (1793) he became by purchase captain in the 6th Dragoon Guards, and he served in this regiment during the campaigns of the duke of York in Flanders. While yet in his twentieth year, he joined the 25th Light Dragoons (subsequently 22nd) as lieutenant-colonel, and, while in attendance with his regiment on George III. at Weymouth, he became a great favourite of the king. In 1796 he went with his regiment to India, taking part *en route* in the operations in Cape Colony (July-August 1796), and in 1799 served in the war with Tippoo Sahib, and at the storming of Seringapatam. Soon after this, having become heir to the family baronetcy, he was, at his father's desire, exchanged into a regiment at home, the 16th Light Dragoons. He was stationed in Ireland during Emmett's insurrection, became colonel in 1800, and major-general five years later. From 1806 to 1814 he was M.P. for Newark. In 1808 he was sent to the seat of war in Portugal, where he shortly rose to the position of commander of Wellington's cavalry, and it was here that he most displayed that courage and judgment which won for him his fame as a cavalry officer. He succeeded to the baronetcy in 1809, but continued his military career. His share in the battle of Salamanca (22nd of July 1812) was especially marked, and he received the personal thanks of Wellington. The day after, he was accidentally wounded. He was now a lieutenant-general in the British army and a K.B., and on the conclusion of peace (1814) was raised to the peerage under the style of Baron Combermere. He was not present at Waterloo, the command, which he expected, and bitterly regretted not receiving, having been given to Lord Uxbridge. When the latter was wounded Cotton was sent for to take over his command, and he remained in France until the reduction of the allied army of occupation. In 1817 he was appointed governor of Barbadoes and commander of the West Indian forces. From 1822 to 1825 he commanded in Ireland. His career of active service was concluded in India (1826), where he besieged and took Bhurtpore—a fort which twenty-two years previously had defied the genius of Lake and was deemed impregnable. For this service he was created Viscount Combermere. A long

period of peace and honour still remained to him at home. In 1834 he was sworn a privy councillor, and in 1852 he succeeded Wellington as constable of the Tower and lord lieutenant of the Tower Hamlets. In 1855 he was made a field-marshal and G.C.B. He died at Clifton on the 21st of February 1865. An equestrian statue in bronze, the work of Baron Marochetti, was raised in his honour at Chester by the inhabitants of Cheshire. Combermere was succeeded by his only son, Wellington Henry (1818-1891), and the viscountcy is still held by his descendants.

See Viscountess Combermere and Captain W. W. Knollys, *The Combermere Correspondence* (London, 1866).

COMBES, [JUSTIN LOUIS] ÉMILE (1835-), French statesman, was born at Roquecourbe in the department of the Tarn. He studied for the priesthood, but abandoned the idea before ordination, and took the diploma of doctor of letters (1860), then he studied 752
medicine, taking his degree in 1867, and setting up in practice at Pons in Charente-Inférieure. In 1881 he presented himself as a political candidate for Saintes, but was defeated. In 1885 he was elected to the senate by the department of Charente-Inférieure. He sat in the Democratic left, and was elected vice-president in 1893 and 1894. The reports which he drew up upon educational questions drew attention to him, and on the 3rd of November 1895 he entered the Bourgeois cabinet as minister of public instruction, resigning with his colleagues on the 21st of April following. He actively supported the Waldeck-Rousseau ministry, and upon its retirement in 1903 he was himself charged with the formation of a cabinet. In this he took the portfolio of the Interior, and the main energy of the government was devoted to the struggle with clericalism. The parties of the Left in the chamber, united upon this question in the *Bloc republicain*, supported Combes in his application of the law of 1901 on the religious associations, and voted the new bill on the congregations (1904), and under his guidance France took the first definite steps toward the separation of church and state. He was opposed with extreme violence by all the Conservative parties, who regarded the secularization of the schools as a persecution of religion. But his stubborn enforcement of the law won him the applause of the people, who called him familiarly *le petit père*. Finally the defection of the Radical and Socialist groups induced him to resign on the 17th of January 1905, although he had not met an adverse vote in the Chamber. His policy was still carried on; and when the law of the separation of church and state was passed, all the leaders of the Radical parties entertained him at a noteworthy banquet in which they openly recognized him as the real originator of the movement.

COMBINATION (Lat. *combinare*, to combine), a term meaning an association or union of persons for the furtherance of a common object, historically associated with agreements amongst workmen for the purpose of raising their wages. Such a combination was for a long time expressly prohibited by statute. See Trade Unions; also Conspiracy and Strikes and Lock Outs.

COMBINATORIAL ANALYSIS. The Combinatorial Analysis, as it was understood up to the end of the 18th century, was of limited scope and restricted application. P. Nicholson, in his *Essays on the Combinatorial Analysis*, published in 1818, states that "the Combinatorial Analysis is a branch of mathematics which teaches us to ascertain and exhibit all the possible ways in which a given number of things may be associated and mixed together; so that we may be certain that we have not missed any collection or arrangement of these things that has not been enumerated." Writers on the subject seemed to recognize fully that it was in need of

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cultivation, that it was of much service in facilitating algebraical operations of all kinds, and that it was the fundamental method of investigation in the theory of Probabilities. Some idea of its scope may be gathered from a statement of the parts of algebra to which it was commonly applied, viz., the expansion of a multinomial, the product of two or more multinomials, the quotient of one multinomial by another, the reversion and conversion of series, the theory of indeterminate equations, &c. Some of the elementary theorems and various particular problems appear in the works of the earliest algebraists, but the true pioneer of modern researches seems to have been Abraham Demoivre, who first published in *Phil. Trans.* (1697) the law of the general coefficient in the expansion of the series $a + bx + cx^2 + dx^3 + \ldots$ raised to any power. (See also *Miscellanea Analytica*, bk. iv. chap. ii. prob. iv.) His work on Probabilities would naturally lead him to consider questions of this nature. An important work at the time it was published was the *De Partitione Numerorum* of Leonhard Euler, in which the consideration of the reciprocal of the product $(1 - xz)(1 - x^2z)(1 - x^3z) \ldots$ establishes a fundamental connexion between arithmetic and algebra, arithmetical addition being made to depend upon algebraical multiplication, and a close bond is secured between the theories of discontinuous and continuous quantities. (Cf. NUMBERS, PARTITION OF.) The multiplication of the two powers x^a, x^b, viz. $x^a + x^b = x^{a+b}$, showed Euler that he could convert arithmetical addition into algebraical multiplication, and in the paper referred to he gives the complete formal solution of the main problems of the partition of numbers. He did not obtain general expressions for the coefficients which arose in the expansion of his generating functions, but he gave the actual values to a high order of the coefficients which arise from the generating functions corresponding to various conditions of partitionment. Other writers who have contributed to the solution of special problems are James Bernoulli, Ruggiero Guiseppe Boscovich, Karl Friedrich Hindenburg (1741-1808), William Emerson (1701-1782), Robert Woodhouse (1773-1827), Thomas Simpson and Peter Barlow. Problems of combination were generally undertaken as they became necessary for the advancement of some particular part of mathematical science: it was not recognized that the theory of combinations is in reality a science by itself, well worth studying for its own sake irrespective of applications to other parts of analysis. There was a total absence of orderly development, and until the first third of the 19th century had passed, Euler's classical paper remained alike the chief result and the only scientific method of combinatorial analysis.

In 1846 Karl G. J. Jacobi studied the partitions of numbers by means of certain identities involving infinite series that are met with in the theory of elliptic functions. The method employed is essentially that of Euler. Interest in England was aroused, in the first instance, by Augustus De Morgan in 1846, who, in a letter to Henry Warburton, suggested that combinatorial analysis stood in great need of development, and alluded to the theory of partitions. Warburton, to some extent under the guidance of De Morgan, prosecuted researches by the aid of a new instrument, viz. the theory of finite differences. This was a distinct advance, and he was able to obtain expressions for the coefficients in partition series in some of the simplest cases (*Trans. Camb. Phil. Soc.*, 1849). This paper inspired a valuable paper by Sir John Herschel (*Phil. Trans.* 1850), who, by introducing the idea and notation of the circulating function, was able to present results in advance of those of Warburton. The new idea involved a calculus of the imaginary roots of unity. Shortly afterwards, in 1855, the subject was attacked simultaneously by Arthur Cayley and James Joseph Sylvester, and their combined efforts resulted in the practical solution of the problem that we have to-day. The former added the idea of the prime circulator, and the latter applied Cauchy's theory of residues to the subject, and invented the arithmetical entity termed a denumerant. The next distinct advance was made by Sylvester, Fabian Franklin, William Pitt Durfee and others, about the year 1882 (*Amer. Journ. Math.* vol. v.) by the employment of a graphical method. The results obtained were not only valuable in themselves, but also threw considerable light upon the theory of algebraic series. So far it will be seen that researches had for their object the discussion of the partition of numbers. Other branches of combinatorial analysis were, from any general point of view, absolutely neglected. In 1888 P. A. MacMahon investigated the general problem of distribution, of which the partition of a number is a particular case. He introduced the method of symmetric functions and the method of differential operators, applying both methods to the two important subdivisions, the theory of composition and the theory of partition. He introduced the notion of the separation of a partition, and extended all the results so as to include multipartite as well as unipartite numbers. He showed how to introduce zero and negative numbers, unipartite and multipartite, into the general theory; he extended Sylvester's graphical method to three dimensions; and finally, 1898, he invented the "Partition Analysis" and applied it to the solution of novel questions in arithmetic and algebra. An important paper by G. B. Mathews, which reduces the problem of compound partition to that of simple

partition, should also be noticed. This is the problem which was known to Euler and his contemporaries as “The Problem of the Virgins,” or “the Rule of Ceres”; it is only now, nearly 200 years later, that it has been solved.

Fundamental problem.

The most important problem of combinatorial analysis is connected with the distribution of objects into classes. A number n may be regarded as enumerating n similar objects; it is then said to be unipartite. On the other hand, if the objects be not all similar they cannot be effectively enumerated by a single integer; we require a succession of integers. If the objects be p in number of one kind, q of a second kind, r of a third, &c., the enumeration is given by the succession pqr... which is termed a multipartite number, and written,

$$\overline{pqr\ldots},$$

where p + q + r + ... = n. If the order of magnitude of the numbers p, q, r, ... is immaterial, it is usual to write them in descending order of magnitude, and the succession may then be termed a partition of the number n, and is written (pqr...). The succession of integers thus has a twofold signification: (i.) as a multipartite number it may enumerate objects of different kinds; (ii.) it may be viewed as a partitionment into separate parts of a unipartite number. We may say either that the objects are represented by the multipartite number $\overline{pqr\ldots}$, or that they are defined by the partition (pqr...) of the unipartite number n. Similarly the classes into which they are distributed may be m in number all similar; or they may be p_1 of one kind, q_1 of a second, r_1 of a third, &c., where $p_1 + q_1 + r_1 + \ldots = m$. We may thus denote the classes either by the multipartite numbers $\overline{p_1 q_1 r_1\ldots}$, or by the partition $(p_1 q_1 r_1\ldots)$ of the unipartite number m. The distributions to be considered are such that any number of objects may be in any one class subject to the restriction that no class is empty. Two cases arise. If the order of the objects in a particular class is immaterial, the class is termed a *parcel*; if the order is material, the class is termed a *group*. The distribution into parcels is alone considered here, and the main problem is the enumeration of the distributions of objects defined by the partition (pqr...) of the number n into parcels defined by the partition $(p_1 q_1 r_1\ldots)$ of the number m. (See “Symmetric Functions and the Theory of Distributions,” *Proc. London Mathematical Society*, vol. xix.) Three particular cases are of great importance. Case I. is the “one-to-one distribution,” in which the number of parcels is equal to the number of objects, and one object is distributed in each parcel. Case II. is that in which the parcels are all different, being defined by the partition (1111...), conveniently written (1^m); this is the theory of the compositions of unipartite and multipartite numbers. Case III. is that in which the parcels are all similar, being defined by the partition (m); this is the theory of the partitions of unipartite and multipartite numbers. Previous to discussing these in detail, it is necessary to describe the method of symmetric functions which will be largely utilized.

Let α, β, γ, ... be the roots of the equation

$$x^n - a_1 x^{n-1} + a_2 x^{n-2} - \ldots = 0$$

The symmetric function $\Sigma\alpha^p\beta^q\gamma^r\ldots$, where p + q + r + ... = n is, in the partition notation, written (pqr...). Let $A_{(pqr\ldots),\ (p1q1r1\ldots)}$ denote the number of ways of distributing the n objects defined by the partition (pqr...) into the m parcels defined by the partition $(p_1 q_1 r_1\ldots)$. The expression

The distribution function.

$$\Sigma A_{(pqr\ldots),\ (p1q1r1\ldots)} \cdot (pqr\ldots),$$

where the numbers p_1, q_1, r_1 ... are fixed and assumed to be in descending order of magnitude, the summation being for every partition (pqr...) of the number n, is defined to be the distribution function of the objects defined by (pqr...) into the parcels defined by $(p_1 q_1 r_1\ldots)$. It gives a complete enumeration of n objects of whatever species into parcels of the given species.

Case I.

1. *One-to-One Distribution. Parcels* m *in number* (*i.e.* m = n).—Let h_s be the homogeneous product-sum of degree s of the quantities α, β, γ, ... so that

$$(1 - \alpha x.\ 1 - \beta x.\ 1 - \gamma x.\ \ldots)^{-1} = 1 + h_1 x + h_2 x^2 + h_3 x^3 + \ldots$$

$$h_1 = \Sigma\alpha = (1)$$
$$h_2 = \Sigma\alpha^2 + \Sigma\alpha\beta = (2) + (1^2)$$
$$h_3 = \Sigma\alpha^3 + \Sigma\alpha^2\beta + \Sigma\alpha\beta\gamma = (3) + (21) + (1^3).$$

Form the product $h_{p1}h_{q1}h_{r1}$...

Any term in h_{p1} may be regarded as derived from p_1 objects distributed into p_1 similar parcels, one object in each parcel, since the order of occurrence of the letters α, β, γ, ... in any term is immaterial. Moreover, every selection of p_1 letters from the letters in $\alpha^p\beta^q\gamma^r$ ... will occur in some term of h_{p1}, every further selection of q_1 letters will occur in some term of h_{q1}, and so on. Therefore in the product $h_{p1}h_{q1}h_{r1}$ ... the term $\alpha^p\beta^q\gamma^r$ ..., and therefore also the symmetric function (pqr ...), will occur as many times as it is possible to distribute objects defined by (pqr ...) into parcels defined by ($p_1q_1r_1$ ...) one object in each parcel. Hence

$$\Sigma A_{(pqr...),\ (p1q1r1...)} \cdot (pqr...) = h_{p1}h_{q1}h_{r1}....$$

This theorem is of algebraic importance; for consider the simple particular case of the distribution of objects (43) into parcels (52), and represent objects and parcels by small and capital letters respectively. One distribution is shown by the scheme

A A A A A B B
a a a a b b b

wherein an object denoted by a small letter is placed in a parcel denoted by the capital letter immediately above it. We may interchange small and capital letters and derive from it a distribution of objects (52) into parcels (43); viz.:—

A A A A B B B
a a a a a b b.

The process is clearly of general application, and establishes a one-to-one correspondence between the distribution of objects (pqr ...) into parcels ($p_1q_1r_1$ ...) and the distribution of objects ($p_1q_1r_1$ ...) into parcels (pqr ...). It is in fact, in Case I., an intuitive observation that we may either consider an object placed in or attached to a parcel, or a parcel placed in or attached to an object. Analytically we have

Theorem.—"The coefficient of symmetric function (pqr ...) in the development of the product $h_{p1}h_{q1}h_{r1}$ ... is equal to the coefficient of symmetric function ($p_1q_1r_1$ ...) in the development of the product $h_ph_qh_r$ ...."

The problem of Case I. may be considered when the distributions are subject to various restrictions. If the restriction be to the effect that an aggregate of similar parcels is not to contain more than one object of a kind, we have clearly to deal with the elementary symmetric functions a_1, a_2, a_3, ... or (1), (1^2), (1^3), ... in lieu of the quantities h_1, h_2, h_3, ... The distribution function has then the value $a_{p1}a_{q1}a_{r1}$ ... or $(1^p{}_1)$ $(1^q{}_1)$ $(1^r{}_1)$ ..., and by interchange of object and parcel we arrive at the well-known theorem of symmetry in symmetric functions, which states that the coefficient of symmetric function (pqr ...) in the development of the product $a_{p1}a_{q1}a_{r1}$ ... in a series of monomial symmetric functions, is equal to the coefficient of the function ($p_1q_1r_1$ ...) in the similar development of the product $a_pa_qa_r$....

The general result of Case I. may be further analysed with important consequences.

Write

$$X_1 = (1)x_1,$$
$$X_2 = (2)x_2 + (1^2)x_1{}^2,$$
$$X_3 = (3)x_3 + (21)x_2x_1 + (1^3)x_1{}^3$$

. . . . . .

and generally

$$X_s = \Sigma(\lambda\mu\nu ...)\ x_\lambda\ x_\mu\ x_\nu ...$$

the summation being in regard to every partition of s. Consider the result of the multiplication—

$$X_{p1}X_{q1}X_{r1} ... = \Sigma P\ x^{\sigma1}_{s1}\ x^{\sigma2}_{s2}\ x^{\sigma3}_{s3} ...$$

To determine the nature of the symmetric function P a few definitions are necessary.

Definition I.—Of a number n take any partition $(\lambda_1\lambda_2\lambda_3 \ldots \lambda_s)$ and separate it into component partitions thus:—

$$(\lambda_1\lambda_2)\ (\lambda_3\lambda_4\lambda_5)\ (\lambda_6)\ \ldots$$

in any manner. This may be termed a *separation* of the partition, the numbers occurring in the separation being identical with those which occur in the partition. In the theory of symmetric functions the separation denotes the product of symmetric functions—

$$\Sigma\, \alpha^{\lambda 1}\, \beta^{\lambda 2}\, \Sigma\, \alpha^{\lambda 3}\, \beta^{\lambda 4}\, \gamma^{\lambda 5}\, \Sigma\, \alpha^{\lambda 6} \ldots$$

The portions $(\lambda_1\lambda_2)$, $(\lambda_3\lambda_4\lambda_5)$, (λ_6), ... are termed *separates*, and if $\lambda_1 + \lambda_2 = p_1$, $\lambda_3 + \lambda_4 + \lambda_5 = q_1$, $\lambda_6 = r_1$... be in descending order of magnitude, the usual arrangement, the separation is said to have a *species* denoted by the partition $(p_1q_1r_1 \ldots)$ of the number n.

Definition II.—If in any distribution of n objects into n parcels (one object in each parcel), we write down a number ξ, whenever we observe ξ similar objects in similar parcels we will obtain a succession of numbers $\xi_1, \xi_2, \xi_3, \ldots$, where $(\xi_1, \xi_2, \xi_3 \ldots)$ is some partition of n. The distribution is then said to have a *specification* denoted by the partition $(\xi_1\xi_2\xi_3 \ldots)$.

Now it is clear that P consists of an aggregate of terms, each of which, to a numerical factor *près*, is a separation of the partition $(s^{\sigma 1}_1\, s^{\sigma 3}_2\, s^{\sigma 3}_3 \ldots)$ of species $(p_1q_1r_1 \ldots)$. Further, P is the distribution function of objects into parcels denoted by $(p_1q_1r_1 \ldots)$, subject to the restriction that the distributions have each of them the specification denoted by the partition $(s^{\sigma 1}_1\, s^{\sigma 3}_2\, s^{\sigma 3}_3 \ldots)$ Employing a more general notation we may write

$$X^{\pi 1}_{p1}\, X^{\pi 2}_{p2}\, X^{\pi 3}_{p3} \ldots = \Sigma P\, x^{\sigma 1}_{s1}\, x^{\sigma 2}_{s2}\, x^{\sigma 3}_{s3} \ldots$$

and then P is the distribution function of objects into parcels $(p^{\pi 1}_1\ p^{\pi 2}_2\ p^{\pi 3}_3 \ldots)$, the distributions being such as to have the specification $(s^{\sigma 1}_1\, s^{\sigma 2}_2\, s^{\sigma 3}_3 \ldots)$. Multiplying out P so as to exhibit it as a sum of monomials, we get a result—

$$X^{\pi 1}_{p1}\, X^{\pi 2}_{p2}\, X^{\pi 3}_{p3} \ldots = \Sigma\Sigma\theta\, (\lambda^{l1}_1\, \lambda^{l2}_2\, \lambda^{l3}_3 \ldots)\, x^{\sigma 1}_{s1}\, x^{\sigma 2}_{s2}\, x^{\sigma 3}_{s3} \ldots$$

indicating that for distributions of specification $(s^{\sigma 1}_1\ s^{\sigma 3}_2\ s^{\sigma 3}_3 \ldots)$ there are θ ways of distributing n objects denoted by $(\lambda^{l1}_1\, \lambda^{l2}_2\, \lambda^{l3}_3 \ldots)$ amongst n parcels denoted by $(p^{\pi 1}_1\, p^{\pi 2}_2\, p^{\pi 3}_3 \ldots)$, one object in each parcel. Now observe that as before we may interchange parcel and object, and that this operation leaves the specification of the distribution unchanged. Hence the number of distributions must be the same, and if

$$X^{\pi 1}_{p1}\, X^{\pi 2}_{p2}\, X^{\pi 3}_{p3} \ldots = \ldots + \theta\, (\lambda^{l1}_1\, \lambda^{l2}_2\, \lambda^{l3}_3 \ldots)\, x^{\sigma 1}_{s1}\, x^{\sigma 2}_{s2}\, x^{\sigma 3}_{s3} \ldots + \ldots$$

then also

$$X^{l1}_{\lambda 1}\, X^{l2}_{\lambda 2}\, X^{l3}_{\lambda 3} \ldots = \ldots + \theta\, (p^{\pi 1}_1\, p^{\pi 2}_2\, p^{\pi 3}_3 \ldots)\, x^{\sigma 1}_{s1}\, x^{\sigma 2}_{s2}\, x^{\sigma 3}_{s3} \ldots + \ldots$$

This extensive theorem of algebraic reciprocity includes many known theorems of symmetry in the theory of Symmetric Functions.

The whole of the theory has been extended to include symmetric functions symbolized by partitions which contain as well zero and negative parts.

2. *The Compositions of Multipartite Numbers. Parcels denoted by* (I^m).—There are here no similarities between the parcels.

Case II.

Let $(\pi_1\ \pi_2\ \pi_3)$ be a partition of m.

$(p^{\pi 1}_1\, p^{\pi 2}_2\, p^{\pi 3}_3 \ldots)$ a partition of n.

Of the whole number of distributions of the n objects, there will be a certain number such that n_1 parcels each contain p_1 objects, and in general π_s parcels each contain p_s objects, where s = 1, 2, 3, ... Consider the product $h^{\pi 1}_{p1}\, h^{\pi 2}_{p2}\, h^{\pi 3}_{p3} \ldots$ which can be permuted in $m! / \pi_1!\pi_2!\pi_3! \ldots$ ways. For each of these ways $h^{\pi 1}_{p1}\, h^{\pi 2}_{p2}\, h^{\pi 3}_{p3} \ldots$ will be a distribution function for distributions of the specified type. Hence, regarding all the permutations, the distribution function is

$$\frac{m!}{\pi_1!\pi_2!\pi_3! \ldots}\, h^{\pi 1}_{p1}\, h^{\pi 2}_{p2}\, h^{\pi 3}_{p3} \ldots$$

and regarding, as well, all the partitions of n into exactly m parts, the desired distribution

function is

$$\Sigma \frac{m!}{\pi_1!\pi_2!\pi_3! \ldots} h^{\pi 1}_{p1} h^{\pi 2}_{p2} h^{\pi 3}_{p3} \ldots \qquad [\Sigma\pi = m, \Sigma\pi\, p = n],$$

that is, it is the coefficient of x^n in $(h_1x + h_2x^2 + h_3x^3 + \ldots)^m$. The value of $A\,(p^{\pi 1}_1\, p^{\pi 2}_2\, p^{\pi 3}_3 \ldots)$ is the coefficient of $(p^{\pi 1}_1\, p^{\pi 2}_2\, p^{\pi 3}_3 \ldots)x^n$ in the development of the above expression, and is easily shown to have the value

$$\begin{aligned}
&\binom{p_1 + m - 1}{p_1}^{\pi 1} \binom{p_2 + m - 1}{p_2}^{\pi 2} \binom{p_3 + m - 1}{p_3}^{\pi 3} \ldots \\
- &\binom{m}{1}\binom{p_1 + m - 2}{p_1}^{\pi 1} \binom{p_2 + m - 2}{p_2}^{\pi 2} \binom{p_3 + m - 2}{p_3}^{\pi 3} \ldots \\
+ &\binom{m}{2}\binom{p_1 + m - 3}{p_1}^{\pi 1} \binom{p_2 + m - 3}{p_2}^{\pi 2} \binom{p_3 + m - 3}{p_3}^{\pi 3} \ldots \\
- &\ldots \text{ to } m \text{ terms.}
\end{aligned}$$

Observe that when $p_1 = p_2 = p_3 = \ldots = \pi_1 = \pi_2 = \pi_3 \ldots = 1$ this expression reduces to the mth divided differences of 0^n. The expression gives the compositions of the multipartite number $\overline{p^{\pi 1}_1\, p^{\pi 2}_2\, p^{\pi 3}_3} \ldots$ into m parts. Summing the distribution function from m = 1 to m = ∞ and putting x = 1, as we may without detriment, we find that the totality of the compositions is given by $(h_1 + h_2 + h_3 + \ldots) / (1 - h_1 - h_2 - h_3 + \ldots)$ which may be given the form $(a_1 - a_2 + a_3 - \ldots) / [1 - 2(a_1 - a_2 + a_3 - \ldots)]$ Adding ½ we bring this to the still more convenient form

$$\tfrac{1}{2} \frac{1}{1 - 2(a_1 - a_2 + a_3 - \ldots)}.$$

Let $F\,(p^{\pi 1}_1\, p^{\pi 2}_2\, p^{\pi 3}_3 \ldots)$ denote the total number of compositions of the multipartite $\overline{p^{\pi 1}_1\, p^{\pi 2}_2\, p^{\pi 3}_3} \ldots$. Then $\tfrac{1}{2} \cdot (1 / 1 - 2a) = \tfrac{1}{2} + \Sigma\, F(p)\alpha^p$, and thence $F(p) = 2^{p-1}$. Again $\tfrac{1}{2} \cdot [1 / 1 - 2(\alpha + \beta - \alpha\beta)] = \Sigma\, F(p_1p_2)\, \alpha^{p1}\beta^{p2}$, and expanding the left-hand side we easily find

$$F(p_1p_2) = 2^{p1 + p2 - 1} \frac{(p_1 + p_2)!}{0!\, p_1!\, p_2!} - 2^{p1 + p2 - 2} \frac{(p_1 + p_2 - 1)!}{1!\, (p_1 - 1)!\, (p_2 - 1)!} + 2^{p1 + p2 - 3} \frac{(p_1 + p_2 - 2)!}{2!\, (p_1 - 2)!\, (p_2 - 2)!} - \ldots$$

We have found that the number of compositions of the multipartite $\overline{p_1 p_2 p_3 \ldots p_s}$ is equal to the coefficient of symmetric function $(p_1p_2p_3 \ldots p_s)$ *or* of the single term $\alpha^{p1}_1\, \alpha^{p2}_2\, \alpha^{p2}_2 \ldots \alpha^{ps}_s$ in the development according to ascending powers of the algebraic fraction

$$\tfrac{1}{2} \cdot \frac{1}{1 - 2\,(\Sigma\alpha_1 - \Sigma\alpha_1\alpha_2 + \Sigma\alpha_1\alpha_2\alpha_3 - \ldots + (-)^{S+1}\, \alpha_1\alpha_2\alpha_3 \ldots \alpha_s}.$$

This result can be thrown into another suggestive form, for it can be proved that this portion of the expanded fraction

$$\tfrac{1}{2} \cdot \frac{1}{\{1 - t_1\,(2\alpha_1 + \alpha_2 + \ldots + \alpha_s)\}\ \{1 - t_2\,(2\alpha_1 + 2\alpha_2 + \ldots + \alpha_s)\} \ldots \{1 - t_s\,(2\alpha_1 + 2\alpha_2 + \ldots + 2\alpha_s)\}},$$

which is composed entirely of powers of

$$t_1\alpha_1,\ t_2\alpha_2,\ t_3\alpha_3,\ \ldots\ t_s\alpha_s$$

has the expression

$$\tfrac{1}{2} \cdot \frac{1}{1 - 2\,(\Sigma t_1\alpha_1 - \Sigma t_1t_2\alpha_1\alpha_2 + \Sigma t_1t_2t_3\alpha_1\alpha_2\alpha_3 - \ldots + (-)^{s+1} t_1t_2 \ldots t_s\alpha_1\alpha_2 \ldots \alpha_s)},$$

and therefore the coefficient of $\alpha^{p1}_1\, \alpha^{p2}_2 \ldots \alpha^{ps}_s$ in the latter fraction, when t_1, t_2, &c., are put equal to unity, is equal to the coefficient of the same term in the product

$$\tfrac{1}{2}\,(2\alpha_1 + \alpha_2 + \ldots + \alpha_s)^{p1}\,(2\alpha_1 + 2\alpha_2 + \ldots + \alpha_s)^{p2} \ldots (2\alpha_1 + 2\alpha_2 + \ldots + 2\alpha_s)^{ps}.$$

This result gives a direct connexion between the number of compositions and the permutations of the letters in the product $\alpha^{p1}_1\, \alpha^{p2}_2 \ldots \alpha^{ps}_s$. Selecting any permutation, suppose that the letter a_r occurs q_r times in the last $p_r + p_{r+1} + \ldots + p_s$ places of the permutation; the coefficient in question may be represented by $\tfrac{1}{2}\, \Sigma 2^{q1+q2+\ \ldots\ +qs}$, the summation being for every permutation, and since $q_1 = p_1$ this may be written

$$2p_1^{-1}\, \Sigma 2^{q1+q2+\ \ldots\ +qs}.$$

Ex. Gr.—For the bipartite $\overline{22}$, $p_1 = p_2 = 2$, and we have the following scheme:—

$$\alpha_1 \quad \alpha_1 \,\big|\, \alpha_2 \quad \alpha_2 \quad q_2 = 2$$

$$\begin{array}{cc|cc|l} \alpha_1 & \alpha_2 & \alpha_1 & \alpha_2 & = 1 \\ \alpha_1 & \alpha_2 & \alpha_2 & \alpha_1 & = 1 \\ \alpha_2 & \alpha_1 & \alpha_1 & \alpha_2 & = 1 \\ \alpha_2 & \alpha_1 & \alpha_2 & \alpha_1 & = 1 \\ \alpha_2 & \alpha_2 & \alpha_1 & \alpha_1 & = 0 \end{array}$$

Hence

$$F(22) = 2\,(2^2 + 2 + 2 + 2 + 2 + 2^\circ) = 26.$$

We may regard the fraction

$$\tfrac{1}{2} \cdot \frac{1}{\{1 - t_1\,(2\alpha_1 + \alpha_2 + \ldots + \alpha_s)\}\ \{1 - t_2\,(2\alpha_1 + 2\alpha_2 + \ldots + \alpha_s)\} \ldots \{1 - t_s\,(2\alpha_1 + 2\alpha_2 + \ldots + 2\alpha_s)\}},$$

as a redundant generating function, the enumeration of the compositions being given by the coefficient of

$$(t_1\alpha_1)^{p1}\,(t_2\alpha_2)^{p2} \ldots (t_s\alpha_s)^{ps}.$$

The transformation of the pure generating function into a factorized redundant form supplies the key to the solution of a large number of questions in the theory of ordinary permutations, as will be seen later.

The theory of permutations.

[The transformation of the last section involves a comprehensive theory of Permutations, which it is convenient to discuss shortly here.

If $X_1, X_2, X_3, \ldots X_n$ be linear functions given by the matricular relation

$$(X_1, X_2, X_3, \ldots X_n) = (a_{11}\ a_{12}\ \ldots\ a_{1n})\ (x_1, x_2, \ldots x_n)$$
$$\left|\begin{array}{cccc} a_{21} & a_{22} & \ldots & a_{2n} \\ . & . & \ldots & . \\ . & . & \ldots & . \\ a_{n1} & a_{n2} & \ldots & a_{nn} \end{array}\right|$$

that portion of the algebraic fraction,

$$\frac{1}{(1 - s_1X_1)\,(1 - s_2X_2) \ldots (1 - s_nX_n)},$$

which is a function of the products $s_1x_1, s_2x_2, s_3x_3, \ldots s_nx_n$ only is

$$\frac{1}{|(1 - a_{11}s_1x_1)\,(1 - a_{22}s_2x_2)\,(1 - a_{33}s_3x_3) \ldots (1 - a_{nn}s_nx_n)|}$$

where the denominator is in a symbolic form and denotes on expansion

$$1 - \Sigma\,|a_{11}|s_1x_1 + \Sigma\,|a_{11}a_{22}|s_1s_2x_1x_2 - \ldots + (-)^n\,|a_{11}a_{22}a_{33} \ldots a_{nn}|\ s_1s_2 \ldots s_nx_1x_2 \ldots x_n,$$

where $|a_{11}|, |a_{11}a_{22}|, \ldots |a_{11}a_{22}, \ldots a_{nn}|$ denote the several co-axial minors of the determinant

$$|a_{11}a_{22} \ldots a_{nn}|$$

of the matrix. (For the proof of this theorem see MacMahon, “A certain Class of Generating Functions in the Theory of Numbers,” *Phil. Trans. R. S.* vol. clxxxv. A, 1894). It follows that the coefficient of

$$x_1^{\xi 1}\,x_2^{\xi 2} \ldots x_n^{\xi n}$$

in the product

$$(a_{11}x_1 + a_{12}x_2 + \ldots + a_{1n}x_n)^{\xi 1}\,(a_{21}x_1 + a_{22}x_2 + \ldots + a_{2n}x_n)^{\xi 2} \ldots (a_{n1}x_1 + a_{n2}x_2 + \ldots + a_{nn}x_n)^{\xi n}$$

is equal to the coefficient of the same term in the expansion ascending-wise of the fraction

$$\frac{1}{1 - \Sigma\,|a_{11}|x_1 + \Sigma\,|a_{11}a_{22}|x_1x_2 + (-)^n\,|a_{11}a_{22} \ldots |\ x_1x_2 \ldots x_n}.$$

If the elements of the determinant be all of them equal to unity, we obtain the functions which enumerate the unrestricted permutations of the letters in

$$x_1^{\xi 1}\,x_2^{\xi 2} \ldots x_n^{\xi n},$$

viz.

$$(x_1 + x_2 + \ldots - x_n)^{\xi 1+\xi 2+ \ldots +\xi n}$$

and

$$\frac{1}{1 - (x_1 + x_2 + \ldots + x_n)}.$$

Suppose that we wish to find the generating function for the enumeration of those permutations of the letters in $x_1^{\xi 1}\, x_2^{\xi 2} \ldots x_n^{\xi n}$ which are such that no letter x_s is in a position originally occupied by an x_3 for all values of s. This is a generalization of the “Problème des rencontres” or of “derangements.” We have merely to put

$$a_{11} = a_{22} = a_{33} = \ldots = a_{nn} = 0$$

and the remaining elements equal to unity. The generating product is

$$(x_2 + x_2 + \ldots + x_n)^{\xi 1}\, (x_1 + x_3 + \ldots + x_n)^{\xi 2} \ldots (x_1 + x_2 + \ldots + x_{n-1})^{\xi n},$$

and to obtain the condensed form we have to evaluate the co-axial minors of the invertebrate determinant—

$$\begin{vmatrix} 0 & 1 & 1 & \ldots & 1 \\ 1 & 0 & 1 & \ldots & 1 \\ 1 & 1 & 0 & \ldots & 1 \\ . & . & . & \ldots & . \\ 1 & 1 & 1 & \ldots & 0 \end{vmatrix}$$

The minors of the 1st, 2nd, 3rd ... nth orders have respectively the values

$$\begin{gathered} 0 \\ -1 \\ +2 \\ . \\ . \\ . \\ (-)^{n-1}\,(n - 1), \end{gathered}$$

therefore the generating function is

$$\frac{1}{1 - \Sigma\, x_1x_2 - 2\Sigma\, x_1x_2x_3 - \ldots - s\Sigma\, x_1x_2 \ldots x_{s+1} - \ldots - (n - 1)\, x_1x_2 \ldots x_n};$$

or writing

$$(x - x_1)\,(x - x_2) \ldots (x - x_n) = x_n - a_1x^{n-1} + a_2x^{n-2} - \ldots,$$

this is

$$\frac{1}{1 - a_2 - 2a_3 - 3a_4 - \ldots - (n - 1)\, a_n}$$

Again, consider the general problem of “derangements.” We have to find the number of permutations such that exactly *m* of the letters are in places they originally occupied. We have the particular redundant product

$$(ax_1 + x_2 + \ldots + x_n)^{\xi 1}\, (x_1 + ax_2 + \ldots + x_n)^{\xi 2} \ldots (x_1 + x_2 + \ldots + ax_n)^{\xi n}$$

in which the sought number is the coefficient of $a^m\, x_1^{\xi 1}\, x_2^{\xi 2} \ldots x_n^{\xi n}$. The true generating function is derived from the determinant

$$\begin{vmatrix} a & 1 & 1 & 1 & . & . & . \\ 1 & a & 1 & 1 & . & . & . \\ 1 & 1 & a & 1 & . & . & . \\ 1 & 1 & 1 & a & . & . & . \\ . & . & . & . & & & \\ . & . & . & . & & & \end{vmatrix}$$

and has the form

$$\frac{1}{1 - a\Sigma x_1 + (a - 1)(a + 1)\Sigma x_1x_2 - \ldots + (-)^n (a - 1)^{n-1} (a + n - 1)x_1x_2 \ldots x_n}.$$

It is clear that a large class of problems in permutations can be solved in a similar manner, viz. by giving special values to the elements of the determinant of the matrix. The redundant product leads uniquely to the real generating function, but the latter has generally more than one representation as a redundant product, in the cases in which it is representable at all. For the existence of a redundant form, the coefficients of x_1, x_2, ... x_1x_2 ... in the denominator of the real generating function must satisfy $2^n - n^2 + n - 2$ conditions, and assuming this to be the case, a redundant form can be constructed which involves n - 1 undetermined quantities. We are thus able to pass from any particular redundant generating function to one equivalent to it, but involving n - 1 undetermined quantities. Assuming these quantities at pleasure we obtain a number of different algebraic products, each of which may have its own meaning in arithmetic, and thus the number of arithmetical correspondences obtainable is subject to no finite limit (cf. MacMahon, *loc. cit.* pp. 125 et seq.)]

3. *The Theory of Partitions. Parcels defined by (m).*—When an ordinary unipartite number n is broken up into other numbers, and the order of occurrence of the numbers is immaterial, the collection of numbers is termed a partition of the number n. It is usual to arrange the numbers comprised in the collection, termed the parts of the partition, in descending order of magnitude, and to indicate repetitions of the same part by the use of exponents. Thus (32111), a partition of 8, is written (321^3). Euler's pioneering work in the subject rests on the observation that the algebraic multiplication

Case III.

$$x^a \times x^b \times x^c \times \ldots x^{a+b+c+\ldots}$$

is equivalent to the arithmetical addition of the exponents a, b, c, ... He showed that the number of ways of composing n with p integers drawn from the series a, b, c, ..., repeated or not, is equal to the coefficient of $\zeta^p x^n$ in the ascending expansion of the fraction

$$\frac{1}{1 - \zeta x^a . 1 - \zeta x^b . 1 - \zeta x^c . \ldots},$$

which he termed the generating function of the partitions in question.

If the partitions are to be composed of p, or fewer parts, it is merely necessary to multiply this fraction by $1/(1 - \zeta)$. Similarly, if the parts are to be unrepeated, the generating function is the algebraic product

$$(1 + \zeta x^a)(1 + \zeta x^b)(1 + \zeta x^c) \ldots;$$

if each part may occur at most twice,

$$(1 + \zeta x^a + \zeta^2 x^{2a})(1 + \zeta x^b + \zeta^2 x^{2b})(1 + \zeta x^c + \zeta^2 x^{2c}) \ldots;$$

and generally if each part may occur at most k - 1 times it is

$$\frac{1 - \zeta^k x^{ka}}{1 - \zeta x^a} \cdot \frac{1 - \zeta^k x^{kb}}{1 - \zeta x^b} \cdot \frac{1 - \zeta^k x^{kc}}{1 - \zeta x^c} \cdot \ldots$$

It is thus easy to form generating functions for the partitions of numbers into parts subject to various restrictions. If there be no restriction in regard to the numbers of the parts, the generating function is

$$\frac{1}{1 - x^a . 1 - x^b . 1 - x^c . \ldots}$$

and the problems of finding the partitions of a number n, and of determining their number, are the same as those of solving and enumerating the solutions of the indeterminate equation in positive integers

$$ax + by + cz + \ldots = n.$$

Euler considered also the question of enumerating the solutions of the indeterminate simultaneous equation in positive integers

$$ax + by + cz + \ldots = n$$

$$a'x + b'y + c'z + \ldots = n'$$
$$a''x + b''y + c''z + \ldots = n''$$

which was called by him and those of his time the "Problem of the Virgins." The enumeration is given by the coefficient of $x^n y^{n'} z^{n''} \ldots$ in the expansion of the fraction

$$\frac{1}{(1 - x^a y^b z^c \ldots)(1 - x^{a'} y^{b'} z^{c'} \ldots)(1 - x^{a''} y^{b''} z^{c''} \ldots) \ldots}$$

which enumerates the partitions of the multipartite number $\overline{nn'n''\ldots}$ into the parts

$$\overline{abc\ldots}, \overline{a'b'c'\ldots}, \overline{a''b''c''\ldots} \ldots.$$

Sylvester has determined an analytical expression for the coefficient of x^n in the expansion of

$$\frac{1}{(1 - x^a)(1 - x^b) \ldots (1 - x^i)}.$$

To explain this we have two lemmas:—

Lemma 1.—The coefficient of x^{-1}, *i.e.*, after Cauchy, the residue in the ascending expansion of $(1 - e^x)^{-i}$, is -1. For when i is unity, it is obviously the case, and

$$(1 - e^x)^{-i-1} = (1 - e^x)^{-i} + e^x(1 - e^x)^{-i-1} = (1 - e^x)^{-i} + \frac{d}{dx}(1 - e^x)^{-i} \cdot \frac{1}{i}.$$

Here the residue of $d/dx\ (1 - e^x)^{-i} \cdot 1/i$ is zero, and therefore the residue of $(1 - e^x)^{-i}$ is unchanged when i is increased by unity, and is therefore always -1 for all values of i.

Lemma 2.—The constant term in any proper algebraical fraction developed in ascending powers of its variable is the same as the residue, with changed sign, of the sum of the fractions obtained by substituting in the given fraction, in lieu of the variable, its exponential multiplied in succession by each of its values (zero excepted, if there be such), which makes the given fraction infinite. For write the proper algebraical fraction

$$F(x) = \Sigma\Sigma \frac{c_{\lambda,\mu}}{(a_\mu - x)\lambda} + \Sigma \frac{\gamma\lambda}{x_\lambda}.$$

The constant term is

$$\Sigma\Sigma \frac{c_{\lambda,\mu}}{a_\mu^\lambda}.$$

Let a_ν be a value of x which makes the fraction infinite. The residue of

$$\Sigma\Sigma\Sigma \frac{c_{\lambda,\mu}}{(a_\mu - a_\nu e^x)^\lambda} + \Sigma \frac{\gamma_\lambda}{a_\nu^\lambda e^{\lambda x}}$$

is equal to the residue of

$$\Sigma\Sigma\Sigma \frac{c_{\lambda,\mu}}{(a_\mu - a_\nu e^x)^\lambda},$$

and when $\nu = \mu$, the residue vanishes, so that we have to consider

$$\Sigma\Sigma \frac{c_{\lambda,\mu}}{a_\nu^\lambda (1 - e^x)^\lambda},$$

and the residue of this is, by the first lemma,

$$-\Sigma\Sigma \frac{c_{\lambda,\mu}}{a_\nu^\lambda},$$

which proves the lemma.

Take $F(x) = 1 / [x^n (1 - x^a)(1 - x^b) \ldots (1 - x^l)] = \int(x) / x^n$, since the sought number is its constant term.

Let ρ be a root of unity which makes $\int(x)$ infinite when substituted for x. The function of which we have to take the residue is

$$\Sigma\, \rho^{-n} e^{nx} \int(\rho e^{-x}) = \Sigma \frac{\rho^{-n} e^{nx}}{(1 - \rho^a e^{-ax})(1 - \rho^b e^{-bx}) \ldots (1 - \rho^l e^{-lx})}.$$

We may divide the calculation up into sections by considering separately that portion of the

summation which involves the primitive qth roots of unity, q being a divisor of one of the numbers a, b, ... l. Thus the qth *wave* is

$$\Sigma \frac{\rho_q^{-n} e^{nx}}{(1 - \rho_q^a e^{-ax})(1 - \rho_q^b e^{-bx}) \ldots (1 - \rho_q^l e^{-lx})},$$

which, putting $1 / \rho_q$ for ρ_q and $\nu = \frac{1}{2}(a + b + \ldots + l)$, may be written

$$\Sigma \frac{\rho_q^{\nu} e^{\nu x}}{(\rho_q^{\frac{1}{2}a} e^{\frac{1}{2}ax} - \rho_q^{-\frac{1}{2}a} e^{-\frac{1}{2}ax})(\rho_q^{\frac{1}{2}b} e^{\frac{1}{2}bx} - \rho_q^{-\frac{1}{2}b} e^{-\frac{1}{2}bx}) \ldots (\rho_q^{\frac{1}{2}l} e^{\frac{1}{2}lx} - \rho_q^{-\frac{1}{2}l} e^{-\frac{1}{2}lx})},$$

and the calculation in simple cases is practicable.

Thus Sylvester finds for the coefficient of x^n in

$$\frac{1}{1 - x.\ 1 - x^2.\ 1 - x^3}$$

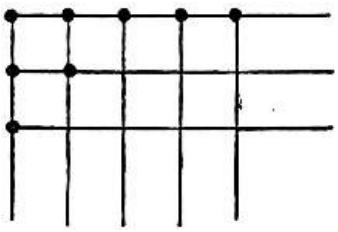
the expression

$$\frac{\nu^2}{12} - \frac{7}{72} - \frac{1}{8}(-)\nu + \frac{1}{9}(\rho_3^{\nu} + \rho_3^{-\nu}),$$

where $\nu = n + 3$.

Sylvester, Franklin, Durfee, G. S. Ely and others have evolved a constructive theory of partitions, the object of which is the contemplation of the partitions themselves, and the evolution of their properties from a study of their inherent characters. It is concerned for the most part with the partition of a number into parts drawn from the natural series of numbers 1, 2, 3 .... Any partition, say (521) of the number 8, is represented by nodes placed in order at the points of a rectangular lattice,

Sylvester's graphical method.



when the partition is given by the enumeration of the nodes by lines. If we enumerate by columns we obtain another partition of 8, viz. (321^3), which is termed the conjugate of the former. The fact or conjugacy was first pointed out by Norman Macleod Ferrers. If the original partition is one of a number n in i parts, of which the largest is j, the conjugate is one into j parts, of which the largest is i, and we obtain the theorem:— "The number of partitions of any number into [i parts | i parts or fewer,] and having the largest part [equal to j | equal or less than j,] remains the same when the numbers i and j are interchanged."

The study of this representation on a lattice (termed by Sylvester the "graph") yields many theorems similar to that just given, and, moreover, throws considerable light upon the expansion of algebraic series.

The theorem of reciprocity just established shows that the number of partitions of n into; parts or fewer, is the same as the number of ways of composing n with the integers 1, 2, 3, ... j. Hence we can expand $1 / (1 - a.\ 1 - ax.\ 1 - ax^2.\ 1 - ax^3 \ldots$ ad inf.) in ascending powers of a; for the coefficient of $a^j x^n$ in the expansion is the number of ways of composing n with j or fewer parts, and this we have seen in the coefficients of x^n in the ascending expansion of $1 / (1 - x.\ 1 - x^2 \ldots 1 - x^j)$. Therefore

$$\frac{1}{1 - a.\ 1 - ax.\ 1 - ax^2 \ldots.} = 1 + \frac{a}{1 - x} + \frac{a^2}{1 - x.\ 1 - x^2} + \ldots + \frac{a^j}{1 - x.\ 1 - x^2 \ldots.\ 1 - x^j} + \ldots.$$

The coefficient of $a^j x^n$ in the expansion of

$$\frac{1}{1 - a.\ 1 - ax.\ 1 - ax^2.\ \ldots\ 1 - ax^i}$$

denotes the number of ways of composing n with j or fewer parts, none of which are greater

than i. The expansion is known to be

$$\Sigma \frac{1 - x^{j+1}.\ 1 - x^{j+2}.\ \dots\ 1 - x^{j+i}}{1 - x.\ 1 - x^2.\ \dots\ 1 - x^i}\ a^j.$$

It has been established by the constructive method by F. Franklin (*Amer. Jour. of Math.* v. 254), and shows that the generating function for the partitions in question is

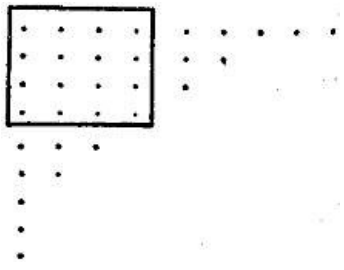
$$\frac{1 - x^{j+1}.\ 1 - x^{j+2}.\ \dots\ 1 - x^{j+i}}{1 - x.\ 1 - x^2.\ \dots\ 1 - x^i},$$

which, observe, is unaltered by interchange of i and j.

Franklin has also similarly established the identity of Euler

$$(1 - x)(1 - x^2)(1 - x^3)\ \dots\ \textit{ad inf.} \overset{j = -\infty}{\underset{j = +\infty}{=}} \Sigma\ (-)^j x^{\frac{1}{2}(3j^2+j)},$$

known as the “pentagonal number theorem,” which on interpretation shows that the number of ways of partitioning n into an even number of unrepeated parts is equal to that into an uneven number, except when n has the pentagonal form $\frac{1}{2}(3j^2 + j)$, j positive or negative, when the difference between the numbers of the partitions is $(-)^j$.



To illustrate an important dissection of the graph we will consider those graphs which read the same by columns as by lines; these are called self-conjugate. Such a graph may be obviously dissected into a square, containing say θ^2 nodes, and into two graphs, one lateral and one subjacent, the latter being the conjugate of the former. The former graph is limited to contain not more than θ parts, but is subject to no other condition. Hence the number of self-conjugate partitions of n which are associated with a square of θ^2 nodes is clearly equal to the number of partitions of $\frac{1}{2}(n - \theta^2$ into θ or few parts, *i.e.* it is the coefficient of $x^{\frac{1}{2}(n-\theta^2)}$ in

$$\frac{1}{1 - x.\ 1 - x^2.\ 1 - x^3.\ \dots\ 1 - x^\theta.},$$

or of x^n in

$$\frac{x^{\theta 2}}{1 - x^2.\ 1 - x^4.\ 1 - x^6.\ \dots\ 1 - x^{2\theta}},$$

and the whole generating function is

$$1 + \Sigma\ \underset{\theta = 1}{\overset{\theta = \infty}{}} \frac{x^{\theta 2}}{1 - x^2.\ 1 - x^4.\ 1 - x^6.\ \dots\ 1 - x^{2\theta}}.$$

Now the graph is also composed of θ angles of nodes, each angle containing an uneven number of nodes; hence the partition is transformable into one containing θ unequal uneven numbers. In the case depicted this partition is (17, 9, 5, 1). Hence the number of the partitions based upon a square of θ^2 nodes is the coefficient of $a^\theta x^n$ in the product $(1 + ax)\ (1 + ax^3)\ (1 + ax^5)\ \dots\ (1 + ax^{2s+1})$ ..., and thence the coefficient of a^θ in this product is $x^{\theta 2}$ / $(1 - x^2.\ 1 - x^4.\ 1 - x^6\ \dots\ 1 - x^{2\theta})$, and we have the expansion

$$(1 + ax)\ (1 + ax^3)\ (1 + ax^5)\ \dots\ \textit{ad inf.} = 1 + \frac{x}{1 - x^2} a + \frac{x^4}{1 - x^2.\ 1 - x^4} a^2 + \frac{x^9}{1 - x^2.\ 1 - x^4.\ 1 - x^6} a^3 + \dots$$

Again, if we restrict the part magnitude to i, the largest angle of nodes contains at most 2i - 1 nodes, and based upon a square of θ^2 nodes we have partitions enumerated by the coefficient of $a^\theta x^n$ in the product $(1 + ax)\ (1 + ax^3)\ (1 + ax^5)\ \dots\ (1 + ax^{2i-1})$; moreover the same number enumerates the partition of $\frac{1}{2}(n - \theta^2)$ into θ or fewer parts, of which the largest part is equal to or less than i - θ, and is thus given by the coefficient of $x^{\frac{1}{2}(n-\theta^2)}$ in the expansion of

$$\frac{1 - x^{i-\theta+1}.\ 1 - x^{i-\theta+2}.\ 1 - x^{i-\theta+3}.\ \dots\ 1 - x^i}{1 - x.\ 1 - x^2.\ 1 - x^3.\ \dots\ 1 - x^\theta},$$

or of x^n in

$$\frac{1 - x^{2i-2\theta+2}.\ 1 - x^{2i-2\theta+4}.\ \ldots\ 1 - x^{2i}}{1 - x^{2}.\ 1 - x^{4}.\ 1 - x^{6}.\ \ldots\ 1 - x^{2\theta}}\ x\theta^{2};$$

hence the expansion

$$(1 + ax)\ (1 + ax^3)\ (1 + ax^5)\ \ldots\ (1 + ax^{2i-1}) = 1 + \Sigma_{\theta=1}^{\theta=i} \frac{1 - x^{2i-2\theta+2}.\ 1 - x^{2i-2\theta+4}.\ \ldots\ 1 + x^{2i}}{1 - x^{2}.\ 1 - x^{4}.\ 1 - x^{6}.\ \ldots\ 1 - x^{2\theta}}\ x^{\theta^2}\ a^{\theta}.$$

Extension to three dimensions.

There is no difficulty in extending the graphical method to three dimensions, and we have then a theory of a special kind of partition of multipartite numbers. Of such kind is the partition

$$\overline{(a_1 a_2 a_3 \ldots,\ (b_1 b_2 b_3 \ldots,\ (c_1 c_2 c_3 \ldots,\ \ldots)}$$

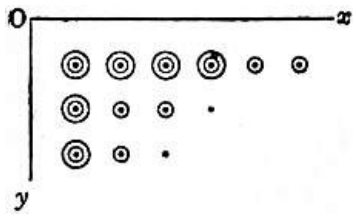
of the multipartite number

$$\overline{(a_1 + b_1 + c_1 + \ldots,\ a_2 + b_2 + c_2 + \ldots,\ a_3 + b_3 + c_3 + \ldots,\ \ldots)}$$

if

$$a_1 \geq a_2 \geq a_3 \geq \ldots;\ b_1 \geq b_2 \geq b_3 \geq \ldots,\ \ldots$$
$$a_3 \geq b_3 \geq c_3 \geq \ldots,$$

for then the graphs of the parts $\overline{a_1 a_2 a_3 \ldots}$, $\overline{b_1 b_2 b_3 \ldots}$, ... are superposable, and we have what we may term a *regular* graph in three dimensions. Thus the partition ($\overline{643}$, $\overline{632}$, $\overline{411}$) of the multipartite $\overline{(16, 8, 6)}$ leads to the graph



and every such graph is readable in six ways, the axis of z being perpendicular to the plane of the paper.

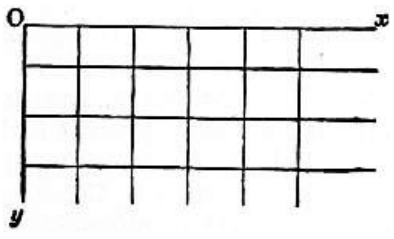
Ex. Gr.

Plane	parallel to	xy,	direction	Ox	reads	($\overline{643}$, $\overline{632}$, $\overline{411}$)
”	”	xy,	”	Oy	”	($\overline{333211}$, $\overline{332111}$, $\overline{311100}$)
”	”	yz,	”	Oy	”	($\overline{333}$, $\overline{331}$, $\overline{321}$, $\overline{211}$, $\overline{110}$, $\overline{110}$)
”	”	yz,	”	Oz	”	($\overline{333}$, $\overline{322}$, $\overline{321}$, $\overline{310}$, $\overline{200}$, $\overline{200}$)
”	”	zx,	”	Oz	”	($\overline{333322}$, $\overline{322100}$, $\overline{321000}$)
”	”	zx,	”	Ox	”	($\overline{664}$, $\overline{431}$, $\overline{321}$)

the partitions having reference to the multipartite numbers $\overline{16,\ 8,\ 6}$, $\overline{976422}$, $\overline{13,\ 11,\ 6}$, which are brought into relation through the medium of the graph. The graph in question is more conveniently represented by a numbered diagram, viz.—

3 3 3 3 2 2
3 2 2 1
3 2 1

and then we may evidently regard it as a unipartite partition on the points of a lattice,



the descending order of magnitude of part being maintained along *every* line of route which proceeds from the origin in the positive directions of the axes.

This brings in view the modern notion of a partition, which has enormously enlarged the scope of the theory. We consider any number of points *in plano* or *in solido* connected (or not) by lines in pairs in any desired manner and fix upon any condition, such as is implied by the symbols ≥, >, =, <, ≤, ≷, as affecting any pair of points so connected. Thus in ordinary unipartite partition we have to solve in integers such a system as

$$\alpha_1 \geq \alpha_2 \geq \alpha_3 \geq \ldots \ldots \alpha_n$$
$$\alpha_1 + \alpha_2 + \alpha_3 + \ldots + \alpha_n = n,$$

the points being in a straight line. In the simplest example of the three-dimensional graph we have to solve the system

$$\begin{array}{l} \alpha_1 \geq \alpha_2 \\ \quad \gtrless \quad \triangleq \\ \alpha_3 \geq \alpha_4 \end{array} \qquad \alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 = n,$$

and a system for the general lattice constructed upon the same principle. The system has been discussed by MacMahon, *Phil. Trans.* vol. clxxxvii. A, 1896, pp. 619-673, with the conclusion that if the numbers of nodes along the axes of x, y, z be limited not to exceed the numbers m, n, l respectively, then writing for brevity $1 - x^s = (s)$, the generating function is given by the product of the factors

$$\begin{array}{l|l} & x \\ \hline \dfrac{(l+1)}{(1)} \cdot \dfrac{(l+2)}{(2)} \ldots\ldots \dfrac{(l+m)}{(m)} & \\ \dfrac{(l+2)}{(2)} \cdot \dfrac{(l+3)}{(3)} \ldots\ldots \dfrac{(l+m+1)}{(m+1)} & \\ \quad . \quad . \quad \ldots\ldots \quad . & \\ \quad . \quad . \quad \ldots\ldots \quad . & \\ \quad . \quad . \quad \ldots\ldots \quad . & \\ \dfrac{(l+n)}{(n)} \cdot \dfrac{(l+n+1)}{(n+1)} \ldots\ldots \dfrac{(l+m+n-1)}{(m+n-1)} & \\ \hline y & \end{array}$$

one factor appearing at each point of the lattice.

In general, partition problems present themselves which depend upon the solution of a number of simultaneous relations in integers of the form

$$\lambda_1\alpha_1 + \lambda_2\alpha_2 + \lambda_3\alpha_3 + \ldots \geq 0,$$

the coefficients λ being given positive or negative integers, and in some cases the generating function has been determined in a form which exhibits the fundamental solutions of the problems from which all other solutions are derivable by addition. (See MacMahon, *Phil. Trans.* vol. cxcii. (1899), pp. 351-401; and *Trans. Camb. Phil. Soc.* vol. xviii. (1899), pp. 12-34.)

Method of symmetric functions.

The number of distributions of n objects $(p_1p_2p_3 \ldots)$ into parcels (m) is the coefficient of $b^m(p_1p_2p_3 \ldots)x^n$ in the development of the fraction

$$\begin{array}{rl} & \dfrac{1}{(1 - b\alpha x.\ 1 - b\beta x.\ 1 - b\gamma x \ldots \quad)} \\ \times & (1 - b\alpha^2x^2.\ 1 - b\alpha\beta x^2.\ 1 - b\beta^2x^2 \ldots \quad) \\ \times & (1 - b\alpha^3x^3.\ 1 - b\alpha^2\beta x^3.\ 1 - b\alpha\beta\gamma x^3 \ldots \quad) \\ & \quad . \quad . \quad . \quad . \quad . \quad . \end{array}$$

and if we write the expansion of that portion which involves products of the letters α, β, γ, ... of degree r in the form

$$1 + h_{r1}\, bx^r + h_{r2}\, b^2x^{2r} + \ldots ,$$

we may write the development

$$\Pi_{r=1}^{r=\infty} (1 + h_{r1}\, bx^r + h_{r2}\, b^2x^{2r} + \ldots),$$

and picking out the coefficient of $b^m x^n$ we find

$$\Sigma_{t_1\ t_2\ t_3} h_{\tau 1}h_{\tau 2}h_{\tau 3} \ldots ,$$

where

$$\Sigma \tau = m,\ \Sigma rt = n.$$

The quantities h are symmetric functions of the quantities α, β, γ, ... which in simple cases can be calculated without difficulty, and then the distribution function can be formed.

Ex. Gr.—Required the enumeration of the partitions of all multipartite numbers $(p_1p_2p_3 \ldots)$ into exactly two parts. We find

$$h_{2^2} = h_4 - h_3h_1 + h^2{}_2$$
$$h_{3^2} = h_6 - h_5h_1 + h_4h_2$$
$$h_{4^2} = h_8 - h_7h_1 + h_6h_2 + h_5h_3 + h^2{}_4,$$

and paying attention to the fact that in the expression of h_{r2} the term $h^2{}_r$ is absent when r is uneven, the law is clear. The generating function is

$$h_2x^2 + h_2h_1x^3 + (h_4 + h_2^2)x^4 + (h_4h_1 + h_3h_2)x^5 + (h_6 + 2h_4h_2)x^6 + (h_6h_1 + h_5h_2 + h_4h_3)x^7 + (h_8 + 2h_6h_2 + h_4^2)x^8 + \ldots$$

Taking

$$h_4 + h_2^2 = h_4 + \{(2) + (1^2)\}^2 = 2(4) + 3(31) + 4(2^2) + 5(21^2) + 7(1^4),$$

the term $5(21^2)$ indicates that objects such as a, a, b, c can be partitioned in five ways into two parts. These are a | a, b, c; b | a; a, c; c | a, a, b; a, a | b, c; a, b | a, c. The function h_{r^s} has been studied. (See MacMahon, *Proc. Lond. Math. Soc.* vol. xix.) Putting x equal to unity, the function may be written $(h_2 + h_4 + h_6 + \ldots)(1 + h_1 + h_2 + h_3 + h_4 + \ldots)$, a convenient formula.

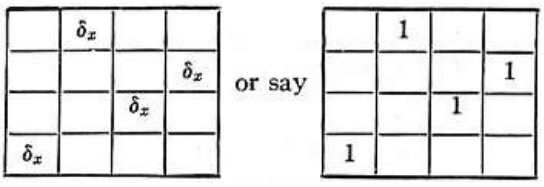
Method of differential operators.

The method of differential operators, of wide application to problems of combinatorial analysis, has for its leading idea the designing of a function and of a differential operator, so that when the operator is performed upon the function a number is reached which enumerates the solutions of the given problem. Generally speaking, the problems considered are such as are connected with lattices, or as it is possible to connect with lattices.

To take the simplest possible example, consider the problem of finding the number of permutations of n different letters. The function is here x^n, and the operator $(d/dx)^n = \delta_x^n$, yielding $\delta_x^n\, x^n = n!$ the number which enumerates the permutations. In fact— 758

$$\delta_x x^n = \delta_x \,.\, x \,.\, x \,.\, x \,.\, x \,.\, x \,.\, \ldots,$$

and differentiating we obtain a sum of n terms by striking out an x from the product in all possible ways. Fixing upon any one of these terms, say $x \,.\, \not{x} \,.\, x \,.\, x \,.\, \ldots$, we again operate with δ_x by striking out an x in all possible ways, and one of the terms so reached is $x \,.\, \not{x} \,.\, x \,.\, \not{x} \,.\, x \,.\, \ldots$. Fixing upon this term, and again operating and continuing the process, we finally arrive at one solution of the problem, which (taking say n = 4) may be said to be in correspondence with the operator diagram—



the number in each row of cempartments denoting an operation of δ_x. Hence the permutation problem is equivalent to that of placing n units in the compartments of a square

lattice of order n in such manner that each row and each column contains a single unit. Observe that the method not only enumerates, but also gives a process by which each solution is actually formed. The same problem is that of placing n rooks upon a chess-board of n^2 compartments, so that no rook can be captured by any other rook.

Regarding these elementary remarks as introductory, we proceed to give some typical examples of the method. Take a lattice of m columns and n rows, and consider the problem of placing units in the compartments in such wise that the sth column shall contain λ_s units (s = 1, 2, 3, ... m), and the tth row p_1 units (t = l, 2, 3, ... n).

Writing

$$1 + a_1x + a_2x^2 + \ldots + \ldots = (1 + a_1x)\,(1 + a_2x)(1 + a_3x)\ldots$$

and $D_p = 1/p!\ (\delta_{\alpha 1} + \alpha_1\delta_{\alpha 2} + \alpha_2\delta_{\alpha 3} + \ldots)^p$, the multiplication being symbolic, so that D_p is an operator of order p, the function is

$$a_{\lambda 1}a_{\lambda 2}a_{\lambda 3}\ldots a_{\lambda m},$$

and the operator $D_{p1}D_{p2}D_{p3}\ldots D_{pn}$. The number $D_{p1}D_{p2}\ldots D_{pn}a_{\lambda 1}a_{\lambda 2}a_{\lambda 3}\ldots a_{\lambda m}$ enumerates the solutions. For the mode of operation of D_p upon a product reference must be made to the section on “Differential Operators” in the article Algebraic Forms. Writing

$$a_{\lambda 1}a_{\lambda 2}\ldots a_{\lambda m} = \ldots A\Sigma\,\alpha^{p1}_1\,\alpha^{p2}_2\ldots\alpha^{pn}_n + \ldots,$$

or, in partition notation,

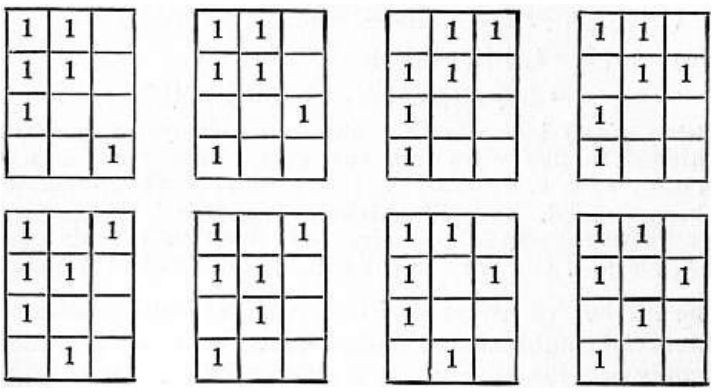
$$(1^{\lambda 1})\,(1^{\lambda 2})\ldots(1^{\lambda m}) = \ldots + A(p_1p_2\ldots p_n)\ldots + D_{p1}D_{p2}\ldots D_{pn}\,(1^{\lambda 1})\,(1^{\lambda 2})\ldots(1^{\lambda m}) = A$$

and the law by which the operation is performed upon the product shows that the solutions of the given problem are enumerated by the number A, and that the process of operation actually represents each solution.

Ex. Gr.—Take

$$\lambda_1 = 3,\ \lambda_2 = 2,\ \lambda_3 = 1,$$
$$p_1 = 2,\ p_2 = 2,\ p_3 = 1,\ p_4 = 1,$$
$$D^2{}_2D^2{}_1\,a_3a_2a_1 = 8,$$

and the process yields the eight diagrams:—



viz. every solution of the problem. Observe that transposition of the diagrams furnishes a proof of the simplest of the laws of symmetry in the theory of symmetric functions.

For the next example we have a similar problem, but no restriction is placed upon the magnitude of the numbers which may appear in the compartments. The function is now $h_{\lambda 1}h_{\lambda 2}\ldots h_{\lambda m}$, $h_{\lambda m}$ being the homogeneous product sum of the quantities a, of order λ. The operator is as before

$$D_{p1}D_{p2}\ldots D_{pn},$$

and the solutions are enumerated by

$$D_{p1}D_{p2}\ldots D_{pn}\,h_{\lambda 1}h_{\lambda 2}\ldots h_{\lambda m}.$$

Putting as before $\lambda_1 = 2$, $\lambda_2 = 2$, $\lambda_3 = 1$, $p_1 = 2$, $p_2 = 2$, $p_3 = 1$, $p_4 = 1$, the reader will have no difficulty in constructing the diagrams of the eighteen solutions.

The next and last example of a multitude that might be given shows the extraordinary power of the method by solving the famous problem of the "Latin Square," which for hundreds of years had proved beyond the powers of mathematicians. The problem consists in placing n letters a, b, c, ... n in the compartments of a square lattice of n^2 compartments, no compartment being empty, so that no letter occurs twice either in the same row or in the same column. The function is here

$$(\Sigma\, \alpha_1^{2^{n-1}}\, \alpha_2^{2^{n-2}} \ldots \alpha_{n-1}^2\, \alpha_n)^n,$$

and the operator $D^n_{2^{n-1}}$, the enumeration being given by

$$D^n_{2^{n-1}}\, (\Sigma\, \alpha_1^{2^{n-1}}\, \alpha_2^{2^{n-2}} \ldots \alpha_{n-1}^2\, \alpha_n)^n.$$

See *Trans. Camb. Phil. Soc.* vol. xvi. pt. iv. pp. 262-290.

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(P. A. M.)

COMBUSTION (from the Lat. *comburere*, to burn up), in chemistry, the process of burning or, more scientifically, the oxidation of a substance, generally with the production of flame and the evolution of heat. The term is more customarily given to productions of flame such as we have in the burning of oils, gas, fuel, &c., but it is conveniently extended to other cases of oxidation, such as are met with when metals are heated for a long time in air or oxygen. The term "spontaneous combustion" is used when a substance smoulders or inflames apparently without the intervention of any external heat or light; in such cases, as, for example, in heaps of cotton-waste soaked in oil, the oxidation has proceeded slowly, but steadily, for some time, until the heat evolved has raised the mass to the temperature of ignition.

The explanation of the phenomena of combustion was attempted at very early times, and the early theories were generally bound up in the explanation of the nature of fire or flame. The idea that some extraneous substance is essential to the process is of ancient date; Clement of Alexandria (c. 3rd century A.D.) held that some "air" was necessary, and the same view was accepted during the middle ages, when it had been also found that the products of combustion weighed more than the original combustible, a fact which pointed to the conclusion that some substance had combined with the combustible during the process. This theory was supported by the French physician Jean Ray, who showed also that in the cases of tin and lead there was a limit to the increase in weight. Robert Boyle, who made many researches on the origin and nature of fire, regarded the increase as due to the fixation of the particles of fire. Ideas identical with the modern ones were expressed by John Mayow in his *Tractatus quinque medico-physici* (1674), but his death in 1679 undoubtedly accounts for the neglect of his suggestions by his contemporaries. Mayow perceived the similarity of the processes of respiration and combustion, and showed that one constituent of the atmosphere, which he termed *spiritus nitro-aereus*, was essential to combustion and life, and that the second constituent, which he termed *spiritus nitri acidi*, inhibited combustion and life. At the beginning of the 18th century a new theory of combustion was promulgated by Georg Ernst Stahl. This theory regarded combustibility as due to a principle named phlogiston (from the Gr. φλογιστός, burnt), which was present in all combustible bodies in an amount proportional to their degree of combustibility; for instance, coal was regarded as practically pure phlogiston. On this theory, all substances which could be burnt were

composed of phlogiston and some other substance, and the operation of burning was simply equivalent to the liberation of the phlogiston. The Stahlian theory, originally a theory of combustion, came to be a general theory of chemical reactions, since it provided simple explanations of the ordinary chemical processes (when regarded qualitatively) and permitted generalizations which largely stimulated its acceptance. Its inherent defect—that the products of combustion were invariably heavier than the original substance instead of less as the theory demanded—was ignored, and until late in the 18th century it dominated chemical thought. Its overthrow was effected by Lavoisier, who showed that combustion was simply an oxidation, the oxygen of the atmosphere (which was isolated at about this time by K. W. Scheele and J. Priestley) combining with the substance burnt.

COMEDY, the general term applied to a type of drama the chief object of which, according to modern notions, is to amuse. It is contrasted on the one hand with tragedy and on the other with farce, burlesque, &c. As compared with tragedy it is distinguished by having a happy ending (this being considered for a long time the essential difference), by quaint situations, and by lightness of dialogue and character-drawing. As compared with farce it abstains from crude and boisterous jesting, and is marked by some subtlety of dialogue and plot. It is, however, difficult to draw a hard and fast line of demarcation, there being a distinct tendency to combine the characteristics of farce with those of true comedy. This is perhaps more especially the case in the so-called "musical comedy," which became popular in Great Britain and America in the later 19th century, where true comedy is frequently subservient to broad farce and spectacular effects.

The word "comedy" is derived from the Gr. κωμῳδία, which is a compound either of κῶμος (revel) and ἀοιδός (singer; ἀείδειν, ᾄδειν, to sing), or of κώμη (village) and ἀοιδός: it is possible that κῶμος itself is derived from κώμη, and originally meant a village revel. The word comes into modern usage through the Lat. *comoedia* and Ital. *commedia*. It has passed through various shades of meaning. In the middle ages it meant simply a story with a happy ending. Thus some of Chaucer's Tales are called comedies, and in this sense Dante used the term in the title of his poem, *La Commedia* (cf. his *Epistola* X., in which he speaks of the comic style as "loquutio vulgaris, in qua et mulierculae communicant"; again "comoedia vero remisse et humiliter"; "differt a tragoedia per hoc, quod t. in principio est admirabilis et quieta, in fine sive exitu est foetida et horribilis"). Subsequently the term is applied to mystery plays with a happy ending. The modern usage combines this sense with that in which Renaissance scholars applied it to the ancient comedies.

The adjective "comic" (Gr. κωμικός), which strictly means that which relates to comedy, is in modern usage generally confined to the sense of "laughter-provoking": it is distinguished from "humorous" or "witty" inasmuch as it is applied to an incident or remark which provokes spontaneous laughter without a special mental effort. The phenomena connected with laughter and that which provokes it, the comic, have been carefully investigated by psychologists, in contrast with other phenomena connected with the emotions. It is very generally agreed that the predominating characteristics are incongruity or contrast in the object, and shock or emotional seizure on the part of the subject. It has also been held that the feeling of superiority is an essential, if not the essential, factor: thus Hobbes speaks of laughter as a "sudden glory." Physiological explanations have been given by Kant, Spencer and Darwin. Modern investigators have paid much attention to the origin both of laughter and of smiling, babies being watched from infancy and the date of their first smile being carefully recorded. For an admirable analysis and account of the theories see James Sully, *On Laughter* (1902), who deals generally with the development of the "play instinct" and its emotional expression.

See Drama; also Humour; Caricature; Play, &c.

COMENIUS (or Komensky), **JOHANN AMOS** (1592-1671), a famous writer on education, and the last bishop of the old church of the Moravian and Bohemian Brethren, was born at

Comna, or, according to another account, at Niwnitz, in Moravia, of poor parents belonging to the sect of the Moravian Brethren. Having studied at Herborn and Heidelberg, and travelled in Holland and England, he became rector of a school at Prerau, and after that pastor and rector of a school at Fulnek. In 1621 the Spanish invasion and persecution of the Protestants robbed him of all he possessed, and drove him into Poland. Soon after he was made bishop of the church of the Brethren. He supported himself by teaching Latin at Lissa, and it was here that he published his *Pansophiae prodromus* (1630), a work on education, and his *Janua linguarum reserata* (1631), the latter of which gained for him a widespread reputation, being produced in twelve European languages, and also in Arabic, Persian and Turkish. He subsequently published several other works of a similar kind, as the *Eruditionis scholasticae janua* and the *Janua linguarum trilinguis*. His method of teaching languages, which he seems to have been the first to adopt, consisted in giving, in parallel columns, sentences conveying useful information, in the vernacular and the languages intended to be taught (*i.e.* in Comenius's works, Latin and sometimes Greek). In some of his books, as the *Orbis sensualium pictus* (1658), pictures are added; this work is, indeed, the first children's picture-book. In 1638 Comenius was requested by the government of Sweden to draw up a scheme for the management of the schools of that country; and a few years after he was invited to join the commission that the English parliament then intended to appoint, in order to reform the system of education. He visited England in 1641, but the disturbed state of politics prevented the appointment of the commission, and Comenius passed over to Sweden in August 1642. The great Swedish minister, Oxenstjerna, obtained for him a pension, and a commission to furnish a plan for regulating the Swedish schools according to his own method. Devoting himself to the elaboration of his scheme, Comenius settled first at Elbing, and then at Lissa; but, at the burning of the latter city by the Poles, he lost nearly all his manuscripts, and he finally removed to Amsterdam, where he died in 1671.

As an educationist, Comenius holds a prominent place in history. He was disgusted at the pedantic teaching of his own day, and he insisted that the teaching of words and things must go together. Languages should be taught, like the mother tongue, by conversation on ordinary topics; pictures, object lessons, should be used; teaching should go hand in hand with a happy life. In his course he included singing, economy, politics, world-history, geography, and the arts and handicrafts. He was one of the first to advocate teaching science in schools.

As a theologian, Comenius was greatly influenced by Boehme. In his *Synopsis physicae ad lumen divinum reformatae* he gives a physical theory of his own, said to be taken from the book of Genesis. He was also famous for his prophecies and the support he gave to visionaries. In his *Lux in tenebris* he published the visions of Kotterus, Dabricius and Christina Poniatovia. Attempting to interpret the book of Revelation, he promised the millennium in 1672, and guaranteed miraculous assistance to those who would undertake the destruction of the Pope and the house of Austria, even venturing to prophesy that Cromwell, Gustavus Adolphus, and Rakoczy, prince of Transylvania, would perform the task. He also wrote to Louis XIV., informing him that the empire of the world should be his reward if he would overthrow the enemies of God.

Comenius also wrote against the Socinians, and published three historical works—*Ratio disciplinae ordinisque in unitate fratrum Bohemorum*, which was republished with remarks by Buddaeus, *Historia persecutionum ecclesiae Bohemicae* (1648), and *Martyrologium Bohemicum*. See Raumer's *Geschichte der Pädogogik*, and Carpzov's *Religionsuntersuchung der böhmischen und mährischen Brüder*.

COMET (Gr. κομήτης, long-haired), in astronomy, one of a class of seemingly nebulous bodies, moving under the influence of the sun's attraction in very eccentric orbits. A comet is visible only in a small arc of its orbit near perihelion, differing but slightly from the arc of a parabola. An obvious but not sharp classification of comets is into bright comets visible to the naked eye, and telescopic comets which can be seen only with a telescope. The telescopic class is much the more numerous of the two, only from 20 to 30 bright comets usually appearing in any one century, while several telescopic comets, frequently 6 or 8, are generally observed in the course of a year.

A bright comet consists of (1) a star-like nucleus; (2) a nebulous haze, called the *coma*,

surrounding this nucleus, the latter fading into the haze by insensible gradations; (3) a tail or luminous stream flowing from the coma in a direction opposite to that of the sun. The nuclei and comae of different comets exhibit few peculiarities to the unaided vision except in respect to brightness; but the tails of comets differ widely, both in brightness and in extent. They range from a barely visible brush or feather of light to a phenomenon extending over a considerable arc of the heavens, which, comparatively bright near the head of the comet, becomes gradually fainter and more diffuse towards its end, fading out by gradations so insensible that a precise length cannot be assigned to it. When a telescopic comet is first discovered the nucleus is frequently invisible, the object presenting the appearance of a faint nebulous haze, scarcely distinguishable in aspect from a nebula. When the nucleus appears it may at first be only a comparatively faint condensation, and may or may not develop into a point of light as the comet approaches the sun. A tail also is generally not seen at great distances from the sun, but gradually develops as the comet approaches perihelion, to fade away again as the comet recedes from the sun.

A few comets are known to revolve in orbits with a regular period, while, in the case of others, no evidence is afforded by observation that the orbit deviates from a parabola. Were the orbit a parabola or hyperbola the comet would never return (see ORBIT). Periodicity may be recognized in two ways: observations during the apparition may show that the motion is in an elliptic and not in a parabolic orbit; or a comet may have been observed at more than one return. In the latter case the comet is recognized as distinctly periodic, and therefore a member of the solar system. The shortest periods range between 3 and 10 years. The majority of comets which have been observed are shown by observation to be periodic; the period is usually very long, being sometimes measured by centuries, but generally by thousands of years. It is conceivable that a comet might revolve in a hyperbolic orbit. Although there are several of these bodies observations on which indicate such an orbit, the deviation from the parabolic form has not in any case been so well marked as to be fully established. Circumstances lead to the classification of newly appearing comets as *expected* and *unexpected*. An expected comet is a periodic one of which the return is looked for at a determinate time and in a certain region of the heavens. When this is not the case the comet is an unexpected one.

Physical Constitution of Comets.—The subject of the physical constitution of these bodies is one as to the details of which much uncertainty still exists. The considerations on which conclusions in this field rest are very various, and can best be set forth by beginning with what we may consider to be the best established facts.

We must regard it as well established that comets are not, like planets and satellites, permanent in mass, but are continuously losing minute portions of the matter which belongs to them, through a progressive dissipation—at least when they are in the neighbourhood of the sun. When near perihelion the matter of a comet is seen to be undergoing a process in the nature of evaporation, successive envelopes of vapour rising from the nucleus to form the coma, and then gradually repelled from the sun to form the tail. If this process went on indefinitely every comet would, in the course of ages, be entirely dissipated. This result has actually happened in the case of some known comets, the best established example of which is that of Biela, in which the process of disintegration was clearly followed. As the amount of matter lost by a comet at any one return cannot be estimated, and may be very small, it is impossible to set any limit to the period during which its life may continue. It is still an unsettled question whether, in every case, the evaporation will ultimately cease, leaving a residuum as permanent as any other mass of matter.

The next question in logical order is one of great difficulty. It is whether the nucleus of a comet is an opaque solid body, a cluster of such bodies, or a mass of particles of extreme tenuity. Some light is thrown on this and other questions by the spectroscope. This instrument shows in the spectrum of nearly every comet three bright bands, recognized as those of hydrocarbons. The obvious conclusion is that the light forming these bands is not reflected sunlight, but light radiated by the gaseous hydrocarbons. Since a gas at so great a distance from the sun cannot be heated to incandescence, the question arises how incandescence is excited. The generalizations of recent years growing out of the phenomena of radioactivity make it highly probable that the source is to be found in some form of electrical excitation, produced by electrons or other corpuscles thrown out by the sun. The resemblance of the cometary spectrum to the spectrum of hydrocarbons in the Geissler tube lends great plausibility to this view. It is remarkable that the great comet of 1882 also showed the bright lines of sodium with such intensity that they were observed in daylight by R. Copeland and W. O. Lohse. In addition to these gaseous spectra, all but the fainter comets show a continuous spectrum, crossed by the Fraunhofer lines, which is doubtless due to

reflected sunlight. It happens that, since the spectroscope has been perfected, no comet of great brilliancy has been favourably situated for observation. Until the opportunity is offered, the conclusions to be derived from spectroscopic observation cannot be further extended.

PLATE I.

FIG. 1.—COMET 1892, I. (SWIFT), 1892, APRIL 26.

By permission of Lick Observatory (E. E. Barnard)

FIG. 2.—COMET C, 1908, NOV. 16d. 13h. 10m.

By permission of Yerkes Observatory (E. E. Barnard).

PLATE II.

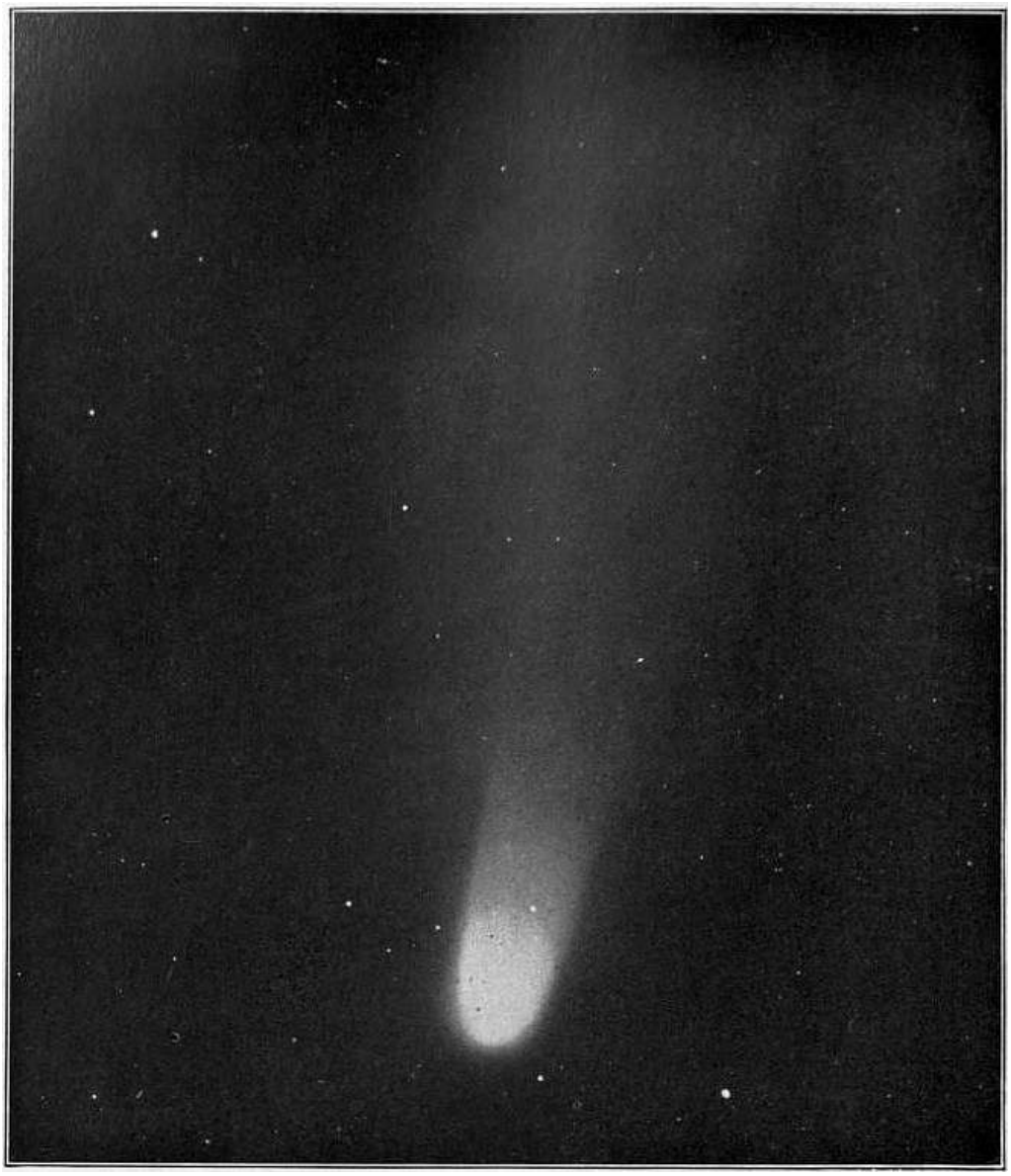

FIG. 3.—HALLEY'S COMET, 1910, APRIL 27.

By permission of Helwân Observatory, Egypt.

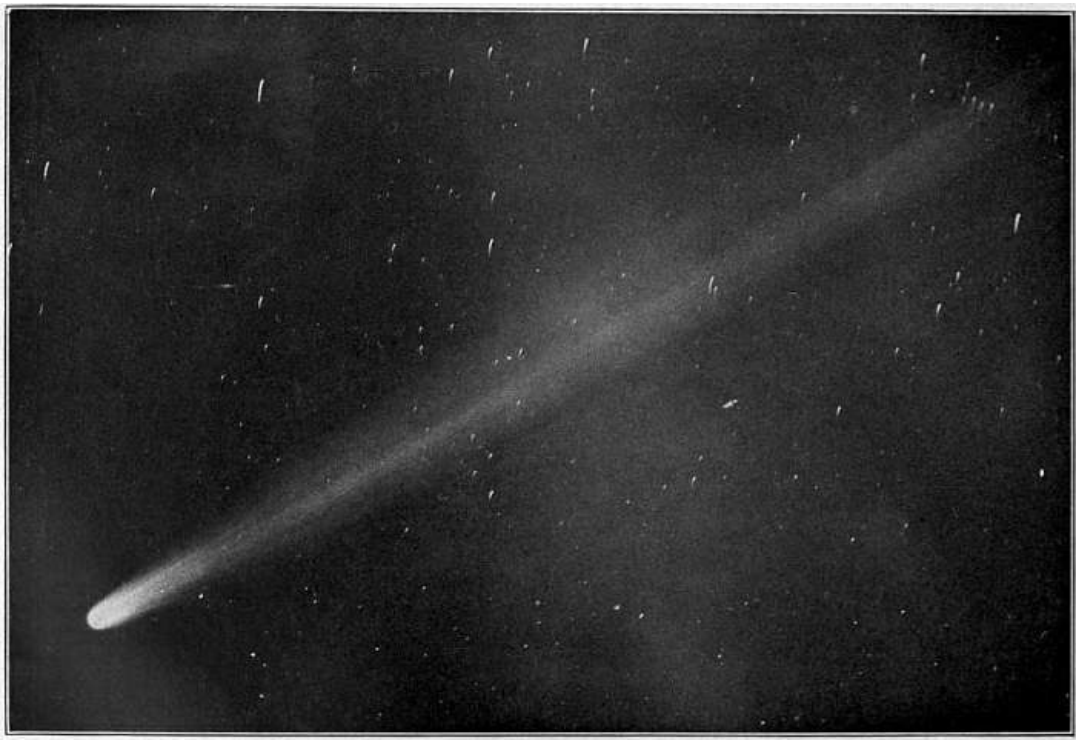

FIG. 4.—HALLEY'S COMET, 1910, MAY 4.

By permission of Yerkes Observatory (E. E. Barnard).

In the telescope the nucleus of a bright comet appears as an opaque mass, one or more seconds in diameter, the absolute dimensions comparing with those of the satellites of the planets, sometimes, indeed, equal to our moon. But the actual results of micrometric measures are found to differ very widely. In the case of Donati's comet of 1858 the nucleus seemed to grow smaller as perihelion was approached. This is evidently due to the fact that the coma immediately around the nucleus was so bright as apparently to form a part of it at considerable distances from the sun. G. P. Bond estimated the diameter of the actual nucleus at 500 m. That the nucleus is a body of appreciable mass seems to be made probable by the fact that, except for the central attraction of such a body, a comet would speedily be dissipated by the different attractions of the sun on different parts of the mass, which would result in each particle pursuing an orbit of its own. It follows that there must be a mass sufficient to hold the parts of the comet, if not absolutely together, at least in each other's immediate neighbourhood. How great a central mass may be required for this is a subject not yet investigated. It might be supposed that the amount of matter must be sufficient to make the nucleus quite opaque. But two considerations based on observations militate against this view. One is that an opaque body, reflecting much sunlight, would show a brighter continuous spectrum than has yet been found in any comet. Another and yet more remarkable observation is on record which goes far to prove not only the tenuity, but the transparency of a cometary nucleus. The great comet of 1882 made a transit over the sun on the 17th of September, an occurrence unique in the history of astronomy. But the fact of the transit escaped attention except at the observatory of the Cape of Good Hope. Here the comet was watched by W. H. Finlay and by W. L. Elkin as it approached the sun, and was kept in sight until it came almost or quite in contact with the sun's disk, when it disappeared. It should, if opaque, have appeared a few minutes later, projected on the sun's disk; but not a trace of it could be seen. The sun was approaching Table Mountain at the critical moment, and its limb was undulating badly, making the detection of a minute point difficult. The possibility of a very small opaque nucleus is therefore still left open; yet the remarkable conclusion still holds, that, immediately around a possible central nucleus, the matter of the head of the comet was so rare as not to intercept any appreciable fraction of the sun's light. This result seems also to show that, with the possible exception of a very small central mass, what seems to telescopic vision as a nucleus is really only the central portion of the coma, which, as the distance from the centre increases, becomes less and less dense by imperceptible gradations.

