

Afghanistan.—The Bala Hissar or Black Citadel, Kabul.

mental, with great heat in summer and severe cold in winter (above 5,000 ft.), but is generally healthy. The rainfall is slight, and the snowfall heavy in the highlands. The n.w. 'wind of the 120 days' blows from March to end of July.

Though the minerals are not much worked, they are tolerably plentiful in N. Afghanistan, and comprise gold, silver, rubies, lapis lazuli, iron, copper, lead, antimony, zinc, copper, sal-ammoniac, gypsum, and nitre. There are two harvests (summer and autumn) in the year in most parts of Afghanistan, and wheat, barley, lentils, rice, millet, sorghum, maize, tobacco, beet, sugar-cane, madder, mulberry, and fruits (grapes, melons, etc.) are largely grown, the fruits forming the principal food of most of the people. Domestic animals are camels, horses and ponies, cattle, sheep (two fat-tailed varieties), goats, and dogs.

The population consists of many discordant elements: one-half probably belongs to the dominant Afghan race, the Duranis; next are the Ghilzais, probably of Turki origin; the Hazaras and Aimaks, of Tartar origin; other races are Arabs, Jews, Baluchis, and Kafirs. The language is Pushtu, but Persian is in general use. Most of the Afghans are pastoral and nomadic, others are agricultural. Agriculture is carried on wherever possible, and with the aid of irrigation. Manufactures are unimportant, and are mainly confined to the production of silks, carpets, felts, and fabrics from wool of sheep, goats, and camels. The sheepskin *postin* manufacture is one of the most important industries. Industrial expansion is much impeded by prohibitive duties.

Trade is carried on with Persia, Russian Central Asia, China, and India. The chief exports are wool, silk, sheepskins, horses, cattle, and

fruits. The imports are cotton, silk, and woollen goods (chiefly from Britain), coarse cloths, sugar, tea, indigo, drugs, arms, metal goods. The chief highways are through the Khyber, Gumal, and Bolan Passes to Kabul, Ghazni, and Kandahar; from Kabul to Bokhara, Herat, and Kandahar; from Kandahar to Seistan, Herat, and Meshed. Oxen, camels, and horses are used for caravans. There are few made roads except about Kabul, and there is but one local railway, also at the capital.

The government is a hereditary monarchy based on a tribal organization. At its head is the Ameer, who belongs to the Barakzai branch of the Duranis. There is a council of state, consisting of Ameer, sirdars, khans, and mullahs.

There are five provinces: Kabul, Kandahar, Herat, Turkestan, and Badakhshan. At the head of each is a *hakim* or governor. The supreme court and court of appeal is that of the Ameer of Kabul. Justice in most cases is left to the administration of a *kazi*, or chief magistrate, assisted by *muftis* or *mutaassibs*, who somewhat resemble detective officers. The laws, which are largely disregarded, are tolerably equitable. The Ameer receives a subsidy of £120,000 from the Indian government, and grants of arms. He has no foreign relations save with India.

The Afghan army is supposed to number 70,000 or 80,000 men, including 9,000 horse, and 300 guns. Guns, small arms, and ammunition are now manufactured at Kabul arsenal.

The religion of the Afghans is (Sunni) Islam. They were conquered and converted to this faith in the 7th century A.D. Many of the tribes are fanatical, and the mullahs have much power. There is little education, and the policy of the Ameer has been one of isolation.

The chief towns are Kabul (150,000), Kandahar (50,000 upwards), Herat (45,000), Ghazni (10,000).

Afghanistan is the gateway to India. Most historic invasions of that peninsula have been made through its passes, from the days of Darius and Alexander (330-329 B.C.) to Moslem and Mogul times; the Afghans themselves have made many predatory incursions, and have even set up Afghan or Pathan dynasties. After forming successively part of the Parthian and Sassanian empires, the country was at times partly subject to Persia, partly to the Mogul empire, and at times divided amongst small native dynasties, of which that of Ghazni (1001-1186) was the most notable. Eventually in 1708 the Ghilji rose against Persia and set up an independent kingdom at Kandahar, and in 1717 the Afghans asserted their independence at Herat. Nadir Shah of Persia, who had levied a strong Afghan contingent for his invasion of India, was assassinated (1747), and the Afghans chose as king Ahmed, a general in Nadir's army. Ahmed reduced to his rule the whole of Afghanistan, and annexed Sindh, part of the Punjab, and Kashmir. The years following 1793 were disturbed by domestic conflict and anarchy, out of which Dost Mohammed emerged as chief (1823), assuming the title of Ameer ('commander') in 1826. Beset by Persia on the w. and the Sikhs on the e., the Ameer sent to Lord Auckland, governor-general of India, with a view to British aid in the recovery of Peshawar. His terms, refused by Britain, were accepted by Russia, leading to the siege of Herat by a Persian army, and the splendid defence of El-dred Pottinger. Lord Auckland then declared war against Afghanistan; and Sir John Keane, with 21,000 men, occupied Kandahar

and Kabul, and set Shah Shuja on the throne (1839). Dost Mohammed, who had surrendered, was sent to Calcutta; but his eldest son, Akbar Khan, continued resistance. In a revolt at Kabul (Nov. 2, 1841) Sir A. Burnes, British resident, was killed; Sir W. Macnaghten, envoy, was shot by Akbar (Dec. 23); and on Jan. 6, 1842, the garrison capitulated upon terms of a safe escort to India. Practically the whole army was massacred, or perished of hunger and exposure during the retreat, the only white man who escaped being Dr. Brydon. An avenging army under General Pollock relieved Jelalabad (April 16, 1842), demolished the citadel of Kabul (Sept. 15), and, Shah Shuja having been killed, replaced Dost Mohammed on the throne. From this time his friendly relations with Britain were marked by British aid against Persia, and by his faithfulness during the time of the mutiny. Having taken Herat, and thus consolidated the whole kingdom, he died (1863), and was succeeded by his son Shere Ali. The new Ameer's reign was greatly harassed by a series of conflicts with Azim, his brother, and Abdur-Rahman, his nephew, who occupied Kabul (1866); but he regained his throne and kingdom in 1869, and received a subsidy of money and arms from Britain, and a recognition of his northern boundary by Russia was secured for him. Alarmed by the fall of Khiva, Shere Ali sent to Simla to request an offensive and defensive alliance, with recognition of his heir-apparent, and was so deeply offended at the British refusal to accord his request that he declined to admit British agents to any part of the country, and concluded a treaty with Russia (1878). His action was regarded as hostile; the British occupied Kandahar; and Shere Ali died a fugitive from Kabul (Feb. 1879).

His son, Yakub Khan, came into the British camp, and signed the treaty of Gandamak (May 26), by which a resident was to be admitted at Kabul, the Khyber Pass and certain districts in Baluchistan were ceded to Britain, and Afghan foreign relations were to be submitted to British guardianship. In the same year, however, the envoy (Sir Louis Cavagnari) and the whole garrison were murdered (Sept. 3). General Roberts occupied Kabul (Oct. 12), and sent Yakub Khan to India. Early in 1880, Abdur-Rahman, who had invaded the Turkestan province, was suggested by Lord Lytton as a suitable ruler, and was proclaimed Ameer (July 22); and the British prepared to withdraw (Aug. 10), when news of the defeat of General Burrows at Maiwand by Eyyub Khan, and of the siege of Kandahar, arrived. Then followed Roberts's famous march to Kandahar (Aug. 9-31), and its relief and the defeat of Eyyub Khan. Abdur-Rahman regained Herat, and was occupied, during most of his reign, in putting down opposition and disaffection. As early as 1883 he had justified his selection by the British, and his rule was endowed with an annual subsidy of twelve lakhs of rupees. After the occupation of Merv by Russia (1884), it was found necessary to have the north-western boundary defined. An Anglo-Russian commission was appointed; finally, a protocol was signed at St. Petersburg (July 22, 1887). The Durand mission visited Kabul (1893) and settled the Anglo-Afghan border; at the same time the subsidy was increased to sixteen lakhs. Abdur-Rahman broke the power of the tribal chieftains by maintaining a standing army, and by skilfully husbanding the resources of his treasury. Habibullah, his eldest son, succeeded him (Oct. 3, 1901), and in 1905 signed a treaty accepting and confirm-

ing the engagements entered into by his father. Friendly feelings were further established by the Amir's visit to India in 1907. In July 1905 the Seistan Boundary Commission concluded its work of delimiting the boundary between E. Persia and Afghanistan. See Elphinstone's *Account of the Kingdom of Cabul* (1815); Sale's (Lady) *Journal* (1843); Mohan Lal's *Life of Ameer Dost Mohammed Khan of Cabul* (1846); Kaye's *History of the War in Afghanistan* (4th ed. 1890); Rawlinson's *England and Russia in the East* (1875); Durand's *The First Afghan War* (1879); Malletson's *History of Afghanistan* (1879); Bellew's *Afghanistan and the Afghans* (1879), and *Races of Afghanistan* (1880); Hensman's *Afghan War* (1881); Hamley's 'Russia's Approach of India,' *J.U.S.I.* (1885); Edwards's *Russian Projects against India* (1885); Yates's (A. C.) *England and Russia Face to Face in Asia* (1887); Yates's (C. E.) *Northern Afghanistan* (1888); Curzon's *Russia in Central Asia*, with bibliography (1889); Oliver's *Across the Border* (1890); S. S. Thorburn's *Asiatic Neighbour* (1894); Forbes's *Afghan War* (1892); Wheeler's *The Ameer Abdur-Rahman* (1895); Lane Poole's *Mohammedan Dynasties* (1896); Roberts's *Forty-one Years in India* (1897); Hanna's *Second Afghan War* (1899); Balfour's (Lady Betty) *Indian Administration of Lord Lytton* (1899); Gray's *At the Court of the Ameer* (1900); Lebedev's *Russes et Anglais en Asie Centrale* (1900); Colquhoun's *Russia against India* (1900); Mohammed Khan's *Constitution and Laws of Afghanistan* (1900), and *Life of Abdur-Rahman* (1900); Warburton's *Eighteen Years in the Khyber* (1900); Holdich's *The Indian Borderland* (1901); Hamilton's *Afghanistan* (1906); Martin's *The Amir at Home* (1907); and Holdich's *Gates of India* (1910).

Afium-Kara-Hissar, or **KARA-HISSAR-SAHIB** (anc. *Synnada*), important commercial tn., Anatolia (Khodavendikiar-Brusa prov.), 180 m. E. of Smyrna, with ry. stn. where the Anatolian Ry. joins the Smyrna system; the centre of the opium (*afium*) dist. A ruined citadel stands on a hill 800 ft. above the plain. Pop. 20,000.