Another fact tending towards this same conclusion is that after this comet passed perihelion it showed several nuclei following each other. Evidently the powerful attraction of the sun had separated the parts of the apparent nucleus, which were following each other in nearly the same orbit. As they could not have been completely brought together again, we may suppose that in such cases the smaller nuclei were permanently separated from the main body. In addition to this, the remarkable similarity of the orbit of this comet to that of several others indicates a group of bodies moving in nearly the same orbit. The other members of the group were the great comets of 1843, 1880 and 1887. The latter, though so bright as to be conspicuous to the naked eye, showed no nucleus whatever. The closely related orbits of the four bodies are also remarkable for approaching nearer the sun at perihelion than does the orbit of any other known body. All of these comets pass through the matter of the sun's corona with a velocity of more than 100 m. per second without suffering any retardation. As it is beyond all reasonable probability that several independent bodies should have moved in orbits so nearly the same, the conclusion is that the comets were originally portions of one mass, which gradually separated in the course of ages by the powerful attraction of the sun as the collection successively passed the perihelion. It may be remarked that observations on the comet of 1843 seemed to show a slight ellipticity of the orbit, corresponding to a period of several centuries; but the deviation of all the orbits from a parabola is too slight to be established by observations. The periods of the comets are therefore unknown except that they must be counted by centuries and possibly by thousands of years.

Another fact which increases the complexity of the question is the well-established connexion of comets with meteoric showers. The shower of November 13-15, now known as the Leonids, which recurred for several centuries at intervals of about one-third of a century, are undoubtedly due to a stream of particles left behind by a comet observed in 1866. The same is true of Biela's comet, the disintegrated particles of which give rise to the Andromedids, and probably true also of the Perseids, or August meteors, the orbits of which have a great similarity to a comet seen in 1862. The general and well-established conclusion seems to be that, in addition to the visible features of a comet, every such body is followed in

its orbit by a swarm of meteoric particles which must have been gradually detached and separated from it. (See METEOR.)

The source of the repulsive force by which the matter forming the tail of a comet is driven away from the sun is another question that has not yet been decisively answered. Two causes have been suggested, of which one has only recently been brought to light. This is the repulsion of the sun's rays, a form of action the probability of which was shown by J. Clerk Maxwell in 1870, and which was experimentally established about thirty years later. The intensity of this action on a particle is proportional to the surface presented by the particle to the rays, and therefore to the square of its diameter, while its mass, and therefore its gravitation to the sun, are proportional to the cube of the diameter. It follows that if the size and mass of a particle in space are below a certain limit, the repulsion of the rays will exceed the attraction of the sun, and the particle will be driven off into space. But, in order that this repulsive force may act, the particles, however minute they may be, must be opaque. Moreover, theory shows that there is a lower as well as an upper limit to their magnitude, and that it is only between certain definable limits of magnitude that the force acts. Conceiving the particle to be of the density of water, and considering its diameter as a diminishing variable, theory shows that the repulsion will balance gravity when the diameter has reached 0.0015 of a millimetre. As the diameter is reduced below this limit the ratio of the repulsive to the attractive force increases, but soon reaches a maximum, after which it diminishes down to a diameter of 0.00007 mm., when the two actions are again balanced. Below this limit the light speedily ceases to act. It follows that a purely gaseous body, such as would emit a characteristic bright line spectrum, would not be subject to the repulsion. We must therefore conclude that both the solid and gaseous forms of matter are here at play, and this view is consonant with the fact that the comet leaves behind it particles of meteoric matter.

Another possible cause is electrical repulsion. The probability of this cause is suggested by recent discoveries in radioactivity and by the fact that the sun undoubtedly sends forth electrical emanations which may ionize the gaseous molecules rising from the nucleus, and lead to their repulsion from the sun, thus resulting in the phenomena of the tail. But well-established laws are not yet sufficiently developed to lead to definite conclusions on this point, and the question whether both causes are combined, and, if not, to which one the phenomena in question are mainly due, must be left to the future.

A curious circumstance, which may be explained by a duplex character of the matter forming a cometary tail, is the great difference between the visual and photographic aspect of these bodies. The soft, delicate, feathery-like form which the comet with its tail presents to the eye is wanting in a photograph, which shows principally a round head with an irregularly formed tail much like the knotted stalk of a plant. It follows that the light emitted by the central axis of the tail greatly exceeds in actinic power the diffuse light around it. A careful comparison of the form and intensity of the photographic and visual tails may throw much light on the question of the constitution of these bodies, but no good opportunity of making the comparison has been afforded since the art of celestial photography has been brought to its present state of perfection.

The main conclusion to which the preceding facts and considerations point is that the matter of a comet is partly solid and partly gaseous. The gaseous form is shown conclusively by the spectroscope, but in view of the extreme delicacy of the indications with this instrument no quantitative estimate of the gas can be made. As there is no central mass sufficient to hold together a continuous atmosphere of elastic gas of any sort, it seems probable that the gaseous molecules are only those rising from the coma, possibly by ordinary evaporation, but more probably by the action of the ultra-violet and other rays of the sun giving rise to an ionization of disconnected gaseous molecules. The matter cannot be wholly gaseous because in this case there could be no central force sufficient to keep the parts of the comet together.

The facts also point to the conclusion that the solid matter of a comet is formed of a swarm or cloud of small disconnected masses, probably having much resemblance to the meteoric masses which are known to be flying through the solar system and possibly of the same general kind as these. The question whether there is any central solid of considerable mass is still undecided; it can only be said that if so, it is probably small relative to cosmic masses in general—more likely less than greater than 100 m. in diameter. The light of the comet therefore proceeds from two sources: one the incandescence of gases, the other the sunlight reflected from the solid parts. No estimate can be formed of the ratio between these two kinds of light until a bright comet shall be spectroscopically observed during an entire apparition.

Origin and Orbits of Comets.—The great difference which we have pointed out between comets and the permanent bodies of the solar system naturally suggested the idea that these bodies do not belong to that system at all, but are nebulous masses, scattered through the stellar spaces, and brought one by one into the sphere of the sun's attraction. The results of this view are easily shown to be incompatible with the observed facts. The sun, carrying the whole solar system with it, is moving through space with a speed of about 10 m. per second. If it approached a comet nearly at rest the result would be a relative motion of this amount which, as the comet came nearer, would be constantly increased, and would result in the 762
comet describing relative to the sun a markedly hyperbolic orbit, deviating too widely from a parabola to leave any doubt, even in the most extreme cases. Moreover, a large majority of comets would then have their aphelia in the direction of the sun's motion, and therefore their perihelia in the opposite direction. Neither of these results corresponds to the fact. The conclusion is that if we regard a comet as a body not belonging to the solar system, it is at least a body which before its approach to the sun had the same motion through the stellar spaces that the sun has. As this unity of motion must have been maintained from the beginning, we may regard comets as belonging to the solar system in the sense of not being visitors from distant regions of space.

The acceptance of this seemingly inevitable conclusion leads to another: that no comet yet known moves in a really hyperbolic orbit, but that the limit of eccentricity must be regarded as 1, or that of the parabola. It is true that seeming evidence of hyperbolic eccentricity is sometimes afforded by observations and regarded by some astronomers as sufficient. The objections to the reality of the hyperbolic orbit are two: (1) A comet moving in a decidedly hyperbolic orbit must have come from so great a distance within a finite time, say a few millions of years, as to have no relation to the sun, and must after its approach to the sun return into space, never again to visit our system. In this case the motion of the sun through space renders it almost infinitely improbable that the orbit would have been so nearly a parabola as all such orbits are actually found to be. (2) The apparent deviation from a very elongated ellipse has never been in any case greater than might have been the result of errors of observation on bodies of this class.

This being granted, a luminous view of the causes which lead to the observed orbits of comets is readily gained by imagining these bodies to be formed of nebulous masses, which originally accompanied the sun in its journey through space, but at distances, in most cases, vastly greater than that of the farthest planet. Such a mass, when drawn towards the sun, would move round it in a nearly parabolic orbit, similar to the actual orbits of the great majority of comets. The period might be measured by thousands, tens of thousands, or hundreds of thousands of years, according to the distances of the comet in the beginning; but instead of bodies extraneous to the system, we should have bodies properly belonging to the system and making revolutions around the sun.

Were it not for the effect of planetary attraction long periods like these would be the general rule, though not necessarily universal. But at every return to perihelion the motion of a comet will be to some extent either accelerated or retarded by the action of Jupiter or any other planet in the neighbourhood of which it may pass. Commonly the action will be so slight as to have little influence on the orbit and the time of revolution. But should the comet chance to pass the orbit of Jupiter just in front of the planet, its motion would be retarded and the orbit would be changed into one of shorter period. Should it pass behind the planet, its motion would be accelerated and its period lengthened. In such cases the orbit might be changed to a hyperbola, and then the comet would never return. It follows that there is a tendency towards a gradual but constant diminution in the total number of comets. If we call Δe the amount by which the eccentricity of a cometary orbit is less than unity, Δe will be an extremely minute fraction in the case of the original orbits. If we call $\pm \delta$ the change which the eccentricity $1 - \Delta e$ undergoes by the action of the planets during the passage of the comet through our system, it will leave the system with the eccentricity $1 - \Delta e \pm \delta$. The possibilities are even whether δ shall be positive or negative. If negative, the eccentricity will be diminished and the period shortened. If positive, and greater than Δe, the eccentricity $1 - \Delta e + \delta$ will be greater than 1, and then the comet will be thrown into a hyperbolic orbit and become for ever a wanderer through the stellar spaces.

The nearer a comet passes to a planet, especially to Jupiter, the greatest planet, the greater δ may be. If δ is a considerable negative fraction, the eccentricity will be so reduced that the comet will after the approach be one of short period. It follows that, however long the period of a comet may be, there is a possibility of its becoming one of short period if it approaches Jupiter. There have been several cases of this during the past two centuries, the most recent being that of Brooks's comet, 1889, V. Soon after its discovery this body was

found to have a period of only about seven years. The question why it had not been observed at previous returns was settled after the orbit had been determined by computing its motion in the past. It was thus found that in October 1886 the comet had passed in the immediate neighbourhood of Jupiter, the action of which had been such as to change its orbit from one of long period to the short observed period. A similar case was that of Lexel's comet, seen in 1770. Originally moving in an unknown orbit, it encountered the planet Jupiter, made two revolutions round the sun, in the second of which it was observed, then again encountered the planet, to be thrown out of its orbit into one which did not admit of determination. The comet was never again found.

A general conclusion which seems to follow from these conditions, and is justified by observations, so far as the latter go, is that comets are not to be regarded as permanent bodies like the planets, but that the conglomerations of matter which compose them are undergoing a process of gradual dissipation in space. This process is especially rapid in the case of the fainter periodic comets. It was first strikingly brought out in the case of Biela's comet. This object was discovered in 1772, was observed to be periodic after several revolutions had been made, and was observed with a fair degree of regularity at different returns until 1852. At the previous apparition it was found to have separated into two masses, and in 1852 these masses were so widely separated that they might be considered as forming two comets. Notwithstanding careful search at times and places when the comet was due, no trace of it has since been seen. An examination of the table of periodic comets given at the end of this article will show that the same thing is probably true of several other comets, especially Brorsen's and Tempel's, which have each made several revolutions since last observed, and have been sought for in vain.

In view of the seemingly inevitable dissipation of comets in the course of ages, and of the actually observed changes of their orbits by the attraction of Jupiter, the question arises whether the orbits of all comets of short period may not have been determined by the attraction of the planets, especially of Jupiter. In this case the orbit would, for a period of several centuries, have continued to nearly intersect that of the planet. We find, as a matter of fact, that several periodic comets either pass near Jupiter or have their aphelia in the neighbourhood of the orbit of Jupiter. The approach, however, is not sufficiently close to have led to the change unless in former times the proximity of the orbits was much greater than it is now. As the orbits of all the bodies of the solar system are subject to a slow secular change of their form and position, this may only show that it must have been thousands of years since the comet became one of short period. The two cases of most difficulty are those of Halley's and Encke's comets. The orbit of the former is so elongated and so inclined to the general plane of the planetary orbits that its secular variation must be very slow indeed. But it does not pass near the orbit of any planet except Venus; and even here the proximity is far from being sufficient to have produced an appreciable change in the period. The orbit of Encke's comet is entirely within the orbit of Jupiter, and it also cannot have passed near enough to a planet for thousands of years to have had its orbit changed by the action in question. It therefore seems difficult to regard these two comets as other than permanent members of the solar system.

Special Periodic Comets.—One of the most remarkable periodic comets with which we are acquainted is that known to astronomers as Halley's. Having perceived that the elements of the comet of 1682 were nearly the same as those of two comets which had respectively appeared in 1531 and 1607, Edmund Halley concluded that all the three orbits belonged to 763
the same comet, of which the periodic time was about 76 years. After a rough estimate of the perturbations it must sustain from the attraction of the planets, he predicted its return for 1757,—a bold prediction at that time, but justified by the event, for the comet again made its appearance as was expected, though it did not pass through its perihelion till the month of March 1759, the attraction of Jupiter and Saturn having caused, as was computed by Clairault previously to its return, a retardation of 618 days. This comet had been observed in 1066, and the accounts which have been preserved represent it as having then appeared to be four times the size of Venus, and to have shone with a light equal to a fourth of that of the moon. History is silent respecting it from that time till the year 1456, when it passed very near to the earth: its tail then extended over 60° of the heavens, and had the form of a sabre. It returned to its perihelion in 1835, and was well observed in almost every observatory. But its brightness was far from comparing with the glorious accounts of its former apparitions. That this should have been due to the process of dissipation does not seem possible in so short a period; we must therefore consider either that the earlier accounts are greatly exaggerated, or that the brightness of the comet is subject to changes from some unknown cause. Previous appearances of Halley's comet have been calculated by J. R. Hind, and more recently by P. H. Cowell and A. C. D. Crommelin of Greenwich, the

latter having carried the comet back to 87 B.C. with certainty, and to 240 B.C. with fair probability. It was detected by Max Wolf at Heidelberg on plates exposed on Sept. 11, 1909, and subsequently on a Greenwich plate of Sept. 9.

The known comet of shortest period bears the name of J. F. Encke, the astronomer who first investigated its orbit and showed its periodicity. It was originally discovered in 1789, but its periodicity was not recognized until 1818, after it had been observed at several returns. This comet has given rise to a longer series of investigations than any other, owing to Encke's result that the orbit was becoming smaller, and the revolutions therefore accelerated, by some unknown cause, of which the most plausible was a resisting medium surrounding the sun. As this comet is almost the only one that passes within the orbit of Mercury, it is quite possible that it alone would show the effect of such a medium. Recent investigations of this subject have been made at the Pulkova Observatory, first by F. E. von Asten and later by J. O. Backlund who, in 1909, was awarded the Gold Medal of the Royal Astronomical Society for his researches in this field. During some revolutions there was evidence of a slight acceleration of the return, and during others there was not.

The following is a list (compiled in 1909) of comets which are well established as periodic, through having been observed at one or more returns. In addition to what has already been said of several comets in this list the following remarks may be made. Tuttle's comet was first seen by P. F. A. Méchain in 1790, but was not recognized as periodic until found by Tuttle in 1858, when the resemblance of the two orbits led to the conclusion of the identity of the bodies, the period of which was soon made evident by continued observations. The comets of Pons and Olbers are remarkable for having an almost equal period. But their orbits are otherwise totally different, so that there does not seem to be any connexion between them. Brorsen's comet seems also to be completely dissipated, not having been seen since 1879.

List of Periodic Comets observed at more than one Return.

Designation.	1st Perih. Passage.	Last Perih. Passage obs.	Period Years.	Least Dist. Ast. Units.	Gr. Dist. Ast. Units.
Halley	1456 June 8.2	1835 Nov. 15.9	75.9	0.58	35.42
Biela	1772 Feb. 16.7	1852 Sept. 23.4	6.67	0.98	6.18
Encke	1786 Jan. 30.9	1905 Jan. 11.4	3.29	0.34	4.08
Tuttle	1790 Jan. 30.9	1899 May 4.5	13.78	1.03	10.53
Poris	1812 Sept. 15.3	1884 Jan. 25.7	72.28	0.78	33.70
Olbers	1815 April 26.0	1887 Oct. 8.5	73.32	1.21	33.99
Winnecke	1819 July 18.9	1898 Mar. 20.4	5.67	0.77	5.55
Faye	1843 Oct. 17.1	1896 Mar. 19.3	7.50	1.69	5.93
De Vico	1844 Sept. 2.5	1894 Oct. 12.2	5.66	1.19	5.01
Brorsen	1846 Feb. 11.1	1879 Mar. 30.5	5.52	0.65	5.63
D'Arrest	1851 July 8.7	1897 May 21.7	6.56	1.17	5.71
Tempel I.	1867 May 23.9	1879 May 7.0	5.84	1.56	4.82
Tempel-Swift	1869 Nov. 18.8	1891 Nov. 15.0	5.51	1.06	5.16
Tempel II.	1873 June 25.2	1904 Nov. 10.5	5.28	1.34	4.66
Wolf	1884 Nov. 17.8	1898 July 4.6	6.80	1.59	5.57
Finlay	1886 Nov. 22.4	1893 July 12.2	6.64	0.99	6.17
Brooks	1889 Sept. 30.3	1903 Dec. 6.5	7.10	1.95	5.44
Holmes	1892 June 13.2	1899 April 28.1	6.89	2.14	4.50

There are also a number of cases in which a comet has been observed through one apparition, and found to be apparently periodic, but which was not seen to return at the end of its supposed period. In some of these cases it seems likely that the comet passed near the planet Jupiter and thus had its orbit entirely changed. It is possible that in other cases the apparent periodicity is due to the unavoidable errors of observation to which, owing to their diffused outline, the nuclei of comets are liable.

(S. N.)

COMET-SEEKER, a small telescope (*q.v.*) adapted especially to searching for comets: commonly of short focal length and large aperture, in order to secure the greatest brilliancy

of light.

COMILLA, or KUMILLA, a town of British India, headquarters of Tippera district in Eastern Bengal and Assam, situated on the river Gumti, with a station on the Assam-Bengal railway, 96 m. from the coast terminus at Chittagong. Pop. (1901) 19,169. The town has many large tanks and an English church, built in 1875.

COMINES, or COMMINES (Flem. *Komen*), a town of western Flanders, 13 m. N.N.W. of Lille by rail. It is divided by the river Lys, leaving one part on French (department of Nord), the other on Belgian territory (province of West Flanders). Pop. of the French town 6359 (1906); of the Belgian town, 6453 (1904). The former has a belfry of the 14th century, restored in the 17th and 19th centuries, and remains of a chateau. Comines carries on the spinning of flax, wool and cotton.

COMITIA, the name applied, always in technical and generally in popular phraseology, to the most formal types of gathering of the sovereign people in ancient Rome. It is the plural of *comitium*, the old "meeting-place" (Lat. *cum*, together, *ire*, to go) on the north-west of the Forum. The Romans had three words for describing gatherings of the people. These were *concilium*, *comitia* and *contio*. Of these concilium had the most general significance. It could be applied to any kind of meeting and is often used to describe assemblies in foreign states. It was, therefore, a word that might be employed to denote an organized gathering of a portion of the Roman people such as the plebs, and in this sense is contrasted with *comitia*, which when used strictly should signify an assembly of the whole people. Thus the Roman draughtsman who wishes to express the idea "magistrates of any kind as president of assemblies" writes "Magistratus queiquomque comitia conciliumve habebit" (*Lex Latina tabulae Bantinae*, l. 5), and formalism required that a magistrate who summoned only a portion of the people to meet him should, in his summons, use the word *concilium*. This view is expressed by Laelius Felix, a lawyer probably of the age of Hadrian, when he writes "Is qui non universum populum, sed partem aliquam adesse jubet, non comitia, sed concilium edicere debet" (Gellius, *Noctes Atticae*, xv. 27). But popular phraseology did not conform to this canon, and *comitia*, which gained in current Latin the sense of "elections" was sometimes used of the assemblies of the plebs (see the instances in Botsford, distinction between *Comitia* and *Concilium*, p. 23). The distinction between *comitia* and *contio* was more clearly marked. Both were formal assemblies convened by a magistrate; but while, in the case of the *comitia*, the magistrate's purpose was to ask a question of the people and to elicit their binding response, his object in summoning a *contio* was merely to bring the people together either for their instruction or for a declaration of his will as expressed in an edict ("contionem habere est verba facere ad populum sine ulla rogatione," Gell. op. cit. xiii. 6). The word comitia merely means "meetings."

The earliest *comitia* was one organized on the basis of parishes (*curiae*) and known in later times as the *comitia curiata*. The *curia* voted as a single unit and thus furnished the type for that system of group-voting which runs through all the later organization of the popular assemblies. This *comitia* must originally have been composed exclusively of patricians (*q.v.*); but there is reason to believe that, at an early period of the Republic, it had, in imitation of the centuriate organization, come to include plebeians (see CURIA). The organization which gave rise to the *comitia centuriata* was the result of the earliest steps in the political emancipation of the plebs. Three stages in this process may be conjectured. In the first place the plebeians gained full rights of ownership and transfer, and could thus become freeholders of the land which they occupied and of the appurtenances of this land (*res*

mancipi). This legal capacity rendered them liable to military service as heavy-armed fighting men, and as such they were enrolled in the military units called *centuriae*. When the enrolment was completed the whole host (*exercitus*) was the best organized and most representative gathering that Rome could show. It therefore either usurped, or became gradually invested with voting powers, and gained a range of power which for two centuries (508-287 B.C.) made it the dominant assembly in the state. But its aristocratic organization, based as this was on property qualifications which gave the greatest voting power to the richest men, prevented it from being a fitting channel for the expression of plebeian claims. Hence the plebs adopted a new political organization of their own. The tribunate called into existence a purely plebeian assembly, firstly, for the election of plebeian magistrates; secondly, for jurisdiction in cases where these magistrates had been injured; thirdly, for presenting petitions on behalf of the plebs through the consuls to the *comitia centuriata*. This right of petitioning developed into a power of legislation. The stages of the process (marked by the Valerio-Horatian laws of 449 B.C., the Publilian law of 339 B.C., and the Hortensian law of 287 B.C.) are unknown; but it is probable that the two first of the laws progressively weakened the discretionary power of senate and consuls in admitting such petitions; and that the Hortensian law fully recognized the right of resolutions of the plebs (*plebiscita*) to bind the whole community. The plebeian assembly, which had perhaps originally met by *curiae*, was organized on the basis of the territorial tribes in 471 B.C. This change suggested a renewed organization of the whole people for comitial purposes. The *comitia tributa populi* was the result. This assembly seems to have been already in existence at the epoch of the Twelve Tables in 451 B.C., its electoral activity is perhaps attested in 447 B.C., and it appears as a legislative body in 357 B.C.

In spite of the formal differences of these four assemblies and the real distinction springing from the fact that patricians were not members of the plebeian bodies, the view which is appropriate to the developed Roman constitution is that the people expressed its will equally through all, although the mode of expression varied with the channel. This will was in theory unlimited. It was restricted only by the conservatism of the Roman, by the condition that the initiative must always be taken by a magistrate, by the *de facto* authority of the senate, and by the magisterial veto which the senate often had at its command (see SENATE). There were no limitations on the legislative powers of the *comitia* except such as they chose to respect or which they themselves created and might repeal. They never during the Republican period lost the right of criminal jurisdiction, in spite of the fact that so many spheres of this jurisdiction had been assigned in perpetuity to standing commissions (*quaestiones perpetuae*). This power of judging exercised by the assemblies had in the main developed from the use of the right of appeal (*provocatio*) against the judgments of the magistrates. But it is probable that, in the developed procedure, where it was known that the judgment pronounced might legally give rise to the appeal, the magistrate pronounced no sentence, but brought the case at once before the people. The case was then heard in four separate *contiones*. After these hearings the *comitia* gave its verdict. Finally, the people elected to every magistracy with the exception of the occasional offices of Dictator and Interrex. The distribution of these functions amongst the various *comitia*, and the differences in their organization, were as follows:—

The *comitia curiata* had in the later Republic become a merely formal assembly. Its main function was that of passing the *lex curiata* which was necessary for the ratification both of the *imperium* of the higher magistracies of the people, and of the *potestas* of those of lower rank. This assembly also met, under the name of the *comitia calata* and under the presidency of the pontifex maximus, for certain religious acts. These were the inauguration of the rex sacrorum and the flamens, and that abjuration of hereditary worship (*detestatio sacrorum*) which was made by a man who passed from his clan (*gens*) either by an act of adrogation (see ROMAN LAW and ADOPTION) or by transition from the patrician to the plebeian order. For the purpose of passing the *lex curiata*, and probably for its other purposes as well, this *comitia* was in Cicero's day represented by but thirty lictors (Cic. *de Lege Agraria*, ii. 12, 31).

The *comitia centuriata* could be summoned and presided over only by the magistrates with *imperium*. The consuls were its usual presidents for elections and for legislation, but the praetors summoned it for purposes of jurisdiction. It elected the magistrates with *imperium* and the censors, and alone had the power of declaring war. According to the principle laid down in the Twelve Tables (Cicero, *de Legibus*, iii. 4. 11) capital cases were reserved for this assembly. It was not frequently employed as a legislative body after the two assemblies of the tribes, which were easier to summon and organize, had been recognized as possessing sovereign rights. The internal structure of the *comitia centuriata* underwent a great change

during the Republic—a change which has been conjecturally attributed to the censorship of Flaminius in 220 B.C. (Mommsen, *Staatsrecht*, iii. p. 270). In the early scheme, at a time when a pecuniary valuation had replaced land and its appurtenances (*res mancipi*) as the basis of qualification, five divisions (*classes*) were recognized whose property was assessed respectively at 100,000, 75,000, 50,000, 25,000 and 11,000 (or 12,500) asses. The first class contained 80 centuries; the second, third and fourth 20 each; the fifth 30. Added to these were the 18 centuries of knights (see EQUITES). The combined vote of the first class and the knights was thus represented by 98 centuries; that of the whole of the other *classes* (including 4 or 5 centuries of professional corporations connected with the army, such as the *fabri* and 1 century of *proletarii*, *i.e.* of all persons below the minimum census) was represented by 95 or 96 centuries. Thus the upper classes in the community possessed more than half the votes in the assembly. The newer scheme aimed at a greater equality of voting power; but it has been differently interpreted. The interpretation most usually accepted, which was first suggested by Pantagathus, a 17th-century scholar, is based on the view that the five *classes* were distributed over the tribes in such a manner that there were 2 centuries of each class in a single tribe. As the number of the tribes was 35, the total number of centuries would be 350. To these we must add 18 centuries of knights, 4 of *fabri*, &c., and 1 of *proletarii*. Here the first class and the knights command but 88 votes out of a total of 373. Mommsen's interpretation (*Staatsrecht*, iii. p. 275) was different. He allowed the 70 votes for the 70 centuries of the first class, but thought that the 280 centuries of the other classes were so combined as to form only 100 votes. The total votes in the comitia would thus be 70 + 100 + 5 (*fabri*, &c.) + 18 (knights), *i.e.* 193, as in the earlier arrangement. In 88 B.C. a return was made to the original and more aristocratic system by a law passed by the consuls Sulla and Pompeius. At least this seems to be the meaning of Appian (*Bellum Civile*, i. 59) when he says ἐσηγοῦντο ... τὰς χειροτονίας μὴ κατὰ φυλὰς ἀλλὰ κατὰ λόχους ... γίγνεσθαι. But this change was not permanent as the more liberal system prevails in the Ciceronian period.

The *comitia tributa* was in the later Republic the usual organ for laws passed by the whole people. Its presidents were the magistrates of the people, usually the consuls and praetors, and, for purposes of jurisdiction, the curule aediles. It elected these aediles and other lower magistrates of the people. Its jurisdiction was limited to monetary penalties. 765

The *concilium plebis*, although voting, like this last assembly, by tribes, could be summoned and presided over only by plebeian magistrates, and never included the patricians. Its utterances (*plebiscita*) had the full force of law; it elected the tribunes of the plebs and the plebeian aediles, and it pronounced judgment on the penalties which they proposed. The right of this assembly to exercise capital jurisdiction was questioned; but it possessed the undisputed right of pronouncing outlawry (*aquae et ignis interdictio*) against any one already in exile (Livy xxv. 4, and xxvi. 3).

When the tenure of the religious colleges—formerly filled up by co-optation—was submitted to popular election, a change effected by a *lex Domitia* of 104 B.C., a new type of *comitia* was devised for this purpose. The electoral body was composed of 17 tribes selected by lot from the whole body of 35.

There was a body of rules governing the *comitia* which were concerned with the time and place of meeting, the forms of promulgation and the methods of voting. Valid meetings might be held on any of the 194 "comitial" days of the year which were not market or festal days (*nundinae, feriae*). The *comitia curiata* and the two assemblies of the tribes met within the walls, the former usually in the Comitium, the latter in the Forum or on the Area Capitolii; but the elections at these assemblies were in the later Republic held in the Campus Martius outside the walls. The *comitia centuriata* was by law compelled to meet outside the city and its gathering place was usually the Campus. Promulgation was required for the space of 3 *nundinae* (*i.e.* 24 days) before a matter was submitted to the people. The voting was preceded by a *contio* at which a limited debate was permitted by the magistrate. In the assemblies of the *curiae* and the tribes the voting of the groups took place simultaneously, in that of the centuries in a fixed order. In elections as well as in legislative acts an absolute majority was required, and hence the candidate who gained a mere relative majority was not returned.

The *comitia* survived the Republic. The last known act of comitial legislation belongs to the reign of Nerva (A.D. 96-98). After the essential elements in the election of magistrates had passed to the senate in A.D. 14, the formal announcement of the successful candidates (*renuntiatio*) still continued to be made to the popular assemblies. Early in the 3rd century Dio Cassius still saw the *comitia centuriata* meeting with all its old solemnities (Dio Cassius

lviii. 20).

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(A. H. J. G.)

COMITY (from the Lat. *comitas*, courtesy, from *cemis*, friendly, courteous), friendly or courteous behaviour; a term particularly used in international law, in the phrase "comity of nations," for the courtesy of nations towards each other. This has been held by some authorities to be the basis for the recognition by courts of law of the judgments and rules of law of foreign tribunals (see INTERNATIONAL LAW, PRIVATE). "Comity of nations" is sometimes wrongly used, from a confusion with the Latin *comes*, a companion, for the whole body or company of nations practising such international courtesy.

COMMA (Gr. κομμα, a thing stamped or cut off, from κόπτειν, to strike), originally, in Greek rhetoric, a short clause, something less than the "colon"; hence a mark (,), in punctuation, to show the smallest break in the construction of a sentence. The mark is also used to separate numerals, mathematical symbols and the like. Inverted commas, or "quotation-marks," *i.e.* pairs of commas, the first inverted, and the last upright, are placed at the beginning and end of a sentence or word quoted, or of a word used in a technical or conventional sense; single commas are similarly used for quotations within quotations. The word is also applied to comma-shaped objects, such as the "comma-bacillus," the causal agent in cholera.

COMMANDEER (from the South African Dutch *kommanderen*, to command), properly, to compel the performance of military duty in the field, especially of the military service of the Boer republics (see COMMANDO); also to seize property for military purposes; hence used of any peremptory seizure for other than military purposes.

COMMANDER, in the British navy, the title of the second grade of captains. He commands a small vessel, or is second in command of a large one. A staff commander is entrusted with the navigation of a large ship, and ranks above a navigating lieutenant. Since 1838 the officer next in rank to a captain in the U.S. navy has been called commander.

COMMANDERY (through the Fr. *commanderie*, from med. Lat. *commendaria*, a trust or

charge), a division of the landed property in Europe of the Knights Hospitallers (see St John of Jerusalem). The property of the order was divided into “priorates,” subdivided into “bailiwicks,” which in turn were divided into “commanderies”; these were placed in charge of a “commendator” or commander. The word is also applied to the emoluments granted to a commander of a military order of knights.

COMMANDO, a Portuguese word meaning “command,” adopted by the Boers in South Africa through whom it has come into English use, for military and semi-military expeditions against the natives. More particularly a “commando” was the administrative and tactical unit of the forces of the former Boer republics, “commandeered” under the law of the constitutions which made military service obligatory on all males between the ages of sixteen and sixty. Each “commando” was formed from the burghers of military age of an electoral district.

COMMEMORATION, a general term for celebrating some past event. It is also the name for the annual act, or *Encaenia*, the ceremonial closing of the academic year at Oxford University. It consists of a Latin oration in commemoration of benefactors and founders; of the recitation of prize compositions in prose and verse, and the conferring of honorary degrees upon English or foreign celebrities. The ceremony, which is usually on the third Wednesday after Trinity Sunday, is held in the Sheldonian Theatre, in Broad St., Oxford. “Commencement” is the term for the equivalent ceremony at Cambridge, and this is also used in the case of American universities.

COMMENDATION (from the Lat. *commendare*, to entrust to the charge of, or to procure a favour for), approval, especially when expressed to one person on behalf of another, a recommendation. The word is used in a liturgical sense for an office commending the souls of the dying and dead to the mercies of God. In feudal law the term is applied to the practice of a freeman placing himself under the protection of a lord (see Feudalism), and in ecclesiastical law to the granting of benefices *in commendam*. A benefice was held *in commendam* when granted either temporarily until a vacancy was filled up, or to a layman, or, in case of a monastery or abbey, to a secular cleric to enjoy the revenues and privileges for life (see Abbot), or to a bishop to hold together with his see. An act of 1836 prohibited the holding of benefices *in commendam* in England.

COMMENTARII (Lat. = Gr. ὑπομνήματα), notes to assist the memory, memoranda. This original idea of the word gave rise to a variety of meanings: notes and abstracts of speeches for the assistance of orators; family memorials, the origin of many of the legends introduced into early Roman history from a desire to glorify a particular family; diaries of events occurring in their own circle kept by private individuals,—the day-book, drawn up for Trimalchio in Petronius (*Satyricon*, 53) by his *actuarius* (a slave to whom the duty was specially assigned) is quoted as an example; memoirs of events in which they had taken part drawn up by public men,—such were the “Commentaries” of Caesar on the Gallic and Civil wars, and of Cicero on his consulship. Different departments of the imperial administration and certain high functionaries kept records, which were under the charge of an official

known as a *commentariis* (cf. *a secretis*, *ab epistulis*). Municipal authorities also kept a register of their official acts.

The *Commentarii Principis* were the register of the official acts of the emperor. They contained the decisions, favourable or unfavourable, in regard to certain citizens; accusations brought before him or ordered by him; lists of persons in receipt of special privileges. These must be distinguished from the *commentarii diurni*, a daily court-journal. At a later period records called *ephemerides* were kept by order of the emperor; these were much used by the Scriptores Historiae Augustae (see AUGUSTAN HISTORY). The *Commentarii Senatus*, only once mentioned (Tacitus, *Annals*, xv. 74) are probably identical with the Acta Senatus (*q.v.*). There were also Commentarii of the priestly colleges: (a) *Pontificum*, collections of their decrees and responses for future reference, to be distinguished from their *Annales*, which were historical records, and from their *Acta*, minutes of their meetings; (b) *Augurum*, similar collections of augural decrees and responses; (c) *Decemvirorum*; (d) *Fratrum Arvalium*. Like the priests, the magistrates also had similar notes, partly written by themselves, and partly records of which they formed the subject. But practically nothing is known of these *Commentarii Magistratuum*. Mention should also be made of the *Commentarii Regum*, containing decrees concerning the functions and privileges of the kings, and forming a record of the acts of the king in his capacity of priest. They were drawn up in historical times like the so-called *leges regiae* (*jus Papirianum*), supposed to contain the decrees and decisions of the Roman kings.

See the exhaustive article by A. von Premerstein in Pauly-Wissowa, *Realencyclopädie* (1901); Teuffel-Schwabe, *Hist. of Roman Lit.* (Eng. trans.), pp. 72, 77-79; and the concise account by H. Thédenat in Daremberg and Saglio, *Dictionnaire des antiquités*.

COMMENTRY, a town of central France, in the department of Allier, 42 m. S.W. of Moulins by the Orléans railway. Pop. (1906) 7581. Commentry gives its name to a coalfield over 5000 acres in extent, and has important foundries and forges.

COMMERCE (Lat. *commercium*, from *cum*, together, and *merx*, merchandise), in its general acceptation, the international traffic in goods, or what constitutes the foreign trade of all countries as distinct from their domestic trade.

In tracing the history of such dealings we may go back to the early records found in the Hebrew Scriptures. Such a transaction as that of Abraham, for example, weighing down "four hundred shekels of silver, *current with the merchant*," for the field of Ephron, is suggestive of a group of facts and ideas indicating an advanced condition of commercial intercourse,—property in land, sale of land, arts of mining and purifying metals, the use of silver of recognized purity as a common medium of exchange, and merchandise an established profession, or division of labour. That other passage in which we read of Joseph being sold by his brethren for twenty pieces of silver to "a company of Ishmaelites, coming from Gilead, with their camels bearing spicery and balm and myrrh to Egypt," extends our vision still farther, and shows us the populous and fertile Egypt in commercial relationship with Chaldaea, and Arabians, foreign to both, as intermediaries in their traffic, generations before the Hebrew commonwealth was founded.

The first foreign merchants of whom we read, carrying goods and bags of silver from one distant region to another, were the southern Arabs, reputed descendants of Ishmael and Esau. The first notable navigators and maritime carriers of goods were the Phoenicians. In the commerce of the ante-Christian ages the Jews do not appear to have performed any conspicuous part. Both the agricultural and the theocratic constitution of their society were unfavourable to a vigorous prosecution of foreign trade. In such traffic as they had with other nations they were served on their eastern borders by Arabian merchants, and on the west and south by the Phoenician shippers. The abundance of gold, silver and other precious commodities gathered from distant parts, of which we read in the days of greatest Hebrew

prosperity, has more the character of spoils of war and tributes of dependent states than the conquest by free exchange of their domestic produce and manufacture. It was not until the Jews were scattered by foreign invasions, and finally cast into the world by the destruction of Jerusalem, that they began to develop those commercial qualities for which they have since been famous.

Primary conditions of commerce.

There are three conditions as essential to extensive international traffic as diversity of natural resources, division of labour, accumulation of stock, or any other primal element—(1) means of transport, (2) freedom of labour and exchange, and (3) security; and in all these conditions the ancient world was signally deficient.

The great rivers, which became the first seats of population and empire, must have been of much utility as channels of transport, and hence the course of human power of which they are the geographical delineation, and probably the idolatry with which they were sometimes honoured. Nor were the ancient rulers insensible of the importance of opening roads through their dominions, and establishing post and lines of communication, which, though primarily for official and military purposes, must have been useful to traffickers and to the general population. But the free navigable area of great rivers is limited, and when diversion of traffic had to be made to roads and tracks through deserts, there remained the slow and costly carriage of beasts of burden, by which only articles of small bulk and the rarest value could be conveyed with any hope of profit. Corn, though of the first necessity, could only be thus transported in famines, when beyond price to those who were in want, and under this extreme pressure could only be drawn from within a narrow sphere, and in quantity sufficient to the sustenance of but a small number of people. The routes of ancient commerce were thus interrupted and cut asunder by barriers of transport, and the farther they were extended became the more impassable to any considerable quantity or weight of commodities. As long as navigation was confined to rivers and the shores of inland gulfs and seas, the oceans were a *terra incognita*, contributing nothing to the facility or security of transport from one part of the world to another, and leaving even one populous part of Asia as unapproachable from another as if they had been in different hemispheres. The various routes of trade from Europe and north-western Asia to India, which have been often referred to, are to be regarded more as speculations of future development than as realities of ancient history. It is not improbable that the ancient traffic of the Red Sea may have been extended along the shores of the Arabian Sea to some parts of Hindustan, but that vessels braved the Indian Ocean and passed round Cape Comorin into the Bay of Bengal, 2000 or even 1000 years before mariners had learned to double the Cape of Good Hope, is scarcely to be believed. The route by the Euxine and the Caspian Sea has probably never in any age reached India. That by the Euphrates and the Persian Gulf is shorter, and was besides the more likely from passing through tracts of country which in the most remote times were seats of great population. There may have been many merchants who traded on all these various routes, but that commodities were passed in bulk over great distances is inconceivable. It may be doubted whether in the ante-Christian ages there was any heavy transport over even 500 m., save for warlike or other purposes, which engaged the public resources of imperial states, and in which the idea of commerce, as now understood, is in a great measure lost.

The advantage which absolute power gave to ancient nations in their warlike enterprises, and in the execution of public works of more or less utility, or of mere ostentation and monumental magnificence, was dearly purchased by the sacrifice of individual freedom, the right to labour, produce and exchange under the steady operation of natural economic principles, which more than any other cause vitalizes the individual and social energies, and multiplies the commercial resource of communities. Commerce in all periods and countries has obtained a certain freedom and hospitality from the fact that the foreign merchant has something desirable to offer; but the action of trading is reciprocal, and requires multitudes of producers and merchants, as free agents, on both sides, searching out by patient experiment wants more advantageously supplied by exchange than by direct production, before it can attain either permanence or magnitude, or can become a vital element of national life. The ancient polities offered much resistance to this development, and in their absolute power over the liberty, industry and property of the masses of their subjects raised barriers to the extension of commerce scarcely less formidable than the want of means of communication itself. The conditions of security under which foreign trade can alone flourish equally exceeded the resources of ancient civilization. Such roads as exist must be protected from robbers, the rivers and seas from pirates; goods must have safe passage and safe storage, must be held in a manner sacred in the territories through which they pass, be insured against accidents, be respected even in the madness of hostilities; the laws of

nations must give a guarantee on which traders can proceed in their operations with reasonable confidence; and the governments, while protecting the commerce of their subjects with foreigners as if it were their own enterprise, must in their fiscal policy, and in all their acts, be endued with the highest spirit of commercial honour. Every great breach of this security stops the continuous circulation, which is the life of traffic and of the industries to which it ministers. But in the ancient records we see commerce exposed to great risks, subject to constant pillage, hunted down in peace and utterly extinguished in war. Hence it became necessary that foreign trade should itself be an armed force in the world; and though the states of purely commercial origin soon fell into the same arts and wiles as the powers to which they were opposed, yet their history exhibits clearly enough the necessity out of which they arose. Once organized, it was inevitable that they should meet intrigue with intrigue, and force with force. The political empires, while but imperfectly developing industry and traffic within their own territories, had little sympathy with any means of prosperity from without. Their sole policy was either to absorb under their own spirit and conditions of rule, or to destroy, whatever was rich or great beyond their borders. Nothing is more marked in the past history of the world than this struggle of commerce to establish conditions of security and means of communication with distant parts. When almost driven from the land, it often found both on the sea; and often, when its success had become brilliant and renowned, it perished under the assault of stronger powers, only to rise again in new centres and to find new channels of intercourse.

Carthage.

While Rome was giving laws and order to the half-civilized tribes of Italy, Carthage, operating on a different base, and by other methods, was opening trade with less accessible parts of Europe. The strength of Rome was in her legions, that of Carthage in her ships; and her ships could cover ground where the legions were powerless. Her mariners had passed the mythical straits into the Atlantic, and established the port of Cadiz. Within the Mediterranean itself they founded Carthagena and Barcelona on the same Iberian peninsula, and ahead of the Roman legions had depots and traders on the shores of Gaul. After the destruction of Tyre, Carthage became the greatest power in the Mediterranean, and inherited the trade of her Phoenician ancestors with Egypt, Greece and Asia Minor, as well as her own settlements in Sicily and on the European coasts. An antagonism between the great naval and the great military power, whose interests crossed each other at so many points, was sure to occur; and in the three Punic wars Carthage measured her strength with that of Rome both on sea and on land with no unequal success. But a commercial state impelled into a series of great wars has departed from its own proper base; and in the year 146 B.C. Carthage was so totally destroyed by the Romans that of the great city, more than 20 m. in circumference, and containing at one period near a million of inhabitants, only a few thousands were found within its ruined walls. In the same year Corinth, one of the greatest of the Greek capitals and seaports, was captured, plundered of vast wealth and given to the flames by a Roman consul. Athens and her magnificent harbour of the Piraeus fell into the same hands 60 years later. It may be presumed that trade went on under the Roman conquests in some degree as before; but these were grave events to occur within a brief period, and the spirit of the seat of trade in every case having been broken, and its means and resources more or less plundered and dissipated—in some cases, as in that of Carthage, irreparably—the most necessary commerce could only proceed with feeble and languid interest under the military, consular and proconsular licence of Rome at that period. Tyre, the great seaport of Palestine, having been destroyed by Alexander the Great, Palmyra, the great inland centre of Syrian trade, was visited with a still more complete annihilation by the Roman Emperor Aurelian within little more than half a century after the capture and spoliation of Athens. The walls were razed to their foundations; the population—men, women, children and the rustics round the city—were all either massacred or dispersed; and the queen Zenobia was carried captive to Rome. Palmyra had for centuries, as a centre of commercial intercourse and transit, been of great service to her neighbours, east and west. In the wars of the Romans and Parthians she was respected by both as an asylum of common interests which it would have been simple barbarity to invade or injure; and when the Parthians were subdued, and Palmyra became a Roman *annexe*, she continued to flourish as before. Her relations with Rome were more than friendly; they became enthusiastic and heroic; and her citizens having inflicted signal chastisement on the king of Persia for the imprisonment of the emperor Valerian, the admiration of this conduct at Rome was so great that their spirited leader Odaenathus, the husband of Zenobia, was proclaimed Augustus, and became co-emperor with Gallienus. It is obvious that the destruction of Palmyra must not only have doomed Palestine, already bereft of her seaports, to greater poverty and commercial isolation than had been known in long preceding ages, but have also

Roman conquests.

Palmyra.

rendered it more difficult to Rome herself to hold or turn to any profitable account her conquests in Asia; and, being an example of the policy of Rome to the seats of trade over nearly the whole ancient world, it may be said to contain in graphic characters a presage of what came to be the actual event—the collapse and fall of the Roman empire itself.

Venice.

The repeated invasions of Italy by the Goths and Huns gave rise to a seat of trade in the Adriatic, which was to sustain during more than a thousand years a history of unusual splendour. The Veneti cultivated fertile lands on the Po, and built several towns, of which Padua was the chief. They appear from the earliest note of them in history to have been both an agricultural and trading people; and they offered a rich prey to the barbarian hordes when these broke through every barrier into the plains of Italy. Thirty years before Attila razed the neighbouring city of Aquileia, the consuls and senate of Padua, oppressed and terrified by the prior ravages of Alaric, passed a decree for erecting Rialto, the largest of the numerous islets at the mouth of the Po, into a chief town and port, not more as a convenience to the islanders than as a security for themselves and their goods. But every fresh incursion, every new act of spoliation by the dreaded enemies, increased the flight of the rich and the industrious to the islands, and thus gradually arose the second Venice, whose glory was so greatly to exceed that of the first. Approachable from the mainland only by boats, through river passes easily defended by practised sailors against barbarians who had never plied an oar, the Venetian refugees could look in peace on the desolation which swept over Italy; their warehouses, their markets, their treasures were safe from plunder; and stretching their hands over the sea, they found in it fish and salt, and in the rich possessions of trade and territory which it opened to them more than compensation for the fat lands and inland towns which had long been their home. The Venetians traded with Constantinople, Greece, Syria and Egypt. They became lords of the Morea, and of Candia, Cyprus and other islands of the Levant. The trade of Venice with India, though spoken of, was probably never great. But the crusades of the 12th and 13th centuries against the Saracens in Palestine extended her repute more widely east and west, and increased both her naval and her commercial resources. It is enough, indeed, to account for the grandeur of Venice that in course of centuries, from the security of her position, the growth and energy of her population, and the regularity of her government at a period when these sources of prosperity were rare, she became the great emporium of the Mediterranean —all that Carthage, Corinth and Athens had been in a former age on a scene the most remarkable in the world for its fertility and facilities of traffic,—and that as Italy and other parts of the Western empire became again more settled her commerce found always a wider range. The bridge built from the largest of the islands to the opposite bank became the “Rialto,” or famous exchange of Venice, whose transactions reached farther, and assumed a more consolidated form, than had been known before. There it was where the first public bank was organized; that bills of exchange were first negotiated, and funded debt became transferable; that finance became a science and book-keeping an art. Nor must the effect of the example of Venice on other cities of Italy be left out of account. Genoa, following her steps, rose into great prosperity and power at the foot of the Maritime Alps, and became her rival, and finally her enemy. Naples, Gaeta, Florence, many other towns of Italy, and Rome herself, long after her fall, were encouraged to struggle for the preservation of their municipal freedom, and to foster trade, arts and navigation, by the brilliant success set before them on the Adriatic; but Venice, from the early start she had made, and her command of the sea, had the commercial pre-eminence.

The middle ages.

The state of things which arose on the collapse of the Roman empire presents two concurrent facts, deeply affecting the course of trade—(1) the ancient seats of industry and civilization were undergoing constant decay, while (2) the energetic races of Europe were rising into more civilized forms and manifold vigour and copiousness of life. The fall of the Eastern division of the empire prolonged the effect of the fall of the Western empire; and the advance of the Saracens over Asia Minor, Syria, Greece, Egypt, over Cyprus and other possessions of Venice in the Mediterranean, over the richest provinces of Spain, and finally across the Hellespont into the Danubian provinces of Europe, was a new irruption of barbarians from another point of the compass, and revived the calamities and disorders inflicted by the successive invasions of Goths, Huns and other Northern tribes. For more than ten centuries the naked power of the sword was vivid and terrible as flashes of lightning over all the seats of commerce, whether of ancient or more modern origin. The feudal system of Europe, in organizing the open country under military leaders and defenders subordinated in possession and service under a legal system to each other and to the sovereign power, must have been well adapted to the necessity of the times in which it spread so rapidly; but it would be impossible to say that the feudal system was favourable to trade, or the extension

of trade. The commercial spirit in the feudal, as in preceding ages, had to find for itself places of security, and it could only find them in towns, armed with powers of self-regulation and defence, and prepared, like the feudal barons themselves, to resist violence from whatever quarter it might come. Rome, in her best days, had founded the municipal system, and when this system was more than ever necessary as the bulwark of arts and manufactures, its extension became an essential element of the whole European civilization. Towns formed themselves into leagues for mutual protection, and out of leagues not infrequently arose commercial republics. The Hanseatic League, founded as early as 1241, gave the first note of an increasing traffic between countries on the Baltic and in northern Germany, which a century or two before were sunk in isolated barbarism. From Lübeck and Hamburg, commanding the navigation of the Elbe, it gradually spread over 85 towns, including Amsterdam, Cologne and Frankfort in the south, and Danzig, Königsberg and Riga in the north. The last trace of this league, long of much service in protecting trade, and as a means of political mediation, passed away in the erection of the German empire (1870), but only from the same cause that had brought about its gradual dissolution—the formation of powerful and legal governments—which, while leaving to the free cities their municipal rights, were well capable of protecting their mercantile interests. The towns of Holland found lasting strength and security from other causes. Their foundations were laid as literally in the sea as those of Venice had been. They were not easily attacked whether by sea or land, and if attacked had formidable means of defence. The Zuyder Zee, which had been opened to the German Ocean in 1282, carried into the docks and canals of Amsterdam the traffic of the ports of the Baltic, of the English Channel and of the south of Europe, and what the seas did for Amsterdam from without the Rhine and the Maese did for Dort and Rotterdam from the interior. By the Union of Utrecht in 1579 Holland became an independent republic, and for long after, as it had been for some time before, was the greatest centre of maritime traffic in Europe. The rise of the Dutch power in a low country, exposed to the most destructive inundations, difficult to cultivate or even to inhabit, affords a striking illustration of those conditions which in all times have been found specially favourable to commercial development, and which are not indistinctly reflected in the mercantile history of England, preserved by its insular position from hostile invasions, and capable by its fleets and arms to protect its goods on the seas and the rights of its subjects in foreign lands.

The progress of trade and productive arts in the middle ages, though not rising to much international exchange, was very considerable both in quality and extent. The republics of Italy, which had no claim to rival Venice or Genoa in maritime power or traffic, developed a degree of art, opulence and refinement commanding the admiration of modern times; and if any historian of trans-Alpine Europe, when Venice had already attained some greatness, could have seen it five hundred years afterwards, the many strong towns of France, Germany and the Low Countries, the great number of their artizans, the products of their looms and anvils, and their various cunning workmanship, might have added many a brilliant page to his annals. Two centuries before England had discovered any manufacturing quality, or knew even how to utilize her most valuable raw materials, and was importing goods from the continent for the production of which she was soon to be found to have special resources, the Flemings were selling their woollen and linen fabrics, and the French their wines, silks and laces in all the richer parts of the British Islands. The middle ages placed the barbarous populations of Europe under a severe discipline, trained them in the most varied branches of industry, and developed an amount of handicraft and ingenuity which became a solid basis for the future. But trade was too walled in, too much clad in armour, and too incessantly disturbed by wars and tumults, and violations of common right and interest, to exert its full influence over the general society, or even to realize its most direct advantages. It wanted especially the freedom and mobility essential to much international increase, and these it was now to receive from a series of the most pregnant events.

Opening of a new era.

The mariner’s compass had become familiar in the European ports about the beginning of the 14th century, and the seamen of Italy, Portugal, France, Holland and England entered upon a more enlightened and adventurous course of navigation. The Canary Islands were sighted by a French vessel in 1330, and colonized in 1418 by the Portuguese, who two years later landed on Madeira. In 1431 the Azores were discovered by a shipmaster of Bruges. The Atlantic was being gradually explored. In 1486, Diaz, a Portuguese, steering his course almost unwittingly along the coast of Africa, came upon the land’s-end of that continent; and eleven years afterwards Vasco da Gama, of the same nation, not only doubled the Cape of Good Hope, but reached India. About the same period Portuguese travellers penetrated to India by the old

time-honoured way of Suez; and a land which tradition and imagination had invested with almost fabulous wealth and splendour was becoming more real to the European world at the moment when the expedition of Vasco da Gama had made an oceanic route to its shores distinctly visible. One can hardly now realize the impression made by these discoveries in an age when the minds of men were awakening out of a long sleep, when the printing press was disseminating the ancient classical and sacred literature, and when geography and astronomy were subjects of eager study in the seats both of traffic and of learning. But their practical effect was seen in swiftly-succeeding events. Before the end of the century Columbus had thrice crossed the Atlantic, touched at San Salvador, discovered Jamaica, Porto Rico and the Isthmus of Darien, and had seen the waters of the Orinoco in South America. Meanwhile Cabot, sent out by England, had discovered Newfoundland, planted the English flag on Labrador, Nova Scotia and Virginia, and made known the existence of an expanse of land now known as Canada. This tide of discovery by navigators flowed on without intermission. But the opening of a maritime route to India and the discovery of America, surprising as these events must have been at the time, were slow in producing the results of which they were a sure prognostic. The Portuguese established in Cochin the first European factory in India a few years after Vasco da Gama's expedition, and other maritime nations of Europe traced a similar course. But it was not till 1600 that the English East India Company was established, and the opening of the first factory of the Company in India must be dated some ten or eleven years later. So also it was one thing to discover the two Americas, and another, in any real sense, to possess or colonize them, or to bring their productions into the general traffic and use of the world. Spain, following the stroke of the valiant oar of Columbus, found in Mexico and Peru remarkable remains of an ancient though feeble civilization, and a wealth of gold and silver mines, which to Europeans of that period was fascinating from the rarity of the precious metals in their own realms, and consequently gave to the Spanish colonizations and conquests in South America an extraordinary but unsolid prosperity. The value of the precious metals in Europe was found to fall as soon as they began to be more widely distributed, a process in itself at that period of no small tediousness; and it was discovered further, after a century or two, that the production of gold and silver is limited like the production of other commodities for which they exchange, and only increased in quantity at a heavier cost, that is only reduced again by greater art and science in the process of production. Many difficulties, in short, had to be overcome, many wars to be waged, and many deplorable errors to be committed, in turning the new advantages to account. But given a maritime route to India and the discovery of a new world of continent and islands in the richest tropical and sub-tropical latitudes, it could not be difficult to foresee that the course of trade was to be wholly changed as well as vastly extended.

Maritime route to India.

The substantial advantage of the oceanic passage to India by the Cape of Good Hope, as seen at the time, was to enable European trade with the East to escape from the Moors, Algerines and Turks who now swarmed round the shores of the Mediterranean, and waged a predatory war on ships and cargoes which would have been a formidable obstacle even if traffic, after running this danger, had not to be further lost, or filtered into the smallest proportions, in the sands of the Isthmus, and among the Arabs who commanded the navigation of the Red and Arabian Seas. Venice had already begun to decline in her wars with the Turks, and could inadequately protect her own trade in the Mediterranean. Armed vessels sent out in strength from the Western ports often fared badly at the hands of the pirates. European trade with India can scarcely be said, indeed, to have yet come into existence. The maritime route was round about, and it lay on the hitherto almost untrodden ocean, but the ocean was a safer element than inland seas and deserts infested by the lawlessness and ferocity of hostile tribes of men. In short, the maritime route enabled European traders to see India for themselves, to examine what were its products and its wants, and by what means a profitable exchange on both sides could be established; and on this basis of knowledge, ships could leave the ports of their owners in Europe with a reasonable hope, via the Cape, of reaching the places to which they were destined without transhipment or other intermediary obstacle. This is the explanation to be given of the joy with which the Cape of Good Hope route was received, as well as the immense influence it exerted on the future course and extension of trade, and of the no less apparent satisfaction with which it was to some extent discarded in favour of the ancient line, via the Mediterranean, Isthmus of Suez and the Red Sea.

The maritime route to India was the discovery to the European nations of a "new world" quite as much as the discovery of North and South America and their central isthmus and islands. The one was the far, populous Eastern world, heard of from time immemorial, but

Discovery of America. with which there had been no patent lines of communication. The other was a vast and comparatively unpeopled solitude, yet full of material resources, and capable in a high degree of European colonization. America offered less resistance to the action of Europe than India, China and Japan; but on the other hand this new populous Eastern world held out much attraction to trade. These two great terrestrial discoveries were contemporaneous; and it would be difficult to name any conjuncture of material events bearing with such importance on the history of the world. The Atlantic Ocean was the medium of both; and the waves of the Atlantic beat into all the bays and tidal rivers of western Europe. The centre of commercial activity was thus physically changed; and the formative power of trade over human affairs was seen in the subsequent phenomena —the rise of great seaports on the Atlantic seaboard, and the ceaseless activity of geographical exploration, manufactures, shipping and emigration, of which they became the outlets.

The Portuguese are entitled to the first place in utilizing the new sources of wealth and commerce. They obtained Macao as a settlement from the Chinese as early as 1537, and their trading operations followed close on the discoveries of their navigators on the coast of Africa, in India and in the Indian Archipelago. Spain spread her dominion over Central and South America, and forced the labour of the subject natives into the gold and silver mines, which seemed in that age the chief prize of her conquests. France introduced her trade in both the East and West Indies, and was the first to colonize Canada and the Lower Mississippi. The Dutch founded New York in 1621; and England, which in boldness of naval and commercial enterprize had attained high rank in the reign of Elizabeth, established the thirteen colonies which became the United States, and otherwise had a full share in all the operations which were transforming the state of the world. The original disposition of affairs was destined to be much changed by the fortune of war; and success in foreign trade and colonization, indeed, called into play other qualities besides those of naval and military prowess. The products of so many new countries—tissues, dyes, metals, articles of food, chemical substances—greatly extended the range of European manufacture. But in addition to the mercantile faculty of discovering how they were to be exchanged and wrought into a profitable trade, their use in arts and manufactures required skill, invention and aptitude for manufacturing labour, and those again, in many cases, were found to depend on abundant possession of natural materials, such as coal and iron. In old and populous countries, like India and China, modern manufacture had to meet and contend with ancient manufacture, and had at once to learn from and improve economically on the established models, before an opening could be made for its extension. In many parts of the New World there were vast tracts of country, without population or with native races too wild and savage to be reclaimed to habits of industry, whose resources could only be developed by the introduction of colonies of Europeans; and innumerable experiments disclosed great variety of qualification among the European nations for the adventure, hardship and perseverance of colonial life. There were countries which, whatever their fertility of soil or favour of climate, produced nothing for which a market could be found; and products such as the sugar-cane and the seed of the cotton plant had to be carried from regions where they were indigenous to other regions where they might be successfully cultivated, and the art of planting had to pass through an ordeal of risk and speculation. There were also countries where no European could labour; and the ominous work of transporting African negroes as slaves into the colonies—begun by Spain in the first decade of the 16th century, followed up by Portugal, and introduced by England in 1562 into the West Indies, at a later period into New England and the Southern States, and finally domiciled by royal privilege of trade in the Thames and three or more outports of the kingdom,—after being done on an elaborate scale, and made the basis of an immense superstructure of labour, property and mercantile interest over nearly three centuries, had, under a more just and ennobling view of humanity, to be as elaborately undone at a future time.

Increase of trading settlements and colonies.

These are some of the difficulties that had to be encountered in utilizing the great maritime and geographical conquests of the new epoch. But one cannot leave out of view the obstacles, arising from other sources, to what might be expected to be the regular and easy course of affairs. Commerce, though an undying and prevailing interest of civilized countries, is but one of the forces acting on the policy of states, and has often to yield the pace to other elements of national life. It were needless to say what injury the great but vain and purposeless wars of Louis XIV. of France inflicted in that country, or how largely the fruitful and heroic energies of England were absorbed in the civil wars between Charles and the Parliament, to what poverty Scotland was reduced, or in what distraction and savagery

Ireland was kept by the same course of events. The grandeur of Spain in the preceding century was due partly to the claim of her kings to be Holy Roman emperors, in which imperial capacity they entailed intolerable mischief on the Low Countries and on the commercial civilization of Europe, and partly to their command of the gold and silver mines of Mexico and Peru, in an eager lust of whose produce they brought cruel calamities on a newly-discovered continent where there were many traces of antique life, the records of which perished in their hands or under their feet. These ephemeral causes of greatness removed, the hollowness of the situation was exposed; and Spain, though rich in her own natural resources, was found to be actually poor—poor in number of people, poor in roads, in industrial art, and in all the primary conditions of interior development. An examination of the foreign trade of Europe two centuries after the opening of the maritime route to India and the discovery of America would probably give more reason to be surprised at the smallness than the magnitude of the use that had been made of these events.

19th century.

By the beginning of the 19th century the world had been well explored. Colonies had been planted on every coast; great nations had sprung up in vast solitudes or in countries inhabited only by savage or decadent races of men; the most haughty and exclusive of ancient nations had opened their ports to foreign merchantmen; and all parts of the world been brought into habitual commercial intercourse. The seas, subdued by the progress of navigation to the service of man, had begun to yield their own riches in great abundance and the whale, seal, herring, cod and other fisheries, prosecuted with ample capital and hardy seamanship, had become the source of no small traffic in themselves. The lists of imports and exports and of the places from which they flowed to and from the centres of trade, as they swelled in bulk from time to time, show how busily and steadily the threads of commerce had been weaving together the labour and interests of mankind, and extending a security and bounty of existence unknown in former ages. The 19th century witnessed an extension of the commercial relations of mankind of which there was no parallel in previous history. The heavy debts and taxes, and the currency complications in which the close of the Napoleonic wars left the European nations, as well as the fall of prices which was the necessary effect of the sudden closure of a vast war expenditure and absorption of labour, had a crippling effect for many years on trading energies. Yet even under such circumstances commerce is usually found, on its well-established modern basis, to make steady progress from one series of years to another. The powers of production had been greatly increased by a brilliant development of mechanical arts and inventions. The United States had grown into a commercial nation of the first rank. The European colonies and settlements were being extended, and assiduously cultivated, and were opening larger and more varied markets for manufactures. In 1819 the first steamboat crossed the Atlantic from New York to Liverpool, and a similar adventure was accomplished from England to India in 1825—events in themselves the harbingers of a new era in trade. China, after many efforts, was opened under treaty to an intercourse with foreign nations which was soon to attain surprising dimensions. These various causes supported the activity of commerce in the first four decades; but the great movement which made the 19th century so remarkable was chiefly disclosed in practical results from about 1840. The outstanding characteristics of the 19th century were the many remarkable inventions which so widened the field of commerce by the discovery of new and improved methods of production, the highly organized division of labour which tended to the same end, and, above all, the powerful forces of steam navigation, railways and telegraphs.

Commerce has thus acquired a security and extension, in all its most essential conditions, of which it was void in any previous age. It can hardly ever again exhibit that wandering course from route to route, and from one solitary centre to another, which is so characteristic of its ancient history, because it is established in every quarter of the globe, and all the seas and ways are open to it on terms fair and equal to every nation. Wherever there is population, industry, resource, art and skill, there will be international trade. Commerce will have many centres, and one may relatively rise or relatively fall; but such decay and ruin as have smitten many once proud seats of wealth into dust cannot again occur without such cataclysms of war, violence and disorder as the growing civilization and reason of mankind, and the power of law, right and common interest forbid us to anticipate. But the present magnitude of commerce devolves serious work on all who are engaged in it. If in the older times it was thought that a foreign merchant required to be not only a good man of business, but even a statesman, it is evident that all the higher faculties of the mercantile profession must still more be called into request when imports and exports are reckoned by hundreds instead of fives or tens of millions, when the markets are so much larger and more numerous, the competition so much more keen and varied, the problems to

be solved in every course of transaction so much more complex, the whole range of affairs to be overseen so immensely widened. It is not a company of merchants, having a monopoly, and doing whatever they please, whether right or wrong, that now hold the commerce of the world in their hands, but large communities of free merchants in all parts of the world, affiliated to manufacturers and producers equally free, each under strong temptation to do what may be wrong in the pursuit of his own interest, and the only security of doing right being to follow steady lights of information and economic science common to all. Easy transport of goods by land and sea, prompt intelligence from every point of the compass, general prevalence of mercantile law and safety, have all been accomplished; and the world is opened to trade. But intellectual grasp of principles and details, and the moral integrity which is the root of all commercial success, are severely tested in this vaster sphere.

See TRADE ORGANIZATION; ECONOMICS; COMMERCIAL TREATIES, and the sections under the headings of countries.

COMMERCE, the name of a card-game. Any number can play with an ordinary pack. There are several variations of the game, but the following is a common one. Each player receives three cards, and three more are turned up as a "pool." The first player may exchange one or two of his cards for one or two of the exposed cards, putting his own, face upwards, in their place. His object is to "make his hand" (see below), but if he changes all three cards at once he cannot change again. The next player can do likewise, and so on. Usually there are as many rounds as there are players, and a fresh card is added to the pool at the beginning of each. If a player passes once he cannot exchange afterwards. When the rounds are finished the hands are shown, the holder of the best either receiving a stake from all the others, or, supposing each has started with three "lives," taking one life from the lowest. The hands, in order of merit, are: (i.) *Tricon*—three similar cards, three aces ranking above three kings, and so on. (ii.) *Sequence*—three cards of the same suit in consecutive order; the highest sequence is the best. (iii.) *Flush*—three cards of the same suit, the highest "point" wins, *i.e.* the highest number of pips, ace counting eleven and court-cards ten. (iv.) *Pair*—two similar cards, the highest pair winning. (v.) *Point*—the largest number of pips winning, as in "flush," but there is no restriction as to suit. Sometimes "pair" and "point" are not recognized. A popular variation of Commerce is *Pounce Commerce*. In this, if a player has already three similar cards, *e.g.* three nines, and the fourth nine comes into the pool, he says "Pounce!" and takes it, thus obtaining a hand of four, which is higher than any hand of three: whenever a pounce occurs, a new card is turned up from the pack.

COMMERCIAL COURT, in England, a court presided over by a single judge of the king's bench division, for the trial, as expeditiously as may be, of commercial cases. By the Rules of the Supreme Court, Order xviii. a (made in November 1893), a plaintiff was allowed to dispense with pleadings altogether, provided that the indorsement of his writ of summons contained a statement sufficient to give notice of his claim, or of the relief or remedy required in the action, and stating that the plaintiff intended to proceed to trial without pleadings. The judge might, on the application of the defendant, order a statement of claim to be delivered, or the action to proceed to trial without pleadings, and if necessary particulars of the claim or defence to be delivered. Out of this order grew the commercial court. It is not a distinct court or division or branch of the High Court, and is not regulated by any special rules of court made by the rule committee. It originated in a notice issued by the judges of the queen's bench division, in February 1895 (see W.N., 2nd of March 1895), the provisions contained in which represent only "a practice agreed on by the judges, who have the right to deal by convention among themselves with this mode of disposing of the business in their courts" (per Lord Esher in *Barry* v. *Peruvian Corporation*, 1896, 1 Q. B. p. 209). A separate list of causes of a commercial character is made and assigned to a particular judge, charged with commercial business, to whom all applications before the trial are made. The 8th paragraph is as follows:—

> Such judge may at any time after appearance and without pleadings make such order as he thinks fit for the speedy determination, in accordance with existing rules, of the questions really in controversy between the parties.

Practitioners before Sir George Jessel, at the rolls, in the years 1873 to 1880, will be reminded of his mode of ascertaining the point in controversy and bringing it to a speedy determination. Obviously the scheme is only applicable to cases in which there is some single issue of law or fact, or the case depends on the construction of some contract or other instrument or section of an act of parliament, and such issue or question is either agreed upon by the parties or at once ascertainable by the judge. The success of the scheme also depends largely on the personal qualities of the judge to whom the list is assigned. Under the able guidance of Mr (afterwards Lord) Justice Mathew (d. 1908), the commercial court became very successful in bringing cases to a speedy and satisfactory determination without any technicality or unnecessary expense.

COMMERCIAL LAW, a term used rather indefinitely to include those main rules and principles which, with more or less minor differences, characterize the commercial transactions and customs of most European countries. It includes within its compass such titles as principal and agent; carriage by land and sea; merchant shipping; guarantee; marine, fire, life and accident insurance; bills of exchange, partnership, &c.

COMMERCIAL TREATIES. A commercial treaty is a contract between states relative to trade. It is a bilateral act whereby definite arrangements are entered into by each contracting party towards the other—not mere concessions. As regards technical distinctions, an “agreement,” an “exchange of notes,” or a “convention” properly applies to one specific subject; whereas a “treaty” usually comprises several matters, whether commercial or political.

In ancient times foreign intercourse, trade and navigation were in many instances regulated by international arrangements. The text is extant of treaties of commerce and navigation concluded between Carthage and Rome in 509 and 348 B.C. Aristotle mentions that nations were connected by commercial treaties; and other classical writers advert to these engagements. Under the Roman empire the matters thus dealt with became regulated by law, or by usages sometimes styled laws. When the territories of the empire were contracted, and the imperial authority was weakened, some kind of international agreements again became necessary. At Constantinople in the 10th century treaties cited by Gibbon protected “the person, effects and privileges of the Russian merchant”; and, in western Europe, intercourse, trade and navigation were carried on, at first tacitly by usage derived from Roman times, or under verbal permission given to merchants by the ruler to whose court they resorted. Afterwards, security in these transactions was afforded by means of formal documents, such as royal letters, charters, laws and other instruments possessing the force of government measures. Instances affecting English commercial relations are the letter of Charlemagne in 796, the Brabant Charter of 1305, and the Russian ukase of 1569. Medieval treaties of truce or peace often contained a clause permitting in general terms the renewal of personal and commercial communication as it subsisted before the war. This custom is still followed. But these medieval arrangements were precarious: they were often of temporary duration, and were usually only effective during the lifetime of the contracting sovereigns.

Passing over trade agreements affecting the Eastern empire, the modern commercial treaty system came into existence in the 12th century. Genoa, Pisa and Venice were then well-organized communities, and were in keen rivalry. Whenever their position in a foreign country was strong, a trading centre was established, and few or no specific engagements were made on their part. But in serious competition or difficulty another course was adopted: a formal agreement was concluded for the better security of their commerce and navigation. The arrangements of 1140 between Venice and Sicily; the Genoese conventions

of 1149 with Valencia, of 1161 with Morocco, and of 1181 with the Balearic Islands; the Pisan conventions of 1173 with Sultan Saladin, and of 1184 with the Balearic Islands, were the earliest Western commercial treaties. Such definite arrangements, although still of a personal character, were soon perceived to be preferable to general provisions in a treaty of truce or peace. They afforded also greater security than privileges enjoyed under usage; or under grants of various kinds, whether local or royal. The policy thus inaugurated was adopted gradually throughout Europe. The first treaties relative to the trade of the Netherlands were between Brabant and Holland in 1203, Holland and Utrecht in 1204, and Brabant and Cologne in 1251. Early northern commercial treaties are those between Riga and Smolensk 1229, and between Lübeck and Sweden 1269. The first commercial relations between the Hanse Towns and foreign countries were arrangements made by gilds of merchants, not by public authorities as a governing body. For a long period the treaty system did not entirely supersede conditions of intercourse between nations dependent on permission.

The earliest English commercial treaty is that with Norway in 1217. It provides “ut mercatores et homines qui sunt de potestate vestra liberè et sine impedimento terram nostram adire possint, et homines et mercatores nostri similiter vestram.” These stipulations are in due treaty form. The next early English treaties are:—with Flanders, 1274 and 1314; Portugal, 1308, 1352 and 1386; Baltic Cities, 1319 and 1388; Biscay and Castile, 1351; Burgundy, 1417 and 1496; France, 1471, 1497 and 1510; Florence, 1490. The commercial treaty policy in England was carried out systematically under Henry IV. and Henry VII. It was continued under James I. to extend to Scotland English trading privileges. The results attained in the 17th century were—regularity in treaty arrangements; their durable instead of personal nature; the conversion of permissive into perfect rights; questions as to contraband and neutral trade stated in definite terms. Treaties were at first limited to exclusive and distinct engagements between the contracting states; each treaty differing more or less in its terms from other similar compacts. Afterwards by extending to a third nation privileges granted to particular countries, the *most favoured nation article* began to be framed, as a unilateral engagement by a particular state. The Turkish capitulations afford the earliest instances; and the treaty of 1641 between the Netherlands and Portugal contains the first European formula. Cromwell continued the commercial treaty policy partly in order to obtain a formal recognition of the commonwealth from foreign powers. His treaty of 1654 with Sweden contains the first reciprocal “most favoured nation clause”:—Article IV. provides that the people, subjects and inhabitants of either confederate “shall have and possess in the countries, lands, dominions and kingdoms of the other as full and ample privileges, and as many exemptions, immunities and liberties, as any foreigner doth or shall possess in the dominions and kingdoms of the said confederate.” The government of the Restoration replaced and enlarged the Protectorate arrangements by fresh agreements. The general policy of the commonwealth was maintained, with further provisions on behalf of colonial trade. In the new treaty of 1661 with Sweden the privileges secured were those which “any foreigner whatsoever doth or shall enjoy in the said dominions and kingdoms on both sides.”

In contemporary treaties France obtained from Spain (1659) that French subjects should enjoy the same liberties as had been granted to the English; and England obtained from Denmark (1661) that the English should not pay more or greater customs than the people of the United Provinces and other foreigners, the Swedes only excepted. The colonial and navigation policy of the 17th century, and the proceedings of Louis XIV., provoked animosities and retaliatory tariffs. During the War of the Spanish Succession the Methuen Treaty of 1703 was concluded. Portugal removed prohibitions against the importation of British woollens; Great Britain engaged that Portuguese wines should pay one-third less duty than the rate levied on French wines. At the peace of Utrecht in 1713 political and commercial treaties were concluded. England agreed to remove prohibitions on the importation of French goods, and to grant most favoured nation treatment in relation to goods and merchandise of the like nature from any other country in Europe; the French general tariff of the 18th of September 1664, was to be again put in force for English trade. The English provision was at variance with the Methuen Treaty. A violent controversy arose as to the relative importance in 1713 of Anglo-Portuguese or Anglo-French trade. In the end the House of Commons, by a majority of 9, rejected the bill to give effect to the commercial treaty of 1713; and trade with France remained on an unsatisfactory footing until 1786. The other commercial treaties of Utrecht were very complete in their provisions, equal to those of the present time; and contained most favoured nation articles—England secured in 1715 reduction of duties on woollens imported into the Austrian Netherlands; and trading privileges in Spanish America. Moderate import duties for woollens were obtained in Russia

by the commercial treaty of 1766. In the meanwhile the Bourbon family compact of the 15th of August 1761 assured national treatment for the subjects of France, Spain and the Two Sicilies, and for their trade in the European territories of the other two states; and most favoured nation treatment as regards any special terms granted to any foreign country. The first commercial treaties concluded by the United States with European countries contained most favoured nation clauses: this policy has been continued by the United States, but the wording of the clause has often varied.

In 1786 France began to effect tariff reform by means of commercial treaties. The first was with Great Britain, and it terminated the long-continued tariff warfare. But the wars of the French Revolution swept away these reforms, and brought about a renewal of hostile tariffs. Prohibitions and differential duties were renewed, and prevailed on the continent until the sixth decade of the 19th century. In 1860 a government existed in France sufficiently strong and liberal to revert to the policy of 1786. The bases of the Anglo-French treaty of 1860, beyond its most favoured nation provisions, were in France a general transition from prohibition or high customs duties to a moderate tariff; in the United Kingdom abandonment of all protective imposts, and reduction of duties maintained for fiscal purposes to the lowest rates compatible with these exigencies. Other European countries were obliged to obtain for their trade the benefit of the conventional tariff thus established in France, as an alternative to the high rates inscribed in the general tariff. A series of commercial treaties was accordingly concluded by different European states between 1861 and 1866, which effected further reductions of customs duties in the several countries that came within this treaty system. In 1871 the Republican government sought to terminate the treaties of the empire. The British negotiators nevertheless obtained the relinquishment of the attempt to levy protective duties under the guise of compensation for imposts on raw materials; the duration of the treaty of 1860 was prolonged; and stipulations better worded than those before in force were agreed to for shipping and most favoured nation treatment. In 1882, however, France terminated her existing European tariff treaties. Belgium and some other countries concluded fresh treaties, less liberal than those of the system of 1860, yet much better than anterior arrangements. Great Britain did not formally accept these higher duties; the treaty of the 28th of February 1882, with France, which secured most favoured nation treatment in other matters, provided that customs duties should be “henceforth regulated by the internal legislation of each of the two states.” In 1892 France also fell out of international tariff arrangements; and adopted the system of double columns of customs duties—one, of lower rates, to be applied to the goods of all nations receiving most favoured treatment; and the other, of higher rates, for countries not on this footing. Germany then took up the treaty tariff policy; and between 1891 and 1894 concluded several commercial treaties.

International trade in Europe in 1909 was regulated by a series of tariffs which came into operation, mainly on the initiative of Germany in 1906. Austria-Hungary, Belgium, Bulgaria, Germany, Italy, Rumania, Russia, Servia and Switzerland, were parties to them. Their object and effect was protectionist. The British policy then became one of obtaining modifications to remedy disadvantages to British trade, as was done in the case of Bulgaria and Rumania. An important series of commercial arrangements had been concluded between 1884 and 1900 respecting the territories and spheres of interest of European powers in western, central and eastern Africa. In these regions exclusive privileges were not claimed; most favoured nation treatment was recognized, and there was a disposition to extend national treatment to all Europeans and their trade.

The Turkish *Capitulations* (*q.v.*) are grants made by successive sultans to Christian nations, conferring rights and privileges in favour of their subjects resident or trading in the Ottoman dominions, following the policy towards European states of the Eastern empire. In the first instance capitulations were granted separately to each Christian state, beginning with the Genoese in 1453, which entered into pacific relations with Turkey. Afterwards new capitulations were obtained which summed up in one document earlier concessions, and added to them in general terms whatever had been conceded to one or more other states; a stipulation which became a most favoured nation article. The English capitulations date from 1569, and then secured the same treatment as the Venetians, French, Poles and the subjects of the emperor of Germany; they were revised in 1675, and as then settled were confirmed by treaties of subsequent date “now and for ever.” Capitulations signify that which is arranged under distinct “headings”; the Turkish phrase is “ahid nameh,” whereas a treaty is “mouahedé”—the latter does, and the former does not, signify a reciprocal engagement. Thus, although the Turkish capitulations are not in themselves treaties, yet by subsequent confirmation they have acquired the force of commercial treaties of perpetual duration as regards substance and principles, while details, such as rates of customs duties,

may, by mutual consent, be varied from time to time.

The *most favoured nation* article already referred to concedes to the state in the treaty with which it is concluded whatever advantages in the matters comprised within its stipulations have been allowed to any foreign or third state. It does not in itself directly confer any particular rights, but sums up the whole of the rights in the matters therein mentioned which have been or may be granted to foreign countries. The value of the privileges under this article accordingly varies with the conditions as to these rights in each state which concedes this treatment.

The article is drafted in different form:

(1) That contracting states A. and B. agree to extend to each other whatever rights and privileges they concede to countries C. and D., or to C. and D. and any other country. The object in this instance is to ensure specifically to B. and A. whatever advantages C. and D. may possess. A recent instance is Article XI. of the treaty of May 10, 1871, between France and Germany, which binds them respectively to extend to each other whatever advantages they grant to Austria, Belgium, Great Britain, the Netherlands, Russia and Switzerland.

(2) The present general formula: A. and B. agree to extend to each other whatever advantages they concede to any third country; and engage that no other or higher duties shall be levied on the importation into A. and B. respectively of goods the produce or manufacture of B. and A. than are levied on the like goods the produce or manufacture of any third country the most favoured in this respect. There is a similar clause in regard to exportation.

(3) The conditional or reciprocity formula, often used in the 18th and in the early part of the 19th century, namely, that whenever A. and B. make special concessions in return for corresponding concessions, B. and A. respectively are either excluded from participation therein, or must make some additional equivalent concession in order to participate in those advantages.

It may further be observed that the word “like” relates to the goods themselves, to their material or quality, not to conditions of manufacture, mode of conveyance or anything beyond the fact of their precise description; small local facilities allowed to traffic between conterminous land districts are not at variance with this article.

A recent complete and concise English formula is that of Article 2 of the treaty of commerce and navigation of the 31st of October 1905, with Rumania. “The contracting parties agree that, in all matters relating to commerce, navigation and industry, any privilege, favour or immunity which either contracting party has actually granted, or may hereafter grant, to the subjects or citizens of any other foreign state, shall be extended immediately and unconditionally to the subjects of the other; it being their intention that the commerce, navigation and industry of each country shall be placed, in all respects, on the footing of the most favoured nation.”

Colonies.—The application of commercial treaties to colonies depends upon the wording of each treaty. The earlier colonial policy of European states was to subordinate colonial interests to those of the mother country, to reserve colonial trade for the mother country, and to abstain from engagements contrary to these general rules. France, Portugal and Spain have adhered in principle to this policy. Germany and Holland have been more liberal. The self-government enjoyed by the larger British colonies has led since 1886 to the insertion of an article in British commercial and other treaties whereby the assent of each of these colonies, and likewise of India, is reserved before they apply to each of these possessions. And further, the fact that certain other British colonies are now within the sphere of commercial intercourse controlled by the United States, has since 1891 induced the British government to enter into special agreements on behalf of colonies for whose products the United States is now the chief market. As regards the most favoured nation article, it is to be remembered that the mother country and colonies are not distinct—not foreign or third—countries with respect to each other. The most favoured nation article, therefore, does not preclude special arrangements between the mother country and colonies, nor between colonies.

Termination.—Commercial treaties are usually concluded for a term of years, and either lapse at the end of this period, or are terminable then, or subsequently, if either state gives the required notice. When a portion of a country establishes its independence, for example the several American republics, according to present usage foreign trade is placed on a uniform most favoured nation footing, and fresh treaties are entered into to regulate the commercial relations of the new communities. In the case of former Turkish provinces, the capitulations remain in force in principle until they are replaced by new engagements. If one

state is absorbed into another, for instance Texas into the United States, or when territory passes by conquest, for instance Alsace to Germany, the commercial treaties of the new supreme government take effect. In administered territories, as Cyprus and formerly Bosnia, and in protected territories, it depends on the policy of the administering power how far the previous fiscal system shall remain in force. When the separate Italian states were united into the kingdom of Italy in 1861, the commercial engagements of Sardinia superseded those of the other states, but fresh treaties were concluded by the new kingdom to place international relations on a regular footing. When the German empire was established under the king of Prussia in 1871, the commercial engagements of any state which were at variance with a Zollverein treaty were superseded by that treaty.

Scope.—The scope of commercial treaties is well expressed by Calvo in his work on international law. They provide for the importation, exportation, transit, transhipment and bonding of merchandise; customs tariffs; navigation charges; quarantine; the admission of vessels to roadsteads, ports and docks; coasting trade; the admission of consuls and their rights; fisheries; they determine the local position of the subjects of each state in the other country in regard to residence, property, payment of taxes or exemptions, and military service; nationality; and a most favoured nation clause. They usually contain a termination, and sometimes a colonial article. Some of the matters enumerated by Calvo—consular privileges, fisheries and nationality—are now frequently dealt with by separate conventions. Contraband and neutral trade are not included as frequently as they were in the 18th century.

The preceding statement shows that commercial treaties afford to foreigners, personally, legal rights, and relief from technical disabilities: they afford security to trade and navigation, and regulate other matters comprised in their provisions. In Europe the general principles established by the series of treaties 1860-1866 hold good, namely, the substitution of uniform rates of customs duties for prohibitions or differential rates. The disadvantages urged are that these treaties involve government interference and bargaining, whereas each state should act independently as its interests require, that they are opposed to free trade, and restrict the fiscal freedom of the legislature. It may be observed that these objections imply some confusion of ideas. All contracts may be designated bargains, and some of the details of commercial treaties in Calvo’s enumeration enter directly into the functions of government; moreover, countries cannot remain isolated. If two countries agree by simultaneous action to adopt fixed rates of duty, this agreement is favourable to commerce, and it is not apparent how it is contrary, even to free trade principles. Moreover, security in business transactions, a very important consideration, is provided.

Our conclusions are—

(1) that under the varying jurisprudence of nations commercial treaties are adopted by common consent;

(2) that their provisions depend upon the general and fiscal policy of each state;

(3) that tariff arrangements, if judiciously settled, benefit trade;

(4) that commercial treaties are now entered into by all states; and that they are necessary under present conditions of commercial intercourse between nations.

(C. M. K.*)

See the British parliamentary *Return* (Cd. 4080) of all commercial treaties between various countries in force on Jan. 1, 1908.

COMMERCY, a town of north-eastern France, capital of an arrondissement in the department of Meuse, on the left bank of the Meuse, 26 m. E. of Bar-le-Duc by rail. Pop. (1906) 5622. Commercy possesses a château of the 17th century, now used as cavalry barracks, a Benedictine convent occupied by a training-college for primary teachers, and a communal college for boys. A statue of Dom Calmet, the historian, born in the vicinity, stands in one of the squares. The industries include iron-working and the manufacture of nails, boots and shoes, embroidery and hosiery. The town has trade in cattle, grain and wood, and is well known for its cakes (*madeleines*). Commercy dates back to the 9th

century, and at that time its lords were dependent on the bishop of Metz. In 1544 it was besieged by Charles V. in person. For some time the lordship was in the hands of François Paul de Gondi, cardinal de Retz, who lived in the town for a number of years, and there composed his memoirs. From him it was purchased by Charles IV., duke of Lorraine. In 1744 it became the residence of Stanislas, king of Poland, who spent a great deal of care on the embellishment of the town, castle and neighbourhood.

COMMERS (from Lat. *commercium*), the German term for the German students' social gatherings held annually on occasions such as the breaking-up of term and the anniversary of the university's founding. A Commers consists of speeches and songs and the drinking of unlimited quantities of beer. The arrangements are governed by officials (*Chargierte*) elected by the students from among themselves. Strict rules as to drinking exist, and the chairman after each speech calls for what is called a salamander (*ad exercitium Salamandris bibite, tergite*). All rise and having emptied their glasses hammer three times on the table with them. On the death of a student, his memory is honoured with a salamander, the glasses being broken to atoms at the close.

COMMINES, PHILIPPE DE (c. 1445-c. 1511), French historian, called the father of modern history, was born at the castle of Renescure, near Hazebrouck in Flanders, a little earlier than 1447. He lost both father and mother in his earliest years. In 1463 his godfather, Philip V., duke of Burgundy, summoned him to his court, and soon after transferred him to the household of his son, afterwards known as Charles the Bold. He speedily acquired considerable influence over Charles, and in 1468 was appointed chamberlain and councillor; consequently when in the same year Louis XI. was entrapped at Péronne, Commines was able both to soften the passion of Charles and to give useful advice to the king, whose life he did much to save. Three years later he was charged with an embassy to Louis, who gained him over to himself by many brilliant promises, and in 1472 he left Burgundy for the court of France. He was at once made chamberlain and councillor; a pension of 6000 livres was bestowed on him; he received the principality of Talmont, the confiscated property of the Amboise family, over which the family of La Trémoille claimed to have rights. The king arranged his marriage with Hélène de Chambes, who brought him the fine lordship of Argenton, and Commines took the name d'Argenton from then (27th of January 1473). He was employed to carry out the intrigues of Louis in Burgundy, and spent several months as envoy in Italy. On his return he was received with the utmost favour, and in 1479 obtained a decree confirming him in possession of his principality.

On the death of Louis in 1483 a suit was commenced against Commines by the family of La Trémoille, and he was cast in heavy damages. He plotted against the regent, Anne of Beaujeu, and joined the party of the duke of Orleans, afterwards Louis XII. Having attempted to carry off the king, Charles VIII., and so free him from the tutelage of his sister, he was arrested, and put in one of his old master's iron cages at Loches. In 1489 he was banished to one of his own estates for ten years, and made to give bail to the amount of 10,000 crowns of gold for his good behaviour. Recalled to the council in 1492, he strenuously opposed the Italian expedition of Charles VIII., in which, however, he took part, notably as representing the king in the negotiations which resulted in the treaty of Vercelli. During the rest of his life, notwithstanding the accession of Louis XII., whom he had served as duke of Orleans, he held no position of importance; and his last days were disturbed by lawsuits. He died at Argenton on the 18th of October, probably in 1511. His wife Hélène de Chambes survived him till 1532; their tomb is now in the Louvre.

The *Memoirs*, to which Commines owes his reputation as a statesman and man of letters, were written during his latter years. The graphic style of his narrative and above all the keenness of his insight into the motives of his contemporaries, an insight undimmed by undue regard for principles of right and wrong, make this work one of the great classics of history. His portrait of Louis XI. remains unique, in that to such a writer was given such a

subject. Scott in *Quentin Durward* gives an interesting picture of Commines, from whom he largely draws. Sainte-Beuve, after speaking of Commines as being in date the first truly modern writer, and comparing him with Montaigne, says that his history remains the definitive history of his time, and that from it all political history took its rise. None of this applause is undeserved, for the pages of Commines abound with excellences. He analyses motives and pictures manners; he delineates men and describes events; his reflections are pregnant with suggestiveness, his conclusions strong with the logic of facts.

The *Memoirs* divided themselves into two parts, the first from the reign of Louis XI., 1464-1483, the second on the Italian expedition and the negotiations at Venice leading to the Vercelli treaty, 1494-1495. The first part was written between 1489 and 1491, while Commines was at the château of Dreux, the second from 1495 to 1498. Seven MSS. are known, derived from a single holograph, and as this was undoubtedly badly written, the copies were inaccurate; the best is that which belonged to Anne de Polignac, niece of Commines, and it is the only one containing books vii. and viii.

The best edition of Commines is the one edited by B. de Mandrot and published at Paris in 1901-1903. For this edition the author used a manuscript hitherto unknown and more complete than the others, and in his introduction he gives an account of the life of Commines.

BIBLIOGRAPHY.—The *Memoirs* remained in MS. till 1524, when part of them were printed by Galliot du Pré, the remainder first seeing light in 1525. Subsequent editions were put forth by Denys Sauvage in 1552, by Denys Godefroy in 1649, and by Lenglet Dufresnoy in 1747. Those of Mademoiselle Dupont (1841-1848) and of M. de Chantelauze (1881) have many merits, but the best was given by Bernard de Mandrot: *Memoirs de Philippe de Commynes*, from the MS. of Anne de Polignac (1901). Various translations of Commines into English have appeared, from that of T. Danett in 1596 to that, based on the Dupont edition, which was printed in Bohn's series in 1855.

(C. B.*)

COMMISSARIAT, the department of an army charged with the provision of supplies, both food and forage, for the troops. The supply of military stores such as ammunition is not included in the duties of a commissariat. In almost every army the duties of transport and supply are performed by the same corps of departmental troops.

COMMISSARY (from Med. Lat. *commissarius*, one to whom a charge or trust is committed), generally, a representative; *e.g.*, the emperor's representative who presided in his absence over the imperial diet; and especially, an ecclesiastical official who exercises in special circumstances the jurisdiction of a bishop (*q.v.*); in the Church of England this jurisdiction is exercised in a Consistory Court (*q.v.*), except in Canterbury, where the court of the diocesan as opposed to the metropolitan jurisdiction of the archbishop is called a commissary court, and the judge is the commissary general of the city and diocese of Canterbury. When a see is vacant the jurisdiction is exercised by a "special commissary" of the metropolitan. Commissary is also a general military term for an official charged with the duties of supply, transport and finance of an army. In the 17th and 18th centuries the *commissaire des guerres*, or *Kriegskommissär* was an important official in continental armies, by whose agency the troops, in their relation to the civil inhabitants, were placed upon semi-political control. In French military law, *commissaires du gouvernement* represent the ministry of war on military tribunals, and more or less correspond to the British judge-advocate (see COURT-MARTIAL).

COMMISSION (from Lat. *commissio*, *committere*), the action of committing or entrusting any charge or duty to a person, and the charge or trust thus committed, and so particularly an authority, or the document embodying such authority, given to some person to act in a particular capacity. The term is thus applied to the written authority to command troops, which the sovereign or president, as the ultimate commander-in-chief of the nation's armed forces, grants to persons selected as officers, or to the similar authority issued to certain qualified persons to act as justices of the peace. For the various commissions of assize see ASSIZE. The word is also used of the order issued to a naval officer to take the command of a ship of war, and when manned, armed and fully equipped for active service she is said to be "put in commission."

In the law of evidence (*q.v.*) the presence of witnesses may, for certain necessary causes, be dispensed with by the order of the court, and the evidence be taken by a commissioner. Such evidence in England is said to be "on commission" (see R.S.C. Order XXXVII.). Such causes may be illness, the intention of the witness to leave the country before the trial, residence out of the country or the like. Where the witness is out of the jurisdiction of the court, and his place of residence is a foreign country where objection is taken to the execution of a commission, or is a British colony or India, "letters of request" for the examination of the witness are issued, addressed to the head of the tribunal in the foreign country, or to the secretary of state for the colonies or for India.

Where the functions of an office are transferred from an individual to a body of persons, the body exercising these delegated functions is generally known as a commission and the members as commissioners; thus the office of lord high admiral of Great Britain is administered by a permanent board, the lords of the admiralty. Such a delegation may be also temporary, as where the authority under the great seal to give the royal assent to legislation is issued to lords commissioners. Similarly bodies of persons or single individuals may be specially charged with carrying out particular duties; these may be permanent, such as the Charity Commission or the Ecclesiastical and Church Estates Commission, or may be temporary, such as various international bodies of inquiry, like the commission which met in Paris in 1905 to inquire into the North Sea incident (see DOGGER BANK), or such as the various commissions of inquiry, royal, statutory or departmental, of which an account is given below.

A commission may be granted by one person to another to act as his agent, and particularly in business; thus the term is applied to that method of business in which goods are entrusted to an agent for sale, the remuneration being a percentage on the sales. This percentage is known as the "commission," and hence the word is extended to all remuneration which is based on a percentage on the value of the work done. The right of an agent to remuneration in the form of a "commission" is always founded upon an express or implied contract between himself and his principal. Such a contract may be implied from custom or usage, from the conduct of the principal or from the circumstances of the particular case. Such commissions are only payable on transactions directly resulting from agency and may be payable though the principal acquires no benefit. In order to claim remuneration an agent must be legally qualified to act in the capacity in which he claims remuneration. He cannot recover in respect of unlawful or wagering transactions, or in cases of misconduct or breach of duty.

Secret Commissions.—The giving of a commission, in the sense of a bribe or unlawful payment to an agent or employé in order to influence him in relation to his principal's or employer's affairs, has grown to considerable proportions in modern times; it has been rightly regarded as a gross breach of trust upon the part of employés and agents, inasmuch as it leads them to look to their own interests rather than to those of their employers. In order to suppress this bribing of employés the English legislature in 1906 passed the Prevention of Corruption Act, which enacts that if an agent corruptly accepts or obtains for himself or for any other person any gift or consideration as an inducement or reward for doing or forbearing to do any act or business, or for showing or forbearing to show favour or disfavour to any person in relation to his principal's affairs, he shall be guilty of a misdemeanour and shall be liable on conviction or indictment to imprisonment with or without hard labour for a term not exceeding two years, or to a fine not exceeding £500, or to both, or on summary conviction to imprisonment not exceeding four months with or without hard labour or to a fine not exceeding £50, or both. The act also applies the same punishment to any person who corruptly gives or offers any gift or consideration to an agent. Also if a person knowingly gives an agent, or if an agent knowingly uses, any receipt, account or document with intent to mislead the principal, they are guilty of a misdemeanour and liable to the punishment already mentioned. For the purposes of the act "consideration"

includes valuable consideration of any kind, and “agent” includes any person employed by or acting for another. No prosecution can be instituted without the consent of the attorney-general, and every information must be upon oath.

Legislation to the same effect has been adopted in Australia. A federal act was passed in 1905 dealing with secret commissions, and in the same year both Victoria and Western Australia passed drastic measures to prevent the giving or receiving corruptly of commissions. The Victorian act applies to trustees, executors, administrators and liquidators as well as to agents. Both the Victorian and the Western Australian acts enact that gifts to the parent, wife, child, partner or employer of an agent are to be deemed gifts to the agent unless the contrary is proved; also that the custom of any trade or calling is not in itself a defence to a prosecution.

Commissions of Inquiry, *i.e.* commissions for the purpose of eliciting information as to the operation of laws, or investigating particular matters, social, educational, &c., are distinguished, according to the terms of their appointment, as *royal*, *statutory* and *departmental*. A royal commission in England is appointed by the crown, and the commissions usually issue from the office of the executive government which they specially concern. The objects of the inquiry are carefully defined in the warrant constituting the commission, which is termed the “reference.” The commissioners give their services gratuitously, but where they involve any great degree of professional skill compensation is allowed for time and labour. The expenses incurred are provided out of money annually voted for the purpose. Unless expressly empowered by act of parliament, a commission cannot compel the production of documents or the giving of evidence, nor can it administer an oath. A commission may hold its sittings in any part of the United Kingdom, or may institute and conduct experiments for the purpose of testing the utility of invention, &c. When the inquiry or any particular portion of it is concluded, a report is presented to the crown through the home department. All the commissioners, if unanimous, sign the report, but those who are unable to agree with the majority can record their dissent, and express their individual opinions, either in paragraphs appended to the report or in separately signed memoranda.

Statutory commissions are created by acts of parliament, and, with the exception that they are liable to have their proceedings questioned in parliament, have absolute powers within the limits of their prescribed functions and subject to the provisions of the act defining the same. Departmental commissions or committees are appointed either by a treasury minute or by the authority of a secretary of state, for the purpose of instituting inquiries into matters of official concern or examining into proposed changes in administrative arrangements. They are generally composed of two or more permanent officials of the department concerned in the investigation, along with a subordinate member of the administration. Reports of such committees are usually regarded as confidential documents.

A full account of the procedure in royal commissions will be found in A. Todd’s *Parliamentary Government in England*, vol. ii.

COMMISSIONAIRE, the designation of an attendant, messenger or subordinate employé in hotels on the continent of Europe, whose chief duty is to attend at railway stations, secure customers, take charge of their luggage, carry out the necessary formalities with respect to it and have it sent on to the hotel. They are also employed in Paris as street messengers, light porters, &c. The Corps of Commissionaires, in England, is an association of pensioned soldiers of trustworthy character, founded in 1859 by Captain Sir Edward Walter, K.C.B. (1823-1904). It was first started in a very small way, with the intention of providing occupation for none but wounded soldiers. The nucleus of the corps consisted of eight men, each of whom had lost a limb. The demand, however, for neat, uniformed, trusty men, to perform certain light duties, encouraged the founder to extend his idea, and the corps developed into a large self-supporting organization. In 1906 there were over 3000 members of the corps, more than 2000 of whom served in London. Out-stations were established in various large towns of the kingdom, and the corps extended its operations also to the colonies.

COMMISSIONER, in general an officer appointed to carry out some particular work, or to discharge the duty of a particular office; one who is a member of a commission (*q.v.*). In this sense the word is applied to members of a permanently constituted department of the administration, as civil service commissioners, commissioners of income tax, commissioners in lunacy, &c. It is also the title given to the heads of or important officials in various governmental departments, as commissioner of customs. In some British possessions in Africa and the Pacific the head of the government is styled high commissioner. In India a commissioner is the chief administrative official of a division which includes several districts. The office does not exist in Madras, where the same duties are discharged by a board of revenue, but is found in most of the other provinces. The commissioner comes midway between the local government and the district officer. In the regulation provinces the district officer is called a collector (*q.v.*), and in the non-regulation provinces a deputy-commissioner. In the former he must always be a member of the covenanted civil service, but in the latter he may be a military officer.

A chief commissioner is a high Indian official, governing a province inferior in status to a lieutenant-governorship, but in direct subordination to the governor-general in council. The provinces which have chief commissioners are the Central Provinces and Berar, the North-West Frontier Province and Coorg. The agent to the governor-general of Baluchistan is also chief commissioner of British Baluchistan, the agent to the governor-general of Rajputana is also chief commissioner of the British district of Ajmere-Merwara, and there is a chief commissioner of the Andaman and Nicobar islands. Several provinces, such as the Punjab, Oudh, Burma and Assam, were administered by chief commissioners before they were raised to the status of lieutenant-governorships (see LIEUTENANT).

A commissioner for oaths in England is a solicitor appointed by the lord chancellor to administer oaths to persons making affidavits for the purpose of any cause or matter. The Commissioner for Oaths Act 1889 (with an amending act 1891), amending and consolidating various other acts, regulates the appointment and powers of such commissioners. In most large towns the minimum qualification for appointment is six years' continuous practice, and the application must be supported by two barristers, two solicitors and at least six neighbours of the applicant. The charge made by commissioners for every oath, declaration, affirmation or attestation upon honour is one shilling and sixpence; for marking each exhibit (a document or other thing sworn to in an affidavit and shown to a deponent when being sworn), one shilling.

COMMITMENT, in English law, a precept or warrant *in writing*, made and issued by a court or judicial officer (including, in cases of treason, the privy council or a secretary of state), directing the conveyance of a person named or sufficiently described therein to a prison or other legal place of custody, and his detention therein for a time specified, or until the person to be detained has done a certain act specified in the warrant, *e.g.* paid a fine imposed upon him on conviction. Its character will be more easily grasped by reference to a form now in use under statutory authority:—

> In the county of A, Petty Sessional Division of B.
>
> To each and all of the constables of the county of A and the governor of His Majesty's Prison at C.
>
> E. F. hereinafter called the defendant has this day been convicted before the court of summary jurisdiction sitting at D.
>
> (Here the conviction and adjudication is stated.)
>
> You the said constables are hereby commanded to convey the defendant to the said prison, and there deliver him to the governor thereof together with this warrant: and you the governor of the said prison to receive the defendant into your custody and keep him to hard labour for the space of three calendar months.
>
> Dated
>
> Signature and seal of a justice of the peace.

A commitment as now understood differs from "committal," which is the decision of a

court to send a person to prison, and not the document containing the directions to executive and ministerial officers of the law which are consequent on the decision. An interval must necessarily elapse between the decision to commit and the making out of the warrant of commitment, during which interval the detention in custody of the person committed is undoubtedly legal. A commitment differs also from a warrant of arrest (*mandat d'amener*), in that it is not made until after the person to be detained has actually appeared, or has been summoned, before the court which orders committal, to answer to some charge.

If not always, at any rate since 1679, a warrant of commitment has been necessary to justify officers of the law in conveying a prisoner to gaol and a gaoler in receiving and detaining him there. It is ordinarily essential to a valid commitment that it should contain a specific statement of the particular cause of the detention ordered. To this the chief, if not the only exception, is in the case of commitments by order of either House of Parliament (May, *Parl. Pr.*, 11th ed., 63, 70, 90). Commitments by justices of the peace must be under their hands and seals. Commitments by a court of record if formally drawn up are under the seal of the court.

Every person in custody is entitled, under the Habeas Corpus Act 1679, to receive within six hours of demand from the officer in whose custody he is, a copy of any warrant of commitment under which he is detained, and may challenge its legality by application for a writ of habeas corpus.

So far as concerns the acts of justices and tribunals of limited jurisdiction, the stringency of the rules as to commitments is an important aid to the liberty of the subject.

In the case of superior courts no statutory forms of commitment exist, and the same formalities are not so strictly enforced. Committal of a person present in court for contempt of the court is enforced by his immediate arrest by the tipstaff as soon as committal is ordered, and he may be detained in prison on a memorandum of the clerk or registrar of the court while a formal order is being drawn up. And in the case of persons sentenced at assizes and quarter sessions the only written authority for enforcement is a calendar of the prisoners tried, on which the sentences are entered up, signed by the presiding judge.

Commitments are usually made by courts of criminal jurisdiction in respect of offences against the criminal law, but are also occasionally made as a punishment for disobedience to the orders made in a civil court, *e.g.* where a judgment debtor having means to pay refuses to satisfy the judgment debt, or in cases where the person committed has been guilty of a direct contempt of the court.

The expenses of executing a warrant of commitment, so far as not paid by the prisoner, are defrayed out of the parliamentary grants for the maintenance of prisons.

COMMITTEE (from *committé*, an Anglo-Fr. past participle of *commettre*, Lat. *committere*, to entrust; the modern Fr. equivalent *comité* is derived from the Eng.), a person or body of persons to whom something is "committed" or entrusted. The term is used of a person or persons to whom the charge of the body ("committee of the person") or of the property and business affairs ("committee of the estate") of a lunatic is committed by the court (see INSANITY). In this sense the English usage is to pronounce the word *commi-ttee*. The more common meaning of "committee" (pronounced *commítt-y*) is that of a body of persons elected or appointed to consider and deal with certain matters of business, specially or generally referred to it.

COMMODIANUS, a Christian Latin poet, who flourished about A.D. 250. The only ancient writers who mention him are Gennadius, presbyter of Massilia (end of 5th century), in his *De scriptoribus ecclesiasticis*, and Pope Gelasius in *De libris recipiendis et non recipiendis*, in which his works are classed as *Apocryphi*, probably on account of certain heterodox statements contained in them. Commodianus is supposed to have been an African. As he

himself tells us, he was originally a heathen, but was converted to Christianity when advanced in years, and felt called upon to instruct the ignorant in the truth. He was the author of two extant Latin poems, *Instructiones* and *Carmen apologeticum* (first published in 1852 by J. B. Pitra in the *Spicilegium Solesmense*, from a MS. in the Middlehill collection, now at Cheltenham, supposed to have been brought from the monastery of Bobbio). The *Instructiones* consist of 80 poems, each of which is an acrostic (with the exception of 60, where the initial letters are in alphabetical order). The initials of 80, read backwards, give Commodianus Mendicus Christi. The *Apologeticum*, undoubtedly by Commodianus, although the name of the author (as well as the title) is absent from the MS., is free from the acrostic restriction. The first part of the *Instructiones* is addressed to the heathens and Jews, and ridicules the divinities of classical mythology; the second contains reflections on Antichrist, the end of the world, the Resurrection, and advice to Christians, penitents and the clergy. In the *Apologeticum* all mankind are exhorted to repent, in view of the approaching end of the world. The appearance of Antichrist, identified with Nero and the Man from the East, is expected at an early date. Although they display fiery dogmatic zeal, the poems cannot be considered quite orthodox. To the classical scholar the metre alone is of interest. Although they are professedly written in hexameters, the rules of quantity are sacrificed to accent. The first four lines of the *Instructiones* may be quoted by way of illustration:

> “Praefatio nostra viam erranti demonstrat,
> Respectumque bonum, cum venerit saeculi meta,
> Aeternum fieri, quod discredunt inscia corda:
> Ego similiter erravi tempore multo.”

These *versus politici* (as they are called) show that the change was already passing over Latin which resulted in the formation of the Romance languages. The use of cases and genders, the construction of verbs and prepositions, and the verbal forms exhibit striking irregularities. The author, however, shows an acquaintance with Latin poets—Horace, Virgil, Lucretius.

The best edition of the text is by B. Dombart (Vienna, 1887), and a good account of the poems will be found in M. Manitius, *Geschichte der christlich-lateinischen Poesie* (1891), with bibliography, to which may be added G. Boissier, “Commodien,” in the *Mélanges Renier* (1887); H. Brewer, *Kommodian von Gaza* (Paderborn, 1906); L. Vernier, “La Versification latine populaire en Afrique,” in *Revue de philologie*, xv. (1891); and C. E. Freppel, *Commodien, Arnobe, Lactance* (1893). Teuffel-Schwabe, *Hist. of Roman Literature* (Eng. trans., 384), should also be consulted.

COMMODORE (a form of “commander”; in the 17th century the term “commandore” is used), a temporary rank in the British navy for an officer in command of a squadron. There are two kinds, one with and the other without a captain below him in his ship, the first holding the temporary rank, pay, &c., of a rear-admiral, the other that of captain. It is also given as a courtesy title to the senior officer of a squadron of more than three vessels. In the United States navy “commodore” was a courtesy title given to captains who had been in command of a squadron. In 1862 it was made a commissioned rank, but was abolished in 1899. The name is given to the president of a yacht club, as of the Royal Yacht Squadron, and to the senior captain of a fleet of merchant vessels.

COMMODUS, LUCIUS AELIUS AURELIUS (161-192), also called Marcus Antoninus, emperor of Rome, son of Marcus Aurelius and Faustina, was born at Lanuvium on the 31st of August 161. In spite of a careful education he soon showed a fondness for low society and amusement. At the age of fifteen he was associated by his father in the government. On the death of Aurelius, whom he had accompanied in the war against the Quadi and Marcomanni, he hastily concluded peace and hurried back to Rome (180). The first years of his reign were

uneventful, but in 183 be was attacked by an assassin at the instigation of his sister Lucilla and many members of the senate, which felt deeply insulted by the contemptuous manner in which Commodus treated it. From this time he became tyrannical. Many distinguished Romans were put to death as implicated in the conspiracy, and others were executed for no reason at all. The treasury was exhausted by lavish expenditure on gladiatorial and wild beast combats and on the soldiery, and the property of the wealthy was confiscated. At the same time Commodus, proud of his bodily strength and dexterity, exhibited himself in the arena, slew wild animals and fought with gladiators, and commanded that he should be worshipped as the Roman Hercules. Plots against his life naturally began to spring up. That of his favourite Perennis, praefect of the praetorian guard, was discovered in time. The next danger was from the people, who were infuriated by the dearth of corn. The mob repelled the praetorian guard, but the execution of the hated minister Cleander quieted the tumult. The attempt also of the daring highwayman Maternus to seize the empire was betrayed; but at last Eclectus the emperor's chamberlain, Laetus the praefect of the praetorians, and his mistress Marcia, finding their names on the list of those doomed to death, united to destroy him. He was poisoned, and then strangled by a wrestler named Narcissus, on the 31st of December 192. During his reign unimportant wars were successfully carried on by his generals Clodius Albinus, Pescennius Niger and Ulpius Marcellus. The frontier of Dacia was successfully defended against the Scythians and Sarmatians, and a tract of territory reconquered in north Britain. In 1874 a statue of Commodus was dug up at Rome, in which he is represented as Hercules—a lion's skin on his head, a club in his right and the apples of the Hesperides in his left hand.

See Aelius Lampridius, Herodian, and fragments in Dio Cassius; H. Schiller, *Geschichte der römischen Kaiserzeit*; J. Zürcher, "Commodus" (1868, in Büdinger's *Untersuchungen zur römischen Kaisergeschichte*, a criticism of Herodian's account); Pauly-Wissowa, *Realencyclopädie*, ii. 2464 ff. (von Rohden); Heer, "Der historische Wert des Vita Commodi" (*Philologus*, Supplementband ix.).

COMMON LAW, like "civil law," a phrase with many shades of meaning, and probably best defined with reference to the various things to which it is opposed. It is contrasted with statute law, as law not promulgated by the sovereign body; with equity, as the law prevailing between man and man, unless when the court of chancery assumed jurisdiction; and with local or customary law, as the general law for the whole realm, tolerating variations in certain districts and under certain conditions. It is also sometimes contrasted with civil, or canon, or international law, which are foreign systems recognized in certain special courts only and within limits defined by the common law. As against all these contrasted kinds of law, it may be described broadly as the universal law of the realm, which applies wherever they have not been introduced, and which is supposed to have a principle for every possible case. Occasionally, it would appear to be used in a sense which would exclude the law developed by at all events the more modern decisions of the courts.

Blackstone divides the civil law of England into *lex scripta* or statute law, and *lex non scripta* or common law. The latter, he says, consists of (1) general customs, which are the common law strictly so called, (2) particular customs prevailing in certain districts, and (3) laws used in particular courts. The first is the law by which "proceedings and determinations in the king's ordinary courts of justice are guided and directed." That the eldest son alone is heir to his ancestor, that a deed is of no validity unless sealed and delivered, that wills shall be construed more favourably and deeds more strictly, are examples of common law doctrines, "not set down in any written statute or ordinance, but depending on immemorial usage for their support." The validity of these usages is to be determined by the judges—"the depositaries of the law, the living oracles who must decide in all cases of doubt, and who are bound by an oath to decide according to the law of the land." Their judgments are preserved as records, and "it is an established rule to abide by former precedents where the same points come again in litigation." The extraordinary deference paid to precedents is the source of the most striking peculiarities of the English common law. There can be little doubt that it was the rigid adherence of the common law courts to established precedent which caused the rise of an independent tribunal administering justice on more equitable principles—the tribunal of the chancellor, the court of chancery. And the old common law courts—the king's bench, common pleas and

exchequer—were always, as compared with the court of chancery, distinguished for a certain narrowness and technicality of reasoning. At the same time the common law was never a fixed or rigid system. In the application of old precedents to the changing circumstances of society, and in the development of new principles to meet new cases, the common law courts displayed an immense amount of subtlety and ingenuity, and a great deal of sound sense. The continuity of the system was not less remarkable than its elasticity. Two great defects of form long disfigured the English law. One was the separation of common law and equity. The Judicature Act of 1873 remedied this by merging the jurisdiction of all the courts in one supreme court, and causing equitable principles to prevail over those of the common law where they differ. The other is the overwhelming mass of precedents in which the law is embedded. This can only be removed by some well-conceived scheme of the nature of a code or digest; to some extent this difficulty has been overcome by such acts as the Bills of Exchange Act 1882, the Partnership Act 1890 and the Sale of Goods Act 1893.

The English common law may be described as a pre-eminently national system. Based on Saxon customs, moulded by Norman lawyers, and jealous of foreign systems, it is, as Bacon says, as mixed as the English language and as truly national. And like the language, it has been taken into other English-speaking countries, and is the foundation of the law in the United States.

COMMON LODGING-HOUSE, “a house, or part of a house, where persons of the poorer classes are received for gain, and in which they use one or more rooms in common with the rest of the inmates, who are not members of one family, whether for eating or sleeping” (*Langdon* v. *Broadbent*, 1877, 37 L.T. 434; *Booth* v. *Ferrett*, 1890, 25 Q.B.D. 87). There is no statutory definition of the class of houses in England intended to be included in the expression “common lodging-house,” but the above definition is very generally accepted as embracing those houses which, under the Public Health and other Acts, must be registered and inspected. The provisions of the Public Health Act 1875 are that every urban and rural district council must keep registers showing the names and residences of the keepers of all common lodging-houses in their districts, the situation of every such house, and the number of lodgers authorized by them to be received therein. They may require the keeper to affix and keep undefaced and legible a notice with the words “registered common lodging-house” in some conspicuous place on the outside of the house, and may make by-laws fixing the number of lodgers, for the separation of the sexes, for promoting cleanliness and ventilation, for the giving of notices and the taking of precautions in case of any infectious disease, and generally for the well ordering of such houses. The keeper of a common lodging-house is required to limewash the walls and ceilings twice a year—in April and October—and to provide a proper water-supply. The whole of the house must be open at all times to the inspection of any officer of a council. The county of London (except the city) is under the Common Lodging Houses Acts 1851 and 1853, with the Sanitary Act 1866 and the Sanitary Law Amendment Act 1874. The administration of these acts was, from 1851 to 1894, in the hands of the chief commissioner of police, when it was transferred to the London County Council.

COMMON ORDER, BOOK OF, sometimes called *The Order of Geneva* or *Knox’s Liturgy*, a directory for public worship in the Reformed Church in Scotland. In 1557 the Scottish Protestant lords in council enjoined the use of the English Common Prayer, *i.e.* the Second Book of Edward VI. Meanwhile, at Frankfort, among British Protestant refugees, a controversy was going on between the upholders of the English liturgy and the French Reformed Order of Worship respectively. By way of compromise John Knox and other ministers drew up a new liturgy based upon earlier Continental Reformed Services, which was not deemed satisfactory, but which on his removal to Geneva he published in 1556 for the use of the English congregations in that city. The Geneva book made its way to Scotland, and was used here and there by Reformed congregations. Knox’s return in 1559

strengthened its position, and in 1562 the General Assembly enjoined the uniform use of it as the “Book of Our Common Order” in “the administration of the Sacraments and solemnization of marriages and burials of the dead.” In 1564 a new and enlarged edition was printed in Edinburgh, and the Assembly ordered that “every Minister, exhorter and reader” should have a copy and use the Order contained therein not only for marriage and the sacraments but also “in Prayer,” thus ousting the hitherto permissible use of the Second Book of Edward VI. at ordinary service. “The rubrics as retained from the Book of Geneva made provision for an extempore prayer before the sermon, and allowed the minister some latitude in the other two prayers. The forms for the special services were more strictly imposed, but liberty was also given to vary some of the prayers in them. The rubrics of the Scottish portion of the book are somewhat stricter, and, indeed, one or two of the Geneva rubrics were made more absolute in the Scottish emendations; but no doubt the ‘Book of Common Order’ is best described as a discretionary liturgy.”

It will be convenient here to give the contents of the edition printed by Andrew Hart at Edinburgh in 1611, and described (as was usually the case) as *The Psalmes of David in Meeter, with the Prose, whereunto is added Prayers commonly used in the Kirke, and private houses; with a perpetuall Kalendar and all the Changes of the Moone that shall happen for the space of Six Yeeres to come*. They are as follows:—

(i.) The Calendar; (ii.) The names of the Faires of Scotland; (iii.) The Confession of Faith used at Geneva and received by the Church of Scotland; (iv.-vii.) Concerning the election and duties of Ministers, Elders and Deacons, and Superintendent; (viii.) An order of Ecclesiastical Discipline; (ix.) The Order of Excommunication and of Public Repentance; (x.) The Visitation of the Sick; (xi.) The Manner of Burial; (xii.) The Order of Public Worship—Forms of Confession and Prayer after Sermon; (xiii.) Other Public Prayers; (xiv.) The Administration of the Lord’s Supper; (xv.) The Form of Marriage; (xvi.) The Order of Baptism; (xvii.) A Treatise on Fasting with the order thereof; (xviii.) The Psalms of David; (xix.) Conclusions or Doxologies; (xx.) Hymns—metrical versions of the Decalogue, Magnificat, Apostles’ Creed, &c.; (xxi.) Calvin’s Catechism; (xxii. and xxiii.) Prayers for Private Houses and Miscellaneous Prayers, *e.g.* for a man before he begins his work.

The Psalms and Catechism together occupy more than half the book. The chapter on burial is significant. In place of the long office of the Catholic Church we have simply this statement:—“The corpse is reverently brought to the grave, accompanied with the Congregation, without any further ceremonies: which being buried, the Minister (if he be present and required) goeth to the Church, if it be not far off, and maketh some comfortable exhortation to the people, touching death and resurrection.” This (with the exception of the bracketed words) was taken over from the Book of Geneva. The Westminster Directory which superseded the Book of Common Order also enjoins interment “without any ceremony,” such being stigmatized as “no way beneficial to the dead and many ways hurtful to the living.” Civil honours may, however, be rendered.

Revs. G. W. Sprott and Thomas Leishman, in the introduction to their edition of the Book of Common Order, and of the Westminster Directory published in 1868, collected a valuable series of notices as to the actual usage of the former book for the period (1564-1645) during which it was enjoined by ecclesiastical law. Where ministers were not available suitable persons (often old priests, sometimes schoolmasters) were selected as readers. Good contemporary accounts of Scottish worship are those of W. Cowper (1568-1619), bishop of Galloway, in his *Seven Days’ Conference between a Catholic Christian and a Catholic Roman* (*c.* 1615), and Alexander Henderson in *The Government and Order of the Church of Scotland* (1641). There was doubtless a good deal of variety at different times and in different localities. Early in the 17th century under the twofold influence of the Dutch Church, with which the Scottish clergy were in close connexion, and of James I.’s endeavours to “justle out” a liturgy which gave the liberty of “conceiving” prayers, ministers began in prayer to read less and extemporize more.

Turning again to the legislative history, in 1567 the prayers were done into Gaelic; in 1579 parliament ordered all gentlemen and yeomen holding property of a certain value to possess copies. The assembly of 1601 declined to alter any of the existing prayers but expressed a willingness to admit new ones. Between 1606 and 1618 various attempts were made under English and Episcopal influence, by assemblies afterwards declared unlawful, to set aside the “Book of Common Order.” The efforts of James I., Charles I. and Archbishop Laud proved fruitless; in 1637 the reading of Laud’s draft of a new form of service based on the English prayer book led to riots in Edinburgh and to general discontent in the country. The General Assembly of Glasgow in 1638 abjured Laud’s book and took its stand again by the Book of Common Order, an act repeated by the assembly of 1639, which also demurred against

innovations proposed by the English separatists, who objected altogether to liturgical forms, and in particular to the Lord's Prayer, the *Gloria Patri* and the minister kneeling for private devotion in the pulpit. An Aberdeen printer named Raban was publicly censured for having on his own authority shortened one of the prayers. The following years witnessed a counter attempt to introduce the Scottish liturgy into England, especially for those who in the southern kingdom were inclined to Presbyterianism. This effort culminated in the Westminster Assembly of divines which met in 1643, at which six commissioners from the Church of Scotland were present, and joined in the task of drawing up a Common Confession, Catechism and Directory for the three kingdoms. The commissioners reported to the General Assembly of 1644 that this Common Directory "is so begun ... that we could not think upon any particular Directory for our own Kirk." The General Assembly of 1645 after careful study approved the new order. An act of Assembly on the 3rd of February and an act of parliament on the 6th of February ordered its use in every church, and henceforth, though there was no act setting aside the "Book of Common Order," the Westminster Directory was of primary authority. The Directory was meant simply to make known "the general heads, the sense and scope of the Prayers and other parts of Public Worship," and if need be, "to give a help and furniture." The act of parliament recognizing the Directory was annulled at the Restoration and the book has never since been acknowledged by a civil authority in Scotland. But General Assemblies have frequently recommended its use, and worship in Presbyterian churches is largely conducted on the lines of the Westminster Assembly's Directory.

The modern *Book of Common Order* or *Euchologion* is a compilation drawn from various sources and issued by the Church Service Society, an organization which endeavours to promote liturgical usages within the Established Church of Scotland.

COMMONPLACE, a translation of the Gr. κοινὸς τόπος, *i.e.* a passage or argument appropriate to several cases; a "common-place book" is a collection of such passages or quotations arranged for reference under general heads either alphabetically or on some method of classification. To such a book the name *adversaria* was given, which is an adaptation of the Latin *adversaria scripta*, notes written on one side, the side opposite (*adversus*), of a paper or book. From its original meaning the word came to be used as meaning something hackneyed, a platitude or truism, and so, as an adjective, equivalent to trivial or ordinary. It was first spelled as two words, then with a hyphen, and so still in the sense of a "common-place book."

COMMON PLEAS, COURT OF, formerly one of the three English common law courts at Westminster—the other two being the king's bench and exchequer. The court of common pleas was an offshoot of the Curia Regis or king's council. Previous to Magna Carta, the king's council, especially that portion of it which was charged with the management of judicial and revenue business, followed the king's person. This, as far as private litigation was concerned, caused great inconvenience to the unfortunate suitors whose plaints awaited the attention of the court, for they had, of necessity, also to follow the king from place to place, or lose the opportunity of having their causes tried. Accordingly, Magna Carta enacted that common pleas (*communia placita*) or causes between subject and subject, should be held in some fixed place and not follow the court. This place was fixed at Westminster. The court was presided over by a chief (*capitalis justiciarius de communi banco*) and four puisne judges. The jurisdiction of the common pleas was, by the Judicature Act 1873, vested in the king's bench division of the High Court of Justice.

COMMONS,[1] the term for the lands held in commonalty, a relic of the system on which the lands of England were for the most part cultivated during the middle ages. The country was divided into vills, or townships—often, though not necessarily, or always, coterminous with the parish. In each stood a cluster of houses, a village, in which dwelt the men of the township, and around the village lay the arable fields and other lands, which they worked as one common farm. Save for a few small inclosures near the village—for gardens, orchards or paddocks for young stock—the whole township was free from permanent fencing. The arable lands lay in large tracts divided into compartments or fields, usually three in number, to receive in constant rotation the triennial succession of wheat (or rye), spring crops (such as barley, oats, beans or peas), and fallow. Low-lying lands were used as meadows, and there were sometimes pastures fed according to fixed rules. The poorest land of the township was left waste—to supply feed for the cattle of the community, fuel, wood for repairs, and any other commodity of a renewable or practically inexhaustible character.[2] This waste land is the common of our own days.

Early history.

It would seem likely that at one time there was no division, as between individual inhabitants or householders, of any of the lands of the township, but only of the products. But so far back as accurate information extends the arable land is found to be parcelled out, each householder owning strips in each field. These strips are always long and narrow, and lie in sets parallel with one another. The plough for cultivating the fields was maintained at the common expense of the village, and the draught oxen were furnished by the householders. From the time when the crop was carried till the next sowing, the field lay open to the cattle of the whole vill, which also had the free run of the fallow field throughout the year. But when two of the three fields were under crops, and the meadows laid up for hay, it is obvious that the cattle of the township required some other resort for pasturage. This was supplied by the waste or common. Upon it the householder turned out the oxen and horses which he contributed to the plough, and the cows and sheep, which were useful in manuring the common fields,—in the words of an old law case: “horses and oxen to plough the land, and cows and sheep to compester it.” Thus the use of the common by each householder was naturally measured by the stock which he kept for the service of the common fields; and when, at a later period, questions arose as to the extent of the rights on the common, the necessary practice furnished the rule, that the commoner could turn out as many head of cattle as he could keep by means of the lands which were parcelled out to him, —the rule of levancy and couchancy, which has come down to the present day.

In the earliest post-conquest times the vill or township is found to be associated with an over-lord. There has been much controversy on the question, whether the vill originally owned its lands free from any control, and was subsequently reduced to a state of subjection and to a large extent deprived of its ownership, or whether its whole history has been one of gradual emancipation, the ownership of the waste, or common, now ascribed by the law to the lord being a remnant of his ownership of all the lands of the vill. (See Manor.)

Status of township.

At whatever date the over-lord first appeared, and whatever may have been the personal relations of the villagers to him from time to time after his appearance, there can be hardly any doubt that the village lands, whether arable, meadow or waste, were substantially the property of the villagers for the purposes of use and enjoyment. They resorted freely to the common for such purposes as were incident to their system of agriculture, and regulated its use amongst themselves. The idea that the common was the “lord’s waste,” and that he had the power to do what he liked with it, subject to specific and limited qualifying rights in others, was, there is little doubt, the creation of the Norman lawyers.

One of the earliest assertions of the lord’s proprietary interest in waste lands is contained in the Statute of Merton, a statute which, it is well to notice, was passed in one of the first assemblies of the barons of England, before the commons of the realm were summoned to parliament. This statute, which became law in the year 1235, provided “that the great men of England (which had enfeoffed knights and their freeholders of small tenements in their great manors)” might “make their profit of their lands, wastes, woods and pastures,” if they left sufficient pasture for the service of the tenements they had granted. Some fifty years later, another statute, that of Westminster the Second, supplemented the Statute of Merton by enabling the lord of the soil to inclose common lands, not only against his own tenants, but against “neighbours” claiming pasture there. These two pieces of legislation undoubtedly mark the growth of the doctrine which converted the over-lord’s territorial sway into property of the modern kind, and a corresponding loosening of the hold of the rural townships on the wastes of their neighbourhood. To what extent the two acts were

Statutes of Merton and Westminster the Second.

used, it is very difficult to say. We know, from later controversies, that they made no very great change in the system on which the country was cultivated, a system to which, as we have seen, commons were essential. In some counties, indeed, inclosures had, by the Tudor period, made greater progress than in others. T. Tusser, in his eulogium on inclosed farming, cites Suffolk and Essex as inclosed counties by way of contrast to Norfolk, Cambridgeshire and Leicestershire, where the open or "champion" (champain) system prevailed. The Statutes of Merton and Westminster may have had something to do with the progress of inclosed farming; but it is probable that their chief operation lay in furnishing the lord of the manor with a farm on the new system, side by side with the common fields, or with a deer park.

The Black Death.

The first event which really endangered the village system was the coming of the Black Death. This scourge is said to have swept away half the population of the country. The disappearance, by no means uncommon, of a whole family gave the over-lord of the vill the opportunity of appropriating, by way of escheat, the holding of the household in the common fields. The land-holding population of the townships and the persons interested in the commons were thus sensibly diminished.

During the Wars of the Roses the small cultivator is thought to have again made headway. But his diminished numbers, and the larger interest which the lords had acquired in the lands of each vill, no doubt facilitated the determined attack on the common-field system which marked the reigns of Henry VIII. and Edward VI.

The Tudor agrarian revolution.

This attack, which had for its chief object the conversion of arable land into pasture for the sake of sheep-breeding, was the outcome of many causes. It was no longer of importance to a territorial magnate to possess a large body of followers pledged to his interests by their connexion with the land. On the other hand, wool commanded a high price, and the growth of towns and of foreign commerce supplied abundant markets. At the same time the confiscation of the monastic possessions introduced a race of new over-lords—not bound to their territories by any family traditions, and also tended to spread the view that the strong hand was its own justification. In order to keep large flocks and send many bales of wool to market, each landowner strove to increase his range of pasture, and with this view to convert the arable fields of his vill into grass land. There is abundant evidence both from the complaints of writers such as Latimer and Sir Thomas More, and from the Statutes and royal commissions of the day, that large inclosures were made at this time, and that the process was effected with much injustice and accompanied by great hardship. "Where," says Bishop Latimer in one of his courageous and vigorous denunciations of "inclosers and rent-raisers," "there have been many householders and inhabitants, there is now but a shepherd and his dog." In the full tide of this movement, and despite Latimer's appeals, the Statutes of Merton and Westminster the Second were confirmed and re-enacted. Both common fields and commons no doubt disappeared in many places; and the country saw the first notable instalment of inclosure. But from the evidence of later years it is clear that a very large area of the country was still cultivated on the common-field system for another couple of centuries. When inclosure on any considerable scale again came into favour, it was effected on quite different principles; and before describing what was essentially a modern movement, it will be convenient to give a brief outline of the principles of law applicable to commons at the present day.

Rights of common.

Law.—The distinguishing feature in law of common land is, that it is land the soil of which belongs to one person, and from which certain other persons take certain profits—for example, the bite of the grass by the mouth of cattle, or gorse, bushes or heather for fuel or litter. The right to take such a profit is a right of common; the right to feed cattle on common land is a right of common of pasture; while the right of cutting bushes, gorse or heather (more rarely of lopping trees) is known as a right of common of *estovers* (*estouviers*) or *botes* (respectively from the Norman-French *estouffer*, and the Saxon *botan*, to furnish). Another right of common is that of *turbary*, or the right to cut turf or peat for fuel. There are also rights of taking sand, gravel or loam for the repair and maintenance of land. The persons who enjoy any of these rights are called commoners.

From the sketch of the common-field system of agriculture which has been given, we shall readily infer that a large proportion of the commons of the country, and of the peculiarities of the law relating to commons, are traceable to that system. Thus, common rights are mostly attached to, or enjoyed with, certain lands or houses. A right of common of pasture usually consists of the right to turn out as many cattle as the farm or other private land of

the commoner can support in winter; for, as we have seen, the enjoyment of the common, in the village system, belonged to the householders of the village, and was necessarily measured by their holdings in the common fields. The cattle thus commonable are said to be *levant* and *couchant*, *i.e.* uprising and down-lying on the land. But it has now been decided that they need not in fact be so kept. At the present day a commoner may turn out any cattle belonging to him, wherever they are kept, provided they do not exceed in number the head of cattle which can be supported by the stored summer produce of the land in respect of which the right is claimed, together with any winter herbage it produces. The animals which a commoner may usually turn out are those which were employed in the village system—horses, oxen, cows and sheep. These animals are termed commonable animals. A right may be claimed for other animals, such as donkeys, pigs and geese; but they are termed non-commonable, and the right can only be established on proof of special usage. A right of pasture attached to land in the way we have described is said to be *appendant* or *appurtenant* to such land. Common of pasture appendant to land can only be claimed for commonable cattle; and it is held to have been originally attached only to arable land, though in claiming the right no proof that the land was originally arable is necessary. This species of common right is, in fact, the direct survival of the use by the village householder of the common of the township; while common of pasture appurtenant represents rights which grew up between neighbouring townships, or, in later times, by direct grant from the owner of the soil of the common to some other landowner, or (in the case of copyholders) by local custom.

The characteristic of connexion with house or land also marks other rights of common. Thus a right of taking gorse or bushes, or of lopping wood for fuel, called *fire-bote*, is limited to the taking of such fuel as may be necessary for the hearths of a particular house, and no more may be taken than is thus required. The same condition applies to common of *turbary*, which in its more usual form authorizes the commoner to cut the heather, which grows thickly upon poor soils, with the roots and adhering earth, to a depth of about 9 in. Similarly, wood taken for the repairs of buildings (*house-bote*), or of hedges (*hedge-bote* or *hey-bote*), must be limited in quantity to the requirements of the house, farm buildings and hedges of the particular property to which the right is attached. And heather taken for litter cannot be taken in larger quantities than is necessary for manuring the lands in respect of which the right is enjoyed. It is illegal to take the wood or heather from the common, and to sell it to any one who has not himself a right to take it. So, also, a right of digging sand, gravel, clay or loam is usually appurtenant to land, and must be exercised with reference to the repair of the roads, or the improvement of the soil, of the particular property to which the right is attached.

We have already alluded to the fact that, in Norman and later days, every vill or township was associated with some over-lord,—some one responsible to the crown, either directly or through other superior lords, for the holding of the land and the performance of certain duties of defence and military support. To this lord the law has assigned the ownership of the soil of the common of the vill; and the common has for many centuries been styled the waste of the manor. The trees and bushes on the common belong to the lord, subject to any rights of lopping or cutting which the commoners may possess. The ground, sand and subsoil are his, and even the grass, though the commoners have the right to take it by the mouths of their cattle. To the over-lord, also, was assigned a seignory over all the other lands of the vill; and the vill came to be termed his manor. At the present day it is the manorial system which must be invoked in most cases as the foundation of the curiously conflicting rights which co-exist on a common. (See MANOR.)

Manorial commons.

Within the bounds of a manor, speaking generally, there are three classes of persons possessing an interest in the land, viz.:—

(a) Persons holding land freely of the manor, or freehold tenants.

(b) Persons holding land of the manor by copy of court roll, or copyhold tenants.

(c) Persons holding from the lord of the manor, by lease or agreement, or from year to year, land which was originally demesne, or which was once freehold or copyhold and has come into the lord’s hands by escheat or forfeiture.

Amongst the first two classes we usually find the majority of the commoners on the wastes or commons of the manor. To every freehold tenant belongs a right of common of pasture on the commons, such right being “appendant” to the land which he holds freely of the manor. This right differs from most other rights of common in the characteristic that actual exercise of the right need not be proved. When once it is shown that certain land is held freely of the

manor, it follows of necessity that a right of common of pasture for commonable cattle attaches to the land, and therefore belongs to its owner, and may be exercised by its occupant. “Common appendant,” said the Elizabethan judges, “is of common right, and commences by operation of law and in favour of tillage.”

Now this is exactly what we saw to be the case with reference to the use of the common of the vill by the householder cultivating the arable fields. The use was a necessity, not depending upon the habits of this or that householder; it was a use for commonable cattle only, and was connected with the tillage of the arable lands. It seems almost necessarily to follow that the freehold tenants of the manor are the representatives of the householders of the vill. However this may be, it is amongst the freehold tenants of the manor that we must first look for commoners on the waste of the manor.

Owing, however, to the light character of the services rendered by the freeholders, the connexion of their lands with the manor is often difficult to prove. Copyhold tenure, on the other hand, cannot be lost sight of; and in many manors copyholders are numerous, or were, till quite recently. Copyholders almost invariably possess a right of common on the waste of the manor; and when (as is usual) they exist side by side with freeholders, their rights are generally of the same character. They do not, however, exist as of common right, without proof of usage, but by the custom of the manor. Custom has been defined by a great judge (Sir George Jessel, M.R., in *Hammerton* v. *Honey*) as local law. Thus, while the freehold tenants enjoy their rights by the general law of the land, the copyholders have a similar enjoyment by the local law of the manor. This, again, is what one might expect from the ancient constitution of a village community. The copyholders, being originally serfs, had no rights at law; but as they had a share in the tillage of the land, and gradually became possessed of strips in the common fields, or of other plots on which they were settled by the lord, they were admitted by way of indulgence to the use of the common; and the practice hardened into a custom. As might be expected, there is more variety in the details of the rights they exercise. They may claim common for cattle which are not commonable, if the custom extends to such cattle; and their claim is not necessarily connected with arable land.

In the present day large numbers of copyhold tenements have been enfranchised, *i.e.* converted into freehold. The effect of this step is to sever all connexion between the land enfranchised and the manor of which it was previously held. Technically, therefore, the common rights previously enjoyed in respect of the land would be gone. When, however, there is no indication of any intention to extinguish such rights, the courts protect the copyholders in their continued enjoyment; and when an enfranchisement is effected under the statutes passed in modern years, the rights are expressly preserved. The commoners on a manorial common then will be, prima facie, the freeholders and copyholders of the manor, and the persons who own lands which were copyhold of the manor but have been enfranchised.

The occupants of lands belonging to the lord of the manor, though they usually turn out their cattle on the common, do so by virtue of the lord’s ownership of the soil of the common, and can, as a rule, make no claim to any right of common as against the lord, even though the practice of turning out may have obtained in respect of particular lands for a long series of years. When, however, lands have been sold by the lord of the manor, although no right of common attached by law to such lands in the lord’s hands, their owners may subsequently enjoy such a right, if it appears from the language of the deeds of conveyance, and all the surrounding circumstances, that there was an intention that the use of the common should be enjoyed by the purchaser. The rules on this point are very technical; it is sufficient here to indicate that lands bought from a lord of a manor are not necessarily destitute of common rights.

So far we have considered common rights as they have arisen out of the manorial system, and out of the still older system of village communities. There may, however, be rights of common quite unconnected with the manorial system. Such rights may be proved either by producing a specific grant from the owner of the manor or by long usage. It is seldom that an actual grant is produced, although it would seem likely that such grants were not uncommon at one time. But a claim founded on actual user is by no means unusual. Such a claim may be based (a) on immemorial usage, *i.e.* usage for which no commencement later than the coronation of Richard I. (1189) can be shown, (b) on a presumed modern grant which has been lost, or (c) (in some cases) on the Prescription Act 1832. There are special rules applicable to each kind of claim.

Rights of common not connected with manorial system.

A right of common not connected with the manorial system may be, and usually is,

attached to land; it may be measured, like a manorial right, by levancy and couchancy, or it may be limited to a fixed number of animals. Rights of the latter character seem to have been not uncommon in the middle ages. In one of his sermons against inclosure, Bishop Latimer tells us his father "had walk (*i.e.* right of common) for 100 sheep." This may have been a right in gross, but was more probably attached to the "farm of £3 or £4 by year at the uttermost" which his father held. A right of common appurtenant may be sold separately, and enjoyed by a purchaser independently of the tenement to which it was originally appurtenant. It then becomes a right of common in gross.

A right of common in gross is a right enjoyed irrespective of the ownership or occupancy of any lands. It may exist by express grant, or by user implying a modern lost grant, or by immemorial usage. It must be limited to a certain number of cattle, unless the right is claimed by actual grant. Such rights seldom arise in connexion with commons in the ordinary sense, but are a frequent incident of regulated or stinted pastures; the right is then generally known as a cattle-gate or beast-gate.

There may be rights over a common which exclude the owner of the soil from all enjoyment of some particular product of the common. Thus a person, or a class of persons, may be entitled to the whole of the corn, grass, underwood, or sweepage, (*i.e.* everything which falls to the sweep of the scythe) of a tract of land, without possessing any ownership in the land itself, or in the trees or mines. Such a right is known as a right of sole vesture.

A more limited right of the same character is a right of sole pasturage—the exclusive right to take everything growing on the land in question by the mouths of cattle, but not in any other way. Either of these rights may exist throughout the whole year, or during part only. A right of sole common pasturage and herbage was given to a certain class of commoners in Ashdown Forest on the partition of the forest at the end of the 18th century.

Rights in common fields.

We have seen that the common arable fields and common meadows of a vill were thrown open to the stock of the community between harvest and seed-time. There is still to be found, here and there, a group of arable common fields, and occasionally a piece of grass land with many of the characteristics of a common, which turns out to be a common field or meadow. The Hackney Marshes and the other so-called commons of Hackney are really common fields or common meadows, and along the valley of the Lea a constant succession of such meadows is met with. They are still owned in parcels marked by metes; the owners have the right to grow a crop of hay between Lady day and Lammas day; and from Lammas to March the lands are subject to the depasturage of stock. In the case of some common fields and meadows the right of feed during the open time belongs exclusively to the owners; in others to a larger class, such as the owners and occupiers of all lands within the bounds of the parish. Anciently, as we have seen, the two classes would be identical. In some places newcomers not owning strips in the fields were admitted to the right of turn out; in others, not. Hence the distinction. Similar divergences of practice will be found to exist in Switzerland at the present day; *nieder-gelassene*, or newcomers, are in some communes admitted to all rights, while, in others, privileges are reserved to the *bürger*, or old inhabitant householders.

Rights in royal forests.

Some of the largest tracts of waste land to be found in England are the waste or commonable lands of royal forests or chases. The thickets and pastures of Epping Forest, now happily preserved for London under the guardianship of the city corporation, and the noble woods and far-stretching heaths of the New Forest, will be called to mind. Cannock Chase, unhappily inclosed according to law, though for the most part still lying waste, Dartmoor, and Ashdown Forest in Sussex, are other instances; and the list might be greatly lengthened. Space will not permit of any description of the forest system; it is enough, in this connexion, to say that the common rights in a forest were usually enjoyed by the owners and occupiers of land within its bounds (the class may differ in exact definition, but is substantially equivalent to this) without reference to manorial considerations. Epping Forest was saved by the proof of this right. It is often said that the right was given, or confirmed, to the inhabitants in consideration of the burden of supporting the deer for the pleasure of the king or of the owner of the chase. It seems more probable that the forest law prevented the growth of the manorial system, and with it those rules which have tended to restrict the class of persons entitled to enjoy the waste lands of the district.

We have seen that in the case of each kind of common there is a division of interest. The soil belongs to one person; other persons are entitled to take certain products of the soil. This division of interest preserves the common as an open space. The commoners cannot

Prevention of inclosure. inclose, because the land does not belong to them. The owner of the soil cannot inclose, because inclosure is inconsistent with the enjoyment of the commoners' rights. At a very early date it was held that the right of a commoner proceeded out of every part of the common, so that the owner of the soil could not set aside part for the commoner and inclose the rest. The Statutes of Merton and Westminster the Second were passed to get over this difficulty. But under these statutes the burden of proving that sufficient pasture was left was thrown upon the owner of the soil; such proof can very seldom be given. Moreover, the statutes have never enabled an inclosure to be made against commoners entitled to *estovers* or *turbary*. It seems clear that the statutes had become obsolete in the time of Edward VI., or they would not have been re-enacted. And we know that the zealous advocates of inclosure in the 18th century considered them worthless for their purposes. Practically it may be taken that, save where the owner of the soil of a common acquires all the lands in the township (generally coterminous with the parish) with which the common is connected, an inclosure cannot legally be effected by him. And even in the latter case it may be that rights of common are enjoyed in respect of lands outside the parish, and that such rights prevent an inclosure.

Modern Inclosure.—When, therefore, the common-field system began to fall out of gear, and the increase of population brought about a demand for an increased production of corn, it was felt to be necessary to resort to parliament for power to effect inclosure. The legislation which ensued was based on two principles. One was that all persons interested in the open land to be dealt with should receive a proportionate equivalent in inclosed land; the other, that inclosure should not be prevented by the opposition, or the inability to act, of a small minority. Assuming that inclosure was desirable, no more equitable course could have been adopted, though in details particular acts may have been objectionable. The first act was passed in 1709; but the precedent was followed but slowly, and not till the middle of the 18th century did the annual number of acts attain double figures. The high-water mark was reached in the period from 1765 to 1785, when on an average forty-seven acts were passed every year. From some cause, possibly the very considerable expense attending upon the obtaining of an act, the numbers then began slightly to fall off. In the year 1793 a board of agriculture, apparently similar in character to the chambers of commerce of our own day, was established. Sir John Sinclair was its president, and Arthur Young, the well-known agricultural reformer, was its secretary. Owing to the efforts of this body, and of a select committee appointed by the House of Commons on Sinclair's motion, the first General Inclosure Act was passed in 1801. This act would at the present day be called an Inclosure Clauses Act. It contained a number of provisions applicable to inclosures, which could be incorporated by reference, in a private bill. By this means, it was hoped, the length and complexity, and consequently the expense, of inclosure bills would be greatly diminished. Under the stimulus thus applied inclosure proceeded apace. In the year 1801 no less than 119 acts were passed, and the total area inclosed probably exceeded 300,000 acres. Three 783
inclosures in the Lincolnshire Fens account for over 53,000 acres. As before, the movement after a time spent its force, the annual average of acts falling to about twelve in the decade 1830-1840. Another parliamentary committee then sat to consider how inclosure might be promoted; and the result was the Inclosure Act 1845, which, though much amended by subsequent legislation, still stands on the statute-book. The chief feature of that act was the appointment of a permanent commission to make in each case all the inquiries previously made (no doubt capriciously and imperfectly) by committees of the two Houses. The commission, on being satisfied of the propriety of an inclosure was to draw up a provisional order prescribing the general conditions on which it was to be carried out, and this order was to be submitted to parliament by the government of the day for confirmation. It is believed that these inclosure orders afford the first example of the provisional order system of legislation, which has attained such large proportions.

The modern Inclosure Act.

Again inclosure moved forward, and between 1845 and 1869 (when it received a sudden check) 600,000 acres passed through the hands of the inclosure commission. Taking the whole period of about a century and a half, when parliamentary inclosure was in favour, and making an estimate of acreage where the acts do not give it, the result may be thus summarized:—

	Acres.
From 1709 to 1797	2,744,926
” 1801 to 1842	1,307,964
” 1845 to 1869	618,000
Add for Forests inclosed under Special Acts	100,000
	————

4,770,890

The total area of England being 37,000,000 acres, we shall probably not be far wrong in concluding that about one acre in every seven was inclosed during the period in question. During the first period, the lands inclosed consisted mainly of common arable fields; during the second, many great tracts of moor and fen were reduced to severalty ownership. In the third period, inclosure probably related chiefly to the ordinary manorial common; and it seems likely that, on the whole, England would have gained, had inclosure stopped in 1845.

As a fact it stopped in 1869. Before the inclosure commission had been in existence twenty years the feeling of the nation towards commons began to change. The rapid growth of towns, and especially of London, and the awakening sense of the importance of protecting the public health, brought about an appreciation of the value of commons as open spaces. Naturally, the metropolis saw the birth of this sentiment. An attempted inclosure in 1864 of the commons at Epsom and Wimbledon aroused strong opposition; and a select committee of the House of Commons was appointed to consider how the London commons could best be preserved. The Metropolitan Board of Works, then in the vigour of youth, though eager to become the open-space authority for London, could make no better suggestion than that all persons interested in the commons should be bought out, that the board should defray the expense by selling parts for building, and should make parks of what was left. Had this advice been followed, London would probably have lost two-thirds of the open space which she now enjoys. Fortunately a small knot of men, who afterwards formed the Commons Preservation Society, took a broader and wiser view. Chief amongst them were the late Philip Lawrence, who acted as solicitor to the Wimbledon opposition, and subsequently organized the Commons Preservation Society, George Shaw-Lefevre, chairman of that society since its foundation, the late John Locke, and the late Lord Mount Temple (then Mr W. F. Cowper). They urged that the conflict of legal interests, which is the special characteristic of a common, might be trusted to preserve it as an open space, and that all that parliament could usefully do, was to restrict parliamentary inclosure, and to pass a measure of police for the protection of commons as open spaces. The select committee adopted this view. On their report, was passed the Metropolitan Commons Act 1866, which prohibited any further parliamentary inclosures within the metropolitan police area, and provided means by which a common could be put under local management. The lords of the manors in which the London commons lay felt that their opportunity of making a rich harvest out of land, valuable for building, though otherwise worthless, was slipping away; and a battle royal ensued. Inclosures were commenced, and the Statute of Merton prayed in aid. The public retorted by legal proceedings taken in the names of commoners. These proceedings—which culminated in the mammoth suit as to Epping Forest, with the corporation of London as plaintiffs and fourteen lords of manors as defendants—were uniformly successful; and London commons were saved. By degrees the manorial lords, seeing that they could not hope to do better, parted with their interest for a small sum to some local authority; and a large area of the common land, not only in the county of London, but in the suburbs, is now in the hands of the representatives of the ratepayers, and is definitely appropriated to the recreation of the public.

Open Space movement.

Moreover, the Commons Preservation Society was able to base, upon the uniform success of the commoners in the law courts, a plea for the amendment of the law. The Statute of Merton, we have seen, purports to enable the lord of the soil to inclose a common, if he leaves sufficient pasture for the commoners. This statute was constantly vouched in the litigation about London commons; but in no single instance was an inclosure justified by virtue of its provisions. It thus remained a trap to lords of manors, and a source of controversy and expense. In the year 1893 Lord Thring, at the instance of the Commons Preservation Society, carried through parliament the Commons Law Amendment Act, which provided that in future no inclosure under the Statute of Merton should be valid, unless made with the consent of the Board of Agriculture, which was to consider the expediency of the inclosure from a public point of view.

Amendment of Statue of Merton.

The movement to preserve commons as open spaces soon spread to the rural districts. Under the Inclosure Act of 1845 provision was made for the allotment of a part of the land to be inclosed for field gardens for the labouring poor, and for recreation. But those who were interested in effecting an inclosure often convinced the inclosure commissioners that for some reason such allotments would be useless. To such an extent did the reservation of such allotments become discredited that, in 1869, the commission proposed to parliament the inclosure of 13,000

Rural commons.

acres, with the reservation of only one acre for recreation, and none at all for field gardens. This proposal attracted the attention of Henry Fawcett, who, after much inquiry and consideration, came to the conclusion that inclosures were, speaking generally, doing more harm than good to the agricultural labourer, and that, under such conditions as the commissioners were prescribing, they constituted a serious evil. With characteristic intrepidity he opposed the annual inclosure bill (which had come to be considered a mere form) and moved for a committee on the whole subject. The ultimate result was the passing, seven years later, of the Commons Act 1876. This measure, introduced by a Conservative government, laid down the principle that an inclosure should not be allowed unless distinctly shown to be for the benefit, not merely of private persons, but of the neighbourhood generally and the public. It imposed many checks upon the process, and following the course already adopted in the case of metropolitan commons, offered an alternative method of making commons more useful to the nation, viz. their management and regulation as open spaces. The effect of this legislation and of the changed attitude of the House of Commons towards inclosure has been almost to stop that process, except in the case of common fields or extensive mountain wastes.

Regulation.

We have alluded to the regulation of commons as open spaces. The primary object of this process is to bring a common under the jurisdiction of some constituted authority, which may make by-laws, enforceable in a summary way before the magistrates of the district, for its protection, and may appoint watchers or keepers to preserve order and prevent wanton mischief. There are several means of attaining this object. Commons within the metropolitan police district—the Greater London of the registrar-general—are in this respect in a position by themselves. Under the Metropolitan Commons Acts, schemes for their local management may be made by the Board of Agriculture (in which the inclosure commission is now merged) without the consent either of the owner of the soil or the commoners—who, however, are entitled to compensation if they can show that they are injuriously affected. Outside the metropolitan police district a provisional order for regulation may be made under the Commons Act 1876, with the consent of the owner of the soil and of persons representing two-thirds in value of all the interests in the common. And under an act passed in 1899 the council of any urban or rural district may, with the approval of the Board of Agriculture and without recourse to parliament, make a scheme for the management of any common within its district, provided no notice of dissent is served on the board by the lord of the manor or by persons representing one-third in value of such interests in the common as are affected by the scheme. There is yet another way of protecting a common. A parish council may, by agreement, acquire an interest in it, and may make by-laws for its regulation under the Local Government Act 1894. The acts of 1894 and 1899 undoubtedly proceed on right lines. For, with the growth of efficient local government, commons naturally fall to be protected and improved by the authority of the district.

Statistics.

It remains to say a word as to the extent of common land still remaining open in England and Wales. In 1843 it was estimated that there were still 10,000,000 acres of common land and common-field land. In 1874 another return made by the inclosure commission made a guess of 2,632,772. These two returns were made from the same materials, viz. the tithe commutation awards. As less than 700,000 acres had been inclosed in the intervening period, it is obvious that the two estimates are mutually destructive. In July 1875 another version was given in the Return of Landowners (generally known as the Modern Domesday Book), compiled from the valuation lists made for the purposes of rating. This return put the commons of the country (not including common fields) at 1,542,648 acres. It is impossible to view any of these returns as accurate. Those compiled from the tithe commutation awards are based largely on estimates, since there are many parishes where the tithes had not been commuted. On the other hand, the valuation lists do not show waste and unoccupied land (which is not rated), and consequently the information as to such lands in the Return of Landowners was based on any materials which might happen to be at the disposal of the clerk of the guardians. All we can say, therefore, is that the acreage of the remaining common land of the country is probably somewhere between 1,500,000 and 2,000,000 acres. It is most capriciously distributed. In the Midlands there is very little to be found, while in a county of poor soil, like Surrey, nearly every parish has its common, and there are large tracts of heath and moor. In 1866, returns were made to parliament by the overseers of the poor of the commons within 15 and within 25 m. of Charing Cross. The acreage within the larger area was put at 38,450 acres, and within the smaller at 13,301; but owing to the difference of opinion which sometimes prevails upon the question, whether land is common or not, and the carelessness of some parish authorities as to the accuracy of their returns, even these

figures cannot be taken as more than approximately correct. The metropolitan police district, within which the Metropolitan Commons Acts are in force, approaches in extent to a circle of 15 miles' radius. Within this district nearly 12,000 acres of common land have been put under local management, either by means of the Commons Acts or under special legislation. London is fortunate in having secured so much recreation ground on its borders. But when the enormous population of the capital and its rapid growth and expansion are considered, the conclusion is inevitable, that not one acre of common land within an easy railway journey of the metropolis can be spared.

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(R. H.*)

1 For the commons (*communitates*) in a socio-political sense see REPRESENTATION and PARLIAMENT.

2 There is an entry on the court rolls of the manor of Wimbledon of the division amongst the inhabitants of the vill of the crab-apples growing on the common.

COMMONWEALTH, a term generally synonymous with commonweal, *i.e.* public welfare, but more particularly signifying a form of government in which the general public have a direct voice. "The Commonwealth" is used in a special sense to denote the period in English history between the execution of Charles I. in 1649 and the Restoration in 1660. Commonwealth is also the official designation in America of the states of Massachusetts, Pennsylvania, Virginia and Kentucky. The Commonwealth of Australia is the title of the federation of Australian colonies carried out in 1900.

COMMUNE (Med. Lat. *communia*, Lat. *communis*, common), in its most general sense, a group of persons acting together for purposes of self-government, especially in towns. (See BOROUGH, and COMMUNE, MEDIEVAL, below.) "Commune" (Fr. *commune*, Ital. *comune*, Ger. *Gemeinde*, &c.) is now the term generally applied to the smallest administrative division in many European countries. (See the sections dealing with the administration of these countries under their several headings.) "The Commune" is the name given to the period of the history of Paris from March 18 to May 28, 1871, during which the commune of Paris attempted to set up its authority against the National Assembly at Versailles. It was a political movement, intended to replace the centralized national organization by one based on a federation of communes. Hence the "communists" were also called "federalists." It had nothing to do with the social theories of Communism (*q.v.*). (See FRANCE: *History*.)

COMMUNE, MEDIEVAL. Under this head it is proposed to give a short account of the rise and development of towns in central and western continental Europe since the downfall of the Roman Empire. All these, including also the British towns (for which, however, see BOROUGH), may be said to have formed one unity, inasmuch as all arose under similar

conditions, economic, legal and political, irrespective of local peculiarities. Kindred economic conditions prevailed in all the former provinces of the Western empire, while new law concepts were everywhere introduced by the Germanic invaders. It is largely for the latter reason that it seems advisable to begin with an account of the German towns, the term German to correspond to the limits of the old kingdom of Germany, comprising the present empire, German Austria, German Switzerland, Holland and a large portion of Belgium. In their development the problem, as it were, worked out least tainted by foreign interference, showing at the same time a rich variety in detail; and it may also be said that their constitutional and economic history has been more thoroughly investigated than any other.

Like the others, the German towns should be considered from three points of view, viz. as jurisdictional units, as self-administrative units and as economic units. One of the chief distinguishing features of early as opposed to modern town-life is that each town formed a jurisdictional district distinct from the country around. Another trait, more in accordance with the conditions of to-day, is that local self-government was more fully developed and strongly marked in the towns than without. And, thirdly, each town in economic matters followed a policy as independent as possible of that of any other town or of the country in general. The problem is, how this state of things arose.

From this point of view the German towns may be divided into two main classes: those that gradually resuscitated on the ruins of former Roman cities in the Rhine and Danube countries, and those that were newly founded at a later date in the interior.[1] Foremost in 785
importance among the former stand the episcopal cities. Most of these had never been entirely destroyed during the Germanic invasion. Roman civic institutions perished; but probably parts of the population survived, and small Christian congregations with their bishops in most cases seem to have weathered all storms. Much of the city walls presumably remained standing, and within them German communities soon settled.

In the 10th century it became the policy of the German emperors to hand over to the bishops full jurisdictional and administrative powers within their cities. The bishop henceforward directly or indirectly appointed all officers for the town's government. The chief of these was usually the *advocatus* or *Vogt*, some neighbouring noble who served as the proctor of the church in all secular affairs. It was his business to preside three times a year over the chief law-court, the so-called *echte* or *ungebotene Ding*, under the cognizance of which fell all cases relating to real property, personal freedom, bloodshed and robbery. For the rest of the legal business and as president of the ordinary court he appointed a *Schultheiss*, *centenarius* or *causidicus*. Other officers were the *Burggraf*[2] or *praefectus* for military matters, including the preservation of the town's defences, walls, moat, bridges and streets, to whom also appertained some jurisdiction over the craft-gilds in matters relating to their crafts; further the customs-officer or *teleonarius* and the mint-master or *monetae magister*. It was not, however, the fact of their being placed under the bishop that constituted these towns as separate jurisdictional units. The chief feature rather is the existence within their walls of a special law, distinct in important points from that of the country at large. The towns enjoyed a special peace, as it was called, *i.e.* breaches of the peace were more severely punished if committed in a town than elsewhere. Besides, the inhabitants might be sued before the town court only, and to fugitives from the country who had taken refuge in the town belonged a similar privilege. This special legal status probably arose from the towns being considered in the first place as the king's fortresses[3] or burgs (see Borough), and, therefore, as participating in the special peace enjoyed by the king's palace. Hence the terms "burgh," "borough" in English, *baurgs* in Gothic, the earliest Germanic designations for a town; "burgher," "burgess" for its inhabitants. What struck the townless early Germans most about the Roman towns was their mighty walls. Hence they applied to all fortified habitations the term in use for their own primitive fortifications; the walls remained with them the main feature distinguishing a town from a village; and the fact of the town being a fortified place, likewise necessitated the special provisions mentioned for maintaining the peace.

The new towns in the interior of Germany were founded on land belonging to the founder, some ecclesiastical or lay lord, and frequently adjoining the cathedral close of one of the new sees or the lord's castle, and they were laid out according to a regular plan. The most important feature was the market-square, often surrounded by arcades with stalls for the sale of the principal commodities, and with a number of straight streets leading thence to the city gates.[4] As for the fortifications, some time naturally passed before they were completed. Furthermore, the governmental machinery would be less complex than in the older towns. The legal peculiarities distinguishing town and country, on the other hand, may be said to have been conferred on the new towns in a more clearly defined form from the

beginning.

An important difference lay in the mode of settlement. There is evidence that in the quondam Roman towns the German newcomers settled much as in a village, *i.e.* each full member of the community had a certain portion of arable land allotted to him and a share in the common. Their pursuits would at first be mainly agricultural. The new towns, on the other hand, general economic conditions having meanwhile begun to undergo a marked change, were founded with the intention of establishing centres of trade. Periodical markets, weekly or annual, had preceded them, which already enjoyed the special protection of the king's ban, acts of violence against traders visiting them or on their way towards them being subject to special punishment. The new towns may be regarded as markets made permanent. The settlers invited were merchants (*mercatores personati*) and handicraftsmen. The land now allotted to each member of the community was just large enough for a house and yard, stabling and perhaps a small garden (50 by 100 ft. at Freiburg, 60 by 100 ft. at Bern). These building plots were given as free property or, more frequently, at a merely nominal rent (*Wurtzins*) with the right of free disposal, the only obligation being that of building a house. All that might be required besides would be a common for the pasture of the burgesses' cattle.

The example thus set was readily followed in the older towns. The necessary land was placed at the disposal of new settlers, either by the members of the older agricultural community, or by the various churches. The immigrants were of widely differing status, many being serfs who came either with or without their lords' permission. The necessity of putting a stop to belated prosecutions on this account in the town court led to the acceptance of the rule that nobody who had lived in a town undisturbed for the term of a year and a day could any longer be claimed by a lord as his serf. But even those who had migrated into a town with their lords' consent could not very well for long continue in serfdom. When, on the other hand, certain bishops attempted to treat all new-comers to their city as serfs, the emperor Henry V. in charters for Spires and Worms proclaimed that in these towns all serf-like conditions should cease. This ruling found expression in the famous saying: *Stadtluft macht frei*, "town-air renders free." As may be imagined, this led to a rapid increase in population, mainly during the 11th to 13th centuries. There would be no difficulty for the immigrants to find a dwelling, or to make a living, since most of them would be versed in one or other of the crafts in practice among villagers.

The most important further step in the history of the towns was the establishment of an organ of self-government, the town-council (*Rat*, *consilium*, its members, *Ratmänner*, *consules*, less frequently *consiliarii*), with one, two or more burgomasters (*Bürgermeister*, *magistri civium*, *proconsules*) at its head. (It was only after the Renaissance that the town-council came to be styled *senate*, and the burgomasters in Latin documents, *consules*.) As *units of local government* the towns must be considered as originally placed on the same legal basis as the villages, viz. as having the right of taking care of all common interests below the cognizance of the public courts or of those of their lord.[5] In the towns, however, this right was strengthened at an early date by the *jus negotiale*. At least as early as the beginning of the 11th century, but probably long before that date, mercantile communities claimed the right, confirmed by the emperors, of settling mercantile disputes according to a law of their own, to the horror of certain conservative-minded clerics.[6] Furthermore, in the rapidly developing towns, opportunities for the exercise of self-administrative functions constantly increased. The new self-governing body soon began to legislate in matters of local government, imposing fines for the breach of its by-laws. Thus it assumed a jurisdiction, partly concurrent with that of the lord, which it further extended to breaches of the peace. And, finally, it raised funds by means of an excise-duty, *Ungeld* (cf. the English *malatolta*) or *Accise*, *Zeise*. In the older and larger towns it soon went beyond what the bishops thought proper to tolerate; conflicts ensued; and in the 13th century several bishops obtained decrees in the imperial court, either to suppress the *Rat* altogether, or to make it subject to their nomination, and more particularly to abolish the *Ungeld*, as detrimental to episcopal finances. In the long run, however, these attempts proved of little avail.

Meanwhile the tendency towards self-government spread even to the lower ranks of town society, resulting in the establishment of craft-gilds. From a very early period there is reason to believe merchants among themselves formed gilds for social and religious purposes, and for the furtherance of their economic interests. These gilds would, where they existed, no doubt also influence the management of town affairs; but nowhere has the *Rat*, as used to be thought, developed out of a gild, nor has the latter anywhere in Germany played a part at all similar in importance to that of the English gild merchant, the only exception being for a time the *Richerzeche*, or Gild of the Rich of Cologne, from early times by far the largest, the

richest, and the most important trading centre among German cities, and therefore provided with an administration more complex, and in some respects more primitive, than any other. On the other hand, the most important commodities offered for sale in the market had been subject to official examination already in Carolingian times. Bakers', butchers', shoemakers' stalls were grouped together in the market-place to facilitate control, and with the same object in view a master was appointed for each craft as its responsible representative. By and by these crafts or "offices" claimed the right of electing their master and of assisting him in examining the goods, and even of framing by-laws regulating the quality of the wares and the process of their manufacture. The bishops at first resented these attempts at self-management, as they had done in the case of the town council, and imperial legislation in their interests was obtained. But each craft at the same time formed a society for social, beneficial and religious purposes, and, as these were entirely in accordance with the wishes of the clerical authorities, the other powers could not in the long run be withheld, including that of forcing all followers of any craft to join the gild (*Zunftzwang*). Thus the official inspection of markets, community of interests on the part of the craftsmen, and co-operation for social and religious ends, worked together in the formation of craft-gilds. It is not suggested that in each individual town the rise of the gilds was preceded by an organization of crafts on the part of the lord and his officers; but it is maintained that as a general thing voluntary organization could hardly have proceeded on such orderly lines as on the whole it did, unless the framework had in the first instance been laid down by the authorities: much as in modern times the working together in factories has practically been an indispensable preliminary to the formation of trade unions. Much less would the principle of forced entrance have found such ready acceptance both on the part of the authorities and on that of the men, unless it had previously been in full practice and recognition under the system of official market-control. The different names for the societies, viz. *fraternitas*, *Brüderschaft*, *officium*, *Amt*, *condictum*, *Zunft*, *unio*, *Innung*, do not signify different kinds of societies, but only different aspects of the same thing. The word *Gilde* alone forms an exception, inasmuch as, generally speaking, it was used by merchant gilds only.[7]

From an early date the towns, more particularly the older episcopal cities, took a part in imperial politics. Legally the bishops were in their cities mere representatives of the imperial government. This fact found formal expression mainly in two ways. The *Vogt*, although appointed by the bishop, received the "ban," *i.e.* the power of having justice executed, which he passed on to the lesser officers, from the king or emperor direct. Secondly, whenever the emperor held a *curia generalis* (or general assembly, or diet) in one of the episcopal cities, and for a week before and after, all jurisdictional and administrative power reverted to him and his immediate officers. The citizens on their part clung to this connexion and made use of it whenever their independence was threatened by their bishops, who strongly inclined to consider themselves lords of their cathedral cities, much as if these had been built on church-lands. As early as 1073, therefore, we find the citizens of Worms successfully rising against their bishop in order to provide the emperor Henry IV. with a refuge against the rebellious princes. Those of Cologne made a similar attempt in 1074. But a second class of imperial cities (*Reichsstädte*), much more numerous than the former, consisted of those founded on demesne-land belonging either to the Empire or to one of the families who rose to imperial rank. This class was largely reinforced, when after the extinction of the royal house of Hohenstaufen in the 13th century, a great number of towns founded by them on their demesne successfully claimed immediate subjection to the crown. About this time, during the interregnum, a federation of more than a hundred towns was formed, beginning on the Rhine, but spreading as far as Bremen in the north, Zürich in the south, and Regensburg in the east, with the object of helping to preserve the peace. After the death of King William in 1256, they resolved to recognize no king unless unanimously elected. This league was joined by a powerful group of princes and nobles and found recognition by the prince-electors of the Empire; but for want of leadership it did not stand the test, when Richard of Cornwall and Alphonso of Castile were elected rival kings in 1257.[8] In the following centuries the imperial cities in south Germany, where most of them were situated, repeatedly formed leagues to protect their interests against the power of the princes and the nobles, and destructive wars were waged; but no great political issue found solution, the relative position of the parties after each war remaining much what it had been before. On the part of the towns this was mainly due to lack of leadership and of unity of purpose. At the time of the Reformation the imperial towns, like most of the others, stood forward as champions of the new cause and did valuable service in upholding and defending it. After that, however, their political part was played out, mainly because they proved unable to keep up with modern conditions of warfare. It should be stated that seven among the episcopal cities, viz. Cologne, Mainz, Worms, Spires, Strassburg, Basel and Regensburg, claimed a privileged position as "Free Cities," but neither is the ground for this claim clearly

established, nor its nature well defined. The general obligations of the imperial cities towards the Empire were the payment of an annual fixed tax and the furnishing of a number of armed men for imperial wars, and from these the above-named towns claimed some measure of exemption. Some of the imperial cities lost their independence at an early date, as unredeemed pledges to some prince who had advanced money to the emperor. Others seceded as members of the Swiss Confederation. But a considerable number survived until the reorganization of the Empire in 1803. At the peace in 1815, however, only four were spared, namely, Frankfort, Bremen, Hamburg and Lübeck, these being practically the only ones still in a sufficiently flourishing and economically independent position to warrant such preferential treatment. But finally Frankfort, having chosen the wrong side in the war of 1866, was annexed by Prussia, and only the three seaboard towns remain as full members of the new confederate Empire under the style of *Freie und Hansestädte*. But until modern times most of the larger *Landstädte* or mesne-towns for all intents and purposes were as independent under their lords as the imperial cities were under the emperor. They even followed a foreign policy of their own, concluded treaties with foreign powers or made war upon them. Nearly all the *Hanseatic towns* belonged to this category. With others like Bremen, Hamburg and Magdeburg, it was long in the balance which class they belonged to. All towns of any importance, however, were for a considerable time far ahead of the principalities in administration. It was largely this fact that gave them power. When, 787
therefore, from about the 15th century the princely territories came to be better organized, much of the *raison d'être* for the exceptional position held by the towns disappeared. The towns from an early date made it their policy to suppress the exercise of all handicrafts in the open country. On the other hand, they sought an increase of power by extending rights of citizenship to numerous individual inhabitants of the neighbouring villages (*Pfalbürger*, a term not satisfactorily explained). By this and other means, *e.g.* the purchase of estates by citizens, many towns gradually acquired a considerable territory. These tendencies both princes and lesser nobles naturally tried to thwart, and the mediate towns or *Landstädte* were finally brought to stricter subjection, at least in the greater principalities such as Austria and Brandenburg. Besides, the less favourably situated towns suffered through the concentration of trade in the hands of their more fortunate sisters. But the economic decay and consequent loss of political influence among both imperial and territorial towns must be chiefly ascribed to inner causes.

Certain leading political economists, notably K. Bücher (*Die Bevölkerung von Frankfurt a. M. im 14ten und 15ten Jahrhundert*, i., Tübingen, 1886; *Die Entstehung der Volkswirtschaft*, 5th ed., Tübingen, 1906), and, in a modified form, W. Sombart (*Der moderne Kapitalismus*, 2 vols., Leipzig, 1902), have propounded the doctrine of one gradual progression from an agricultural state to modern capitalistic conditions. This theory, however, is nothing less than an outrage on history. As a matter of fact, as far as modern Europe is concerned, there has twice been a progression, separated by a period of retrogression, and it is to the latter that Bücher's picture of the agricultural and strictly protectionist town (the *geschlossene Stadtwirtschaft*) of the 14th and 15th centuries belongs, while Sombart's notion of an entire absence of a spirit of capitalistic enterprise before the middle of the 15th century in Europe north of the Alps, or the 14th century in Italy, is absolutely fantastic.[9] The period of the rise of cities till well on in the 13th century was naturally a period of expansion and of a considerable amount of freedom of trade. It was only afterwards that a protectionist spirit gained the upper hand, and each town made it its policy to restrict as far as possible the trade of strangers. In this revolution the rise of the lower strata of the population to power played an important part.

The craft-gilds had remained subordinate to the *Rat*, but by-and-by they claimed a share in the government of the towns. Originally any inhabitant holding a certain measure of land, freehold or subject to the mere nominal ground-rent above-mentioned, was a full citizen independently of his calling, the clergy and the lord's retainers and servants of whatever rank, who claimed exemption from scot and lot, to use the English formula, alone excepted. The majority of the artisans, however, were not in this happy position. Moreover, the town council, instead of being freely elected, filled up vacancies in its ranks by co-optation, with the result that all power became vested in a limited number of rich families. Against this state of things the crafts rebelled, alleging mismanagement, malversation and the withholding of justice. During the 14th and 15th centuries revolutions and counter-revolutions, sometimes accompanied by considerable slaughter, were frequent, and a great variety of more democratic constitutions were tried. Zürich, however, is the only German place where a kind of *tyrannis*, so frequent in Italy, came to be for a while established. On the whole it must be said that in those towns where the democratic party gained the upper hand an unruly policy abroad and a narrow-minded protection at home resulted. An

inclination to hasty measures of war and an unwillingness to observe treaties among the democratic towns of Swabia were largely responsible for the disasters of the war of the Swabian League in the 14th century. At home, whereas at first markets had been free and open to any comer, a more and more protective policy set in, traders from other towns being subjected more and more to vexatious restrictions. It was also made increasingly difficult to obtain membership in the craft-gilds, high admission fees and so-called masterpieces being made a condition. Finally, the number of members became fixed, and none but members' sons and sons-in-law, or members' widows' husbands were received. The first result was the formation of a numerous proletariate of life-long assistants and of men and women forcibly excluded from following any honest trade; and the second consequence, the economic ruin of the town to the exclusive advantage of a limited number. From the end of the 15th century population in many towns decreased, and not only most of the smaller ones, but even some once important centres of trade, sank to the level almost of villages. Those cities, on the other hand, where the mercantile community remained in power, like Nuremberg and the seaboard towns, on the whole followed a more enlightened policy, although even they could not quite keep clear of the ever-growing protective tendencies of the time. Many even of the richer towns, notably Nuremberg, ran into debt irretrievably, owing partly to an exorbitant expenditure on magnificent public buildings and extensive fortifications, calculated to resist modern instruments of destruction, partly to a faulty administration of the public debt. From the 13th century the towns had issued ("sold," as it was called) annuities, either for life or for perpetuity in ever-increasing number, until it was at last found impossible to raise the funds necessary to pay them.

One of the principal achievements of the towns lay in the field of *legislation*. Their law was founded originally on the general national (or provincial) law, on custom, and on special privilege. New foundations were regularly provided by their lord with a charter embodying the most important points of the special law of the town in question. This miniature code would thenceforth be developed by means of statutes passed by the town council. The codification of the law of Augsburg in 1276 already fills a moderate volume in print (ed. by Christian Meyer, Augsburg, 1872). Later foundations were frequently referred by their founders to the nearest existing town of importance, though that might belong to a different lord. Afterwards, if a question in law arose which the court of a younger town found itself unable to answer, the court next senior in affiliation was referred to, which in turn would apply to the court above, until at last that of the original mother town was reached, whose decision was final. This system was chiefly developed in the colonial east, where most towns were affiliated directly or indirectly either to Lübeck or to Magdeburg; but it was by no means unknown in the home country. A number of collections of such judgments (*Schöffensprüche*) have been published. It is also worth mentioning that it was usual to read the police by-laws of a town at regular intervals to the assembled citizens in a morning-speech (*Morgenspraehe*).[10]

To turn to *Italy*, the country for so many centuries in close political connexion with Germany, the foremost thing to be noted is that here the towns grew to even greater independence, many of them in the end acknowledging no overlord whatever after the yoke of the German kings had been shaken off. On the other hand, nearly all of them in the long run fell under the sway of some local tyrant-dynasty.

From Roman times the country had remained thickly studded with towns, each being the seat of a bishop. From this arose their most important peculiarity. For it was largely due to an identification of dioceses and municipal territories that the nobles of the surrounding country took up their headquarters in the cities, either voluntarily or because forced to do so by the citizens, who made it their policy thus to turn possible opponents into partisans and defenders. In Germany, on the other hand, nobles and knights were carefully shut out so long as the town's independence was at stake, the members of a princely garrison being required to take up their abode in the citadel, separated from the town proper by a wall. Only in the comparatively few cathedral cities this rule does not obtain. It will be seen that, in consequence of this, municipal life in Italy was from the first more complex, the main constituent parts of the population being the *capitani*, or greater nobles, the *valvassori*, or lesser nobles (knights) and the people (*popolo*). Furthermore, the bishops being in most cases the exponents of the imperial power, the struggle for freedom from the latter ended in a radical riddance from all temporal episcopal government as well. Foremost in this struggle stood the cities of Lombardy, most of which all through the barbarian invasions had kept their walls in repair and maintained some importance as economic centres, and whose *popolo* largely consisted of merchants of some standing. As early as the 8th century the laws of the Langobard King Aistulf distinguished three classes of merchants (*negotiantes*), among whom the *majores et potentes* were required to keep themselves provided with horse, lance,

shield and a cuirass. The valley of the Po formed the main artery of trade between western Europe and the East, Milan being besides the point of convergence for all Alpine passes west of the Brenner (the St Gotthard, however, was not made accessible until early in the 13th century). Lombard merchants soon spread all over western Europe, a chief source of their ever-increasing wealth being their employment as bankers of the papal see.

The struggle against the bishops, in which a clamour for a reform of clerical life and a striving for local self-government were strangely interwoven, had raged for a couple of generations when King Henry V., great patron of municipal freedom as he was, legalized by a series of charters the *status quo* (Cremona, 1114, Mantua, 1116). But under his weak successors the independence of the cities reached such a pitch as to be manifestly intolerable to an energetic monarch like Frederick I. Besides, the more powerful among them would subdue or destroy their weaker neighbours, and two parties were formed, one headed by Milan, the other by Cremona. Como and Lodi complained of the violence used to them by the former city. Therefore in 1158 a commission was appointed embracing four Roman legists as representatives of the emperor, as well as those of fourteen towns, to examine into the imperial and municipal rights. The claims of the imperial government, jurisdictional and other, were acknowledged, only such rights of self-government being admitted as could be shown to be grounded on imperial charters. But when it came to carrying into effect these Roncaglian decrees, a general rising resulted. Milan was besieged by the emperor and destroyed in 1162 in accordance with the verdict of her rivals. Nevertheless, after a defeat at Legnano in 1176, Frederick was forced to renounce all pretensions to interference with the government of the cities, merely retaining an overlordship that was not much more than formal (peace of Constance in 1183). All through this war the towns had been supported by Pope Alexander III. Similarly under Frederick II. the renewal of the struggle between emperor and pope dovetailed with a fresh outbreak of the war with the cities, who feared lest an imperial triumph over the church would likewise threaten their independence. The emperor’s death finally decided the issue in their favour.

Constitutionally, municipal freedom was based on the formation of a commune headed by elected consuls, usually to the number of twelve, representing the three orders of *capitani*, *valvassori* and *popolo*. Frequently, however, the number actually wielding power was much more restricted, and their position altogether may rather be likened to that of their Roman predecessors than to that of their German contemporaries. In all important matters they asked the advice and support of “wise men,” *sapientes, discretiores, prudentes*, as a body called the *credenza*, while the popular assembly (*parlamentum, concio, consilium generale*) was the true sovereign. The consuls with the assistance of *judices* also presided in the law-courts; but besides the consuls of the commune there were *consules de placitis* specially appointed for jurisdictional purposes.

In spite of these multifarious safeguards, however, family factions early destroyed the fabric of liberty, especially as, just as there was an imperial, or Ghibelline, and a papal, or Guelph party among the cities as a whole, thus also within each town each faction would allege adherence to and claim support by one or other of the great world-powers. To get out of the dilemma of party-government, resort was thereupon had to the appointment as chief magistrate of a *podestà* from among the nobles or knights of a different part of the country not mixed up with the local feuds. But the end was in most cases the establishment of the despotism of some leading family, such as the Visconti at Milan, the Gonzaga at Mantua, the della Scala in Verona and the Carrara in Padua.

In Tuscany, the historic rôle of the cities, with the exception of Pisa, begins at a later date, largely owing to the overlordship of the powerful margraves of the house of Canossa and their successors, who here represented the emperor. Pisa, however, together with Genoa, all through the 11th century distinguished itself by war waged in the western Mediterranean and its isles against the Saracens. Both cities, along with Venice, but especially the Genoese, also did excellent service in reducing the Syrian coast towns still in the hands of the Turks in the reigns of Kings Baldwin I. and Baldwin II. of Jerusalem, while more particularly Pisa with great constancy placed her fleet at the disposal of the Hohenstaufen emperors for warfare with Sicily.

Meanwhile communes with consuls at their head were formed in Tuscany much as elsewhere. On the other hand the Tuscan cities managed to prolong the reign of liberty to a much later epoch, no *podestà* ever quite succeeding here in his attempts to establish the rule of his dynasty. Even when in the second half of the 15th century the Medici in Florence attained to power, the form at least of a republic was still maintained, and not till 1531 did one of them, supported by Charles V., assume the ducal title.

Long before the last stage, the rule of *signori*, was reached, however, the commune as originally constituted had everywhere undergone radical changes. As early as the 13th century the lower orders among the inhabitants formed an organization under officers of their own, side by side with that of the commune, which was controlled by the great and the rich; *e.g.* at Florence the people in 1250 rose against the turbulent nobles and chose a *capitano del popolo* with twelve *anziani*, two from each of the six city-wards (*sestieri*), as his council. The *popolo* itself was divided into twenty armed companies, each under a *gonfaloniere*. But later the *arti* (craft-gilds), some of whom, however, can be shown to have existed under consuls of their own as early as 1203, attained supreme importance, and in 1282 the government was placed in the hands of their *priori*, under the name of the *signoria*. The Guelph nobles were at first admitted to a share in the government, on condition of their entering a gild, but in 1293 even this privilege was withdrawn. The *ordinamenti della giustizia* of that year robbed the nobility of all political power. The lesser or lower *arti*, on the other hand, were conceded a full share in it, and a *gonfaloniere della giustizia* was placed at the head of the militia. In the 14th century twelve *buoni uomini* representing the wards (*sestieri*) were superadded, all these dignitaries holding office for two months only. And besides all these, there existed three competing chief justices and commanders of the forces called in from abroad and holding office for six months, viz. the *podestà*, the *capitano del popolo*, and the *esecutore della giustizia*. In spite of all this complicated machinery of checks and balances, revolution followed upon revolution, nor could an occasional reign of terror be prevented like that of the Signore Gauthier de Brienne, duke of Athens (1342-1343). It was not till after a rising of the lowest order of all, the industrial labourers, had been suppressed in 1378 (*tumulto dei Ciompi*, the wool-combers), that quieter times ensued under the wise leadership, first of the Albizzi and finally of the Medici.