Afra. (1.) A patron saint of Brescia, who became a Christian on witnessing the fortitude of her brothers when thrown to the wild beasts by Hadrian. She was martyred in 121. (2.) A patron saint of Augsburg, converted by the teaching and example of a Spanish priest who had taken refuge in her house during the Diocletian persecution. She was burned at the stake in 307.

Afragola, tn., Italy, 4 m. N.E. of Naples; manufactures straw hats. Pop. 22,500.

Afranius, LUCIUS. (1.) Roman comic poet, flourished about 100 B.C. Roman scenes and manners, for the most part of the lower classes, form the subjects of his comedies. Fragments of his works have been published by Bothe in his *Poetæ Latini Scenici Fragmenta*, and by Ribbek in *Comitorum Romanorum Fragmenta* (Leipzig, 1873). (2.) Roman general and friend of Pompey, whom he served in the Sertorian and Mithridatic wars, B.C. 77. He was elected consul in B.C. 60, and when Pompey obtained the provinces of the two Spains in B.C. 55 he sent Afranius and Petreius to govern them. On the breaking out of hostilities between Cæsar and Pompey, Petreius and Afranius were, after a short campaign, compelled to surrender at Ilerda, B.C. 49. (*Cæsar, Civil War I.*) Afranius was present at the battle of Pharsalia; and on the defeat of Pompey at Thapsus he fell into the hands of Sittius, and was slain, B.C. 46.

I.

Africa, a continent forming the southernmost prolongation of the Old World. The greater bulk of its compact mass lies between the tropics; the equator crosses it almost half-way between N. and S. The distance from N. to S. is 5,000 m., and from W. to E. (Cape Verde to Ras Hafun, S. of Cape Guardafui) 4,650 m., but its breadth at 10° S. is only about 1,800 m. In the N.E. it is separated from Asia by the deep waters of the Gulf of Aden and the Red Sea, between which it is almost joined to Asia at the Strait of Bab-el-Mandeb (14 m. wide). In the N. it is actually continuous with Asia at the Isthmus of Suez (75 m. wide), across which the shallow trough of the Suez Canal has been cut. The deep Mediterranean separates Africa from Europe in the N., but the two continents approach to within 9 m. of each other at the Strait of Gibraltar. Africa is bounded by the Atlantic in the W., and by the Indian Ocean in the E. The area is 11,500,000 sq. m., or roughly three times that of Europe. The coast-line, neglecting minor indentations, is 19,000 m. There are no true peninsulas of any size in Africa, and the islands (which are all small, with the exception of Madagascar) form but two per cent. of the total area.

Relief.—Africa is a massive platform rising out of deep seas. The continental ledge or shelf, which is covered with water not deeper than 600 ft., is everywhere narrow. It is most marked in the S., where it forms the triangular Agulhas bank. The lowlands under 660 ft. above the sea are also narrow, and represent only about 15 per cent. of the surface (*cf.* Europe, 57 per cent.). The greater part of the land between 660 and 1,650 ft. in elevation lies in the N., and is 34 per cent. of the whole; but much of the land between 3,300 and 6,600 ft.—*viz.* 19 per cent. of the whole—lies in the S. Only 2½ per cent. of

Africa is over 6,600 ft., and this is mostly in Abyssinia and the Atlas region. The average elevation of the continent is 2,130 ft.

Natural Regions.—Except for the folded chain of (1) the Atlas, which is sharply distinguished from the rest of the continent, the natural divisions are not well marked. A line from the mouth of the Nile to that of the Zambezi separates (2) East Africa from the rest of the table-land, which may be subdivided into (3) the Northern Plateau, n. of 5° n.; (4) the Central Plateau, or Congo basin; and (5) the Southern Plateau, s. of 10° s. The (6) Eastern Islands and (7) the Western Islands must also be considered as separate natural divisions.

The Atlas Mountains, which lie to the n. of a line drawn from the Wadi Draa to the Gulf of Gabes, are a continuation of the folded mountain system of Southern Europe. In the e., two parallel ranges, the Mediterranean and Saharan ranges, are separated by the Algerian Plateau, which is over 3,000 ft. high. In the w., the Great Atlas of Morocco has an average height of 10,000 ft.—its lowest pass, Tell Remt, being 7,000 ft., and its highest summit over 14,000 ft. South of and parallel to it rise the plateaus of the Little or Anti-Atlas (9,500 to 11,000 ft.).

The Northern Plateau, with an area of between four and five million sq. m., and an average elevation of 1,500 ft., is much the most extensive region of Africa. The lowlands are in the w. and n. The band of Tarso (Tibesti highlands), rising from 6,000 to 8,000 ft. high, crosses this region diagonally from n.w. to s.e., and the Upper Guinea Plateau bounds it in the s. The n. and centre of this region form the Sahara, a land of barren stony plateaus and shifting sand-dunes, crossed by a few dry valleys. In the s. the land becomes less arid, and the Niger and its tributary

the Benue flow across it to the Gulf of Guinea, the Shari to Lake Chad, and the Bahr-el-Ghazal to the Nile.

The Congo basin is a hollow in the Central Plateau formerly occupied by a great lake. This depression is almost circular in shape, and is about 1,000 ft. above the sea at its floor, rising to from 4,000 to 5,000 ft. round its rim, but rarely higher. The divide with the Shari is less than 1,500 ft. high, and the river forces its way to the w. over a still lower lip by a series of rapids to a great estuary.

East Africa is bounded on the west by the Nile and the great lakes—Albert, Edward, Tanganyika, and Nyasa. It is characterized by two lines of rift valleys—the w., that of the lakes just mentioned; and the e., that passing from the n. of Nyasa, by Lakes Naivasha, Rudolf, and Margherita, to the s. and e. escarpments of Abyssinia. The Red Sea trough and the Jordan valley are regarded by many authorities as a continuation of this e. rift. Much of the plateau s. of Abyssinia lies about 4,000 ft. above the Indian Ocean, to which it descends by a series of terraces. The lowest terrace forms the low coastal plain, which attains a considerable width only in the s. near the Zambezi delta, and in the n. in the Somali peninsula. Between the two rifts the Victoria Nyanza, with an area equal to that of Scotland, fills the lowest basin, and in the e. the land rises to an average height of 7,000 ft. in the Nandi plateau. Near the w. rift active volcanoes, such as Mt. Kirunga, are found near Lake Kivu, between Lakes Tanganyika and Edward. Farther north is the great igneous mass of Ruwenzori (variously estimated at from 16,000 to 20,000 ft.). This and the extinct volcanic peaks of Kilima-Njaro (19,200 ft.) and Kenia (17,300 ft.), which rise near the e. rift, are the culminating

points of Africa. Abyssinia is also mainly composed of young volcanic accumulations, rising in Ras Dashan to 15,000 ft. Here Jurassic rock is found beneath the loose volcanic deposits, in which the rivers have excavated gorges some thousand feet deep. In the heart of the plateau is Lake Tsana or Dembea, the source of the Blue Nile. North of Abyssinia the plateau is both narrower and lower, although it attains 9,000 ft. at the highest point. It is composed of crystalline rocks much older than the sedimentary ones of Nubia. A depression, probably an old Nile course, runs from the first turn of the great s. bend of the Nile to the Red Sea, and the towns of Berber and Suakin have arisen at its extremities.

The South African Plateau has also a high average elevation, between 3,000 and 4,000 ft.; but no great heights rise above it, except in the s.e., where the massive tables of the Drakenberg or Quathlamba Mountains reach over 11,000 ft. This plateau is divided into four regions, each over 4,000 ft., by the valleys of the Zambezi, Limpopo, and Orange—the Congo-Zambezi plateau in the n., the Matabili plateau in the e., the High Veld in the s.e., and the Damara plateau in the w. Across these most of the rivers flow in gorges, and the undulating landscape is diversified by flat-topped hills (the tables or *mesas* locally known as kopjes), which are often steep-sided. The descent to the coast is by a series of terraces, those in the e. being cut up into more rounded hilly regions, which gradually sink to the sea-line. In the s. the terrace flats widen, and form the Great and Little Karroos, each bounded on its s. side by a parapet of older folded mountains, the Zwarte and Lange Bergen chains.

Coastal Belt and Islands.—The coast-line is very regular. Islands

are few, and the coast is either steep, or a flat, sandy plain of varying width, leading to the steep terraces of the inland plateau. The n.w. coast is steep from the Wadi Draa to Cape Bon, and from the Barka peninsula to the Nile. Between the Atlas and Barka a low coast curves s., and forms the Gulf of Gabes in the w. and the Gulf of Sidra in the e. The e. coast, along the Red Sea and to beyond Cape Guardafui, is straight, regular, and steep. The island of Sokotra is an outlier of the Somali peninsula, which protrudes eastwards s. of the Gulf of Aden like a horn, and is bordered on the e. by a low plain. From the equator to Delagoa Bay the coastal plain is narrow, with hills which here and there approach the sea. In this portion of the coast are two incurves and outcurves which have no special names. In the n. incurve lie the little islands of Pemba, Zanzibar, and Mafia; and off the s. incurve is the island of Madagascar, which is separated from the mainland by the Strait of Mozambique, having the Comoro Is. in the n. The coast is regular s. of Delagoa Bay, both round the s. coast and n. along the w. coast as far as the mouth of the Orange. The rest of the w. coast is bordered by sandy shores, except at the head of the Bight of Biafra and in some parts of the N. Guinea coast. The Gulf of Guinea is formed where the w. coast changes from a n.s. to an e.w. direction, and is divided by the Niger delta into two bays—the Bight of Biafra in the e., and the Bight of Benin in the w. A line of volcanic islands, including Fernando Po, Prince's I., St. Thomas, and Annobon, rises above the Bight of Biafra. The N. Guinea coast, trending e. and w., is known by various names—*e.g.* the Slave Coast (immediately w. of the Niger delta), the Gold Coast, the Ivory Coast, the Grain or Pepper Coast, each

succeeding the other to the w. Off Cape Verde lie the Cape Verde Is., and off the n.w. the Canary and Madeira groups.

Climate.—Three-quarters of Africa lies between the tropics, and here the days are of nearly uniform length, with, except for clouds, almost twelve hours of bright sunshine every day. At sea-level the mean temperature of the coldest month is over 70° F., except near the extremities of the continent, where it falls to 55° F. Round the tropics the daily and seasonal ranges of temperature are great—over 30° F. between the warmest and coldest month; but in equatorial regions, and towards the n. and s. of the continent, where it is bordered by seas, the range is small. A narrow strip of the s.w. coast is kept cool at all seasons by an upwelling of cold water along the coast and by low fogs (*cf.* Port Nolloth, 40 ft. above the sea, 59·5° F. in Jan., 54·3° in July, and 57·2° for the mean ann., with Springbokfontein, 3,200 ft. above the sea, Jan. 73·7°, July 51·7°, and the mean ann. 63°). At the equinoxes a belt of rising air and heavy rains is found near the equator, and this moves n. and s. with the zenithal sun; so that round the equator there are two rainy seasons, and in some regions almost constant rains, while at the tropics there are one wet and one dry season.

There are nine climatic regions in Africa:—1 and 2. The Mediterranean and extreme s.w. regions, with mild winters (during which rain falls) and warm, dry summers. 3 and 4. The n. and s. desert regions, round the two tropics, where little rain falls, and the extremes of temperature are considerable. In the N. Sahara the rain showers usually come in winter; in the S. Sahara and Kalahari they usually occur in summer. 5 and 6. The subtropical regions of summer rains,

with a smaller range of temperature, and a short but adequate rainy season at the height of summer. 7. The equatorial regions, hot and wet nearly all the year round, but with the maximum rainfall when the sun is at the zenith. These include the Congo basin and the Guinea Coast, the e. coast of the mainland from the equator to the Tropic of Capricorn, and the e. coast of Madagascar. 8. The higher land surrounding these regions forms the high plateau regions. Owing to their elevation the temperature is lower and the rainfall less, and, except on the great lake plateau, there is only one rainy season in summer. 9. The high mountain region, above 5,000 ft.

Hydrography.—Each climatic region has its own type of river, and most African rivers, where they leave the plateau, have their courses impeded by cataracts, usually in their upper courses. The rivers of the equatorial rainy regions are constantly supplied with water, and where they flow through flat ground—as in the case of the Congo between Stanley Falls and Stanley Pool, and of the Lower Niger—they spread out into numerous channels or loops, so that the limits between water and land are indefinite. The Zambezi and the Niger are fullest after the summer rains, and both reach the sea across great deltas fringed with mangrove swamps. The E. African rivers receive most rain in summer. The Orange (which flows in a deep gorge, with many rapids in its course) and the Senegal have their sources in coastal lands, with summer rains; but in their lower courses they flow through arid regions, where their volume steadily diminishes. The deserts are intersected by numerous wadis, filled only after heavy rains. The Nile crosses all the climatic zones, and consequently is an epitome of African rivers. The greatest

precipitation over the basin, considered as a whole, occurs in the northern summer, both in the Sudan and Abyssinia, causing the annual floods of the Nile, to which Egypt owes its very existence. The great lakes act as reservoirs, and in summer they are supplemented by the temporary lake No, which is formed in the flat Sudanese lands.

Flora and Fauna.—Physiologically, the biological regions correspond with the climatic ones. Morphologically, the Sahara is a barrier between the Mediterranean and true African forms. Hence the species differ greatly in Barbary and at the Cape, in the Sahara and the Kalahari, although there is a general resemblance in the manner in which they have become adapted to similar environments. The regions with winter rains are characterized by heaths and other dry, scrubby plants; water-storing species, like mesembryanthemum; and thick-skinned plants, such as the agave. The olive is typical of the wetter regions of the Mediterranean, but does not flourish in the s. The deserts have a very poor flora, of even more spiny, leathery, or water-storing plants than the above. Animals are few, reptiles being relatively important. The grass lands consist of poorer scrub near the desert and in the karroos of the s. The most important grass lands are the savannas, which are continuous from the Upper Niger across the Sudan by the Eastern and the Matabili plateaus; and the High Veld, a branch running westwards along the Congo-Zambezi divide. Flat-topped trees are dotted about the savannas, and form continuous woods along the river courses. The savannas are very rich in animal life, the most numerous and characteristic being antelopes. On the borders of the forest lions, elephants, buffaloes, leop-

ards, hyænas, and giraffes are still found; but elephants and most other big game are becoming scarce, owing to indiscriminate shooting by hunters. The double-horned rhinoceros is abundant on some of the grassy plateaus, while the hippopotamus and crocodile are found in the rivers. Among the birds are the ibis, pelican, and secretary bird. Termites, tsetse flies, and mosquitoes require special mention. The wet jungles of the equatorial forests cover the coastal plain of Upper Guinea, the lower part of the Congo basin, and the E. of Madagascar. They are characterized by the number of palms, their comparative poverty in mammals, and their wealth of bird and insect life. The gorilla, chimpanzee, and other monkeys, the hippopotamus and elephant, are among the most important mammals.

Population.—The population is estimated at 170,000,000, or fifteen inhabitants per sq. m. Vast areas are uninhabited, especially in the deserts, and the dense wet jungles are but sparsely peopled. The most populous regions are the savanna lands and the N. and S. coasts. In the W. Sudan, the Nile valley, and between the Atlas and the coast the density is between fifty and a hundred per sq. m.

Economic Conditions.—The majority of native Africans live partly by hunting, partly by superficial cultivation of the soil or by pastoral pursuits. In the s. and N.W., in the Nile valley and Abyssinia, agriculture flourishes. Tropical plantations are being extended in the European possessions of W. and E. Africa and Madagascar. The mineral wealth is in parts great. Iron is worked by many native tribes, gold and diamonds have attracted Europeans to S. Africa, and gold is found along the Gold Coast and elsewhere. The economic possibilities are also very great. The warm, moist

regions might, or do, produce abundantly all kinds of tropical products; but the steamy heat, though favourable to vegetation, is unhealthy even for the native negro. On the lands between the tropics over 4,000 ft. above the sea Europeans can live and maintain a fairly healthy existence with care; and although neither temperature nor rainfall is so high as in the lowlands, the savannas might be made to yield rich crops, as has been proved in Nyasaland. The desert regions are healthy, and are fertile where water can be obtained either by storage or from artesian wells. The labour problem is one of the chief difficulties in opening up Africa.

Races.—The majority of Africans are Negroes, or have strains of Negro blood in them. In the N., however, the Mediterranean long-headed white race is represented among the Berbers, and the alpine or mountain long-headed race by the Arabs. About 1,000,000 Europeans live in the N., and as many in the S. The black races are divided into the true Negroes of the Sudan, and the diverse races S. of the Congo-Nile divide—those who speak Bantu languages. In the equatorial forests are a number of dwarf races, such as the Akka, and in the S.W. the small Bushmen and taller Hottentots. The W. of Madagascar is inhabited by Negroid peoples, who, some authorities contend, are of Eastern origin. Much of its E. plateau is peopled by Hovas, probably of Malay origin.

Languages.—Various classifications of the African languages have been proposed. The following proceeds on the basis of racial difference:—

(1.) SEMITIC, the tongues spoken by the Arabs and certain Abyssinian tribes. They were introduced into the continent by invaders or immigrants.

(2.) HAMITIC, including Libyan

and various Abyssinian dialects, and the languages of the Berbers, Tuaregs, and other Saharan tribes.

(3.) NEGRO, spoken mainly in the Beled-es-Sudan, or 'Land of the Blacks.' Though physically similar, the Sudan negroes speak a bewildering variety of languages.

(4.) BANTU, spoken by all the black races S. of a line running roughly eastward from the head of the Gulf of Guinea. Of this group the Zulu is the most perfect type.

(5.) HOTTENTOT-BUSHMAN, spoken by the Hottentots and Bushmen, whose precise relationship is as yet in doubt. The language is distinguished by 'clicks.'

(6.) BAGHIRMI, spoken in the Central Sudan.

(7.) KANURI and TIBU, allied languages in the Eastern Sudan.

Several dwarf tribes S. of 8° S. lat. still retain their own languages. The Malagasy language of Madagascar is related to that of Malay.

Racial Movements.—In the S. Bushmen and Hottentots formerly roamed over a much wider area than at present, but have been driven towards the more barren S.W. by advancing Bantus, who are more or less pastoral peoples, some with a powerful military organization. The most remarkable of these Bantus are the Zulus, who devastated much of east South Africa early in the 19th century, and from whom the Matabili warriors have sprung. The Arabs have expanded steadily for the last thousand years, and their traders and slave-traders penetrate as far S. as the Tropic of Capricorn. Mediterranean Africa has witnessed Egyptian, Phœnician, Grecian, and Roman civilization. Central and S. Africa are isolated from Mediterranean culture by the Sahara and the sea. The Portuguese navigators of the 15th century made known the central and S. coasts to Europe, the

Cape having been rounded by Diaz in 1487. The Portuguese traded in Upper and Lower Guinea, and in the s.e.; but the Dutch were the first to settle in the temperate lands of the s., round their 'refreshment station' at Table Bay. Hither, in the 17th century, came refugee Huguenots, and the resulting mixed race gradually spread over the s. terraces and the High Veld. In the e. of these terraces, and in Natal, British and Germans settled in some numbers, especially in the middle third of the 19th century. Indian coolies have been brought as labourers to Natal, as Malays were formerly brought to the Cape, and Chinese were imported for the gold fields. Italians, Spanish, and French have settled on the African shores opposite their own lands.

Exploration of the Interior.—In every case the exploration of the great rivers of Africa has been from the source to the sea. Mungo Park, at the end of the 18th and beginning of the 19th century, followed by Lander, solved the Niger problem. Laing and Caillié reached Timbuktu, the mysterious, early in the 19th century. Barth reached it in the 'fifties by crossing from Tripoli to the s. and going up the Niger. Nachtigal, Schweinfurth, and Junker are the chief explorers of the E. Sudan. Speke and Grant traced the Nile from Lake Victoria, and Baker discovered Lake Albert in the 'sixties, the Blue Nile having been followed by Bruce in the previous century. Oswell, accompanied by Livingstone, crossed the Kalahari, discovered Lake Ngami, and reached the Zambezi, which Livingstone afterwards explored, and gave up his life in trying to solve the problem of the Congo (which he took to be the Nile) in 1873. Tanganyika was reached by Burton and Speke in 1858, Cameron crossed the Congo

basin in 1874-5, and Stanley followed the great river to its mouth in 1876-7. In Central Africa, Stanley, Emin Pasha, Joseph Thomson, Johnston, Wissmann, Baumann, and many others, filled in our knowledge during the last quarter of the 19th century, as did French explorers on the Niger. Exploration during the last few years has been mainly in connection with the Central Equatorial regions, Northern Nigeria, the Algerian Sahara, and notably with the Ruwenzori Mts. and the regions around Lake Chad.