The history of the other Tuscan towns was equally tumultuous, all of them save Lucca, after many fitful changes finally passing under the sway of Florence, or the grand-duchy of Tuscany, as the state was now called. Pisa, one time the mightiest, had been crushed between its inland neighbour and its maritime rival Genoa (battle of Meloria, 1282).

Apart in its constitutional development from all other towns in Italy, and it might be added, in Europe, stands Venice. Almost alone among Italian cities its origin does not go back to Roman times. It was not till the invasions of Hun and Langobard that fugitives from the Venetian mainland took refuge among the poor fishermen on the small islands in the lagoons and on the *lido*—the narrow stretch of coast-line which separates the lagoons from the Adriatic—some at Grado, some at Malamocco, others on Rialto. A number of small communities was formed under elected tribunes, acknowledging as their sovereign the emperor at Constantinople. Treaties of commerce were concluded with the Langobard kings, thus assuring a market for the sale of imports from the East and for the purchase of agricultural produce. Just before or after A.D. 700 the young republic seems to have thrown off the rule of the Byzantine *dux Histriae et Venetiae* and elected a duke (*doge*) of its own, in whom was vested the executive power, the right to convoke the popular assembly (*concio*) and appoint tribunes and justices. Political unity was thus established, but it was not till after another century of civil war that Rialto was definitely chosen the seat of government and thus the foundation of the present city laid. After a number of attempts to establish a hereditary dukedom, Duke Domenico Flabianico in 1032 passed a law providing that no duke was to appoint his successor or procure him to be elected during his own lifetime. Besides this two councils were appointed without whose consent nothing of importance was to be done. After the murder by the people of Duke Vitale Michiel in 1172, who had suffered naval defeat, it was deemed necessary to introduce a stricter constitutional order. According to the orthodox account, some details of which have, however, recently been impugned,[11] the irregular popular meeting was replaced by a great council of from 450 to 480 members elected annually by special appointed electors in equal proportion from each of the six wards. One of the functions of this body was to appoint most of the state officials or their electors. There was also an executive council of six, one from each ward. Besides these, the duke, who was henceforward elected by a body of eleven electors from among the aristocracy, would invite persons of prominence (the *pregadi*) in order to secure their assent and co-operation, whenever a measure of importance was to be placed before the great council. Only under extraordinary circumstances the *concio* was still to be called. The tenure of the duke’s office was for life. The general tendency of constitutional development in Venice henceforward ran in an exactly opposite direction to that of all other Italian cities towards a growing restriction of popular rights, until in 1296 the great council was for all future time closed to all but the descendants of a limited number of noble families, whose names were in that year entered in the Golden Book. It still remained to appoint a board to superintend the executive power. These were the *avvogadori di commune*, and, since

Tiepolo's conspiracy in 1310, the *Consiglio dei Dieci*, the Council of Ten, which controlled the whole of the state, and out of which there developed in the 16th century the state inquisition.

While in all prominent Italian cities the leading classes of the community were largely made up of merchants, in Venice the nobility was entirely commercial. The marked steadiness in the evolution of the Venetian constitution is no doubt largely due to this fact. Elsewhere the presence of large numbers of turbulent country nobles furnished the first germ for the unending dissensions which ruined such promising beginnings. In Venice, on the contrary, its businesslike habits of mind led the ruling class to make what concessions might seem needful, while both the masses and the head of the state were kept in due subjection to the laws. Too much stability, however, finally changed into stagnation, and decay followed. The foreign policy of Venice was likewise mainly dictated by commercial motives, the chief objectives being commercial privilege in the Byzantine empire and in the Frankish states in the East, domination of the Adriatic, occupation of a sufficient hinterland on the *terra firma*, non-sufferance of the rivalry of Genoa, and, finally, maintenance of trade-supremacy in the eastern Mediterranean through a series of alternating wars and treaties with Turkey, the lasting monument of which was the destruction of the Parthenon in 1685 by a Venetian bomb. At last the proud republic surrendered to Napoleon without a stroke.

The cities of southern Italy do not here call for special attention. Several of them developed a certain amount of independence and free institutions, and took an important part in trade with the East, notably so Amalfi. But after incorporation in the Norman kingdom all individual history for them came to an end.

Rome, finally, derived its importance from being the capital of the popes and from its proud past. From time to time spasmodic attempts were made to revive the forms of the ancient republic, as under Arnold of Brescia in the 12th and by Niccolò di Rienzo in the 14th century; but there was no body of stalwart, self-reliant citizens to support such measures: nothing but turbulent nobles on the one hand and a rabble on the other.

In no country is there such a clear grouping of the towns on geographical lines as in *France*, these geographical lines, of course, having in the first instance been drawn by historical causes. Another feature is the extent to which, in the unruly times preceding the civic movement, serfdom had spread among the inhabitants even of the towns throughout the greater part of the country, and the application of feudal ideas to town government. In some other respects the constitution of the cities in the south of France, as will be seen, has more in common with that of the Italian communes, and that of the northern French towns with those of Germany, than the constitutions of the various groups of French towns have among each other.

In the group of the *villes consulaires*, comprising all important towns in the south, the executive was, as in Italy, in the hands of a body of *consules*, whose number in most cases rose to twelve. They were elected for the term of one year and re-eligible only after an interval, and they were supported by a municipal council (*commune consilium, consilium magnum* or *secretum* or *generale*, or *colloquium*) and a general assembly (*parlamentum, concio, commune consilium, commune, universitas civium*), which, however, as a rule was far from comprising the whole body of citizens. Another feature which these southern towns had in common with their Italian neighbours was the prominent part played by the native nobility. The relations with the clergy were generally of a more friendly character than in the north, and in some cases the bishop or archbishop even retained a considerable influence in the management of the town's affairs. Dissensions among the citizens, or between the nobles and the bourgeois, frequently ended in the adoption of a *podestat*. And in several cities of the Languedoc, each of the two classes composing the population retained its separate laws and customs. It is matter of dispute whether vestiges of Roman institutions had survived in these parts down to the time when the new constitutions sprang into being; but all investigators are pretty well agreed that in no case did such remnants prove of any practical importance. Roman law, however, was never quite superseded by Germanic law, as appears from the *statuts municipaux*. In the improvement and expansion of these statutes a remarkable activity was displayed by means of an annual *correctio statutorum* carried out by specially appointed *statutores*. In the north, on the other hand, the *carta communiae*, forming as it were the basis of the commune's existence, seems to have been considered almost as something sacred and unchangeable.

The constitutional history of the communes in northern France in a number of points widely differed from that of these *villes consulaires*. First of all the movement for their establishment in most cases was to a far greater degree of a revolutionary character. These

revolutions were in the first place directed against the bishops; but the position both of the higher clergy and of the nobility was here of a nature distinctly more hostile to the aspirations of the citizens than it was in the south. As a result the clergy and the nobles were excluded from all membership of the commune, except inasmuch as that those residing in the town might be required to swear not to conspire against it. The commune (*communia, communa, communio, communitas, conjuratio, confoederatio*) was formed by an oath of mutual help (*sacramentum, juramentum communiae*). The members were described as *jurati* (also *burgenses, vicini, amici*), although in some communes that term was reserved for the members of the governing body. None but men of free and legitimate birth, and free from debt and contagious or incurable disease were received. The members of the governing body were styled *jurés* (*jurati*), *pairs* (*pares*) or *échevins* (*scabini*). The last was, however, as in Germany, more properly the title of the jurors in the court of justice, which in many cases remained in the hands of the lord. In some cases the town council developed out of this body; but in the larger cities, like Rouen, several councils worked and all these names were employed side by side. The number of the members of the governing body proper varies from twelve to a hundred, and its functions were both judicial and administrative. There was also known an arrangement corresponding to the German *alte und sitzende Rat*, viz. of retired members who could be called in to lend assistance on important occasions. The most striking distinction, however, as against the *villes consulaires* was the elevation of the president of the body to the position of *maire* or *mayeur* (sometimes also called *prévôt*, *praepositus*). As elsewhere, at first none but the civic aristocracy were admitted to take part in the management of the town's affairs; but from the end of the 13th century a share had to be conceded to representatives of the crafts. Dissatisfaction, however, was not easily allayed; the lower orders applied for the intervention of the king; and that effectively put an end to political freedom. This tendency of calling in state help marks a most striking difference as against the policy followed by the German towns, where all classes appear to have been always far too jealous of local independence. The result for the nation was in the one case despotism, equality and order, in the other individual liberty and an inability to move as a whole. At an earlier stage the king had frequently come to the assistance of the communes in their struggle with their lords. By-and-by the king's confirmation came to be considered necessary for their lawful existence. This proved a powerful lever for the extension of the king's authority. It may seem strange that in France the towns never had recourse to those interurban leagues which played so important a part in Italian and in German history.

These two varieties, the *communes* and the *villes consulaires* together form the group of *villes libres*. As opposed to these stand the *villes franches*, also called *villes prévotales* after the chief officer, *villes de bourgeoisie* or *villes soumises*. They make up by far the majority of French towns, comprising all those situated in the centre of the kingdom, and also a large number in the north and the south. They are called *villes franches* on account of their possessing a franchise, a charter limiting the services due by the citizens to their lord, but political status they had little or none. According to the varying extent of the liberties conceded them, there may be distinguished towns governed by an elective body and more or less fully authorized to exercise jurisdiction; towns possessing some sort of municipal organization, but no rights of jurisdiction, except that of simple police; and, thirdly, those governed entirely by seignorial officers. To this last class belong some of the most important cities in France, wherever the king had power enough to withhold liberties deemed dangerous and unnecessary. On the other hand, towns of the first category often come close to the *villes libres*. A strict line of demarcation, however, remains in the mutual oath which forms the basis of the civic community in both varieties of the latter, and in the fact that the *ville libre* stands to its lord in the relation of vassal and not in that of an immediate possession. But however *complètement assujettie* Paris might be, its organization, naturally, was immensely more complex than that of hundreds of smaller places which, formally, might stand in an identical relationship to their lords. Like other *villes franches* under the king, Paris was governed by a *prévôt* (provost), but certain functions of self-government for the city were delegated to the company of the *marchands de l'eau, mercatores aquae*, also called *mercatores ansati*, that is, the gild of merchants whose business lay down the river Seine, in other words, a body naturally exclusive, not, however, to the citizens as such. At their head stood a *prévôt des marchands* and four *eschevins de la marchandise*. Other *prud'hommes* were occasionally called in, and from 1296 *prévôt* and *échevins*, appointed twenty-four councillors to form with themselves a *parloir aux bourgeois*. The crafts of Paris were organized in *métiers*, whose masters were appointed, some by the *prévôt de Paris*, and some by certain great officers of the court. In the tax rolls of A.D. 1292 to 1300 no fewer than 448 names of crafts occur, while the *Livre des métiers* written in 1268 by Étienne de Boileau, then *prévôt de Paris*, enumerates 101 organized bodies of tradesmen or women and

artisans. Among the duties of these bodies, as elsewhere, was the *guet* or night-watch, which necessitated a military organization under *quartiniers, cinquantainiers* and *dixainiers*. This gave them a certain power. But both their revolutions, under the *prévôt des marchands*, Étienne Marcel, after the battle of Maupertuis, and again in 1382, were extremely short-lived, and the only tangible result was a stricter subjection to the king and his officers.

An exceptional position among the cities of France is taken up by those of *Flanders*, more particularly the three "Great Towns," Bruges, Ghent and Ypres, whose population was Flemish, *i.e.* German. They sprang up at the foot of the count's castles and rose in close conjunction with his power. On the accession of a new house they made their power felt as early as 1128. Afterwards the counts of the house of Dampierre fell into financial dependence on the burghers, and therefore allied themselves with the rising artisans, led by the weavers. These, however, proved far more unruly, bloody conflicts ensued, and for a considerable period the three great cities ruled the whole of Flanders with a high hand. Their influence in the foreign relations of the country was likewise great, it being in their interest to keep up friendly relations with England, on whose wool the flourishing state of the staple industry of Flanders depended. It is a remarkable fact that the historical position taken up by these cities, which politically belonged to France, is much more akin to the part played by the German towns, whereas Cambrai, whose population was French, is the only city politically situated in Germany, where a commune came to be established.

In the *Spanish peninsula*, the chief importance of the numerous small towns lay in the part they played as fortresses during the unceasing wars with the Moors. The kings therefore extended special privileges (*fueros*) to the inhabitants, and they were even at an early date admitted to representation in the Cortes (parliament). Of greater individual importance than all the rest was Barcelona. Already in 1068 Count Berengarius gave the city a special law (*usatici*) based on its ancient usages, and from the 14th century its commercial code (*libro del consolat del mar*) became influential all over southern Europe.

The constitutions of the *Scandinavian* towns were largely modelled on those of Germany, but the towns never attained anything like the same independence. Their dependence on the royal government most strongly comes out in the fact of their being uniformly regulated by royal law in each of the three kingdoms. In Sweden particularly, German merchants by law took an equal share in the government of the towns. In Denmark their influence was also great, and only in Norway did they remain in the position of foreigners in spite of their famous settlement at Bergen. The details, as well as those of the German settlement at Wisby and on the east coast of the Baltic, belong rather to the history of the Hanseatic League (*q.v.*). Denmark appears to be the only one of the three kingdoms where gilds at an early date played a part of importance.

BIBLIOGRAPHY.—The only book dealing with the subject in general, viz. K. D. Hüllmann, *Städtewesen des Mittelalters* (4 vols., Bonn, 1826-1828), is quite antiquated. For Germany it is best to consult Richard Schröder, *Lehrbruch der deutschen Rechtsgeschichte* (5th ed., Leipzig, 1907), §§ 51 and 56, where a bibliography as complete as need be is given, both of monographs dealing with various aspects of the question, and of works on the history of individual towns. The latter alone covers two large octavo pages of small print. As a sort of complement to Schröder's chapters may be considered, F. Keutgen, *Urkunden zur städtischen Verfassungsgeschichte* (Berlin, 1901 = *Ausgewählte Urkunden zur deutschen Verfassungsgeschichte*, by G. von Below and F. Keutgen, vol. i.), a collection of 437 select charters and other documents, with a very full index. The great work of G. L. von Maurer, *Geschichte der Städteverfassung von Deutschland* (4 thick vols., Erlangen, 1869-1871), contains an enormous mass of information not always treated quite so critically as the present age requires. There is an excellent succinct account for general readers by Georg von Below, "Das ältere deutsche Städtewesen und Bürgertum," *Monographien zur Weltgeschichte*, vol. vi. (Bielefeld and Leipzig, 1898, illustrated). A number of the most important recent monographs have been mentioned above. As fpr Italy, the most valuable general work for the early times is still Carl Hegel, *Geschichte der Städteverfassung von Italien seit der Zeit der römischen Herrschaft bis zum Ausgang des zwölften Jahrhunderts* (2 small vols., Leipzig, 1847, price second-hand, M. 40), in which it was for the first time fully proved that there is no connexion between Roman and modern municipal constitutions. For the period from the 13th century it will perhaps be best to consult W. Assmann, *Geschichte des Mittelalters*, 3rd ed., by L. Viereck, dritte Abteilung, *Die letzten beiden Jahrhunderts des Mittelalters: Deutschland, die Schweiz, und Italien*, by R. Fischer, R. Scheppig and L. Viereck (Brunswick, 1906). In this volume, pp. 679-943 contain an excellent account of the various Italian states and cities during that period, with a full bibliography for each. Among recent critical contributions to the history of individual towns, the following works deserve to be specially mentioned: Robert Davidsohn, *Geschichte von Florenz* (Berlin, 1896-1908);

down to the beginning of the 14th century; the same, *Forschungen zur Geschichte von Florenz* (vols. i.-iv., Berlin, 1896-1908); Heinrich Kretschmayr, *Geschichte von Venedig* (vol. i., Gotha, 1905, to 1205). For France, there are the works by Achille Luchaire, *Les Communes françaises à l'époque des Capétiens directs* (Paris, 1890), and Paul Viollet, "Les Communes françaises au moyen âge," *Mémoires de l'Académie des Inscriptions et Belles-lettres*, tome xxxvi. (Paris, 1900). There are, of course, also accounts in the great works on French institutions by Flach, Glasson, Viollet, Luchaire, but perhaps the one in Luchaire's *Manuel des institutions françaises, période des Capétiens directs* (Paris, 1892) deserves special recommendation. Another valuable account for France north of the Loire is that contained in the great work by Karl Hegel, *Städte und Gilden der germanischen Völker im Mittelaller* (2 vols., Leipzig, 1891; see *English Historical Review*, viii. 120-127). Of course, there are also numerous monographs, among which the following may be mentioned: Édouard Bonvalot, *Le Tiers État d'après la charte de Beaumont et ses filiales* (Paris, 1884); and A. Giry, *Les Établissements de Rouen* (2 vols., Paris, 1883-1885); also a collection of documents by Gustave Fagniez, *Documents relatifs à l'histoire de l'industrie et du commerce en France* (2 vols., Paris, 1898, 1900). Some valuable works on the commercial history of southern Europe should still be mentioned, such as W. Heyd, *Geschichte des Levantehandels im Mittelalter* (2 vols., Stuttgart, 1879; French edition by Furcy Raynaud, 2 vols., Paris, 1885 seq., improved by the author), recognized as a standard work; Adolf Schaube, *Handelsgeschichte der romanischen Völker des Mittelmeergebietes bis zum Ende der Kreuzzüge* (Munich and Berlin, 1906); Aloys Schulte, *Geschichte des mittelalterlichen Handels und Verkehrs zwischen Westdeutschland und Italien mit Ausschluss Venedigs* (2 vols., Leipzig, 1900); L. Goldschmidt, *Universalgesdiichte des Handelsrechts* (vol. i., Stuttgart, 1891). As for the Scandinavian towns, the best guide is perhaps the book by K. Hegel, *Städte und Gilden der germanischen Völker*, already mentioned; but see also Dietrich Schäfer, "Der Stand der Geschichtswissenschaft im skandinavischen Norden," *Internationale Wochenschrift*, November 16, 1907.

(F. K.)

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1 As to the former, see S. Rietschel, *Die Civitas auf deutschem Boden bis zum Ausgange der Karolingerzeit* (Leipzig, 1894); and, for the newly founded towns, the same author, *Markt und Stadt in ihrem rechtlichen Verhältnis* (Leipzig, 1897).

2 About the *Burggraf*, see S. Rietschel, *Das Burggrafenamt und die hohe Gerichtsbarkeit in den deutschen Bischofsstädten während des früheren Mittelalters* (Leipzig, 1905).

3 As to the towns as fortresses, see also F. Keutgen, *Untersuchungen über den Ursprung der deutschen Stadtverfassung* (Leipzig, 1895); and "Der Ursprung der deutschen Stadtverfassung" (*Neue Jahrbücher für das klassische Altertum*, &c, N.F. vol. v.).

4 See S. Rietschel, *Markt und Stadt*, and J. Fritz, *Deutsche Stadtanlagen* (Strassburg, 1894).

5 G. von Below, *Die Entstehung der deutschen Stadtgemeinde* (Düsseldorf, 1889); and *Der Ursprung der deutschen Stadtverfassung* (Düsseldorf, 1892).

6 F. Keutgen, *Urkunden zur städtischen Verfassungsgeschichte*, No. 74 and No. 75 (Berlin, 1901).

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8 J. Weizsäcker, *Der rheinische Bund* (Tübingen, 1879).

9 G. v. Below, *Der Untergang der mittelalterlichen Stadtwirtschaft; Über Theorien der wirtschaftlichen Entwicklung der Völker*; F. Keutgen, "Hansische Handelsgesellschaften, vornehmlich des 14ten Jahrhunderts," in *Vierteljahrsschrift für Sozial- und Wirtschaftsgeschichte*, vol. iv. (1906).

10 On this whole subject see Richard Schröder, *Lehrbuch der deutschen Rechtsgeschichte* (5th ed., Leipzig, 1907), § 56, "Die Stadtrechte." Also Charles Gross, *The Gild Merchant* (Oxford, 1890), vol. i. Appendix E, "Affiliation of Medieval Boroughs."

11 H. Kretschmayr, *Geschichte von Venedig*, vol. i. (Gotha, 1905).

COMMUNISM, the name loosely given to schemes of social organizations depending on the abolition of private property and its absorption into the property of a community as such. It is a form of what is now generally called socialism (*q.v.*), the terminology of which has varied a good deal according to time and place; but the expression "communism" may be conveniently used, as opposed to "socialism" in its wider political sense, or to the political

and municipal varieties known as “collectivism,” “state socialism,” &c., in order to indicate more particularly the historical schemes propounded or put into practice for establishing certain ideally arranged communities composed of individuals living and working on the basis of holding their property in common. It has nothing, of course, to do with the Paris Commune, overthrown in May 1871, which was a political and not an economic movement. Communistic schemes have been advocated in almost every age and country, and have to be distinguished from mere anarchism or from the selfish desire to transfer other people’s property into one’s own pockets. The opinion that a communist is merely a man who has no property to lose, and therefore advocates a redistribution of wealth, is contrary to the established facts as to those who have historically supported the theory of communism. The Corn-law Rhymer’s lines on this subject are amusing, but only apply to the baser sort:—

> “What is a Communist! One that hath yearnings
> For equal division of unequal earnings.
> Idler or bungler, or both, he is willing
> To fork out his penny and pocket your shilling.”

This is the communist of hostile criticism—a criticism, no doubt, ultimately based on certain fundamental facts in human nature, which have usually wrecked communistic schemes of a purely altruistic type in conception. But the great communists, like Plato, More, Saint-Simon, Robert Owen, were the very reverse of selfish or idle in their aims; and communism as a force in the historical evolution of economic and social opinion must be regarded on its ideal side, and not merely in its lapses, however natural the latter may be in operation, owing to the defects of human character. As a theory it has inspired not only some of the finest characters in history, but also much of the gradual evolution of economic organization —especially in the case of co-operation (*q.v.*); and its opportunities have naturally varied according to the state of social organization in particular countries. The communism of the early Christians, for instance, was rather a voluntary sharing of private property than any abnegation of property as such. The Essenes and the Therapeutae, however, in Palestine, had a stricter form of communism, and the former required the surrender of individual property; and in the middle ages various religious sects, followed by the monastic orders, were based on the communistic principle.

Communistic schemes have found advocates in almost every age and in many different countries. The one thing that is shared by all communists, whether speculative or practical, is deep dissatisfaction with the economic conditions by which they are surrounded. In Plato’s *Republic* the dissatisfaction is not limited to merely economic conditions. In his examination of the body politic there is hardly any part which he can pronounce to be healthy. He would alter the life of the citizens of his state from the very moment of birth. Children are to be taken away from their parents and nurtured under the supervision of the state. The old nursery tales, “the blasphemous nonsense with which mothers fool the manhood out of their children,” are to be suppressed. Dramatic and imitative poetry are not to be allowed. Education, marriage, the number of births, the occupations of the citizens are to be controlled by the guardians or heads of the state. The most perfect equality of conditions and careers is to be preserved; the women are to have similar training with the men, no careers and no ambition are to be forbidden to them; the inequalities and rivalries between rich and poor are to cease, because all will be provided for by the state. Other cities are divided against themselves. “Any ordinary city, however small, is in fact two cities, one the city of the poor, the other of the rich, at war with one another” (*Republic*, bk. iv. p. 249, Jowett’s translation). But this ideal state is to be a perfect unit; although the citizens are divided into classes according to their capacity and ability, there is none of the exclusiveness of birth, and no inequality is to break the accord which binds all the citizens, both male and female, together into one harmonious whole. The marvellous comprehensiveness of the scheme for the government of this ideal state makes it belong as much to the modern as to the ancient world. Many of the social problems to which Plato draws attention are yet unsolved, and some are in process of solution in the direction indicated by him. He is not appalled by the immensity of the task which he has sketched out for himself and his followers. He admits that there are difficulties to be overcome, but he says in a sort of parenthesis, “Nothing great is easy.” He refuses to be satisfied with half measures and patchwork reforms. “Enough, my friend! but what is enough while anything remains wanting?” These sentences indicate the spirit in which philosophical as distinguished from practical communists from the time of Plato till to-day have undertaken to reconstruct human society.

Sir Thomas More’s *Utopia* has very many of the characteristics of *The Republic*. There is

in it the same wonderful power of shaking off the prejudices of the place and time in which it was written. The government of Utopia is described as founded on popular election; community of goods prevailed, the magistrates distributed the instruments of production among the inhabitants, and the wealth resulting from their industry was shared by all. The use of money and all outward ostentation of wealth were forbidden. All meals were taken in common, and they were rendered attractive by the accompaniment of sweet strains of music, while the air was filled by the scent of the most delicate perfumes. More's ideal state differs in one important respect from Plato's. There was no community of wives in Utopia. The sacredness of the family relation and fidelity to the marriage contract were recognized by More as indispensable to the well-being of modern society. Plato, notwithstanding all the extraordinary originality with which he advocated the emancipation of women, was not able to free himself from the theory and practice of regarding the wife as part and parcel of the property of her husband. The fact, therefore, that he advocated community of property led him also to advocate community of wives. He speaks of "the *possession and use* of women and children," and proceeds to show how this possession and use must be regulated in his ideal state. Monogamy was to him mere exclusive possession on the part of one man of a piece of property which ought to be for the benefit of the public. The circumstance that he could not think of wives otherwise than as the property of their husbands only makes it the more remarkable that he claimed for women absolute equality of training and careers. The circumstance that communists have so frequently wrecked their projects by attacking marriage and advocating promiscuous intercourse between the sexes may probably be traced to the notion which regards a wife as being a mere item among the goods and chattels of her husband. It is not difficult to find evidence of the survival of this ancient habit of mind. "I will be master of what is mine own," says Petruchio. "She is my goods, my chattels."

The Perfectionists of Oneida, on the other hand, held that there was "no intrinsic difference between property in persons and property in things; and that the same spirit which abolished exclusiveness in regard to money would abolish, if circumstances allowed full scope to it, exclusiveness in regard to women and children" (Nordhoff's *Communistic Societies of the United States*). It is this notion of a wife as property that is responsible for the wild opinions communists have often held in favour of a community of wives and the break-up of family relations. If they could shake off this notion and take hold of the conception of marriage as a contract, there is no reason why their views on the community of property should lead them to think that this contract should not include mutual fidelity and remain in force during the life of the contracting parties. It was probably not this conception of the marriage relation so much as the influence of Christianity which led More to discountenance community of wives in Utopia. It is strange that the same influence did not make him include the absence of slavery as one of the characteristics of his ideal state. On the contrary, however, we find in Utopia the anomaly of slavery existing side by side with institutions which otherwise embody the most absolute personal, political and religious freedom. The presence of slaves in Utopia is made use of to get rid of one of the practical difficulties of communism, viz. the performance of disagreeable work. In a society where one man is as good as another, and the means of subsistence are guaranteed to all alike, it is easy to imagine that it would be difficult to ensure the performance of the more laborious, dangerous and offensive kinds of labour. In Utopia, therefore, we are expressly told that "all the uneasy and sordid services" are performed by slaves. The institution of slavery was also made supplementary to the criminal system of Utopia, as the slaves were for the most part men who had been convicted of crime; slavery for life was made a substitute for capital punishment.

In many respects, however, More's views on the labour question were vastly in advance of his own time. He repeats the indignant protest of the *Republic* that existing society is a warfare between rich and poor. "The rich," he says, "desire every means by which they may in the first place secure to themselves what they have amassed by wrong, and then take to their own use and profit, at the lowest possible price, the work and labour of the poor. And so soon as the rich decide on adopting these devices in the name of the public, then they become law." One might imagine these words had been quoted from the programme of The International (*q.v.*), so completely is their tone in sympathy with the hardships of the poor in all ages. More shared to the full the keen sympathy with the hopeless misery of the poor which has been the strong motive power of nearly all speculative communism. The life of the poor as he saw it was so wretched that he said, "Even a beast's life seems enviable!" Besides community of goods and equality of conditions, More advocated other means of ameliorating the condition of the people. Although the hours of labour were limited to six a day there was no scarcity, for in Utopia every one worked; there was no idle class, no idle individual even.

The importance of this from an economic point of view is insisted on by More in a passage remarkable for the importance which he attaches to the industrial condition of women. “And this you will easily apprehend,” he says, “if you consider how great a part of all other nations is quite idle. First, women generally do little, who are the half of mankind.” Translated into modern language his proposals comprise universal compulsory education, a reduction of the hours of labour to six a day, the most modern principles of sanitary reform, a complete revision of criminal legislation, and the most absolute religious toleration. The romantic form which Sir Thomas More gave to his dream of a new social order found many imitators. The *Utopia* may be regarded as the prototype of Campanella’s *City of the Sun*, Harrington’s *Oceana*, Bacon’s *Nova Atlantis*, Defoe’s *Essay on Projects*, Fénelon’s *Voyage dans l’Île des Plaisirs*, and other works of minor importance.

All communists have made a great point of the importance of universal education. All ideal communes have been provided by their authors with a perfect machinery for securing the education of every child. One of the first things done in every attempt to carry communistic theories into practice has been to establish a good school and guarantee education to every child. The first impulse to national education in the 19th century probably sprang from the very marked success of Robert Owen’s schools in connexion with the cotton mills at New Lanark. Compulsory education, free trade, and law reform, the various movements connected with the improvement of the condition of women, have found their earliest advocates among theoretical and practical communists. The communists denounce the evils of the present state of society; the hopeless poverty of the poor, side by side with the self-regarding luxury of the rich, seems to them to cry aloud to Heaven for the creation of a new social organization. They proclaim the necessity of sweeping away the institution of private property, and insist that this great revolution, accompanied by universal education, free trade, a perfect administration of justice, and a due limitation of the numbers of the community, would put an end to half the self-made distress of humanity.

The various communistic experiments in America are the most interesting in modern times, opportunities being naturally greater there for such deviations from the normal forms of regulations as compared with the closely organized states of Europe, and particularly in the means of obtaining land cheaply for social settlements with peculiar views. They have been classified by Morris Hillquit (*History of Socialism in the United States*, 1903) as (1) sectarian, (2) Owenite, (3) Fourieristic, (4) Icarian.

1. The oldest of the sectarian group was the society of the Shakers (*q.v.*), whose first settlement at Watervliet was founded in 1776. The Harmony Society or Rappist Community was introduced into Pennsylvania by George Rapp (1770-1847) from Württemberg in 1804, and in 1815 they moved to a settlement (New Harmony) in Indiana, returning to Pennsylvania again in 1824, and founding the village of Economy, from which they were also known as Economites. Emigrants from Württemberg also founded the community of Zoar in Ohio in 1817, being incorporated in 1832 as the Society of Separatists of Zoar; it was dissolved in 1898. The Amana (*q.v.*) community, the strongest of all American communistic societies, originated in Germany in the early part of the 18th century as “the True Inspiration Society,” and some 600 members removed to America in 1842-1844. The Bethel (Missouri) and Aurora (Oregon) sister communities were founded by Dr Keil (1812-1877) in 1844 and 1856 respectively, and were dissolved in 1880 and 1881. The Oneida Community (*q.v.*), created by John Humphrey Noyes (1811-1886), the author of a famous *History of American Socialisms* (1870), was established in 1848 as a settlement for the Society of Perfectionists. All these bodies had a religious basis, and were formed with the object of enjoying the free exercise of their beliefs, and though communistic in character they had no political or strictly economic doctrine to propagate.

2. The Owenite communities rose under the influence of Robert Owen’s work at New Lanark, and his propaganda in America from 1824 onwards, the principal being New Harmony (acquired from the Rappists in 1825); Yellow Springs, near Cincinnati, 1824; Nashoba, Tennessee, 1825; Haverstraw, New York, 1826; its short-lived successors, Coxsackie, New York, and the Kendal Community, Canton, Ohio, 1826. All these had more or less short existences, and were founded on Owen’s theories of labour and economics.

3. The Fourierist communities similarly were due to the Utopian teachings of the Frenchman Charles Fourier (*q.v.*), introduced into America by his disciple Albert Brisbane (1809-1890), author of *The Social Destiny of Man* (1840), who was efficiently helped by Horace Greeley, George Ripley and others. The North American Phalanx, in New Jersey, was started in 1843 and lasted till 1855. Brook Farm (*q.v.*) was started as a Fourierist Phalanx in 1844, after three years’ independent career, and became the centre of Fourierist propaganda, lasting till 1847. The Wisconsin Phalanx, or Ceresco, was organized in 1844,

and lasted till 1850. In Pennsylvania seven communities were established between 1843 and 1845, the chief of which were the Sylvania Association, the Peace Union Settlement, the Social Reform Unity, and the Leraysville Phalanx. In New York state the chief were the Clarkson Phalanx, the Sodus Bay Phalanx, the Bloomfield Association, and the Ontario Union. In Ohio the principal were the Trumbull Phalanx, the Ohio Phalanx, the Clermont Phalanx, the Integral Phalanx, and the Columbian Phalanx; and of the remainder the Alphadelphia Phalanx, in Michigan, was the best-known. It is pointed out by Morris Hillquit that while only two Fourierist Phalanxes were established in France, over forty were started in the United States.

4. The Icarian communities were due to the communistic teachings of another Frenchman, Étienne Cabet (*q.v.*) (1788-1856), the name being derived from his social romance, *Voyage en Icarie* (1840), sketching the advantages of an imaginary country called Icaria, with a co-operative system, and criticizing the existing social organization. It was his idea, in fact, of a Utopia. Robert Owen advised him to establish his followers, already numerous, in Texas, and thither about 1500 went in 1848. But disappointment resulted, and their numbers dwindled to less than 500 in 1849; some 280 went to Nauvoo, Illinois; after a schism in 1856 some formed a new colony (1858) at Cheltenham, near St Louis; others went to Iowa, others to California. The last branch was dissolved in 1895.

See also the articles Socialism; Owen; Saint-Simon; Fourier, &c.; and the bibliography to Socialism. The whole subject is admirably covered in Morris Hillquit's work, referred to above; and see also Noyes's *History of American Socialisms* (1870); Charles Nordhoff's *Communistic Societies of the United States* (1875); and W. A. Hinds's *American Communities* (1878; 2nd edition, 1902), a very complete account.

COMMUTATION (from Lat. *commutare*, to change), a process of exchanging one thing for another, particularly of one method of payment for another, such as payment in money for payment in kind or by service, or of payment of a lump sum for periodical payments; for various kinds of such substitution see Annuity; Copyhold and Tithes. The word is also used similarly of the substitution of a lesser sentence on a criminal for a greater. In electrical engineering, the word is applied to the reversal of the course of an electric current, the contrivance for so doing being known as a "commutator" (see Dynamo). In America, a "commutation ticket" on a railway is one which allows a person to travel at a lower rate over a particular route for a certain time or for a certain number of times; the person holding such a ticket is known as a "commuter."

COMNENUS, the name of a Byzantine family which from 1081 to 1185 occupied the throne of Constantinople. It claimed a Roman origin, but its earliest representatives appear as landed proprietors in the district of Castamon (mod. *Kastamuni*) in Paphlagonia. Its first member known in Byzantine history is Manuel Eroticus Comnenus, an able general who rendered great services to Basil II. (976-1025) in the East. At his death he left his two sons Isaac and John in the care of Basil, who gave them a careful education and advanced them to high official positions. The increasing unpopularity of the Macedonian dynasty culminated in a revolt of the nobles and the soldiery of Asia against its feeble representative Michael VI. Stratioticus, who abdicated after a brief resistance. Isaac was declared emperor, and crowned in St Sophia on the 2nd of September 1057. For the rulers of this dynasty see Roman Empire, Later, and separate articles.

With Andronicus I. (1183-1185) the rule of the Comneni proper at Constantinople came to an end. A younger line of the original house, after the establishment of the Latins at Constantinople in 1204, secured possession of a fragment of the empire in Asia Minor, and founded the empire of Trebizond (*q.v.*), which lasted till 1461, when David Comnenus, the last emperor, was deposed by Mahommed II.

For a general account of the family and its alleged survivors see article "Komnenen," by G.

F. Hertzberg, in Ersch and Gruber's *Allgemeine Encyklopädie*, and an anonymous monograph, *Précis historique de la maison impériale des Comnènes* (Amsterdam, 1784); and, for the history of the period, the works referred to under Roman Empire, Later.

COMO (anc. *Comum*), a city and episcopal see of Lombardy, Italy, the capital of the province of Como, situated at the S. end of the W. branch of the Lake of Como, 30 m. by rail N. by W. of Milan. Pop. (1881) 25,560; (1905) 34,272 (town), 41,124 (commune). The city lies in a valley enclosed by mountains, the slopes of which command fine views of the lake. The old town, which preserves its rectangular plan from Roman times, is enclosed by walls, with towers constructed in the 12th century. The cathedral, built entirely of marble, occupies the site of an earlier church, and was begun in 1396, from which period the nave dates: the façade belongs to 1457-1486, while the east of the exterior was altered into the Renaissance style, and richly decorated with sculptures by Tommaso Rodari in 1487-1526. The dome is an unsuitable addition of 1731 by the Sicilian architect Filippo Juvara (1685-1735), and its baroque decorations spoil the effect of the fine Gothic interior. It contains some good pictures and fine tapestries. In the same line as the façade of the cathedral are the Broletto (in black and white marble), dating from 1215, the seat of the original rulers of the commune, and the massive clock-tower. The Romanesque church of S. Abondio outside the town was founded in 1013 and consecrated in 1095; it has two fine campanili, placed at the ends of the aisles close to the apse. It occupies the site of the 5th-century church of SS. Peter and Paul. Near it is the Romanesque church of S. Carpoforo. Above it is the ruined castle of Baradello. The churches of S. Giacomo (1095-1117) and S. Fedele (12th century), both in the town, are also Romanesque, and the apses have external galleries. The Palazzo Giovio contains the Museo Civico. Como is a considerable tourist resort, and the steamboat traffic on the lake is largely for travellers. A climate station is established on the hill of Brunate (2350 ft.) above the town to the E., reached by a funicular railway. The Milanese possess many villas here. Como is an industrial town, having large silk factories and other industries (see Lombardy). It is connected with Milan by two lines of railway, one via Monza (the main line, which goes on to Chiasso—Swiss frontier—and the St Gotthard), the other via Saronno and also with Lecco and Varese. 794

Of the Roman Comum little remains above ground; a portion of its S.E. wall was discovered and may be seen in the garden of the Liceo Volta, 88 ft. within the later walls: later fortifications (but previous to 1127), largely constructed with Roman inscribed sepulchral urns and other fragments, had been superimposed on it. Thermae have also been discovered (see V. Barelli in *Notizie degli scavi*, 1880, 333; 1881, 333; 1882, 285). The inscriptions, on the other hand, are numerous, and give an idea of its importance. The statements as to the tribe which originally possessed it are various. It belonged to Gallia Cisalpina, and first came into contact with Rome in 196 B.C., when M. Claudius Marcellus conquered the Insubres and the Comenses. In 89 B.C., having suffered damage from the Raetians, it was restored by Cn. Pompeius Strabo, and given Latin rights with the rest of Gallia Transpadana. Shortly after this 3000 colonists seem to have been sent there; 5000 were certainly sent by Caesar in 59 B.C., and the place received the name Novum Comum. It appears in the imperial period as a *municipium*, and is generally spoken of as Comum simply. The place was prosperous; it had an important iron industry; and the banks of the lake were, as now, dotted with villas. It was also important as the starting-point for the journey across the lake in connexion with the Splugen and Septimer passes (see Chiavenna). It was the birthplace of both the elder and the younger Pliny, the latter of whom founded baths and a library here and gave money for the support of orphan children. There was a *praefectus classis Comensis* under the late empire, and it was regarded as a strong fortress. See Ch. Hulsen in Pauly-Wissowa, *Realencyclopädie*, Suppl. Heft i. (Stuttgart, 1903), 326.

Como suffered considerably from the early barbarian invasions, many of the inhabitants taking refuge on the Isola Comacina off Sala, but recovered in Lombard times. It was from that period that the *magistri Comacini* formed a privileged corporation of architects and sculptors, who were employed in other parts of Italy also, until, at the end of the 11th century, individuals began to come more to the front (G. T. Rivoira, *Origini del l'architettura Lombarda*, Rome, 1901, i. 127 f.). Como then became subject to the archbishops of Milan, but gained its freedom towards the end of the 11th century. At the beginning of the 12th century war broke out between Como and Milan, and after a ten years' war Como was taken

and its fortifications dismantled in 1127. In 1154, however, it took advantage of the arrival of Barbarossa, and remained faithful to him throughout the whole war of the Lombard League. After frequent struggles with Milan, it fell under the power of the Visconti in 1335. In 1535, like the rest of Lombardy, it fell under Spanish dominion, and in 1714 under Austrian. Thenceforth it shared the fortunes of Milan, becoming in the Napoleonic period the chief town of the department of the Lario. Its silk industry and its position at the entrance to the Alpine passes gave it some importance even then. It bore a considerable part in the national risings of 1848-1859 against Austrian rule. (T. As.)

COMO, Lake of (the *Lacus Larius* of the Romans, and so sometimes called Lario to the present day, though in the 4th century it is already termed *Lacus Comacinus*), one of the most celebrated lakes in Lombardy, Northern Italy. It lies due N. of Milan and is formed by the Adda that flows through the Valtelline to the north end of the lake (here falls in the Maira or Mera, coming from the Val Bregaglia) and flows out of it at its south-eastern extremity, on the way to join the Po. Its area is 55½ sq. m., it is about 43 m. from end to end (about 30½ m. from the north end of Bellagio), it is from 1 to 2½ m. in breadth, its surface is 653 ft. above the sea, and its greatest depth is 1365 ft. A railway line now runs along its eastern shore from Colico to Lecco (24½ m.), while on its western shore Menaggio is reached by a steam tramway from Porlezza on the Lake of Lugano (8 m.). Colico, at the northern extremity, is by rail 17 m. from Chiavenna and 42 m. from Tirano, while at its southern end Como (on the St Gotthard line) is 32 m. from Milan, and Lecco about the same distance. The lake fills a remarkable depression which has been cut through the limestone ranges that enclose it, and once doubtless extended as far as Chiavenna, the Lake of Mezzola being a surviving witness of its ancient bed. Towards the south the promontory of Bellagio divides the lake into two arms. That to the south-east ends at Lecco and is the true outlet, for the south-western arm, ending at Como, is an enclosed bay. During the morning the *Tivano* wind blows from the north, while in the afternoon the *Breva* wind blows from the south. But, like other Alpine lakes, the Lake of Como is exposed to sudden violent storms. Its beauties have been sung by Virgil and Claudian, while the two Plinys are among the celebrities associated with the lake. The shores are bordered by splendid villas, while perhaps the most lovely spot on it is Bellagio, built in an unrivalled position. Among the other villages that line the lake, the best-known are Varenna (E.) and Menaggio (W.), nearly opposite one another, while Cadenabbia (W.) faces Bellagio.

(W. A. B. C.)

COMONFORT, IGNACIO (1812-1863), a Mexican soldier and politician, who, after occupying a variety of civil and military posts, was in December 1855 made provisional president by Alvarez, and from December 1857 was for a few weeks constitutional president. (See Mexico.)

COMORIN, CAPE, a headland in the state of Travancore, forming the extreme southern point of the peninsula of India. It is situated in 8° 4′ 20″ N., 77° 35′ 35″ E., and is the terminating point of the western Ghats. The village of Comorin, with the temple of Kanniyambal, the “virgin goddess,” on the coast at the apex of the headland, is a frequented place of pilgrimage.

COMORO ISLANDS, a group of volcanic islands belonging to France, in the Indian Ocean, at the northern entrance of the Mozambique Channel midway between Madagascar and the African continent. The following table of the area and population of the four largest islands gives one of the sets of figures offered by various authorities:—

	Area sq. m.	Population.
Great Comoro	385	50,000
Anjuan or Johanna	145	12,000
Mayotte	140	11,000
Moheli	90	9,000
Total	760	82,000

There are besides a large number of islets of coral formation. Particulars of the four islands named follow.

1. Great Comoro, or Angazia, the largest and most westerly, has a length of about 38 m., with a width of about 12 m. Near its southern extremity it rises into a fine dome-shaped volcanic mountain, Kartola (Karthala), which is over 8500 ft. high, and is visible for more than 100 m. Up to about 6000 ft. it is clothed with dense vegetation. Eruptions are recorded for the years 1830, 1855 and 1858; and another eruption occurred in 1904. In the north the ground rises gradually to a plateau some 2000 ft. above the sea; from this plateau many regularly shaped truncated cones rise another 2000 ft. The centre of the island consists of a desert field of lava streams, about 1600 ft. high. The chief towns are Maroni (pop. about 2000), Itzanda and Mitsamuli; the first, situated at the head of a bay in 11° 40′ S., being the seat of the French administrator.

2. Anjuan, or Johanna, next in size, lies E. by S. of Comoro. It is some 30 m. long by 20 at its greatest breadth. The land rises in a succession of richly wooded heights till it culminates in a central peak, upwards of 5000 ft. above the sea, in 12° 14′ S., 44° 27′ E. The former capital, Mossamondu, on the N.W. coast, is substantially built of stone, surrounded by a wall, and commanded by a dilapidated citadel; it is the residence of the sultan and of the French administrator. There is a small but safe anchorage at Pomony, on the S. side, formerly used as a coal depot by ships of the British navy.

3. Mayotte, about 21 m. long by 6 or 7 m. broad, is surrounded by an extensive and dangerous coral reef. The principal heights on its extremely irregular surface are: Mavegani Mountain, which rises in two peaks to a maximum of 2164 ft., and Uchongin, 2100 ft. The 795
French headquarters are on the islet of Zaudzi, which lies within the reef in 12° 46′ S., 45° 20′ E. There are substantial government buildings and store-houses. On the mainland opposite Zaudzi is Msapéré, the chief centre of trade. Mayotte was devastated in 1898 by a cyclone of great severity.

4. Moheli or Mohilla lies S. of and between Anjuan and Grand Comoro. It is 15 m. long and 7 or 8 m. at its maximum breadth. Unlike the other three it has no peaks, but rises gradually to a central ridge about 1900 ft. in height. Fomboni (pop. about 2000) in the N.W. and Numa Choa in the S.W. are the chief towns.

All the islands possess a very fertile soil; there are forests of coco-nut palms, and among the products are rice, maize, sweet-potatoes, yams, coffee, cotton, vanilla and various tropical fruits, the papaw tree being abundant. The fauna is allied to that of Madagascar rather than to the mainland of Africa; it includes some land birds and a species of lemur peculiar to the islands. Large numbers of cattle and sheep, the former similar to the small species at Aden, are reared as well as, in Great Comoro, the zebra. Turtles are caught in abundance along the coasts, and form an article of export. The climate is in general warm, but not torrid nor unsuitable for Europeans. The dry season lasts from May to the end of October, the rest of the year being rainy. The natives are of mixed Malagasy, Negro and Arab blood. The majority are Mahommedans. The European inhabitants, mostly French, number about 600. There are some 200 British Indians, traders, in the islands. The external trade of the islands has developed since the annexation of Madagascar to France, and is of the value of about £100,000 a year. Sugar refineries, distilleries of rum, and sawmills are worked in Mayotte by French settlers. Cane sugar and vanilla are the chief exports. The islands are regularly visited by vessels of the Messageries Maritimes fleet, and a coaling station for the French navy has been established.

The islands were first visited by Europeans in the 16th century; they are marked on the map of Diego Ribero made in 1527. At that time, and for long afterwards, the dominant

influence in, and the civilization of, the islands was Arab. According to tradition the islands were first peopled by Arab voyagers driven thither by tempests. The petty sultans who exercised authority were notorious slave traders. A Sakalava chief who had been driven from Madagascar by the Hovas took refuge in Mayotte *c.* 1830, and, with the aid of the sultan of Johanna, conquered the island, which for a century had been given over to civil war. French naval officers having reported on the strategic value of Mayotte, Admiral de Hell, governor of Réunion, sent an officer there in 1841, and a treaty was negotiated ceding the island to France. Possession was taken in 1843, the sultan of Johanna renouncing his claims in the same year. In 1886 the sultans of the other three islands were placed under French protection, France fearing that otherwise the islands would be taken by Germany. The French experienced some difficulty with the natives, but by 1892 had established their position. The islands, as regulated by the decree of the 9th of April 1908, are under the supreme authority of the governor-general of Madagascar. The local administration is in the hands of an official who himself governs Mayotte but is represented in the other islands by administrators. On the council which assists the governor are two nominated native notables. In 1910 the sultan of Great Comoro ceded his sovereign rights to France. In Anjuan the native government is continued under French supervision. The budgets of the four islands in 1904 came to some £30,000, that of Mayotte being about half the total. The chief sources of revenue are poll and house taxes, and, in Mayotte, a land tax.

The *Iles Glorieuses*, three islets 160 m. N.E. of Mayotte, with a population of some 20 souls engaged in the collection of guano and the capture of turtles, were in 1892 annexed to France and placed under the control of the administrator of Mayotte.

See *Notice sur Mayotte et les Comores*, by Emile Vienne, one of the memoirs on the French colonies prepared for the Paris Exhibition of 1900; *Le Sultanat d'Anjouan*, by Jules Repiquet (Paris, 1901), a systematic account of the geography, ethnology and history of Johanna; *Les colonies françaises* (Paris, 1900), vol. ii. pp. 179-197, in which the story of the archipelago is set forth by various writers; an account of the islands by A. Voeltzkow in the *Zeitschrift* of the Berlin Geog. Soc. (No. 9, 1906), and *Carte des Iles Comores*, by A. Meunier (Paris, 1904).

COMPANION (through the O. Fr. *compaignon* or *compagnon*, from the Late Lat. *companio*,—*cum*, with, and *panis*, bread,—one who shares meals with another; the word has been wrongly derived from the Late Lat. *compagnus*, one of the same *pagus* or district), a mess-mate or "comrade" (a term which itself has a similar origin, meaning one who shares the same *camera* or room). "Companion" is particularly used of soldiers, as in the expression "companion in arms," and so is the title of the lowest rank in a military or other order of knighthood; the word is also used of a person who lives with another in a paid position for the sake of company, and is looked on rather as a friend than a servant; and of a pair or match, as of pictures and the like. Similar in ultimate origin but directly adapted from the Fr. *chambre de la compagne*, and Ital. *camera della compagna*, the storeroom for provisions on board ship, is the use of "companion" for the framed windows over a hatchway on the deck of a ship, and also for the hooded entrance-stairs to the captain's cabin.

COMPANY, one of a number of words like "partnership," "union," "gild," "society," "corporation," denoting—each with its special shade of meaning—the association of individuals in pursuit of some common object. The taking of meals together was, as the word signifies (*cum*, with, *panis*, bread,) a characteristic of the early company. Gild had a similar meaning: but this characteristic, though it survives in the Livery company (see Livery Companies), has in modern times disappeared. The word "company" is now monopolized—in British usage—by two great classes of companies—(1) the joint stock company, constituted under the Companies (Consolidation) Act 1908, which consolidated the various acts from 1862 to 1907, and (2) the "public company," constituted under a special act to carry on some work of public utility, such as a railway, docks, gasworks or waterworks, and regulated

by the Companies Clauses Acts 1845 and 1863.

1. *Joint Stock Companies.*

The joint stock company may be defined as an association of persons incorporated to promote by joint contributions to a common stock the carrying on of some commercial enterprise. Associations formed not for "the acquisition of gain" but to promote art, science, religion, charity or some other useful or philanthropic object, though they may be constituted under the Companies (Consolidation) Act 1908, seldom call themselves companies, but adopt some name more appropriate to express their objects, such as society, club, institute, college or chamber. The joint stock company has had a long history which can only be briefly sketched here. The name of "joint stock company" is—or was—used to distinguish such a company from the "regulated company," which did not trade on a joint stock but was in the nature of a trade gild, the members of which had a monopoly of foreign trade with particular countries or places (see Adam Smith, *Wealth of Nations*, bk. v. ch. i. pt. iii.).

The earliest kind of joint stock company is the chartered (see Chartered Companies). The grant of a charter is one of the exclusive privileges of the crown, and the crown has from time to time exercised it in furtherance of trading enterprise. Examples of such grants are the Merchant Adventurers of England, chartered by Richard II. (1390); the East India Co., chartered by Queen Elizabeth (1600); the Bank of England, chartered by William and Mary (1694); the Hudson's Bay Co.; the Royal African Co.; the notorious South Sea Co.; and in later times the New Zealand Co., the North Borneo Co., and the Royal Niger Co. Chartered companies had, however, several disadvantages. A charter was not easily obtainable. It was costly. The members could not be made personally liable for the debts of the company: and once created—though only for defined objects—such a company was invested with entire independence and could not be kept to the conditions imposed by the grant, which was against public policy. A new form of commercial association was wanted, free from these defects, and it was found in the common law company—the lineal ancestor of the modern 796
trading company. The common law company was not an incorporated association: it was simply a great partnership with transferable shares. Companies of this kind multiplied rapidly towards the close of the 17th century and the beginning of the 18th century, but they were regarded with strong disfavour by the law, for reasons not very intelligible to modern notions; the chief of these reasons being that such companies purported to act as corporate bodies, raised transferable stock, used charters for purposes not warranted by the grant, and were—or were supposed to be—dangerous and mischievous, tending (in the words of the preamble of the Bubble Act) to "the common grievance, prejudice and inconvenience of His Majesty's subjects or great numbers of them in trade, commerce or other lawful affairs." They were too often—and this no doubt was the real ground of the prejudice against them—utilized by unprincipled persons to promote fantastic and often fraudulent schemes. Matthew Green, in his poem "The Spleen," notes how

"Wrecks appear each day,
And yet fresh fools are cast away."

The result was that by the act (6 Geo. I. c. 18) commonly known as the Bubble Act (1719) such companies were declared to be common nuisances and indictable as such. But the act, though it remained on the statute book for more than one hundred years and was not formally repealed till 1825, proved quite ineffectual to check the growth of joint stock enterprise, and the legislature, finding that such companies had to be tolerated, adopted the wiser course of regulating what it could not repress. One great inconvenience of these common law trading companies arose from their being unincorporated. They were formed of large fluctuating bodies of individuals, and a person dealing with them did not know with whom he was contracting or whom he was to sue. This evil the legislature sought to rectify by empowering the crown to grant to companies by letters patent without incorporation the privilege of suing and being sued by a public officer. Ten years afterwards—in 1844—a more important line of policy was adopted, and all companies with some exceptions were enabled to obtain a certificate of incorporation without applying for a charter or special act. The act of 1862 carried this policy one step farther by prohibiting all associations of more than twenty persons from carrying on business without registering under the act. These were all useful amendments, but they were amendments of form rather than substance. The real vitality of joint stock enterprise lies in the co-operative principle, and the natural growth and expansion of this fruitful principle was checked until the middle of the 19th century by the notorious risks attaching to unlimited liability. In the case of an ordinary partnership,

though their liability is unlimited (or was until the Limited Partnerships Act 1907), the partners can generally tell what risks they are incurring. Not so the shareholders of a company. They delegate the management of their business to a board of directors, and they may easily find themselves committed by the fraud or folly of its members to engagements which in the days of unlimited liability meant ruin. Failures like those of Overend and Gurney, and of the Glasgow Bank, caused widespread misery and alarm. It was not until limited liability had been grafted on the stock of the co-operative system that the real potency of the principle of industrial co-operation became apparent. We owe the adoption of the limited liability principle to the clear-sightedness of Lord Sherbrooke—then Mr Robert Lowe—and to the vigorous advocacy of Lord Bramwell. We owe it to Lord Bramwell also that the principle was made a feasible one. The practical difficulty was how to bring home to persons dealing with the company notice that the liability of the shareholders was limited. Lord Bramwell solved the problem by a happy suggestion—"write it on my tombstone," he said humorously to a friend. This was that the company should add to its name the word "Limited "—paint it up on its premises, and use it on all invoices, bills, promissory notes and other documents. The proposal was adopted by the Legislature and has worked successfully. While limited companies have been multiplying at the rate of over 4000 a year, the unlimited company has become practically an extinct species. The growth of limited companies is, indeed, one of the most striking phenomena of our day. Their number may be estimated at quite 40,000. Their paid-up capital amounts to the stupendous sum of £1,850,000,000 and, what is even more significant, as the 1st Viscount Goschen remarks in his *Essays and Addresses*, is that "the number of shareholders has grown in a much greater ratio than the colossal growth of the aggregate capital. The profits and risks of nearly every kind of business have been spread from year to year over fresh thousands of individuals, and the middle class with moderate incomes are more and more participating in that accumulation of wealth from business of every description which formerly built up the fortunes of individual traders or of bankers or of single families."

It is with the limited company then—the company limited by shares—as the normal type and incomparably the most important, that this article mainly deals.

Companies Limited by Shares.—The Companies Act 1862, was intended to constitute a comprehensive code of law applicable to joint stock trading companies for the whole of the United Kingdom. Recognizing the mischief above alluded to—of trading concerns being carried on by large and fluctuating bodies, the act begins by declaring that no company, association or partnership, consisting of more than twenty persons, or ten in the case of banking, shall be formed after the commencement of the act for the purpose of carrying on any business which has for its object the acquisition of gain by the company, association or partnership, or by the individual members thereof, unless it is registered as a company under the act, or is formed in pursuance of some other act of parliament or of letters patent, or is a company engaged in working mines within and subject to the jurisdiction of the Stannaries. Broadly speaking, the meaning of the act is that all commercial undertakings, as distinguished from literary or charitable associations, shall be registered. "Business" has a more extensive signification than "trade." Having thus cleared the ground the act goes on to provide in what manner a company may be formed under the act. The machinery is simple, and is described as follows:—

"Any seven or more persons associated for any lawful purpose may, by subscribing their names to a memorandum of association and otherwise complying with the requisitions of this act in respect of registration, form an incorporated company with or without limited liability" (§ 6). It is not necessary that the subscribers should be traders nor will the fact that six of the subscribers are mere dummies, clerks or nominees of the seventh affect the validity of the company; so the House of Lords decided in *Salomon* v. *Salomon & Co.*, 1897, A. C. 22.

Memorandum of Association.

The document to be subscribed—the Memorandum of Association—corresponds, in the case of companies formed under the Companies Act 1862, to the charter or deed of settlement in the case of other companies. The form of it is given in the schedule to the act, and varies slightly according as the company is limited by shares or guarantee, or is unlimited. (See the 3rd schedule to the Consolidation Act 1908, forms A, B, C, D.) It is required to state, in the case of a company limited by shares, the five following matters:—

1. The name of the proposed company, with the addition of the word "limited" as the last word in such name.

2. The part of the United Kingdom, whether England, Scotland or Ireland, in which the

registered office of the company is proposed to be situate.

3. The objects for which the proposed company is to be established.

4. A declaration that the liability of the members is limited.

5. The amount of capital with which the company proposes to be registered, divided into shares of a certain fixed amount.

No subscriber of the memorandum is to take less than one share, and each subscriber is to write opposite his name the number of shares he takes.

These five matters the legislature has deemed of such intrinsic importance that it has required them to be set out in the company's Memorandum of Association. They are the essential conditions of incorporation, and as such they must not only be stated, but the policy of the legislature has made them with certain exceptions unalterable.

The most important of these five conditions is the third, and its importance consists in this, that the objects defined in the memorandum circumscribe the sphere of the company's activities. This principle, which is one of public policy and convenience, and is known as the "*ultra vires* doctrine," carries with it important consequences, because every act done or contract made by a company *ultra vires*, *i.e.* in excess of its powers, is absolutely null and void. The policy, too, is a sound one. Shareholders contribute their money on the faith that it is to be employed in prosecuting certain objects, and it would be a violation of good faith if the company, *i.e.* the majority of shareholders, were to be allowed to divert it to something quite different. So strict is the rule that not even the consent of every individual shareholder can give validity to an *ultra vires* act.

Articles of Association.

The articles of association are the regulations for internal management of the company—the terms of the partnership agreed upon by the shareholders among themselves. A model or specimen set of articles known as Table A was given by the Companies Act 1862, and is appended in a revised form to the Companies (Consolidation) Act 1908. When a company is to be registered the memorandum of association accompanied by a copy of the articles is taken to the office of the registrar of joint stock companies at Somerset House, together with the following documents:—

1. A list of persons who have consented to be directors of the company (fee stamp 5s.).

2. A statutory declaration by a solicitor of the High Court engaged in the formation of the company, or by a person named in the articles of association as a director or secretary of the company, that the requisitions of the act in respect of registration and of matters precedent and incidental thereto have been complied with (fee stamp 5s.).

3. A statement as to the nominal share capital (stamped with an *ad valorem* duty of 5s. per £100).

4. If no prospectus is to be issued, a company must now (Companies Act 1907, s. 1; Consolidation Act 1908, s. 82) in lieu thereof file with the registrar a statement, in the form prescribed by the 1st schedule to the act, of all the material facts relating to the company. Till this has been done the company cannot allot any shares or debentures.

If these documents are in order the registrar registers the company and issues a certificate of incorporation (see Companies (Consolidation) Act 1908, sect. 82); on registration, the memorandum and articles of association become public documents, and any person may inspect them on payment of a fee of one shilling. This has important consequences, because every person dealing with the company is presumed to be acquainted with its constitution, and to have read its memorandum and articles. The articles also, upon registration, bind the company and its members to the same extent as if each member had subscribed his name and affixed his seal to them.

The total cost of registering a company with a capital of £1000 is about £7; £10,000 about £34; £100,000 about £280.

Capital.

The capital which is required to be stated in the memorandum of association, and which represents the amount which the company is empowered to issue, is what is known as the nominal capital. This nominal capital must be distinguished from the subscribed capital. Subscribed capital is the aggregate amount agreed to be paid by those who have taken shares in the company. Under the Companies Act 1900, Companies Act 1908, s. 85, a "minimum subscription" may be fixed by the articles, and if it is the directors cannot go to allotment on less: if it is not, then the whole of the

capital offered for subscription must be subscribed. A company may increase its capital, consolidate it, subdivide it into shares of smaller amount and convert paid-up shares into stock. It may also, with the sanction of the court, otherwise reorganize its capital (Companies Act 1907, s. 39; Companies (Consolidation) Act 1908, s. 45), and for this purpose modify its Memorandum of Association; but a limited company cannot reduce its capital either by direct or indirect means without the sanction of the court. The inviolability of the capital is a condition of incorporation—the price of the privilege of trading with limited liability, and by no subterfuge will a company be allowed to evade this cardinal rule of policy, either by paying dividends out of capital, or buying its own shares, or returning money to shareholders. But the prohibition against reduction means that the capital must not be reduced by the voluntary act of the company, not that a company's capital must be kept intact. It is embarked in the company's business, and it must run the risks of such business. If part of it is lost there is no obligation on the company to replace it and to cease paying dividends until such lost capital is repaid. The company may in such a case write off the lost capital and go on trading with the reduced amount. But for this purpose the sanction of the court must be obtained by petition.

Shares.

A share is an aliquot part of a company's nominal capital. The amount may be anything from 1s. to £1000. The tendency of late years has been to keep the denomination low, and so to appeal to a wider public. Shares of £100, or even £10, are now the exception. The most common amount is either £1 or £5. Shares are of various kinds—ordinary, preference, deferred, founders' and management. Into what classes of shares the original capital of the company shall be divided, what shall be the amount of each class, and their respective rights, privileges and priorities, are matters for the consideration of the promoters of the company, and must depend on its special circumstances and requirements.

A company may issue preference shares even if there is no mention of them in the Memorandum of Association, and any preference or special privilege so given to a class of shares cannot be interfered with on any reorganization of capital except by a resolution passed by a majority of shareholders of that class representing three-fourths of the capital of that class (Companies (Consolidation) Act 1908, s. 45). The preference given may be as to dividends only, or as to dividends and capital. The dividend, again, may be payable out of the year's profits only, or it may be cumulative, that is, a deficiency in one year is to be made good out of the profits of subsequent years. Prima facie, a preferential dividend is cumulative. For issuing preference shares the question for the directors is, what must be offered to attract investors. Preference shareholders are given by the Companies Act 1907, s. 23; Companies (Consolidation) Act 1908, s. 114, the right to inspect balance sheets. Founders' shares—which originated with private companies—are shares which usually take the whole or half the profits after payment of a dividend of 7 or 10% to the ordinary shareholders. They are much less in favour than they used to be.

Promoters and promotion.

The machinery of company formation is generally set in motion by a person known as a promoter. This is a term of business, not law. It means, to use Chief Justice Cockburn's words, a person "who undertakes to form a company with reference to a given project and to set it going, and who takes the necessary steps to accomplish that purpose." Whether what a person has done towards this end constitutes him a promoter or not, is a question of fact; but once an affirmative conclusion is reached, equity clothes such promoter with a fiduciary relation towards the company which he has been instrumental in creating. This doctrine is now well established, and its good sense is apparent when once the position of the promoter towards the company is understood. Promoters—to use Lord Cairns's language in *Erlanger* v. *New Sombrero Phosphate Co.*, 3 A. C. 1236—"have in their hands the creation and moulding of the company. They have the power of defining how and when and in what shape and under what supervision it shall start into existence and begin to act as a trading corporation." Such a control over the destinies of the company involves correlative obligations towards it, and one of these obligations is that the promoter must not take advantage of the company's helplessness. A promoter may sell his property to the company, but he must first see that the company is furnished with an independent board of directors to protect its interests and he must make full and fair disclosure of his interest in order that the company may determine whether it will or will not authorize its trustee or agent (for such the promoter in equity is) to make a profit out of the sale. It is not a sufficient disclosure in such a case for the promoter merely to refer in the prospectus to a contract which, if read by the shareholders, would inform them of his interest. They are under no obligation to inquire. It is for the promoter to bring home notice, not constructive but actual, to the shareholders.

When a company is promoted for acquiring property—to work a mine or patent, for instance, or carry on a going business—the usual course is for the promoter to frame a draft agreement for the sale of the property to the company or to a trustee on its behalf. The memorandum and articles of the intended company are then prepared, and an article is inserted authorizing or requiring the directors to adopt the draft agreement for sale. In pursuance of this authority the directors at the first meeting after incorporation take the draft agreement into consideration; and if they approve, adopt it. Where they do so in the exercise of an honest and independent judgment, no exception can be taken to the transaction; but where the directors happen to be nominees of the promoter, perhaps qualified by him and acting in his interest, the situation is obviously open to grave abuse. It is not too much, indeed, to say that the fastening of an onerous or improvident contract on a company at its start, by interested promoters acting in collusion with the directors, has been the principal cause of the scandals associated with company promotion.

Concurrently with the adoption of the contract for the acquisition of the property which is the company's *raison d'être*, the directors have to consider how they will best get the company's capital subscribed. Down to the passing of the Companies Act 1900 the usual mode of doing this was to issue a prospectus inviting the public to subscribe for shares. After the act of 1900 the prospectus fell into general disuse. In the year 1903, out of a total of 3596 companies which registered, only 358 issued a prospectus, the directors preferring, it would seem, to place the share capital through the medium of brokers, financial agents and other intermediaries rather than run the risk of incurring, personally, liability under the stringent provisions for disclosure contained in the act (s. 10). Of late the prospectus has, however, returned into favour. Under the act of 1907, incorporated in the Consolidation Act 1908 (s. 82), a company, if it does not issue a prospectus, must file a statement of all the material facts relating to the company.

Prospectus.

A prospectus is an invitation to the public to take shares on the faith of the statements therein contained, and is thus the basis of the agreement to take the shares; there therefore rests on those who are responsible for its issue an obligation to act with the most perfect good faith—*uberrima fides*—and this obligation has been repeatedly emphasized by judges of the highest eminence. (See the observations of Kindersley, V.C., in *New Brunswick Railway Co.* v. *Muggeridge*, 1860, 1 Dr. & Sm. 383, and of Lord Herschell in *Derry* v. *Peek*, 1889, 14 A. C. 376.) Directors must be perfectly candid with the public; they must not only state what they do state with strict and scrupulous accuracy, but they must not omit any fact which, if disclosed, would falsify the statements made. This is the general obligation of directors when issuing a prospectus; but on this general obligation the legislature has engrafted special requirements. By the Companies Act 1867, it required the dates and names of the parties to any contract entered into by the company or its promoters or directors before the issue of the prospectus, to be disclosed in the prospectus; otherwise the prospectus was to be deemed fraudulent. This enactment was repealed by the Companies Act 1900, but only in favour of more stringent provisions incorporated in the Consolidation Act of 1908. Now, not only is every prospectus to be signed and filed with the registrar of Joint Stock Companies before it can be issued, but the prospectus must set forth a long and elaborate series of particulars about the company—the contents of the Memorandum of Association, with the names of the signatories, the share qualification (if any) of the directors, the minimum subscription on which the directors may proceed to allotment, the shares and debentures issued otherwise than for cash, the names and addresses of the vendors, the amount paid for underwriting the company, the amount of preliminary expenses, of promotion money (if any), and the interest (if any) of every director in the promotion or in property to be acquired by the company. Neglect of this statutory duty of disclosure will expose directors to personal liability. For false or fraudulent statements—as distinguished from non-disclosure—in a prospectus directors are liable in an action of deceit or under the Directors' Liability Act 1890, now incorporated in the act of 1908. This act was passed to meet the decision of the House of Lords in *Peek* v. *Derry* (12 A. C. 337), that a director could not be made liable in an action of deceit for an untrue statement in a prospectus, unless the plaintiff could prove that the director had made the untrue statement fraudulently. The Directors' Liability Act enacted in substance that when once a prospectus is proved to contain a material statement of fact which is untrue, the persons responsible for the prospectus are to be liable to pay compensation to any one who has subscribed on the faith of the prospectus, unless they can prove that they had reasonable ground to believe, and did in fact believe, the statement to be true. Actions under this act have been rare, but their rarity may be due to the act having had the effect of making directors more careful in their statements.

Before the passing of the Companies Act 1900, it was a matter for directors' discretion on

what subscription they should go to allotment. They often did so on a scandalously inadequate subscription. To remedy this abuse the Companies Act 1900 (Companies (Consolidation) Act 1908, s. 85) provided that no allotment of any share capital offered to the public for subscription is to be made unless the amount fixed by the memorandum and articles of association and named in the prospectus as "the minimum subscription" upon which the directors may proceed to allotment has been subscribed and the application moneys—which must not be less than 5% of the nominal amount of the share—paid to and received by the company. If no minimum is fixed the whole amount of the share capital offered for subscription must have been subscribed before the directors can go to allotment. The "minimum subscription" is to be reckoned exclusively of any amount payable otherwise than in cash. If these conditions are not complied with within forty days the application moneys must be returned. Any "waiver clause" or contract to waive compliance with the section is to be void.

Allotment of shares.

An allotment of shares made in contravention of these provisions is irregular and voidable at the option of the applicant for shares within one month after the first or statutory meeting of the company (Companies (Consolidation) Act, s. 86). Even when a company has got what under the name of the "minimum subscription" the directors deem enough capital for its enterprise, it cannot now commence business or make any binding contract or exercise any borrowing powers until it has obtained a certificate entitling it to commence business (Companies (Consolidation) Act 1908, s. 87). To obtain this certificate the company must have fulfilled certain statutory conditions, which are briefly these:—

(a) The company must have allotted shares to the amount of not less than the "minimum subscription."

(b) Every director must have paid up his shares in the same proportion as the other members of the company.

(c) A statutory declaration, made by the secretary of the company or one of the directors, must have been filed with the registrar of joint stock companies, that these conditions have been complied with.

These conditions fulfilled, the company gets its certificate and starts on its business career, carrying on its business through the agency of directors, as to whose powers and duties see DIRECTORS.

The Companies Act as consolidated in the act of 1908, and the regulations under them, treat the directors of a company as the persons in whom the management of the company's affairs is vested. But they also contemplate the ultimate controlling power as residing in the shareholders. A controlling power of this kind can only assert itself through general meetings; and that it may have proper opportunities of doing so, every company is required to hold a general meeting, commonly called the statutory meeting, within—as fixed by the Companies Act 1900—three months from the date at which it is entitled to commence business. This first statutory meeting acquired new significance under the Companies Act of 1900 and marks an important stage in the early history of a company. Seven days before it takes place the directors are required to send round to the members a certified report informing them of the general state of the company's affairs—the number of shares allotted, cash received for them, and names and addresses of the members, the amount of preliminary expenses, the particulars of any contract to be submitted to the meeting, &c. Furnished with this report the members come to the meeting in a position to discuss and exercise an intelligent judgment upon the state and prospects of the company. Besides the statutory meeting a company must hold one general meeting at least in every calendar year, and not more than fifteen months after the holding of the last preceding general meeting (Companies (Consolidation) Act 1908, s. 64). This annual general meeting is usually called the ordinary general meeting. Other meetings are extraordinary general meetings. Notices convening a general meeting must inform the shareholders of the particular business to be transacted; otherwise any resolutions passed at the meeting will be invalidated. Voting is generally regulated by the articles. Sometimes a vote is given to a shareholder for every share held by him, but more often a scale is adopted; for instance, one vote is given for every share up to ten, with an additional vote for every five shares beyond the first ten shares up to one hundred, and an additional vote for every ten shares beyond the first hundred. In default of any regulations, every member has one vote only. Sometimes preference shareholders are given no vote at all. A poll may be demanded on any special resolution by three persons unless the articles require five (Companies (Consolidation) Act 1908, s. 69).

Meetings.

A contract to take shares is like any other contract. It is constituted by offer, acceptance

and communication of the acceptance to the offerer. The offer in the case of shares is usually in the form of an application in writing to the company, made in response to a prospectus, requesting the company to allot the applicant a certain number of shares in the undertaking on the terms of the prospectus, and agreeing to accept the shares, or any smaller number, which may be allotted to the applicant. An allottee is under the Companies (Consolidation) Act 1908, s. 86, entitled to rescind his contract where the allotment is irregular, *e.g.* where the minimum subscription has not been obtained. When an application is accepted the shares are allotted, and a letter of allotment is posted to the applicant. Allotment is the usual, but not the only, evidence of acceptance. As soon as the letter of allotment is posted the contract is complete, even though the letter never reaches the applicant. An application for shares can be withdrawn at any time before acceptance. As soon as the contract is complete, it is the duty of the company to enter the shareholder's name in the register of members, and to issue to him a certificate under the seal of the company, evidencing his title to the shares.

Agreement for shares.

The register of members plays an important part in the scheme of the company system, under the Companies Act 1862. The principle of limited liability having been once adopted by the legislature, justice required not only that such limitation of liability should be brought home by every possible means to persons dealing with the company, but also that such persons should know as far as possible what was the limited capital which was the sole fund available to satisfy their claims—what amount had been called up, what remained uncalled, who were the persons to pay, and in what amounts. These data might materially assist a person dealing with the company in determining, whether he would give it credit or not; in any case they are matters which the public had a right to know. The legislature, recognizing this, has exacted as a condition of the privilege of trading with limited liability that the company shall keep a register with those particulars in it, which shall be accessible to the public at all reasonable times. In order that this register may be accurate, and correspond with the true liability of membership for the time being, the court is empowered under the Companies Act 1862, and the Companies (Consolidation) Act 1908, s. 32, to rectify it in a summary way, on application by motion, by ordering the name of a person to be entered on or removed therefrom. This power can be exercised by the court, whether the dispute as to membership is one between the company and an alleged member, or between one alleged member and another, but the machinery of the section is not meant to be used to try claims to rescind agreements to take shares. The proper proceeding in such cases is by action.

Register of members.

The same policy of guarding against an abuse of limited liability is evinced in the Companies Act 1862, which required that shares in the case of a limited company should be paid for in full. The legislature has allowed such companies to trade with limited liability, but the price of the privilege is that the limited capital to which alone the creditors can look shall at least be a reality. It is therefore *ultra vires* for a limited company to issue its shares at a discount; but there was nothing in the Companies Act 1862 which required that the shares of a limited company, though they must be paid up in full, must be paid up in cash. They might be paid "in meal or in malt," and it accordingly became common for shares to be allotted in payment for furniture, plate, advertisements or services. The result was that the consideration was often illusory, shares being issued to be paid for in some commodity which had no certain criterion of value. To remedy this evil the legislature enacted in the Companies Act 1867, s. 25, that every share in any company should be held subject to the payment of the whole amount thereof in cash, unless otherwise determined by a contract in writing filed with the registrar of joint stock companies at or before the issue of the shares. This section not infrequently caused hardship where shares had been honestly paid for in the equivalent of cash, but owing to inadvertence no contract had been filed; and it was repealed by the Companies Act 1900, and the old law restored. In reverting to the earlier law, and allowing shares to be paid for in any adequate consideration, the legislature has, however, exacted a safeguard. It has required the company to file with the registrar of joint stock companies a return stating, in the case of shares allotted in whole or in part for a consideration other than cash, the number of the shares so allotted, and the nature of the consideration—property, services, &c.—for which they have been allotted.

Payment for shares.

Though every share carries with it the liability to pay up the full amount in cash or its equivalent, the liability is only to pay when and if the directors call for it to be paid up. A call must fix the time and place for payment, otherwise it is bad.

When a person takes shares from a company on the faith of a prospectus containing any false or fraudulent representations of fact material to the contract, he is entitled to rescind

Rescission of agreement. the contract. The company cannot keep a contract obtained by the misrepresentation or fraud of its agents. This is an elementary principle of law. The misrepresentation, for purposes of rescission, need not be fraudulent; it is sufficient that it is false in fact: fraud or recklessness of assertion will give the shareholder a further remedy by action of deceit, or under the Directors' Liability Act 1890 (see *supra*); but, to entitle a shareholder to rescind, he must show that he took the shares on the faith or partly on the faith of the false representation: if not, it was innocuous. A shareholder claiming to rescind must do so promptly. It is too late to commence proceedings after a winding-up has begun.

Transfer of shares. The shares or other interest of any member in a company are personal estate and may be transferred in the manner provided by the regulations of the company. As Lord Blackburn said, one of the chief objects when joint stock companies were established was that the shares should be capable of being easily transferred; but though every shareholder has a prima facie right to transfer his shares, this right is subject to the regulations of the company, and the company may and usually does by its regulations require that a transfer shall receive the approval of the board of directors before being registered,—the object being to secure the company against having an insolvent or undesirable shareholder (the nominee perhaps of a rival company) substituted for a solvent and acceptable one. This power of the directors to refuse a transfer must not, however, be exercised arbitrarily or capriciously. If it were, it would amount to a confiscation of the shares. Directors, for instance, cannot veto a transfer because they disapprove of the purpose for which it is being made (*e.g.* to multiply votes), if there is no objection to the transferee.

Blank transfers. It is a common and convenient practice to deposit share or stock certificates with bankers and others to secure an advance. When this is done the share or stock certificate is usually accompanied by a blank transfer—that is, a transfer executed by the shareholder borrower, but with a blank left for the name of the transferee. The handing over by the borrower of such blank transfer signed by him is an implied authority to the banker, or other pledgee, if the loan is not paid, to fill in the blank with his name and get himself registered as the owner.

Dividends. A company can only pay dividends out of profits—which have been defined as the "earnings of a concern after deducting the expenses of earning them." To pay dividends out of capital is not only *ultra vires* but illegal, as constituting a return of capital to shareholders. Before paying dividends, directors must take reasonable care to secure the preparation of proper balance-sheets and estimates, and must exercise their judgment as business men on the balance-sheets and estimates submitted to them. If they fail to do this, and pay dividends out of capital, they will not be held excused, unless the court should think that they ought to be under the new discretion given to the court by ss. 32-34 of the Companies Act 1907 (Companies (Consolidation) Act 1908, s. 279). The onus is on them to show that the dividends have been paid out of profits. The court as a rule does not interfere with the discretion of directors in the matter of paying dividends, unless they are doing something *ultra vires*.

Auditors. By the Companies (Consolidation) Act 1908, ss. 112, 113, incorporating provisions of the act of 1900 (ss. 21-23), as amended by the act of 1907 (s. 19), the legislature has made strict provisions for the appointment and remuneration of auditors by a company, and has defined their rights and duties. Prior to the act of 1900 audit clauses, except in the case of banking companies, were left to the articles of association and were not matter of statutory obligation.

Private companies. The "private company" may best be described as an incorporated partnership. The term is statutorily defined—for the first time—by s. 37 of the Companies Act 1907 (s. 121 of the Consolidating Act of 1908). Individual traders and trading firms have in recent years become much more alive to the advantages offered by incorporation. They have discovered that incorporation gives them the protection of limited liability; that it prevents dislocation of a business by the death, bankruptcy or lunacy of any of its members; that it enables a trader to distribute among the members of his family interests in his business on his decease through the medium of shares; that it facilitates borrowing on debentures or debenture stock, and with a view to secure these advantages thousands of traders have converted their businesses into limited companies. To so large an extent has this been done that private companies now form one-third of the whole number of companies registered.

A private company does not appeal to the public to subscribe its capital, but in the main

features of its constitution a private company differs little from a public one. It is only in one or two particulars that special provisions are requisite. It is generally desired for instance: (1) to keep all the shares among the members—the partners or the family—and not to let them get into the hands of the public; and (2) to give the principal shareholders, the original partners, a paramount control over the management. For this purpose it is usual to provide specially in the articles that no share shall be transferred to a stranger so long as any member is willing to purchase it at a fair value; that a member desirous of transferring his shares shall give notice to the company; that the company shall offer the shares to the other members; that if within a certain period the company finds a purchaser the shares shall be transferred to him, and that in case of dispute the value shall be settled by arbitration or shall be such a sum as the auditor certifies to be in his opinion the fair value. So in regard to the management it is common to provide that the owner or owners of the business shall be entitled to hold office as directors for a term of years or for life, provided he or they continue to hold a certain number of shares; or an owner is empowered to authorize his executors or trustees whilst holding a certain number of shares to appoint directors. Directors holding office on these special terms are described as “governing” or “permanent” or “life” directors. This union of interest and management in the same persons gives a private company an unquestionable advantage over a public company.

The so-called “one-man company” is merely a variety of the private company. The fact that a company is formed by one man, with the aid of six dummy subscribers, is not in itself (as was at one time supposed) a fraud on the policy of the Companies Act, but it is occasionally used for the purpose of committing a fraud, as where an insolvent trader turns himself into a limited company in order to evade bankruptcy; and it is to an abuse of this kind that the term “one-man company” owes its opprobrious signification.

Companies Limited by Guarantee.—The second class of limited companies are those limited by guarantee, as distinguished from those limited by shares. In the company limited by guarantee each member agrees, in the event of a winding-up, to contribute a certain amount to the assets,—£5, £1 or 10s.—whatever may be the amount of the guarantee. The peculiarity of this form of company is that the interests of the members of a guarantee company are not expressed in any terms of nominal money value like the shares of other companies, a form of constitution designed, as stated by Lord Thring, the draftsman of the Companies Act 1862, to give a superior elasticity to the company. The property of the company simply belongs to the company in certain fractional amounts. This makes it convenient for clubs, syndicates and other associations which do not require the interest of members to be expressed in terms of cash.

Companies not for Gain.—Associations formed to promote commerce, art, science, religion, charity or any other useful object may, with the sanction of the Board of Trade, register under the Companies Act 1862, with limited liability, but without the addition of the word “Limited,” upon proving to the board that it is the intention of the association to apply the profits or income of the association in promoting its objects, and not in payment of dividends to members (C.A. 1867, s. 23). This licence was made revocable by s. 42 of the Companies Act 1907 (Consolidation Act of 1908, ss. 19, 20). In lieu of the word “Company,” the association may adopt as part of its name some such title as chamber, club, college, guild, institute or society. The power given by this section has proved very useful, and many kinds of associations have availed themselves of it, such as medical institutes, law societies, nursing homes, chambers of commerce, clubs, high schools, archaeological, horticultural and philosophical societies. The guarantee form (see *supra*) is well adapted for associations of this kind intended as they usually are to be supported by annual subscriptions. No such association can hold more than two acres of land without the licence of the Board of Trade.

Cost-Book Mining Companies.—These are in substance mining partnerships. They derive their name from the fact of the partnership agreement, the expenses and receipts of the mine, the names of the shareholders, and any transfers of shares being entered in a “cost-book.” The affairs of the company are managed by an agent known as a “purser,” who from time to time makes calls on the members for the expenses of working. A cost-book company is not bound to register under the Companies Act 1862, but it may do so.

Winding-up.

A company once incorporated under the Companies Act 1862 cannot be put an end to except through the machinery of a winding-up, though the name of a company which is commercially defunct may be struck off the register of joint stock companies by the registrar (s. 242 of the Companies (Consolidation) Act 1908, incorporating s. 7 of the act of 1880, as amended by s. 26 of the act of 1900). Winding-up is of two kinds: (1) voluntary winding-up, either purely voluntary or carried on under the supervision of the court; and (2) winding-up by the court. Of these

voluntary winding-up is by far the more common. Of the companies that come to an end 90% are so wound up; and this is in accordance with the policy of the legislature, evinced throughout the Companies Acts, that shareholders should manage their own affairs—winding-up being one of such affairs. A voluntary winding-up is carried out by the shareholders passing a special resolution requiring the company to be wound up voluntarily, or an extraordinary resolution (now defined by s. 182 of the Companies (Consolidation) Act 1908) to the effect that it has been proved to the shareholders' satisfaction that the company cannot, by reason of its liabilities, continue its business, and that it is advisable to wind it up (C.A. 1862, s. 129). The resolution is generally accompanied by the appointment of a liquidator. In a purely voluntary winding-up there is a power given by s. 138 for the company or any contributory to apply to the court in any matter arising in the winding-up, but seemingly by an oversight of the legislature the same right was not given to creditors. This was rectified by the Companies Act 1900, s. 25. Section 27 of the Companies Act 1907 (s. 188 of the Consolidation Act 1908) further provides for the liquidator under a voluntary winding-up summoning a meeting of creditors to determine on the choice of a liquidator. A creditor may also in a proper case obtain an order for continuing the voluntary winding-up under the supervision of the court. Such an order has the advantage of operating as a stay of any actions or executions pending against the company. Except in these respects, the winding-up remains a voluntary one. The court does not actively intervene unless set in motion; but it requires the liquidator to bring his accounts into chambers every quarter, so that it may be informed how the liquidation is proceeding. When the affairs of the company are fully wound up, the liquidator calls a meeting, lays his accounts before the shareholders, and the company is dissolved by operation of law three months after the date of the meeting (C.A. 1862, ss. 142, 143).

Voluntary.

Irrespective of voluntary winding-up, the legislature has defined certain events in which a company formed under the Companies Act 1862 may be wound up by the court. These events are: (1) when the company has passed a resolution requiring the company to be wound up by the court; (2) when the company does not commence its business within a year or suspends it for a year; (3) when the members are reduced to less than seven; (4) when the company is unable to pay its debts, and (5) whenever the court is of opinion that it is just and equitable that the company should be wound up (C.A. 1862, s. 79; s. 129 of the Consolidation Act 1908). A petition for the purpose may be presented either by a creditor, a contributory or the company itself. Where the petition is presented by a creditor who cannot obtain payment of his debt, a winding-up order is *ex debito justitiae* as against the company or shareholders, but not as against the wishes of a majority of creditors. A winding-up order is not to be refused because the company's assets are over mortgaged (Companies Act 1907, s. 29; s. 141 of Consolidation Act 1908).

By the court.

The procedure on the making of a winding-up order is now governed by ss. 7, 8, 9 of the Winding-up Act 1890. The official receiver, as liquidator pro tem., requires a statement of the affairs of the company verified by the directors, and on it reports to the court as to the causes of the company's failure and whether further inquiry is desirable. If he further reports that in his opinion fraud has been committed in the promotion or formation of the company by a particular person, the court may order such person to be publicly examined.

A liquidator's duty is to protect, collect, realize and distribute the company's assets in due course of administration; and for this purpose he advertises for creditors, makes calls on contributories, sues debtors, takes misfeasance proceedings, if necessary, against directors or promoters, and carries on the company's business—supposing the goodwill to be an asset of value—with a view to selling it as a going concern. He may be assisted, like a trustee in bankruptcy, by a committee of inspection, composed of creditors and contributories.

When the affairs of the company have been completely wound up the court is, by s. 111 of the Companies Act 1862 (s. 127 of the act of 1908), to make an order that the company be dissolved from the date of such order, and the company is dissolved accordingly. A company which has been dissolved may, where necessary, on petition to the court be reinstated on the register (Companies Act 1880, s. 1).

A large number of companies now wind up only to reconstruct. The reasons for a reconstruction are generally either to raise fresh capital, or to get rid of onerous preference shares, or to enlarge the scope of the company's objects, which is otherwise impracticable owing to the unalterability of the Memorandum of Association. Reconstructions are carried out in one of three ways: (1) by sale and transfer of the company's undertaking and assets to a new company, under a power to sell contained in the company's memorandum of association, or (2) by sale and transfer

Reconstruction.

under s. 161 of the Companies Act 1862; or (3) by a scheme of arrangement, sanctioned by the court, under the Joint Stock Companies Arrangements Act 1870, as amended by the Companies Act 1907, s. 38 (C.A. 1908, s. 192).

The first of these modes is now the most in favour.

Wrongs by a company.

A company, though a mere legal abstraction, without mind or will, may, it is now well settled, be liable in damages for malicious prosecution, for nuisance, for fraud, for negligence, for trespass. The sense of the thing is that the "company" is a *nomen collectivum* for the members. It is they who have put the directors there to carry on their business and they must be answerable, collectively, for what is done negligently, fraudulently or maliciously by their agents.

2. Public Companies.

Besides trading companies there is another large class, exceeding in their number even trading companies, which for shortness may be called public companies, that is to say, companies constituted by special act of parliament for the purpose of constructing and carrying on undertakings of public utility, such as railways, canals, harbours, docks, waterworks, gasworks, bridges, ferries, tramways, drainage, fisheries or hospitals. The objects of such companies nearly always involve an interference with the rights of private persons, often necessitate the commission of a public nuisance, and require therefore the sanction of the legislature. For this purpose a special act has to be obtained. A private bill to authorize the undertaking is introduced before one or other of the Houses of Parliament, considered in committee, and either passed or rejected like a public bill. These parliamentary (private bill) committees are tribunals acknowledging certain rules of policy, taking evidence from witnesses and hearing arguments from professional advocates. In many of these special acts, dealing as they do with a similar subject matter, similar provisions are required, and to avoid repetition and secure uniformity the legislature has passed certain general acts—codes of law for particular subject matters frequently recurring—which can be incorporated by reference in any special act with the necessary modifications. Thus the Companies Clauses Acts 1845, 1863 and 1869 supply the general powers and provisions which are commonly inserted in the constitution of such public company, regulating the distribution of capital, the transfer of shares, payment of calls, borrowing and general meetings. The Lands Clauses Consolidation Act 1845 supplies the machinery for the compulsory taking of land incident to most undertakings of a public character. The Railway Clauses Consolidation Act, the Waterworks Clauses Acts 1847 and 1863, the Gasworks Clauses Act 1847, and the Electric Lighting (Clauses) Act 1899 are other codes of law designed for incorporation in special acts creating companies for the construction of railways or the supply of water, gas or electric light. A distinguishing feature of these companies is that, being sanctioned by the legislature for undertakings of public utility, the policy of the law will not allow them to be broken up or destroyed by creditors. It gives creditors only a charge—by a receiver—on the earnings of the undertaking—the "fruit of the tree."

3. British Companies Abroad.

The status of British companies trading abroad, so far as Germany, France, Belgium, Greece, Italy and Spain are concerned, is expressly recognized in a series of conventions entered into between those countries and Great Britain. The value of the convention with France has been much impaired by the interpretation put upon the words of it by the court of cassation in *La Construction Lim*. According to this case the nationality of a company depends not on its place of origin but on where it has its centre of affairs, its principal establishment. The result is that a company registered in Britain under the Companies Acts may be transmuted by a French court into a French company in direct violation of the convention. The convention with Germany, which is in similar terms to that with France, has also been narrowed by judicial construction. The "power of exercising all their rights" given by the convention to British companies has been construed to mean that a British company will be recognized as a corporate body in Germany, but it does not follow from the terms of the convention that any British company may as a matter of course establish a branch and carry on business within the German empire. It must still get permission to trade, permission to hold land. It must register itself in the communal register. It must pay stamp duties.