Political Spheres.—European states in the last fifteen years of the 19th century marked off protectorates and spheres of influence, so that only three states in Africa still remain nominally independent—Morocco in the n.w., Abyssinia in the e., and the republic of Liberia on the Guinea Coast. In N. Africa, France is overlord of all w. of and including the Tarso Mts. and n. of the Congo-Ubangi, except Morocco, Spanish Rio de Oro, Portuguese Guinea, British Gambia, Sierra Leone, Gold Coast, and the protectorates of N. and S. Nigeria, and German Togoland and Kamerun. Tripoli and Barka are Turkish. Egypt is nominally under Turkish suzerainty, but is controlled by Britain. In the Nilotic Sudan this Anglo-Egyptian co-dominion is predominantly British; and British interests alone prevail in the Uganda and E. African protectorates and in Zanzibar. Round Abyssinia on the e. and s. are the Italian Eritrea and Somaliland, separated by French and British Somaliland. The rest of the E. African plateau is German to the Rovuma, and Portuguese beyond to Delagoa Bay. In the w. the Congo basin is controlled by Belgium, Angolaland by Portugal, and Damara and Namaqua lands by Germany. The rest of Africa s. of Tanganyika and Nyasa is

British, forming the Nyasaland Protectorate—N. and S. Rhodesia, Bechuanaland, Transvaal, Orange Free State, Natal, and Cape of Good Hope, the last four being original provs. of the Union of South Africa. Madagascar, the Comoro Is., and Réunion are French; the other E. African islands—Mauritius, Admiralty, Rodriguez, Seychelles, and Sokotra—are British. Portugal owns Madeira, the Cape Verde Is., Principe, and São Thomé; and Spain the Canaries, Fernando Po, Annobon, and Corisco Bay in W. Africa. Ascension and St. Helena, on the mid-Atlantic ridge, are British. Roughly, of the 11,500,000 sq. m. Great Britain has secured about 3,000,000, France, 4,000,000, Egypt (including the Anglo-Egyptian Sudan), the Congo State, Germany, and Portugal, approaching 1,000,000 sq. m. each, the remaining area being divided between Italy and Spain and the independent kingdoms of Abyssinia and Morocco.

Communications.—In addition to the telegraph lines and railways extending throughout the more settled divisions of Africa, a telegraph line to stretch overland from Cape Town to Cairo was begun by the late Cecil Rhodes in 1893. See AFRICAN TRANS-CONTINENTAL TELEGRAPH.

The project for a Cape to Cairo Railway running as far as possible through British territory, and serving as a link to bind together the various sections of British Africa, was also due to Cecil Rhodes. The direct distance is about 5,700 m. From Cairo the railhead has been carried southwards (except for the river gap between Aswan and Wady Halfa) to Wad Medani, 120 m. beyond Khartum. From Cape Town the line has been carried N. as far as Broken Hill, and from there linked up with the Congo railways by a line of 134 m. to the s. frontier of the Congo

Free State, 2,147 m. from Cape Town. Railways into the interior of the Continent have been constructed in all the British possessions as well as in the French and German territories, and further extensions, on an enormous scale, of these lines and the laying of new railways are proposed and under construction.

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Africa, a British first-class battleship of 16,350 tons and 18½ knots, launched at Chatham, May 1905.

Africander, or AFRIKANDER, a native of S. Africa descended from European parents settled there.—AFRIKANDER BUND, a S.

African association, formed (1879) for the furtherance and consolidation of Afrikaner influence in S. Africa. Its founders were Borchsenius, Du Toit, and Hofmeyr. In addition to the Cape, the organization embraced the Transvaal and the Orange Free State, and after the Jameson raid (1895) it became Boer rather than Afrikaner. In the Anglo-Boer war of 1899-1902 it sympathized warmly with the Boers. See *Political Hist. of England* xii. 15 (1907).

African Lakes Trading Corporation, an association (Glasgow) trading in Africa, particularly on Lake Nyasa, the Zambezi, and the Shire. It was founded in 1878, and from 1885-96 was engaged in almost continuous warfare with the Arab slave-traders.

African Lily. See AGAPAN-THUS.

African Steamship Company carries on a passenger and goods traffic between Liverpool and the Continent and the W. Coast of Africa. Incorporated by royal charter in 1852. It owns a fleet of twenty-two steamships, aggregating 68,721 tons gross. It is now managed, in conjunction with the British and African Steam Navigation Co. Ltd., by Messrs. Elder, Dempster & Co.

African Teak (or AFRICAN OAK), a heavy, hard timber used in shipbuilding, obtained from *Oldfieldia africana* (Euphorbiaceæ).

African Transcontinental Telegraph, a line conceived by Cecil Rhodes, and begun by him in 1893, to stretch overland from Cape Town to Cairo. The line, which is erected on light iron posts, runs from Cape Town to Tete, on the Zambezi; thence to Blantyre, Abercorn, and Ujiji (on Lake Tanganyika), where it stops for the present. When construction is resumed it is proposed to take the line from Ujiji through German East Africa to Bukoba on the west coast of Victoria Nyanza;

then through Uganda to Gondokoro on the Nile, which is the present terminus of the Egyptian telegraphic system. The total length would be over 5,000 miles. See article by H. Hensman in Vol. I. of *Engineering Wonders of the World* (1909).

Africanus, a title of honour borne by the two greatest Scipios, in commemoration of their African victories. (See SCIPIO.) Also, the name of—(1.) SEX. CÆCILIUS, a Roman jurisconsult and orator of the time of Antoninus Pius. Extracts from his *Libri IX. Quæstionum* appear in the *Digest*. The remains of his works have been expounded by Cujas, and annotated by Scipio Gentili (1602-7). (2.) SEX. JULIUS, a Christian writer of the 3rd century, who lived at Emmaus in Palestine, but visited Alexandria. His works, with the exception of extracts found in Eusebius, have been lost.

Afridis, an Afghan or Pathan people, numbering about 300,000, inhabiting the mountainous region lying s. of the Hindu-Kush, their great stronghold being the high plateau of Tirah, w. of Peshawar. They have no distinctly national life, but consist of a number of clans, often at feud with each other. Fanatical Mohammedans and fiercely independent, they resented the inclusion, in 1893, of their territory within the British frontier; and their consequent revolt in 1897 led to the Tirah campaign of 1897-8, in which a force of nearly 35,000 British and Indian troops took part.

Afrit, or AFREET. See IFRIT.

After Birth. See LABOUR.

After-damp. See CHOKE-DAMP.

After-glow, the glow sometimes seen in the sky after sunset, illuminating the upper strata of the clouds, usually in shades of red and yellow; due to the presence of fine dust in the higher atmosphere. It is most frequent

in October and November, when the earth passes through meteoric swarms. During the autumn and winter of 1883, following the tremendous eruptions of Krakatoa, in the Str. of Sunda, peculiarly bright and continuous examples were seen in every part of the globe; this was also the case in 1902-3 after the eruption in Martinique.

After-images are representations to the mind of bygone impressions. They are sensations for which at the time of their occurrence there is no present external stimulus. They may be due to—(1) a simple persistence of sensation; (2) a recurrence of sensation; or (3) fatigue of the nerve cells concerned in the reception of previous stimuli. The two former are positive images, while the third is negative. Negative after-images are manifested chiefly in relation to the sense of sight, and depend upon exhaustion of the receptive sight mechanism.

Afzelius. (1.) ADAM (1750-1837), a Swedish naturalist, pupil of Linnæus; demonstrator of botany at Upsala (1785); visited Sierra Leone (1792); lived for a time in London as secretary to the Swedish ambassador; and from 1812 was professor of materia medica, Upsala; author of numerous botanical works. (2.) ARVID AUGUST (1785-1871), Swedish poet, and pastor (1828-71) of Enköping; translator of the *Edda*, and editor, with Geijer, of *Svenska Folkvisor från Forntiden* (1814-17)—*i.e.* 'Ancient Swedish Folk-songs.'

Aga, or AGHA, a Turkish title borne by officers in the army under the rank of major, and by various lower officials in the ministries.

Agades, AGHADES, or AGADEZ, tn., cap. of oasis of Air or Asben, Sahara, Africa; lat. 18° 10' N., and long. 8° E.; an important centre on caravan route between the Sudan and Tripoli. Pop. 8,000 (Tuaregs).

Agama, a genus of lizards with many species, common in Africa and Asia. An example is *A. stellio*, which occurs in Egypt, Asia Minor, and parts of the Grecian Archipelago. It reaches a length of about 15 in., and is brown in colour.

Agamemnon, son of Atreus or Pleisthenes, husband of Clytemnestra, and father of Orestes, Iphigenia, Chrysothemis, and Electra. He was king of Mycenæ in Argos, then the richest city of Greece, and because of his position became leader of the Greeks against Troy. His character, as depicted by Homer, is eminently that of a king: a great warrior, though not the greatest; wise in counsel, always dignified in speech and action, yet capable of displays of arbitrary temper and caprice. After the fall of Troy he was murdered, on his return home, by his unfaithful wife and her paramour Ægisthus.

Agamemnon, a British battleship launched in 1906. Displacement, 16,500 tons; speed, 18 knots. The name is associated with Rodney's victory off Les Saintes (1782), Toulon (1793), Bastia (1794), Calvi (1794), battle of Genoa (1795), battle of Hyères (1795), Copenhagen (1801), Calder's victory off Ferrol (1805), Trafalgar (1805), Duckworth's victory off San Domingo (1806), Copenhagen (1807), and Sebastopol (1854).

Agami (*Psophia crepitans*), one of the trumpeters, a family of birds found in tropical America.

Agamidæ, a family of lizards in which the teeth are inserted on the edge of the jaw (acrodont). The family includes such interesting forms as *Draco volans* (the flying lizard of Java), the hideous *Moloch horridus* of Australia, and the curious frilled lizard (*Chlamydosaurus*), also from Australia.

Agamogenesis. See SEX.

Agaña (SAN IGNACIO DE AGAÑA), fort. tn., cap. of Guam or Guahan I., Pacific Ocean; lat.

12° N., and long. 145° E. Pop. 6,000.

Agapæ, the love-feasts of the early Christians. Usually associated with the Eucharist, they continued the Last Supper, served as an expression of the Church's brotherhood, and helped to relieve the poorer members. When the converts from heathenism increased, these brought with them the associations with the funeral feasts, and the agapæ were often celebrated on the anniversary of departed friends. (See Dr. Keating, *The Agapé and the Eucharist*, 1901; Dr. Anderson, *Proc. Soc. Antiq. Scot.*, xi. 387). Because of abuses connected with them, the feasts were discontinued, but have been revived in the Herrnhuter community and among the Wesleyans.