Foreign companies may found an affiliated company or have a branch establishment in Italy, provided they publish their memorandum and articles and the names of their directors. Where no convention exists the status of an immigrant corporation depends upon

international comity, which allows foreign corporations, as it does foreign persons, to sue, to make contracts and hold real estate, in the same way as domestic corporations or citizens; provided the stranger corporation does not offend against the policy of the state in which it seeks to trade.

There is, however, a growing practice now for states to impose by express legislation conditions on foreign corporations coming to do business within their territory. These conditions are mainly directed to securing that the immigrant corporation shall make known its constitution and shall be amenable to the jurisdiction of the courts of the country where it trades. Thus, by the law of Western Australia—to take a typical instance,—a foreign company is not to commence or carry on business until it empowers some person to act as its attorney to sue and be sued and has an office or place of business within the state, to be approved of by the registrar, where all legal proceedings may be served. New Zealand, Manitoba and many other states have adopted similar precautions; and by the Companies Act 1907, s. 35; C.A. 1908, s. 274 foreign companies having a place of business within the United Kingdom are required to file with the registrar of joint stock companies a copy of the company's charter or memorandum and articles, a list of directors, and the names and addresses of one or more persons authorized to accept service of process. Special conditions of a more stringent nature are often imposed in the case of particular classes of companies of a quasi-public character, such as banking companies, building societies or insurance companies. Regulations of this kind are perfectly legitimate and necessary. They are in truth only an application of the law of vagrancy to corporations, and have their analogy in the restrictions now generally imposed by states on the immigration of aliens.

4. Company Law outside the United Kingdom.

Australia.—Company law in Australia and in New Zealand follows very closely the lines of company legislation in the United Kingdom.

In New South Wales the law is consolidated by Act No. 40 of 1899, amended 1900 and 1906. In Victoria the law is contained in the Acts Nos. 1074 of 1890 and 355 of 1896; in Queensland in a series of Acts—No. 4 of 1863, No. 18 of 1899, No. 10 of 1891, No. 24 of 1892, No. 3 of 1893, No. 19 of 1894 and No. 21 of 1896; in South Australia in No. 56 of 1892, amended by No. 576 of 1893; in Tasmania by Nos. 22 of 1869, 19 of 1895 and 3 of 1896; in Western Australia by No. 8 of 1893, amended 1897 and 1898.

In New Zealand the law was consolidated in 1903.

Canada.—The act governing joint stock companies in Canada is the Companies Act 1902, amended 1904. It empowers the secretary of state by letters patent to grant a charter to any number of persons not less than five for any objects other than railway or telegraph lines, banking or insurance.

Applicants must file an application—analogous to the British memorandum of association—showing certain particulars—the purposes of incorporation, the place of business, the amount of the capital stock, the number of shares and the amount of each, the names and addresses of the applicants, the amount of stock taken by each and the amount and mode of payment. Other provisions may also be embodied. A company cannot commence business until 10% of its authorized capital has been subscribed and paid for. The word "limited" as part of the company's name is—as in the case of British companies—to be conspicuously exhibited and used in all documents. The directors are not to be less than three or more than fifteen, and must be holders of stock. Directors are jointly and severally liable to the clerks, labourers and servants of the company for six months' wages. Borrowing powers may be taken by a vote of holders of two-thirds in value of the subscribed stock of the company.

South Africa.—In Cape Colony the law is contained in No. 25 of 1892, amended 1895 and 1906; it follows English law.

In Natal the law is contained in Nos. 10 of 1864, 18 of 1865, 19 of 1893 and 3 of 1896.

In the Orange Free State in Law Ch. 100 and Nos. 2 and 4 of 1892.

For the Transvaal see Nos. 5 of 1874, 6 of 1874, 1 of 1894 and 30 of 1904.

In Rhodesia companies are regulated by the Companies Ordinance 1895—a combination of the Cape Companies Act 1892, and the British Companies Acts 1862-1890.

France.—There are two kinds of limited liability companies in France—the *société en commandite* and the *société anonyme*. The *société en commandite* corresponds in some respects to the British private company or limited partnership, but with this difference, that

in the *société en commandite* the managing partner is under unlimited liability of creditors; the sleeping partner's liability is limited to the amount of his capital. The French equivalent of the English ordinary joint stock company is the *société anonyme*. The minimum number of subscribers necessary to form such a company is (as in the case of a British trading company) seven, but, unlike a British company, the *société anonyme* is not legally constituted unless the whole capital is subscribed and one-fourth of each share paid up. Another precaution unknown to British practice is that assets, not in money, brought into a company are subject to verification of value by a general meeting. The minimum nominal value of shares, where the company's capital is less than 200,000 fcs., is 25 fcs.; where the capital is more than 200,000 fcs., 100 fcs. The *société* is governed by articles which appoint the directors, and there is one general meeting held every year. A *société anonyme* may, since 1902, issue preference shares. The doctrine that a corporation never dies has no place in French law. A *société anonyme* may come to an end.

Germany.—In Germany the class of companies most nearly corresponding to English companies limited by shares are "share companies" (*Aktiengesellschaften*) and "commandite companies" with a share capital (*Kommanditgesellschaften auf Aktien*). Since 1892 a new form of association has come into existence known by the name of partnership with limited liability (*Gesellschaften mit beschrankter Haftung*), which has largely superseded the commandite company.

The "share company."

In forming this paid-up company certain preliminary steps have to be taken before registration:—

1. The articles must be agreed on;

2. A managing board and a board of supervision must be appointed;

3. The whole of the share capital must be allotted and 25%, at least, must be paid up in coin or legal tender notes;

4. Reports on the formation of the company must be made by certain persons; and

5. Certain documents must be filed in the registry.

In all cases where shares are issued for any consideration, not being payment in full in cash, or in which contracts for the purchase of property have been entered into, the promoters must sign a declaration in which they must state on what grounds the prices agreed to be given for such property appear to be justified. In the great majority of cases shares are issued in certificates to bearer. The amount of such a share—to bearer—must as a general rule be not less than £50, but registered shares of £10 may be issued. Balance sheets have to be published periodically.

Partnerships with limited liability may be formed by two or more members. The articles of partnership must be signed by all the members, and must contain particulars as to the amount of the capital and of the individual shares. If the liability on any shares is not to be satisfied in cash this also must be stated. The capital of a limited partnership must amount to £1000. Shares must be registered. Insolvent companies in Germany are subject to the bankruptcy law in the same manner as natural persons.

Limited partnerships.

For further information see a memorandum on German companies printed in the appendix to the *Report of Lord Davey's Committee on the Amendment of Company Law*, pp. 13-26.

Italy.—Commercial companies in Italy are of three kinds:—(1) General partnerships, in which the members are liable for all debts incurred; (2) companies in *accomodita*, in which some members are liable to an unlimited extent and others within certain limits; (3) joint stock companies, in which the liability is limited to the capital of the company and no member is liable beyond the amount of his holding. None of these companies needs authority from the government for its constitution; all that is needed is a written agreement brought before the public in the ways indicated in the code (Art. 90 et seq.). In joint stock companies the trustees (directors) must give security. They are appointed by a general meeting for a period not exceeding four years (Art. 124). The company is not constituted until the whole of its capital is subscribed, and until three-tenths of the capital at least has been actually paid up. When a company's capital is diminished by one-third, the trustees must call the members together and consult as to what is to be done.

An ordinary meeting is held once at least every year. Shares may not be made payable "to bearer" until fully paid up (Art. 166). A company may issue debentures if this is agreed to by a certain majority (Art. 172). One-twentieth, at least, of the dividends of the company must

be added to the reserve fund, until this has become equal to one-fifth of the company's capital (Art. 182). Three or five assessors—members or non-members—keep watch over the way in which the company is carried on.

United States.—In the United States the right to create corporations is a sovereign right, and as such is exercisable by the several states of the Union. The law of private corporations must therefore be sought in some fifty collections or groups of statutory and case-made rules. These collections or groups of rules differ in many cases essentially from each other. The acts regulating business corporations generally provide that the persons proposing to form a corporation shall sign and acknowledge an instrument called the articles of association, setting forth the name of the corporation, the object for which it is to be formed, the principal place of business, the amount of its capital stock, and the number of shares into which it is to be divided, and the duration of its corporate existence. These articles are filed in the office of the secretary of state or in designated courts of record, and a certificate is then issued reciting that the provisions of the act have been complied with, and thereupon the incorporators are vested with corporate existence and the general powers incident thereto. This certificate is the charter of the corporation. The power to make bylaws is usually vested in the stockholders, but it may be conferred by the certificate on the directors. Stockholders remain liable until their subscriptions are fully paid. Nothing but money is considered payment of capital stock except where property is purchased. Directors must usually be stockholders.

The right of a state to forfeit a corporation's charter for misuser or non-user of its franchises is an implied term of the grant of incorporation. Corporations are liable for every wrong they commit, and in such cases cannot set up by way of protection the doctrine of *ultra vires*.

See for authorities *Commentaries on the Law of Private Corporations*, by Seymour D. Thompson, LL.D., 6 vols.; Beach on *Corporations*, and the *American Encyclopaedia of Law*.

(E. Ma.)

COMPARATIVE ANATOMY, a term employed to designate the study of the structure of man as compared with that of lower animals, and sometimes the study of lower animals in contra-distinction to human anatomy; the term is now falling into desuetude, and lingers practically only in the titles of books or in the designation of university chairs. The change in terminology is chiefly the result of modern conceptions of zoology. From the point of view of structure, man is one of the animals; all investigations into anatomical structure must be comparative, and in this work the subject is so treated throughout. See Anatomy and Zoology.

COMPARETTI, DOMENICO (1835-), Italian scholar, was born at Rome on the 27th of June 1835. He studied at the university of Rome, took his degree in 1855 in natural science and mathematics, and entered his uncle's pharmacy as assistant. His scanty leisure was, however, given to study. He learned Greek by himself, and gained facility in the modern language by conversing with the Greek students at the university. In spite of all disadvantages, he not only mastered the language, but became one of the chief classical scholars of Italy. In 1857 he published, in the *Rheinisches Museum*, a translation of some recently discovered fragments of Hypereides, with a dissertation on that orator. This was followed by a notice of the annalist Granius Licinianus, and one on the oration of Hypereides on the Lamian War. In 1859 he was appointed professor of Greek at Pisa on the recommendation of the duke of Sermoneta. A few years later he was called to a similar post at Florence, remaining emeritus professor at Pisa also. He subsequently took up his residence in Rome as lecturer on Greek antiquities and greatly interested himself in the Forum excavations. He was a member of the governing bodies of the academies of Milan, Venice, Naples and Turin. The list of his writings is long and varied. Of his works in classical literature, the best known are an edition of the *Euxenippus* of Hypereides, and monographs on Pindar and Sappho. He also edited the great inscription which contains a collection of the

municipal laws of Gortyn in Crete, discovered on the site of the ancient city. In the *Kalewala and the Traditional Poetry of the Finns* (English translation by I. M. Anderton, 1898) he discusses the national epic of Finland and its heroic songs, with a view to solving the problem whether an epic could be composed by the interweaving of such national songs. He comes to a negative conclusion, and applies this reasoning to the Homeric problem. He treats this question again in a treatise on the so-called Peisistratean edition of Homer (*La Commissione omerica di Pisistrato*, 1881). His *Researches concerning the Book of Sindibād* have been translated in the *Proceedings* of the Folk-Lore Society. His *Vergil in the Middle Ages* (translated into English by E. F. Benecke, 1895) traces the strange vicissitudes by which the great Augustan poet became successively grammatical fetich, Christian prophet and wizard. Together with Professor Alessandro d'Ancona, Comparetti edited a collection of Italian national songs and stories (9 vols., Turin, 1870-1891), many of which had been collected and written down by himself for the first time.

COMPASS (Fr. *compas*, ultimately from Lat. *cum*, with, and *passus*, step), a term of which the evolution of the various meanings is obscure; the general sense is "measure" or "measurement," and the word is used thus in various derived meanings—area, boundary, circuit. It is also more particularly applied to a mathematical instrument ("pair of compasses") for measuring or for describing a circle, and to the mariner's compass.

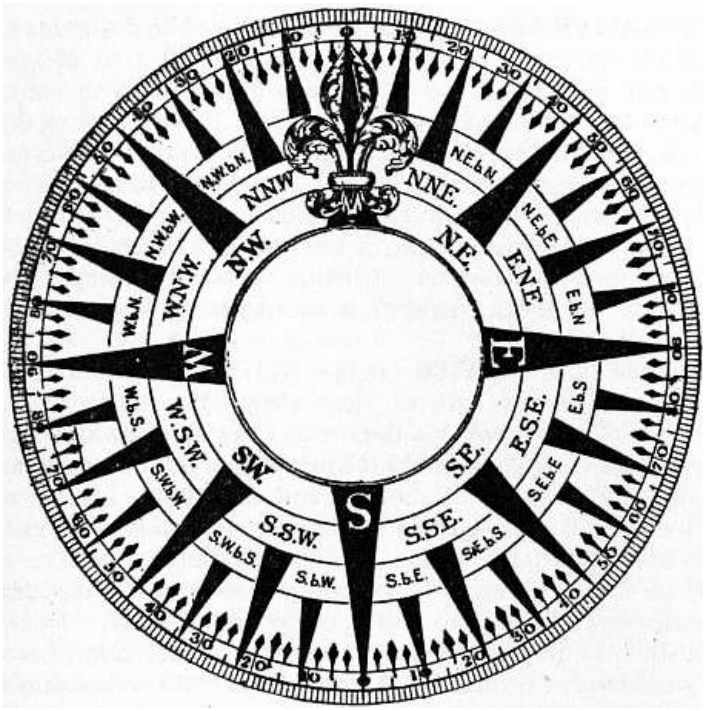

FIG. 1.—Compass Card.

The mariner's compass, with which this article is concerned, is an instrument by means of which the directive force of that great magnet, the Earth, upon a freely-suspended needle, is utilized for a purpose essential to navigation. The needle is so mounted that it only moves freely in the horizontal plane, and therefore the horizontal component of the earth's force alone directs it. The direction assumed by the needle is not generally towards the geographical north, but diverges towards the east or west of it, making a horizontal angle with the true meridian, called the magnetic variation or declination; amongst mariners this angle is known as the variation of the compass. In the usual navigable waters of the world the variation alters from 30° to the east to 45° to the west of the geographical meridian, being westerly in the Atlantic and Indian oceans, easterly in the Pacific. The vertical plane passing through the longitudinal axis of such a needle is known as the magnetic meridian. Following the first chart of lines of equal variation compiled by Edmund Halley in 1700, charts of similar type have been published from time to time embodying recent observations and corrected for the secular change, thus providing seamen with values of the variation accurate to about 30' of arc. Possessing these data, it is easy to ascertain by observation the effects of the iron in a ship in disturbing the compass, and it will be found for the most part

in every vessel that the needle is deflected from the magnetic meridian by a horizontal angle called the deviation of the compass; in some directions of the ship's head adding to the known variation of the place, in other directions subtracting from it. Local magnetic disturbance of the needle due to magnetic rocks is observed on land in all parts of the world, and in certain places extends to the land under the sea, affecting the compasses on board the ships passing over it. The general direction of these disturbances in the northern hemisphere is an attraction of the north-seeking end of the needle; in the southern hemisphere, its repulsion. The approaches to Cossack, North Australia; Cape St Francis, Labrador; the coasts of Madagascar and Iceland, are remarkable for such disturbance of the compass.

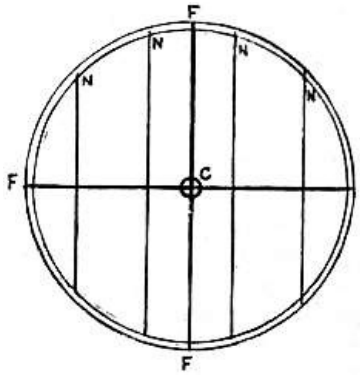

FIG. 2.—Admiralty Compass (Frame and Needles).

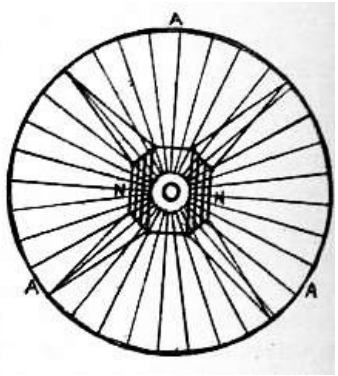

FIG. 3.—Thomson's (Lord Kelvin's) Compass (Frame and Needles).

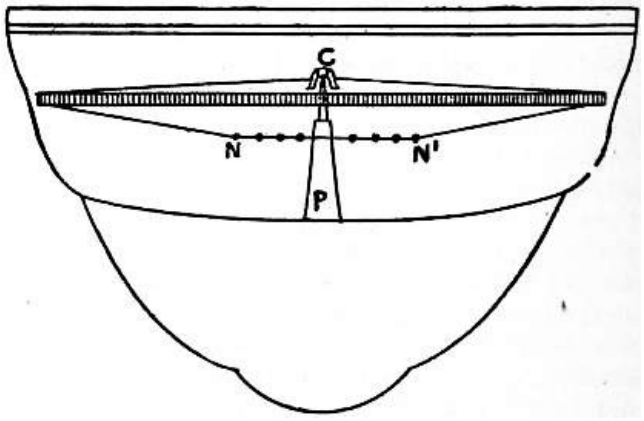

FIG. 4.—Section of Thomson's Compass Bowl. C, aluminium cap with sapphire centre; N, N', needles; P, pivot stem with pivot.

The compass as we know it is the result of the necessities of navigation, which have increased from century to century. It consists of five principal parts—the card, the needles, the bowl, a jewelled cap and the pivot. The card or "fly," formerly made of cardboard, now consists of a disk either of mica covered with paper or of paper alone, but in all cases the card is divided into points and degrees as shown in fig. 1. The outer margin is divided into degrees with 0° at north and south, and 90° at east and west; the 32 points with half and quarter points are seen immediately within the degrees. The north point is marked with *fleur de lis*, and the principal points, N.E., E., S.E., &c., with their respective names, whilst the intermediate points in the figure have also their names engraved for present information. The arc contained between any two points is 11° 15'. The mica card is generally mounted on a brass framework, F F, with a brass cap, C, fitted with a sapphire centre and carrying four magnetized needles, N, N, N, N, as in fig. 2. The more modern form of card consists of a broad ring of paper marked with degrees and points, as in fig. 1, attached to a frame like that in fig. 3, where an outer aluminium ring, A A, is connected by 32 radial silk threads to a central disk of aluminium, in the centre of which is a round hole designed to receive an aluminium cap with a highly polished sapphire centre worked to the form of an open cone. To direct the card eight short light needles, N N, are suspended by silk threads from the outer ring. The magnetic axis of any system of needles must exactly coincide with the axis passing through the north and south points of the card. Single needles are never used, two being the least number, and these so arranged that the moment of inertia about every diameter of the card shall be the same. The combination of card, needles and cap is generally termed "the card"; on the continent of Europe it is called the "rose." The section of a compass bowl in fig. 4 shows the mounting of a Thomson card on its pivot, which in

common with the pivots of most other compasses is made of brass, tipped with osmium-iridium, which although very hard can be sharply pointed and does not corrode. Fig. 4 shows the general arrangement of mounting all compass cards in the bowl. In fig. 5 another form of compass called a liquid or spirit compass is shown partly in section. The card nearly floats in a bowl filled with distilled water, to which 35% of alcohol is added to prevent freezing; the bowl is hermetically sealed with pure india-rubber, and a corrugated expansion chamber is attached to the bottom to allow for the expansion and contraction of the liquid. The card is a mica disk, either painted as in fig. 1, or covered with linen upon which the degrees and points are printed, the needles being enclosed in brass.

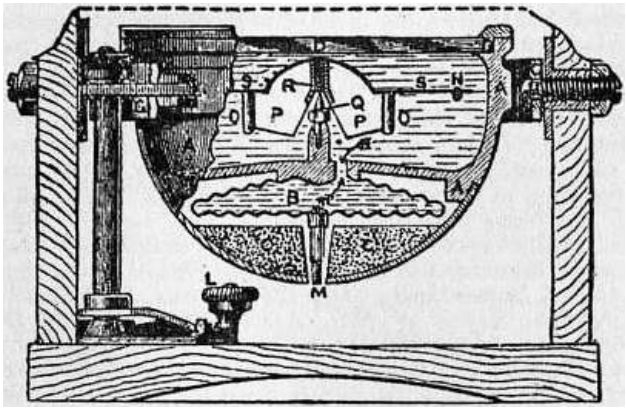

FIG. 5.—Liquid Compass.

A, Bowl, partly in section.
B, Expansion chamber.
D, The glass.
G, Gimbal ring.
L, Nut to expand chamber when filling bowl.
M, Screw connector.
N, Hole for filling, with screw plug.
O, O, Magnetic needles.
P, Buoyant chamber.
Q, Iridium pivot.
R, Sapphire cap.
S, Mica card.

Great steadiness of card under severe shocks and vibrations, combined with a minimum of friction in the cap and pivot, is obtained with this compass. All compasses are fitted with a gimbal ring to keep the bowl and card level under every circumstance of a ship's motion in a seaway, the ring being connected with the binnacle or pedestal by means of journals or knife edges. On the inside of every compass bowl a vertical black line is drawn, called the "lubber's point," and it is imperative that when the compass is placed in the binnacle the line joining the pivot and the lubber's point be parallel to the keel of the vessel. Thus, when a degree on the card is observed opposite the lubber's point, the angle between the direction in which the ship is steering and the north point of the compass or course is at once seen; and if the magnetic variation and the disturbing effects of the ship's iron are known, the desired angle between the ship's course and the geographical meridian can be computed. In every ship a position is selected for the navigating or standard compass as free from neighbouring iron as possible, and by this compass all courses are shaped and bearings taken. It is also provided with an azimuth circle or mirror and a shadow pin or style placed in the centre of the glass cover, by either of which the variable angle between the compass north and true north, called the "total error," or variation and deviation combined, can be observed. The binnacles or pedestals for compasses are generally constructed of wood about 45 in. high, and fitted to receive and alter at pleasure the several magnet and soft iron correctors. They are also fitted with different forms of suspension in which the compass is mounted to obviate the mechanical disturbance of the card caused by the vibration of the hull in ships driven by powerful engines.

The effects of the iron and steel used in the construction of ships upon the compass occupied the attention of the ablest physicists of the 19th century, with results which enable navigators to conduct their ships with perfect safety. The hull of an iron or steel ship is a magnet, and the distribution of its magnetism depends upon the direction of the ship's head when building, this result being produced by induction from the earth's magnetism, developed and impressed by the hammering of the plates and frames during the process of building. The disturbance of the compass by the magnetism of the hull is generally modified, sometimes favourably, more often unfavourably, by the magnetized fittings of the ship, such as masts, conning towers, deck houses, engines and boilers. Thus in every ship the compass needle is more or less subject to deviation differing in amount and direction for every azimuth of the ship's head. This was first demonstrated by Commander Matthew Flinders by experiments made in H.M.S. "Investigator" in 1800-1803, and in 1810 led that officer to

introduce the practice of placing the ship's head on each point of the compass, and noting the amount of deviation whether to the east or west of the magnetic north, a process which is in full exercise at the present day, and is called "swinging ship." When speaking of the magnetic properties of iron it is usual to adopt the terms "soft" and "hard." Soft iron is iron which becomes instantly magnetized by induction when exposed to any magnetic force, but has no power of retaining its magnetism. Hard iron is less susceptible of being magnetized, but when once magnetized it retains its magnetism permanently. The term "iron" used in these pages includes the "steel" now commonly employed in shipbuilding. If an iron ship be swung when upright for deviation, and the mean horizontal and vertical magnetic forces at the compass positions be also observed in different parts of the world, mathematical analysis shows that the deviations are caused partly by the permanent magnetism of hard iron, partly by the transient induced magnetism of soft iron both horizontal and vertical, and in a lesser degree by iron which is neither magnetically hard nor soft, but which becomes magnetized in the same manner as hard iron, though it gradually loses its magnetism on change of conditions, as, for example, in the case of a ship, repaired and hammered in dock, steaming in an opposite direction at sea. This latter cause of deviation is called sub-permanent magnetism. The horizontal directive force on the needle on board is nearly always less than on land, sometimes much less, whilst in armour-plated ships it ranges from .8 to .2 when the directive force on land = 1.0. If the ship be inclined to starboard or to port additional deviation will be observed, reaching a maximum on north and south points, decreasing to zero on the east and west points. Each ship has its own magnetic character, but there are certain conditions which are common to vessels of the same type.

Instead of observing the deviation solely for the purposes of correcting the indications of the compass when disturbed by the iron of the ship, the practice is to subject all deviations to mathematical analysis with a view to their mechanical correction. The whole of the deviations when the ship is upright may be expressed nearly by five co-efficients, A, B, C, D, E. Of these A is a deviation constant in amount for every direction of the ship's head. B has reference to horizontal forces acting in a longitudinal direction in the ship, and caused partly by the permanent magnetism of hard iron, partly by vertical induction in vertical soft iron either before or abaft the compass. C has reference to forces acting in a transverse direction, and caused by hard iron. D is due to transient induction in horizontal soft iron, the direction of which passes continuously under or over the compass. E is due to transient induction in horizontal soft iron unsymmetrically placed with regard to the compass. When data of this character have been obtained the compass deviations may be mechanically corrected to within 1°—always adhering to the principal that "like cures like." Thus the part of B caused by the permanent magnetism of hard iron must be corrected by permanent magnets horizontally placed in a fore and aft direction; the other part caused by vertical soft iron by means of bars of vertical soft iron, called Flinders bars, before or abaft the compass. C is compensated by permanent magnets athwart-ships and horizontal; D by masses of soft iron on both sides of the compass, and generally in the form of cast-iron spheres, with their centres in the same horizontal plane as the needles; E is usually too small to require correction; A is fortunately rarely of any value, as it cannot be corrected. The deviation observed when the ship inclines to either side is due—(1) to hard iron acting vertically upwards or downwards; (2) to vertical soft iron immediately below the compass; (3) to vertical induction in horizontal soft iron when inclined. To compensate (1) vertical magnets are used; (3) is partly corrected by the soft iron correctors of D; (2) and the remaining part of (3) cannot be conveniently corrected for more than one geographical position at a time. Although a compass may thus be made practically correct for a given time and place, the magnetism of the ship is liable to changes on changing her geographical position, and especially so when steaming at right angles or nearly so to the magnetic meridian, for then sub-permanent magnetism is developed in the hull. Some vessels are more liable to become sub-permanently magnetized than others, and as no corrector has been found for this source of deviation the navigator must determine its amount by observation. Hence, however carefully a compass may be placed and subsequently compensated, the mariner has no safety without constantly observing the bearings of the sun, stars or distant terrestrial objects, to ascertain its deviation. The results of these observations are entered in a compass journal for future reference when fog or darkness prevails.

Every compass and corrector supplied to the ships of the British navy is previously examined in detail at the Compass Observatory established by the admiralty at Deptford. A trained observer acting under the superintendent of compasses is charged with this important work. The superintendent, who is a naval officer, has to investigate the magnetic character of the ships, to point out the most suitable positions for the compasses when a ship is designed, and subsequently to keep himself informed of their behaviour from the

time of the ship's first trial. A museum containing compasses of various types invented during the 19th century is attached to the Compass Observatory at Deptford.

The mariner's compass during the early part of the 19th century was still a very imperfect instrument, although numerous inventors had tried to improve it. In 1837 the Admiralty Compass Committee was appointed to make a scientific investigation of the subject, and propose a form of compass suitable alike for azimuth and steering purposes. The committee reported in July 1840, and after minor improvements by the makers the admiralty compass, the card of which is shown in figs. 1 and 2, was adopted by the government. Until 1876, when Sir William Thomson introduced his patent compass, this compass was not only the regulation compass of the British navy, but was largely used in other countries in the same or a modified form. The introduction of powerful engines causing serious vibration to compass cards of the admiralty type, coupled with the prevailing desire for larger cards, the deviation of which could also be more conveniently compensated, led to the gradual introduction of the Thomson compass. Several important points were gained in the latter: the quadrantal deviation could be finally corrected for all latitudes; frictional error at the cap and pivot was reduced to a minimum, the average weight of the card being 200 grains; the long free vibrational period of the card was found to be favourable to its steadiness when the vessel was rolling. The first liquid compass used in England was invented by Francis Crow, of Faversham, in 1813. It is said that the idea of a liquid compass was suggested to Crow by the experience of the captain of a coasting vessel whose compass card was oscillating wildly until a sea broke on board filling the compass bowl, when the card became steady. Subsequent improvements were made by E. J. Dent, and especially by E. S. Ritchie, of Boston, Massachusetts. In 1888 the form of liquid compass (fig. 5) now solely used in torpedo boats and torpedo boat destroyers was introduced. It has also proved to be the most trustworthy compass under the shock of heavy gun fire at present available. The deflector is an instrument designed to enable an observer to reduce the deviations of the compass to an amount not exceeding 2° during fogs, or at any time when bearings of distant objects are not available. It is certain that if the directive forces on the north, east, south and west points of a compass are equal, there can be no deviation. With the deflector any inequality in the directive force can be detected, and hence the power of equalizing the forces by the usual soft iron and magnet correctors. Several kinds of deflector have been invented, that of Lord Kelvin (Sir William Thomson) being the simplest, but Dr Waghorn's is also very effective. The use of the deflector is generally confined to experts.

The Magnetism of Ships.—In 1814 Flinders first showed (see Flinders's *Voyage*, vol. ii. appx. ii.) that the abnormal values of the variation observed in the wood-built ships of his day was due to deviation of the compass caused by the iron in the ship; that the deviation was zero when the ship's head was near the north and south points; that it attained its maximum on the east and west points, and varied as the sine of the azimuth of the ship's head reckoned from the zero points. He also described a method of correcting deviation by means of a bar of vertical iron so placed as to correct the deviation nearly in all latitudes. This bar, now known as a "Flinders bar," is still in general use. In 1820 Dr T. Young (see Brande's *Quarterly Journal*, 1820) investigated mathematically the magnetism of ships. In 1824 Professor Peter Barlow (1776-1862) introduced his correcting plate of *soft* iron. Trials in certain ships showed that their magnetism consisted partly of hard iron, and the use of the plate was abandoned. In 1835 Captain E. J. Johnson, R.N., showed from experiments in the iron steamship "Garry Owen" that the vessel acted on an external compass as a magnet. In 1838 Sir G. B. Airy magnetically examined the iron steamship "Rainbow" at Deptford, and from his mathematical investigations (see *Phil. Trans.*, 1839) deduced his method of correcting the compass by permanent magnets and soft iron, giving practical rules for the same in 1840. Airy's and Flinders's correctors form the basis of all compass correctors to this day. In 1838 S. D. Poisson published his *Memoir on the Deviations of the Compass caused by the Iron in a Vessel*. In this he gave equations resulting from the hypothesis that the magnetism of a ship is partly due to the permanent magnetism of hard iron and partly to the transient induced magnetism of soft iron; that the latter is proportional to the intensity of the inducing force, and that the length of the needle is infinitesimally small compared to the distance of the surrounding iron. From Poisson's equations Archibald Smith deduced the formulae given in the *Admiralty Manual for Deviations of the Compass* (1st ed., 1862), a work which has formed the basis of numerous other manuals since published in Great Britain and other countries. In view of the serious difficulties connected with the inclining of every ship, Smith's formulae for ascertaining and providing for the correction of the heeling error with the ship upright continue to be of great value to safe navigation. In 1855 the Liverpool Compass Committee began its work of investigating the magnetism of ships of the mercantile marine, resulting in three reports to the Board of Trade, all of great value, the last being presented in 1861.

See also Magnetism, and Navigation; articles on Magnetism of Ships and Deviations of the Compass, *Phil. Trans.*, 1839-1883, *Journal United Service Inst.*, 1859-1889, *Trans. Inst. Nav.*

Archit., 1860-1861-1862, *Report of Brit. Assoc.*, 1862, *London Quarterly Rev.*, 1865; also *Admiralty Manual*, edit. 1862-1863-1869-1893-1900; and Towson's *Practical Information on Deviations of the Compass* (1886).

(E. W. C.)

History of the Mariner's Compass.

The discovery that a lodestone, or a piece of iron which has been touched by a lodestone, will direct itself to point in a north and south position, and the application of that discovery to direct the navigation of ships, have been attributed to various origins. The Chinese, the Arabs, the Greeks, the Etruscans, the Finns and the Italians have all been claimed as originators of the compass. There is now little doubt that the claim formerly advanced in favour of the Chinese is ill-founded. In Chinese history we are told how, in the sixty-fourth year of the reign of Hwang-ti (2634 B.C.), the emperor Hiuan-yuan, or Hwang-ti, attacked one Tchi-yeou, on the plains of Tchou-lou, and finding his army embarrassed by a thick fog raised by the enemy, constructed a chariot (Tchi-nan) for indicating the south, so as to distinguish the four cardinal points, and was thus enabled to pursue Tchi-yeou, and take him prisoner. (Julius Klaproth, *Lettre à M. le Baron Humboldt sur l'invention de la boussole*, Paris, 1834. See also Mailla, *Histoire générale de la Chine*, tom. i. p. 316, Paris, 1777.) But, as other versions of the story show, this account is purely mythical. For the south-pointing chariots are recorded to have been first devised by the emperor Hian-tsoung (A.D. 806-820); and there is no evidence that they contained any magnet. There is no genuine record of a Chinese marine compass before A.D. 1297, as Klaproth admits. No sea-going ships were built in China before 139 B.C. The earliest allusion to the power of the lodestone in Chinese literature occurs in a Chinese dictionary, finished in A.D. 121, where the lodestone is defined as "a stone with which an attraction can be given to a needle," but this knowledge is no more than that existing in Europe at least five hundred years before. Nor is there any nautical significance in a passage which occurs in the Chinese encyclopaedia, *Poei-wen-yun-fou*, in which it is stated that under the Tsin dynasty, or between A.D. 265 and 419, "there were ships indicating the south."

The Chinese, Sir J. F. Davis informs us, once navigated as far as India, but their most distant voyages at present extend not farther than Java and the Malay Islands to the south (*The Chinese*, vol. iii. p. 14, London, 1844). According to an Arabic manuscript, a translation of which was published by Eusebius Renaudot (Paris, 1718), they traded in ships to the Persian Gulf and Red Sea in the 9th century. Sir G. L. Staunton, in vol. i. of his *Embassy to China* (London, 1797), after referring to the early acquaintance of the Chinese with the property of the magnet to point southwards, remarks (p. 445), "The nature and the cause of the qualities of the magnet have at all times been subjects of contemplation among the Chinese. The Chinese name for the compass is *ting-nan-ching*, or needle pointing to the south; and a distinguishing mark is fixed on the magnet's southern pole, as in European compasses upon the northern one." "The sphere of Chinese navigation," he tells us (p. 447), "is too limited to have afforded experience and observation for forming any system of laws supposed to govern the variation of the needle.... The Chinese had soon occasion to perceive how much more essential the perfection of the compass was to the superior navigators of Europe than to themselves, as the commanders of the 'Lion' and 'Hindostan,' trusting to that instrument, stood out directly from the land into the sea." The number of points of the compass, according to the Chinese, is twenty-four, which are reckoned from the south pole; the form also of the instrument they employ is different from that familiar to Europeans. The needle is peculiarly poised, with its point of suspension a little below its centre of gravity, and is exceedingly sensitive; it is seldom more than an inch in length, and is less than a line in thickness. "It may be urged," writes Mr T. S. Davies, "that the different manner of constructing the needle amongst the Chinese and European navigators shows the independence of the Chinese of us, as theirs is the worse method, and had they copied from us, they would have used the better one" (Thomson's *British Annual*, 1837, p. 291). On the other hand, it has been contended that a knowledge of the mariner's compass was communicated by them directly or indirectly to the early Arabs, and through the latter was introduced into Europe. Sismondi has remarked (*Literature of Europe*, vol. i.) that it is peculiarly characteristic of all the pretended discoveries of the middle ages that when the historians mention them for the first time they treat them as things in general use. Gunpowder, the compass, the Arabic numerals and paper, are nowhere spoken of as discoveries, and yet they must have wrought a total change in war, in navigation, in science, and in education. G. Tiraboschi (*Storia della letteratura italiana*, tom. iv. lib. ii. p. 204, et seq., ed. 2., 1788), in support of the conjecture that the compass was introduced into Europe by the Arabs, adduces their superiority in scientific learning and their early skill in navigation. He quotes a passage on the polarity of the lodestone from a treatise translated

by Albertus Magnus, attributed by the latter to Aristotle, but apparently only an Arabic compilation from the works of various philosophers. As the terms *Zoron* and *Aphron*, used there to signify the south and north poles, are neither Latin nor Greek, Tiraboschi suggests that they may be of Arabian origin, and that the whole passage concerning the lodestone may have been added to the original treatise by the Arabian translators.

Dr W. Robertson asserts (*Historical Disquisition concerning Ancient India*, p. 227) that the Arabs, Turks and Persians have no original name for the compass, it being called by them *Bossola*, the Italian name, which shows that the thing signified is foreign to them as well as the word. The Rev. G. P. Badger has, however, pointed out (*Travels of Ludovico di Varthema*, trans. J. W. Jones, ed. G. P. Badger, Hakluyt Soc, 1863, note, pp. 31 and 32) that the name of Bushla or Busba, from the Italian *Bussola*, though common among Arab sailors in the Mediterranean, is very seldom used in the Eastern seas,—*Daïrah* and *Beit el-Ibrah* (the Circle, or House of the Needle) being the ordinary appellatives in the Red Sea, whilst in the Persian Gulf *Kiblah-nāmeh* is in more general use. Robertson quotes Sir J. Chardin as boldly asserting "that the Asiatics are beholden to us for this wonderful instrument, which they had from Europe a long time before the Portuguese conquests. For, first, their compasses are exactly like ours, and they buy them of Europeans as much as they can, scarce daring to meddle with their needles themselves. Secondly, it is certain that the old navigators only coasted it along, which I impute to their want of this instrument to guide and instruct them in the middle of the ocean.... I have nothing but argument to offer touching this matter, having never met with any person in Persia or the Indies to inform me when the compass was first known among them, though I made inquiry of the most learned men in both countries. I have sailed from the Indies to Persia in Indian ships, when no European has been aboard but myself. The pilots were all Indians, and they used the forestaff and quadrant for their observations. These instruments they have from us, and made by our artists, and they do not in the least vary from ours, except that the characters are Arabic. The Arabs are the most skilful navigators of all the Asiatics or Africans; but neither they nor the Indians make use of charts, and they do not much want them; some they have, but they are copied from ours, for they are altogether ignorant of perspective." The observations of Chardin, who flourished between 1643 and 1713, cannot be said to receive support from the testimony of some earlier authorities. That the Arabs must have been acquainted with the compass, and with the construction and use of charts, at a period nearly two centuries previous to Chardin's first voyage to the East, may be gathered from the description given by Barros of a map of all the coast of India, shown to Vasco da Gama by a Moor of Guzerat (about the 15th of July 1498), in which the bearings were laid down "after the manner of the Moors," or "with meridians and parallels very small (or close together), without other bearings of the compass; because, as the squares of these meridians and parallels were very small, the coast was laid down by these two bearings of N. and S., and E. and W., with great certainty, without that multiplication of bearings of the points of the compass usual in our maps, which serves as the root of the others." Further, we learn from Osorio that the Arabs at the time of Gama "were instructed in so many of the arts of navigation, that they did not yield much to the Portuguese mariners in the science and practice of maritime matters." (See *The Three Voyages of Vasco da Gama*, Hakluyt Soc, 1869; note to chap. xv. by the Hon. H. E. J. Stanley, p. 138.) Also the Arabs that navigated the Red Sea at the same period are shown by Varthema to have used the mariner's chart and compass (*Travels*, p. 31).

Again, it appears that compasses of a primitive description, which can hardly be supposed to have been brought from Europe, were employed in the East Indies certainly as early as several years previous to the close of the 16th century. In William Barlowe's *Navigator's Supply*, published in 1597, we read:—"Some fewe yeeres since, it so fell out that I had severall conferences with two East Indians which were brought into England by master Candish [Thomas Cavendish], and had learned our language: The one of them was of Mamillia [Manila] in the Isle of Luzon, the other of Miaco in Japan. I questioned with them concerning their shipping and manner of sayling. They described all things farre different from ours, and shewed, that in steade of our Compas, they use a magneticall needle of sixe ynches long, and longer, upon a pinne in a dish of white *China* earth filled with water; In the bottome whereof they have two crosse lines, for the foure principall windes; the rest of the divisions being reserved to the skill of their Pilots." Bailak Kibdjaki, also, an Arabian writer, shows in his *Merchant's Treasure*, a work given to the world in 1282, that the magnetized needle, floated on water by means of a splinter of wood or a reed, was employed on the Syrian seas at the time of his voyage from Tripoli to Alexandria (1242), and adds:—"They say that the captains who navigate the Indian seas use, instead of the needle and splinter, a sort of fish made out of hollow iron, which, when thrown into the water, swims upon the surface, and points out the north and south with its head and tail" (Klaproth, *Lettre*, p. 57). E.

Wiedemann, in *Erlangen Sitzungsberichte* (1904, p. 330), translates the phrase given above as splinter of wood, by the term wooden cross. Furthermore, although the sailors in the Indian vessels in which Niccola de' Conti traversed the Indian seas in 1420 are stated to have had no compass, still, on board the ship in which Varthema, less than a century later, sailed from Borneo to Java, both the mariner's chart and compass were used; it has been questioned, however, whether in this case the compass was of Eastern manufacture (*Travels of Varthema*, Introd. xciv, and p. 249). We have already seen that the Chinese as late as the end of the 18th century made voyages with compasses on which but little reliance could be placed; and it may perhaps be assumed that the compasses early used in the East were mostly too imperfect to be of much assistance to navigators, and were therefore often dispensed with on customary routes. The Arab traders in the Levant certainly used a floating compass, as did the Italians before the introduction of the pivoted needle; the magnetized piece of iron being floated upon a small raft of cork or reeds in a bowl of water. The Italian name of *calamita*, which still persists, for the magnet, and which literally signifies a frog, is doubtless derived from this practice.

The simple water-compass is said to have been used by the Coreans so late as the middle of the 18th century; and Dr T. Smith, writing in the *Philosophical Transactions* for 1683-1684, says of the Turks (p. 439), "They have no genius for Sea-voyages, and consequently are very raw and unexperienced in the art of Navigation, scarce venturing to sail out of sight of land. I speak of the natural *Turks*, who trade either into the *black Sea* or some part of the *Morea*, or between *Constantinople* and *Alexandria*, and not of the Pyrats of *Barbary*, who are for the most part Renegado's, and learnt their skill in Christendom. ... The Turkish compass consists but of 8 points, the four Cardinal and the four Collateral." That the value of the compass was thus, even in the latter part of the 17th century, so imperfectly recognized in the East may serve to explain how in earlier times that instrument, long after the first discovery of its properties, may have been generally neglected by navigators.

The Arabic geographer, Edrisi, who lived about 1100, is said by Boucher to give an account, though in a confused manner, of the polarity of the magnet (Hallam, *Mid. Ages*, vol. iii. chap. 9, part 2); but the earliest definite mention as yet known of the use of the mariner's compass in the middle ages occurs in a treatise entitled *De utensilibus*, written by Alexander Neckam in the 12th century. He speaks there of a needle carried on board ship which, being placed on a pivot, and allowed to take its own position of repose, shows mariners their course when the polar star is hidden. In another work, *De naturis rerum*, lib. ii. c. 89, he writes,—"Mariners at sea, when, through cloudy weather in the day which hides the sun, or through the darkness of the night, they lose the knowledge of the quarter of the world to which they are sailing, touch a needle with the magnet, which will turn round till, on its motion ceasing, its point will be directed towards the north" (W. Chappell, *Nature*, No. 346, June 15, 1876). The magnetical needle, and its suspension on a stick or straw in water, are clearly described in *La Bible Guiot*, a poem probably of the 13th century, by Guiot de Provins, wherein we are told that through the magnet (*la manette* or *l'amanière*), an ugly brown stone to which iron turns of its own accord, mariners possess an art that cannot fail them. A needle touched by it, and floated by a stick on water, turns its point towards the pole-star, and a light being placed near the needle on dark nights, the proper course is known (*Hist. littéraire de la France*, tom. ix. p. 199; Barbazan, *Fabliaux*, tom. ii. p. 328). Cardinal Jacques de Vitry, bishop of Acon in Palestine, in his *History* (cap. 89), written about the year 1218, speaks of the magnetic needle as "most necessary for such as sail the sea";[1] and another French crusader, his contemporary, Vincent de Beauvais, states that the adamant (lodestone) is found in Arabia, and mentions a method of using a needle magnetized by it which is similar to that described by Kibdjaki. In 1248 Hugo de Bercy notes a change in the construction of compasses, which are now supported on two floats in a glass cup. From quotations given by Antonio Capmany (*Questiones Criticas*) from the *De contemplatione* of Raimon Lull, of the date 1272, it appears that the latter was well acquainted with the use of the magnet at sea;[2] and before the middle of the 13th century Gauthier d'Espinois alludes to its polarity, as if generally known, in the lines:—

"Tous autresi comme l'aimant decoit [detourne]
L'aiguillette par force de vertu,
A ma dame tor le mont [monde] retenue
Qui sa beauté connoit et aperçoit."

Guido Guinizzelli, a poet of the same period, writes:—"In those parts under the north are the mountains of lodestone, which give the virtue to the air of attracting iron; but because it [the lodestone] is far off, [it] wishes to have the help of a similar stone to make it [the virtue]

work, and to direct the needle towards the star."[3] Brunetto Latini also makes reference to the compass in his encyclopaedia *Livres dou trésor*, composed about 1260 (Livre i. pt. ii. ch. cxx.):—"Por ce nagent li marinier à l'enseigne des estoiles qui i sont, que il apelent tramontaines, et les gens qui sont en Europe et es parties decà nagent à la tramontaine de septentrion, et li autre nagent à cele de midi. Et qui n'en set la verité, praigne une pierre d'aimant, et troverez que ele a ij faces: l'une qui gist vers l'une tramontaine, et l'autre gist vers l'autre. Et à chascune des ij faces la pointe d'une aguille vers cele tramontaine à cui cele face gist. Et por ce seroient li marinier deceu se il ne se preissent garde" (p. 147, Paris edition, 1863). Dante (*Paradiso*, xii. 28-30) mentions the pointing of the magnetic needle toward the pole star. In Scandinavian records there is a reference to the nautical use of the magnet in the *Hauksbók*, the last edition of the *Landnámabók* (Book of the Colonization of Iceland):—"Floki, son of Vilgerd, instituted a great sacrifice, and consecrated three ravens which should show him the way (to Iceland); for at that time no men sailing the high seas had lodestones up in northern lands."

Haukr Erlendsson, who wrote this paragraph about 1300, died in 1334; his edition was founded on material in two earlier works, that of Styrmir Karason (who died 1245), which is lost, and that of Hurla Thordson (died 1284) which has no such paragraph. All that is certain is a knowledge of the nautical use of the magnet at the end of the 13th century. From T. Torfaeus we learn that the compass, fitted into a box, was already in use among the Norwegians about the middle of the 13th century (*Hist. rer. Norvegicarum*, iv. c. 4, p. 345, Hafniae, 1711); and it is probable that the use of the magnet at sea was known in Scotland at or shortly subsequent to that time, though King Robert, in crossing from Arran to Carrick in 1306, as Barbour writing in 1375 informs us, "na nedill had na stane," but steered by a fire on the shore. Roger Bacon (*Opus majus* and *Opus minus*, 1266-1267) was acquainted with the properties of the lodestone, and wrote that if set so that it can turn freely (swimming on water) it points toward the poles; but he stated that this was not due to the pole-star, but to the influence of the northern region of the heavens.

The earliest unquestionable description of a pivoted compass is that contained in the remarkable *Epistola de magnete* of Petrus Peregrinus de Maricourt, written at Lucera in 1269 to Sigerus de Foncaucourt. (First printed edition Augsburg, 1558. See also Bertelli in Boncompagni's *Bollettino di bibliografia*, t. i., or S. P. Thompson in *Proc. British Academy*, vol. ii.) Of this work twenty-eight MSS. exist; seven of them being at Oxford. The first part of the epistle deals generally with magnetic attractions and repulsions, with the polarity of the stone, and with the supposed influence of the poles of the heavens upon the poles of the stone. In the second part Peregrinus describes first an improved floating compass with fiducial line, a circle graduated with 90 degrees to each quadrant, and provided with movable sights for taking bearings. He then describes a new compass with a needle thrust through a pivoted axis, placed in a box with transparent cover, cross index of brass or silver, divided circle, and an external "rule" or alhidade provided with a pair of sights. In the Leiden MS. of this work, which for long was erroneously ascribed to one Peter Adsiger, is a spurious passage, long believed to mention the variation of the compass.

Prior to this clear description of a pivoted compass by Peregrinus in 1269, the Italian sailors had used the floating magnet, probably introduced into this region of the Mediterranean by traders belonging to the port of Amalfi, as commemorated in the line of the poet Panormita:—

"Prima dedit nautis usum magnetis Amalphis."

This opinion is supported by the historian Flavius Blondus in his *Italia illustrata*, written about 1450, who adds that its certain origin is unknown. In 1511 Baptista Pio in his *Commentary* repeats the opinion as to the invention of the use of the magnet at Amalfi as related by Flavius. Gyraldus, writing in 1540 (*Libellus de re nautica*), misunderstanding this reference, declared that this observation of the direction of the magnet to the poles had been handed down as discovered "by a certain Flavius." From this passage arose a legend, which took shape only in the 17th century, that the compass was invented in the year 1302 by a person to whom was given the fictitious name of Flavio Gioja, of Amalfi.

From the above it will have been evident that, as Barlowe remarks concerning the compass, "the lame tale of one Flavius at Amelphus, in the kingdome of Naples, for to have devised it, is of very slender probabilitie"; and as regards the assertion of Dr Gilbert, of Colchester (*De magnete*, p. 4, 1600), that Marco Polo introduced the compass into Italy from the East in 1260,[4] we need only quote the words of Sir H. Yule (*Book of Marco Polo*): —"Respecting the mariner's compass and gunpowder, I shall say nothing, as no one now, I believe, imagines Marco to have had anything to do with their introduction."

When, and by whom, the compass card was added is a matter of conjecture. Certainly the *Rosa Ventorum*, or *Wind-rose*, is far older than the compass itself; and the naming of the eight principal "winds" goes back to the Temple of the Winds in Athens built by Andronicus Cyrrhestes. The earliest known wind-roses on the *portulani* or sailing charts of the Mediterranean pilots have almost invariably the eight principal points marked with the initials of the principal winds, Tramontano, Greco, Levante, Scirocco, Ostro, Africo (or Libeccio), Ponente and Maestro, or with a cross instead of L, to mark the east point. The north point, indicated in some of the oldest compass cards with a broad arrow-head or a spear, as well as with a T for Tramontano, gradually developed by a combination of these, about 1492, into a *fleur de lis*, still universal. The cross at the east continued even in British compasses till about 1700. Wind-roses with these characteristics are found in Venetian and Genoese charts of early 14th century, and are depicted similarly by the Spanish navigators. The naming of the intermediate subdivisions making up the thirty-two points or rhumbs of the compass card is probably due to Flemish navigators; but they were recognized even in the time of Chaucer, who in 1391 wrote, "Now is thin Orisonte departed in xxiiii partiez by thi azymutz, in significacion of xxiiii partiez of the world: al be it so that ship men rikne thilke partiez in xxxii" (*Treatise on the Astrolabe*, ed. Skeat, Early English Text Soc., London, 1872). The mounting of the card upon the needle or "flie," so as to turn with it, is probably of Amalphian origin. Da Buti, the Dante commentator, in 1380 says the sailors use a compass at the middle of which is pivoted a wheel of light paper to turn on its pivot, on which wheel the needle is fixed and the star (wind-rose) painted. The placing of the card at the bottom of the box, fixed, below the needle, was practised by the compass-makers of Nuremberg in the 16th century, and by Stevinus of Bruges about 1600. The gimbals or rings for suspension hinged at right-angles to one another, have been erroneously attributed to Cardan, the proper term being *cardine*, that is hinged or pivoted. The earliest description of them is about 1604. The term *binnacle*, originally *bittacle*, is a corruption of the Portuguese abitacolo, to denote the housing enclosing the compass, probably originating with the Portuguese navigators.

The improvement of the compass has been but a slow process. *The Libel of English Policie*, a poem of the first half of the 15th century, says with reference to Iceland (chap. x.)—

> "Out of Bristowe, and costes many one,
> Men haue practised by nedle and by stone
> Thider wardes within a litle while."
>
> Hakluyt, *Principal Navigations*, p. 201 (London, 1599).

From this it would seem that the compasses used at that time by English mariners were of a very primitive description. Barlowe, in his treatise *Magnetical Advertisements*, printed in 1616 (p. 66), complains that "the Compasse needle, being the most admirable and usefull instrument of the whole world, is both amongst ours and other nations for the most part, so bungerly and absurdly contrived, as nothing more." The form he recommends for the needle is that of "a true circle, having his Axis going out beyond the circle, at each end narrow and narrower, unto a reasonable sharpe point, and being pure steele as the circle it selfe is, having in the middest a convenient receptacle to place the capitell in." In 1750 Dr Gowan Knight found that the needles of merchant-ships were made of two pieces of steel bent in the middle and united in the shape of a rhombus, and proposed to substitute straight steel bars of small breadth, suspended edgewise and hardened throughout. He also showed that the Chinese mode of suspending the needle conduces most to sensibility. In 1820 Peter Barlow reported to the Admiralty that half the compasses in the British Navy were mere lumber and ought to be destroyed. He introduced a pattern having four or five parallel straight strips of magnetized steel fixed under a card, a form which remained the standard admiralty type until the introduction of the modern Thomson (Kelvin) compass in 1876.

(F. H. B.; S. P. T.)

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1 Adamas in India reperitur ... Ferrum occulta quadam natura ad se trahit. Acus ferrea postquam adamantem contigerit, ad stellam septentrionalem ... semper convertitur, unde valde necessarius est navigantibus in mari.

2 Sicut acus per naturam vertitur ad septentrionem dum sit tacta a magnete.—Sicut acus nautica dirigit marinarios in sua navigatione.

3 Ginguené, *Hist. lit. de l'Italie*, t. i. p. 413.

4 "According to all the texts he returned to Venice in 1295 or, as is more probable, in 1296."—Yule.

COMPASS PLANT, a native of the North American prairies, which takes its name from the position assumed by the leaves. These turn their edges to north and south, thus avoiding the excessive mid-day heat, while getting the full benefit of the morning and evening rays. The plant is known botanically as *Silphium laciniatum*, and belongs to the natural order Compositae. Another member of the same order, *Lactuca Scariola*, which has been regarded as the origin of the cultivated lettuce (*L. sativa*), behaves in the same way when growing in dry exposed places; it is a native of Europe and northern Asia which has got introduced into North America.

COMPAYRE, JULES GABRIEL (1843-), French educationalist, was born at Albi. He entered the École Normale Supérieure in 1862 and became professor of philosophy. In 1876 he was appointed professor in the Faculty of Letters of Toulouse, and upon the creation of the École normale d'institutrices at Fontenay aux Roses he became teacher of pedagogy (1880). From 1881 to 1889 he was deputy for Lavaur in the chamber, and took an active part in the discussions on public education. Defeated at the elections of 1889, he was appointed rector of the academy of Poitiers in 1890, and five years later to the academy of Lyons. His principal publications are his *Histoire critique des doctrines de l'éducation en France* (1879); *Éléments d'éducation civique* (1881), a work placed on the index at Rome, but very widely read in the primary schools of France; *Cours de pédagogie théorique et pratique* (1885, 13th ed., 1897); *The Intellectual and Moral Development of the Child*, in English (2 vols., New York, 1896-1902); and a series of monographs on *Les Grands Éducateurs*.

COMPENSATION (from Lat. *compensare*, to weigh one thing against another), a term applied in English law to a number of different forms of legal reparation; *e.g.* under the Forfeiture Act 1870 (s. 4), for loss of property caused by felony, or—under the Riot (Damages) Act 1886—to persons whose property has been stolen, destroyed or injured by rioters (see Riot). It is due, under the Agricultural Holdings Acts 1883-1906, for agricultural improvements (see Landlord and Tenant; cf. also Allotments and Small Holdings), and under the Workmen's Compensation Act 1906 to workmen, in respect of accidents in the course of their employment (see Employers' Liability); and under the Licensing Act 1904, to the payments to be made on the extinction of licences to sell intoxicants. The term "Compensation water" is used to describe the water given from a reservoir in compensation for water abstracted from a stream, under statutory powers, in connexion with public works (see Water Supply). As to the use of the word "compensation" in horology, see Clock; Watch.

Compensation, in its most familiar sense, is however a *nomen juris* for the reparation or satisfaction made to the owners of property which is taken by the state or by local authorities or by the promoters of parliamentary undertakings, under statutory authority, for public purposes. There are two main legal theories on which such appropriation of private property is justified. The American may be taken as a representative illustration of the one, and the English of the other. Though not included in the definition of "eminent domain," the necessity for compensation is recognized as incidental to that power. (See Eminent Domain, under which the American law of compensation, and the closely allied doctrine of *expropriation pour cause d'utilité* publique of French law, and the law of other continental countries, are discussed.) The rule of English constitutional law, on the other hand, is that the property of the citizen cannot be seized for purposes which are really "public" without a fair pecuniary equivalent being given to him; and, as the money for such compensation must come from parliament, the practical result is that the seizure can only be effected under legislative authority. An action for illegal interference with the property of the subject is not

maintainable against officials of the crown or government sued in their official capacity or as an official body. But crown officials may be sued in their individual capacity for such interference, even if they acted with the authority of the government (cp. *Raleigh* v. *Goschen* [1898], 1 Ch. 73).

Law of England.—Down to 1845 every act authorizing the purchase of lands had, in addition to a number of common form clauses, a variety of special clauses framed with a view to meeting the particular circumstances with which it dealt. In 1845, however, a statute based on the recommendations of a select committee, appointed in the preceding year, was passed; the object being to diminish the bulk of the special acts, and to introduce uniformity into private bill legislation by classifying the common form clauses, embodying them in general statutes, and facilitating their incorporation into the special statutes by reference. The statute by which this change was initiated was the Lands Clauses Consolidation Act 1845; and the policy has been continued by a series of later statutes which, together with the act of 1845, are now grouped under the generic title of the Lands Clauses Acts.

The public purposes for which lands are taken are threefold. Certain public departments, such as the war office and the admiralty, may acquire lands for national purposes (see the Defence Acts 1842 to 1873; and the Lands Clauses Consolidation Act 1860, s. 7). Local authorities are enabled to exercise similar powers for an enormous variety of municipal purposes, *e.g.* the housing of the working classes, the improvement of towns, and elementary and secondary education. Lastly, the promoters of public undertakings of a commercial character, such as railways and harbours, carry on their operations under statutes in which the provisions of the Lands Clauses Acts are incorporated.

Lands may be taken under the Lands Clauses Acts either by agreement or compulsorily. The first step in the proceedings is a “notice to treat,” or intimation by the promoters of their readiness to purchase the land, coupled with a demand for particulars as to the estate and the interests in it. The landowner on whom the notice is served may meet it by agreeing to sell, and the terms may then be settled by consent of the parties themselves, or by arbitration, if they decide to have recourse to that mode of adjusting the difficulty. If the property claimed is a house, or other building or manufactory, the owner has a statutory right to require the promoters by a counternotice to take the whole, even although a part would serve their purpose. This rule, however, is, in modern acts, often modified by special clauses. On receipt of the counter-notice the promoters must either assent to the requirement contained in it, or abandon their notice to treat. On the other hand, if the landowner fails within twenty-one days after receipt of the notice to treat to give the particulars which it requires, the promoters may proceed to exercise their compulsory powers and to obtain assessment of the compensation to be paid. As a general rule, it is a condition precedent to the exercise of these powers by a company that the capital of the undertaking should be fully subscribed. Compensation, under the Lands Clauses Acts, is assessed in four different modes:—(1) by justices, where the claim does not exceed £50, or a claimant who has no greater interest than that of a tenant for a year, or from year to year, is required to give up possession before the expiration of his tenancy; (2) by arbitration (a) when the claim exceeds £50, and the claimant desires arbitration, and the interest is not a yearly tenancy, (b) when the amount has been ascertained by a surveyor, and the claimant is dissatisfied, (c) when superfluous lands are to be sold, and the parties entitled to pre-emption and the promoters cannot agree as to the price. (Lands become “superfluous” if taken compulsorily on an erroneous estimate of the area needed, or if part only was needed and the owner compelled the promoters under the power above mentioned to take the whole, or in cases of abandonment); (3) by a jury, when the claim exceeds £50, and (a) the claimant does not signify his desire for arbitration, or no award has been made within the prescribed time, or (b) the claimant applies in writing for trial by jury; (4) by surveyors, nominated by justices, where the owner is under disability, or does not appear at the appointed time, or the claim is in respect of commonable rights, and a committee has not been appointed to treat with the promoters.

Promoters are not allowed without the consent of the owner to enter upon lands which are the subject of proceedings under the Lands Clauses Acts, except for the purpose of making a survey, unless they have executed a statutory bond and made a deposit, at the Law Courts Branch of the Bank of England, as security for the performance of the conditions of the bond.

Measure of Value.—(1) Where land is taken, the basis on which compensation is assessed is the commercial value of the land to the owner at the date of the notice to treat. Potential value may be taken into account, and also good-will of the property in a business. This rule,

however, excludes any consideration of the principle of “betterment.” (2) Where land, although not taken, is “injuriously affected” by the works of the promoters, compensation is payable for loss or damage resulting from any act, legalized by the promoters’ statutory powers, which would otherwise have been actionable, or caused by the execution (not the use) of the works authorized by the undertaking.

The following examples of how land may be “injuriously affected,” so as to give a right to compensation under the acts, may be given:—narrowing or obstructing a highway which is the nearest access to the lands in question; interference with a right of way; substantial interference with ancient lights; noise of children outside a board school.

Scotland and Ireland.—The Lands Clauses Act 1845 extends to Ireland. There is a Scots enactment similar in character (Lands Clauses [Scotland] Act 1845). The principles and practice of the law of compensation are substantially the same throughout the United Kingdom.

India and the British Colonies.—Legislation analogous to the Lands Clauses Acts is in force in India (Land Acquisition Act 1894 [Act I of 1894]) and in most of the colonies (see western Australia, Lands Resumption Act 1894 [58 Vict. No. 33], Victoria, Lands Compensation Act 1890 [54 Vict. No. 1109]; New Zealand, Public Works Act 1894 [58 Vict. No. 42]; Ontario [Revised Stats. 1897, c. 37]).

AUTHORITIES.—*English Law*: Balfour Browne and Allan, *Compensation* (2nd ed., London, 1903); Cripps, *Compensation* (5th edition, London, 1905); Hudson, *Compensation* (London, 1906); Boyle and Waghorn, *Compensation* (London, 1903); Lloyd, *Compensation* (6th ed. by Brooks, London, 1895); Clifford, *Private Bill Legislation*, London, 1885 (vol. i.), 1887 (vol. ii.) *Scots Law*: Deas, *Law of Railways in Scotland* (ed. by Ferguson; Edinburgh, 1897); Rankine, *Law of Landownership* (3rd ed., 1891).

(A. W. R.)

COMPIÈGNE, a town of northern France, capital of an arrondissement in the department of Oise, 52 m. N.N.E. of Paris on the Northern railway between Paris and St Quentin. Pop. (1906) 14,052. The town, which is a favourite summer resort, stands on the north-west border of the forest of Compiègne and on the left bank of the Oise, less than 1 m. below its confluence with the Aisne. The river is crossed by a bridge built in the reign of Louis XV. The Rue Solférino, a continuation of the bridge ending at the Place de l’Hôtel de Ville, is the busy street of the town; elsewhere, except on market days, the streets are quiet. The hôtel de ville, with a graceful façade surmounted by a lofty belfry, is in the late Gothic style of the early 16th century and was completed in modern times. Of the churches, St Antoine (13th and 16th centuries) with some fine Renaissance stained glass, and St Jacques (13th and 15th centuries), need alone be mentioned. The remains of the ancient abbey of St Corneille are used as a military storehouse. Compiègne, from a very early period until 1870, was the occasional residence of the French kings. Its palace, one of the most magnificent structures of its kind, was erected, chiefly by Louis XV. and Louis XVI., on the site of a château of King Charles V. of France. It now serves as an art museum. It has two façades, one overlooking the Place du Palais and the town, the other, more imposing, facing towards a fine park and the forest, which is chiefly of oak and beech and covers over 36,000 acres. Compiègne is the seat of a subprefect, and has tribunals of first instance and of commerce, a communal college, library and hospital. The industries comprise boat-building, rope-making, steam-sawing, distilling and the manufacture of chocolate, machinery and sacks and coarse coverings, and at Margny, a suburb, there are manufactures of chemicals and felt hats. Asparagus is cultivated in the environs. There is considerable trade in timber and coal, chiefly river-borne.

Compiègne, or as it is called in the Latin chronicles, Compendium, seems originally to have been a hunting-lodge of the early Frankish kings. It was enriched by Charles the Bald with two castles, and a Benedictine abbey dedicated to Saint Corneille, the monks of which retained down to the 18th century the privilege of acting for three days as lords of Compiègne, with full power to release prisoners, condemn the guilty, and even inflict sentence of death. It was in Compiègne that King Louis I. the Debonair was deposed in 833; and at the siege of the town in 1430 Joan of Arc was taken prisoner by the English. A monument to her faces the hôtel de ville. In 1624 the town gave its name to a treaty of

alliance concluded by Richelieu with the Dutch; and it was in the palace that Louis XV. gave welcome to Marie Antoinette, that Napoleon I. received Marie Louise of Austria, that Louis XVIII. entertained the emperor Alexander of Russia, and that Leopold I., king of the Belgians, was married to the princess Louise. In 1814 Compiègne offered a stubborn resistance to the Prussian troops. Under Napoleon III. it was the annual resort of the court during the hunting season. From 1870 to 1871 it was one of the headquarters of the German army.

COMPLEMENT (Lat. *complementum*, from *complere*, to fill up), that which fills up or completes anything, *e.g.* the number of men necessary to man a ship. In geometry, the complement of an angle is the difference between the angle and a right angle; the complements of a parallelogram are formed by drawing parallel to adjacent sides of a parallelogram two lines intersecting on a diagonal; four parallelograms are thus formed, and the two not about the diagonal of the original parallelogram are the complements of the parallelogram. In analysis, a complementary function is a partial solution to a differential equation (*q.v.*); complementary operators are reciprocal or inverse operators, *i.e.* two operations A and B are complementary when both operating on the same figure or function leave it unchanged. A "complementary colour" is one which produces white when mixed with another (see COLOUR). In Spanish the word *cumplimento* was used in a particular sense of the fulfilment of the duties of polite behaviour and courtesy, and it came through the French and Italian forms into use in English, with a change in spelling to "compliment," with the sense of an act of politeness, especially of a polite expression of praise, or of social regard and greetings. The word "comply," meaning to act in accordance with wishes, orders or conditions, is also derived from the same origin, but in sense is connected with "ply" or "pliant," from Lat. *plicare*, to bend, with the idea of subserviently yielding to the wishes of another.

COMPLUVIUM (from Lat. *compluere*, to flow together, *i.e.* in reference to the rain being collected and falling through), in architecture, the Latin term for the open space left in the roof of the atrium of a Roman house for lighting it and the rooms round (see CAVAEDIUM).

COMPOSITAE, the name given to the largest natural order of flowering plants, containing about one-tenth of the whole number and characterized by the crowding of the flowers into heads. The order is cosmopolitan, and the plants show considerable variety in habit. The great majority, including most British representatives, are herbaceous, but in the warmer parts of the world shrubs and arborescent forms also occur; the latter are characteristic of the flora of oceanic islands. In herbaceous plants the leaves are often arranged in a rosette on a much shortened stem, as in dandelion, daisy and others; when the stem is elongated the leaves are generally alternate. The root is generally thickened, sometimes, as in dahlia, tuberous; root and stem contain oil passages, or, as in lettuce and dandelion, a milky white latex. The flowers are crowded in heads (*capitula*) which are surrounded by an involucre of green bracts,—these protect the head of flowers in the bud stage, performing the usual function of a calyx. The enlarged top of the axis, the receptacle, is flat, convex or conical, and the flowers open in centripetal succession. In many cases, as in the sunflower or daisy, the outer or ray-florets are larger and more conspicuous than the inner, or disk-florets; in other cases, as in dandelion, the florets are all alike. Ray-florets when present are usually pistillate, but neuter in some genera (as *Centaurea*); the disk-florets are hermaphrodite. The flower is epigynous; the calyx is sometimes absent, or is represented by a rim on the top of the ovary, or takes the form of hairs or bristles which

enlarge in the fruiting stage to form the pappus by means of which the seed is dispersed. The corolla, of five united petals, is regular and tubular in shape as in the disk-florets, or irregular when it is either strap-shaped (ligulate), as in the ray-florets of daisy, &c., or all the florets of dandelion, or more rarely two-lipped. The five stamens are attached to the interior of the corolla-tube; the filaments are free; the anthers are joined (syngenesious) to form a tube round the single style, which ends in a pair of stigmas. The inferior ovary contains one ovule (attached to the base of the chamber), and ripens to form a dry one-seeded fruit; the seed is filled with the straight embryo.

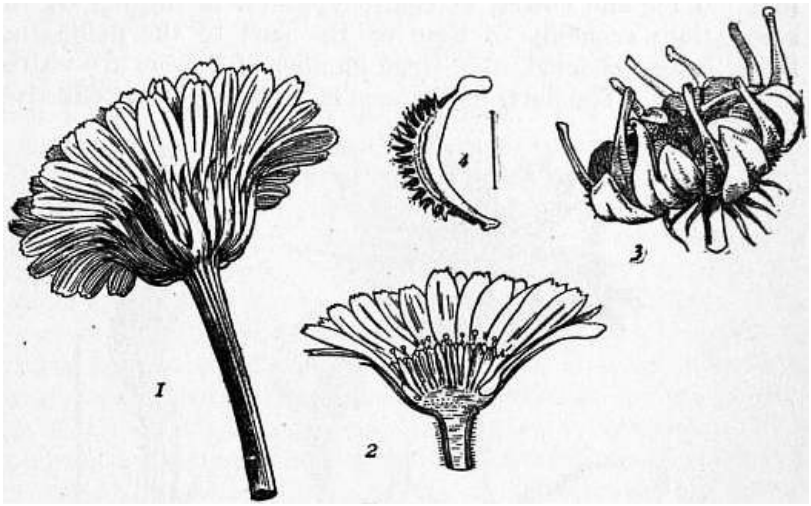

Fig. 1.

1. Flower head of Marigold.
2. Same in vertical section.
3. Head of fruits, nat. size.
4. A single fruit.

The flower-heads are an admirable example of an adaptation for pollination by aid of insects. The crowding of the flowers in heads ensures the pollination of a large number as the result of a single insect visit. Honey is secreted at the base of the style, and is protected from rain or dew and the visits of short-lipped insects by the corolla-tube, the length of which is correlated with the length of proboscis of the visiting insect. When the flower opens, the two stigmas are pressed together below the tube formed by the anthers, the latter split on the inside, and the pollen fills the tube; the style gradually lengthens and carries the pollen out of the anther tube, and finally the stigmas spread and expose their receptive surface which has hitherto been hidden, the two being pressed together. Thus the life history of the flower falls into two stages, an earlier or male and a later or female. This favours cross-pollination as compared with self-pollination. In many cases there is a third stage, as in dandelion, where the stigmas finally curl back so that they touch any pollen grains which have been left on the style, thus ensuring self-pollination if cross-pollination has not been effected.

The devices for distribution of the fruit are very varied. Frequently there is a hairy or silky pappus forming a tuft of hairs, as in thistle or coltsfoot, or a parachute-like structure as in dandelion; these render the fruit sufficiently light to be carried by the wind. In *Bidens* the pappus consists of two or more stiff-barbed bristles which cause the fruit to cling to the coats of animals. Occasionally, as in sunflower or daisy, the fruits bear no special appendage and remain on the head until jerked off.

FIG. 2.—Flowering shoot of Cornflower.
1. Disk-floret in vertical section.

Compositae are generally considered to represent the most highly developed order of flowering plants. By the massing of the flowers in heads great economy is effected in the material required for one flower, as conspicuousness is ensured by the association; economy of time on the part of the pollinating insect is also effected, as a large number of flowers are visited at one time. The floral mechanism is both simple and effective, favouring cross-pollination, but ensuring self-pollination should that fail. The means of seed-distribution are also very effective.

A few members of the order are of economic value, *e.g. Lactuca* (lettuce; *q.v.*), *Cichorium* (chicory; *q.v.*), *Cynara* (artichoke and cardoon; *q.v.*), *Helianthus* (Jerusalem artichoke). Many are cultivated as garden or greenhouse plants, such as *Solidago* (golden rod), *Ageratum*, Aster (*q.v.*) (Michaelmas daisy), *Helichrysum* (everlasting), *Zinnia, Rudbeckia, Helianthus* (sunflower), *Coreopsis*, Dahlia (*q.v.*), *Tagetes* (French and African marigold), *Gaillardia, Achillea* (yarrow), *Chrysanthemum, Pyrethrum* (feverfew; now generally included under *Chrysanthemum*), *Tanacetum* (tansy), *Arnica, Doronicum, Cineraria Calendula* (common marigold) (fig. 1), *Echinops* (globe thistle), *Centaurea* (cornflower) (fig. 2). Some are of medicinal value, such as *Anthemis* (chamomile), *Artemisia* (wormwood), *Tussilago* (coltsfoot), *Arnica*. Insect powder is prepared from species of *Pyrethrum*.

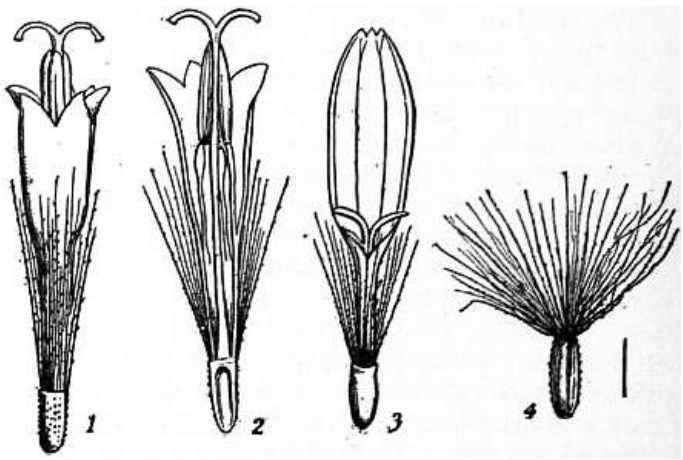

FIG. 3.—Groundsel (*Senecio vulgaris*).

1. Disk-floret.
2. Same cut vertically.
3. Ray-floret.
4. Fruit with pappus.

The order is divided into two suborders:—*Tubuliflorae*, characterized by absence of latex, and the florets of the disk being not ligulate, and *Liguliflorae*, characterized by presence of latex and all the florets being ligulate. The first suborder contains the majority of the genera, and is divided into a number of tribes, characterized by the form of the anthers and styles, the presence or absence of scales on the receptacle, and the similarity or otherwise of the florets of one and the same head. The order is well represented in Britain, in which forty-two genera are native. These include some of the commonest weeds, such as dandelion (*Taraxacum Dens-leonis*), daisy (*Bellis perennis*), groundsel (fig. 3) (*Senecio vulgaris*) and ragwort (*S. Jacobaea*); coltsfoot (*Tussilago Farfara*) is one of the earliest plants to flower, and other genera are *Chrysanthemum* (ox-eye daisy and corn-marigold), *Arctium* (burdock), *Centaurea* (knapweed and cornflower), *Carduus* and *Cnicus* (thistles), *Hieracium* (hawkweed), *Sonchus* (sow-thistle), *Achillea* (yarrow, or milfoil, and sneezewort), *Eupatorium* (hemp-agrimony), *Gnaphalium* (cudweed), *Erigeron* (fleabane), *Solidago* (golden-rod), *Anthemis* (may-weed and chamomile), *Cichorium* (chicory), *Lapsana* (nipplewort), *Crepis* (hawk's-beard), *Hypochaeris* (cat's-ear), and *Tragopogon* (goat's-beard).

COMPOSITE ORDER, in architecture, a compound of the Ionic and Corinthian orders (see Order), the chief characteristic of which is found in the capital (*q.v.*), where a double row of acanthus leaves, similar to those carved round the Corinthian capital, has been added under the Ionic volutes. The richer decoration of the Ionic capital had already been employed in those of the Erechtheum, where the necking was carved with the palmette or honeysuckle. Similar decorated Ionic capitals were found in the forum of Trajan. The earliest example of the Composite capital is found in the arch of Titus at Rome. The entablature was borrowed from that of the Corinthian order.

COMPOSITION (Lat. *compositio*, from *componere*, to put together), the action of putting together and combining, and the product of such action. There are many applications of the word. In philology it is used of the putting together of two distinct words to form a single word; and in grammar, of the combination of words into sentences, and sentences into periods, and then applied to the result of such combination, and to the art of producing a work in prose or verse, or to the work itself. In music "composition" is used both of the art of combining musical sounds in accordance with the rules of musical form, and, more generally, of the whole art of creation or invention. The name "composer" is thus particularly applied to the musical creator in general. In the other fine arts the word is more strictly used of the balanced arrangement of the parts of a picture, of a piece of sculpture or a building, so that they should form one harmonious whole. The word also means an agreement or an adjustment of differences between two or more parties, and is thus the best general term to describe the agreement, often called by the equivalent German word "Ausgleich," between Austria and Hungary in 1867. A more particular use is the legal one, for an agreement by which a creditor agrees to take from his debtor a sum less than his debt in satisfaction of the whole (see Bankruptcy). In logic "composition" is the name given to a fallacy of equivocation, where what is true distributively of each member of a class is inferred to be true of the whole class collectively. The fallacy of "division" is the converse of this, where what is true of a term used collectively is inferred to be true of its several parts. A common source of these errors in reasoning is the confusion between the collective and distributive meanings of the word "all." Composition, often shortened to "compo," is the name given to many materials compounded of more than one substance, and is used in various trades and manufactures, as in building, for a mixture, such as stucco, cement and plaster, for covering walls, &c., often made to represent stone or marble; a similar moulded compound is employed to represent carved wood.

COMPOUND (from Lat. *componere*, to combine or put together), a combination of various elements, substances or ingredients, so as to form one composite whole. A “chemical compound” is a substance which can be resolved into simple constituents, as opposed to an element which cannot be so resolved (see CHEMISTRY); a word is said to be a “compound” when it is made up of different words or parts of different words. The term is also used in an adjectival form with many applications; a “compound engine” is one where the expansion of the steam is effected in two or more stages (see STEAM-ENGINE); in zoology, the “compound eye” possessed by insects and crustacea is one which is made up of several *ocelli* or simple eyes, set together so that the whole has the appearance of being faceted (see EYE); in botany, the “compound leaf” has two or more separate blades on a common leaf-stalk; in surgery, in a “compound fracture” the skin is broken as well as the bone, and there is a communication between the two. There are many mathematical and arithmetical uses of the term, particularly of those forms of addition, multiplication, division and subtraction which deal with quantities of more than one denomination. Compound interest is interest paid upon interest, the accumulation of interest forming, as it were, a secondary principal. The verb “to compound” is used of the arrangement or settlement of differences, and especially of an agreement made to accept or to pay part of a debt in full discharge of the whole, and thus of the arrangement made by an insolvent debtor with his creditors (see BANKRUPTCY); similarly of the substitution of one payment for annual or other periodic payments,—thus subscriptions, university or other dues, &c., may be “compounded”; a particular instance of this is the system of “compounding” for rates, where the occupier of premises pays an increased rent, and the owner makes himself responsible for the payment of the rates. The householder who thus compounds with the owner of the premises he occupies is known as a “compound householder.” The payment of poor rate forming part of the qualification necessary for the parliamentary franchise in the United Kingdom, various statutes, leading up to the Compound Householders Act 1851, have enabled such occupiers to claim to be placed on the rate. In law, to compound a felony is to agree with the felon not to prosecute him for his crime, in return for valuable consideration, or, in the case of a theft, on return of the goods stolen. Such an agreement is a misdemeanour and is punishable with fine and imprisonment.

The name “compounders” was given during the reign of William III. of England to the members of a Jacobite faction, who were prepared to restore James II. to the throne, on the condition of an amnesty and an undertaking to preserve the constitution. Until 1853, in the university of Oxford, those possessing private incomes of a certain amount paid special dues for their degrees, and were known as Grand and Petty Compounders.

The corruption “compound” (from the Malay *kampung* or *kampong*, a quarter of a village) is the name applied to the enclosed ground, whether garden or waste, which surrounds an Anglo-Indian house. In India the European quarter, as a rule, is separate from the native quarter, and consists of a number of single houses, each standing in a compound, sometimes many acres in extent.

COMPOUND PIER, the architectural term given to a clustered column or pier which consists of a centre mass or newel, to which engaged or semi-detached shafts have been attached, in order to perform, or to suggest the performance of, certain definite structural objects, such as to carry arches of additional orders, or to support the transverse or diagonal ribs of a vault, or the tie beam of an important roof. In these cases, though performing different functions, the drums of the pier are often cut out of one stone. There are, however, cases where the shafts are detached from the pier and coupled to it by armulets at regular heights, as in the Early English period.

COMPRADOR (a Portuguese word used in the East, derived from the Lat. *comparare*, to procure), originally a native servant in European households in the East, but now the name given to the native managers in European business houses in China, and also to native contractors supplying ships in the Philippines and elsewhere in the East.

COMPRESSION, in astronomy, the deviation of a heavenly body from the spherical form, called also the “ellipticity.” It is numerically expressed by the ratio of the differences of the axes to the major axis of the spheroid. The compression or “flattening” of the earth is about 1/298, which means that the ratio of the equatorial to the polar axis is 298:297 (see Earth, Figure of the). In engineering the term is applied to the arrangement by which the exhaust valve of a steam-engine is made to close, shutting a portion of the exhaust steam in the cylinder, before the stroke of the piston is quite complete. This steam being compressed as the stroke is completed, a cushion is formed against which the piston does work while its velocity is being rapidly reduced, and thus the stresses in the mechanism due to the inertia of the reciprocating parts are lessened. This compression, moreover, obviates the shock which would otherwise be caused by the admission of the fresh steam for the return stroke. In internal combustion engines it is a necessary condition of economy to compress the explosive mixture before it is ignited: in the Otto cycle, for instance, the second stroke of the piston effects the compression of the charge which has been drawn into the cylinder by the first forward stroke.

COMPROMISE (pronounced *cómprŏmize*; through Fr. from Lat. *compromittere*), a term, meaning strictly a joint agreement, which has come to signify such a settlement as involves a mutual adjustment, with a surrender of part of each party’s claim. From the element of danger involved has arisen an invidious sense of the word, imputing discredit, so that being “compromised” commonly means injured in reputation.

COMPROMISE MEASURES OF 1850, in American history, a series of measures the object of which was the settlement of five questions in dispute between the pro-slavery and anti-slavery factions in the United States. Three of these questions grew out of the annexation of Texas and the acquisition of western territory as a result of the Mexican War. The settlers who had flocked to California after the discovery of gold in 1848 adopted an anti-slavery state constitution on the 13th of October 1849, and applied for admission into the Union. In the second place it was necessary to form a territorial government for the remainder of the territory acquired from Mexico, including that now occupied by Nevada and Utah, and parts of Wyoming, Colorado, Arizona and New Mexico. The fundamental issue was in regard to the admission of slavery into, or the exclusion of slavery from, this region. Thirdly, there was a dispute over the western boundary of Texas. Should the Rio Grande be the line of division north of Mexico, or should an arbitrary boundary be established farther to the eastward; in other words, should a considerable part of the new territory be certainly opened to slavery as a part of Texas, or possibly closed to it as a part of the organized territorial section? Underlying all of these issues was of course the great moral and political problem as to whether slavery was to be confined to the south-eastern section of the country or be permitted to spread to the Pacific. The two questions not growing out of the Mexican War were in regard to the abolition of the slave trade in the District of Columbia, and the passage of a new fugitive slave law.

Congress met on the 3rd of December 1849. Neither faction was strong enough in both houses to carry out its own programme, and it seemed for a time that nothing would be

done. On the 29th of January 1850 Henry Clay presented the famous resolution which constituted the basis of the ultimate compromise. His idea was to combine the more conservative elements of both sections in favour of a settlement which would concede the Southern view on two questions, the Northern view on two, and balance the fifth. Daniel Webster supported the plan in his great speech of the 7th of March, although in doing so he alienated many of his former admirers. Opposed to the conservatives were the extremists of the North, led by William H. Seward and Salmon P. Chase, and those of the South, led by Jefferson Davis. Most of the measures were rejected and the whole plan seemed likely to fail, when the situation was changed by the death of President Taylor and the accession of Millard Fillmore on the 9th of July 1850. The influence of the administration was now thrown in favour of the compromise. Under a tacit understanding of the moderates to vote together, five separate bills were passed, and were signed by the president between 9th and 20th September 1850. California was admitted as a free state, and the slave trade was abolished in the District of Columbia; these were concessions to the North. New Mexico (then including the present Arizona) and Utah were organized without any prohibition of slavery (each being left free to decide for or against, on admission to statehood), and a rigid fugitive slave law was enacted; these were concessions to the South. Texas (*q.v.*) was compelled to give up much of the western land to which it had a good claim, and received in return $10,000,000.

This legislation had several important results. It helped to postpone secession and Civil War for a decade, during which time the North-West was growing more wealthy and more populous, and was being brought into closer relations with the North-East. It divided the Whigs into “Cotton Whigs” and “Conscience Whigs,” and in time led to the downfall of the party. In the third place, the rejection of the Wilmot Proviso and the acceptance (as regards New Mexico and Utah) of “Squatter Sovereignty” meant the adoption of a new principle in dealing with slavery in the territories, which, although it did not apply to the same territory, was antagonistic to the Missouri Compromise of 1820. The sequel was the repeal of the Missouri Compromise in the Kansas-Nebraska Bill of 1854. Fourthly, the enforcement of the fugitive slave law aroused a feeling of bitterness in the North which helped eventually to bring on the war, and helped to make it, when it came, quite as much an anti-slavery crusade as a struggle for the preservation of the Union. Finally, although Clay for his support of the compromises and Seward and Chase for their opposition have gained in reputation, Webster has been selected as the special target for hostile criticism. The Compromise Measures are sometimes spoken of collectively as the Omnibus Bill, owing to their having been grouped originally—when first reported (May 8) to the Senate—into one bill.

The best account of the above Compromises is to be found in J. F. Rhodes, *History of the United States from the Compromise of 1850*, vol. i. (New York, 1896).

(W. R. S.*)

COMPSA (mod. *Conza*), an ancient city of the Hirpini, near the sources of the Aufidus, on the boundary of Lucania and not far from that of Apulia, on a ridge 1998 ft. above sea-level. It was betrayed to Hannibal in 216 B.C. after the defeat of Cannae, but recaptured two years later. It was probably occupied by Sulla in 89 B.C., and was the scene of the death of T. Annius Milo in 48 B.C. Most authorities (cf. Hülsen in Pauly-Wissowa, *Realencyclopädie*, Stuttgart, 1901, iv. 797) refer Caes. *Bell. civ.* iii. 22, and Plin. *Hist. Nat.* ii. 147, to this place, supposing the MSS. to be corrupt. The usual identification of the site of Milo’s death with Cassano on the Gulf of Taranto must therefore be rejected. In imperial times, as inscriptions show, it was a *municipium*, but it lay far from any of the main high-roads. There are no important ancient remains.

COMPTON, HENRY (1632-1713), English divine, was the sixth and youngest son of the second earl of Northampton. He was educated at Queen’s College, Oxford, and then

travelled in Europe. After the restoration of Charles II. he became cornet in a regiment of horse, but soon quitted the army for the church. After a further period of study at Cambridge and again at Oxford, he held various livings. He was made bishop of Oxford in 1674, and in the following year was translated to the see of London. He was also appointed a member of the Privy Council, and entrusted with the education of the two princesses—Mary and Anne. He showed a liberality most unusual at the time to Protestant dissenters, whom he wished to reunite with the established church. He held several conferences on the subject with the clergy of his diocese; and in the hope of influencing candid minds by means of the opinions of unbiassed foreigners, he obtained letters treating of the question (since printed at the end of Stillingfleet's *Unreasonableness of Separation*) from Le Moyne; professor of divinity at Leiden, and the famous French Protestant divine, Jean Claude. But to Roman Catholicism he was strongly opposed. On the accession of James II. he consequently lost his seat in the council and his deanery in the Chapel Royal; and for his firmness in refusing to suspend John Sharp, rector of St Giles's-in-the-Fields, whose anti-papal writings had rendered him obnoxious to the king, he was himself suspended. At the Revolution Compton embraced the cause of William and Mary; he performed the ceremony of their coronation; his old position was restored to him; and among other appointments, he was chosen as one of the commissioners for revising the liturgy. During the reign of Anne he remained a member of the privy council, and was one of the commissioners appointed to arrange the terms of the union of England and Scotland; but, to his bitter disappointment, his claims to the primacy were twice passed over. He died at Fulham on the 7th of July 1713. He had conspicuous defects both in spirit and intellect, but was benevolent and philanthropic. He was a successful botanist. He published, besides several theological works, *A Translation from the Italian of the Life of Donna Olympia Maladichini, who governed the Church during the time of Pope Innocent X., which was from the year 1644 to 1655* (1667), and *A Translation from the French of the Jesuits' Intrigues* (1669).

COMPTROLLER, the title of an official whose business primarily was to examine and take charge of accounts, hence to direct or control, *e.g.* the English comptroller of the household, comptroller and auditor-general (head of the exchequer and audit department), comptroller-general of patents, &c., comptroller-general (head of the national debt office). On the other hand, the word is frequently spelt *controller*, as in controller of the navy, controller or head of the stationery office. The word is used in the same sense in the United States, as comptroller of the treasury, an official who examines accounts and signs drafts, and comptroller of the currency, who administers the law relating to the national banks.

COMPURGATION (from Lat. *compurgare*, to purify completely), a mode of procedure formerly employed in ecclesiastical courts, and derived from the canon law (*compurgatio canonica*), by which a clerk who was accused of crime was required to make answers on the oath of himself and a certain number of other clerks (compurgators) who would swear to his character or innocence. The term is more especially applied to a somewhat similar procedure, the old Teutonic or Anglo-Saxon mode of trial by oath-taking or oath-helping (see JURY).

COMTE, AUGUSTE [ISIDORE AUGUSTE MARIE FRANÇOIS XAVIER] (1798-1857), French Positive philosopher, was born on the 19th of January 1798 at Montpellier, where his father was a receiver-general of taxes for the district. He was sent for his earliest instruction to the school of the town, and in 1814 was admitted to the École Polytechnique. His youth was marked by a constant willingness to rebel against merely official authority; to genuine

excellence, whether moral or intellectual, he was always ready to pay unbounded deference. That strenuous application which was one of his most remarkable gifts in manhood showed itself in his youth, and his application was backed or inspired by superior intelligence and aptness. After he had been two years at the École Polytechnique he took a foremost part in a mutinous demonstration against one of the masters; the school was broken up, and Comte like the other scholars was sent home. To the great dissatisfaction of his parents, he resolved to return to Paris (1816), and to earn his living there by giving lessons in mathematics. Benjamin Franklin was the youth's idol at this moment. "I seek to imitate the modern Socrates," he wrote to a school friend, "not in talents, but in way of living. You know that at five-and-twenty he formed the design of becoming perfectly wise and that he fulfilled his design. I have dared to undertake the same thing, though I am not yet twenty." Though Comte's character and aims were as far removed as possible from Franklin's type, neither Franklin nor any man that ever lived could surpass him in the heroic tenacity with which, in the face of a thousand obstacles, he pursued his own ideal of a vocation.

For a moment circumstances led him to think of seeking a career in America, but a friend who preceded him thither warned him of the purely practical spirit that prevailed in the new country. "If Lagrange were to come to the United States, he could only earn his livelihood by turning land surveyor." So Comte remained in Paris, living as he best could on something less than £80 a year, and hoping, when he took the trouble to break his meditations upon greater things by hopes about himself, that he might by and by obtain an appointment as mathematical master in a school. A friend procured him a situation as tutor in the house of Casimir Périer. The salary was good, but the duties were too miscellaneous, and what was still worse, there was an end of the delicious liberty of the garret. After a short experience of three weeks Comte returned to neediness and contentment. He was not altogether without the young man's appetite for pleasure; yet when he was only nineteen we find him wondering, amid the gaieties of the carnival of 1817, how a gavotte or a minuet could make people forget that thirty thousand human beings around them had barely a morsel to eat.

Towards 1818 Comte became associated as friend and disciple with Saint-Simon, who was destined to exercise a very decisive influence upon the turn of his speculation. In after years he so far forgot himself as to write of Saint-Simon as a depraved quack, and to deplore his connexion with him as purely mischievous. While the connexion lasted he thought very differently. Saint-Simon is described as the most estimable and lovable of men, and the most delightful in his relations; he is the worthiest of philosophers. Even at the very moment when Comte was congratulating himself on having thrown off the yoke, he honestly admits that Saint-Simon's influence has been of powerful service in his philosophic education. "I certainly," he writes to his most intimate friend, "am under great personal obligations to Saint-Simon; that is to say, he helped in a powerful degree to launch me in the philosophical direction that I have now definitely marked out for myself, and that I shall follow without looking back for the rest of my life." Even if there were no such unmistakable expressions as these, the most cursory glance into Saint-Simon's writings is enough to reveal the thread of connexion between the ingenious visionary and the systematic thinker. We see the debt, and we also see that when it is stated at the highest possible, nothing has really been taken either from Comte's claims as a powerful original thinker, or from his immeasurable pre-eminence over Saint-Simon in intellectual grasp and vigour and coherence. As high a degree of originality may be shown in transformation as in invention, as Molière and Shakespeare have proved in the region of dramatic art. In philosophy the conditions are not different. *Il faut prendre son bien où on le trouve.*

It is no detriment to Comte's fame that some of the ideas which he recombined and incorporated in a great philosophic structure had their origin in ideas that were produced almost at random in the incessant fermentation of Saint-Simon's brain. Comte is in no true sense a follower of Saint-Simon, but it was undoubtedly Saint-Simon who launched him, to take Comte's own word, by suggesting the two starting-points of what grew into the Comtist system—first, that political phenomena are as capable of being grouped under laws as other phenomena; and second, that the true destination of philosophy must be social, and the true object of the thinker must be the reorganization of the moral, religious and political systems. We can readily see what an impulse these far-reaching conceptions would give to Comte's meditations. There were conceptions of less importance than these, in which it is impossible not to feel that it was Saint-Simon's wrong or imperfect idea that put his young admirer on the track to a right and perfected idea. The subject is not worthy of further discussion. That Comte would have performed some great intellectual achievement, if Saint-Simon had never been born, is certain. It is hardly less certain that the great achievement which he did actually perform was originally set in motion by Saint-Simon's conversation, though it was afterwards directly filiated with the fertile speculations of A. R. J. Turgot and Condorcet.

Comte thought almost as meanly of Plato as he did of Saint-Simon, and he considered Aristotle the prince of all true thinkers; yet their vital difference about Ideas did not prevent Aristotle from calling Plato master.

After six years the differences between the old and the young philosopher grew too marked for friendship. Comte began to fret under Saint-Simon's pretensions to be his director. Saint-Simon, on the other hand, perhaps began to feel uncomfortably conscious of the superiority of his disciple. The occasion of the breach between them (1824) was an attempt on Saint-Simon's part to print a production of Comte's as if it were in some sort connected with Saint-Simon's schemes of social reorganization. Not only was the breach not repaired, but long afterwards Comte, as we have said, with painful ungraciousness took to calling the encourager of his youth by very hard names.

In 1825 Comte married a Mdlle Caroline Massin. His marriage was one of those of which "magnanimity owes no account to prudence," and it did not turn out prosperously. His family were strongly Catholic and royalist, and they were outraged by his refusal to have the marriage performed other than civilly. They consented, however, to receive his wife, and the pair went on a visit to Montpellier. Madame Comte conceived a dislike to the circle she found there, and this was the too early beginning of disputes which lasted for the remainder of their union. In the year of his marriage we find Comte writing to the most intimate of his correspondents:—"I have nothing left but to concentrate my whole moral existence in my intellectual work, a precious but inadequate compensation; and so I must give up, if not the most dazzling, still the sweetest part of my happiness." He tried to find pupils to board with him, but only one pupil came, and he was soon sent away for lack of companions. "I would rather spend an evening," wrote the needy enthusiast, "in solving a difficult question, than in running after some empty-headed and consequential millionaire in search of a pupil." A little money was earned by an occasional article in *Le Producteur*, in which he began to expound the philosophic ideas that were now maturing in his mind. He announced a course of lectures (1826), which it was hoped would bring money as well as fame, and which were to be the first dogmatic exposition of the Positive Philosophy. A friend had said to him, "You talk too freely, your ideas are getting abroad, and other people use them without giving you the credit; put your ownership on record." The lectures attracted hearers so eminent as Humboldt the cosmologist, Poinsot the geometer and Blainville the physiologist.

Marriage.

Unhappily, after the third lecture of the course, Comte had a severe attack of cerebral derangement, brought on by intense and prolonged meditation, acting on a system that was already irritated by the chagrin of domestic discomfort. He did not recover his health for more than a year, and as soon as convalescence set in he was seized by so profound a melancholy at the disaster which had thus overtaken him, that he threw himself into the Seine. Fortunately he was rescued, and the shock did not stay his return to mental soundness. One incident of this painful episode is worth mentioning. Lamennais, then in the height of his Catholic exaltation, persuaded Comte's mother to insist on her son being married with the religious ceremony, and as the younger Madame Comte apparently did not resist, the rite was duly performed, in spite of the fact that Comte was at the time raving mad. Philosophic assailants of Comtism have not always resisted the temptation to recall the circumstance that its founder was once out of his mind. As has been justly said, if Newton once suffered a cerebral attack without forfeiting our veneration for the *Principia*, Comte may have suffered in the same way, and still not have forfeited our respect for Positive Philosophy and Positive Polity.

Serious illness.

In 1828 the lectures were renewed, and in 1830 was published the first volume of the *Course of Positive Philosophy*. The sketch and ground plan of this great undertaking had appeared in 1826. The sixth and last volume was published in 1842. The twelve years covering the publication of the first of Comte's two elaborate works were years of indefatigable toil, and they were the only portion of his life in which he enjoyed a certain measure, and that a very modest measure, of material prosperity. In 1833 he was appointed examiner of the boys who in the various provincial schools aspired to enter the École Polytechnique at Paris. This and two other engagements as a teacher of mathematics secured him an income of some £400 a year. He made M. Guizot, then Louis Philippe's minister, the important proposal to establish a chair of general history of the sciences. If there are four chairs, he argued, devoted to the history of philosophy, that is to say, the minute study of all sorts of dreams and aberrations through the ages, surely there ought to be at least one to explain the formation and progress of our real knowledge? This wise suggestion, still unfulfilled, was at first welcomed, according to Comte's own account, by Guizot's philosophic instinct, and then repulsed by his

Official work.

“metaphysical rancour.”

Meanwhile Comte did his official work conscientiously, sorely as he grudged the time which it took from the execution of the great object of his thoughts. “I hardly know if even to you,” he writes to his wife, “I dare disclose the sweet and softened feeling that comes over me when I find a young man whose examination is thoroughly satisfactory. Yes, though you may smile, the emotion would easily stir me to tears if I were not carefully on my guard.” Such sympathy with youthful hope, in union with industry and intelligence, shows that Comte’s dry and austere manner veiled the fires of a generous social emotion. It was this which made him add to his labours the burden of delivering every year from 1831 to 1848 a course of gratuitous lectures on astronomy for a popular audience. The social feeling that inspired this disinterested act showed itself in other ways. He suffered imprisonment rather than serve in the national guard; his position was that though he would not take arms against the new monarchy of July, yet being a republican he would take no oath to defend it. The only amusement that Comte permitted himself was a visit to the opera. In his youth he had been a playgoer, but he shortly came to the conclusion that tragedy is a stilted and bombastic art, and after a time comedy interested him no more than tragedy. For the opera he had a genuine passion, which he gratified as often as he could, until his means became too narrow to afford even that single relaxation.

Of his manner and personal appearance we have the following account from one who was his pupil:—“Daily as the clock struck eight on the horologe of the Luxembourg, while the ringing hammer on the bell was yet audible, the door of my room opened, and there entered a man, short, rather stout, almost what one might call sleek, freshly shaven, without vestige of whisker or moustache. He was invariably dressed in a suit of the most spotless black, as if going to a dinner party; his white neck-cloth was fresh from the laundress’s hands, and his hat shining like a racer’s coat. He advanced to the arm-chair prepared for him in the centre of the writing-table, laid his hat on the left-hand corner; his snuff-box was deposited on the same side beside the quire of paper placed in readiness for his use, and dipping the pen twice into the ink-bottle, then bringing it to within an inch of his nose to make sure it was properly filled, he broke silence: ‘We have said that the chord AB,’ &c. For three-quarters of an hour he continued his demonstration, making short notes as he went on, to guide the listener in repeating the problem alone; then, taking up another cahier which lay beside him, he went over the written repetition of the former lesson. He explained, corrected or commented till the clock struck nine; then, with the little finger of the right hand brushing from his coat and waistcoat the shower of superfluous snuff which had fallen on them, he pocketed his snuff-box, and resuming his hat, he as silently as when he came in made his exit by the door which I rushed to open for him.”

Completion of “Positive Philosophy.”

In 1842, as we have said, the last volume of the *Positive Philosophy* was given to the public. Instead of that contentment which we like to picture as the reward of twelve years of meritorious toil devoted to the erection of a high philosophic edifice, Comte found himself in the midst of a very sea of small troubles, of that uncompensated kind that harass without elevating, and waste a man’s spirit without softening or enlarging it. First, the jar of temperament between Comte and his wife had become so unbearable that they separated (1842). We know too little of the facts to allot blame to either of them. In spite of one or two disadvantageous facts in her career, Madame Comte seems to have uniformly comported herself towards her husband with an honourable solicitude for his well-being. Comte made her an annual allowance, and for some years after the separation they corresponded on friendly terms. Next in the list of the vexations was a lawsuit with his publisher. The publisher had inserted in the sixth volume a protest against a certain footnote, in which Comte had used some hard words about Arago. Comte threw himself into the suit with an energy worthy of Voltaire and won it. Third, and worst of all, he had prefixed a preface to the sixth volume, in which he went out of his way to rouse the enmity of the men on whom depended his annual re-election to the post of examiner for the Polytechnic school. The result was that he lost the appointment, and with it one-half of his very modest income. This was the occasion of an episode, which is of more than merely personal interest.

J. S. Mill.

Before 1842 Comte had been in correspondence with J. S. Mill, who had been greatly impressed by Comte’s philosophic ideas; Mill admits that his own *System of Logic* owes many valuable thoughts to Comte, and that, in the portion of that work which treats of the logic of the moral sciences, a radical improvement in the conceptions of logical method was derived from the *Positive Philosophy*. Their correspondence, which was full and copious, turned principally upon the two great questions of the equality between men and women, and of the expediency and constitution

of a sacerdotal or spiritual order. When Comte found himself straitened, he confided the entire circumstances to Mill. As might be supposed by those who know the affectionate anxiety with which Mill regarded the welfare of any one whom he believed to be doing good work in the world, he at once took pains to have Comte's loss of income made up to him, until Comte should have had time to repair that loss by his own endeavour. Mill persuaded Grote, Molesworth, and Raikes Currie to advance the sum of £240. At the end of the year (1845) Comte had taken no steps to enable himself to dispense with the aid of the three Englishmen. Mill applied to them again, but with the exception of Grote, who sent a small sum, they gave Comte to understand that they expected him to earn his own living. Mill had suggested to Comte that he should write articles for the English periodicals, and expressed his own willingness to translate any such articles from the French. Comte at first fell in with the plan, but he speedily surprised and disconcerted Mill by boldly taking up the position of "high moral magistrate," and accusing the three defaulting contributors of a scandalous falling away from righteousness and a high mind. Mill was chilled by these pretensions; and the correspondence came to an end. There is something to be said for both sides. Comte, regarding himself as the promoter of a great scheme for the benefit of humanity, might reasonably look for the support of his friends in the fulfilment of his designs. But Mill and the others were fully justified in not aiding the propagation of a doctrine in which they might not wholly concur. Comte's subsequent attitude of censorious condemnation put him entirely in the wrong.

From 1845 to 1848 Comte lived as best he could, as well as made his wife her allowance, on an income of £200 a year. His little account books of income and outlay, with every item entered down to a few hours before his death, are accurate and neat enough to have satisfied an ancient Roman householder. In 1848, through no fault of his own, his salary was reduced to £80. Littré and others, with Comte's approval, published an appeal for subscriptions, and on the money thus contributed Comte subsisted for the remaining nine years of his life. By 1852 the subsidy produced as much as £200 a year. It is worth noticing that Mill was one of the subscribers, and that Littré continued his assistance after he had been driven from Comte's society by his high pontifical airs. We are sorry not to be able to record any similar trait of magnanimity on Comte's part. His character, admirable as it is for firmness, for intensity, for inexorable will, for iron devotion to what he thought the service of mankind, yet offers few of those softening qualities that make us love good men and pity bad ones.

It is best to think of him only as the intellectual worker, pursuing in uncomforted obscurity the laborious and absorbing task to which he had given up his whole life. His singularly conscientious fashion of elaborating his ideas made the mental strain more intense than even so exhausting a work as the abstract exposition of the principles of positive science need have been. He did not write down a word until he had first composed the whole matter in his mind. When he had thoroughly meditated every sentence, he sat down to write, and then, such was the grip of his memory, the exact order of his thoughts came back to him as if without an effort, and he wrote down precisely what he had intended to write, without the aid of a note or a memorandum, and without check or pause. For example, he began and completed in about six weeks a chapter in the *Positive Philosophy* (vol. v. ch. 55) which would fill forty pages of this Encyclopaedia. When we reflect that the chapter is not narrative, but an abstract exposition of the guiding principles of the movements of several centuries, with many threads of complex thought running along side by side all through the speculation, then the circumstances under which it was reduced to literary form are really astonishing. It is hardly possible, however, to share the admiration expressed by some of Comte's disciples for his style. We are not so unreasonable as to blame him for failing to make his pages picturesque or thrilling; we do not want sunsets and stars and roses and ecstasy; but there is a certain standard for the most serious and abstract subjects. When compared with such philosophic writing as Hume's, Diderot's, Berkeley's, then Comte's manner is heavy, laboured, monotonous, without relief and without light. There is now and then an energetic phrase, but as a whole the vocabulary is jejune; the sentences are overloaded; the pitch is flat. A scrupulous insistence on making his meaning clear led to an iteration of certain adjectives and adverbs, which at length deadened the effect beyond the endurance of all but the most resolute students. Only the interest of the matter prevents one from thinking of Rivarol's ill-natured remark upon Condorcet, that he wrote with opium on a page of lead. The general effect is impressive, not by any virtues of style, for we do not discern one, but by reason of the magnitude and importance of the undertaking, and the visible conscientiousness and the grasp with which it is executed. It is by sheer strength of thought, by the vigorous perspicacity with which he strikes the lines of cleavage of his subject, that he makes his way

Literary method.

into the mind of the reader; in the presence of gifts of this power we need not quarrel with an ungainly style.

Comte pursued one practice which ought to be mentioned in connexion with his personal history, the practice of what he style *hygiène cérébrale*. After he had acquired what he considered to be a sufficient stock of material, and this happened before he had completed the *Positive Philosophy*, he abstained from reading newspapers, reviews, scientific transactions and everything else, except two or three poets (notably Dante) and the *Imitatio Christi*. It is true that his friends kept him informed of what was going on in the scientific world. Still this partial divorce of himself from the record of the social and scientific activity of his time, though it may save a thinker from the deplorable evils of dispersion, moral and intellectual, accounts in no small measure for the exaggerated egoism, and the absence of all feeling for reality, which marked Comte's later days.

Hygiène cérébrale.

In 1845 Comte made the acquaintance of Madame Clotilde de Vaux, a lady whose husband had been sent to the galleys for life. Very little is known about her qualities. She wrote a little piece which Comte rated so preposterously as to talk about George Sand in the same sentence; it is in truth a flimsy performance, though it contains one or two gracious thoughts. There is true beauty in the saying —"*It is unworthy of a noble nature to diffuse its pain.*" Madame de Vaux's letters speak well for her good sense and good feeling, and it would have been better for Comte's later work if she had survived to exert a wholesome restraint on his exaltation. Their friendship had only lasted a year when she died (1846), but the period was long enough to give her memory a supreme ascendancy in Comte's mind. Condillac, Joubert, Mill and other eminent men have shown what the intellectual ascendancy of a woman can be. Comte was as inconsolable after Madame de Vaux's death as D'Alembert after the death of Mademoiselle L'Espinasse. Every Wednesday afternoon he made a reverential pilgrimage to her tomb, and three times every day he invoked her memory in words of passionate expansion. His disciples believe that in time the world will reverence Comte's sentiment about Clotilde de Vaux, as it reveres Dante's adoration of Beatrice—a parallel that Comte himself was the first to hit upon. Yet we cannot help feeling that it is a grotesque and unseemly anachronism to apply in grave prose, addressed to the whole world, those terms of saint and angel which are touching and in their place amid the trouble and passion of the great mystic poet. Whatever other gifts Comte may have had—and he had many of the rarest kind,—poetic imagination was not among them, any more than poetic or emotional expression was among them. His was one of those natures whose faculty of deep feeling is unhappily doomed to be inarticulate, and to pass away without the magic power of transmitting itself.

Madame de Vaux.

Comte lost no time, after the completion of his *Course of Positive Philosophy*, in proceeding with the *System of Positive Polity*, for which the earlier work was designed to be a foundation. The first volume was published in 1851, and the fourth and last in 1854. In 1848, when the political air was charged with stimulating elements, he founded the Positive Society, with the expectation that it might grow into a reunion as powerful over the new revolution as the Jacobin Club had been in the revolution of 1789. The hope was not fulfilled, but a certain number of philosophic disciples gathered round Comte, and eventually formed themselves, under the guidance of the new ideas of the latter half of his life, into a kind of church, for whose use was drawn up the *Positivist Calendar* (1849), in which the names of those who had advanced civilization replaced the titles of the saints. Gutenberg and Shakespeare were among the patrons of the thirteen months in this calendar. In the years 1849, 1850 and 1851 Comte gave three courses of lectures at the Palais Royal. They were gratuitous and popular, and in them he boldly advanced the whole of his doctrine, as well as the direct and immediate pretensions of himself and his system. The third course ended in the following uncompromising terms—"In the name of the Past and of the Future, the servants of Humanity—both its philosophical and its practical servants—come forward to claim as their due the general direction of this world. Their object is to constitute at length a real Providence in all departments,—moral, intellectual and material. Consequently they exclude once for all from political supremacy all the different servants of God—Catholic, Protestant or Deist—as being at once behindhand and a cause of disturbance." A few weeks after this invitation, a very different person stepped forward to constitute himself a real Providence.

Positive Polity.

In 1852 Comte published the *Catechism of Positivism*. In the preface to it he took occasion to express his approval of Louis Napoleon's *coup d'état* of the 2nd of December,—"a fortunate crisis which has set aside the parliamentary system and instituted a dictatorial

republic." Whatever we may think of the political sagacity of such a judgment, it is due to Comte to say that he did not expect to see his dictatorial republic transformed into a dynastic empire, and, next, that he did expect from the Man of December freedom of the press and of public meeting. His later hero was the emperor Nicholas, "the only statesman in Christendom,"—as unlucky a judgment as that which placed Dr Francia in the Comtist Calendar.

Death.

In 1857 he was attacked by cancer, and died peaceably on the 5th of September of that year. The anniversary is celebrated by ceremonial gatherings of his French and English followers, who then commemorate the name and the services of the founder of their religion. By his will he appointed thirteen executors who were to preserve his rooms at 10 rue Monsieur-le-Prince as the headquarters of the new religion of Humanity.

Comte's philosophic consistency.

In proceeding to give an Outline of Comte's system, we shall consider the *Positive Polity* as the more or less legitimate sequel of the *Positive Philosophy*, notwithstanding the deep gulf which so eminent a critic as J. S. Mill insisted upon fixing between the earlier and the later work. There may be, as we think there is, the greatest difference in their value, and the temper is not the same, nor the method. But the two are quite capable of being regarded, and for the purposes of an account of Comte's career ought to be regarded, as an integral whole. His letters when he was a young man of one-and-twenty, and before he had published a word, show how strongly present the social motive was in his mind, and in what little account he should hold his scientific works, if he did not perpetually think of their utility for the species. "I feel," he wrote, "that such scientific reputation as I might acquire would give more value, more weight, more useful influence to my political sermons." In 1822 he published a *Plan of the Scientific Works necessary to reorganize Society*. In this he points out that modern society is passing through a great crisis, due to the conflict of two opposing movements,—the first, a disorganizing movement owing to the break-up of old institutions and beliefs; the second, a movement towards a definite social state, in which all means of human prosperity will receive their most complete development and most direct application. How is this crisis to be dealt with? What are the undertakings necessary in order to pass successfully through it towards an organic state? The answer to this is that there are two series of works. The first is theoretic or spiritual, aiming at the development of a new principle of co-ordinating social relations, and the formation of the system of general ideas which are destined to guide society. The second work is practical or temporal; it settles the distribution of power, and the institutions that are most conformable to the spirit of the system which has previously been thought out in the course of the theoretic work. As the practical work depends on the conclusions of the theoretical, the latter must obviously come first in order of execution.

Early writing.

In 1826 this was pushed farther in a most remarkable piece called *Considerations on the Spiritual Power*—the main object of which is to demonstrate the necessity of instituting a spiritual power, distinct from the temporal power and independent of it. In examining the conditions of a spiritual power proper for modern times, he indicates in so many terms the presence in his mind of a direct analogy between his proposed spiritual power and the functions of the Catholic clergy at the time of its greatest vigour and most complete independence,—that is to say, from about the middle of the 11th century until towards the end of the 13th. He refers to de Maistre's memorable book, *Du Pape*, as the most profound, accurate and methodical account of the old spiritual organization, and starts from that as the model to be adapted to the changed intellectual and social conditions of the modern time. In the *Positive Philosophy*, again (vol. v. p. 344), he distinctly says that Catholicism, reconstituted as a system on new intellectual foundations, would finally preside over the spiritual reorganization of modern society. Much else could be quoted to the same effect. If unity of career, then, means that Comte, from the beginning designed the institution of a spiritual power, and the systematic reorganization of life, it is difficult to deny him whatever credit that unity may be worth, and the credit is perhaps not particularly great. Even the readaptation of the Catholic system to a scientific doctrine was plainly in his mind thirty years before the final execution of the *Positive Polity*, though it is difficult to believe that he foresaw the religious mysticism in which the task was to land him. A great analysis was to precede a great synthesis, but it was the synthesis on which Comte's vision was centred from the first. Let us first sketch the nature of the analysis. Society is to be reorganized on the base of knowledge. What is the sum and significance of knowledge? That is the question which Comte's first master-work professes to answer.

The *Positive Philosophy* opens with the statement of a certain law of which Comte was the

discoverer, and which has always been treated both by disciples and dissidents as the key to his system. This is the Law of the Three States. It is as follows. Each of our leading conceptions, each branch of our knowledge, passes successively through three different phases; there are three different ways in which the human mind explains phenomena, each way following the other in order. These three stages are the Theological, the Metaphysical and the Positive. Knowledge, or a branch of knowledge, is in the Theological state, when it supposes the phenomena under consideration to be due to immediate volition, either in the object or in some supernatural being. In the Metaphysical state, for volition is substituted abstract force residing in the object, yet existing independently of the object; the phenomena are viewed as if apart from the bodies manifesting them; and the properties of each substance have attributed to them an existence distinct from that substance. In the Positive state, inherent volition or external volition and inherent force or abstraction personified have both disappeared from men's minds, and the explanation of a phenomenon means a reference of it, by way of succession or resemblance, to some other phenomenon,—means the establishment of a relation between the given fact and some more general fact. In the Theological and Metaphysical state men seek a cause or an essence; in the Positive they are content with a law. To borrow an illustration from an able English disciple of Comte:—"Take the phenomenon of the sleep produced by opium. The Arabs are content to attribute it to the 'will of God.' Molière's medical student accounts for it by a *soporific principle* contained in the opium. The modern physiologist knows that he cannot account for it at all. He can simply observe, analyse and experiment upon the phenomena attending the action of the drug, and classify it with other agents analogous in character."—(*Dr Bridges.*)

Law of the Three States.

The first and greatest aim of the Positive Philosophy is to advance the study of society into the third of the three stages,—to remove social phenomena from the sphere of theological and metaphysical conceptions, and to introduce among them the same scientific observation of their laws which has given us physics, chemistry, physiology. Social physics will consist of the conditions and relations of the facts of society, and will have two departments,—one, statical, containing the laws of order; the other dynamical, containing the laws of progress. While men's minds were in the theological state, political events, for example, were explained by the will of the gods, and political authority based on divine right. In the metaphysical state of mind, then, to retain our instance, political authority was based on the sovereignty of the people, and social facts were explained by the figment of a falling away from a state of nature. When the positive method has been finally extended to society, as it has been to chemistry and physiology, these social facts will be resolved, as their ultimate analysis, into relations with one another, and instead of seeking causes in the old sense of the word, men will only examine the conditions of social existence. When that stage has been reached, not merely the greater part, but the whole, of our knowledge will be impressed with one character, the character, namely, of positivity or scientificalness; and all our conceptions in every part of knowledge will be thoroughly homogeneous. The gains of such a change are enormous. The new philosophical unity will now in its turn regenerate all the elements that went to its own formation. The mind will pursue knowledge without the wasteful jar and friction of conflicting methods and mutually hostile conceptions; education will be regenerated; and society will reorganize itself on the only possible solid base—a homogeneous philosophy.

The *Positive Philosophy* has another object besides the demonstration of the necessity and propriety of a science of society. This object is to show the sciences as branches from a single trunk,—is to give to science the ensemble or spirit or generality hitherto confined to philosophy, and to give to philosophy the rigour and solidity of science. Comte's special object is a study of social physics, a science that before his advent was still to be formed; his second object is a review of the methods and leading generalities of all the positive sciences already formed, so that we may know both what system of inquiry to follow in our new science, and also where the new science will stand in relation to other knowledge.

Classification of sciences.

The first step in this direction is to arrange scientific method and positive knowledge in order, and this brings us to another cardinal element in the Comtist system, the classification of the sciences. In the front of the inquiry lies one main division, that, namely, between speculative and practical knowledge. With the latter we have no concern. Speculative or theoretic knowledge is divided into abstract and concrete. The former is concerned with the laws that regulate phenomena in all conceivable cases: the latter is concerned with the application of these laws. Concrete science relates to objects or beings; abstract science to events. The former is particular or descriptive; the latter is general. Thus, physiology is an abstract science; but zoology is concrete. Chemistry is abstract;

mineralogy is concrete. It is the method and knowledge of the abstract sciences that the Positive Philosophy has to reorganize in a great whole.

Comte's principle of classification is that the dependence and order of scientific study follows the dependence of the phenomena. Thus, as has been said, it represents both the objective dependence of the phenomena and the subjective dependence of our means of knowing them. The more particular and complex phenomena depend upon the simpler and more general. The latter are the more easy to study. Therefore science will begin with those attributes of objects which are most general, and pass on gradually to other attributes that are combined in greater complexity. Thus, too, each science rests on the truths of the sciences that precede it, while it adds to them the truths by which it is itself constituted. Comte's series or hierarchy is arranged as follows:— (1) Mathematics (that is, number, geometry, and mechanics), (2) Astronomy, (3) Physics, (4) Chemistry, (5) Biology, (6) Sociology. Each of the members of this series is one degree more special than the member before it, and depends upon the facts of all the members preceding it, and cannot be fully understood without them. It follows that the crowning science of the hierarchy, dealing with the phenomena of human society, will remain longest under the influence of theological dogmas and abstract figments, and will be the last to pass into the positive stage. You cannot discover the relations of the facts of human society without reference to the conditions of animal life; you cannot understand the conditions of animal life without the laws of chemistry; and so with the rest.

This arrangement of the sciences, and the Law of the Three States, are together explanatory of the course of human thought and knowledge. They are thus the double key of Comte's systematization of the philosophy of all the sciences from mathematics to physiology, and his analysis of social evolution, which is the base of sociology. Each science contributes its philosophy. The co-ordination of all these partial philosophies produces the general Positive Philosophy. "Thousands had cultivated science, and with splendid success; not one had conceived the philosophy which the sciences when organized would naturally evolve. A few had seen the necessity of extending the scientific method to all inquiries, but no one had seen how this was to be effected.... The Positive Philosophy is novel as a philosophy, not as a collection of truths never before suspected. Its novelty is the organization of existing elements. Its very principle implies the absorption of all that great thinkers had achieved; while incorporating their results it extended their methods.... What tradition brought was the results; what Comte brought was the organization of these results. He always claimed to be the founder of the Positive Philosophy. That he had every right to such a title is demonstrable to all who distinguish between the positive sciences and the philosophy which co-ordinated the truths and methods of these sciences into a doctrine."—*G. H. Lewes.*

The double key of positive philosophy.

Comte's classification of the sciences has been subjected to a vigorous criticism by Herbert Spencer. Spencer's two chief points are these:—(1) He denies that the principle of the development of the sciences is the principle of decreasing generality; he asserts that there are as many examples of the advent of a science being determined by increasing generality as by increasing speciality. (2) He holds that any grouping of the sciences in a succession gives a radically wrong idea of their genesis and their interdependence; no true filiation exists; no science develops itself in isolation; no one is independent, either logically or historically. Littré, by far the most eminent of the scientific followers of Comte, concedes a certain force to Spencer's objections, and makes certain secondary modifications in the hierarchy in consequence, while still cherishing his faith in the Comtist theory of the sciences. J. S. Mill, while admitting the objections as good, if Comte's arrangement pretended to be the only one possible, still holds the arrangement as tenable for the purpose with which it was devised. G. H. Lewes asserts against Spencer that the arrangement in a series is necessary, on grounds similar to those which require that the various truths constituting a science should be systematically co-ordinated although in nature the phenomena are intermingled.

Criticism on Comte's classification.

The first three volumes of the *Positive Philosophy* contain an exposition of the partial philosophies of the five sciences that precede sociology in the hierarchy. Their value has usually been placed very low by the special followers of the sciences concerned; they say that the knowledge is second-hand, is not coherent, and is too confidently taken for final. The Comtist replies that the task is philosophic; and is not to be judged by the minute accuracies of science. In these three volumes Comte took the sciences roughly as he found them. His eminence as a man of science must be measured by his only original work in that

department,—the construction, namely, of the new science of society. This work is accomplished in the last three volumes of the *Positive Philosophy*, and the second and third volumes of the *Positive Polity*. The Comtist maintains that even if these five volumes together fail in laying down correctly and finally the lines of the new science, still they are the first solution of a great problem hitherto unattempted. “Modern biology has got beyond Aristotle’s conception; but in the construction of the biological science, not even the most unphilosophical biologist would fail to recognize the value of Aristotle’s attempt. So for sociology. Subsequent sociologists may have conceivably to remodel the whole science, yet not the less will they recognize the merit of the first work which has facilitated their labours.”—*Congreve.*

Sociological conceptions.

We shall now briefly describe Comte’s principal conceptions in sociology, his position in respect to which is held by himself, and by others, to raise him to the level of Descartes or Leibnitz. Of course the first step was to approach the phenomena of human character and social existence with the expectation of finding them as reducible to general laws as the other phenomena of the universe, and with the hope of exploring these laws by the same instruments of observation and verification as had done such triumphant work in the case of the latter. Comte separates the collective facts of society and history from the individual phenomena of biology; then he withdraws these collective facts from the region of external volition, and places them in the region of law. The facts of history must be explained, not by providential interventions, but by referring them to conditions inherent in the successive stages of social existence. This conception makes a science of society possible. What is the method? It comprises, besides observation and experiment (which is, in fact, only the observation of abnormal social states), a certain peculiarity of verification. We begin by deducing every well-known historical situation from the series of its antecedents. Thus we acquire a body of empirical generalizations as to social phenomena, and then we connect the generalizations with the positive theory of human nature. A sociological demonstration lies in the establishment of an accordance between the conclusions of historical analysis and the preparatory conceptions of biological theory. As Mill puts it:—“If a sociological theory, collected from historical evidence, contradicts the established general laws of human nature; if (to use M. Comte’s instances) it implies, in the mass of mankind, any very decided natural bent, either in a good or in a bad direction; if it supposes that the reason, in average human beings, predominates over the desires, or the disinterested desires over the personal,—we may know that history has been misinterpreted, and that the theory is false. On the other hand, if laws of social phenomena, empirically generalized from history, can, when once suggested, be affiliated to the known laws of human nature; if the direction actually taken by the developments and changes of human society, can be seen to be such as the properties of man and of his dwelling-place made antecedently probable, the empirical generalizations are raised into positive laws, and sociology becomes a science.” The result of this method, is an exhibition of the events of human experience in co-ordinated series that manifest their own graduated connexion.

Method.

Next, as all investigation proceeds from that which is known best to that which is unknown or less well known, and as, in social states, it is the collective phenomenon that is more easy of access to the observer than its parts, therefore we must consider and pursue all the elements of a given social state together and in common. The social organization must be viewed and explored as a whole. There is a nexus between each leading group of social phenomena and other leading groups; if there is a change in one of them, that change is accompanied by a corresponding modification of all the rest. “Not only must political institutions and social manners, on the one hand, and manners and ideas, on the other, be always mutually connected; but further, this consolidated whole must be always connected by its nature with the corresponding state of the integral development of humanity, considered in all its aspects of intellectual, moral and physical activity.”—*Comte.*

Is there any one element which communicates the decisive impulse to all the rest,—any predominating agency in the course of social evolution? The answer is that all the other parts of social existence are associated with, and drawn along by, the contemporary condition of intellectual development. The Reason is the superior and preponderant element which settles the direction in which all the other faculties shall expand. “It is only through the more and more marked influence of the reason over the general conduct of man and of society, that the gradual march of our race has attained that regularity and persevering continuity which distinguish it so radically from the desultory and barren expansion of even the highest animal orders, which share, and with enhanced strength, the appetites, the passions, and even the primary sentiments of man.” The history

Decisive Importance of Intellectual development.

of intellectual development, therefore, is the key to social evolution, and the key to the history of intellectual development is the Law of the Three States.

Among other central thoughts in Comte's explanation of history are these:—The displacement of theological by positive conceptions has been accompanied by a gradual rise of an industrial régime out of the military régime;—the great permanent contribution of Catholicism was the separation which it set up between the temporal and the spiritual powers;—the progress of the race consists in the increasing preponderance of the distinctively human elements over the animal elements;—the absolute tendency of ordinary social theories will be replaced by an unfailing adherence to the relative point of view, and from this it follows that the social state, regarded as a whole, has been as perfect in each period as the co-existing condition of humanity and its environment would allow.

The elaboration of these ideas in relation to the history of the civilization of the most advanced portion of the human race occupies two of the volumes of the *Positive Philosophy*, and has been accepted by very different schools as a masterpiece of rich, luminous, and far-reaching suggestion. Whatever additions it may receive, and whatever corrections it may require, this analysis of social evolution will continue to be regarded as one of the great achievements of human intellect.

Social dynamics in the Positive Polity.

The third volume of the *Positive Polity* treats of social dynamics, and takes us again over the ground of historic evolution. It abounds with remarks of extraordinary fertility and comprehensiveness; but it is often arbitrary; and its views of the past are strained into coherence with the statical views of the preceding volume. As it was composed in rather less than six months, and as the author honestly warns us that he has given all his attention to a more profound co-ordination, instead of working out the special explanations more fully, as he had promised, we need not be surprised if the result is disappointing to those who had mastered the corresponding portion of the *Positive Philosophy*. Comte explains the difference between his two works. In the first his "chief object was to discover and demonstrate the laws of progress, and to exhibit in one unbroken sequence the collective destinies of mankind, till then invariably regarded as a series of events wholly beyond the reach of explanation, and almost depending on arbitrary will. The present work, on the contrary, is addressed to those who are already sufficiently convinced of the certain existence of social laws, and desire only to have them reduced to a true and conclusive system."

The Positivist system.

The main principles of the Comtian system are derived from the *Positive Polity* and from two other works,—the *Positivist Catechism: a Summary Exposition of the Universal Religion, in Twelve Dialogues between a Woman and a Priest of Humanity*; and, second, *The Subjective Synthesis* (1856), which is the first and only volume of a work upon mathematics announced at the end of the *Positive Philosophy*. The system for which the *Positive Philosophy* is alleged to have been the scientific preparation contains a Polity and a Religion; a complete arrangement of life in all its aspects, giving a wider sphere to Intellect, Energy and Feeling than could be found in any of the previous organic types,—Greek, Roman or Catholic-feudal. Comte's immense superiority over such prae-Revolutionary utopians as the Abbé Saint Pierre, no less than over the group of post-revolutionary Utopians, is especially visible in this firm grasp of the cardinal truth that the improvement of the social organism can only be effected by a moral development, and never by any changes in mere political mechanism, or any violences in the way of an artificial redistribution of wealth. A moral transformation must precede any real advance. The aim, both in public and private life, is to secure to the utmost possible 821
extent the victory of the social feeling over self-love, or Altruism over Egoism.[1] This is the key to the regeneration of social existence, as it is the key to that unity of individual life which makes all our energies converge freely and without wasteful friction towards a common end. What are the instruments for securing the preponderance of Altruism? Clearly they must work from the strongest element in human nature, and this element is Feeling or the Heart. Under the Catholic system the supremacy of Feeling was abused, and the Intellect was made its slave. Then followed a revolt of Intellect against Sentiment. The business of the new system will be to bring back the Intellect into a condition, not of slavery, but of willing ministry to the Feelings. The subordination never was, and never will be,

The Religion of humanity.

effected except by means of a religion, and a religion, to be final, must include a harmonious synthesis of all our conceptions of the external order of the universe. The characteristic basis of a religion is the existence of a Power without us, so superior to ourselves as to command the complete submission of our whole life. This basis is to be found in the Positive stage, in Humanity,

past, present and to come, conceived as the Great Being.

> "A deeper study of the great universal order reveals to us at length the ruling power within it of the true Great Being, whose destiny it is to bring that order continually to perfection by constantly conforming to its laws, and which thus best represents to us that system as a whole. This undeniable Providence, the supreme dispenser of our destinies, becomes in the natural course the common centre of our affections, our thoughts, and our actions. Although this Great Being evidently exceeds the utmost strength of any, even of any collective, human force, its necessary constitution and its peculiar function endow it with the truest sympathy towards all its servants. The least amongst us can and ought constantly to aspire to maintain and even to improve this Being. This natural object of all our activity, both public and private, determines the true general character of the rest of our existence, whether in feeling or in thought; which must be devoted to love, and to know, in order rightly to serve, our Providence, by a wise use of all the means which it furnishes to us. Reciprocally this continued service, whilst strengthening our true unity, renders us at once both happier and better."

Remarks on the religion.

The exaltation of Humanity into the throne occupied by the Supreme Being under monotheistic systems made all the rest of Comte's construction easy enough. Utility remains the test of every institution, impulse, act; his fabric becomes substantially an arch of utilitarian propositions, with an artificial Great Being inserted at the top to keep them in their place. The Comtist system is utilitarianism crowned by a fantastic decoration. Translated into the plainest English, the position is as follows: "Society can only be regenerated by the greater subordination of politics to morals, by the moralization of capital, by the renovation of the family, by a higher conception of marriage and so on. These ends can only be reached by a heartier development of the sympathetic instincts. The sympathetic instincts can only be developed by the Religion of Humanity." Looking at the problem in this way, even a moralist who does not expect theology to be the instrument of social revival, might still ask whether the sympathetic instincts will not necessarily be already developed to their highest point, before people will be persuaded to accept the religion, which is at the bottom hardly more than sympathy under a more imposing name. However that may be, the whole battle—into which we shall not enter—as to the legitimateness of Comtism as a religion turns upon this erection of Humanity into a Being. The various hypotheses, dogmas, proposals, as to the family, to capital, &c., are merely propositions measurable by considerations of utility and a balance of expediencies. Many of these proposals are of the highest interest, and many of them are actually available; but there does not seem to be one of them of an available kind, which could not equally well be approached from other sides, and even incorporated in some radically antagonistic system. Adoption, for example, as a practice for improving the happiness of families and the welfare of society, is capable of being weighed, and can in truth only be weighed, by utilitarian considerations, and has been commended by men to whom the Comtist religion is naught. The singularity of Comte's construction, and the test by which it must be tried, is the transfer of the worship and discipline of Catholicism to a system in which "the conception of God is superseded" by the abstract idea of Humanity, conceived as a kind of Personality.

And when all is said, the invention does not help us. We have still to settle what *is* for the good of Humanity, and we can only do that in the old-fashioned way. There is no guidance in the conception. No effective unity can follow from it, because you can only find out the right and wrong of a given course by summing up the advantages and disadvantages, and striking a balance, and there is nothing in the Religion of Humanity to force two men to find the balance on the same side. The Comtists are no better off than other utilitarians in judging policy, events, conduct.

The worship and discipline.

The particularities of the worship, its minute and truly ingenious re-adaptations of sacraments, prayers, reverent signs, down even to the invocation of a New Trinity, need not detain us. They are said, though it is not easy to believe, to have been elaborated by way of Utopia. If so, no Utopia has ever yet been presented in a style so little calculated to stir the imagination, to warm the feelings, to soothe the insurgency of the reason. It is a mistake to present a great body of hypotheses—if Comte meant them for hypotheses—in the most dogmatic and peremptory form to which language can lend itself. And there is no more extraordinary thing in the history of opinion than the perversity with which Comte has succeeded in clothing a philosophic doctrine, so intrinsically conciliatory as his, in a shape that excites so little sympathy and gives so much provocation. An enemy defined Comtism as Catholicism *minus* Christianity, to which an able champion retorted by calling it Catholicism *plus* Science. Comte's Utopia has pleased the followers of the Catholic, just as little as those of

the scientific, spirit.

The priesthood.

The elaborate and minute systematization of life, proper to the religion of Humanity, is to be directed by a priesthood. The priests are to possess neither wealth nor material power; they are not to command, but to counsel; their authority is to rest on persuasion, not on force. When religion has become positive, and society industrial, then the influence of the church upon the state becomes really free and independent, which was not the case in the middle ages. The power of the priesthood rests upon special knowledge of man and nature; but to this intellectual eminence must also be added moral power and a certain greatness of character, without which force of intellect and completeness of attainment will not receive the confidence they ought to inspire. The functions of the priesthood are of this kind:—To exercise a systematic direction over education; to hold a consultative influence over all the important acts of actual life, public and private; to arbitrate in cases of practical conflict; to preach sermons recalling those principles of generality and universal harmony which our special activities dispose us to ignore; to order the due classification of society; to perform the various ceremonies appointed by the founder of the religion. The authority of the priesthood is to rest wholly on voluntary adhesion, and there is to be perfect freedom of speech and discussion. This provision hardly consists with Comte's congratulations to the tsar Nicholas on the "wise vigilance" with which he kept watch over the importation of Western books.

Women.

From his earliest manhood Comte had been powerfully impressed by the necessity of elevating the condition of women. (See remarkable passage in his letters to M. Valat, pp. 84-87.) His friendship with Madame de Vaux had deepened the impression, and in the reconstructed society women are to play a highly important part. They are to be carefully excluded from public action, but they are to do many more important things than things political. To fit them for their functions, they are to be raised above material cares, and they are to be thoroughly educated. The family, which is so important an element of the Comtist scheme of things, exists to carry the influence of woman over man to the highest point of cultivation. Through affection she purifies the activity of man. "Superior in power of affection, more able to keep both the intellectual and the active powers in continual subordination to feeling, women are formed as the natural intermediaries between Humanity and man. The Great Being confides specially to them its moral Providence, maintaining through them the direct and constant cultivation of universal affection, in the midst of all the distractions of thought or action, which are for ever withdrawing men from its influence.... Beside the uniform influence of every woman on every man, to attach him to Humanity, such is the importance and the difficulty of this ministry that each of us should be placed under the special guidance of one of these angels, to answer for him, as it were, to the Great Being. This moral guardianship may assume three types,—the mother, the wife and the daughter; each having several modifications, as shown in the concluding volume. Together they form the three simple modes of solidarity, or unity with contemporaries,—obedience, union and protection—as well as the three degrees of continuity between ages, by uniting us with the past, the present and the future. In accordance with my theory of the brain, each corresponds with one of our three altruistic instincts—veneration, attachment and benevolence."

Conclusion.

How the positive method of observation and verification of real facts has landed us in this, and much else of the same kind, is extremely hard to guess. Seriously to examine an encyclopaedic system, that touches life, society and knowledge at every point, is evidently beyond the compass of such an article as this. There is in every chapter a whole group of speculative suggestions, each of which would need a long chapter to itself to elaborate or to discuss. There is at least one biological speculation of astounding audacity, that could be examined in nothing less than a treatise. Perhaps we have said enough to show that after performing a great and real service to thought Comte almost sacrificed his claims to gratitude by the invention of a system that, as such, and independently of detached suggestions, is markedly retrograde. But the world will take what is available in Comte, while forgetting that in his work which is as irrational in one way as Hegel is in another.

See also the article Positivism.

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(J. Mo.; X.)

1 For Comte's place in the history of ethical theory see Ethics.

COMUS (from κῶμος, revel, or a company of revellers), in the later mythology of the Greeks, the god of festive mirth. In classic mythology the personification does not exist; but Comus appears in the Εἰκόνες, or *Descriptions of Pictures*, of Philostratus, a writer of the 3rd century A.D. as a winged youth, slumbering in a standing attitude, his legs crossed, his countenance flushed with wine, his head—which is sunk upon his breast—crowned with dewy flowers, his left hand feebly grasping a hunting spear, his right an inverted torch. Ben Jonson introduces Comus, in his masque entitled *Pleasure reconciled to Virtue* (1619), as the portly jovial patron of good cheer, "First father of sauce and deviser of jelly." In the *Comus, sive Phagesiposia Cimmeria; Somnium* (1608, and at Oxford, 1634), a moral allegory by a Dutch author, Hendrik van der Putten, or Erycius Puteanus, the conception is more nearly akin to Milton's, and Comus is a being whose enticements are more disguised and delicate than those of Jonson's deity. But Milton's Comus is a creation of his own. His story is one

> "Which never yet was heard in tale or song
> From old or modern bard, in hall or bower."

Born from the loves of Bacchus and Circe, he is "much like his father, but his mother more"—a sorcerer, like her, who gives to travellers a magic draught that changes their human face into the "brutal form of some wild beast," and, hiding from them their own foul disfigurement, makes them forget all the pure ties of life, "to roll with pleasure in a sensual sty."

COMYN, JOHN (d. c. 1300), Scottish baron, was a son of John Comyn (d. 1274), justiciar of Galloway, who was a nephew of the constable of Scotland, Alexander Comyn, earl of Buchan (d. 1289), and of the powerful and wealthy Walter Comyn, earl of Mentieth (d. 1258). With his uncle the earl of Buchan, the elder Comyn took a prominent part in the

affairs of Scotland during the latter part of the 13th century, and he had interests and estates in England as well as in his native land. He fought for Henry III. at Northampton and at Lewes, and was afterwards imprisoned for a short time in London. The younger Comyn, who had inherited the lordship of Badenoch from his great-uncle the earl of Mentieth, was appointed one of the guardians of Scotland in 1286, and shared in the negotiations between Edward I. and the Scots in 1289 and 1290. When Margaret, the Maid of Norway, died in 1290, Comyn was one of the claimants for the Scottish throne, but he did not press his candidature, and like the other Comyns urged the claim of John de Baliol. After supporting Baliol in his rising against Edward I., Comyn submitted to the English king in 1296; he was sent to reside in England, but returned to Scotland shortly before his death.

Comyn's son, John Comyn (d. 1306), called the "red Comyn," is more famous. Like his father he assisted Baliol in his rising against Edward I., and he was for some time a hostage in England. Having been made guardian of Scotland after the battle of Falkirk in 1298 he led the resistance to the English king for about five years, and then early in 1304 made an honourable surrender. Comyn is chiefly known for his memorable quarrel with Robert the Bruce. The origin of the dispute is uncertain. Doubtless the two regarded each other as rivals; Comyn may have refused to join in the insurrection planned by Bruce. At all events the pair met at Dumfries in January 1306; during a heated altercation charges of treachery were made, and Comyn was stabbed to death either by Bruce or by his followers.

Another member of the Comyn family who took an active part in Scottish affairs during these troubled times is John Comyn, earl of Buchan (d. c. 1313). This earl, a son of Earl Alexander, was constable of Scotland, and was first an ally and then an enemy of Robert the Bruce.

CONACRE (a corruption of corn-acre), in Ireland, a system of letting land, mostly in small patches, and usually for the growth of potatoes as a kind of return instead of wages. It is now practically obsolete.

CONANT, THOMAS JEFFERSON (1802-1891), American Biblical scholar, was born at Brandon, Vermont, on the 13th of December 1802. Graduating at Middlebury College in 1823, he became tutor in the Columbian University (now George Washington University) from 1825 to 1827, professor of Greek, Latin and German at Waterville College (now Colby College) from 1827 to 1833, professor of biblical literature and criticism in Hamilton (New York) Theological Institute from 1835 to 1851, and professor of Hebrew and of Biblical exegesis in Rochester Theological Seminary from 1851 to 1857. From 1857 to 1875 he was employed by the American Bible Union on the revision of the New Testament (1871). He married in 1830 Hannah O'Brien Chaplin (1809-1865), who was herself the author of *The Earnest Man*, a biography of Adoniram Judson (1855), and of *The History of the English Bible* (1859), besides being her husband's able assistant in his Hebrew studies. He died in Brooklyn, New York, on the 30th of April 1891. Conant was the foremost Hebrew scholar of his time in America. His treatise, *The Meaning and Use of "Baptizein" Philologically and Historically Investigated* (1860), an "appendix to the revised version of the Gospel by Matthew," is a valuable summary of the evidence for Baptist doctrine. He translated and edited Gesenius's *Hebrew Grammar* (1839; 1877), and published revised versions with notes of *Job* (1856), *Genesis* (1868), *Psalms* (1871), *Proverbs* (1872), *Isaiah* i.-xiii. 22 (1874), and *Historical Books of the Old Testament, Joshua to II. Kings* (1884).

CONATION (from Lat. *conari*, to attempt, strive), a psychological term, originally chosen

by Sir William Hamilton (*Lectures on Metaphysics*, pp. 127 foll.), used generally of an attitude of mind involving a tendency to take *action*, *e.g.* when one decides to remove an object which is causing a painful sensation, or to try to interrupt an unpleasant train of thought. This use of the word tends to lay emphasis on the mind as self-determined in relation to external objects. Another less common use of the word is to describe the pleasant or painful sensations which accompany muscular activity; the *conative* phenomena, thus regarded, are psychic changes brought about by external causes.

The chief difficulty in connexion with Conation is that of distinguishing it from Feeling, a term of very vague significance both in technical and in common usage. Thus the German psychologist F. Brentano holds that no real distinction can be made. He argues that the mental process from sorrow or dissatisfaction, through hope for a change and courage to act, up to the voluntary determination which issues in action, is a single homogeneous whole (*Psychologie*, pp. 308-309). The mere fact, however, that the series is continuous is no ground for not distinguishing its parts; if it were so, it would be impossible to distinguish by separate names the various colours in the solar spectrum, or indeed perception from conception. A more material objection, moreover, is that, in point of fact, the feeling of pleasure or pain roused by a given stimulus is specifically different from, and indeed may not be followed by, the determination to modify or remove it. Pleasure and pain, *i.e.* hedonic sensation *per se*, are essentially distinct from appetition and aversion; the pleasures of hearing music or enjoying sunshine are not in general accompanied by any volitional activity. It is true that painful sensations are generally accompanied by definite aversion or a tendency to take action, but the cases of positive pleasure are amply sufficient to support a distinction. Therefore, though in ordinary language such phrases as “feeling aversion” are quite legitimate, accurate psychology compels us to confine “feeling” to states of consciousness in which no conative activity is present, *i.e.* to the psychic phenomena of pleasure or pain considered in and by themselves. The study of such phenomena is specifically described as Hedonics (Gr. ἡδονή, pleasure) or Algedonics (Gr. ἀλγηδών, pain); the latter term was coined by H. R. Marshall (in *Pain, Pleasure and Aesthetics*, 1894), but has not been generally used.

The problem of conation is closely related to that of Attention (*q.v.*), which indeed, regarded as active consciousness, implies conation (G. T. Ladd, *Psychology*, 1894, p. 213). Thus, whenever the mind deliberately focusses itself upon a particular object, there is implied a psychic effort (for the relation between Attention and Conation, see G. F. Stout, *Analytic Psychology*, book i. chap. vi.). All conscious action, and in a less degree even unconscious or reflex action, implies attention; when the mind “attends” to any given external object, the organ through the medium of which information regarding that object is conveyed to the mind is set in motion. (See Psychology.)

CONCA, SEBASTIANO (1679-1764), Italian painter of the Florentine school, was born at Gaeta, and studied at Naples under Francesco Solimena. In 1706, along with his brother Giovanni, who acted as his assistant, he settled at Rome, where for several years he worked in chalk only, to improve his drawing. He was patronized by the Cardinal Ottoboni, who introduced him to Clement XI.; and a Jeremiah painted in the church of St John Lateran was rewarded by the pope with knighthood and by the cardinal with a diamond cross. His fame grew quickly, and he received the patronage of most of the crowned heads of Europe. He painted till near the day of his death, and left behind him an immense number of pictures, mostly of a brilliant and showy kind, which are distributed among the churches of Italy. Of these the Probatica, or Pool of Siloam, in the hospital of Santa Maria della Scala, at Siena, is considered the finest.

CONCARNEAU, a fishing port of western France in the department of Finistère, 14 m. by road S.E. of Quimper. Pop. (1906) 7887. The town occupies a picturesque situation on an inlet opening into the Bay of La Forêt. The old portion stands on an island, and is

surrounded by ramparts, parts of which are believed to date from the 14th century. It is an important centre of the sardine, mackerel and lobster fisheries. Sardine-preserving, boat-building and the manufacture of sardine-boxes are carried on.

CONCEPCIÓN, a province of southern Chile, lying between the provinces of Maule and Ñuble on the N. and Bio-Bio on the S., and extending from the Pacific to the Argentine boundary. Its outline is very irregular, the Itata river forming its northern boundary, and the Bio-Bio and one of its tributaries a part of its southern boundary. Area (estimated) 3252 sq. m.; pop. (1895) 188,190. Concepción is the most important province of southern Chile because of its advantageous commercial position, fertility and productive industries. Its coast is indented by two large well-sheltered bays, Talcahuano and Arauco, the former having the ports of Talcahuano, Penco and El Tomé, and the latter Coronel and Lota. Its railway communications are good, and the Bio-Bio, which crosses its S.W. corner, has 100 m. of navigable channel. The province produces wheat and manufactures flour for export; its wines are reputed the best in Chile, cattle are bred in large numbers, wool is produced, and considerable timber is shipped. Near the coast are extensive deposits of coal, which is shipped from Lota and Coronel, the former being the site of the most productive coal-mine in South America. The climate is mild and the rainfall is abundant. Large copper-smelting and glass works have been established at Lota because of its coal resources. The valley of the Itata is largely devoted to vine cultivation, and the port of this district, El Tomé, is noted for its wine vaults and trade. It also possesses a small woollen factory. The principal towns are on the coast and had in 1895 the following populations: Talcahuano, 10,431; Lota, 9797 (largely operatives in the mines and smelting works); Coronel, 4575; and El Tomé, 3977.

CONCEPCIÓN, a city of southern Chile, capital of a province and department of the same name, on the right bank of the Bio-Bio river, 7 m. above its mouth, and 355 m. S.S.W. of Santiago by rail. Pop. (1895) 39,837; (1902, estimated) 49,351. It is the commercial centre of a rich agricultural region, but because of obstructions at the mouth of the Bio-Bio its trade passes in great part through the port of Talcahuano, 8 m. distant by rail. The small port of Penco, situated on the same bay and 10 m. distant by rail, also receives a part of the trade because of official restrictions at Talcahuano. Concepción is one of the southern termini of the Chilean central railway, by which it is connected with Santiago to the N., with Valdivia and Puerto Montt to the S., and with the port of Talcahuano. Another line extends southward through the Chilean coal-producing districts to Curanilhué, crossing the Bio-Bio by a steel viaduct 6000 ft. long on 62 skeleton piers; and a short line of 10 m. runs northward to Penco. The Bio-Bio is navigable above the city for 100 m. and considerable traffic comes through this channel. The districts tributary to Concepción produce wheat, wine, wool, cattle, coal and timber, and among the industrial establishments of the city are flour mills, furniture and carriage factories, distilleries and breweries. The city is built on a level plain but little above the sea-level, and is laid out in regular squares with broad streets. It is an episcopal see with a cathedral and several fine churches, and is the seat of a court of appeal. The city was founded by Pedro de Valdivia in 1550, and received the singular title of “La Concepción del Nuevo Extremo.” It was located on the bay of Talcahuano where the town of Penco now stands, about 9 m. from its present site, but was destroyed by earthquakes in 1570, 1730 and 1751, and was then (1755) removed to the margin of the Bio-Bio. In 1835 it was again laid in ruins, a graphic description of which is given by Charles Darwin in *The Voyage of H.M.S. Beagle*. The city was twice burned by the Araucanians during their long struggle against the Spanish colonists.

CONCEPCIÓN, or Villa Concepción, the principal town and a river port of northern Paraguay, on the Paraguay river, 138 m. (234 m. by river) N. of Asunción, and about 345 ft. above sea-level. Pop. (1895, estimate) 10,000, largely Indians and mestizos. It is an important commercial centre, and a port of call for the river steamers trading with the Brazilian town of Corumbá, Matto Grosso. It is the principal point for the exportation of Paraguay tea, or "yerba maté" (*Ilex paraguayensis*). The town has a street railway and telephone service, a national college, a public school, a market, and some important commercial establishments. The neighbouring country is sparsely settled and produces little except forest products. Across the river, in the Paraguayan Chaco, is an English missionary station, whose territory extends inland among the Indians for many miles.

CONCEPT[1] (Lat. *conceptus*, a thought, from *concipere*, to take together, combine in thought; Ger. *Begriff*), in philosophy, a term applied to a general idea derived from and considered apart from the particulars observed by the senses. The mental process by which this idea is obtained is called abstraction (*q.v.*). By the comparison, for instance, of a number of boats, the mind abstracts a certain common quality or qualities in virtue of which the mind affirms the general idea of "boat." Thus the connotation of the term "boat," being the sum of those qualities in respect of which all boats are regarded as alike, whatever their individual peculiarities may be, is described as a "concept." The psychic process by which a concept is affirmed is called "Conception," a term which is often loosely used in a concrete sense for "Concept" itself. It is also used even more loosely as synonymous in the widest sense with "idea," "notion." Strictly, however, it is contrasted with "perception," and implies the mental reconstruction and combination of sense-given data. Thus when one carries one's thoughts back to a series of events, one constructs a psychic whole made up of parts which take definite shape and character by their mutual interrelations. This process is called *conceptual synthesis*, the possibility of which is a *sine qua non* for the exchange of information by speech and writing. It should be noticed that this (very common) psychological interpretation of "conception" differs from the metaphysical or general philosophical definition given above, in so far as it includes mental presentations in which the universal is not specifically distinguished from the particulars. Some psychologists prefer to restrict the term to the narrower use which excludes all mental states in which particulars are cognized, even though the universal be present also.

In biology conception is the coalescence of the male and female generative elements, producing pregnancy.

1 The word "conceit" in its various senses ("idea," "plan," "fancy," "imagination," and, by modern extension, an overweening sense of one's own value) is likewise derived ultimately from the Latin *concipere*. It appears to have been formed directly from the English derivative "conceive" on the analogy of "deceit" from "deceive." According to the *New English Dictionary* there is no intermediate form in Old French.

CONCEPTUALISM (from "Concept"), in philosophy, a term applied by modern writers to a scholastic theory of the nature of universals, to distinguish it from the two extremes of Nominalism and Realism. The scholastic philosophers took up the old Greek problem as to the nature of true reality—whether the general idea or the particular object is more truly real. Between Realism which asserts that the *genus* is more real than the *species*, and that particulars have no reality, and Nominalism according to which *genus* and *species* are merely names (*nomina, flatus vocis*), Conceptualism takes a mean position. The conceptualist holds that universals have a real existence, but only in the mind, as the concepts which unite the individual things: *e.g.* there is in the mind a general notion or idea of boats, by reference to which the mind can decide whether a given object is, or is not, a boat. On the one hand "boat" is something more than a mere sound with a purely arbitrary conventional significance; on the other it has, apart from particular things to which it applies, no reality; its reality is purely abstract or conceptual. This theory was enunciated by

Abelard in opposition to Roscellinus (nominalist) and William of Champeaux (realist). He held that it is only by becoming a predicate that the class-notion or general term acquires reality. Thus similarity (*conformitas*) is observed to exist between a number of objects in respect of a particular quality or qualities. This quality becomes real as a mental concept when it is predicated of all the objects possessing it ("quod de pluribus natum est praedicari"). Hence Abelard's theory is alternatively known as Sermonism (*sermo*, "predicate"). His statement of this position oscillates markedly, inclining sometimes towards the nominalist, sometimes towards the realist statement, using the arguments of the one against the other. Hence he is described by some as a realist, by others as a nominalist. When he comes to explain that objective similarity in things which is represented by the class-concept or general term, he adopts the theological Platonic view that the ideas which are the archetypes of the qualities exist in the mind of God. They are, therefore, *ante rem, in re* and *post rem*, or, as Avicenna stated it, *universalia ante multiplicitatem, in multiplicitate, post multiplicitatem*. (See Logic, Metaphysics.)

CONCERT (through the French from Lat. con-, with, and *certare*, to strive), a term meaning, in general, co-operation, agreement or union; the more specific usages being, in music, for a public performance by instrumentalists, vocalists or both combined, and in diplomacy, for an understanding or agreement for common action between two or more states, whether defined by treaty or not. The term "Concert of Europe" has been commonly applied, since the congress of Vienna (1814-1815), to the European powers consulting or acting together in questions of common interest. (See Alliance and Europe: *History*.)

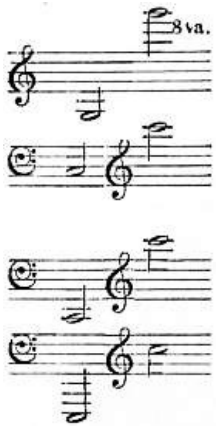
CONCERTINA, or Melodion (Fr. *concertina*, Ger. *Ziehharmonica* or *Bandoneon*), a wind instrument of the seraphine family with free reeds, forming a link in the evolution of the harmonium from the mouth organ, intermediate links being the cheng and the accordion. The concertina consists of two hexagonal or rectangular keyboards connected by a long expansible bellows of many folds similar to that of the accordion. The keyboards are furnished with rows of knobs, which, on being pressed down by the fingers, open valves admitting the air compressed by the bellows to the free reeds, which are thus set in vibration. These free reeds consist of narrow tongues of brass riveted by one end to the inside surface of the keyboard, and having their free ends slightly bent, some outwards, some inwards, the former actuated by suction when the bellows are expanded, the latter by compression. The pitch of the note depends upon the length and thickness of the reeds, reduction of the length tending to sharpen the pitch of the note, while reduction of the thickness lowers it. The bellows being unprovided with a valve can only draw in and emit the air through the reed valves. In order to produce the sound, the concertina is held horizontally between the hands, the bellows being by turns compressed and expanded. The English concertina, invented and patented by Sir Charles Wheatstone in 1829, the year of the reputed invention of the accordion (*q.v.*), is constructed with a double action, the same note being produced on compressing and expanding the bellows, whereas in the German concertina or accordion two different notes are given out. Concertinas are made in complete families—treble, tenor, bass and double bass, having a combined total range of nearly seven octaves. The compass is as follows:—

Treble concertina, double action

Tenor concertina, single action

Bass concertina, single action

Double bass concertina, single action



The timbre of the concertina is penetrating but soft, and capable of the most delicate gradations of tone. This quality is due to a law of acoustics governing the vibration of free reeds by means of which *fortes* and *pianos* are obtained by varying the pressure of the wind, as is also the case with the double reed or the single or beating reed, while the pressure of the reed with the lips combined with greater pressure of wind produces the harmonic overtones which are not given out by free reeds. The English concertina possesses one peculiarity which renders it unsuitable for playing with instruments tuned according to the law of equal temperament, such as the pianoforte, harmonium or melodion, *i.e.* it has enharmonic intervals between G♯ and A♯ and between D♭ and E♭. The German concertina is not constructed according to this system; its compass extends down to C or even B♭, but it is not provided with double action. It is possible on the English concertina to play diatonic and chromatic passages or arpeggios in legato or staccato style with rapidity, shakes single and double in thirds; it is also possible to play in parts as on the pianoforte or organ and to produce very rich chords. Concertos were written for concertina with orchestra by Molique and Regondi, a sonata with piano by Molique, while Tschaikowsky scored in his second orchestral suite for four accordions.

The aeola, constructed by the representatives of the original firm of Wheatstone, is a still more artistically developed concertina, having among other improvements steel reeds instead of brass, which increase the purity and delicacy of the timbre.

See also ACCORDION; CHENG; HARMONIUM; FREE-REED VIBRATOR.

(K. S.)

CONCERTO (Lat. *concertus*, from *certare*, to strive, also confused with *concentus*), in music, a term which appears as early as the beginning of the 17th century, at first as a title of no very definite meaning, but which early acquired a sense justified by its etymology and became applied chiefly to compositions in which unequal instrumental or vocal forces are brought into opposition.

Although by Bach’s time the concerto as a polyphonic instrumental form was thoroughly established, the term frequently appears in the autograph title-pages of his church cantatas, even when the cantata contains no instrumental prelude. Indeed, so entirely does the actual concerto form, as Bach understands it, depend upon the opposition of masses of tone unequal in volume with a compensating inequality in power of commanding attention, that Bach is able to rewrite an instrumental movement as a chorus without the least incongruity of style. A splendid example of this is the first chorus of a university festival cantata, *Vereinigte Zwietracht der wechselnden Saiten*, the very title of which (“united contest of turn-about strings”) is a perfect definition of the earlier form of *concerto grosso*, in which the chief mass of the orchestra was opposed, not to a mere solo instrument, but to a small group called the *concertino*, or else the whole work was for a large orchestral mass in which tutti passages alternate with passages in which the whole orchestra is dispersed in every possible kind of grouping. But the special significance of this particular chorus is that it is arranged from the second movement of the first Brandenburg concerto; and that while the orchestral material is unaltered except for transposition of key, enlargement of force and substitution of trumpets and drums for the original horns, the whole chorus part has been

evolved from the solo part for a kit violin (*violino piccolo*). This admirably illustrates Bach's grasp of the true idea of a concerto, namely, that whatever the relations may be between the forces in respect of volume or sound, the whole treatment of the form must depend upon the healthy relation of function between that force which commands more and that which commands less attention. *Ceteris paribus* the individual, suitably placed, will command more attention than the crowd, whether in real life, drama or instrumental music. And in music the human voice, with human words, will thrust any orchestral force into the background, the moment it can make itself heard at all. Hence it is not surprising that the earlier concerto forms should show the closest affinity (not only in general aesthetic principle, but in many technical details) with the form of the vocal aria, as matured by Alessandro Scarlatti. And the treatment of the orchestra is, *mutatis mutandis*, exactly the same in both. The orchestra is entrusted with a highly pregnant and short summary of the main contents of the movement, and the solo, or the groups corresponding thereto, will either take up this material or first introduce new themes to be combined with it, and, in short, enter into relations with the orchestra very like those between the actors and the chorus in Greek drama. If the aria before Mozart may be regarded as a single large melody expanded by the device of the ritornello so as to give full expression to the power of a singer against an instrumental accompaniment, so the polyphonic concerto form may be regarded as an expansion of the aria form to a scale worthy of the larger and purely instrumental forces employed, and so rendered capable of absorbing large polyphonic and other types of structure incompatible with the lyric idea of the aria. The *da capo* form, by which the aria had attained its full dimensions through the addition of a second strain in foreign keys followed by the original strain *da capo*, was absorbed by the polyphonic concerto on an enormous scale, both in first movements and finales (see Bach's Klavier concerto in E, Violin concerto in E, first movement), while for slow movements the *ground bass* (see Variations), diversified by changes of key (Klavier concerto in D minor), the more melodic types of binary form, sometimes with the repeats ornamentally varied or inverted (Concerto for 3 klaviers in D minor, Concerto for klavier, flute and violin in A minor), and in finales the *rondo* form (Violin concerto in E major, Klavier concerto in F minor) and the binary form (3rd Brandenburg concerto) may be found.

When conceptions of musical form changed and the modern sonata style arose, the peculiar conditions of the concerto gave rise to problems the difficulty of which only the highest classical intellects could appreciate or solve. The number and contrast of the themes necessary to work out a first movement of a sonata are far too great to be contained within the single musical sentence of Bach's and Handel's ritornello, even when it is as long as the thirty bars of Bach's Italian concerto (a work in which every essential of the polyphonic concerto is reproduced on the harpsichord by means of the contrasts between its full register on the lower of its two keyboards and its solo stops on both). Bach's sons had taken shrewd steps in forming the new style; and Mozart, as a boy, modelled himself closely on Johann Christian Bach, and by the time he was twenty was able to write concerto ritornellos that gave the orchestra admirable opportunity for asserting its character and resource in the statement in charmingly epigrammatic style of some five or six sharply contrasted themes, afterwards to be worked out with additions by the solo with the orchestra's co-operation and intervention. As the scale of the works increases the problem becomes very difficult, because the alternation between solo and tutti easily produces a sectional type of structure incompatible with the high degree of organization required in first movements; yet frequent alternation is evidently necessary, as the orchestral solo is audible only above a very subdued orchestral accompaniment, and it would be highly inartistic to use the orchestra for no other purpose. Hence in the classical concerto the ritornello is never abandoned, in spite of the enormous dimensions to which the sonata style expanded it. And though from the time of Mendelssohn onwards most composers have seemed to regard it as a conventional impediment easily abandoned, it may be doubted whether any modern concerto, except the four magnificent examples of Brahms, and Dr Joachim's Hungarian concerto, possesses first movements in which the orchestra seems to enjoy breathing space. And certainly in the classical concerto the entry of the solo instrument, after the long opening tutti, is always dramatic in direct proportion to its delay. The great danger in handling so long an orchestral prelude is that the work may for some minutes be indistinguishable from a symphony and thus the entry of the solo may be unexpected without being inevitable. This is especially the case if the composer has treated his opening tutti like the exposition of a sonata movement, and made a deliberate transition from his first group of themes to a second group in a complementary key, even if the transition is only temporary, as in Beethoven's C minor concerto. Mozart keeps his whole tutti in the tonic, relieved only by his mastery of sudden subsidiary modulation; and so perfect is his marshalling of his resources that in his hands a tutti a hundred bars long passes by with the effect of a splendid pageant, of which the

meaning is evidently about to be revealed by the solo. After the C minor concerto, Beethoven grasped the true function of the opening tutti and enlarged it to his new purposes. With an interesting experiment of Mozart's before him, he, in his G major concerto, *Op. 53*, allowed the solo player to state the opening theme, making the orchestra enter *pianissimo* in a foreign key, a wonderful incident which has led to the absurd statement that he "abolished the opening tutti," and that Mendelssohn in so doing has "followed his example." In this concerto he also gave considerable variety of key to the opening tutti by the use of an important theme which executes a considerable series of modulations, an entirely different thing from a deliberate modulation from material in one key to material in another. His fifth and last pianoforte concerto, in E flat, commonly called the "Emperor," begins with a rhapsodical introduction of extreme brilliance for the solo player, followed by a tutti of unusual length which is confined to the tonic major and minor with a strictness explained by the gorgeous modulations with which the solo subsequently treats the second subject. In this concerto Beethoven also dispenses with the only really conventional feature of the form, namely, the *cadenza*, a custom elaborated from the operatic aria, in which the singer was allowed to extemporize a flourish on a pause near the end. A similar pause was made in the final ritornello of a concerto, and the soloist was supposed to extemporize what should be equivalent to a symphonic coda, with results which could not but be deplorable unless the player (or cadenza writer) were either the composer himself, or capable of entering into his intentions, like Joachim, who has written the finest extant cadenza of classical violin concertos.

Brahms's first concerto in D minor, *Op. 15*, was the result of an immense amount of work, and, though on a mass of material originally intended for a symphony, was nevertheless so perfectly assimilated into the true concerto form that in his next essay, the violin concerto, *Op. 77*, he had no more to learn, and was free to make true innovations. He succeeds in presenting the contrasts even of remote keys so immediately that they are serviceable in the opening tutti and give the form a wider range in definitely functional key than any other instrumental music. Thus in the opening tutti of the D minor concerto the second subject is announced in B flat minor. In the B flat pianoforte concerto, *Op. 83*, it appears in D minor, and in the double concerto, *Op. 102*, for violin and violoncello in A minor it appears in F major. In none of these cases is it in the key in which the solo develops it, and it is reached with a directness sharply contrasted with the symphonic deliberation with which it is approached in the solo. In the violin concerto, *Op. 77*, Brahms develops a counterplot in the opposition between solo and orchestra, inasmuch as after the solo has worked out its second subject the orchestra bursts in, not with the opening ritornello, but with its own version of the material with which the solo originally entered. In other words we have now not only the development by the solo of material stated by the orchestra but also a counter-development by the orchestra of material stated by the solo. This concerto is, on the other hand, remarkable as being the last in which a blank space is left for a cadenza, Brahms having in his friend Joachim a kindred spirit worthy of such trust. In the pianoforte concerto in B flat, and in the double concerto,[1] *Op. 102*, the idea of an introductory statement in which the solo takes part before the opening tutti is carried out on a large scale, and in the double concerto both first and second subjects are thus suggested. It is unnecessary to speak of the other movements of concerto form, as the sectional structure that so easily results from the opposition between solo and orchestra is not of great disadvantage to slow movements and finales, which accordingly do not show important differences from the ordinary types of symphonic and chamber music. The scherzo, on the other hand, is normally of too small a range of contrast for successful adaptation to concerto form, and the solitary great example of its use is the second movement of Brahms's B flat pianoforte concerto.

Nothing is more easy to handle with inartistic or pseudo-classic effectiveness than the opposition between a brilliant solo player and an orchestra; and, as the inevitable tendency of even the most artistic concerto has been to exhaust the resources of the solo instrument in the increased difficulty of making a proper contrast between solo and orchestra, so the technical difficulty of concertos has steadily increased until even in classical times it was so great that the orthodox definition of a concerto is that it is "an instrumental composition designed to show the skill of an executant, and one which is almost invariably accompanied by orchestra." This idea is in flat violation of the whole history and aesthetics of the form, which can never be understood by means of a study of averages. In art the average is always false, and the individual organization of the greatest classical works is the only sound basis for generalizations, historic or aesthetic.

(D. F. T.)

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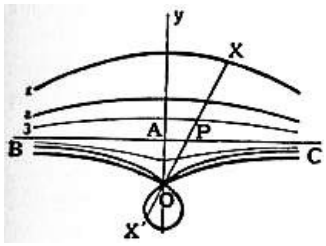
1 Double and triple concertos are concertos with two or three solo players. A concerto for several

solo players is called a concertante.

CONCH (Lat. *concha*, Gr. κόγχη), a shell, particularly one of a mollusc; hence the term "conchology," the science which deals with such shells, more used formerly when molluscs were studied and classified according to the shell formation; the word is chiefly now used for the collection of shells (see MOLLUSCA, and such articles as GASTROPODA, MALACOSTRACA, &c.). Large spiral conchs have been from early times used as a form of trumpet, emitting a very loud sound. They are used in the West Indies and the South Sea Islands. The Tritons of ancient mythology are represented as blowing such "wreathed horns." In anatomy, the term *concha* or "conch" is used of the external ear, or of the hollowed central part leading to the meatus; and, in architecture, it is sometimes given to the half dome over the semicircular apse of the basilica. In late Roman work at Baalbek and Palmyra and in Renaissance buildings shells are frequently carved in the heads of circular niches. A low class of the negro or other inhabitants of the Bahamas and the Florida Keys are sometimes called "Conches" or "Conks" from the shell-fish which form their staple food.

CONCHOID (Gr. κόγχη, shell, and εἶδος, form), a plane curve invented by the Greek mathematician Nicomedes, who devised a mechanical construction for it and applied it to the problem of the duplication of the cube, the construction of two mean proportionals between two given quantities, and possibly to the trisection of an angle as in the 8th lemma of Archimedes. Proclus grants Nicomedes the credit of this last application, but it is disputed by Pappus, who claims that his own discovery was original. The conchoid has been employed by later mathematicians, notably Sir Isaac Newton, in the construction of various cubic curves.



The conchoid is generated as follows:—Let O be a fixed point and BC a fixed straight line; draw any line through O intersecting BC in P and take on the line PO two points X, X′, such that PX = PX′ = a constant quantity. Then the locus of X and X′ is the conchoid. The conchoid is also the locus of any point on a rod which is constrained to move so that it always passes through a fixed point, while a fixed point on the rod travels along a straight line. To obtain the equation to the curve, draw AO perpendicular to BC, and let AO = a; let the constant quantity PX = PX′ = b. Then taking O as pole and a line through O parallel to BC as the initial line, the polar equation is $r = a \operatorname{cosec} \theta \pm b$, the upper sign referring to the branch more distant from O. The cartesian equation with A as origin and BC as axis of x is $x^2y^2 = (a + y)^2 (b^2 - y^2)$. Both branches belong to the same curve and are included in this equation. Three forms of the curve have to be distinguished according to the ratio of a to b. If a be less than b, there will be a node at O and a loop below the initial point (curve 1 in the figure); if a equals b there will be a cusp at O (curve 2); if a be greater than b the curve will not pass through O, but from the cartesian equation it is obvious that O is a conjugate point (curve 3). The curve is symmetrical about the axis of y and has the axis of x for its asymptote.

CONCIERGE (a French word of unknown origin; the Latinized form was *concergius* or *concergerius*), originally the guardian of a house or castle, in the middle ages a court official who was the custodian of a royal palace. In Paris, when the *Palais de la Cité* ceased about 1360 to be a royal residence and became the seat of the courts of justice, the *Conciergerie* was turned into a prison. In modern usage a "concierge" is a hall-porter or janitor.

CONCINI, CONCINO (d. 1617), Count Della Penna, Marshal d'Ancre, Italian adventurer, minister of King Louis XIII. of France, was a native of Florence. He came to France in the train of Marie de' Medici, and married the queen's lady-in-waiting, Leonora Dori, known as Galigai. The credit which his wife enjoyed with the queen, his wit, cleverness and boldness made his fortune. In 1610 he had purchased the marquisate of Ancre and the position of first gentleman-in-waiting. Then he obtained successively the governments of Amiens and of Normandy, and in 1614 the bâton of marshal. From then first minister of the realm, he abandoned the policy of Henry IV., compromised his wise legislation, allowed the treasury to be pillaged, and drew upon himself the hatred of all classes. The nobles were bitterly hostile to him, particularly Condé, with whom he negotiated the treaty of Loudun in 1616, and whom he had arrested in September 1616. This was done on the advice of Richelieu, whose introduction into politics was favoured by Concini. But Louis XIII., incited by his favourite Charles d'Albert, due de Luynes, was tired of Concini's tutelage. The baron de Vitry received in the king's name the order to imprison him. Apprehended on the bridge of the Louvre, Concini was killed by the guards on the 24th of April 1617. Leonora was accused of sorcery and sent to the stake in the same year.

In 1767 appeared at Brescia a *De Concini vita*, by D. Sandellius. On the rôle of Concini see the *Histoire de France*, published under the direction of E. Lavisse, vol. vi. (1905), by Mariéjol.

CONCLAVE (Lat. *conclave*, from *cum*, together, and *clavis*, a key), strictly a room, or set of rooms, locked with a key; in this sense the word is now obsolete in English, though the *New English Dictionary* gives an example of its use so late as 1753. Its present loose application to any private or close assembly, especially ecclesiastical, is derived from its technical application to the assembly of cardinals met for the election of the pope, with which this article is concerned.

Conclave is the name applied to that system of strict seclusion to which the electors of the pope have been and are submitted, formerly as a matter of necessity, and subsequently as the result of a legislative enactment; hence the word has come to be used of the electoral assembly of the cardinals. This system goes back only as far as the 12th century.

Election of the Popes in Antiquity.—The very earliest episcopal nominations, at Rome as elsewhere, seem without doubt to have been made by the direct choice of the founders of the apostolic Christian communities. But this exceptional method was replaced at an early date by that of election. At Rome the method of election was the same as in other towns: the Roman clergy and people and the neighbouring bishops each took part in it in their several capacities. The people would signify their approbation or disapprobation of the candidates more or less tumultuously, while the clergy were, strictly speaking, the electoral body, met to elect for themselves a new head, and the bishops acted as presidents of the assembly and judges of the election. The choice had to meet with general consent; but we can well imagine that in an assembly of such size, in which the candidates were acclaimed rather than elected by counting votes, the various functions were not very distinct, and that persons of importance, whether clerical or lay, were bound to influence the elections, and sometimes decisively. Moreover, this form of election lent itself to cabals; and these frequently gave rise to quarrels, sometimes involving bloodshed and schisms, *i.e.* the election of antipopes, as they were later called. Such was the case at the elections of Cornelius (251), Damasus (366), Boniface (418), Symmachus (498), Boniface II. (530) and others. The remedy for this abuse was found in having recourse, more or less freely, to the support of the civil power. The emperor Honorius upheld Boniface against his competitor Eulalius, at the same time laying down that cases of contested election should henceforth be decided by a fresh election; but this would have been a dangerous method and was consequently never applied. Theodoric upheld Symmachus against Laurentius because he had been elected first and by a greater majority. The accepted fact soon became law, and John II. recognized (532) the right of the Ostrogothic court of Ravenna to ratify the pontifical

elections. Justinian succeeded to this right together with the kingdom which he had destroyed; he demanded, together with the payment of a tribute of 3000 golden *solidi*, that the candidate elected should not receive the episcopal consecration till he had obtained the confirmation of the emperor. Hence arose long vacancies of the See, indiscreet interference in the elections by the imperial officials, and sometimes cases of simony and venality. This bondage became lighter in the 7th century, owing rather to the weakening of the imperial power than to any resistance on the part of the popes.

9th to 12th Centuries.—From the emperors of the East the power naturally passed to those of the West, and it was exercised after 824 by the descendants of Charlemagne, who claimed that the election should not proceed until the arrival of their envoys. But this did not last long; at the end of the 9th century, Rome, torn by factions, witnessed the scandal of the posthumous condemnation of Formosus. This deplorable state of affairs lasted almost without interruption till the middle of the 11th century. When the emperors were at Rome, they presided over the elections; when they were away, the rival factions of the barons, the Crescentii and the Alberici especially, struggled for the spiritual power as they did for the temporal. During this period were seen cases of popes imposed by a faction rather than elected, and then, at the mercy of sedition, deposed, poisoned and thrown into prison, sometimes to be restored by force of arms.

The influence of the Ottos (962-1002) was a lesser evil; that of the emperor Otto III. was even beneficial, in that it led to the election of Gerbert (Silvester II., in 999). But this was only a temporary check in the process of decadence, and in 1146 Clement II., the successor of the worthless Benedict IX., admitted that henceforth not only the consecration but even the *election* of the Roman pontiffs could only take place in presence of the emperor. In fact, after the death of Clement II. the delegates of the Roman clergy did actually go to Polden to ask Henry III. to give them a pope, and similar steps were taken after the death of Damasus II., who reigned only twenty days. Fortunately on this occasion Henry III. appointed, just before his death, a man of high character, his cousin Bruno, bishop of Toul, who presented himself in Rome in company with Hildebrand. From this time began the reform. Hildebrand had the elections of Victor II. (1055), Stephen IX. (1057), and Nicholas II. (1058) carried out according to the canonical form, including the imperial ratification. The celebrated bull *In nomine Domini* of the 13th of April 1059 determined the electoral procedure; it is curious to observe how, out of respect for tradition, it preserves all the former factors in the election though their scope is modified: “In the first place, the cardinal bishops shall carefully consider the election together, then they shall consult with the cardinal clergy, and afterwards the rest of the clergy and the people shall by giving their assent confirm the new election.” The election, then, is reserved to the members of the higher clergy, to the cardinals, among whom the cardinal bishops have the preponderating position. The consent of the rest of the clergy and the people is now only a formality. The same was the case of the imperial intervention, in consequence of the phrase: “Saving the honour and respect due to our dear son Henry (Henry IV.), according to the concession we have made to him, and equally to his successors, who shall receive this right personally from the Apostolic See.” Thus the emperor has no rights save those he has received as a concession from the Holy See. Gregory VII., it is true, notified his election to the emperor; but as he set up a series of five antipopes, none of Gregory’s successors asked any more for the imperial sanction. Further, by this bull, the emperors would have to deal with the *fait accompli*; for it provided that, in the event of disturbances aroused by mischievous persons at Rome preventing the election from being carried out there freely and without bias, the cardinal bishops, together with a small number of the clergy and of the laity, should be empowered to go and hold the election where they should think fit; that should difficulties of any sort prevent the enthronement of the new pope, the pope elect would be empowered immediately to act as if he were actually pope. This legislation was definitely accepted by the emperor by the concordat of Worms (1119).

Election reserved to the cardinals.

A limited electoral body lends itself to more minute legislation than a larger body; the college for electing the pope, thus reduced so as to consist in practice of the cardinals only, was subjected as time went on to laws of increasing severity. Two points of great importance were established by Alexander III. at the Lateran Council of 1179. The constitution *Licet de vitanda discordia* makes all the cardinals equally electors, and no longer mentions the lower clergy or the people; it also requires a majority of two-thirds of the votes to decide an election. This latter provision, which still holds good, made imperial antipopes henceforth impossible.

Abuses nevertheless arose. An electoral college too small in numbers, which no higher

power has the right of forcing to haste, can prolong disagreements and draw out the course of the election for a long time. It is this period during which we actually find the Holy See left vacant most frequently for long spaces of time. The longest of these, however, gave an opportunity for reform and the remedy was found in the conclave, *i.e.* in the forced and rigid seclusion of the electors. As a matter of fact, this method had previously been used, but in a mitigated form: in 1216, on the death of Innocent III., the people of Perugia had shut up the cardinals; and in 1241 the Roman magistrates had confined them within the "Septizonium"; they took two months, however, to perform the election. Celestine IV. died after eighteen days, and this time, in spite of the seclusion of the cardinals, there was an interregnum of twenty months. After the death of Clement IV. in 1268, the cardinals, of whom seventeen were gathered together at Viterbo, allowed two years to pass without coming to an agreement; the magistrates of Viterbo again had recourse to the method of seclusion: they shut up the electors in the episcopal palace, blocking up all outlets; and since the election still delayed, the people removed the roof of the palace and allowed nothing but bread and water to be sent in. Under the pressure of famine and of this strict confinement, the cardinals finally agreed, on the 1st of September 1271, to elect Gregory X., after an interregnum of two years, nine months and two days.

The conclave.

Taught by experience, the new pope considered what steps could be taken to prevent the recurrence of such abuses; in 1274, at the council of Lyons, he promulgated the constitution *Ubi periculum*, the substance of which was as follows: At the death of the pope, the cardinals who were present are to await their absent colleagues for ten days; they are then to meet in one of the papal palaces in a closed conclave; none of them is to have to wait on him more than one servant, or two at most if he were ill; in the conclave they are to lead a life in common, not even having separate cells; they are to have no communication with the outer world, under pain of excommunication for any who should attempt to communicate with them; food is to be supplied to the cardinals through a window which would be under watch; after three days, their meals are to consist of a single dish only; and after five days, of bread and water, with a little wine. During the conclave the cardinals are to receive no ecclesiastical revenue. No account is to be taken of those who are absent or have left the conclave. Finally, the election is to be the sole business of the conclave, and the magistrates of the town where it was held are called upon to see that these provisions be observed. Adrian V. and John XX. were weak enough to suspend the constitution *Ubi periculum*; but the abuses at once reappeared; the Holy See was again vacant for long periods; this further proof was therefore decisive, and Celestine V., who was elected after a vacancy of more than two years, took care, before abdicating the pontificate, to revive the constitution of Gregory X., which was inserted in the Decretals (lib. i. tit. vi., *de election.* cap. 3).

Laws made by Gregory X.

Since then the laws relating to the conclave have been observed, even during the great schism; the only exception was the election of Martin V., which was performed by the cardinals of the three obediences, to which the council of Constance added five prelates of each of the six nations represented in that assembly. The same was the case up to the 16th century. At this period the Italian republics, later Spain, and finally the other powers, took an intimate interest in the choice of the holder of what was a considerable political power; and each brought more or less honest means to bear, sometimes that of simony. It was against simony that Julius II. directed the bull *Cum tam divino* (1503), which directed that simoniacal election of the pope should be declared null; that any one could attack it; that men should withdraw themselves from the obedience of a pope thus elected; that simoniacal agreements should be invalid; that the guilty cardinals should be excommunicate till their death, and that the rest should proceed immediately to a new election. The purpose of this measure was good, but the proposed remedy extremely dangerous; it was fortunately never applied. Similarly, Paul IV. endeavoured by severe punishments to check the intriguing and plotting for the election of a new pope while his predecessor was still living; but the bull *Cum secundum* (1558) was of no effect.

Julius II.

Pius IV. undertook the task of reforming and completing the legislation of the conclave. The bull *In eligendis* (of October 1st, 1562), signed by all the cardinals, is a model of precision and wisdom. In addition to the points already stated, we may add the following: that every day there was to be a scrutiny, *i.e.* a solemn voting by specially prepared voting papers (concealing the name of the voter, and to be opened only in case of an election being made at that scrutiny), and that this was to be followed by the "accessit," *i.e.* a second voting, in which the cardinals might transfer their suffrages to those who had obtained the greatest number of votes in the first. Except in case of urgent matters, the election was to form the whole business of the conclave. The cells

Pius IV.

were to be assigned by lot. The functionaries of the conclave were to be elected by the secret vote of the Sacred College. The most stringent measures were to be taken to ensure seclusion. The bull *Aeterni Patris* of Gregory XV. (15th of November 1621) is a collection of minute regulations. In it is the rule compelling each cardinal, before giving his vote, to take the oath that he will elect him whom he shall judge to be the most worthy; it also makes rules for the forms of voting and of the voting papers, for the counting, the scrutiny, and in fact all the processes of the election. A second bull, *Decet Romanum Pontificem*, of the 12th of March 1622, fixed the ceremonial of the conclave with such minuteness that it has not been changed since.

Gregory XV.

All previous legislation concerning the conclave was codified and renewed by Pius X.'s bull, *Vacante Sede Apostolico* (Dec. 25, 1904), which abrogates the earlier texts, except Leo XIII.'s constitution *Praedecessores Nostri* (May 24, 1882), authorizing occasional derogations in circumstances of difficulty, *e.g.* the death of a pope away from Rome or an attempt to interfere with the liberty of the Sacred College. The bull of Pius X. is rather a codification than a reform, the principal change being the abolition of the scrutiny of accession and the substitution of a second ordinary scrutiny during the same session.