Agapanthus, the African lily, a native of the Cape, with white or blue flowers. One species is grown out of doors in the milder maritime parts of England, but requires protection in winter; others are beautiful conservatory plants.

Agapemone ('abode of love'), called also Lampeter Brethren, the community of mystics founded (1859) at Bridgwater, England, by Henry J. Prince (1811-99), an Anglican clergyman, a native of Bath.

Agapetæ, a name given to virgins of the early church, who lived with monks professing celibacy, and between whom was said to exist a bond of spiritual love. The practice was denounced by Jerome and other fathers, and was put down by the Lateran Council in 1139. Dill, *Roman Society in the Last Century of the Western Empire* (1898).

Agapetus I. (d. 536), a native of Rome, was elevated to the papacy in 535. He was unsuccessful in a mission to Constantinople which he undertook in 536, with a view to making peace with Justinian on

behalf of Theodatus, king of the Eastern Goths. He died there.

Agapetus II., a native of Rome, occupied the papal chair from 946-955. In 951 he refused the request of Otto I., king of Germany, that he would crown him emperor, in spite of the friendly relations between Otto and himself.

Agar, or AUGUR, tn., on rocky height, 1,600 ft., in Gwalior, Central India Agency; about 100 m. N.W. of Bhopal. Pop. 30,000.

Agar-agar, or AGAL-AGAL, Malayan names for a seaweed (*Plocaria lichenoides*), 'Ceylon or Jaffna moss.' It forms an article of trade between China and the E. Indies. It is made into nutritious jellies, and the Chinese also use it as a paper varnish. Edible birds'-nests are made from another *Plocaria* on the coast of Siam. Agar is used by bacteriologists for the cultivation of bacteria.

Agardh. (1.) KARL ADOLF (1785-1859), professor of botany at Lund from 1812 to 1835; best known as a classifier of algæ. (2.) JAKOB GEORG, his son (1813-1901), also professor at Lund; published works on algæ—*e.g.* *Analecta Algologica* (1892-9).

Agaric Mineral, a soft light variety of calcite or calcium carbonate. Bricks made in Tuscany from a stone of this name are so light that they float in water.

Agassiz, ALEXANDER (1835-1910), zoologist, only son of Louis Agassiz, was born at Neuchâtel, Switzerland. He graduated at Harvard University, U.S.A., in 1855; became assistant curator (1860-5) and chief curator (1874-97) of the Museum of Comparative Zoology there; and in 1875 founded the zoological station at Newport, in Rhode I. He specially distinguished himself by his studies in marine zoology—*e.g.* echinoderms, starfishes, jellyfishes, etc. His publications include books on these branches of marine fauna; *Report on the Echini of the 'Chal-*

lenger' Expedition (1881); *Three Cruises of the U.S. Coast and Geodetic Survey Steamer 'Blake,' 1877-80* (1888); *The Islands and Coral Reefs of Fiji* (1899). In 1874-5 he surveyed Lake Titicaca and the copper mines of Peru and Chile, and in 1901-2 investigated the coral formations of the Maldive Is. He left over £200,000 to Harvard and other institutions to promote zoological investigations.

Agassiz, LOUIS (1807-73), a Swiss naturalist, especially distinguished in ichthyology and the study of glaciers. He became (1832) a professor at Neuchâtel. In 1839 he began his never-completed *Histoire Naturelle des Poissons d'Eau Douce de l'Europe Centrale*, and published between 1833 and 1843 the five vols. of text (with five more of plates) of his *Recherches sur les Poissons Fossiles*. Between 1839 and 1845 he made (chiefly on the Unteraar Glacier in the Bernese Oberland) some of the earliest recorded observations on the motion of glaciers. Narrative accounts of their journeys were published by Desor in his two series of *Excursions et Séjours sur les Glaciers* (1844-5); and Agassiz embodied his scientific observations in his *Études sur les Glaciers* (1840) and his *Nouvelles Études* (1847). His theory of glacier motion (dilatation of water frozen in the crevasses) soon gave way, however, to that formulated by Forbes (gravitation *plus* plasticity). In 1847 Agassiz accepted the newly-founded professorship of zoology and geology at Harvard University, Cambridge, Massachusetts—a post which he held till his death, having in 1862 become a naturalized citizen of the United States. He made many scientific journeys in America (particularly one to Brazil in 1865), and in 1859 founded at Harvard the Museum of Comparative Zoology, which is especially rich in fishes. Agassiz's memory is preserved in the Alps

by the Agassizhorn (12,980 ft.), in the Bernese Oberland; and in Arizona, U.S.A., by a peak (10,000 ft.) near the Great Cañon of the Colorado. See *Life and Letters of L. Agassiz*, by his wife (1885).

Agassiz Association, a society first organized in 1875 by H. H. Ballard, president of Lenox (Mass.) Academy, to stimulate scientific interest among his students, and in honour of Louis Agassiz. In 1880 a general association was organized, with local divisions called 'chapters,' and with corresponding members in all parts of the world. The association was incorporated in 1892, and now consists of over ten thousand members.

Agasti, or AGASTYA, a Vedic poet to whom certain hymns are attributed; mentioned in the *Ramayana* as chief of the hermits of the south, and in Tamil literature revered as the first teacher of the Dravidian tribes in literature and science.—The AGASTYA-MALAI is a conical hill (6,150 ft.) in Travancore State, Madras, noted as the haunt of the poet's spirit.

Agate, one of the many minerals which consist of cryptocrystalline silica, and which may be included under the general name of chalcedony. (See also JASPER, ONYX, PLASMA, CHRYSOPRASE, CARNELIAN.) It is also known as 'Scotch pebble,' and is largely used in the manufacture of jewellery. It enters into the construction of certain scientific instruments—*e.g.* the knife-edge on which the beam of a chemical balance is suspended—both because of its great hardness (it is a little harder than steel), and because moist air and chemical fumes do not rust or tarnish it. It is, however, somewhat brittle. The chemist also uses agate mortars and pestles for pulverizing hard substances. Agate is found chiefly in rounded nodules with irregular surfaces, formed most frequently in cavities of

igneous rocks into which silica, dissolved in water, has percolated. Layer after layer has been laid down within this cavity, the outermost and earliest being often a coating of green chloride or celadonite. The deposited silica, if pure, is colourless or gray, and translucent; but various impurities are usually present, causing different colours in successive layers. The commonest of these are the oxides of iron, producing red, brown, or yellow; but bands of green, purple, pink, and other tints are often found. The layers follow the outlines of the original cavity, and hence are mostly concentric, but are in other cases angular, as in 'fortification' or 'parallel ribbon' agate. In Scotland, the use of agate in jewellery formerly gave rise to a considerable industry, which has been less prosperous of late years. The principal sources of Scotch agate are Burn Anne, near Galston, Ayrshire, and the neighbourhood of Montrose. These come from decomposed igneous rocks of Old Red Sandstone age. The great centre of agate working has for long been Oberstein, in Germany, where it is the chief industry of the population. Agate was formerly found abundantly in that district, as also in Hungary and various other places in Europe; but for many years the chief sources have been Brazil and Uruguay. The natural agate may be treated by various methods to heighten and vary its colours. Its layers are often porous, though not equally so, and will absorb solutions of colouring matters to a varying extent. One method is to immerse in solution of sugar, or to boil in oil: when this has penetrated to some depth, the agate is placed in sulphuric acid, which carbonizes these organic matters, producing brown and yellow rings of various intensity. It is believed that other secret methods are employed.

Agatha, St. (d. 251), Sicilian maiden of the 3rd century, canonized on account of her indomitable chastity. Her festival is celebrated on February 5.

Agatharchides, or AGATHARCHUS, Greek historian and geographer of the 2nd century B.C., born at Cnidus, in Asia Minor. He wrote about the campaigns of Alexander the Great and the history of his successors the Diadochi, and described the Nile and its regions. Only fragments of his works survive.

Agathias OF MYRINA (536-582), an advocate at Constantinople, whose work *On the Reign of Justinian* (five books, covering the period 552-558) was a continuation of Procopius, and was used by Gibbon (*Decl. and Fall*, Bury's ed., vol. iv. p. 420, etc.). Ed. in Bonn Series by Niebuhr; by Dindorf in *Hist. Græc. Minores*, vol. ii. (1871).

Agathocles, tyrant of Syracuse (361-289 B.C.), born at Rhegium, Italy; emigrated with his father to Syracuse, and entered the army as a common soldier. There he gained the favour of Damas, whose widow he married, and thus became the richest man in Syracuse. Having in 317 created an army of adventurers, he assembled about four hundred of the rich and influential citizens and killed them. During the ensuing two days four thousand people were slain, as many banished and their property confiscated, and Agathocles was proclaimed tyrant of the town. To gain popularity he cancelled all debts, and divided the confiscated property among the poor; framed good laws, regulated the finances, and created a powerful army and navy. By conquering nearly the whole of Sicily, he came into collision with the Carthaginians. They sent to Sicily an army under Hamilcar, who defeated Agathocles in 310, and besieged him in Syracuse. Upon this Agathocles conceived

the daring project of attacking Carthage. He sailed to Africa, defeated the Carthaginians, and subdued the coast of N. Africa, when he was recalled by the victories of Agrigentum against Syracuse. He defeated the Agrigentines, re-established order in Syracuse, and returned to Africa. But in 306 he suffered defeat, and had to flee back to Sicily. After concluding peace with the Carthaginians, he once more became master over Syracuse, and over most of the Greek cities in Sicily. His government was now marked by good laws and peaceful administration. In 289 he committed suicide, to escape the effects of poison administered by a slave at the instigation of one of his grandsons. His *Life* was written by Diodorus Siculus.

Agathon (c. 447-400 B.C.), Athenian tragic poet, contemporary and friend of Euripides, Aristophanes, and Socrates. He appears to have most nearly approached the great trio, Æschylus, Sophocles, and Euripides, and was the first to write a play, *Anthos* ('The Flower'), with an invented plot; other writers had always based their dramas on the national legends. He is introduced as a speaker in Plato's *Symposium*.

Agave, or AMERICAN ALOE, belongs to the order Amaryllidaceæ; it is also called the century plant, from the mistaken belief that it lives a hundred years before flowering, then flowers and dies. It lives for a varying number of years before flowering; the flowering axis sometimes rises to 20 ft. or more; then the plant apparently dies down to the ground; but a lateral bud springs from the underground part of the stem, and a new plant is formed. The Mexicans grow the plant to form dense hedges, and remove the buds for the sugary sap which exudes from the wounds thus made. This sap is collected in large quantities, and fermented

and distilled to form *pulque*, the national drink of Mexico. Other agaves of tropical America are known as maguey, and their fibres are the source of pita thread. *A. rigida* gives sisal hemp, used in rope-making. The leaves yield a substitute for soap, and are also used for roofing.

Agde, dist. tn. (canton), dep. Hérault, France, on river of same name, 2 m. from the Mediterranean, 30 m. s.w. of Montpellier. Pop. 8,500.

Age. (1.) A historical period marked off by special characteristics. Thus, we speak of the Homeric Age, the Age of Pericles, the Augustan Age, the Elizabethan Age, to denote certain broad distinctions in literature and art; and further, we refer to certain ages as the Golden Age, the Iron Age, etc.—a form of reference originating with Hesiod, who divided the world's history into five periods:—(a) *The Golden Age*, or reign of Saturn; of patriarchal simplicity, when the earth yielded her fruits spontaneously, and spring was eternal. (b) *The Silver Age*, or reign of Jupiter; a lawless time, when troubles began, labour was imposed on man, and property began to be held. (c) *The Brazen Age*, or reign of Neptune; a period of lawlessness, war, and violence. (d) *The Heroic Age*, when men began to aspire to better things. (e) *The Iron Age* (Hesiod's own), from which justice and piety had disappeared (Hesiod's *Theogonia*). Ovid followed Hesiod, leaving out the Heroic Age. Varro (*Fragments*) recognized three ages:—(a) *Before the Deluge*; (b) *after the Deluge to 1st Olympiad*—mythical period; (c) *after the 1st Olympiad*—historical period. Lucretius also noted three:—(a) *The Age of Stone*; (b) *the Age of Bronze*; (c) *the Age of Iron*. This classification is also followed by modern archæologists, but with a special meaning. (See ARCHÆOLOGY.)

Historians divide European history from the fall of the Roman empire to the beginning of modern times into certain ill-defined periods:—(a) *The Dark Ages*, marked by a decline of civilization, brought about by the influx of barbarians from the N. and E., extending to about the 11th century (Hallam). (b) *The Middle Ages*, or the 1,000 years between the fall of Rome (455) and the great movements (spread of humanism, discovery of America and seaway to India, invention of printing, reformation, etc.) of the 15th and 16th centuries. (c) *The Feudal Ages*, from the 10th to the 16th century. (2.) The word is also applied to the term of human life; and, again, to various stages of that life—as in the memorable passage describing 'the seven ages of man,' delineated by Jaques in *As You Like It* (ii. 7). For the biological consideration of length of life, see LONGEVITY. (3.) For legal distinctions, see MAJORITY and MINORITY.

Agen (anc. *Aginum*), cap. of dep. Lot-et-Garonne, France, on r. bk. of Garonne, 75 m. S.E. of Bordeaux; seat of a bishop and of an appeal court; plum-trees extensively grown. The staple industry is dried plums. Birth-place of Joseph Scaliger and Lacépède. Pop. 23,000.

Agence Havas. See HAVAS AGENCY.

Agent. See PRINCIPAL AND AGENT.

Ageratum, a genus of Compositæ, with white or lavender flowers; used as summer bedding plants, mostly in borders, for which they are well adapted on account of their compact and free-flowering habit.

Agesilaus (445–360 B.C.), king of Sparta from 398–360. After the death of his brother he became king with the aid of the general Lysander. Although insignificant, ugly, and lame, he soon made

his great abilities felt. At this time Sparta was at the height of her power. Agesilaus resolved to attack the Persians. He invaded Asia, and defeated them in many battles, and in 396 gained a great victory at the river Pactolus, after which he was preparing to penetrate into the heart of the Persian empire and liberate the subjugated peoples, when he was called back to Sparta, which was threatened by a coalition of Athenians, Thebans, etc. Agesilaus beat the confederates at Coronea (394). In 371 Sparta was defeated by the Thebans, under Pelopidas and Epaminondas, at Leuctra, after which she lost her supremacy in Greece; indeed, her independence was in jeopardy. But the death of Epaminondas at Mantinea in 362 freed Sparta from her danger. After this Agesilaus once more turned his attention to the Persians. In 361 he went to Egypt, at the request of the king, Tachos, who promised him an army against the Persians; but upon his failure to do so, Agesilaus helped Nectanabis to become king. Agesilaus perished in a tempest while returning from this expedition. Xenophon has written his *Life*; also Cornelius Nepos and Plutarch.

Agglomerate, volcanic ash in which are scattered large blocks or bombs. It occurs in beds which are usually of no great extent, though their thickness may be considerable, and it is a very characteristic accumulation in the necks and choked-up vents of old craters. Like all volcanic ash, it is due to the explosive action of steam rising in the molten rock which fills an active crater; and it differs from ordinary ash-beds, or tuff, only in its relative coarseness. The large size of the embedded bombs shows in most cases that the material has accumulated close to the actual crater. Very often, in addition to bombs of ig-

neous origin, large pieces of sedimentary rock are found in the agglomerate. These are known as ejected blocks. See Judd's *Volcanoes* (1878); Bonney's *Volcanoes* (1898); Sir A. Geikie's *Ancient Volcanoes of the British Isles* (1897).

Agglutinative Languages, those languages which add qualifying words as suffixes, making longer or shorter compound words, instead of inflecting the principal word or allowing the qualifying word to stand alone. The principal languages of this group are Hungarian, Finnish, Turkish, Mongolian, and the Dravidian languages (e.g. Tamil, Telugu) of S. India.

Aggtelek (Hung. *Baradla*), vil., co. Gömör, Hungary, 27 m. N.N.W. of Miskolcz, with the largest stalactite caves in Europe. Inclusive of the side branches, the windings of these caves are over five miles in length.

Agha Mohammed (1720-97), Shah of Persia, founder of the reigning Kajar dynasty. The son of Mohammed Hasan, chief of Astrabad, he raised the standard of revolt against Lutf Ali Khan, the last of the Zend dynasty, and gained the throne after a prolonged struggle. The murder of his rival, and the massacre of the inhabitants of the towns which had held out against him, show the barbarity of his nature; but he had sound ideas of policy, and was particularly jealous of Russian interference. He was killed by his own followers. See Forster's *Journey from Bengal to England* (1798).

Aghrim. See AUGHRIM.

Agincourt (Fr. *Azin-court*), BATTLE OF, one of the most important battles in the Hundred Years' war between France and England, was fought on Oct. 25, 1415, near the site of the present vil. of Agincourt, 40 m. S.E. of Boulogne. Henry V. of England, after taking Harfleur, endeavoured to reach Calais. With only about

6,000 men, one-third of them archers, he was opposed by about 30,000 French, including 10,000 archers, under the Constable of France, D'Albret. The English victory was complete in three hours. The French lost about 10,000, of whom many were 'gentle;' among them being the constable, Duke of Alençon, and Duke of Brabant. The English loss is variously estimated at from 1,600 (as by St. Rémy) to under 200, among them the Duke of York and the Earl of Suffolk. See Le Fèvre's (St. Rémy—present at the battle) *Chronique* (1408-35); Nicolas's *Hist. of the Battle of Agincourt* (1827—useful compilation); and *Political Hist. of England* iv. c. 8 (a very full account).

Agio (Ital.), rate of exchange between actual and face values of coinage or paper, or between the standards of different countries; also the amount of appreciation or depreciation from a customary rate of exchange.

Agira (anc. *Agyrium*). tn., Catania, Sicily, in prov. of and 35 m. N.W. of Catania, crowns a lofty hill (2,130 ft.) 9 m. N. of its ry. stn.; one of the oldest Sikelian towns of Sicily. Here Diodorus Siculus was born. Pop. 18,000.

Agis, three kings of Sparta (or four counting the legendary founder of the Agidæ dynasty). AGIS I. (II.) reigned 427-397 B.C.; several times invaded Attica, and defeated the Athenians and their allies at Mantinea (418), and besieged Athens (405).—AGIS II. (III.) reigned 338-331 B.C.; endeavoured to crush the Macedonian supremacy in Greece during the absence of Alexander the Great in Asia.—AGIS III. (IV.), king from 245-241 B.C., sought to revive the institutions of Lycurgus, but was put to death by his suspicious subjects. See Plutarch's *Life*, and Alfieri's tragedy *Agide*.

Agistment, in English law an agreement by which the owner of

land, called 'the agistor,' allows cattle to pasture on his land, generally for hire. The agistor has no lien on the cattle, and is liable for negligence. In agricultural holdings, agisted cattle are not liable to be distrained for rent.

Agitato, a term used in music, generally along with *allegro* or *presto*, to denote a restless and emotional style.

Aglaophon, the name of two Greek painters, supposed to be grandfather and grandson. The elder flourished about 500 B.C.; is famous as the father and instructor of Polygnotus and Aristophon. The painting of the *Winged Victory*, mentioned by the scholiast on the *Birds* of Aristophanes, is supposed to be by him. Antheus mentions two pictures by the younger (fl. 416 B.C.)—*The Crowning of Alcibiades*, and *Nemea with Alcibiades on her Knees*.

Agnadello, or GHIARA D'ADDA, BATTLE OF (May 14, 1509). Here, after the league of Cambray, the French, under Louis XII., defeated the Venetians.

Agnano, LAKE OF, Italy, 2½ m. w. of Naples, filled the basin of an extinct crater, but was drained in 1870 as being a cause of malaria. The carbon-dioxide waters are now used in baths. Near it is the famous Grotta del Cane and the sulphurous baths of San Germain.

Agnates, or AGNATI, in Roman civil law, were relations by blood or adoption on the father's side, tracing their descent exclusively through males—*e.g.* one's father's brother's child, but not one's father's sister's child. They are distinguished from cognati or blood relations. In Scots law, agnates include all blood relations on the father's side.

Agnel, a French gold coin struck during the reign of Louis IX., but not used after the time of Charles IX. So called because it bore the figure of the paschal lamb (*Agnus*).

Agnes, ST., a Roman virgin, martyr to the Christian faith in the reign of Diocletian. At the age of twelve she was publicly humiliated and beheaded. Her feast is the 21st January.

Agnesi, MARIA GAETANA (1718–99), an accomplished linguist and mathematician, was born in Milan. She succeeded her father as professor of mathematics at Bologna, and published *Instituzioni Analitiche* (1748).