On some occasions exceptional circumstances have given rise to transitory measures. In 1797 and 1798 Pius VI. authorized the cardinals to act contrary to such of the laws concerning the conclave as a majority of them should decide not to observe, as being impossible in practice. Similarly Pius IX., by means of various acts which remained secret up till 1892, had taken the most minute precautions in order to secure a free and rapid election, and to avoid all interference on the part of the secular powers. We know that the conclaves in which Leo XIII. and Pius X. were elected enjoyed the most complete liberty, and the hypothetical measures foreseen by Pius IX. were not applied.

Until after the Great Schism the conclaves were held in various towns outside of Rome; but since then they have all been held in Rome, with the single exception of the conclave of Venice (1800), and in most cases in the Vatican.

The conclave at Rome.

There was no place permanently established for the purpose, but removable wooden cells were installed in the various apartments of the palace, grouped around the Sistine chapel, in which the scrutinies took place. The arrangements prepared in the Quirinal in 1823 did duty only three times, and for the most recent conclaves it was necessary to arrange an inner enclosure within the vast but irregular palace of the Vatican. Each cardinal is accompanied by a clerk or secretary, known for this reason as a conclavist, and by one servant only. With the officials of the conclave, this makes about two hundred and fifty persons who enter the conclave and have no further communication with the outer world save by means of turning-boxes. Since 1870 the solemn ceremonies of earlier times have naturally not been seen; for instance the procession which used to celebrate the entry into conclave; or the daily arrival in procession of the clergy and the brotherhoods to enquire at the "rota" (turning-box) of the auditors of the Rota: "Habemusne Pontificem?" and their return accompanied by the chanting of the "*Veni Creator*"; or the "Marshal of the Holy Roman Church and perpetual guardian of the conclave" visiting the churches in state. But a crowd still collects morning and evening in the great square of St Peter's, towards the time of the completion of the vote, to look for the smoke which rises from the burning of the voting-papers after each session; when the election has not been effected, a little straw is burnt with the papers, and the column of smoke then apprises the spectators that they have still no pope. Within the conclave, the cardinals, alone in the common hall, usually the Sistine chapel, proceed morning and evening to their double vote, the direct vote and the "accessit." Sometimes these sessions have been very numerous; for example, in 1740, Benedict XIV. was only elected after 255 scrutinies; on other occasions, however, and notably in the case of the last few popes, a well-defined majority has soon been evident, and there have been but few scrutinies. Each vote is immediately counted by three scrutators, appointed in rotation, the most minute precautions being taken to ensure that the voting shall be secret and sincere. When one cardinal has at last obtained two-thirds of the votes, the dean of the cardinals formally asks him whether he accepts his election, and what name he wishes to assume. As soon as he has accepted, the first "obedience" or "adoration" takes place, and immediately after the first cardinal deacon goes to the *Loggia* of St Peter's and announces the great news to the assembled people. The conclave is dissolved; on the following day take place the two other "obediences," and the election is officially announced to the various governments. If the pope be not a bishop (Gregory XVI. was not), he is then consecrated; and finally, a few days after his election, takes place the coronation, from which the pontificate is officially dated. The pope then receives the tiara with the triple

Modern procedure.

crown, the sign of his supreme spiritual authority. The ceremony of the coronation goes back to the 9th century, and the tiara, in the form of a high conical cap, is equally ancient (see TIARA).

The right of veto.

In conclusion, a few words should be said with regard to the right of *veto*. In the 16th and 17th centuries the character of the conclaves was determined by the influence of what were then known as the "factions," *i.e.* the formation of the cardinals into groups according to their nationality or their relations with one of the Catholic courts of Spain, France or the Empire, or again according as they favoured the political policy of the late pope or his predecessor. These groups upheld or opposed certain candidates. The Catholic courts naturally entrusted the cardinals "of the crown," *i.e.* those of their nation, with the mission of removing, as far as lay in their power, candidates who were distasteful to their party; the various governments could even make public their desire to exclude certain candidates. But they soon claimed an actual right of formal and direct exclusion, which should be notified in the conclave in their name by a cardinal charged with this mission, and should have a decisive effect; this is what has been called the right of veto. We cannot say precisely at what time during the 16th century this transformation of the practice into a right, tacitly accepted by the Sacred College, took place; it was doubtless felt to be less dangerous formally to recognize the right of the three sovereigns each to object to one candidate, than to face the inconvenience of objections, such as were formulated on several occasions by Philip II., which, though less legal in form, might apply to an indefinite number of candidates. The fact remains, however, that it was a right based on custom, and was not supported by any text or written concession; but the diplomatic right was straightforward and definite, and was better than the intrigues of former days. During the 19th century Austria exercised, or tried to exercise, the right of veto at all the conclaves, except that which elected Leo XIII. (1878); it did so again at the conclave of 1903. On the 2nd of August Cardinal Rampolla had received twenty-nine votes, when Cardinal Kolzielsko Puzina, bishop of Cracow, declared that the Austrian government opposed the election of Cardinal Rampolla; the Sacred College considered that it ought to yield, and on the 4th of August elected Cardinal Sarto, who took the name of Pius X. By the bull *Commissum Nobis* (January 20, 1904), Pius X. suppressed all right of "veto" or "exclusion" on the part of the secular governments, and forbade, under pain of excommunication reserved to the future pope, any cardinal or conclavist to accept from his government the charge of proposing a "veto," or to exhibit it to the conclave under any form.

BIBLIOGRAPHY.—The best and most complete work is Lucius Lector, *Le Conclave, origine, histoire, organisation, législation ancienne et moderne* (Paris, 1894). See also Ferraris, *Prompta Bibliotheca, s. v. Papa*, art. i.; Moroni, *Dizionario di erudizione storico-ecclesiastica, s. v. Conclave, Conclavisti, Cella, Elezione, Esclusiva*; Bouix, *De Curia Romana*, part i. c. x.; *De Papa*, part vii. (Paris, 1859, 1870); Barbier de Montault, *Le Conclave* (Paris, 1878). On the conclave of Leo XIII., R. de Cesare, *Conclave di Leone XIII.* (Rome, 1888). On the conclave of Pius X.: an eye-witness (Card. Mathieu), *Les Derniers Jours de Léon XIII et le conclave* (Paris, 1904). See further, for the right of veto: Phillips, *Kirchenrecht*, t. v. p. 138; Sägmüller, *Die Papstwahlen und die Staate* (Tübingen, 1890); *Die Papstwahlbullen und das staatliche Recht des Exclusive* (Tübingen, 1892); Wahrmund, *Ausschliessungsrecht der katholischen Staaten* (Vienna, 1888).

(A. BO.*)

CONCORD, a township of Middlesex county, Massachusetts, U.S.A., about 20 m. N.W. of Boston. Pop. (1900) 5652; (1910, U.S. census) 6421. Area 25 sq. m. It is traversed by the Boston & Maine railway. Where the Sudbury and Assabet unite to form the beautiful little Concord river, celebrated by Thoreau, is the village of Concord, straggling, placid and beautiful, full of associations with the opening of the War of Independence and with American literature. Of particular interest is the "Old Manse," built in 1765 for Rev. William Emerson, in which his grandson R. W. Emerson wrote *Nature*, and Hawthorne his *Mosses from an Old Manse*, containing a charming description of the building and its associations. At Concord there is a state reformatory, whose inmates, about 800 in number, are employed in manufacturing various articles, but otherwise the town has only minor business and industrial interests. The introduction of the "Concord" grape, first produced here by Ephraim Bull in 1853, is said to have marked the beginning of the profitable commercial cultivation of table grapes in the United States. Concord was settled and incorporated as a

township in 1635, and was (with Dedham) the first settlement in Massachusetts back from the sea-coast. A county convention at Concord village in August 1774 recommended the calling of the first Provincial Congress of Massachusetts—one of the first independent legislatures of America—which assembled here on the 11th of October 1774, and again in March and April 1775. The village became thereafter a storehouse of provisions and munitions of war, and hence became the objective of the British expedition that on the 19th of April 1775 opened with the armed conflict at Lexington (*q.v.*) the American War of Independence. As the British proceeded to Concord the whole country was rising, and at Concord about 500 minute-men confronted the British regulars who were holding the village and searching for arms and stores. Volleys were exchanged, the British retreated, the minute-men hung on their flanks and from the hillsides shot them down, driving their columns on Lexington. A granite obelisk, erected in 1837, when Emerson wrote his ode on the battle, marks the spot where the first British soldiers fell; while across the stream a fine bionze “Minute-Man” (1875) by D. C. French (a native of Concord) marks the spot where once “the embattled farmers stood and fired the shot heard round the world” (Emerson). Concord was long one of the shire-townships of Middlesex county, losing this honour in 1867. The village is famous as the home of R. W. Emerson, Nathaniel Hawthorne, Henry D. Thoreau, Louisa M. Alcott and her father, A. Bronson Alcott, who maintained here from 1879 to 1888 (in a building still standing) the Concord school of philosophy, which counted Benjamin Peirce, W. T. Harris, Mrs J. W. Howe, T. W. Higginson, Professor William James and Emerson among its lecturers. Emerson, Hawthorne, Thoreau and the Alcotts are buried here in the beautiful Sleepy Hollow Cemetery. Of the various orations (among others one by Edward Everett in 1825) that have been delivered at Concord anniversaries perhaps the finest is that of George William Curtis, delivered in 1875.

See A. S. Hudson, *The History of Concord*, vol. i. (Concord, 1904); G. B. Bartlett, *Concord: Historic, Literary and Picturesque* (Boston, 1885); and Mrs J. L. Swayne, *Story of Concord* (Boston, 1907).

CONCORD, a city and the county-seat of Cabarrus county, North Carolina, U.S.A., on the Rocky river, about 150 m. W.S.W. of Raleigh. Pop. (1890) 4339; (1900) 7910 (1789 negroes); (1910) 8715. It is served by the Southern railway. Concord is situated in a cotton-growing region, and its chief interest is in the manufacture of cotton goods. The city is the seat of Scotia seminary (for negro girls), founded in 1870 and under the care of the Presbyterian Board of Missions for Freedmen, Pittsburgh Pa. Concord was laid out in 1793 and was first incorporated in 1851.

CONCORD, the capital of New Hampshire, U.S.A., and the county-seat of Merrimack county, on both sides of the Merrimac river, about 75 m. N.W. of Boston, Massachusetts. Pop. (1890) 17,004; (1900) 19,632, of whom 3813 were foreign-born; (1910, census) 21,497. Concord is served by the Boston & Maine railway. The area of the city in 1906 was 45.16 sq. m. Concord has broad streets bordered with shade trees; and has several parks, including Penacook, White, Rollins and the Contoocook river. Among the principal buildings are the state capitol, the state library, the city hall, the county court-house, the post-office, a public library (17,000 vols.), the state hospital, the state prison, the Centennial home for the aged, the Margaret Pillsbury memorial hospital, the Rolfe and Rumford asylum for orphan girls, founded by Count Rumford’s daughter, and some fine churches, including the Christian Science church built by Mrs Eddy. There are a soldiers’ memorial arch, a statue of Daniel Webster by Thomas Ball, and statues of John P. Hale, John Stark, and Commodore George H. Perkins, the last by Daniel C. French; and at Penacook, 6 m. N.W. of Concord, there is a monument to Hannah Dustin (see Haverhill). Among the educational institutions are the well-known St Paul’s school for boys (Protestant Episcopal, 1853), about 2 m. W. of the city, and St Mary’s school for girls (Protestant Episcopal, 1885). From 1847 to 1867 Concord was the seat of the Biblical Institute (Methodist Episcopal), founded in Newbury, Vermont, in 1841, removed to Boston as the Boston Theological Seminary in 1867, and after 1871 a part

of Boston University. The city has various manufactures, including flour and grist mill products, silver ware, cotton and woollen goods, carriages, harnesses and leather belting, furniture, wooden ware, pianos and clothing; the Boston & Maine Railroad has a large repair shop in the city, and there are valuable granite quarries in the vicinity. In 1905 Concord ranked third among the cities of the state in the value of its factory products, which was $6,387,372, being an increase of 51.7% since 1900. When first visited by the English settlers, the site of Concord was occupied by Penacook Indians; a trading post was built here about 1660. In 1725 Massachusetts granted the land in this vicinity to some of her citizens; but this grant was not recognized by New Hampshire, whose legislature issued (1727) a grant (the Township of Bow) overlapping the Massachusetts grant, which was known as Penacook or Penny Cook. The New Hampshire grantees undertook to establish here a colony of Londonderry Irish; but the Massachusetts settlers were firmly established by the spring of 1727, Massachusetts definitely assumed jurisdiction in 1731, and in 1734 her general court incorporated the settlement under the name of Rumford. The conflicting rights of Rumford and Bow gave rise to one of the most celebrated of colonial land cases, and although the New Hampshire authorities enforced their claims of jurisdiction, the privy council in 1755 confirmed the Rumford settlers in their possession. In 1765 the name was changed to the "parish of Concord," and in 1784 the town of Concord was incorporated. Here, for some years before the War of American Independence, lived Benjamin Thompson, later Count Rumford. In 1778 and again in 1781-1782 a state constitutional convention met here; the first New Hampshire legislature met at Concord in 1782; the convention which ratified for New Hampshire the Federal Constitution met here in 1788; and in 1808 the state capital was definitely established here. The New Hampshire *Patriot*, founded here in 1808 (and for twenty years edited) by Isaac Hill (1788-1851), who was a member of the United States Senate in 1831-1836, and governor of New Hampshire in 1836-1839, became one of the leading exponents of Jacksonian Democracy in New England. In 1814 the Middlesex Canal, connecting Concord with Boston, was completed. A city charter granted by the legislature in 1849 was not accepted by the city until 1853.

See J. O. Lyford, *The History of Concord, New Hampshire* (City History Commission) (2 vols., Concord, 1903); *Concord Town Records, 1732-1820* (Concord, 1894); J. B. Moore, *Annals of Concord, 1726-1823* (Concord, 1824); and Nathaniel Bouton, *The History of Concord* (Concord, 1856).

CONCORD, BOOK OF (*Liber Concordiae*), the collective documents of the Lutheran confession, consisting of the *Confessio Augustana*, the *Apologia Confessionis Augustanae*, the *Articula Smalcaldici*, the *Catechismi Major et Minor* and the *Formula Concordiae*. This last was a formula issued on the 25th of June 1580 (the jubilee of the Augsburg Confession) by the Lutheran Church in an attempt to heal the breach which, since the death of Luther, had been widening between the extreme Lutherans and the Crypto-Calvinists. Previous attempts at concord had been made at the request of different rulers, especially by Jacob Andreä with his Swabian Concordia in 1573, and Abel Scherdinger with the Maulbronn Formula in 1575. In 1576 the elector of Saxony called a conference of theologians at Torgau to discuss these two efforts and from them produce a third. The *Book of Torgau* was evolved, circulated and criticized; a new committee, prominent on which was Martin Chemnitz, sitting at Bergen near Magdeburg, considered the criticisms and finally drew up the *Formula Concordiae*. It consists of (a) the "Epitome," (b) the "Solid Repetition and Declaration," each part comprising twelve articles; and was accepted by Saxony, Württemberg, Baden among other states, but rejected by Hesse, Nassau and Holstein. Even the free cities were divided, Hamburg and Lübeck for, Bremen and Frankfort against. Hungary and Sweden accepted it, and so finally did Denmark, where at first it was rejected, and its publication made a crime punishable by death. In spite of this very limited reception the *Formula Concordiae* has always been reckoned with the five other documents as of confessional authority.

See P. Schaff, *Creeds of Christendom*, i. 258-340, iii. 92-180.

CONCORDANCE (Late Lat. *concordantia*, harmony, from *cum*, with, and *cor*, heart), literally agreement, harmony; hence derivatively a citation of parallel passages, and specifically an alphabetical arrangement of the words contained in a book with citations of the passages in which they occur. Concordances in this last sense were first made for the Bible. Originally the word was only used in this connexion in the plural *concordantiae*, each group of parallel passages being properly a *concordantia*. The Germans distinguish between concordances of things and concordances of words, the former indexing the subject matter of a book (“real” concordance), the latter the words (“verbal” concordance).

The original impetus to the making of concordances was due to the conviction that the several parts of the Bible are consistent with each other, as parts of a divine revelation, and may be combined as harmonious elements in one system of spiritual truth. To Anthony of Padua (1195-1231) ancient tradition ascribes the first concordance, the anonymous *Concordantiae Morales*, of which the basis was the Vulgate. The first authentic work of the kind was due to Cardinal Hugh of St Cher, a Dominican monk (d. 1263), who, in preparing for a commentary on the Scriptures, found the need of a concordance, and is reported to have used for the purpose the services of five hundred of his brother monks. This concordance was the basis of two which succeeded in time and importance, one by Conrad of Halberstadt (fl. c. 1290) and the other by John of Segovia in the next century. This book was published in a greatly improved and amplified form in the middle of the 19th century by David Nutt, of London, edited by T. P. Dutripon. The first Hebrew concordance was compiled in 1437-1445 by Rabbi Isaac Nathan b. Kalonymus of Arles. It was printed at Venice in 1523 by Daniel Bomberg, in Basel in 1556, 1569 and 1581. It was published under the title *Meir Natib*, “The Light of the Way.” In 1556 it was translated into Latin by Johann Reuchlin, but many errors appeared in both the Hebrew and the Latin edition. These were corrected by Marius de Calasio, a Franciscan friar, who published a four volume folio *Concordantiae Sacr. Bibl. Hebr. et Latin.* at Rome, 1621, much enlarged, with proper names included. Another concordance based on Nathan’s was Johann Buxtorf the elder’s *Concordantiae Bibl. Ebraicae nova et artificiosa methodo dispositae*, Basel, 1632. It marks a stage in both the arrangement and the knowledge of the roots of words, but can only be used by those who know the massoretic system, as the references are made by Hebrew letters and relate to rabbinical divisions of the Old Testament. Calasio’s concordance was republished in London under the direction of William Romaine in 1747-1749, in four volumes folio, under the patronage of all the monarchs of Europe and also of the pope. In 1754 John Taylor, D.D., a Presbyterian divine in Norwich, published in two volumes the *Hebrew Concordance adapted to the English Bible*, disposed after the manner of Buxtorf. This was the most complete and convenient concordance up to the date of its publication. In the middle of the 19th century Dr Julius Fürst issued a thoroughly revised edition of Buxtorf’s concordance. The *Hebräischen und chaldäischen Concordanz zu den Heiligen Schriften Alten Testaments* (Leipzig, 1840) carried forward the development of the concordance in several directions. It gave (1) a corrected text founded on Hahn’s Vanderhoogt’s Bible; (2) the Rabbinical meanings; (3) explanations in Latin, and illustrations from the three Greek versions, the Aramaic paraphrase, and the Vulgate; (4) the Greek words employed by the Septuagint as renderings of the Hebrew; (5) notes on philology and archaeology, so that the concordance contained a Hebrew lexicon. An English translation by Dr Samuel Davidson was published in 1867. A revised edition of Buxtorf’s work with additions from Fürst’s was published by B. Bär (Stettin, 1862). A new concordance embodying the matter of all previous works with lists of proper names and particles was published by Solomon Mandelkern in Leipzig (1896); a smaller edition of the same, without quotations, appeared in 1900. There are also concordances of Biblical proper names by G. Brecher (Frankfort-on-Main, 1876) and Schusslovicz (Wilna, 1878).

A *Concordance to the Septuagint* was published at Frankfort in 1602 by Conrad Kircher of Augsburg; in this the Hebrew words are placed in alphabetical order and the Greek words by which they are translated are placed under them. A Septuagint concordance, giving the Greek words in alphabetical order, was published in 1718 in two volumes by Abraham Tromm, a learned minister at Groningen, then in the eighty-fourth year of his age. It gives the Greek words in alphabetical order; a Latin translation; the Hebrew word or words for which the Greek term is used by the Septuagint; then the places where the words occur in the order of the books and chapters; at the end of the quotations from the Septuagint places are given where the word occurs in Aquila, Symmachus and Theodotion, the other Greek translations of the O. T.; and the words of the Apocrypha follow in each case. Besides an index to the Hebrew and Chaldaic words there is another index which contains a lexicon to the *Hexapla* of Origen. In 1887 (London) appeared the *Handy Concordance of the Septuagint giving various readings from Codices Vaticanus, Alexandrinus, Sinaiticus and*

Ephraemi, with an appendix of words from Origen's Hexapla, not found in the above manuscripts, by G. M., without quotations. A work of the best modern scholarship was brought out in 1897 by the Clarendon Press, Oxford, entitled *A Concordance to the Septuagint and the other Greek versions of the Old Testament including the Apocryphal Books*, by Edwin Hatch and H. A. Redpath, assisted by other scholars; this was completed in 1900 by a list of proper names.

The first Greek concordance to the New Testament was published at Basel in 1546 by Sixt Birck or Xystus Betuleius (1500-1554), a philologist and minister of the Lutheran Church. This was followed by Stephen's concordance (1594) planned by Robert Stephens and published by Henry, his son. Then in 1638 came Schmied's ταμιεῖον, which has been the basis of subsequent concordances to the New Testament. Erasmus Schmied or Schmid was a Lutheran divine who was professor of Greek in Wittenberg, where he died in 1637. Revised editions of the ταμιεῖον were published at Gotha in 1717, and at Glasgow in 1819 by the University Press. In the middle of the 19th century Charles Hermann Bruder brought out a beautiful edition (Tauchnitz) with many improvements. The *apparatus criticus* was a triumph of New Testament scholarship. It collates the readings of Erasmus, R. Stephens' third edition, the Elzevirs, Mill, Bengel, Webster, Knapp, Tittman, Scholz, Lachmann. It also gives 832
a selection from the most ancient patristic MSS. and from various interpreters. No various reading of critical value is omitted. An edition of Bruder with readings of Samuel Prideaux Tregelles was published in 1888 under the editorship of Westcott and Hort. The *Englishman's Greek Concordance of the New Testament*, and the *Englishman's Hebrew and Chaldee Concordance*, are books intended to put the results of the above-mentioned works at the service of those who know little Hebrew or Greek. Every word in the Bible is given in Hebrew or Greek, the word is transliterated, and then every passage in which it occurs is given—the word, however it may be translated, being italicized. They are the work of George V. Wigram assisted by W. Burgh and superintended by S. P. Tregelles, B. Davidson and W. Chalk (1843; 2nd ed. 1860). Another book which deserves mention is, *A Concordance to the Greek Testament with the English version to each word; the principal Hebrew roots corresponding to the Greek words of the Septuagint, with short critical notes and an index*, by John Williams, LL.D., Lond. 1767.

In 1884 Robert Young, author of an analytical concordance mentioned below, brought out a *Concordance to the Greek New Testament with a dictionary of Bible Words and Synonyms*: this contains a concise concordance to eight thousand changes made in the Revised Testament. Another important work of modern scholarship is the *Concordance to the Greek Testament*, edited by the Rev. W. F. Moulton and A. E. Geden, according to the texts adopted by Westcott and Hort, Tischendorf, and the English revisers.

The first concordance to the English version of the New Testament was published in London, 1535, by Thomas Gybson. It is a black-letter volume entitled *The Concordance of the New Testament most necessary to be had in the hands of all soche as delyte in the communicacion of any place contayned in ye New Testament*.

The first English concordance of the entire Bible was John Marbeck's, *A Concordance, that is to saie, a worke wherein by the order of the letters of the A.B.C. ye maie redely find any worde conteigned in the whole Bible, so often as it is there expressed or mentioned*, Lond. 1550. Although Robert Stephens had divided the Bible into verses in 1545, Marbeck does not seem to have known this and refers to the chapters only. In 1550 also appeared Walter Lynne's translation of the concordance issued by Bullinger, Jude, Pellican and others of the Reformers. Other English concordances were published by Cotton, Newman, and in abbreviated forms by John Downham or Downame (cd. 1652), Vavasor Powell (1617-1670), Jackson and Samuel Clarke (1626-1701). In 1737 Alexander Cruden (*q.v.*), a London bookseller, born and educated in Aberdeen, published his *Complete Concordance to the Holy Scriptures of the Old and New Testament, to which is added a concordance to the books called Apocrypha*. This book embodied, was based upon and superseded all its predecessors. Though the first edition was not remunerative, three editions were published during Cruden's life, and many since his death. Cruden's work is accurate and full, and later concordances only supersede his by combining an English with a Greek and Hebrew concordance. This is done by the *Critical Greek and English Concordance* prepared by C. F. Hudson, H. A. Hastings and Ezra Abbot, LL.D., published in Boston, Mass., and by the *Critical Lexicon and Concordance to the English and Greek New Testament*, by E. L. Bullinger, 1892. The *Interpreting Concordance to the New Testament*, edited by James Gall, shows the Greek original of every word, with a glossary explaining the Greek words of the New Testament, and showing their varied renderings in the Authorized Version. The most convenient of these is *Young's Analytical Concordance*, published in Edinburgh in 1879, and

since revised and reissued. It shows (1) the original Hebrew or Greek of any word in the English Bible; (2) the literal and primitive meaning of every such original word; (3) thoroughly reliable parallel passages. There is a *Students' Concordance to the Revised Version of the New Testament* showing the changes embodied in the revision, published under licence of the universities; and a concordance to the Revised Version by J. A. Thoms for the Christian Knowledge Society.

Biblical concordances having familiarized students with the value and use of such books for the systematic study of an author, the practice of making concordances has now become common. There are concordances to the works of Shakespeare, Browning and many other writers.

(D. Mn.)

CONCORDAT (Lat. *concordatum*, agreed upon, from *con-*, together, and *cor*, heart), a term originally denoting an agreement between ecclesiastical persons or secular persons, but later applied to a pact concluded between the ecclesiastical authority and the secular authority on ecclesiastical matters which concern both, and, more specially, to a pact concluded between the pope, as head of the Catholic Church, and a temporal sovereign for the regulation of ecclesiastical affairs in the territory of such sovereign. It is to concordats in this later sense that this article refers.

No one now questions the profound distinction that exists between the two powers, spiritual and temporal, between the church and the state. Yet these two societies are none the less in inevitable relation. The same men go to compose both; and the church, albeit pursuing a spiritual end, cannot dispense with the aid of temporal property, which in its nature depends on the organization of secular society. It follows of necessity that there are some matters which may be called "mixed," and which are the legitimate concern of the two powers, such as church property, places of worship, the appointment and the emoluments of ecclesiastical dignitaries, the temporal rights and privileges of the secular and regular clergy, the regulation of public worship, and the like. The existence of such mixed matters gives rise to inevitable conflicts of jurisdiction, which may lead, and sometimes have led, to civil war. It is, therefore, to the general interest that all these matters should be settled pacifically, by a common accord; and hence originated those conventions between the two powers which are known by the significant name of concordat, the official name being *pactum concordatum* or *solemnis conventio*. In theory these agreements may result from the spontaneous and pacific initiative of the contracting parties, but in reality their object has almost always been to terminate more or less acute conflicts and remedy more or less disturbed situations. It is for this reason that concordats always present a clearly marked character of mutual concession, each of the two powers renouncing certain of its claims in the interests of peace.

For the purposes of a concordat the state recognizes the official *status* of the church and of its ministers and tribunals; guarantees it certain privileges; and sometimes binds itself to secure for it subsidies representing compensation for past spoliations. The pope on his side grants the temporal sovereign certain rights, such as that of making or controlling the appointment of dignitaries; engages to proceed in harmony with the government in the creation of dioceses or parishes; and regularizes the situation produced by the usurpation of church property &c. The great advantage of concordats—indeed their principal utility—consists in transforming necessarily unequal unilateral claims into contractual obligations analogous to those which result from an international convention. Whatever the obligations of the state towards the ecclesiastical society may be in pure theory, in practice they become more precise and stable when they assume the nature of a bilateral convention by which the state engages itself with regard to a third party. And reciprocally, whatever may be the absolute rights of the ecclesiastical society over the appointment of its dignitaries, the administration of its property, and the government of its adherents, the exercise of these rights is limited and restricted by the stable engagements and concessions of the concordatory pact, which bind the head of the church with regard to the nations.

A concordat may assume divers forms,—historically, three. The most common in modern times is that of a diplomatic convention debated between the authorized mandatories of the high contracting parties and subsequently ratified by the latter; as, for example, the French

concordat of 1801. Or, secondly, the concordat may result from two identical separate acts, one emanating from the pope and the other from the sovereign; this was the form of the first true concordat, that of Worms, in 1122. A third form was employed in the case of the concordat of 1516 between Leo X. and Francis I. of France; a papal bull published the concordat in the form of a concession by the pope, and it was afterwards accepted and published by the king as law of the country. The shades which distinguish these three forms are not without significance, but they in no way detract from the contractual character of concordats.

Since concordats are contracts they give rise to that special mutual obligation which results from every agreement freely entered into; for a contract is binding on both parties to it. Concordats are undoubtedly conventions of a particular nature. They may make certain concessions or privileges once given without any corresponding obligation; they constitute for a given country a special ecclesiastical law; and it is thus that writers have sometimes spoken of concordats as privileges. Again, it is quite certain that the spiritual matters upon which concordats bear do not concern the two powers in the same manner and in the same degree; and in this sense concordats are not perfectly equal agreements. Finally, they do not assume the contracting parties to be totally independent, *i.e.* regard is had to the existence of anterior rights or duties. But with these reservations it must unhesitatingly be said that concordats are bilateral or synallagmatic contracts, from which results an equal mutual obligation for the two parties, who enter into a juridical engagement towards each other. Latterly certain Catholics have questioned this equality of the concordatory obligation, and have aroused keen discussion. According to Maurice de Bonald (*Deux questions sur le concordat de 1801*, Geneva, 1871), who exaggerates the view of Cardinal Tarquini (*Instit. juris publ. eccl.*, 1862 and 1868), concordats would be pure privileges granted by the pope; the pope would not be able to enter into agreements on spiritual matters or impose restraints upon the power of his successors; and consequently he would not bind himself in any juridical sense and would be able freely to revoke concordats, just as the author of a privilege can withdraw it at his pleasure. This exaggerated argument found a certain number of supporters, several of whom nevertheless sensibly weakened it. But the best canonists, from the Roman professor De Angelis (*Prael. juris canon.* i. 106) onwards, and all jurists, have victoriously refuted this theory, either by insisting on the principles common to all agreements or by citing the formal text of several concordats and papal acts, which are as explicit as possible. They have thus upheld the true contractual nature of concordats and the mutual juridical obligation which results from them.

The foregoing statements must not be taken to mean that concordats are in their nature perpetual, and that they cannot be broken or denounced. They have the perpetuity of conventions which contain no time limitation; but, like every human convention, they can be denounced, in the form in use for international treaties, and for good reasons, which are summed up in the exigencies of the general good of the country. Nevertheless, there is no example of a concordat having been denounced or broken by the popes, whereas several have been denounced or broken by the civil powers, sometimes in the least diplomatic manner, as in the case of the French concordat in 1905. The rupture of the concordat at once terminates the obligations which resulted from it on both sides; but it does not break off all relation between the church and the state, since the two societies continue to coexist on the same territory. To the situation defined by concordat, however, succeeds another situation, more or less uncertain and more or less strained, in which the two powers legislate separately on mixed matters, sometimes not without provoking conflicts.

We cannot describe in detail the objects of concordatory conventions. They bear upon very varied matters,[1] and we must confine ourselves here to a brief *résumé*. In the first place is the official recognition by the state of the Catholic religion and its ministers. Sometimes the Catholic religion is declared to be the state religion, and at least the free and public exercise of its worship is guaranteed. Several conventions guarantee the free communication of the bishops, clergy and laity with the Holy See; and this admits of the publication and execution of apostolic letters in matters spiritual. Others define those affairs of major importance which may be or must be referred to the Holy See by appeal, or the decision of which is reserved to the Holy See. On several occasions concordats have established a new division of dioceses, and provided that future erections or divisions should be made by a common accord. Analogous provisions have been made with regard to the territorial divisions within the dioceses; parishes have been recast, and the consent of the two authorities has been required for the establishment of new parishes. As regards candidates for ecclesiastical offices, the concordats concluded with Catholic nations regularly give the sovereign the right to nominate or present to bishoprics, often also to other inferior benefices, such as canonries, important parishes and abbeys; or at least the choice of the ecclesiastical

authority is submitted to the approval of the civil power. In all cases canonical institution (which confers ecclesiastical jurisdiction) is reserved to the pope or the bishops. In countries where the head of the state is not a Catholic, the bishops are regularly elected by the chapters, but the civil power has the right to strike out objectionable names from the list of candidates which is previously submitted to it. Other conventions secure the exercise of the jurisdiction of the bishops in their diocese, and determine precisely their authority over seminaries and other ecclesiastical establishments of instruction and education, as well as over public schools, so far as concerns the teaching of religion. Certain concordats deal with the orders and congregations of monks and nuns with a view to subjecting them to a certain control while securing to them the legal exercise of their activities. Ecclesiastical immunities, such as reservation of the criminal cases of the clergy, exemption from military service and other privileges, are expressly maintained in a certain number of pacts. One of the most important subjects is that of church property. An agreement is come to as to the conditions on which pious foundations are able to be made; the measure in which church property shall contribute to the public expenses is indicated; and, in the 19th century, the position of those who have acquired confiscated church property is regularized. In exchange for this surrender by the church of its ancient property the state engages to contribute to the subsistence of the ministers of public worship, or at least of certain of them.

Scholars agree in associating the earliest concordats with the celebrated contest about investitures (*q.v.*), which so profoundly agitated Christian Europe in the 11th and 12th centuries. The first in date is that which was concluded for England with Henry I. in 1107 by the efforts of St Anselm. The convention of Sutri of 1111 between Pope Paschal II. and the emperor Henry V. having been rejected, negotiations were resumed by Pope Calixtus II. and ended in the concordat of Worms (1122), which was confirmed in 1177 by the convention between Alexander III. and the emperor Frederick I. In this concordat a distinction was made between spiritual investiture, by the ring and pastoral staff, and lay or feudal investiture, by the sceptre. The emperor renounced investiture by ring and staff, and permitted canonical elections; the pope on his part recognized the king’s right to perform lay investiture and to assist at elections. Analogous to this convention was the concordat concluded between Nicholas IV. and the king of Portugal in 1289.

The lengthy discussions on ecclesiastical benefices in Germany ended finally in the concordat of Vienna, promulgated by Nicholas V. in 1448. Already at the council of Constance attempts had been made to reduce the excessive papal reservations and taxes in the matter of benefices, privileges which had been established under the Avignon popes and during the Great Schism; for example, Martin V. had had to make with the different nations special arrangements which were valid for five years only, and by which he renounced the revenues of vacant benefices. The council of Basel went further: it suppressed annates and 834
all the benefice reservations which did not appear in the *Corpus Juris*. Eugenius IV. repudiated the Basel decrees, and the negotiations terminated in what was called the “concordat of the princes,” which was accepted by Eugenius IV. on his death-bed (bulls of February 5 and 7, 1447). In February 1448 Nicholas V. concluded the arrangement, which took the name of the concordat of Vienna. This concordat, however, was not received as law of the Empire. In Germany the concessions made to the pope and the reservations maintained by him in the matter of taxes and benefices were deemed excessive, and the prolonged discontent which resulted was one of the causes of the success of the Lutheran Reformation.

In France the opposition to the papal exactions had been still more marked. In 1438 the Pragmatic Sanction of Bourges adopted and put into practice the Basel decrees, and in spite of the incessant protests of the Holy See the Pragmatic was observed throughout the 15th century, even after its nominal abolition by Louis XI. in 1461. The situation was modified by the concordat of Bologna, which was personally negotiated by Leo X. and Francis I. of France at Bologna in December 1515, inserted in the bull *Primitiva* (August 18, 1516), and promulgated as law of the realm in 1517, but not without rousing keen opposition. All bishoprics, abbeys and priories were in the royal nomination, the canonical institution belonging to the pope. The pope preserved the right to nominate to vacant benefices *in curia* and to certain benefices of the chapters, but all the others were in the nomination of the bishops or other inferior collators. However, the exercise of the pope’s right of provision still left considerable scope for papal intervention, and the pope retained the annates.

In the 17th century we have only to mention the concordat between Urban VIII. and the emperor Ferdinand II. for Bohemia in 1640. In the 18th century concordats are numerous: there are two for Spain, in 1737 and 1753; two for the duchy of Milan, in 1757 and 1784; one for Poland, in 1736; five for Sardinia and Piedmont, in 1727, 1741, 1742, 1750 and

1770; and one for the kingdom of the Two Sicilies in 1741.

After the political and territorial upheavals which marked the end of the 18th century and the beginning of the 19th, all these concordats either fell to the ground or had to be recast. In the 19th century we find a long series of concordats, of which a good number are still in force. The first in date and importance is that of 1801, concluded for France between Napoleon, First Consul, and Pius VII. after laborious negotiations. Save in the provisions relating to ecclesiastical benefices, all the property of which had been confiscated, it reproduced the concordat of 1516. The pope condoned those who had acquired church property; and by way of compensation the government engaged to give the bishops and curés suitable salaries. The concordat was solemnly promulgated on Easter Day 1802, but the government had added to it unilateral provisions of Gallican tendencies, which were known as the Organic Articles. After having been the law of the Church of France for a century, it was denounced by the French government in 1905. It remains, however, partly in force for Belgium and Alsace-Lorraine, which formed part of French territory in 1801.

We conclude with a brief chronological survey of the concordats during the 19th century, some now abrogated or replaced, others maintained. It must be observed that the denunciation of a concordat by a nation does not necessarily entail the separation of the church and the state in that country or the rupture of diplomatic relations with Rome.

1803. For the Italian republic, between Napoleon and Pius VII., analogous to the French concordat; abrogated.

1813. It is impossible to designate as a concordat the concessions which were wrested by violence from Pius VII. when ill and in seclusion at Fontainebleau, and which he at once retracted.

1817. For Bavaria; still in force.

1817. New French concordat, in which Louis XVIII. endeavoured to revive the concordat of 1516; but it was not put to the vote in the chambers, and never came into force.

1817. For Piedmont, completed in 1836 and 1841; was suppressed, like all other Italian concordats, by the formation of the kingdom of Italy.

1818. For the Two Sicilies, completed in 1834; lasted until the invasion of the kingdom of Naples by Piedmont.

1821. For Prussia; still in force.

1821. For the Rhine provinces not incorporated in Prussia, with the special object of regulating episcopal elections; concerned Württemberg, Baden, Hesse, Saxony, Nassau, Frankfort, the Hanseatic towns, Oldenburg and Waldeck. This first concordat was immediately suspended, and was not ratified until 1827; it is partially maintained. It had to be replaced by new concordats concluded with Württemberg in 1857 and the grand-duchy of Baden in 1859; but these conventions, not having been ratified by those countries, never came into force.

1824. For the kingdom of Hanover; maintained.

1827. For Belgium and Holland; abandoned by a common accord.

1828 and 1845. For Switzerland, for the reorganization of the bishoprics of Basel and Soleure; in force.

1847. For Russia, never applied by Russia. It was followed by several partial conventions.

1851. For Tuscany; lasted until the formation of the kingdom of Italy.

1851. For Spain, completed in 1859 and 1888; in force.

A convention on the religious orders was concluded in 1904, but had not received the assent of the Senate in 1908.

1855. For Austria; denounced in 1870. Several of its provisions are maintained by unilateral Austrian laws. The emperor of Austria continues to nominate to bishoprics by virtue of rights anterior to this concordat.

1857. For Portugal, completed in 1886 for the Portuguese possessions in the Indies; in force.

1886. For Montenegro; in force.

The numerous concordats concluded towards the middle of the 19th century with several of the South American republics either have not come into force or have been denounced and replaced by a more or less pacific modus vivendi.

For texts see Vincenzio Nussi, *Quinquaginta conventiones de rebus ecclesiasticis* (Rome, 1869; Mainz, 1870); Branden, *Concordata inter S. Sedem et inclytam nationem Germaniae*, &c. (undated). On the nature and obligation of concordats see Mgr. Giobbio, *I Concordati* (Monza, 1900); *idem, Lezioni di diplomazia ecclesiastica* (Rome, 1899-1903); Cardinal Cavagnis, *Institutiones juris publici ecclesiastici* (Rome, 1906). For the French concordats see A. Baudrillard, *Quatre cents ans de concordat* (Paris, 1905); Boulay de la Meurthe, *Documents sur la négociation du concordat et sur les autres rapports de la France avec le Saint-Siège* (Paris, 1891-1905); Cardinal Mathieu, *Le Concordat de 1801* (Paris, 1903); E. Sevestre, *Le Concordat de 1801, l'histoire, le texte, la destinée* (Paris, 1905). On the relations between the church and the state in various countries see Vering, *Kirchenrecht*, §§ 30-53.

(A. Bo.*)

1 These are arranged under thirty-five distinct heads in Nussi's *Quinquaginta conventiones de rebus ecclesiasticis* (Rome, 1869).

CONCORDIA, a Roman goddess, the personification of peace and goodwill. Several temples in her honour were erected at Rome, the most ancient being one on the Capitol, dedicated to her by Camillus (367 B.C.), subsequently restored by Livia, the wife of Augustus, and consecrated by Tiberius (A.D. 10). Other temples were frequently built to commemorate the restoration of civil harmony. Offerings were made to Concordia on the birthdays of emperors, and Concordia Augusta was worshipped as the promoter of harmony in the imperial household. Concordia was represented as a matron holding in her right hand a *patera* or an olive branch, and in her left a *cornu copiae* or a sceptre. Her symbols were two hands joined together, and two serpents entwined about a herald's staff.

CONCORDIA (mod. *Concordia Sagittaria*), an ancient town of Venetia, in Italy, 16 ft. above sea-level, 31 m. W. of Aquileia, at the junction of roads to Altinum and Patavium, to Opitergium (and thence either to Vicetia and Verona, or Feltria and Tridentum), to Noricum by the valley of the Tilaventus (Tagliamento), and to Aquileia. It was a mere village until the time of Augustus, who made it a colony. Under the later empire it was one of the most important towns of Italy; it had a strong garrison and a factory of missiles for the army. The cemetery of the garrison has been excavated since 1873, and a large number of important 835
inscriptions, the majority belonging to the end of the 4th and the beginning of the 5th centuries, have been discovered. It was taken and destroyed by Attila in A.D. 452. Considerable remains of the ancient town have been found—parts of the city walls, the sites of the forum and the theatre, and probably that of the arms factory. The objects found are preserved at Portogruaro, 1¼ m. to the N. The see of Concordia was founded at an early period, and transferred in 1339 to Portogruaro, where it still remains. The baptistery of Concordia was probably erected in 1100.

See Ch. Hülsen in Pauly-Wissowa, *Realencyclopädie*, iv. (Stuttgart, 1901) 830.

(T. As.)

CONCRETE (Lat. *concretus*, participle of *concrescere*, to grow together), a term used in various technical senses with the general significance of combination, conjunction, solidity. Thus the building material made up of separate substances combined into one is known as

concrete (see below). In mathematics and music, the adjective has been used as synonymous with “continuous” as opposed to “discrete,” *i.e.* “separate,” “discontinuous.” This antithesis is no doubt influenced by the idea that the two words derive from a common origin, whereas “discrete” is derived from the Latin *discernere*. In logic and also in common language concrete terms are those which signify persons or things as opposed to abstract terms which signify qualities, relations, attributes (so J. S. Mill). Thus the term “man” is concrete, while “manhood” and “humanity” are abstract, the names of the qualities implied. Confusions between abstract and concrete terms are frequent; thus the word “relation,” which is strictly an abstract term implying connexion between two things or persons, is often used instead of the correct term “relative” for people related to one another. Concrete terms are further subdivided as Singular, the names of things regarded as individuals, and General or Common, the names which a number of things bear in common in virtue of their possession of common characteristics. These latter terms, though concrete in so far as they denote the persons or things which are known by them (see Denotation), have also an abstract sense when viewed connotatively, *i.e.* as implying the quality or qualities in isolation from the individuals. The ascription of adjectives to the class of concrete terms, upheld by J. S. Mill, has been disputed on the ground that adjectives are applied both to concrete and to abstract terms. Hence some logicians make a separate class for adjectives, as being the names neither of things nor of qualities, and describe them as Attributive terms.

CONCRETE, the name given to a building material consisting generally of a mixture of broken stone, sand and some kind of cement. To these is added water, which combining chemically with the cement conglomerates the whole mixture into a solid mass, and forms a rough but strong artificial stone. It has thus the immense advantage over natural stone that it can be easily moulded while wet to any desired shape or size. Moreover, its constituents can be obtained in almost any part of the world, and its manufacture is extremely simple. On account of these properties, builders have come to give it a distinct preference over stone, brick, timber and other building materials. So popular has it become that besides being used for massive constructions like breakwaters, dock walls, culverts, and for foundations of buildings, lighthouses and bridges, it is also proving its usefulness to the architect and engineer in many other ways. A remarkable extension of the use of concrete has been made possible by the introduction of scientific methods of combining it with steel or iron. The floors and even the walls of important buildings are made of this combination, and long span bridges, tall factory chimneys, and large water-tanks are among the many novel uses to which it has been put. Piles made of steel concrete are driven into the ground with blows that would shatter the best of timber. A fuller description of the combination of steel and concrete will be given later.

Constituents.

The constituents of concrete are sometimes spoken of as the *matrix* and the *aggregate*, and these terms, though somewhat old-fashioned, are convenient. The matrix is the lime or cement, whose chemical action with the added water causes the concrete to solidify; and the aggregate is the broken stone or hard material which is embedded in the matrix. The matrix most commonly used is Portland cement, by far the best and strongest of them all. The subject of its manufacture and examination is a most important and interesting one, and the special article dealing with it should be studied (see Cement), Here it will only be said that before using Portland cement very careful tests should be made to ascertain its quality and condition. Moreover, it should be kept in a damp-proof store for a few weeks; and when taken out for use it should be mixed and placed in position as quickly as possible, because rain, or even moist air, spoils it by causing it to set prematurely. The oldest of all the matrices is lime, and many splendid examples of its use by the Romans still exist. It has been to a great extent superseded by Portland cement, on account of the much greater strength of the latter, though lime concrete is still used in many places for dry foundations and small structures. To be of service the lime should be what is known as “hydraulic,” that is, not pure or “fat,” but containing some argillaceous matter, and should be carefully slaked with water before being mixed with the aggregate. To ensure this being properly done, the lumps of lime should be broken up small, and enough water to slake them should be added, the lime then being allowed to rest for about forty-eight hours, when the water changes the particles of quicklime to hydrate of lime, and breaks up the hard lumps into a powder. The hydrated lime, after being passed through a fine screen to sort out any lumps unaffected by the water, is ready for concrete making, and if not required

at once should be stored in a dry place. Other matrices are slag cement, a comparatively recent invention, and some other natural and artificial cements which find occasional advocates. Materials like tar and pitch are sometimes employed as a matrix; they are used hot and without water, the solidifying action being due to cooling and to evaporation of the mineral oils contained in them. Whatever matrix is used, it is almost invariably “diluted” with sand, the grains of which become coated with the finer particles of the matrix. The sand should be coarse-grained and hard. It should be free from dirt—that is to say, free from clay or soft mud, for instance, which prevents the cement adhering to its particles, or again from sewage matter or any substance which will chemically destroy the matrix. The grains should show no signs of decay, and by preference should be of an angular shape. The sand obtained by crushing granite and hard stones is excellent. When lime is used as a matrix, certain natural earths such as pozzuolana or trass, or, failing these, powdered bricks or tiles, may be used instead of sand with great advantage. They have the property of entering into chemical combination with the lime, forming a hard setting compound, and increasing the hardness of the resulting concrete.

The commonest aggregates are broken stone and natural flint gravel. Broken bricks or tiles and broken furnace slag are sometimes used, the essential points being that the aggregate should be hard, clean and sound. Generally speaking, broken stones will be rough and angular, whereas the stones in flint gravel will be comparatively smooth and round. It might be supposed, therefore, that the broken stone will necessarily be the better aggregate, but this does not always follow. Experience shows that, although spherical pebbles are to be avoided, Portland cement adheres tightly to smooth flint surfaces, and that rough stones often give a less compact concrete than smooth ones on account of the difficulty of bedding them into the matrix when laying the concrete. In mixing concrete there is always a tendency for the stones to separate themselves from the sand and cement, and to form “pockets” of honeycombed concrete which are neither water-tight nor strong. These are much more liable to occur when the stones are flat and angular than when they are round. Modern engineers favour the practice of having the stones of various sizes instead of being uniform, because if these sizes are wisely proportioned the whole mixture can be made more solid, and the rough “pockets” avoided. For first-class work, however, and especially in steel concrete, it is customary to reject very large stones, and to insist that all shall pass through a ring 7/8 of an inch in diameter.

The water, like all the other constituents of concrete, should be clean and free from vegetable matter. At one time sea-water was thought to be injurious, but modern investigation finds no objection to it except on the score of appearance, efflorescence being more likely to occur when it is used.

Sometimes in massive concrete structures large and heavy stones as big as a man can lift are buried in the concrete after it is laid in position but while it is still wet. The stones should be hard and clean, and care must be taken that they are completely surrounded. Such concrete is known as *rubble concrete*.

Proportions.

In proportioning the quantities of matrix to aggregate the ideal to be aimed at is to get a concrete in which the voids or air-spaces shall be as small as possible; and as the lime or cement is usually by far the most expensive item, it is desirable to use as little of it as is consistent with strength. When natural flint gravel containing both stones and sand is used, it is usual to mix so much gravel with so much lime or cement. The proportions in practice generally run from 3 to 1 for very strong work, down to 12 to 1 for unimportant work. Some engineers have the sand separated from the stones by screens or sieves and then remixed in definite proportions. When stones and sand are obtained from different sources, their relative proportions have to be decided upon. A common way of doing this is first to choose a proportion of sand to cement, which will probably vary from 1 to 1 up to 4 to 1. It then remains to determine what proportion of stones should be added. For this purpose a large can, whose volume is known, is filled loosely with stones, and the volume of the voids between them is determined by measuring how much water the can will hold in addition to the stones. It is then assumed that the quantity of sand and cement should be equal to the voids. Moreover, the volume of sand and cement together is generally assumed to be equal to that of the sand alone, as the cement to a large extent fills up voids in the sand. For example, suppose it is resolved to use 2 parts of sand to 1 of cement, and suppose that experiment shows that in a pailful of stones two-fifths of the volume consists of voids, then 2 parts of sand (or sand with cement) will fill voids in 5 parts of stones, and the proportion of cement, sand, stones becomes 1:2:5. There are several weak points in this reasoning, and a more accurate way of determining the best proportions is to try different mixtures of cement, stones and sand, filling them into different

pails of the same size, and then ascertaining, by weighing the pails, which mixture is the densest.

In determining the amount of water to be added, several things must be considered. The amount required to combine chemically with the cement is about 16% by weight, but in practice much more than this is used, because of loss by evaporation, and the difficulty of ensuring that the water shall be uniformly distributed. If the situation is cool, the stone hard, and the concrete carefully rammed directly it is laid down and kept moist with damp cloths, only just sufficient to moisten the whole mass is required. On the other hand, water should be given generously in hot weather, also when absorbent stone is used or when the concrete is not rammed. In these cases the concrete should be allowed to take all it can, but an excess of water which would flow away, carrying the cement with it, should be avoided.

Mixing.

The thorough mixing of the constituents is a most important item in the production of good concrete. Its object is to distribute all the materials evenly throughout the mass, and it is performed in many different ways, both by hand and by machine. The relative values of hand and machine work are often discussed. Roughly it may be said that where a large mass of concrete is to be mixed at one or two places a good machine will be of great advantage. On the other hand, where the mixing platform has to be constantly shifted, hand mixing is the more convenient way. In hand mixing it is usual to measure out from gauge boxes the sand, stones and cement or lime in a heap on a wooden platform. Then they are turned once or twice in their dry state by men with shovels. Next water is carefully added, and the mixture again turned, when it is ready for depositing. For important work and especially for thin structures the number of turnings should be increased. Many types of mixing machines are obtainable; the favourite type is one in which the materials are placed in a large iron box which is made to rotate, thus tumbling the matrix and aggregate over each other again and again. Another simple apparatus is a large vertical pipe or shoot in which sloping baffle plates or shelves are placed at intervals. The materials are fed in at the top of the shoot and fall from shelf to shelf, the mixing being effected by the various shocks thus given. When mixed the concrete is carried at once to the position required, and if the matrix is quick-setting Portland cement this operation must not be delayed.

Moulds.

One of the few drawbacks of concrete is that, unlike brickwork or masonry, it has nearly always to be deposited within moulds or framing which give it the required shape, and which are removed after it is set. Indeed, the trouble and expense of these moulds sometimes prohibit its use. It is essential that they shall be strong and stiff, so as not to yield at all from the pressure of the wet concrete. The moulds for the face of a wall consist generally of wooden shutters, leaning against upright timbers which are secured by horizontal or raking struts to firm ground, or to anything that will bear the weight. If a smooth and neat face is wanted other precautions must be taken. The shutters must be planed, and coated with a mixture of soap and oil, so as to come away easily after the concrete is set. Moreover, when depositing the concrete, a shovel or other tool must be worked between the wet concrete and the shutter. This draws sand and water to the face and prevents the rough stones from showing themselves. Sometimes rough concrete is rendered over with a plaster of cement and sand after the shutters have been removed, but this is liable to peel off and should be avoided.

Depositing.

The method of depositing depends on the situation. If for important walls, or for small scantlings such as steel concrete generally involves, the concrete should be deposited in quite small quantities and very carefully rammed into position. If for massive walls, it is usual to tip it out in large quantities from a barrow or wagon, and simply spread it in layers about a foot thick. Depositing concrete under water for breakwaters and bridge foundations requires special skill and special appliances. It is usually done in one of three ways:—(a) By moulding the concrete ashore into large blocks, which, when sufficiently hard, are lowered through the water into position by a crane or similar machine with the aid of divers. The most notable instance of this type of construction was at the port of Dublin, where Mr B. B. Stoney made blocks no less than 350 tons in weight. Each block formed a piece of the quay wall 12 ft. long and 27 ft. high, being made on shore and then deposited in position by floating sheers of special design. (b) By moulding the concrete into what are called “bag-blocks.” In this system the concrete is filled into bags, which are at once lowered through the water like the blocks. But in this case the concrete being still wet can adapt itself more or less to the shape of the adjoining bags, and strong rough walls can be built in this way. Sometimes the bags are made of enormous size, as at Aberdeen breakwater, where the contents of each bag weighed 50 tons. The canvas was laid in a hopper barge and there filled with the concrete and sewn

up. The enormous bag was then dropped through a door in the bottom of the barge upon the breakwater foundation. (c) By depositing the wet concrete through the water between temporary upright timber frames which form the two faces of the wall. In this case very great care has to be taken to prevent the cement from being washed away from the other constituents when passing through the water. Indeed, this is bound to happen more or less, but it is guarded against by lowering the concrete slowly in a special box, the bottom of which is opened as it reaches the ground on which the concrete is to be laid. This method can only be carried out in still water, and where strong and tight framing can be built which will prevent the concrete from escaping. For small work the box can be replaced by a canvas bag secured by a special tripping noose which can be loosened when the bag has reached the ground. The concrete escapes from the bag, which is then drawn up and refilled.

Concrete may be compared with other building materials like masonry or timber from various points of view, such as strength, durability, convenience of building, fire-resistance, appearance and cost. Its strength varies within very wide limits according to the quality and proportions of the constituents, and the skill shown in mixing and placing them. To give a rough idea, however, it may be said that its safe crushing load would be about ½ cwt. per sq. in. for lime concrete, and 1 to 5 cwt. for Portland cement concrete. The safe tensile strength of Portland cement concrete would be something like one-tenth of its compressive strength, and might be far less. On this account it is usual to neglect the tensile strength of concrete in designing structures, and to arrange the material in such a way that tensile stresses are avoided. Hence slabs or beams of long span should not be built of plain concrete, though when reinforced with steel it is admirably adapted for these purposes.

Strength.

In regard to durability good Portland cement concrete is one of the most durable materials known. Neither hot, cold, nor wet weather has practically any effect whatever upon it. Frost will not injure it after it has once set, though it is essential to guard it from frost during the operations of mixing and depositing. The same praise cannot, however, be given to lime concrete. Even though the best hydraulic lime be used it is wise to confine it to places where it is not exposed to the air, or to running water, and indeed for important structures the use of lime should be avoided. Good Portland cement is so much stronger than any lime that there are few situations where it is not cheaper as well as better to use the former, because, although cement is the more expensive matrix, a smaller proportion of it will suffice for use. Lime should never be used in work exposed to sea-water, or to water containing chemicals of any kind. Portland cement concrete, on the other hand, may be used without fear in sea-water, provided that certain reasonable precautions are taken. Considerable alarm was created about the year 1887 by the failure of two or three large structures of Portland cement concrete exposed to sea-water, both in England and other countries. The matter was carefully investigated, and it was found that the sulphate of magnesia in the sea-water has a decomposing action on Portland cements, especially those which contain a large proportion of lime or even of alumina. Indeed, no Portland cement is free from the liability to be decomposed by sea-water, and on a moderate scale this action is always going on more or less. But to ensure the permanence of structures in sea-water the great object is to choose a cement containing as little lime and alumina as possible, and free from sulphates such as gypsum; and more important still to proportion the sand and stones in the concrete in such a way that the structure is practically non-porous. If this is done there is really nothing to fear. On the other hand, if the concrete is rough and porous the sea-water will gradually eat into the heart of the structure, especially in a case like a dam, where the water, being higher on one side than the other, constantly forces its way through the rough material, and decomposes the Portland cement it contains.

Durability.

As regards its convenience for building purposes it may be said roughly that in “mass” work concrete is vastly more convenient than any other material. But concrete is hampered by the fact that the surface always has to be formed by means of wooden or other framing, and in the case of thin walls or floors this framing becomes a serious item, involving expense and delay. In appearance concrete can rarely if ever rival stone or brickwork. It is true that it can be moulded to any desired shape, but mouldings in concrete generally give the appearance of being unsatisfactory imitations of stone. Moreover, its colour is not pleasing. These defects will no doubt be overcome as concrete grows in popularity as a building material and its aesthetic treatment is better understood. Concrete pavings are being used in buildings of first importance, the aggregate being very carefully selected, and in many cases the whole mixture coloured by the use of pigments. Care must be taken in their selection, however, as certain colouring matters such as red lead are destructive to the cement. One of

Convenience and appearance.

the great objections to the appearance of concrete is the fact that soon after its erection irregular cracks invariably appear on its surface. These cracks are probably due to shrinkage while setting, aggravated by changes in temperature. They occur no less in structures of masonry and brickwork, but in these cases they generally follow the joints, and are almost imperceptible. In the case of a smooth concrete face there are no joints to follow, and the cracks become an ugly feature. They are sometimes regulated by forming artificial "joints" in the structure by embedding strips of wood or sheet iron at regular intervals, thus forming "lines of weakness," at which the cracks therefore take place. A pleasing "rough" appearance can be given to concrete by brushing it over soon after it has set with a stiff brush dipped in water or dilute acid. Or, if hard, its surface can be picked all over with a bush hammer.

Resistance to fire.

At one time Portland cement concrete was considered to be lacking in fireproof qualities, but now it is regarded as one of the best fire-resisting materials known. Although experiments on this matter are badly needed, there is little doubt that good steel concrete is very nearly indestructible by fire. The matrix should be Portland cement, and the nature of the aggregate is important. Cinders have been and are still much favoured for this purpose. The reason for this preference lies in the fact that being porous and full of air, they are a good non-conductor. But they are weak, and modern experience goes to show that a strong concrete is the best, and that probably materials like broken clamp bricks or burnt clay, which are porous and yet strong, are far better than cinders as a fireproof aggregate. Limestone should be avoided, as it soon splits under heat. The steel reinforcement is of immense importance in fireproof work, because, if properly designed, it enables the concrete to hold together and do its work even when it has been cracked by fire and water. On the other hand, the concrete, being a non-conductor, preserves the steel from being softened and twisted by excessive temperature.

Cost.

Only very general remarks can be made on the subject of cost, as this item varies greatly in different situations and with the market price of the materials used. But in England it may be said that for massive work such as big walls and foundations concrete is nearly always cheaper than brickwork or masonry. On the other hand, for reasons already given, thin walls, such as house walls, will cost more in concrete. Steel concrete is even more difficult to generalize about, as its use is comparatively new, but even in the matter of first cost it is proving a serious rival to timber and to plate steel work, in floors, bridges and tanks, and to brickwork and plain concrete in structures such as culverts and retaining walls, towers and domes.

Artificial Stones.—There are many varieties of concrete known as "artificial stones" which can now be bought ready moulded into the form of paving slabs, wall blocks and pipes: they are both pleasing in appearance and very durable, being carefully made by skilled workmen. Granolithic, globe granite and synthetic stone are examples of these. Some, such as victoria stone, imperial stone and others, are hardened and rendered non-porous after manufacture by immersion in a solution of silicate of soda. Others, like Ford's silicate of limestone, are practically lime mortars of excellent quality, which can be carved and cut like a sandstone of fine quality.

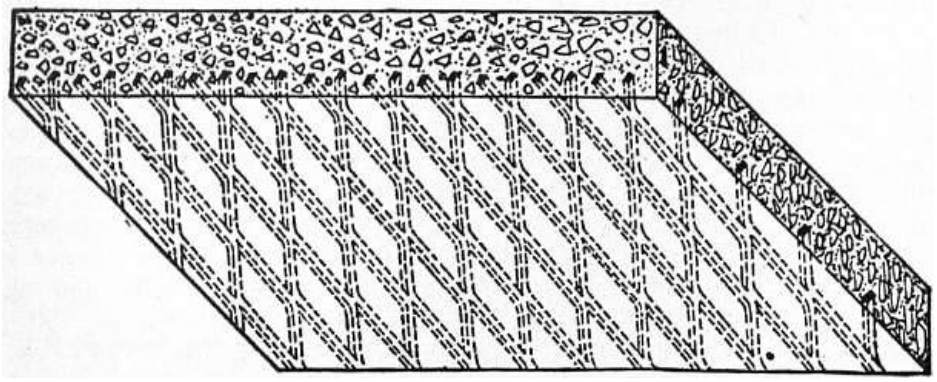
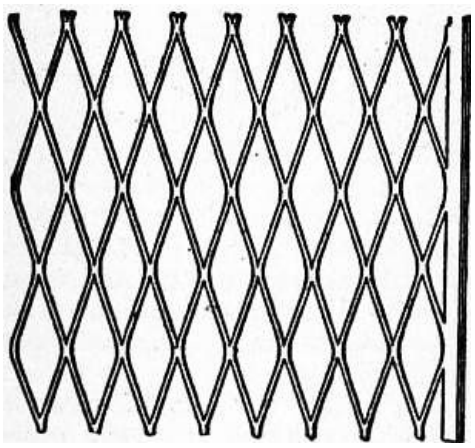


FIG. 1.—Expanded Steel Concrete Slab.

Steel Concrete.—The introduction of steel concrete (also known as ferroconcrete, armoured concrete, or reinforced concrete) is generally attributed to Joseph Monier, a French gardener, who about the year 1868 was anxious to build some concrete water basins. In order to reduce the thickness of the walls and floor he conceived the idea of strengthening them by building in a network of iron rods. As a matter of fact other inventors

were at work before Monier, but he deserves much credit for having pushed his invention with vigour, and for having popularized the use of this invaluable combination. The important point of his idea was that it combined steel and concrete in such a way that the best qualities of each material were brought into play. Concrete is readily procured and easily moulded into shape. It has considerable compressive or crushing strength, but is somewhat deficient in shearing strength, and distinctly weak in tensile or pulling strength. Steel, on the other hand, is easily procurable in simple forms such as long bars, and is exceedingly strong. But it is difficult and expensive to work up into various forms. Concrete has been avoided for making beams, slabs and thin walls, just because its deficiency in tensile strength doomed it to failure in such structures. But if a concrete slab be "reinforced" with a network of small steel rods on its under surface where the tensile stresses occur (see fig. 1) its strength will be enormously increased. Thus the one point of weakness in the concrete slab is overcome by the addition of steel in its simplest form, and both materials are used to their best advantage. The scientific and practical value of this idea was soon seized upon by various inventors and others, and the number of patented systems of combining steel with concrete is constantly increasing. Many of them are but slight modifications of the older systems, and no attempt will be made here to describe them in full. In England it is customary to allow the patentee of one or other system to furnish his own designs, but this is as much because he has gained the experience needed for success as because of any special virtue in this or that system. The majority of these systems have emanated from France, where steel concrete is largely used. America and Germany adopted them readily, and in England some very large structures have been erected with this material.



Expanded Metal.

Section through Intersection.
FIG. 2.

The concrete itself should always be the very best quality, and Portland cement should be used on account of its superiority to all others. The aggregate should be the best obtainable and of different sizes, the stones being freshly crushed and screened to pass through a 7/8 in. ring. Very special care should be taken so to proportion the sand as to make a perfectly impervious mixture. The proportions generally used are 4 to 1 and 5 to 1 in the case of gravel concrete, or 1:2:4 or 1:2½:6 in the case of broken stone concrete. But, generally speaking, in steel concrete the cost of the cement is but a small item of the whole expense, and it is worth while to be generous with it. If It is used in piles or structures where it is likely to be bruised the proportion of cement should be increased. The mixing and laying should all be done very thoroughly; the concrete should be rammed in position, and any old surface of concrete which has to be covered should be cleaned and coated with fresh cement.

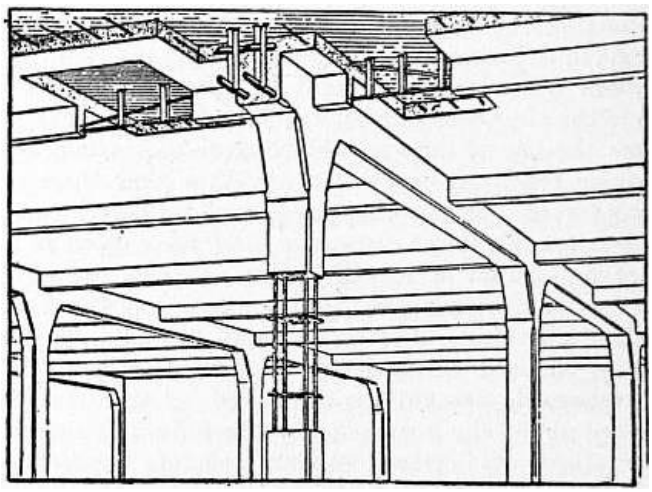


FIG. 3.—Hennebique System.

The reinforcement mostly consists of mild steel and sometimes of wrought iron: steel,

however, is stronger and generally cheaper, so that in English practice it holds the field. It should be mild and is usually specified to have a breaking (tensile) strength of 28 to 32 tons per sq. in., with an elongation of at least 20% in 8 in. Any bar should be capable of being bent cold to the shape of the letter U without breaking it. The steel is generally used in the form of long bars of circular section. At first it was feared that such bars would have a tendency to slip through the concrete in which they were embedded, but experiments have shown that if the bar is not painted but has a natural rusty surface a very considerable adhesion between the concrete and steel—as much as 2 cwt. per sq. in. of contact surface—may be relied upon. Many devices are used, however, to ensure the adhesion between concrete and bar being perfect. (1) In the Hennebique system of construction the bars are flattened at the end and split to form a "fish tail." (2) In the Ransome system round bars are rejected in favour of square bars, which have been twisted in a lathe in "barley sugar" fashion. (3) In the Habrick system a flat bar similarly twisted is used. (4) In the Thacher system a flat bar with projections like rivet heads is specially rolled for this purpose. (5) In the Kahn system a square bar with "branches" is used. (6) In the "expanded metal" system no bars are used, but instead a strong steel netting is manufactured in large sheets by special machinery. It is made by cutting a series of long slots at regular intervals in a plain steel plate, which is then forcibly stretched out sideways until the slots become diamond-shaped openings, and a trellis work of steel without any joints is the result (fig. 2).

The structures in which steel concrete is used may be analysed as consisting essentially of (1) walls, (2) columns, (3) piles, (4) beams, (5) slabs, (6) arches. The designs differ considerably according to which of these purposes the structure is to fulfil.

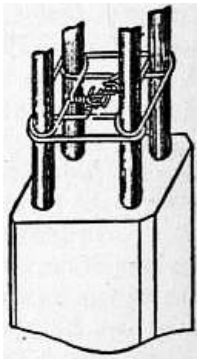


FIG. 4. Hennebique System.

The effect of reinforcing *walls* with steel is that they can be made much thinner. The steel reinforcement is generally applied in the form of vertical rods built in the wall at intervals, with lighter horizontal rods which cross the vertical ones, and thus form a network of steel which is buried in the concrete. These rods assist in taking the weight, and the whole network binds the concrete together and prevents it from cracking under a heavy load. The vertical rods should not be quite in the middle of the wall but near the inner and outer faces alternately. Care must be taken, however, that all the rods are covered by at least an inch of concrete to preserve them from damage by rust or fire. In the Cottancin system the concrete is replaced by bricks pierced with holes through which the vertical rods are threaded; the horizontal tie-rods are also used, but these do not merely cross the vertical ones, but are woven in and out of them.

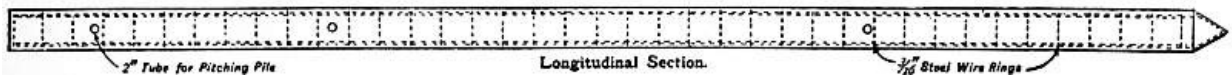


FIG. 5.—Steel and Concrete Pile (Williams System).

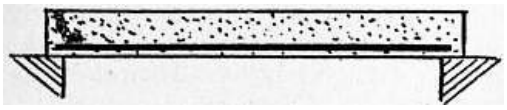


FIG. 6.

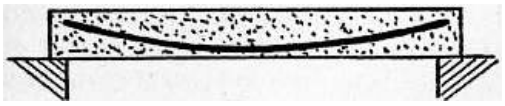


FIG. 7.

Columns have generally to bear a heavier weight than walls, and have to be correspondingly stronger. They have usually been made square with a vertical steel rod at each corner. To prevent these rods from spreading apart they must be tied together at frequent intervals. In some systems this is done by loops of stout wire connecting each rod to its neighbour, and placed one above the other about every 10 in. up the column (figs. 3 and 4). In other systems a stout wire is wound continuously in a spiral form round the four rods. Modern investigation goes to prove that the latter is theoretically the more economical way of using the steel, as the spiral binding wire acts like the binding of a wire gun, and prevents the concrete which it encloses from bursting even under very great loads.

That steel concrete can be used for *piles* is perhaps the most astonishing feature in this invention. The fact that a comparatively brittle material like concrete can be subjected not only to heavy loads but also to

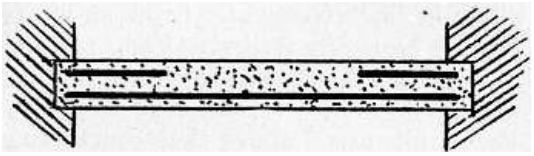


Fig. 8.

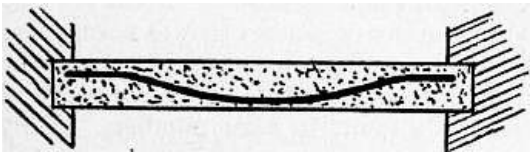


Fig. 9.

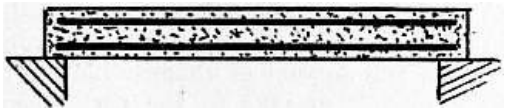


Fig. 10.

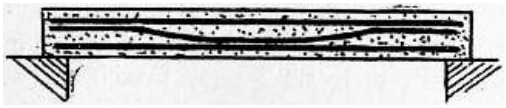


Fig. 11.

the jar and vibration from the blows of a heavy pile ram makes it appear as if its nature and properties had been changed by the steel reinforcement. In a sense this is undoubtedly the case. A. G. Considère's experiments have shown that concrete when reinforced is capable of being stretched, without fracture, about twenty times as much as plain concrete. Most of the piles driven in Great Britain have been made on the Hennebique system with four or six longitudinal steel rods tied together by stirrups or loops at frequent intervals. Piles made on the Williams system have a steel rolled joist of I section buried in the heart of the pile, and round it a series of steel wire hoops at regular intervals (fig. 5). Whatever system is used, care must be taken not to batter the head of the pile to pieces with the heavy ram. To prevent this an iron "helmet" containing a lining of sawdust is fitted over the head of the pile. The sawdust adapts itself to the rough shape of the concrete, and deadens the blow to some extent.

But it is in the design of steel concrete *beams* that the greatest ingenuity has been shown, and almost every patentee of a "system" has some new device for arranging the steel reinforcement to the best advantage. Concrete by itself, though strong in compression, can offer but little resistance to tensile and shearing stresses, and as these stresses always occur in beams the problem arises how best to arrange the steel so as to assist the concrete in bearing them. To meet tensile stresses the steel is nearly always inserted in the form of bars running along the beam. Figs. 6 to 9 show how they are arranged for different loading. In each case the object is to place the bars as nearly as possible where the tensile stresses occur. In cases where all the stresses are heavy, that portion of the beam which is under compression is similarly reinforced, though with smaller bars (figs. 10 and 11). But as these tension and compression bars are generally placed near the under and upper surface of the beam they are of little use in helping to resist the shearing stresses which are greatest at its neutral axis. (See Bridges.) These shearing stresses in a heavily loaded beam would cause it to split horizontally at or near the centre. To prevent this many ingenious devices have been introduced. (1) Perhaps one of the most efficient is a diagonal bracing of steel wire passing to and fro between the upper and lower bars and firmly secured to each by lapping or otherwise (fig. 12); this device is used in the Coignet and other French systems. (2) In the Hennebique system (which has found great favour in England) vertical bands or "stirrups," as they are generally called, of hoop steel are used (fig. 13). They are of U shape, and passing round the tension bars extend to the top of the beam (figs. 14 and 3). They are

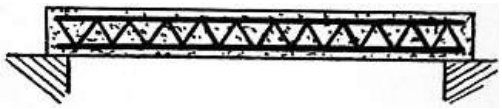


Fig. 12.

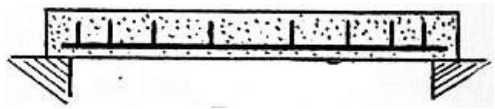


Fig. 13.

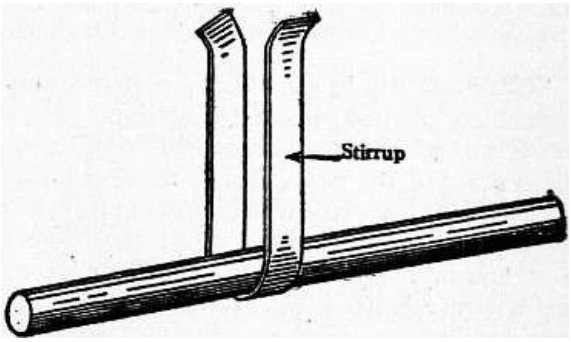


Fig. 14.—Stirrup (Hennebique System).

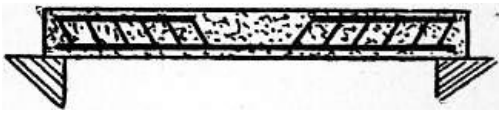


Fig. 15.

exceedingly thin, but being buried in concrete no danger of their perishing from rust is to be feared. (3) In the Boussiron system a similar stirrup is used, but instead of being vertical the two parts are spread so that each is slightly inclined. (4) In the Coularon system, the stirrups are inclined as in fig. 15, and consist of rods, the ends of which are hooked over the tension and compression bars. (5) In the Kahn system the stirrups are similarly arranged, but instead of being merely secured to the tension bar, they form an integral part of it like branches on a stem, the bar being rolled to a special section to admit of this. (6) In many systems such as the "expanded metal" system, the tension and compression rods together with the stirrups are all abandoned in favour of a single rolled steel joist of I section, buried in concrete (see fig. 16). Probably the weight of steel used in this way is excessive, but the joists are cheap, readily procurable and easy to handle.

Floor *slabs* may be regarded as wide and shallow beams, and the remarks made about the stresses in the one apply to the other also; accordingly, the various devices which are used for strengthening beams recur in the slabs. But in a thin slab, with its comparatively small span and light load, the concrete is generally strong enough to bear the shearing stresses unaided, and the reinforcement is devoted to assisting it where the tensile stresses occur. For this purpose many designers simply use the modification of the Monier system, consisting of a horizontal network of crossed steel rods buried in the concrete. "Expanded metal" too is admirably adapted for the purpose (fig. 1). In the Matrai system thin wires are used instead of rods, and are securely fastened to rolled steel joists, which form the beams on which the slabs rest; moreover, the wires instead of being stretched tight from side to side of the slab are allowed to sag as much as the thickness of the concrete will allow. In the Williams system small flat bars are used, which are not quite horizontal, but pass alternately over and under the rolled joists which support the slabs.

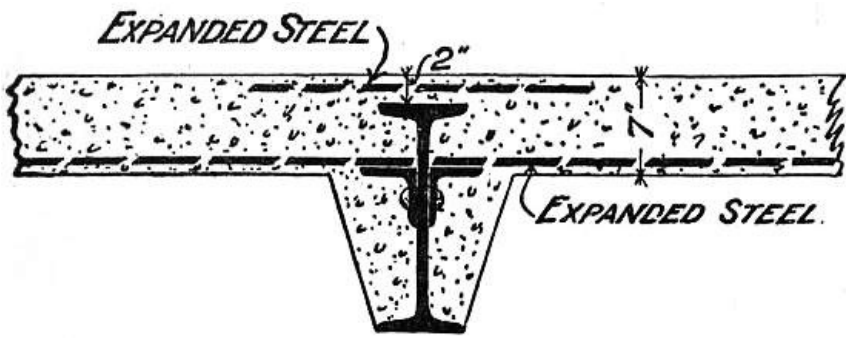


FIG. 16.

A concrete *arch* is reinforced in much the same way as a wall, the stresses being somewhat similar. The reinforcing rods are generally laid both longitudinally and circumferentially. In the case of a culvert the circumferential rods are sometimes laid continuously in the form of a spiral as in the Bordenave system.

To those wishing to pursue the subject further, the following books among others may be suggested:—Sabin, *Cement and Concrete* (New York); Taylor and Thompson, *Concrete, Plain and Reinforced* (London); Sutcliffe, *Concrete, Nature and Uses* (London); Marsh and Dunn, *Reinforced Concrete* (London); Twelvetrees, *Concrete Steel* (London); Paul Christophe, *Le Béton armé* (Paris); Buel and Hill, *Reinforced Concrete Construction* (London).

(F. E. W.-S.)

CONCRETION, in petrology, a name applied to nodular or irregularly shaped masses of various size occurring in a great variety of sedimentary rocks, differing in composition from the main mass of the rock, and in most cases obviously formed by some chemical process which ensued after the rock was deposited. As these bodies present so many variations in composition and in structure, it will conduce to clearness if some of the commonest be briefly adverted to. In sandstones there are often hard rounded lumps, which separate out when the rock is broken or weathered. They are mostly siliceous, but sometimes calcareous, and may differ very little in general appearance from the bulk of the sandstone. Through them the bedding passes uninterrupted, thus showing that they are not pebbles; often in their centres shells or fragments of plants are found. Argillaceous sandstones and flagstones

very frequently contain “clay galls” or concretionary lumps richer in clay than the remainder of the rock. Nodules of pyrites and of marcasite are common in many clays, sandstones and marls. Their outer surfaces are tuberculate; internally they commonly have a radiate fibrous structure. Usually they are covered with a dark brown crust of limonite produced by weathering; occasionally imperfect crystalline faces may bound them. Not infrequently (*e.g.* in the Gault) these pyritous nodules contain altered fossils. In clays also siliceous and calcareous concretions are often found. They present an extraordinary variety of shapes, often grotesquely resembling figures of men or animals, fruits, &c, and have in many countries excited popular wonder, being regarded as of supernatural origin (“fairy-stones,” &c.), and used as charms.

Another type of concretion, very abundant in many clays and shales, is the “septarian nodule.” These are usually flattened disk-shaped or ovoid, often lobulate externally like the surface of a kidney. When split open they prove to be traversed by a network of cracks, which are usually filled with calcite and other minerals. These white infillings of the fissures resemble partitions; hence the name from the Latin *septum*, a partition. Sometimes the cracks are partly empty. They vary up to half an inch in breadth, and are best seen when the nodule is cut through with a saw. These concretions may be calcareous or may consist of carbonate of iron. The former are common in some beds of the London Clay, and were formerly used for making cement. The clay-ironstone nodules or sphaerosiderites are very abundant in some Carboniferous shales, and have served in some places as iron ores. Some of the largest specimens are 3 ft. in diameter. In the centre of these nodules fossils are often found, *e.g.* coprolites, pieces of plants, fish teeth and scales. Phosphatic concretions are often present in certain limestones, clays, shelly sands and marls. They occur, for example, in the Cambridge Greensand, and at the base of certain of the Pliocene beds in the east of England. In many places they have been worked, under the name of “coprolite-beds,” as sources of artificial manures. Bones of animals more or less completely mineralized are frequent in these phosphatic concretions, the commonest being fragments of extinct reptilia. Their presence points to a source for the phosphate of lime.

Another very important series of concretionary structures are the flint nodules which occur in chalk, and the patches and bands of chert which are found in limestones. Flints consist of dark-coloured cryptocrystalline silica. They weather grey or white by the removal of their more soluble portions by percolating water. Their shapes are exceedingly varied, and often they are studded with tubercules and nodosities. Sometimes they have internal cavities, and very frequently they contain shells of echinoderms, molluscs, &c., partly or entirely replaced by silica, but preserving their original forms. Chert occurs in bands and tabular masses rather than in nodules; it often replaces considerable portions of a bed of limestone (as in the Carboniferous Limestones of Ireland). Corals and other fossils frequently occur in chert, and when sliced and microscopically examined both flint and chert often show silicified foraminifera, polyzoa &c., and sponge spicules. Flints in chalk frequently lie along joints which may be vertical or may be nearly horizontal and parallel to the bedding. Hence they increase the stratified appearance of natural exposures of chalk.

It will be seen from the details given above that concretions may be calcareous, siliceous, argillaceous and phosphatic, and they may consist of carbonate or sulphide of iron. In the red clay of the deep sea bottom concretionary masses rich in manganese dioxide are being formed, and are sometimes brought up by the dredge. In clays large crystals of gypsum, having the shape of an arrow-head, are occasionally found in some numbers. They bear a considerable resemblance to some concretions, *e.g.* crystalline marcasite and pyrite nodules. These examples will indicate the great variety of substances which may give rise to concretionary structures.

Some concretions are amorphous, *e.g.* phosphatic nodules; others are cryptocrystalline, *e.g.* flint and chert; others finely crystalline, *e.g.* pyrites, sphaerosiderite; others consist of large crystals, *e.g.* gypsum, barytes, pyrites and marcasite. From this it is clear that the formation of concretions is not closely dependent on any single inorganic substance, or on any type of crystalline structure. Concretions seem to arise from the tendency of chemical compounds to be slowly dissolved by interstitial water, either while the deposit is unconsolidated or at a later period. Certain nuclei, present in the rock, then determine reprecipitation of these solutions, and the deposit once begun goes on till either the supply of material for growth is exhausted, or the physical character of the bed is changed by pressure and consolidation till it is no longer favourable to further accretion. The process resembles the growth of a crystal in a solution by slowly attracting to itself molecules of suitable nature from the surrounding medium. But in the majority of cases it is not the crystalline forces, or not these alone, which attract the particles. The structure of a flint, for

example, shows that the material had so little tendency to crystallize that it remained permanently in cryptocrystalline or sub-crystalline state. That the concretions grew in the solid sediment is proved by the manner in which lines of bedding pass through them and not round them. This is beautifully shown by many siliceous and calcareous nodules out of recent clays. That the sediment was in a soft condition may be inferred from the purity and perfect crystalline form of some of these bodies, *e.g.* gypsum, pyrites, marcasite. The crystals must have pushed aside the yielding matrix as they gradually enlarged. In deep-sea dredgings concretions of phosphate of lime and manganese dioxide are frequently brought up; this shows that concretionary action operates on the sea floor in muddy sediments, which have only recently been laid down. The phosphatic nodules seem to originate around the dead bodies of fishes, and manganese incrustations frequently enclose teeth of sharks, ear-bones of whales, &c. This recalls the occurrence of fossils in septarian nodules, flints, phosphatic concretions, &c., in the older strata. Probably the decomposing organic matter partly supplied substances for the growth of the nodules (phosphates, carbonates, &c.), partly acted as reducing agents, or otherwise determined mineral precipitation in those places where organic remains were mingled with the sediment.

(J. S. F.)

CONCUBINAGE (Lat. *concubina*, a concubine; from *con-*, with, and *cubare*, to lie), the state of a man and woman cohabiting as married persons without the full sanctions of legal marriage. In early historical times, when marriage laws had scarcely advanced beyond the purely customary stage, the concubine was definitely recognized as a sort of inferior wife, differing from those of the first rank mainly by the absence of permanent guarantees. The history of Abraham’s family shows us clearly that the concubine might be dismissed at any time, and her children were liable to be cast off equally summarily with gifts, in order to leave the inheritance free for the wife’s sons (Genesis xxi. 9 ff., xxv. 5 ff.).

The Roman law recognized two classes of legal marriage: (1) with the definite public ceremonies of *confarreatio* or *coemptio*, and (2) without any public form whatever and resting merely on the *affectio maritalis*, *i.e.* the fixed intention of taking a particular woman as a permanent spouse.[1] Next to these strictly lawful marriages came concubinage as a recognized legal status, so long as the two parties were not married and had no other concubines. It differed from the formless marriage in the absence (1) of *affectio maritalis*, and therefore (2) of full conjugal rights. For instance, the concubine was not raised, like the wife, to her husband’s rank, nor were her children legitimate, though they enjoyed legal rights forbidden to mere bastards, *e.g.* the father was bound to maintain them and to leave them (in the absence of legitimate children) one-sixth of his property; moreover, they might be fully legitimated by the subsequent marriage of their parents.

In the East, the emperor Leo the Philosopher (d. 911) insisted on formal marriage as the only legal status; but in the Western Empire concubinage was still recognized even by the Christian emperors. The early Christians had naturally preferred the formless marriage of the Roman law as being free from all taint of pagan idolatry; and the ecclesiastical authorities recognized concubinage also. The first council of Toledo (398) bids the faithful restrict himself “to a single wife or concubine, as it shall please him”;[2] and there is a similar canon of the Roman synod held by Pope Eugenius II. in 826. Even as late as the Roman councils of 1052 and 1063, the suspension from communion of laymen who had a wife and a concubine *at the same time* implies that mere concubinage was tolerated. It was also recognized by many early civil codes. In Germany “left-handed” or “morganatic” marriages were allowed by the Salic law between nobles and women of lower rank. In different states of Spain the laws of the later middle ages recognized concubinage under the name of *barragania*, the contract being lifelong, the woman obtaining by it a right to maintenance during life, and sometimes also to part of the succession, and the sons ranking as nobles if their father was a noble. In Iceland, the concubine was recognized in addition to the lawful wife, though it was forbidden that they should dwell in the same house. The Norwegian law of the later middle ages provided definitely that in default of legitimate sons, the kingdom should descend to illegitimates. In the Danish code of Valdemar II., which was in force from 1280 to 1683, it was provided that a concubine kept openly for three years shall thereby become a legal wife; this was the custom of *hand vesten*, the “handfasting” of the English and Scottish borders, which appears in Scott’s *Monastery*. In Scotland, the laws of William

the Lion (d. 1214) speak of concubinage as a recognized institution; and, in the same century, the great English legist Bracton treats the "concubina *legitima*" as entitled to certain rights.[3] There seems to have been at times a pardonable confusion between some quasi-legitimate unions and those marriages by mere word of mouth, without ecclesiastical or other ceremonies, which the church, after some natural hesitation, pronounced to be valid.[4] Another and more serious confusion between concubinage and marriage was caused by the gradual enforcement of clerical celibacy (see CELIBACY). During the bitter conflict between laws which forbade sacerdotal marriages and long custom which had permitted them, it was natural that the legislators and the ascetic party generally should studiously speak of the priests' wives as concubines, and do all in their power to reduce them to this position. This very naturally resulted in a too frequent substitution of clerical concubinage for marriage; and the resultant evils form one of the commonest themes of complaint in church councils of the later middle ages.[5] Concubinage in general was struck at by the concordat between the Pope Leo X. and Francis I. of France in 1516; and the council of Trent, while insisting on far more stringent conditions for lawful marriage than those which had prevailed in the middle ages, imposed at last heavy ecclesiastical penalties on concubinage and appealed to the secular arm for help against contumacious offenders (Sessio xxiv. cap. 8).

AUTHORITIES.—Besides those quoted in the notes, the reader may consult with advantage Du Cange's *Glossarium, s.v. Concubina*, the article "Concubinat" in Wetzer and Welte's *Kirchenlexikon* (2nd ed., Freiburg i/B., 1884), and Dr H. C. Lea's *History of Sacerdotal Celibacy* (3rd ed., London, 1907).

(G. G. CO.)

1 The difference between English and Scottish law, which once made "Gretna Green marriages" so frequent, is due to the fact that Scotland adopted the Roman law (which on this particular point was followed by the whole medieval church).

2 Gratian, in the 12th century, tried to explain this away by assuming that concubinage here referred to meant a formless marriage; but in 398 a church council can scarcely so have misused the technical terms of the then current civil law (Gratian, *Decretum*, pars i. dist. xxiv. c. 4).

3 Bracton, *De Legibus*, lib. iii. tract. ii. c. 28, § I, and lib. iv. tract. vi. c. 8, § 4.

4 F. Pollock and F. W. Maitland, *Hist. of English Law*, 2nd ed. vol. ii. p. 370. In the case of Richard de Anesty, decided by papal rescript in 1143, "a marriage solemnly celebrated in church, a marriage of which a child had been born, was set aside as null in favour of an earlier marriage constituted by a mere exchange of consenting words" (ibid. p. 367; cf. the similar decretal of Alexander III. on p. 371). The great medieval canon lawyer Lyndwood illustrates the difficulty of distinguishing, even as late as the middle of the 15th century, between concubinage and a clandestine, though legal, marriage. He falls back on the definition of an earlier canonist that if the woman eats out of the same dish with the man, and if he takes her to church, she may be presumed to be his wife; if, however, he sends her to draw water and dresses her in vile clothing, she is probably a concubine (*Provinciale*, ed. Oxon. 1679, p. 10, *s.v. concubinarios*).

5 It may be gathered from the Dominican C. L. Richard's *Analysis Conciliorum* (vol. ii., 1778) that there were more than 110 such complaints in councils and synods between the years 1009 and 1528. Dr Rashdall (*Universities of Europe in the Middle Ages*, vol. ii. p. 691, note) points out that a master of the university of Prague, in 1499, complained openly to the authorities against a bachelor for assaulting his concubine.

CONDÉ, PRINCES OF. The French title of prince of Condé, assumed from the ancient town of Condé-sur-l'Escaut, was borne by a branch of the house of Bourbon. The first who assumed it was the famous Huguenot leader, Louis de Bourbon (see below), the fifth son of Charles de Bourbon, duke of Vendôme. His son, Henry, prince of Condé (1552-1588), also belonged to the Huguenot party. Fleeing to Germany he raised a small army with which in 1575 he joined Alençon. He became leader of the Huguenots, but after several years' fighting was taken prisoner of war. Not long after he died of poison, administered, according to the belief of his contemporaries, by his wife, Catherine de la Trémouille. This event, among others, awoke strong suspicions as to the legitimacy of his heir and namesake, Henry, prince of Condé (1588-1646). King Henry IV., however, did not take advantage of the scandal. In 1609 he caused the prince of Condé to marry Charlotte de Montmorency, whom shortly after Condé was obliged to save from the king's persistent gallantry by a hasty flight,

first to Spain and then to Italy. On the death of Henry, Condé returned to France, and intrigued against the regent, Marie de' Medici; but he was seized, and imprisoned for three years (1616-1619). There was at that time before the court a plea for his divorce from his wife, but she now devoted herself to enliven his captivity at the cost of her own liberty. During the rest of his life Condé was a faithful servant of the king. He strove to blot out the memory of the Huguenot connexions of his house by affecting the greatest zeal against Protestants. His old ambition changed into a desire for the safe aggrandizement of his family, which he magnificently achieved, and with that end he bowed before Richelieu, whose niece he forced his son to marry. His son Louis, the great Condé, is separately noticed below.