Agni, in Hindu mythology god of fire and of the earth, to whom many of the Vedic hymns are addressed.

Agnomen, a name added by the Romans to those of any person, to commemorate his services or other special circumstance, in allusion to his character—*e.g.* Cnæus Marcius *Coriolanus*.

Agnone, tn., Campobasso, Italy, on the w. slope of the Apennines, 22 m. N.W. of Campobasso; with iron and copper industries. Pop. 10,000.

Agnosticism. The word agnosticism was coined by Professor Huxley in 1869; but while the name is new, the thing is old. It may possibly have been suggested to Huxley by the inscription which St. Paul found upon an altar in Athens—'Ἀγνώστῳ Θεῷ, 'To an unknown God' (Acts 17:23). By its form it suggests, and, Huxley tells us, was meant to suggest, a theory the exact opposite of gnosticism, which was a vague and theosophical method of speculation widely prevalent in the early church. Agnosticism restricts our cognition to the manifestations and transformations of matter and energy, and disclaims all knowledge of spiritual existence, whether of God or man. While accepting the conclusions of science and sensible experience, it rejects, as unfounded conjecture, all assertions regarding the unseen. Agnostics do not deny that behind the phenomena of know-

ing, feeling, and willing there *may* be a permanent entity or soul; but they maintain that nothing can be proved or disproved respecting the soul's distinct existence, substance, or durability. Similarly, they admit that behind the material phenomena of the universe there *may* exist a Universal Being; but they hold it impossible to determine whether or not the nature of this Being is conscious and spiritual. To all such questions there is but one answer: we do not know, and nothing leads us to suppose that we shall ever know. At the same time, it is to be remembered that agnostics emphatically protest against their views being confounded with the dogmatic affirmations of atheism and materialism, inasmuch as the latter theories desert the purely nescient attitude with regard to spiritual existence. History, however, appears to prove that much of religious agnosticism tends to issue in ultimate scepticism. There are many shades and varieties of agnosticism, but all reasoned and systematic forms of it at the present day are based more or less covertly upon the speculations of Kant. The conclusion of Kant's critical analysis of human reason is that we can *know* only the phenomenal, while such ideas as God, the soul, and immortality can be apprehended only by practical faith. The negative side of this theory has been adopted and popularized in Britain by Herbert Spencer, whose works present the most elaborate and impressive exposition of agnosticism to be had in English. Agnosticism will always be found to rest upon a subjective theory of knowledge, and can be refuted only by the demonstration that our knowledge of reality, so far as it goes, is genuine and trustworthy. See Huxley's *Lectures and Essays*, Herbert Spencer's

First Principles, and Leslie Stephen's *An Agnostic's Apology* (1893). A masterly criticism of the theory is to be found in Dr. James Ward's *Naturalism and Agnosticism* (Gifford Lectures, 1899); cf. also Flint's *Agnosticism* (1903).

Agnostus, a trilobite common in the Cambrian rocks, is anatomically one of the simplest members of the group.

Agnus Dei (Lat. 'Lamb of God'), a title of our Lord (John 1:29), hence a symbolical representation of Christ as a lamb with a halo, and supporting a banner, as found in the catacombs. Also a prayer which since the 6th century has been used in the service of the mass—*Agnus Dei, qui tollis peccata mundi, miserere nobis*. In the Greek Church the cloth which covers the chalice is known as an *Agnus Dei*, this symbol being embroidered upon it. In mediæval heraldry and religion the *Agnus Dei* was associated with St. John, and was consequently borne by those under the patronage of that saint.

Agonic Lines (Gr. 'without angles'). Lines on the earth's surface joining points at which the variation or declination of the compass-needle is zero. See MAGNETISM, TERRESTRIAL.

Agony Column, the column of newspapers in which advertisements regarding missing relatives and friends, secret correspondence, etc., are inserted. The name derives from the distress betrayed in many such advertisements.

Agora (Gr. 'assembly'), the market-place of ancient Greek towns, corresponding to the Roman forum, and the centre of the religious, commercial, and political life of the town or city. The most famous agoræ were those of Elis and Athens, the latter being a large irregular area bordered by the Acropolis, Colonos Agoræus Hill, and the Areopagus Hill. See Pausanias, vi. 24, and Vitruvius

vius, v. 1; also Hirt's *Die Geschichte der Baukunst beiden Alten*, vol. iii. (1821-7), and Gardner's *Ancient Athens* (1903).

Agoraphobia (Gr. 'fear of the public square'), a nervous disease characterized by fear in certain situations, usually large spaces. The patient suffers palpitation of the heart, trembling, coldness, and other symptoms of terror, which come upon him suddenly in the market-place, street, or theatre; he will slink round the edge of a square rather than cross it. It is a form of neurasthenia. Improvement in general health, and keeping the mind well occupied, usually drive it away.

Agoué, seapt. tn., W. Africa, on Slave Coast, between Great and Little Popo. Pop. 20,000.

Agoult, MARIE CATHÉRINE SOPHIE DE FLAVIGNY, COMTESSE D' (1805-76), French author under the pseudonym 'Daniel Stern,' daughter of Vicomte Flavigny and Marie Bethmann of the Frankfurt banking family, was educated in Paris; married Count d'Agoult in 1827, but left him to live with Franz Liszt; travelled much in Switzerland, where she met George Sand, and in Germany and Italy. To Liszt she bore a son and two daughters, of whom Blandine married Emile Ollivier, and Cosima married first Hans von Bülow, and later Richard Wagner. 'Daniel Stern' wrote *Nélida* (1845), an autobiographical romance; *Lettres républicaines* (1848); *Hist. de la Révolution de 1848* (1851-3); *Esquisses morales et politiques* (1849), by which she is best known; and *Mes Souvenirs, 1806-33* (1877).

Agouti, a name applied to certain S. American rodents, species of the genus *Dasyprocta*. They have three toes on the hind limbs, and all the toes end in hooflike claws.

Agra, chief tn., Agra dist., United Provinces, India, on the

r. bk. of the Jumna, 120 m. s.s.e. of Delhi. It was founded by the Mogul emperor Akbar, who made it the seat of government. The fort, which covers a large area near the river, was built in 1566. It is surrounded by high walls with red stone towers, but has not the strength to resist modern systems of attack. Jehangir commenced the palace, and erected Sikandra, the mausoleum of his father, Akbar, and the tomb of Itmad-ud-Daula, his father-in-law. The Moti Masjid (Pearl Mosque), the Jama Masjid, and the celebrated Taj Mahal, a magnificent tomb of white marble, are monuments of the reign of Shah Jehan, the son of Jehangir. The fort was captured from the Mahrattas by Lord Lake in 1803. In 1857 Agra stood a siege of some months during the mutiny. It is an important market for grain and sugar. The chief industries are shoes, gold lace, and delicate mosaic work. Pop. 188,000. The AGRA CANAL, for irrigation and navigation, taps the Jumna 10 m. below Delhi, and re-enters 20 m. below Agra, with branches to that city and to Muttra.

Agram (Croat. *Zagreb*; Hung. *Zágráb*). (1.) County, Croatia, Hungary, 1,573 sq. m., and pop. 480,000. (2.) Chief tn. of Croatia, and an archiepiscopal see of Hungary, near the l. bk. of the Save, 139 m. by rail n.e. of Fiume. Manufactures of linen, tobacco, and hides. In Nov. 1880 the tn. suffered severely from earthquakes. Pop. 58,000.

Agrapha of Jesus. See LOGIA.

Agraphia, a nervous complaint, analogous to aphasia. The patient is unable to write what he means; his pen sets down meaningless combinations of words or syllables.

Agrarian Laws. See LAND LAWS.

Agrarian Party, a political party of Germany representing

the agricultural interest. It originated about the year 1869, and first made its influence felt in the elections of 1874. For some years it was a free-trade party, but it has recently been the zealous advocate of heavier rates against the importation of foreign agricultural products. The official title of the society is 'The Reformers of German Taxation and Economy.'

Agreement. See CONTRACT.

Agricola, CNAEUS JULIUS (37-93 A.D.), son of Julius Græcinus and Julia Procilla. He was one of the highest type of Romans under the early empire, an upright, able man, a good governor, and a competent general. He served in Britain in 60 A.D.; governed Aquitania, in Gaul, 74-76; and was consul in 77. From 78 to 85 he governed Britain, and did much to reduce the island to order and civilization; he penetrated even north of the Forth, perhaps of the Tay, and defeated the Caledonians in a battle whereof the site is uncertain. From 85 to 93 he lived in Rome; some say he was poisoned by the order of the Emperor Domitian. His *Life* was written by his son-in-law Tacitus; trans. by Church and Brodribb (1877), and by B. B. Townshend (1894).

Agricola, GEORG, whose real name was BAUER (1494-1555), the founder of the modern science of mineralogy, and a valued teacher of practical mining in Germany; practised as a physician at Chemnitz (1531 onwards); wrote *De Re Metallica* (1531; trans. into German *Bergwerksbuch*, 1557), and *De Natura Fossilium* (1657).

Agricola, JOHANN, originally SCHNITTER or SCHNEIDER, also called MAGISTER ISLEBIUS, from his birthplace (1492-1566), was in 1525 sent by Luther to establish the Protestant Church at Frankfurt. From 1526-36 he preached and taught in his native town of Eisleben, and in 1536 was

appointed to a chair at Wittenberg, which he had to resign because of his opposition to Luther and Melanchthon. In 1540 he became court chaplain to Joachim II. at Berlin. He assisted in drawing up the Augsburg Interim. His collection of German proverbs was published in Low German (1528), and in High German (1529). He also wrote many theological works. See Kawerau, *Johann Agricola* (1881); and Latendorf, *Agricola's Sprichwörter* (1862).

Agriculture. The present article is devoted to general considerations: first, with regard to the limits of the science; and secondly, with regard to the more outstanding changes which have marked the history of British agriculture.