The next in succession was Henry Jules, prince of Condé (1643-1709), the son of the great Condé and of Clémence de Maillé, niece of Richelieu. He fought with distinction under his father in Franche-Comté and the Low Countries; but he was heartless, avaricious and undoubtedly insane. The end of his life was marked by singular hypochondriacal fancies. He believed at one time that he was dead, and refused to eat till some of his attendants dressed in sheets set him the example. His grandson, Louis Henry, duke of Bourbon (1692-1740), Louis XV.'s minister, did not assume the title of prince of Condé which properly belonged to him.

The son of the duke of Bourbon, Louis Joseph, prince of Condé (1736-1818), after receiving a good education, distinguished himself in the Seven Years' War, and most of all by his victory at Johannisberg. As governor of Burgundy he did much to improve the industries and means of communication of that province. At the Revolution he took up arms in behalf of the king, became commander of the "army of Condé," and fought in conjunction with the Austrians till the peace of Campo Formio in 1797, being during the last year in the pay of England. He then served the emperor of Russia in Poland, and after that (1800) returned into the pay of England, and fought in Bavaria. In 1800 Condé arrived in England, where he resided for several years. On the restoration of Louis XVIII. he returned to France. He died in Paris in 1818. He wrote *Essai sur la vie du grand Condé* (1798).

Louis Henry Joseph, duke of Bourbon (1756-1830), son of the last named, was the last prince of Condé. Several of the earlier events of his life, especially his marriage with the princess Louise of Orleans, and the duel that the comte d'Artois provoked by raising the veil of the princess at a masked ball, caused much scandal. At the Revolution he fought with the army of the *emigrés* in Liége. Between the return of Napoleon from Elba and the battle of Waterloo, he headed with no success a royalist rising in La Vendée. In 1829 he made a will by which he appointed as his heir the due d'Aumale, and made some considerable bequests to his mistress, the baronne de Feuchères (*q.v.*). On the 27th of August 1830 he was found hanged on the fastening of his window. A crime was generally suspected, and the princes de Rohan, who were relatives of the deceased, disputed the will. Their petition, however, was dismissed by the courts.

Two cadet branches of the house of Condé played an important part: those of Soissons and Conti. The first, sprung from Charles of Bourbon (b. 1566), son of Louis I., prince of Condé, became extinct in the legitimate male line in 1641. The second took its origin from Armand of Bourbon, born in 1629, son of Henry II., prince of Condé, and survived up to 1814.

See Muret, *L'Histoire de l'armée de Condé*; Chamballand, *Vie de Louis Joseph, prince de Condé*; Crétineau-Joly, *Histoire des trois derniers princes de la maison de Condé*; and *Histoire des princes de Condé*, by the due d'Aumale (translated by R. B. Borthwick, 1872).

CONDÉ, LOUIS DE BOURBON, Prince of (1530-1569), fifth son of Charles de Bourbon, duke of Vendôme, younger brother of Antoine, king of Navarre (1518-1562), was the first of the famous house of Condé (see above). After his father's death in 1537 Louis was educated in the principles of the reformed religion. Brave though deformed, gay but extremely poor for his rank, Condé was led by his ambition to a military career. He fought with distinction in Piedmont under Marshal de Brissac; in 1552 he forced his way with reinforcements into Metz, then besieged by Charles V.; he led several brilliant sorties from that town; and in 1554 commanded the light cavalry on the Meuse against Charles. In 1557 he was present at the battle of St Quentin, and did further good service at the head of the light horse. But the descendants of the constable de Bourbon were still looked upon with suspicion in the French

court, and Condé's services were ignored. The court designed to reduce his narrow means still further by despatching him upon a costly mission to Philip II. of Spain. His personal griefs thus combined with his religious views to force upon him a rôle of political opposition. He was concerned in the conspiracy of Amboise, which aimed at forcing from the king the recognition of the reformed religion. He was consequently condemned to death, and was only saved by the decease of Francis II. At the accession of the boy-king Charles IX., the policy of the court was changed, and Condé received from Catherine de' Medici the government of Picardy. But the struggle between the Catholics and the Huguenots soon began once more, and henceforward the career of Condé is the story of the wars of religion (see France: *History*). He was the military as well as the political chief of the Huguenot party, and displayed the highest generalship on many occasions, and notably at the battle of St Denis. At the battle of Jarnac, with only 400 horsemen, Condé rashly charged the whole Catholic army. Worn out with fighting, he at last gave up his sword, and a Catholic officer named Montesquiou treacherously shot him through the head on the 13th of March 1569.

CONDÉ, LOUIS II. DE BOURBON, Prince of (1621-1686), called the Great Condé, was the son of Henry, prince of Condé, and Charlotte Marguerite de Montmorency, and was born at Paris on the 8th of September 1621. As a boy, under his father's careful supervision, he studied diligently at the Jesuits' College at Bourges, and at seventeen, in the absence of his father, he governed Burgundy. The duc d'Enghien, as he was styled during his father's lifetime, took part with distinction in the campaigns of 1640 and 1641 in northern France while yet under twenty years of age.

During the youth of Enghien all power in France was in the hands of Richelieu; to him even the princes of the blood had to yield; and Henry of Condé sought with the rest to win the cardinal's favour. Enghien was forced to conform. He was already deeply in love with Mlle. Marthe du Vigean, who in return was passionately devoted to him, yet, to flatter the cardinal, he was compelled by his father, at the age of twenty, to give his hand to Richelieu's niece, Claire Clémence de Maillé-Brézé, a child of thirteen. He was present with Richelieu during the dangerous plot of Cinq Mars, and afterwards fought in the siege of Perpignan (1642).

In 1643 Enghien was appointed to command against the Spaniards in northern France. He was opposed by experienced generals, and the veterans of the Spanish army were accounted the finest soldiers in Europe; on the other hand, the strength of the French army was placed at his command, and under him were the best generals of the service. The great battle of Rocroy (May 18) put an end to the supremacy of the Spanish army and inaugurated the long period of French military predominance. Enghien himself conceived and directed the decisive attack, and at the age of twenty-two won his place amongst the great captains of modern times. After a campaign of uninterrupted success, Enghien returned to Paris in triumph, and in gallantry and intrigues strove to forget his enforced and hateful marriage. In 1644 he was sent with reinforcements into Germany to the assistance of Turenne, who was hard pressed, and took command of the whole army. The battle of Freiburg (Aug.) was desperately contested, but in the end the French army won a great victory over the Bavarians and Imperialists commanded by Count Mercy. As after Rocroy, numerous fortresses opened their gates to the duke. The next winter Enghien spent, like every other winter during the war, amid the gaieties of Paris. The summer campaign of 1645 opened with the defeat of Turenne by Mercy, but this was retrieved in the brilliant victory of Nördlingen, in which Mercy was killed, and Enghien himself received several serious wounds. The capture of Philipsburg was the most important of his other achievements during this campaign. In 1646 Enghien served under the duke of Orleans in Flanders, and when, after the capture of Mardyck, Orleans returned to Paris, Enghien, left in command, captured Dunkirk (October 11th).

It was in this year that the old prince of Condé died. The enormous power that fell into the hands of his successor was naturally looked upon with serious alarm by the regent and her minister. Condé's birth and military renown placed him at the head of the French nobility; but, added to that, the family of which he was chief was both enormously rich and master of no small portion of France. Condé himself held Burgundy, Berry and the marches of Lorraine, as well as other less important territory; his brother Conti held Champagne, his brother-in-law, Longueville, Normandy. The government, therefore, determined to permit no

increase of his already overgrown authority, and Mazarin made an attempt, which for the moment proved successful, at once to find him employment and to tarnish his fame as a general. He was sent to lead the revolted Catalans. Ill-supported, he was unable to achieve anything, and, being forced to raise the siege of Lerida, he returned home in bitter indignation. In 1648, however, he received the command in the important field of the Low Countries; and at Lens (Aug. 19th) a battle took place, which, beginning with a panic in his own regiment, was retrieved by Condé's coolness and bravery, and ended in a victory that fully restored his prestige.

In September of the same year Condé was recalled to court, for the regent Anne of Austria required his support. Influenced by the fact of his royal birth and by his arrogant scorn for the bourgeois, Condé lent himself to the court party, and finally, after much hesitation, he consented to lead the army which was to reduce Paris (Jan. 1649).

On his side, insufficient as were his forces, the war was carried on with vigour, and after several minor combats their substantial losses and a threatening of scarcity of food made the Parisians weary of the war. The political situation inclined both parties to peace, which was made at Rueil on the 20th of March (see Fronde, The). It was not long, however, before Condé became estranged from the court. His pride and ambition earned for him universal distrust and dislike, and the personal resentment of Anne in addition to motives of policy caused the sudden arrest of Condé, Conti and Longueville on the 18th of January 1650. But others, including Turenne and his brother the duke of Bouillon, made their escape. Vigorous attempts for the release of the princes began to be made. The women of the family were now its heroes. The dowager princess claimed from the parlement of Paris the fulfilment of the reformed law of arrest, which forbade imprisonment without trial. The duchess of Longueville entered into negotiations with Spain; and the young princess of Condé, having gathered an army around her, obtained entrance into Bordeaux and the support of the parlement of that town. She alone, among the nobles who took part in the folly of the Fronde, gains our respect and sympathy. Faithful to a faithless husband, she came forth from the retirement to which he had condemned her, and gathered an army to fight for him. But the delivery of the princes was brought about in the end by the junction of the old Fronde (the party of the parlement and of Cardinal de Retz) and the new Fronde (the party of the Condés); and Anne was at last, in February 1651, forced to liberate them from their prison at Havre. Soon afterwards, however, another shifting of parties left Condé and the new Fronde isolated. With the court and the old Fronde in alliance against him, Condé found no resource but that of making common cause with the Spaniards, who were at war with France. The confused civil war which followed this step (Sept. 1651) was memorable chiefly for the battle of the Faubourg St Antoine, in which Condé and Turenne, two of the foremost captains of the age, measured their strength (July 2, 1652), and the army of the prince was only saved by being admitted within the gates of Paris. La Grande Mademoiselle, daughter of the duke of Orleans, persuaded the Parisians to act thus, and turned the cannon of the Bastille on Turenne's army. Thus Condé, who as usual had fought with the most desperate bravery, was saved, and Paris underwent a new investment. This ended in the flight of Condé to the Spanish army (Sept. 1652), and thenceforward, up to the peace, he was in open arms against France, and held high command in the army of Spain. But his now fully developed genius as a commander found little scope in the cumbrous and antiquated system of war practised by the Spaniards, and though he gained a few successes, and manœuvred with the highest possible skill against Turenne, his disastrous defeat at the Dunes near Dunkirk (14th of June 1658), in which an English contingent of Cromwell's veterans took part on the side of Turenne, led Spain to open negotiations for peace. After the peace of the Pyrenees in 1659, Condé obtained his pardon (January 1660) from Louis, who thought him less dangerous as a subject than as possessor of the independent sovereignty of Luxemburg, which had been offered him by Spain as a reward for his services.

Condé now realized that the period of agitation and party warfare was at an end, and he accepted, and loyally maintained henceforward, the position of a chief subordinate to a masterful sovereign. Even so, some years passed before he was recalled to active employment, and these years he spent on his estate at Chantilly. Here he gathered round him a brilliant company, which included many men of genius—Molière, Racine, Boileau, La Fontaine, Nicole, Bourdaloue and Bossuet. About this time negotiations between the Poles, Condé and Louis were carried on with a view to the election, at first of Condé's son Enghien, and afterwards of Condé himself, to the throne of Poland. These, after a long series of curious intrigues, were finally closed in 1674 by the veto of Louis XIV. and the election of John Sobieski. The prince's retirement, which was only broken by the Polish question and by his personal intercession on behalf of Fouquet in 1664, ended in 1668. In that year he proposed to Louvois, the minister of war, a plan for seizing Franche-Comté, the execution of

which was entrusted to him and successfully carried out. He was now completely re-established in the favour of Louis, and with Turenne was the principal French commander in the celebrated campaign of 1672 against the Dutch. At the forcing of the Rhine passage at Tollhuis (June 12) he received a severe wound, after which he commanded in Alsace against the Imperialists. In 1673 he was again engaged in the Low Countries, and in 1674 he fought his last great battle at Seneff against the prince of Orange (afterwards William III. of England). This battle, fought on the 11th of August, was one of the hardest of the century, and Condé, who displayed the reckless bravery of his youth, had three horses killed under him. His last campaign was that of 1675 on the Rhine, where the army had been deprived of its general by the death of Turenne; and where by his careful and methodical strategy he repelled the invasion of the Imperial army of Montecucculi. After this campaign, prematurely worn out by the toils and excesses of his life, and tortured by the gout, he returned to Chantilly, where he spent the eleven years that remained to him in quiet retirement. In the end of his life he specially sought the companionship of Bourdaloue, Nicole and Bossuet, and devoted himself to religious exercises. He died on the 11th of November 1686 at the age of sixty-five. Bourdaloue attended him at his death-bed, and Bossuet pronounced his *éloge*.

The earlier political career of Condé was typical of the great French noble of his day. Success in love and war, predominant influence over his sovereign and universal homage to his own exaggerated pride, were the objects of his ambition. Even as an exile he asserted the precedence of the royal house of France over the princes of Spain and Austria, with whom he was allied for the moment. But the Condé of 1668 was no longer a politician and a 844
marplot; to be first in war and in gallantry was still his aim, but for the rest he was a submissive, even a subservient, minister of the royal will. It is on his military character, however, that his fame rests. This changed but little. Unlike his great rival Turenne, Condé was equally brilliant in his first battle and in his last. The one failure of his generalship was in the Spanish Fronde, and in this everything united to thwart his genius; only on the battlefield itself was his personal leadership as conspicuous as ever. That he was capable of waging a methodical war of positions may be assumed from his campaigns against Turenne and Montecucculi, the greatest generals of the predominant school. But it was in his eagerness for battle, his quick decision in action, and the stern will which sent his regiments to face the heaviest loss, that Condé is distinguished above all the generals of his time. In private life he was harsh and unamiable, seeking only the gratification of his own pleasures and desires. His enforced and loveless marriage embittered his life, and it was only in his last years, when he had done with ambition, that the more humane side of his character appeared in his devotion to literature.

Condé’s unhappy wife had some years before been banished to Châteauroux. An accident brought about her ruin. Her contemporaries, greedy as they were of scandal, refused to believe any evil of her, but the prince declared himself convinced of her unfaithfulness, placed her in confinement, and carried his resentment so far that his last letter to the king was to request him never to allow her to be released.

AUTHORITIES.—See, besides the numerous *Mémoires* of the time, Puget de la Serre, *Les Sièges, les batailles, &c., de Mr. le prince de Condé* (Paris, 1651); J. de la Brune, *Histoire de la vie, &c., de Louis de Bourbon, prince de Condé* (Cologne, 1694); P. Coste, *Histoire de Louis de Bourbon, &c.* (Hague, 1748); Desormeaux, *Histoire de Louis de Bourbon, &c.* (Paris, 1768); Turpin, *Vie de Louis de Bourbon, &c.* (Paris and Amsterdam, 1767); *Éloge militaire de Louis de Bourbon* (Dijon, 1772); *Histoire du grand Condé*, by A. Lemercier (Tours, 1862); J. J. E. Roy (Lille, 1859); L. de Voivreuil (Tours, 1846); Fitzpatrick, *The Great Condé*, and Lord Mahon, *Life of Louis, prince of Condé* (London, 1845). Works on the Condé family by the prince de Condé and de Sevilinges (Paris, 1820), the due d’Aumale, and Guibout (Rouen, 1856), should also be consulted.

CONDÉ, the name of some twenty villages in France and of two towns of some importance. Of the villages, Condé-en-Brie (Lat. *Condetum*) is a place of great antiquity and was in the middle ages the seat of a principality, a sub-fief of that of Montmirail; Condé-sur-Aisne (*Condatus*) was given in 870 by Charles the Bald to the abbey of St Ouen at Rouen, gave its name to a seigniory during the middle ages, and possessed a priory of which the church and a 12th-century chapel remain; Condé-sur-Marne (*Condate*), once a place of some

importance, preserves one of its parish churches, with a fine Romanesque tower. The two towns are:—

1. Condé-sur-l'Escaut, in the department of Nord, at the junction of the canals of the Scheldt and of Condé-Mons. Pop. (1906) town, 2701; commune, 5310. It lies 7 m. N. by E. of Valenciennes and 2 m. from the Belgian frontier. It has a church dating from the middle of the 18th century. Trade is in coal and cattle. The industries include brewing, rope-making and boat-building, and there is a communal college. Condé (*Condate*) is of considerable antiquity, dating at least from the later Roman period. Taken in 1676 by Louis XIV., it definitely passed into the possession of France by the treaty of Nijmwegen two years later, and was afterwards fortified by Vauban. During the revolutionary war it was besieged and taken by the Austrians (1793); and in 1815 it again fell to the allies. It was from this place that the princes of Condé (*q.v.*) took their title. See Perron-Gelineau, *Condé ancien et moderne* (Nantes, 1887).

2. Condé-sur-Noireau, in the department of Calvados, at the confluence of the Noireau and the Drouance, 33 m. S.S.W. of Caen on the Ouest-État railway. Pop. (1906) 5709. The town is the seat of a tribunal of commerce, a board of trade-arbitration and a chamber of arts and manufactures, and has a communal college. It is important for its cotton-spinning and weaving, and carries on dyeing, printing and machine-construction; there are numerous nursery-gardens in the vicinity. Important fairs are held in the town. The church of St Martin has a choir of the 12th and 15th centuries, and a stained-glass window (15th century) representing the Crucifixion. There is a statue to Dumont d'Urville, the navigator (b. 1790), a native of the town. Throughout the middle ages Condé (*Condatum*, *Condetum*) was the seat of an important castellany, which was held by a long succession of powerful nobles and kings, including Robert, count of Mortain, Henry II. and John of England, Philip Augustus of France, Charles II. (the Bad) and Charles III. of Navarre. The place was held by the English from 1417 to 1449. Of the castle some ruins of the keep survive. See L. Huet, *Hist. de Condé-sur-Noireau, ses seigneurs, son industrie, &c.* (Caen, 1883).

CONDE, JOSÉ ANTONIO (1766-1820), Spanish Orientalist, was born at Peraleja (Cuenca) on the 28th of October 1766, and was educated at the university of Alcalá. His translation of Anacreon (1791) obtained him a post in the royal library in 1795, and in 1796-1797 he published paraphrases from Theocritus, Bion, Moschus, Sappho and Meleager. These were followed by a mediocre edition of the Arabic text of Edrisi's *Description of Spain* (1799), with notes and a translation. Conde became a member of the Spanish Academy in 1802 and of the Academy of History in 1804, but his appointment as interpreter to Joseph Bonaparte led to his expulsion from both bodies in 1814. He escaped to France in February 1813, and returned to Spain in 1814, but was not allowed to reside at Madrid till 1816. Two years later he was re-elected by both academies; he died in poverty on the 12th of June 1820. His *Historia de la Dominación de los Árabes en España* was published in 1820-1821. Only the first volume was corrected by the author, the other two being compiled from his manuscript by Juan Tineo. This work was translated into German (1824-1825), French (1825) and English (1854). Conde's pretensions to scholarship have been severely criticized by Dozy, and his history is now discredited. It had, however, the merit of stimulating abler workers in the same field.

CONDENSATION OF GASES. If the volume of a gas continually decreases at a constant temperature, for which an increasing pressure is required, two cases may occur:—(1) The volume may continue to be homogeneously filled. (2) If the substance is contained in a certain volume, and if the pressure has a certain value, the substance may divide into two different phases, each of which is again homogeneous. The value of the temperature T decides which case will occur. The temperature which is the limit above which the space will always be homogeneously filled, and below which the substance divides into two phases, is called the

Critical temperature.

critical temperature of the substance. It differs greatly for different substances, and if we represent it by T_c, the condition for the condensation of a gas is that T must be below T_c. If the substance is divided into two phases, two different cases may occur. The denser phase may be either a liquid or a solid. The limiting temperature for these two cases, at which the division into three phases may occur, is called the *triple point*. Let us represent it by T_3; if the term "condensation of gases" is taken in the sense of "liquefaction of gases"—which is usually done—the condition for condensation is $T_c > T > T_3$. The opinion sometimes held that for all substances T_3 is the same fraction of T_c (the value being about ½) has decidedly not been rigorously confirmed. Nor is this to be expected on account of the very different form of crystallization which the solid state presents. Thus for carbon dioxide, CO_2, for which $T_c = 304°$ on the absolute scale, and for which we may put $T_3 = 216°$, this fraction is about 0.7; for water it descends down to 0.42, and for other substances it may be still lower.

If we confine ourselves to temperatures between T_c and T_3, the gas will pass into a liquid if the pressure is sufficiently increased. When the formation of liquid sets in we call the gas a *saturated vapour*. If the decrease of volume is continued, the gas pressure remains constant till all the vapour has passed into liquid. The invariability of the properties of the phases is in close connexion with the invariability of the pressure (called *maximum tension*). Throughout the course of the process of condensation these properties remain unchanged, provided the temperature remain constant; only the relative quantity of the two phases changes. Until all the gas has passed into liquid a further decrease of volume will not require increase of pressure. But as soon as the liquefaction is complete a slight decrease of volume will require a great increase of pressure, liquids being but slightly compressible.

Critical pressure.

The pressure required to condense a gas varies with the temperature, becoming higher as the temperature rises. The highest pressure will therefore be found at T_c and the lowest at T_3. We shall represent the pressure at T_c by p_c. It is called the *critical pressure*. The pressure at T_3 we shall represent by p_3. It is called the *pressure of the triple point*. The values of T_c and p_c for different substances will be found at the end of this article. The values of T_3 and p_3 are accurately known only for a few substances. As a rule p_3 is small, though occasionally it is greater than 1 atmosphere. This is the case with CO_2, and we may in general expect it if the value of T_3/T_c is large. In this case there can only be a question of a real boiling-point (under the normal pressure) if the liquid can be supercooled.

We may find the value of the pressure of the saturated vapour for each T in a geometrical way by drawing in the theoretical isothermal a straight line parallel to the v-axis in such a way that $\int_{v1}^{v2} pdv$ will have the same value whether the straight line or the theoretical isothermal is followed. This construction, given by James Clerk Maxwell, may be considered as a result of the application of the general rules for coexisting equilibrium, which we owe to J. Willard Gibbs. The construction derived from the rules of Gibbs is as follows:—Construe the free energy at a constant temperature, *i.e.* the quantity $-\int pdv$ as ordinate, if the abscissa represents v, and determine the inclination of the double tangent. Another construction derived from the rules of Gibbs might be expressed as follows:—Construe the value of $pv - \int pdv$ as ordinate, the abscissa representing p, and determine the point of intersection of two of the three branches of this curve.

As an approximate half-empirical formula for the calculation of the pressure, $-\log_{10} p/p_c = \int(T_c - T)/T$ may be used. It would follow from the law of corresponding states that in this formula the value of f is the same for all substances, the molecules of which do not associate to form larger molecule-complexes. In fact, for a great many substances, we find a value for $\int$, which differs but little from 3, *e.g.* ether, carbon dioxide, benzene, benzene derivatives, ethyl chloride, ethane, &c. As the chemical structure of these substances differs greatly, and association, if it takes place, must largely depend upon the structure of the molecule, we conclude from this approximate equality that the fact of this value of $\int$ being equal to about 3 is characteristic for normal substances in which, consequently, association is excluded. Substances known to associate, such as organic acids and alcohols, have a sensibly higher value of $\int$. Thus T. Estreicher (Cracow, 1896) calculates that for fluor-benzene $\int$ varies between 3.07 and 2.94; for ether between 3.0 and 3.1; but for water between 3.2 and 3.33, and for methyl alcohol between 3.65 and 3.84, &c. For isobutyl alcohol $\int$ even rises above 4. It is, however, remarkable that for oxygen $\int$ has been found almost invariably equal to 2.47 from K. Olszewski's observations, a value which is appreciably smaller than 3. This fact makes us again seriously doubt the correctness of the supposition that $\int = 3$ is a characteristic for non-association.

It is a general rule that the volume of saturated vapour decreases when the temperature is

raised, while that of the coexisting liquid increases. We know only one exception to this rule, and that is the volume of water below 4° C. If we call the liquid volume v_l, and the vapour v_v, $v_v - v_l$ decreases if the temperature rises, and becomes zero at T_c. The limiting value, to which v_l and v_v converge at T_c, is called the *critical volume*, and we shall represent it by v_c. According to the law of corresponding states the values both of v_l/v_c and v_v/v_c must be the same for all substances, if T/T_c has been taken equal for them all. According to the investigations of Sydney Young, this holds good with a high degree of approximation for a long series of substances. Important deviations from this rule for the values of v_v/v_l are only found for those substances in which the existence of association has already been discovered by other methods. Since the lowest value of T, for which investigations on v_l and v_v may be made, is the value of T_3; and since T_3/T_c, as has been observed above, is not the same for all substances, we cannot expect the smallest value of v_l/v_c to be the same for all substances. But for low values of T, viz. such as are near T_3, the influence of the temperature on the volume is but slight, and therefore we are not far from the truth if we assume the minimum value of the ratio v_l/v_c as being identical for all normal substances, and put it at about ⅓. Moreover, the influence of the polymerization (association) on the liquid volume appears to be small, so that we may even attribute the value ⅓ to substances which are not normal. The value of v_v/v_c at $T = T_3$ differs widely for different substances. If we take p_3 so low that the law of Boyle-Gay Lussac may be applied, we can calculate v_3/v_c by means of the formula $p_3v_3/T_3 = k \cdot p_cv_c/T_c$, provided k be known. According to the observations of Sydney Young, this factor has proved to be 3.77 for normal substances. In consequence $v_3/v_c = 3.77\ p_c/p_3 \cdot T_3/T_c$. A similar formula, but with another value of k, may be given for associating substances, but with another value of k, may be given for associating substances, provided the saturated vapour does not contain any complex molecules. But if it does, as is the case with acetic acid, we must also know the degree of association. It can, however, only be found by measuring the volume itself.

Critical volume.

E. Mathias has remarked that the following relation exists between the densities of the saturated vapour and of the coexisting liquid:—

$$\rho_l + \rho_v = 2\rho_c \left\{1 + a\left(1 - T/T_c\right)\right\},$$

and that, accordingly, the curve which represents the densities at different temperatures possesses a rectilinear diameter. According to the law of corresponding states, a would be the same for all substances. Many substances, indeed, actually appear to have a rectilinear diameter, and the value of a appears approximatively to be the same. In a *Mémoire présentê à la société royale à Liège*, 15th June 1899, E. Mathias gives a list of some twenty substances for which a has a value lying between 0.95 and 1.05. It had been already observed by Sydney Young that a is not perfectly constant even for normal substances. For associating substances the diameter is not rectilinear. Whether the value of a, near 1, may serve as a characteristic for normal substances is rendered doubtful by the fact that for nitrogen a is found equal to 0.6813 and for oxygen to 0.8. At $T = T_c/2$, the formula of E. Mathias, if ρ_v be neglected with respect to ρ_l, gives the value $2 + a$ for ρ_l/ρ_c.

Rule of the rectilinear diameter.

The heat required to convert a molecular quantity of liquid coexisting with vapour into saturated vapour at the same temperature is called *molecular latent heat*. It decreases with the rise of the temperature, because at a higher temperature the liquid has already expanded, and because the vapour into which it has to be converted is denser. At the critical temperature it is equal to zero on account of the identity of the liquid and the gaseous states. If we call the molecular weight m and the latent heat per unit of weight r, then, according to the law of corresponding states, mr/T is the same for all normal substances, provided the temperatures are corresponding. According to F. T. Trouton, the value of mr/T is the same for all substances if we take for T the boiling-point. As the boiling-points under the pressure of one atmosphere are generally not equal fractions of T_c, the two theorems are not identical; but as the values of p_c for many substances do not differ so much as to make the ratios of the boiling-points under the pressure of one atmosphere differ greatly from the ratios of T_c, an approximate confirmation of the law of Trouton may be compatible with an approximate confirmation of the consequence of the law of corresponding states. If we take the term boiling-point in a more general sense, and put T in the law of Trouton to represent the boiling-point under an arbitrary equal pressure, we may take the pressure equal to p_c for a certain substance. For this substance mr/T would be equal to zero, and the values of mr/T would no longer show a trace of equality. At present direct trustworthy investigations about the value of r for different substances are wanting; hence the question whether as to the quantity mr/T the substances are to be divided into normal and associating ones cannot be answered. Let us

Latent heat.

divide the latent heat into heat necessary for internal work and heat necessary for external work. Let r′ represent the former of these two quantities, then:—

$$r = r' + p(v_v - v_l).$$

Then the same remark holds good for mr′/T as has been made for mr/T. The ratio between r and that part that is necessary for external work is given in the formula,

$$\frac{r}{p(v_v - v_l)} = \frac{T\,dp}{p\,dT}.$$

By making use of the approximate formula for the vapour tension:—$\log_\varepsilon p/p_c = \int' [(T_c - T) / T]$, we find—

$$\frac{r}{p(v_v - v_l)} = \int' \frac{T_c}{T}.$$

At $T = T_c$ we find for this ratio $\int'$, a value which, for normal substances is equal to 3/0.4343 = 7. At the critical temperature the quantities r and v_v-v_l are both equal to 0, but they have a finite ratio. As we may equate $p(v_v - v_l)$ with $pv_v = RT$ at very low temperatures, we get, if we take into consideration that R expressed in calories is nearly equal to 2/m, the value $2\int' T_c = 14T_c$ as limiting value for mr for normal substances. This value for mr has, however, merely the character of a rough approximation—especially since the factor $\int'$ is not perfectly constant.

Nature of a liquid.

All the phenomena which accompany the condensation of gases into liquids may be explained by the supposition, that the condition of aggregation which we call liquid differs only in quantity, and not in quality, from that which we call gas. We imagine a gas to consist of separate molecules of a certain mass μ, having a certain velocity depending on the temperature. This velocity is distributed according to the law of probabilities, and furnishes a quantity of *vis viva* proportional to the temperatures. We must attribute extension to the molecules, and they will attract one another with a force which quickly decreases with the distance. Even those suppositions which reduce molecules to centra of forces, like that of Maxwell, lead us to the result that the molecules behave in mutual collisions as if they had extension—an extension which in this case is not constant, but determined by the law of repulsion in the collision, the law of the distribution, and the value of the velocities. In order to explain capillary phenomena it was assumed so early as Laplace, that between the molecules of the same substance an attraction exists which quickly decreases with the distance. That this attraction is found in gases too is proved by the fall which occurs in the temperature of a gas that is expanded without performing external work. We are still perfectly in the dark as to the cause of this attraction, and opinion differs greatly as to its dependence on the distance. Nor is this knowledge necessary in order to find the influence of the attraction, for a homogeneous state, on the value of the external pressure which is required to keep the moving molecules at a certain volume (T being given). We may, viz., assume either in the strict sense, or as a first approximation, that the influence of the attraction is quite equal to a pressure which is proportional to the square of the density. Though this molecular pressure is small for gases, yet it will be considerable for the great densities of liquids, and calculation shows that we may estimate it at more than 1000 atmos., possibly increasing up to 10,000. We may now make the same supposition for a liquid as for a gas, and imagine it to consist of molecules, which for non-associating substances are the same as those of the rarefied vapour; these, if T is the same, have the same mean *vis viva* as the vapour molecules, but are more closely massed together. Starting from this supposition and all its consequences, van der Waals derived the following formula which would hold both for the liquid state and for the gaseous state:—

$$(p + a/v^2)(v - b) = RT.$$

It follows from this deduction that for the rarefied gaseous state b would be four times the volume of the molecules, but that for greater densities the factor 4 would decrease. If we represent the volume of the molecules by β, the quantity b will be found to have the following form:—

$$b = 4\beta \left\{ 1 - \gamma_1 (4\beta/v) + \gamma_2 (4\beta/v)^2 \text{ &c.} \right\}$$

Only two of the successive coefficients γ_1, γ_2, &c., have been worked out, for the determination requires very lengthy calculations, and has not even led to definitive results (L. Boltzmann, *Proc. Royal Acad. Amsterdam*, March 1899). The latter formula supposes the

molecules to be rigid spheres of invariable size. If the molecules are things which are compressible, another formula for b is found, which is different according to the number of atoms in the molecule (*Proc. Royal Acad. Amsterdam*, 1900-1901). If we keep the value of a and b constant, the given equation will not completely represent the net of isothermals of a substance. Yet even in this form it is sufficient as to the principal features. From it we may argue to the existence of a critical temperature, to a minimum value of the product pv, to the law of corresponding states, &c. Some of the numerical results to which it leads, however, have not been confirmed by experience. Thus it would follow from the given equation that $p_c v_c/T_c = \frac{3}{8} \cdot pv/T$, if the value of v is taken so great that the gaseous laws may be applied, whereas Sydney Young has found $\frac{1}{3.77}$ for a number of substances instead of the factor $\frac{3}{8}$. Again it follows from the given equation, that if a is thought to be independent of the temperature, $T_c/p_c \cdot (dp/dT)_c = 4$, whereas for a number of substances a value is found for it which is near 7. If we assume with Clausius that a depends on the temperature, and has a value $a' \cdot 273/T$, we find $T_c/p_c \cdot (dp/dT)_c = 7$.

That the accurate knowledge of the equation of state is of the highest importance is universally acknowledged, because, in connexion with the results of thermodynamics, it will enable us to explain all phenomena relating to ponderable matter. This general conviction is shown by the numerous efforts made to complete or modify the given equation, or to replace it by another, for instance, by R. Clausius, P. G. Tait, E. H. Amagat, L. Boltzmann, T. G. Jager, C. Dieterici, B. Galitzine, T. Rose Innes and M. Reinganum.

If we hold to the supposition that the molecules in the gaseous and the liquid state are the same—which we may call the supposition of the identity of the two conditions of aggregation —then the heat which is given out by the condensation at constant T is due to the potential energy lost in consequence of the coming closer of the molecules which attract each other, and then it is equal to $a(1/v_l - 1/v_v)$. If a should be a function of the temperature, it follows from thermodynamics that it would be equal to $(a - T \cdot da/dT)(1/v_l - 1/v_v)$. Not only in the case of liquid and gas, but always when the volume is diminished, a quantity of heat is given out equal to $a(1/v_1 - 1/v_2)$ or $(a - T \cdot da/dT)(1/v_1 - 1/v_2)$.

Associating substances.

If, however, when the volume is diminished at a given temperature, and also during the transition from the gaseous to the liquid state, combination into larger molecule-complexes takes place, the total internal heat may be considered as the sum of that which is caused by the combination of the molecules into greater molecule-complexes and by their approach towards each other. We have the simplest case of possible greater complexity when two molecules combine to one. From the course of the changes in the density of the vapour we assume that this occurs, *e.g.* with nitrogen peroxide, NO_2, and acetic acid, and the somewhat close agreement of the observed density of the vapour with that which is calculated from the hypothesis of such an association to double-molecules, makes this supposition almost a certainty. In such cases the molecules in the much denser liquid state must therefore be considered as double-molecules, either completely so or in a variable degree depending on the temperature. The given equation of state cannot hold for such substances. Even though we assume that a and b are not modified by the formation of double-molecules, yet RT is modified, and, since it is proportional to the number of the molecules, is diminished by the combination. The laws found for normal substances will, therefore, not hold for such associating substances. Accordingly for substances for which we have already found an anormal density of the vapour, we cannot expect the general laws for the liquid state, which have been treated above, to hold good without modification, and in many respects such substances will therefore not follow the law of corresponding states. There are, however, also substances of which the anormal density of vapour has not been stated, and which yet cannot be ranged under this law, *e.g.* water and alcohols. The most natural thing, of course, is to ascribe the deviation of these substances, as of the others, to the fact that the molecules of the liquid are polymerized. In this case we have to account for the following circumstance, that whereas for NO_2 and acetic acid in the state of saturated vapour the degree of association increases if the temperature falls, the reverse must take place for water and alcohols. Such a difference may be accounted for by the difference in the quantity of heat released by the polymerization to double-molecules or larger molecule-complexes. The quantity of heat given out when two molecules fall together may be calculated for NO_2 and acetic acid from the formula of Gibbs for the density of vapour, and it proves to be very considerable. With this the following fact is closely connected. If in the pv diagram, starting from a point indicating the state of saturated vapour, a geometrical locus is drawn of the points which have the same degree of association, this curve, which passes towards isothermals of higher T if the volume diminishes, requires for the same change in T a greater diminution of volume

than is indicated by the border-curve. For water and alcohols this geometrical locus will be found on the other side of the border-curve, and the polymerization heat will be small, *i.e.* smaller than the latent heat. For substances with a small polymerization heat the degree of association will continually decrease if we move along the border-curve on the side of the saturated vapour in the direction towards lower T. With this, it is perfectly compatible that for such substances the saturated vapour, *e.g.* under the pressure of one atmosphere, should show an almost normal density. Saturated vapour of water at 100° has a density which seems nearly 4% greater than the theoretical one, an amount which is greater than can be ascribed to the deviation from the gas-laws. For the relation between v, T, and x, if x represents the fraction of the number of double-molecules, the following formula has been found ("Moleculartheorie," *Zeits. Phys. Chem.*, 1890, vol. v):

$$\log \frac{x(v - b)}{(1 - x)^2} = 2 \frac{E_1 - E_2}{R_1 T} + C,$$

from which

$$\frac{T}{v - b}\left(\frac{dv}{dT}\right)_x = -2 \frac{E_1 - E_2}{R_1 T},$$

which may elucidate what precedes.

Condensation of substances with low T_c.

By far the majority of substances have a value of T_c above the ordinary temperature, and diminution of volume (increase of pressure) is sufficient to condense such gaseous substances into liquids. If T_c is but little above the ordinary temperature, a great increase of pressure is in general required to effect condensation. Substances for which T_c is much higher than the ordinary temperature T_0, *e.g.* $T_c > \frac{5}{3} T_0$, occur as liquids, even without increase of pressure; that is, at the pressure of one atmosphere. The value $\frac{5}{3}$ is to be considered as only a mean value, because of the inequality of p_c. The substances for which T_c is smaller than the ordinary temperature are but few in number. Taking the temperature of melting ice as a limit, these gases are in successive order: CH_4, NO, O_2, CO, N_2 and H_2 (the recently discovered gases argon, helium, &c., are left out of account). If these gases are compressed at 0° centigrade they do not show a trace of liquefaction, and therefore they were long known under the name of "permanent gases." The discovery, however, of the critical temperature carried the conviction that these substances would not be "permanent gases" if they were compressed at much lower T. Hence the problem arose how "low temperatures" were to be brought about. Considered from a general point of view the means to attain this end may be described as follows: we must make use of the above-mentioned circumstance that heat disappears when a substance expands, either with or without performing external work. According as this heat is derived from the substance itself which is to be condensed, or from the substance which is used as a means of cooling, we may divide the methods for condensing the so-called permanent gases into two principal groups.

Liquids as means of cooling.

In order to use a liquid as a cooling bath it must be placed in a vacuum, and it must be possible to keep the pressure of the vapour in that space at a small value. According to the boiling-law, the temperature of the liquid must descend to that at which the maximum tension of the vapour is equal to the pressure which reigns on the surface of the liquid. If the vapour, either by means of absorption or by an air-pump, is exhausted from the space, the temperature of the liquid and that of the space itself depend upon the value of the pressure which finally prevails in the space. From a practical point of view the value of T_3 may be regarded as the limit to which the temperature falls. It is true that if the air is exhausted to the utmost possible extent, the temperature may fall still lower, but when the substance has become solid, a further diminution of the pressure in the space is of little advantage. At any rate, as a solid body evaporates only on the surface, and solid gases are bad conductors of heat, further cooling will only take place very slowly, and will scarcely neutralize the influx of heat. If the pressure p_3 is very small, it is perhaps practically impossible to reach T_3; if so, T_3 in the following lines will represent the temperature practically attainable. There is thus for every gas a limit below which it is not to be cooled further, at least not in this way. If, however, we can find another gas for which the critical temperature is sufficiently above T_3 of the first chosen gas, and if it is converted into a liquid by cooling with the first gas, and then treated in the same way as the first gas, it may in its turn be cooled down to $(T_3)_2$. Going on in this way, continually lower temperatures may be attained, and it would be possible to condense all gases, provided the difference of the successive critical temperatures of two gases fulfils certain conditions. If the ratio of the absolute critical temperatures for two gases, which succeed one another in the series, should be sensibly

greater than 2, the value of T_3 for the first gas is not, or not sufficiently, below the T_c of the second gas. This is the case when one of the gases is nitrogen, on which hydrogen would follow as second gas. Generally, however, we shall take atmospheric air instead of nitrogen. Though this mixture of N_2 and O_2 will show other critical phenomena than a simple substance, yet we shall continue to speak of a T_c for air, which is given at -140° C., and for which, therefore, T_c amounts to 133° absolute. The lowest T which may be expected for air in a highly rarefied space may be evaluated at 60° absolute—a value which is higher than the T_c for hydrogen. Without new contrivances it would, accordingly, not be possible to reach the critical temperature of H_2. The method by which we try to obtain successively lower temperatures by making use of successive gases is called the “cascade method.” It is not self-evident that by sufficiently diminishing the pressure on a liquid it may be cooled to such a degree that the temperature will be lowered to T_3, if the initial temperature was equal to T_c, or but little below it, and we can even predict with certainty that this will not be the case for all substances. It is possible, too, that long before the triple point is reached the whole liquid will have evaporated. The most favourable conditions will, of course, be attained when the influx of heat is reduced to a minimum. As a limiting case we imagine the process to be isentropic. Now the question has become, Will an isentropic line, which starts from a point of the border-curve on the side of the liquid not far from the critical-point, remain throughout its descending course in the heterogeneous region, or will it leave the region on the side of the vapour? As early as 1878 van der Waals (*Verslagen Kon. Akad. Amsterdam*) pointed out that the former may be expected to be the case only for substances for which c_p/c_v is large, and the latter for those for which it is small; in other words, the former will take place for substances the molecules of which contain few atoms, and the latter for substances the molecules of which contain many atoms. Ether is an example of the latter class, and if we say that the quantity h (specific heat of the saturated vapour) for ether is found to be positive, we state the same thing in other words. It is not necessary to prove this theorem further here, as the molecules of the gases under consideration contain only two atoms and the total evaporation of the liquid is not to be feared.

In the practical application of this cascade-method some variation is found in the gases chosen for the successive stages. Thus methyl chloride, ethylene and oxygen are used in the cryogenic laboratory of Leiden, while Sir James Dewar has used air as the last term. Carbonic acid is not to be recommended on account of the comparatively high value of T_3. In order to prevent loss of gas a system of “circulation” is employed. This method of obtaining low temperatures is decidedly laborious, and requires very intricate apparatus, but it has the great advantage that very *constant* low temperatures may be obtained, and can be regulated arbitrarily within pretty wide limits.

Cooling by expansion.

In order to lower the temperature of a substance down to T_3, it is not always necessary to convert it first into the liquid state by means of another substance, as was assumed in the last method for obtaining low temperatures. Its own expansion is sufficient, provided the initial condition be properly chosen, and provided we take care, even more than in the former method, that there is no influx of heat. Those conditions being fulfilled, we may, simply by adiabatic expansion, not only lower the temperature of some substances down to T_3, but also convert them into the liquid state. This is especially the case with substances the molecules of which contain few atoms.

Let us imagine the whole net of isothermals for homogeneous phases drawn in a pv diagram, and in it the border-curve. Within this border-curve, as in the heterogeneous region, the theoretical part of every isothermal must be replaced by a straight line. The isothermals may therefore be divided into two groups, viz. those which keep outside the heterogeneous region, and those which cross this region. Hence an isothermal, belonging to the latter group, enters the heterogeneous region on the liquid side, and leaves it at the same level on the vapour side. Let us imagine in the same way all the isentropic curves drawn for homogeneous states. Their form resembles that of isothermals in so far as they show a maximum and a minimum, if the entropy-constant is below a certain value, while if it is above this value, both the maximum and the minimum disappear, the isentropic line in a certain point having at the same time dp/dv and $d^2p/dv^2 = 0$ for this particular value of the constant. This point, which we might call the critical point of the isentropic lines, lies in the heterogeneous region, and therefore cannot be realized, since as soon as an isentropic curve enters this region its theoretical part will be replaced by an empiric part. If an isentropic curve crosses the heterogeneous region, the point where it enters this region must, just as for the isothermals, be connected with the point where it leaves the region by another curve. When $c_p/c_v = k$ (the limiting value of c_p/c_v for infinite rarefaction is meant) approaches unity,

the isentropic curves approach the isothermals and vice versa. In the same way the critical point of the isentropic curves comes nearer to that of the isothermals. And if k is not much greater than 1, *e.g.* $k < 1.08$, the following property of the isothermals is also preserved, viz. that an isentropic curve, which enters the heterogeneous region on the side of the liquid, leaves it again on the side of the vapour, not of course at the same level, but at a lower point. If, however, k is greater, and particularly if it is so great as it is with molecules of one or two atoms, an isentropic curve, which enters on the side of the liquid, however far prolonged, always remains within the heterogeneous region. But in this case all isentropic curves, if sufficiently prolonged, will enter the heterogeneous region. Every isentropic curve has one point of intersection with the border-curve, but only a small group intersect the border-curve in three points, two of which are to be found not far from the top of the border-curve and on the side of the vapour. Whether the sign of h (specific heat of the saturated vapour) is negative or positive, is closely connected with the preceding facts. For substances having k great, h will be negative if T is low, positive if T rises, while it will change its sign again before T_c is reached. The values of T, at which change of sign takes place, depend on k. The law of corresponding states holds good for this value of T for all substances which have the same value of k.

Now the gases which were considered as permanent are exactly those for which k has a high value. From this it would follow that every adiabatic expansion, provided it be sufficiently continued, will bring such substances into the heterogeneous region, *i.e.* they can be condensed by adiabatic expansion. But since the final pressure must not fall below a certain limit, determined by experimental convenience, and since the quantity which passes into the liquid state must remain a fraction as large as possible, and since the expansion never can take place in such a manner that no heat is given out by the walls or the surroundings, it is best to choose the initial condition in such a way that the isentropic curve of this point cuts the border-curve in a point on the side of the liquid, lying as low as possible. The border-curve being rather broad at the top, there are many isentropic curves which penetrate the heterogeneous region under a pressure which differs but little from p_c. Availing himself of this property, K. Olszewski has determined p_c for hydrogen at 15 atmospheres. Isentropic curves, which lie on the right and on the left of this group, will show a point of condensation at a lower pressure. Olszewski has investigated this for those lying on the right, but not for those on the left.

From the equation of state $(p + a/v^2)(v-b) = RT$, the equation of the isentropic curve follows as $(p + a/v^2)(v - b)^k = C$, and from this we may deduce $T(v - b)^{k-1} = C'$. This latter relation shows in how high a degree the cooling depends on the amount by which k surpasses unity, the change in v - b being the same.

What has been said concerning the relative position of the border-curve and the isentropic curve may be easily tested for points of the border-curve which represent rarefied gaseous states, in the following way. Following the border-curve we found before $\int' (T_c/T)$ for the value of $T/p \cdot dp/dT$. Following the isentropic curve the value of $T/p \cdot dp/dT$ is equal to $k/(k - 1)$. If $k/(k - 1) < \int' (T_c/T)$, the isentropic curve rises more steeply than the border-curve. If we take $\int' = 7$ and choose the value of $T_c/2$ for T—a temperature at which the saturated vapour may be considered to follow the gas-laws—then $k/(k - 1) = 14$, or $k = 1.07$ would be the limiting value for the two cases. At any rate $k = 1.41$ is great enough to fulfil the condition, even for other values of T. Cailletet and Pictet have availed themselves of this adiabatic expansion for condensing some permanent gases, and it must also be used when, in the cascade method, T_3 of one of the gases lies above T_c of the next.

Linde's apparatus.

A third method of condensing the permanent gases is applied in C. P. G. Linde's apparatus for liquefying air. Under a high pressure p_1 a current of gas is conducted through a narrow spiral, returning through another spiral which surrounds the first. Between the end of the first spiral and the beginning of the second the current of gas is reduced to a much lower pressure p_2 by passing through a tap with a fine orifice. On account of the expansion resulting from this sudden decrease of pressure, the temperature of the gas, and consequently of the two spirals, falls sensibly. If this process is repeated with another current of gas, this current, having been cooled in the inner spiral, will be cooled still further, and the temperature of the two spirals will become still lower. If the pressures p_1 and p_2 remain constant the cooling will increase with the lowering of the temperature. In Linde's apparatus this cycle is repeated over and over again, and after some time (about two or three hours) it becomes possible to draw off liquid air.

The cooling which is the consequence of such a decrease of pressure was experimentally determined in 1854 by Lord Kelvin (then Professor W. Thomson) and Joule, who represent

the result of their experiments in the formula

$$T_1\text{-}T_2 = \gamma \frac{p_1 - p_2}{T^2}.$$

In their experiments p_2 was always 1 atmosphere, and the amount of p_1 was not large. It would, therefore, be certainly wrong, even though for a small difference in pressure the empiric formula might be approximately correct, without closer investigation to make use of it for the differences of pressure used in Linde's apparatus, where $p_1 = 200$ and $p_2 = 18$ atmospheres. For the existence of a most favourable value of p_1 is in contradiction with the formula, since it would follow from it that $T_1 - T_2$ would always increase with the increase of p_1. Nor would it be right to regard as the cause for the existence of this most favourable value of p_1 the fact that the heat produced in the compression of the expanded gas, and therefore p_1/p_2, must be kept as small as possible, for the simple reason that the heat is produced in quite another part of the apparatus, and might be neutralized in different ways.

Closer examination of the process shows that if p_2 is given, a most favourable value of p_1 must exist for the cooling itself. If p_1 is taken still higher, the cooling decreases again; and we might take a value for p_1 for which the cooling would be zero, or even negative.

If we call the energy per unit of weight ε and the specific volume v, the following equation holds:—

$$\varepsilon_1 + p_1v_1 - p_2v_2 = \varepsilon_2,$$

or

$$\varepsilon_1 + p_1v_1 = \varepsilon_2 + p_2v_2.$$

According to the symbols chosen by Gibbs, $\chi_1 = \chi_2$.

As χ_1 is determined by T_1 and p_1, and χ_2 by T_2 and p_2, we obtain, if we take T_1 and p_2 as being constant,

$$\left(\frac{\delta\chi_1}{\delta p_1}\right)_{T1} dp_1 = \left(\frac{\delta\chi_2}{\delta T_1}\right)_{p2} dT_2.$$

If T_2 is to have a minimum value, we have

$$\left(\frac{\delta\chi_1}{\delta p_1}\right)_{T1} = 0 \text{ or } \left(\frac{\delta\chi_1}{\delta v_1}\right)_{T1} = 0.$$

From this follows

$$\left(\frac{\delta\varepsilon_1}{\delta v_1}\right)_{T1} + \left[\frac{\delta(p_1v_1)}{\delta v_1}\right]_{T1} = 0.$$

As $(\delta\varepsilon_1/\delta v_1)_T$ is positive, we shall have to take for the maximum cooling such a pressure that the product pv decreases with v, viz. a pressure larger than that at which pv has the minimum value. By means of the equation of state mentioned already, we find for the value of the specific volume that gives the greatest cooling the formula

$$\frac{RT_1b}{(v_1 - b)^2} = \frac{2a}{{v_1}^2},$$

and for the value of the pressure

$$p_1 = 27\, p_c\left[1 - \sqrt{\frac{4\ T_1}{27\ T_c}}\right]\left[3\sqrt{\frac{4\ T_1}{27\ T_c}} - 1\right].$$

If we take the value $2T_c$ for T_1, as we may approximately for air when we begin to work with the apparatus, we find for p_1 about $8p_c$, or more than 300 atmospheres. If we take $T_1 = T_c$, as we may at the end of the process, we find $p_1 = 2.5p_c$, or 100 atmospheres. The constant pressure which has been found the most favourable in Linde's apparatus is a mean of the two calculated pressures. In a theoretically perfect apparatus we ought, therefore, to be able to regulate p_1 according to the temperature in the inner spiral.

The critical temperatures and pressures of the permanent gases are given in the following table, the former being expressed on the absolute scale and the latter in atmospheres:—

	T_c	p_c		T_c	p_c
CH_4	191.2°	55	CO	133.5°	35.5
NO	179.5°	71.2	N_2	127°	35
O_2	155°	50	Air	133°	39

Argon	152°	50.6	H_2	32°	15

The values of T_c and p_c for hydrogen are those of Dewar. They are in approximate accordance with those given by K. Olszewski. Liquid hydrogen was first collected by J. Dewar in 1898. Apparatus for obtaining moderate and small quantities have been described by M. W. Travers and K. Olszewski. H. Kamerlingh Onnes at Leiden has brought about a circulation yielding more than 3 litres per hour, and has made use of it to keep baths of 1.5 litre capacity at all temperatures between 20.2° and 13.7° absolute, the temperatures remaining constant within 0.01°. (See also Liquid Gases.)

(J. D. v. d. W.)

CONDENSER, the name given to many forms of apparatus which have for their object the concentration of matter, or bringing it into a smaller volume, or the intensification of energy. In chemistry the word is applied to an apparatus which cools down, or condenses, a vapour to a liquid; reference should be made to the article Distillation for the various types in use, and also to Gas (*Gas Manufacture*) and Coal Tar; the device for the condensation of the exhaust steam of a steam-engine is treated in the article Steam-Engine. In woollen manufactures, "condensation" of the wool is an important operation and is accomplished by means of a "condenser." The term is also given—generally as a qualification, *e.g.* condensing-syringe, condensing-pump,—to apparatus by which air or a vapour may be compressed. In optics a "condenser" is a lens, or system of lenses, which serves to concentrate or bring the luminous rays to a focus; it is specially an adjunct to the optical lantern and microscope. In electrostatics a condenser is a device for concentrating an electrostatic charge (see Electrostatics; Leyden Jar; Electrophorus).

CONDER, CHARLES (1868-1909), English artist, son of a civil engineer, was born in London, and spent his early years in India. After an English education he went into the government service in Australia, but in 1890 determined to devote himself to art, and studied for several years in Paris, where in 1893 he became an associate of the Société Nationale des Beaux-Arts. About 1895 his reputation as an original painter, particularly of Watteau-like designs for fans, spread among a limited circle of artists in London, mainly connected first with the New English Art Club, and later the International Society; and his unique and charming decorative style, in dainty pastoral scenes, gradually gave him a peculiar vogue among connoisseurs. Examples of his work were bought for the Luxembourg and other art galleries. Conder suffered much in later years from ill-health, and died on the 9th of February 1909.

CONDILLAC, ÉTIENNE BONNOT DE (1715-1780), French philosopher, was born at Grenoble of a legal family on the 30th of September 1715, and, like his elder brother, the well-known political writer, abbé de Mably, took holy orders and became abbé de Mureau.[1] In both cases the profession was hardly more than nominal, and Condillac's whole life, with the exception of an interval as tutor at the court of Parma, was devoted to speculation. His works are *Essai sur l'origine des connaissances humaines* (1746), *Traité des systèmes* (1749), *Traité des sensations* (1754), *Traité des animaux* (1755), a comprehensive *Cours d'études* (1767-1773) in 13 vols., written for the young Duke Ferdinand of Parma, a grandson of Louis XV., *Le Commerce et le gouvernement, considérés relativement l'un à l'autre* (1776), and two posthumous works, *Logique* (1781) and the unfinished *Langue des calculs* (1798). In his earlier days in Paris he came much into contact with the circle of Diderot. A friendship with Rousseau, which lasted in some measure to the end, may have been due in the first instance to the fact that Rousseau had been domestic tutor in the family

of Condillac's uncle, M. de Mably, at Lyons. Thanks to his natural caution and reserve, Condillac's relations with unorthodox philosophers did not injure his career; and he justified abundantly the choice of the French court in sending him to Parma to educate the orphan duke, then a child of seven years. In 1768, on his return from Italy, he was elected to the French Academy, but attended no meeting after his reception. He spent his later years in retirement at Flux, a small property which he had purchased near Beaugency, and died there on the 3rd of August 1780.

Though Condillac's genius was not of the highest order, he is important both as a psychologist and as having established systematically in France the principles of Locke, whom Voltaire had lately made fashionable. In setting forth his empirical sensationism, Condillac shows many of the best qualities of his age and nation, lucidity, brevity, moderation and an earnest striving after logical method. Unfortunately it must be said of him as of so many of his contemporaries, "er hat die Theile in seiner Hand, fehlt leider nur der geistiger Band"; in the analysis of the human mind on which his fame chiefly rests, he has missed out the active and spiritual side of human experience. His first book, the *Essai sur l'origine des connaissances humaines*, keeps close to his English master. He accepts with some indecision Locke's deduction of our knowledge from two sources, sensation and reflection, and uses as his main principle of explanation the association of ideas. His next book, the *Traité des systèmes*, is a vigorous criticism of those modern systems which are based upon abstract principles or upon unsound hypotheses. His polemic, which is inspired throughout with the spirit of Locke, is directed against the innate ideas of the Cartesians, Malebranche's faculty—psychology, Leibnitz's monadism and preestablished harmony, and, above all, against the conception of substance set forth in the first part of the *Ethics* of Spinoza. By far the most important of his works is the *Traité des sensations*, in which he emancipates himself from the tutelage of Locke and treats psychology in his own characteristic way. He had been led, he tells us, partly by the criticism of a talented lady, Mademoiselle Ferrand, to question Locke's doctrine that the senses give us intuitive knowledge of objects, that the eye, for example, judges naturally of shapes, sizes, positions and distances. His discussions with the lady had convinced him that to clear up such questions it was necessary to study our senses separately, to distinguish precisely what ideas we owe to each sense, to observe how the senses are trained, and how one sense aids another. The result, he was confident, would show that all human faculty and knowledge are transformed sensation only, to the exclusion of any other principle, such as reflection. The plan of the book is that the author imagines a statue organized inwardly like a man, animated by a soul which has never received an idea, into which no sense-impression has ever penetrated. He then unlocks its senses one by one, beginning with smell, as the sense that contributes least to human knowledge. At its first experience of smell, the consciousness of the statue is entirely occupied by it; and this occupancy of consciousness is attention. The statue's smell-experience will produce pleasure or pain; and pleasure and pain will thenceforward be the master-principle which, determining all the operations of its mind, will raise it by degrees to all the knowledge of which it is capable. The next stage is memory, which is the lingering impression of the smell-experience upon the attention: "memory is nothing more than a mode of feeling." From memory springs comparison: the statue experiences the smell, say, of a rose, while remembering that of a carnation; and "comparison is nothing more than giving one's attention to two things simultaneously." And "as soon as the statue has comparison it has judgment." Comparisons and judgments become habitual, are stored in the mind and formed into series, and thus arises the powerful principle of the association of ideas. From comparison of past and present experiences in respect of their pleasure-giving quality arises desire; it is desire that determines the operation of our faculties, stimulates the memory and imagination, and gives rise to the passions. The passions, also, are nothing but sensation transformed. These indications will suffice to show the general course of the argument in the first section of the *Traité des sensations*. To show the thoroughness of the treatment it will be enough to quote the headings of the chief remaining chapters: "Of the Ideas of a Man limited to the Sense of Smell," "Of a Man limited to the Sense of Hearing," "Of Smell and Hearing combined," "Of Taste by itself, and of Taste combined with Smell and Hearing," "Of a Man limited to the Sense of Sight." In the second section of the treatise Condillac invests his statue with the sense of touch, which first informs it of the existence of external objects. In a very careful and elaborate analysis, he distinguishes the various elements in our tactile experiences—the touching of one's own body, the touching of objects other than one's own body, the experience of movement, the exploration of surfaces by the hands: he traces the growth of the statue's perceptions of extension, distance and shape. The third section deals with the combination of touch with the other senses. The fourth section deals with the desires, activities and ideas of an isolated man who enjoys possession of all the senses; and ends

with observations on a “wild boy” who was found living among bears in the forests of Lithuania. The conclusion of the whole work is that in the natural order of things everything has its source in sensation, and yet that this source is not equally abundant in all men; men differ greatly in the degree of vividness with which they feel; and, finally, that man is nothing but what he has acquired; all innate faculties and ideas are to be swept away. The last dictum suggests the difference that has been made to this manner of psychologizing by modern theories of evolution and heredity.

Condillac’s work on politics and history, contained, for the most part, in his *Cours d’études*, offers few features of interest, except so far as it illustrates his close affinity to English thought: he had not the warmth and imagination to make a good historian. In logic, on which he wrote extensively, he is far less successful than in psychology. He enlarges with much iteration, but with few concrete examples, upon the supremacy of the analytic method; argues that reasoning consists in the substitution of one proposition for another which is identical with it; and lays it down that science is the same thing as a well-constructed language, a proposition which in his *Langue des calculs* he tries to prove by the example of arithmetic. His logic has in fact the good and bad points that we might expect to find in a sensationist who knows no science but mathematics. He rejects the medieval apparatus of the syllogism; but is precluded by his standpoint from understanding the active, spiritual character of thought; nor had he that interest in natural science and appreciation of inductive reasoning which form the chief merit of J. S. Mill. It is obvious enough that Condillac’s anti-spiritual psychology, with its explanation of personality as an aggregate of sensations, leads straight to atheism and determinism. There is, however, no reason to question the sincerity with which he repudiates both these consequences. What he says upon religion is always in harmony with his profession; and he vindicated the freedom of the will in a dissertation that has very little in common with the *Traité des sensations* to which it is appended. The common reproach of materialism should certainly not be made against him. He always asserts the substantive reality of the soul; and in the opening words of his *Essai*, “Whether we rise to heaven, or descend to the abyss, we never get outside ourselves —it is always our own thoughts that we perceive,” we have the subjectivist principle that forms the starting-point of Berkeley.

As was fitting to a disciple of Locke, Condillac’s ideas have had most importance in their effect upon English thought. In matters connected with the association of ideas, the supremacy of pleasure and pain, and the general explanation of all mental contents as sensations or transformed sensations, his influence can be traced upon the Mills and upon Bain and Herbert Spencer. And, apart from any definite propositions, Condillac did a notable work in the direction of making psychology a science; it is a great step from the desultory, genial observation of Locke to the rigorous analysis of Condillac, short-sighted and defective as that analysis may seem to us in the light of fuller knowledge. His method, however, of 851
imaginative reconstruction was by no means suited to English ways of thinking. In spite of his protests against abstraction, hypothesis and synthesis, his allegory of the statue is in the highest degree abstract, hypothetical and synthetic. James Mill, who stood more by the study of concrete realities, put Condillac into the hands of his youthful son with the warning that here was an example of what to avoid in the method of psychology. In France Condillac’s doctrine, so congenial to the tone of 18th century philosophism, reigned in the schools for over fifty years, challenged only by a few who, like Maine de Biran, saw that it gave no sufficient account of volitional experience. Early in the 19th century, the romantic awakening of Germany had spread to France, and sensationism was displaced by the eclectic spiritualism of Victor Cousin.

Condillac’s collected works were published in 1798 (23 vols.) and two or three times subsequently; the last edition (1822) has an introductory dissertation by A. F. Théry. The *Encyclopédie méthodique* has a very long article on Condillac (Naigeon). Biographical details and criticism of the *Traité des systèmes* in J. P. Damiron’s *Mémoires pour servir à l’histoire de la philosophie au dixhuitième siècle*, tome iii.; a full criticism in V. Cousin’s *Cours de l’histoire de la philosophie moderne*, ser. i. tome iii. Consult also F. Rethoré, *Condillac ou l’empirisme et le rationalisme* (1864); L. Dewaule, *Condillac et la psychologie anglaise contemporaine* (1891); histories of philosophy.

(H. St.)

1 *i.e.* abbot *in commendam* of the Premonstratensian abbey of Mureau in the Vosges. (Ed.)

CONDITION (Lat. *condicio*, from *condicere*, to agree upon, arrange; not connected with *conditio*, from *condere, conditum*, to put together), a stipulation, agreement. The term is applied technically to any circumstance, action or event which is regarded as the indispensable prerequisite of some other circumstance, action or event. It is also applied generally to the sum of the circumstances in which a person is situated, and more specifically to favourable or prosperous circumstances; thus a person of wealth or birth is described as a person "of condition," or an athlete as being "in condition," *i.e.* physically fit, having gone through the necessary course of preliminary training. In all these senses there is implicit the idea of limitation or restraint imposed with a view to the attainment of a particular end.

(1) *In Logic*, the term "condition" is closely related to "cause" in so far as it is applied to prior events, &c., in the absence of which another event would not take place. It is, however, different from "cause" inasmuch as it has a predominantly negative or passive significance. Hence the adjective "conditional" is applied to propositions in which the truth of the main statement is made to depend on the truth of another; these propositions are distinguished from categorical propositions, which simply state a fact, as being "composed of two categorical propositions united by a conjunction," *e.g.* if A is B, C is D. The second statement (the "consequent") is restricted or qualified by the first (the "antecedent"). By some logicians these propositions are classified as (1) Hypothetical, and (2) Disjunctive, and their function in syllogistic reasoning gives rise to the following classification of conditional arguments:—(a) Constructive hypothetical syllogism (*modus ponens*, "affirmative mood"): If A is B, C is D; but A is B; therefore C is D. (b) Destructive hypothetical syllogism (*modus tollens*, mood which "removes," *i.e.* the consequent): if A is B, C is D; but C is not D; therefore A is not B. In (a) the antecedent must be affirmed, in (b) the consequent must be denied; otherwise the arguments become fallacious. A second class of conditional arguments are disjunctive syllogisms consisting of (c) the *modus ponendo tollens*: A is either B or C; but A is B; therefore C is not D; and (d) *modus tollendo ponens*: A is either B or C; A is not B; therefore A is C. A more complicated conditional argument is the dilemma (*q.v.*).[1]

The limiting or restrictive significance of "condition" has led to its use in metaphysical theory in contradistinction to the conception of absolute being, the *aseitas* of the Schoolmen. Thus all finite things exist in certain relations not only to all other things but also to thought; in other words, all finite existence is "conditioned." Hence Sir Wm. Hamilton speaks of the "philosophy of the unconditioned," *i.e.* of thought in distinction to things which are determined by thought in relation to other things. An analogous distinction is made (cf. H. W. B. Joseph, *Introduction to Logic*, pp. 380 foll.) between the so-called universal laws of nature and conditional principles, which, though they are regarded as having the force of law, are yet dependent or derivative, *i.e.* cannot be treated as universal truths. Such principles hold good under present conditions, but other conditions might be imagined under which they would be invalid; they hold good only as corollaries from the laws of nature under existing conditions.

(2) *In Law*, condition in its general sense is a restraint annexed to a thing, so that by the non-performance the party to it shall receive prejudice and loss, and by the performance commodity or advantage. Conditions may be either: (1) condition in a deed or *express* condition, *i.e.* the condition being expressed in actual words; or (2) condition in law or *implied* condition, *i.e.* where, although no condition is actually expressed, the law implies a condition. The word is also used indifferently to mean either the event upon the happening of which some estate or obligation is to begin or end, or the provision or stipulation that the estate or obligation will depend upon the happening of the event. A condition may be of several kinds: (1) a condition *precedent*, where, for example, an estate is granted to one for life upon condition that, if the grantee pay the grantor a certain sum on such a day, he shall have the fee simple; (2) a condition *subsequent*, where, for example, an estate is granted in fee upon condition that the grantee shall pay a certain sum on a certain day, or that his estate shall cease. Thus a condition precedent gets or gains, while a condition subsequent keeps and continues. A condition may also be *affirmative*, that is, the doing of an act; *negative*, the not doing of an act; *restrictive, compulsory*, &c. The word is also used adjectivally in the sense set out above, as in the phrases "conditional legacy," "conditional limitation," "conditional promise," &c.; that is, the legacy, the limitation, the promise is to take effect only upon the happening of a certain event.

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1 The terminology used above has not been adopted by all logicians. "Conditional" has been used as equivalent to "hypothetical" in the widest sense (including "disjunctive"); or narrowed down to be synonymous with "conjunctive" (the condition being there more explicit), as a subdivision of "hypothetical."

CONDITIONAL FEE, at English common law, a fee or estate restrained in its form of donation to some particular heirs, as, to the heirs of a man's body, or to the heirs male of his body. It was called a conditional fee by reason of the condition expressed or implied in the donation of it, that if the donee died without such particular heirs, the land should revert to the donor. In other words, it was a fee simple on condition that the donee had issue, and as soon as such issue was born, the estate was supposed to become absolute by the performance of the condition. A conditional fee was converted by the statute *De Donis Conditionalibus* into an estate tail (see REAL PROPERTY).

CONDITIONAL LIMITATION, in law, a phrase used in two senses. (1) The qualification annexed to the grant of an estate or interest in land, providing for the determination of that grant or interest upon a particular contingency happening. An estate with such a limitation can endure only until the particular contingency happens; it is a present interest, to be divested on a future contingency. The grant of an estate to a man so long as he is parson of Dale, or while he continues unmarried, are instances of conditional limitations of estates for life. (2) A future use or interest in land limited to take effect upon a given contingency. For instance, a grant to N. and his heirs to the use of A., provided that when C. returns from Rome the land shall go to the use of B. in fee simple. B. is said to take under a conditional limitation, operating by executory devise or springing or shifting use (see REMAINDER, REVERSION).

CONDOM, a town of south-western France, capital of an arrondissement in the department of Gers, on the right bank of the Baïse, at its junction with the Gèle, 27 m. by road N.N.W. of Auch. Pop. (1906) town, 4046; commune, 6435. Two stone bridges unite Condom with its suburb on the left bank of the river. The streets are small and narrow and several old houses still remain, but to the east the town is bordered by pleasant promenades. The Gothic church of St Pierre, its chief building, was erected from 1506 to 1521, and was till 1790 a cathedral. The interior, which is without aisles or transept, is surrounded by lateral chapels. On the south is a beautifully sculptured portal. An adjoining cloister of the 16th century is occupied by the hôtel de ville. The former episcopal palace with its graceful Gothic chapel is used as a law-court. The sub-prefecture, a tribunal of first instance, and a communal college, are among the public institutions. Brandy-distilling, wood-sawing, iron-founding and the manufacture of stills are among the industries. The town is a centre for the sale of Armagnac brandy and has commerce in grain and flour, much of which is river-borne.

Condom (*Condomus*) was founded in the 8th century, but in 840 was sacked and burnt by the Normans. A monastery built here c. 900 by the wife of Sancho of Gascony was soon destroyed by fire, but in 1011 was rebuilt, by Hugh, bishop of Agen. Round this abbey the town grew up, and in 1317 was made into an episcopal see by Pope John XXII. The line of bishops, which included Bossuet (1668-1671), came to an end in 1790 when the see was suppressed. Condom was, during the middle ages, a fortress of considerable strength. During the Hundred Years' War, after several unsuccessful attempts, it was finally captured and held by the English. In 1569 it was sacked by the Huguenots under Gabriel, count of Montgomery.

A list of monographs, &c., on the abbey, see and town of Condom is given s.v. in U. Chevalier, *Répertoire des sources. Topobibliogr.* (Montbéliard, 1894-1899).

CONDOR (*Sarcorhamphus gryphus*), an American vulture, and almost the largest of existing birds of flight, although by no means attaining the dimensions attributed to it by early writers. It usually measures about 4 ft. from the point of the beak to the extremity of the tail, and 9 ft. between the tips of its wings, while it is probable that the expanse of wing never exceeds 12 ft. The head and neck are destitute of feathers, and the former, which is much flattened above, is in the male crowned with a caruncle or comb, while the skin of the latter in the same sex lies in folds, forming a wattle. The adult plumage is of a uniform black, with the exception of a frill of white feathers nearly surrounding the base of the neck, and certain wing feathers which, especially in the male, have large patches of white. The middle toe is greatly elongated, and the hinder one but slightly developed, while the talons of all the toes are comparatively straight and blunt, and are thus of little use as organs of prehension. The female, contrary to the usual rule among birds of prey, is smaller than the male.

The condor is a native of South America, where it is confined to the region of the Andes, from the Straits of Magellan to 4° north latitude,—the largest examples, it is said, being found about the volcano of Cayambi, situated on the equator. It is often seen on the shores of the Pacific, especially during the rainy season, but its favourite haunts for roosting and breeding are at elevations of 10,000 to 16,000 ft. There, during the months of February and March, on inaccessible ledges of rock, it deposits two white eggs, from 3 to 4 in. in length, its nest consisting merely of a few sticks placed around the eggs. The period of incubation lasts for seven weeks, and the young are covered with a whitish down until almost as large as their parents. They are unable to fly till nearly two years old, and continue for a considerable time after taking wing to roost and hunt with their parents. The white ruff on the neck, and the similarly coloured feathers of the wing, do not appear until the completion of the first moulting. By preference the condor feeds on carrion, but it does not hesitate to attack sheep, goats and deer, and for this reason it is hunted down by the shepherds, who, it is said, train their dogs to look up and bark at the condors as they fly overhead. They are exceedingly voracious, a single condor of moderate size having been known, according to Orton, to devour a calf, a sheep and a dog in a single week. When thus gorged with food, they are exceedingly stupid, and may then be readily caught. For this purpose a horse or mule is killed, and the carcase surrounded with palisades to which the condors are soon attracted by the prospect of food, for the weight of evidence seems to favour the opinion that those vultures owe their knowledge of the presence of carrion more to sight than to scent. Having feasted themselves to excess, they are set upon by the hunters with sticks, and being unable, owing to the want of space within the pen, to take the run without which they are unable to rise on wing, they are readily killed or captured. They sleep during the greater part of the day, searching for food in the clearer light of morning and evening. They are remarkably heavy sleepers, and are readily captured by the inhabitants ascending the trees on which they roost, and noosing them before they awaken. Great numbers of condors are thus taken alive, and these, in certain districts, are employed in a variety of bull-fighting. They are exceedingly tenacious of life, and can exist, it is said, without food for over forty days. Although the favourite haunts of the condor are at the level of perpetual snow, yet it rises to a much greater height, Humboldt having observed it flying over Chimborazo at a height of over 23,000 ft. On wing the movements of the condor, as it wheels in majestic circles, are remarkably graceful. The birds flap their wings on rising from the ground, but after attaining a moderate elevation they seem to sail on the air, Charles Darwin having watched them for half an hour without once observing a flap of their wings.

CONDORCET, MARIE JEAN ANTOINE NICOLAS CARITAT, Marquis de (1743-1794), French mathematician, philosopher and Revolutionist, was born at Ribemont, in Picardy, on the 17th of September 1743. He descended from the ancient family of Caritat, who took their title from Condorcet, near Nyons in Dauphiné, where they were long settled. His father dying while he was very young, his mother, a very devout woman, had him educated at the Jesuit College in Reims and at the College of Navarre in Paris, where he displayed the most varied mental activity. His first public distinctions were gained in mathematics. At the age of sixteen his performances in analysis gained the praise of D’Alembert and A. C. Clairaut, and at the age of twenty-two he wrote a treatise on the integral calculus which obtained warm approbation from competent judges. With his many-sided intellect and richly-endowed emotional nature, however, it was impossible for him to be a specialist, and least of all a specialist in mathematics. Philosophy and literature attracted him, and social work was

dearer to him than any form of intellectual exercise. In 1769 he became a member of the Academy of Sciences. His contributions to its memoirs are numerous, and many of them are on the most abstruse and difficult mathematical problems.

Being of a very genial, susceptible and enthusiastic disposition, he was the friend of almost all the distinguished men of his time, and a zealous propagator of the religious and political views then current among the literati of France. D'Alembert, Turgot and Voltaire, for whom he had great affection and veneration, and by whom he was highly respected and esteemed, contributed largely to the formation of his opinions. His *Lettre d'un laboureur de Picardie à M. N...* (Necker) was written under the inspiration of Turgot, in defence of free internal trade in corn. Condorcet also wrote on the same subject the *Réflexions sur le commerce des blés* (1776). His *Lettre d'un théologien*, &c., was attributed to Voltaire, being inspired throughout by the Voltairian anti-clerical spirit. He was induced by D'Alembert to take an active part in the preparation of the *Encyclopédie*. His *Éloges des Académiciens de l'Académie Royale des Sciences morts depuis 1666 jusqu'en 1699* (1773) gained him the reputation of being an eloquent and graceful writer. He was elected to the perpetual secretaryship of the Academy of Sciences in 1777, and to the French Academy in 1782. He was also member of the academies of Turin, St Petersburg, Bologna and Philadelphia. In 1785 he published his *Essai sur l'application de l'analyse aux probabilités des décisions prises à la pluralité des voix*,—a remarkable work which has a distinguished place in the history of the doctrine of probability; a second edition, greatly enlarged and completely recast, appeared in 1804 under the title of *Éléments du calcul des probabilités et son application aux jeux de hazard, à la loterie, et aux jugements des hommes, &c.* In 1786 he married Sophie de Grouchy, a sister of Marshal Grouchy, said to have been one of the most beautiful women of her time. Her *salon* at the Hôtel des Monnaies, where Condorcet lived in his capacity as inspector-general of the mint, was one of the most famous of the time. In 1786 Condorcet published his *Vie de Turgot*, and in 1787 his *Vie de Voltaire*. Both works were widely and eagerly read, and are perhaps, from a merely literary point of view, the best of Condorcet's writings.

The political tempest which had been long gathering over France now began to break and to carry everything before it. Condorcet was, of course, at once hurried along by it into the midst of the conflicts and confusion of the Revolution. He greeted with enthusiasm the advent of democracy, and laboured hard to secure and hasten its triumph. He was indefatigable in writing pamphlets, suggesting reforms, and planning constitutions. He was not a member of the States-General of 1789, but he had expressed his ideas in the electoral assembly of the noblesse of Mantes. The first political functions which he exercised were those of a member of the municipality of Paris (1790). He was next chosen by the Parisians to represent them in the Legislative Assembly, and then appointed by that body one of its secretaries. In this capacity he drew up most of its addresses, but seldom spoke, his pen being more effective than his tongue. He was the chief author of the address to the European powers when they threatened France with war. He was keenly interested in education, and, as a member of the committee of public instruction, presented to the Assembly (April 21 and 22, 1792) a bold and comprehensive scheme for the organization of a system of state education which, though more urgent questions compelled its postponement, became the basis of that adopted by the Convention, and thus laid the foundations on which the modern system of national education in France is built up. After the attempted flight of the king, in June 1791, Condorcet was one of the first to declare in favour of a republic, and it was he who drew up the memorandum which led the Assembly, on the 4th of September 1792, to decree the suspension of the king and the summoning of the National Convention. He had, meanwhile, resigned his offices and left the Hôtel des Monnaies; his declaration in favour of republicanism had alienated him from his former friends of the constitutional party, and he did not join the Jacobin Club, which had not yet declared against the monarchy. Though attached to no powerful political group, however, his reputation gave him great influence. At the elections for the Convention he was chosen for five departments, and took his seat for that of Aisne. He now became the most influential member of the committee on the constitution, and as "reporter" he drafted and presented to the Convention (February 15, 1793) a constitution, which was, however, after stormy debates, rejected in favour of that presented by Hérault de Séchelles. The work of constitution-making had been interrupted by the trial of Louis XVI. Condorcet objected to the assumption of judicial functions by the Convention, objected also on principle to the infliction of the death penalty; but he voted the king guilty of conspiring against liberty and worthy of any penalty short of death, and against the appeal to the people advocated by the Girondists. In the atmosphere of universal suspicion that inspired the Terror his independent attitude could not, however, be maintained with impunity. His severe and public criticism of the constitution adopted by

the Convention, his denunciation of the arrest of the Girondists, and his opposition to the violent conduct of the Mountain, led to his being accused of conspiring against the Republic. He was condemned and declared to be *hors la loi*. Friends, sought for him an asylum in the house of Madame Vernet, widow of the sculptor and a near connexion of the painters of the same name. Without even asking his name, this heroic woman, as soon as she was assured that he was an honest man, said, “Let him come, and lose not a moment, for while we talk he may be seized.” When the execution of the Girondists showed him that his presence exposed his protectress to a terrible danger, he resolved to seek a refuge elsewhere. “I am outlawed,” he said, “and if I am discovered you will meet the same sad end as myself. I must not stay.” Madame Vernet’s reply deserves to be immortal, and should be given in her own words: “La Convention, Monsieur, a le droit de mettre hors la loi: elle n’a pas le pouvoir de mettre hors de l’humanité; vous resterez.” From that time she had his movements strictly watched lest he should attempt to quit her house. It was partly to turn his mind from the idea of attempting this, by occupying it otherwise, that his wife and some of his friends, with the co-operation of Madame Vernet, prevailed on him to engage in the composition of the work by which he is best known—the *Esquisse d’un tableau historique des progrès de l’esprit humain*. In his retirement Condorcet wrote also his justification, and several small works, such as the *Moyen d’apprendre à compter sûrement et avec facilitê*, which he intended for the schools of the republic. Several of these works were published at the time, thanks to his friends; the rest appeared after his death. Among the latter was the admirable *Avis d’un proscrit à sa fille*. While in hiding he also continued to take an active interest in public affairs. Thus, he wrote several important memoranda on the conduct of the war against the Coalition, which were laid before the Committee of Public Safety anonymously by a member of the Mountain named Marcoz, who lived in the same house as Condorcet without thinking it his duty to denounce him. In the same way he forwarded to Arbogast, president of the committee for public instruction, the solutions of several problems in higher mathematics.

Certain circumstances having led him to believe that the house of Madame Vernet, 21 rue Servandoni, was suspected and watched by his enemies, Condorcet, by a fatally successful artifice, at last baffled the vigilance of his generous friend and escaped. Disappointed in finding even a night’s shelter at the château of one whom he had befriended, he had to hide for three days and nights in the thickets and stone-quarries of Clamart. Oh the evening of the 7th of April 1794—not, as Carlyle says, on a “bleared May morning,”—with garments torn, with wounded leg, with famished looks, he entered a tavern in the village named, and called for an omelette. “How many eggs in your omelette?” “A dozen.” “What is your trade?” “A carpenter.” “Carpenters have not hands like these, and do not ask for a dozen eggs in an omelette.” When his papers were demanded he had none to show; when his person was searched a Horace was found on him. The villagers seized him, bound him, haled him forthwith on bleeding feet towards Bourg-la-Reine; he fainted by the way, was set on a horse offered in pity by a passing peasant, and, at the journey’s end, was cast into a cold damp cell. Next morning he was found dead on the floor. Whether he had died from suffering and exhaustion, from apoplexy or from poison, is an undetermined question.

Condorcet was undoubtedly a most sincere, generous and noble-minded man. He was eager in the pursuit of truth, ardent in his love of human good, and ever ready to undertake labour or encounter danger on behalf of the philanthropic plans which his fertile mind contrived and his benevolent heart inspired. It was thus that he worked for the suppression of slavery, for the rehabilitation of the chevalier de La Barre, and in defence of Lally-Tollendal. He lived at a time when calumny was rife, and various slanders were circulated regarding him, but fortunately the slightest examination proves them to have been inexcusable fabrications. That while openly opposing royalty he was secretly soliciting the office of tutor to the Dauphin; that he was accessory to the murder of the duc de la Rochefoucauld; or that he sanctioned the burning of the literary treasures of the learned congregations, are stories which can be shown to be utterly untrue.

His philosophical fame is chiefly associated with the *Esquisse ... des’progrès* mentioned above. With the vision of the guillotine before him, with confusion and violence around him, he comforted himself by trying to demonstrate that the evils of life had arisen from a conspiracy of priests and rulers against their fellows, and from the bad laws and institutions which they had succeeded in creating, but that the human race would finally conquer its enemies and free itself of its evils. His fundamental idea is that of a human perfectibility which has manifested itself in continuous progress in the past, and must lead to indefinite progress in the future. He represents man as starting from the lowest stage of barbarism, with no superiority over the other animals save that of bodily organization, and as advancing uninterruptedly, at a more or less rapid rate, in the path of enlightenment, virtue and

happiness. The stages which the human race has already gone through, or, in other words, the great epochs of history, are regarded as nine in number. The first three can confessedly be described only conjecturally from general observations as to the development of the human faculties, and the analogies of savage life. In the first epoch, men are united into hordes of hunters and fishers, who acknowledge in some degree public authority and the claims of family relationship, and who make use of an articulate language. In the second epoch—the pastoral state—property is introduced, and along with it inequality of conditions, and even slavery, but also leisure to cultivate intelligence, to invent some of the simpler arts, and to acquire some of the more elementary truths of science. In the third epoch—the agricultural state—as leisure and wealth are greater, labour better distributed and applied, and the means of communication increased and extended, progress is still more rapid. With the invention of alphabetic writing the conjectural part of history closes, and the more or less authenticated part commences. The fourth and fifth epochs are represented as corresponding to Greece and Rome. The middle ages are divided into two epochs, the former of which terminates with the Crusades, and the latter with the invention of printing. The eighth epoch extends from the invention of printing to the revolution in the method of philosophic thinking accomplished by Descartes. And the ninth epoch begins with that great intellectual revolution, and ends with the great political and moral revolution of 1789, and is illustrious, according to Condorcet, through the discovery of the true system of the physical universe by Newton, of human nature by Locke and Condillac, and of society by Turgot, Richard Price and Rousseau. There is an epoch of the future—a tenth epoch,—and the most original part of Condorcet's treatise is that which is devoted to it. After insisting that general laws regulative of the past warrant general inferences as to the future, he argues that the three tendencies which the entire history of the past shows will be characteristic features of the future are:—(1) the destruction of inequality between nations; (2) the destruction of inequality between classes; and (3) the improvement of individuals, the indefinite perfectibility of human nature itself—intellectually, morally and physically. These propositions have been much misunderstood. The equality to which he represents nations and individuals as tending is not absolute equality, but equality of freedom and of rights. It is that equality which would make the inequality of the natural advantages and faculties of each community and person beneficial to all. Nations and men, he thinks, are equal, if equally free, and are all tending to equality because all tending to freedom. As to indefinite perfectibility, he nowhere denies that progress is conditioned both by the constitution of humanity and the character of its surroundings. But he affirms that these conditions are compatible with endless progress, and that the human mind can assign no fixed limits to its own advancement in knowledge and virtue, or even to the prolongation of bodily life. This theory explains the importance he attached to popular education, to which he looked for all sure progress.

The book is pervaded by a spirit of excessive hopefulness, and contains numerous errors of detail, which are fully accounted for by the circumstances in which it was written. Its value lies entirely in its general ideas. Its chief defects spring from its author's narrow and fanatical aversion to all philosophy which did not attempt to explain the world exclusively on mechanical and sensational principles, to all religion whatever, and especially to Christianity and Christian institutions, and to monarchy. His ethical position, however, gives emphasis to the sympathetic impulses and social feelings, and had considerable influence upon Auguste Comte.

Madame de Condorcet (b. 1764), who was some twenty years younger than her husband, was rendered penniless by his proscription, and compelled to support not only herself and her four years old daughter but her younger sister, Charlotte de Grouchy. After the end of the Jacobin Terror she published an excellent translation of Adam Smith's *Theory of Moral Sentiments*; in 1798 a work of her own, *Lettres sur la sympathie*; and in 1799 her husband's *Éloges des acadêmiciens*. Later she co-operated with Cabanis, who had married her sister, and with Garat in publishing the complete works of Condorcet (1801-1804). She adhered to the last to the political views of her husband, and under the Consulate and Empire her *salon* became a meeting-place of those opposed to the autocratic régime. She died at Paris on the 8th of September 1822. Her daughter was married, in 1807, to General O'Connor.

A *Biographie de Condorcet*, by M. F. Arago, is prefixed to A. Condorcet-O'Connor's edition of Condorcet's works, in 12 volumes (1847-1849). There is an able essay on Condorcet in Lord Morley of Blackburn's *Critical Miscellanies*. On Condorcet as an historical philosopher see Comte's *Cours de philosophie positive*, iv. 252-253, and *Système de politique positive*, iv. Appendice Général, 109-111; F. Laurent, *Études*, xii. 121-126, 89-110; and R. Flint, *Philosophy of History in France and Germany*, i. 125-138. The *Mémoires de Condorcet sur la Révolution française, extraits de sa correspondance et de celles de ses amis* (2 vols., Paris,

Ponthieu, 1824), which were in fact edited by F. G. de la Rochefoucauld-Liancourt, are spurious. See also Dr J. F. E. Robinet, *Condorcet, sa vie et son œuvre*, and more especially L. Cahen, *Condorcet et la Révolution française* (Paris, 1904). On Madame de Condorcet see Antoine Guillois, *La Marquise de Condorcet, sa famille, son salon et ses œuvres* (Paris, 1897).

CONDOTTIERE (plural, *condottieri*), an Italian term, derived ultimately from Latin *conducere*, meaning either "to conduct" or "to hire," for the leader of the mercenary military companies, often several thousand strong, which used to be hired out to carry on the wars of the Italian states. The word is often extended so as to include the soldiers as well as the leader of a company. The condottieri played a very important part in Italian history from the middle of the 13th to the middle of the 15th century. The special political and military circumstances of medieval Italy, and in particular the wars of the Guelphs and Ghibellines, brought it about that the condottieri and their leaders played a more conspicuous and important part in history than the "Free Companies" elsewhere. Amongst these circumstances the absence of a numerous feudal cavalry, the relative luxury of city life, and the incapacity of city militia for wars of aggression were the most prominent. From this it resulted that war was not merely the trade of the condottiere, but also his monopoly, and he was thus able to obtain whatever terms he asked, whether money payments or political concessions. These companies were recruited from wandering mercenary bands and individuals of all nations, and from the ranks of the many armies of middle Europe which from time to time overran Italy.

Montreal d'Albarno, a gentleman of Provence, was the first to give them a definite form. A severe discipline and an elaborate organization were introduced within the company itself, while in their relations to the people the most barbaric licence was permitted. Montreal himself was put to death at Rome by Rienzi, and Conrad Lando succeeded to the command. The Grand Company, as it was called, soon numbered about 7000 cavalry and 1500 select infantry, and was for some years the terror of Italy. They seem to have been Germans chiefly. On the conclusion (1360) of the peace of Bretigny between England and France, Sir John Hawkwood (*q.v.*) led an army of English mercenaries, called the White Company, into Italy, which took a prominent part in the confused wars of the next thirty years. Towards the end of the century the Italians began to organize armies of the same description. This ended the reign of the purely mercenary company, and began that of the semi-national mercenary army which endured in Europe till replaced by the national standing army system. The first company of importance raised on the new basis was that of St George, originated by Alberigo, count of Barbiano, many of whose subordinates and pupils conquered principalities for themselves. Shortly after, the organization of these mercenary armies was carried to the highest perfection by Sforza Attendolo, condottiere in the service of Naples, who had been a peasant of the Romagna, and by his rival Brancaccio di Montone in the service of Florence. The army and the renown of Sforza were inherited by his son Francesco Sforza, who eventually became duke of Milan (1450). Less fortunate was another great condottiere, Carmagnola, who first served one of the Visconti, and then conducted the wars of Venice against his former masters, but at last awoke the suspicion of the Venetian oligarchy, and was put to death before the palace of St Mark (1432). Towards the end of the 15th century, when the large cities had gradually swallowed up the small states, and Italy itself was drawn into the general current of European politics, and became the battlefield of powerful armies—French, Spanish and German—the condottieri, who in the end proved quite unequal to the gendarmerie of France and the improved troops of the Italian states, disappeared.

The soldiers of the condottieri were almost entirely heavy armoured cavalry (men-at-arms). They had, at any rate before 1400, nothing in common with the people among whom they fought, and their disorderly conduct and rapacity seem often to have exceeded that of other medieval armies. They were always ready to change sides at the prospect of higher pay. They were connected with each other by the interest of a common profession, and by the possibility that the enemy of to-day might be the friend and fellow-soldier of to-morrow. Further, a prisoner was always more valuable than a dead enemy. In consequence of all this their battles were often as bloodless as they were theatrical. Splendidly equipped armies were known to fight for hours with hardly the loss of a man (Zagonara, 1423; Molinella,

1467).

*** END OF THE PROJECT GUTENBERG EBOOK ENCYCLOPAEDIA BRITANNICA, 11TH EDITION, "COLUMBUS" TO "CONDOTTIERE" ***

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