There is some risk of confusing horticulture with agriculture; and the subjects certainly overlap each other, and cannot be entirely separated. Forestry, so far as the planting and cultivation of woods are concerned, may be regarded as a branch of agriculture, as also must the improvement and management of pastures and other forms of grass land. The width of the subject is best realized by considering the various matters which must engage the attention of a landowner. Besides cultivated farms, he may possess extensive woods, grazing land, rivers, lakes, and streams, all of which are capable of development. The cultivated land cannot be tilled without implements, cottages, farm-houses, and farm-buildings; while both it and the pastures require a varied knowledge of live stock. The interests involved are therefore very numerous, and it is scarcely too much to say that, for the thorough understanding of them all, every branch of human knowledge must be laid under contribution. Agriculture demands a knowledge of the soil,

atmosphere, climate, and meteorology. Still more directly does it involve a knowledge of vegetable life, not only as regards crops, but also weeds, crop enemies, fungoid attacks, and poisonous and injurious plants. Grasses alone form a group of the first interest to farmers. In ascending series, all the phenomena of animal life are observable in live stock—the anatomy, physiology, pathology, and treatment of animals in health and disease, besides questions of heredity, variation, natural selection, hybridization, and acclimatization. Chemistry is required in the study of the soil, fertilizers, feeding stuffs, and the composition of plants. Geology throws light on the distribution and origin of soils, the presence of springs or of water-bearing strata, and on land drainage. Zoology opens up to us the study of noxious insects, and of the devastating effects of entozoa on live stock. Of late years bacteriology has been shown to be intimately concerned with nitrification in the soil, fermentation and putrefaction, and the variations in cheese and butter in different districts. Sterilization and serous inoculation for tubercle, anthrax, and other diseases, all form parts of the theory of agriculture. Further, agricultural science requires engineering knowledge for construction, drainage, and reclamation, as also a knowledge of machinery and implements. It demands no small knowledge of physics and mathematics.

Antiquity of Agriculture.—That the two principal branches of agriculture should be distinctly separated in Gen. 4:2 is remarkable. 'Abel was a keeper of sheep, but Cain was a tiller of the ground.' Very primitive tribes cultivate the ground, and possess cattle, sheep, and horses. Some knowledge of the art of agriculture must therefore be assumed. The

facts that wheat does not exist in the wild form, and that no truly wild horse exists in the world, show the antiquity of agriculture. Sheep have been domesticated so long that it is difficult to connect them with any truly wild prototype, and the same seems to be true of domesticated cattle in a modified degree. Efforts to trace the origin of European domestic cattle to three types, all now extinct as absolutely wild animals, have been fairly successful; but *Bos primigenius* (Aurochs) is the only one which exists in a semi-wild condition in the wild cattle of Chillingham Park, Northumberland, Cadzow Forest, Lanarkshire, and in parts of Russia and Hungary. Unimproved races of sheep are generally of varied colour; but the efforts of Jacob to breed sheep to particular colours afford evidence that cattle and sheep were bred with care in the earliest times. Charred grains of wheat and barley have been found in Switzerland on the site of ancient lake dwellings, and the bones of domestic animals have been recovered from the prehistoric kitchen-middens in Denmark and elsewhere.

Implements.—The earliest plough was probably a pointed stick charred or shod with iron at the end. According to Stephens (*The Book of the Farm*, 1842), a plough of this kind, known as the caschrom, was in use sixty years ago in some of the Outer Hebrides and in Skye.

The early Saxon plough, as depicted in the Harleian MSS., resembled the caschrom, but was drawn by two bullocks from a central shaft. The implement was entirely of wood, and of the form of a pickaxe, one limb of which was held by the ploughman, while the other scarified the soil.

The ancient Egyptian plough was the same in principle, the strain on the share being relieved

by a rope. The native Egyptian plough of the present day is of very similar construction.

The mould-board or turn-furrow was at first a flat board, still used on the old Kentish gallows turn-wrest plough. It is fastened by a wooden or iron peg, and is transferred from side to side of the plough at the end of every furrow.

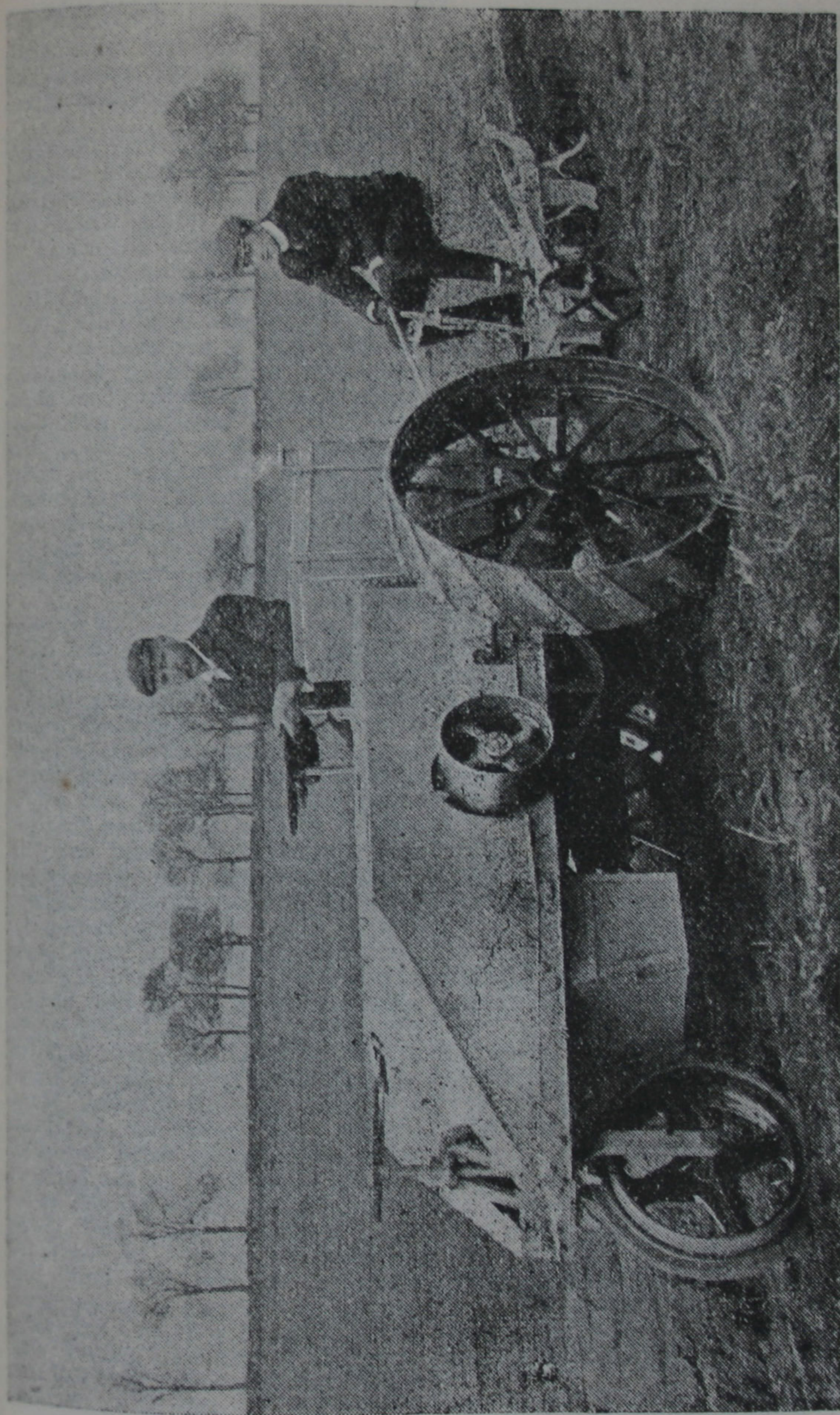
The other tillage implements were at first correspondingly primitive. The harrow was of brushwood or thorns wattled through a frame, and the roller was a cylindrical boll of a tree fitted with axle ends and attached to a frame. Harrows consisted of straight, pointed iron teeth, fixed at the points of intersection of a square framework of hard wood. Ploughs, harrows, and rollers were the only tillage implements. The seed was sown from a basket or a sheet by hand; the crop was reaped by sickles, threshed by flails, and winnowed by a shovel in the wind.

Tillage implements have retained their original type, but they have been altered in form and material. Iron and steel have superseded wood, and steam has in many cases taken the place of manual and horse labour. The modern plough is an instrument for inverting the soil. Slice after slice is cut by the horizontal share and the vertical coulter, and is turned over by the beautifully curved mould-board with the least possible friction. Its parts are adjustable for altering the depth and width of the furrow. The modern harrow is either rhomboidal or zigzag in its iron framework, in order that the teeth may not follow each other in the same track. The roller is of iron, divided into segments to avoid surging in turning; in the clod-crushers and ring-rollers it is composed of toothed or edged discs, which pulverize or cut the hard clods. Steel-tooth cultivators or

scarifiers are sometimes used in preference to ploughs, but the older implement maintains its position as the chief cultivating instrument. The latest innovation in cultivating machinery is the 'digger,' which is devised to pulverize the soil by a series of revolving blades which at once break up the earth and produce a seed-bed. In Britain this system has not replaced the usual methods of reducing the soil by ploughing, harrowing, and rolling, and that because pulverization is best accomplished through weather processes. Alternations of frost and thaw, of rain and dry weather, assist tillage; and the farmer relies upon the aid of these natural forces in producing a tilth. Winter ploughing exposes the up-turned furrow to the influences of weather; and a tilth so produced is superior to a forced one, which is very liable to 'run together' after a heavy fall of rain. Steam cultivation was at one time expected to revolutionize tillage; but there are many operations connected with agriculture in which steam cannot be conveniently employed. Within recent years electric power has been used with success.

Sowing implements include drills and broad-casters. Drills are in universal use for turnips and all root-crops, and are generally employed in sowing corn. But it is in the former that they are of the greatest value; for in corn-growing there is no superiority in a drilled as compared with a broad-cast crop, especially when the land-presser has been used to form grooves for the reception of the scattered seed.

The greatest improvements in implements are seen in all processes for securing and preparing crops for market. Mowing-machines, reapers, self-binders, hay-tedders, horse-rakes, stackers, loaders, elevators, threshing-ma-



Agriculture.—Motor ploughing.

chines, winnowers, screens, may be mentioned as among the most important inventions which were perfected during the second half of the 19th century. Not less important are those implements which have been introduced for the preparation of crops for home consumption by live stock, such as chaff-cutters, cake-breakers, grist mills, turnip pulpers and shredders, and boilers or steamers. Lastly, there are the important dairy implements, such as cream separators, improved churns, cheese-tubs, cheese-presses, butter-works, milking machines, deep-sitting vessels for cream-raising, sterilizers, and a number of smaller appliances for the improved manipulation of dairy produce.

Manuring.—This becomes necessary only when land has been to some degree exhausted of its available plant food. According to Jethro Tull, inventor of drilling and of horse-hoeing, tillage may take the place of manure. By thorough tillage he grew wheat year after year on the same ground without manuring. He held that the decay of straw and dung in the soil was useful only in causing such a separation in the particles of earth as to reduce them to the condition of plant food—*i.e.* to the soluble condition. He denied the actual manurial value of dung, and attributed its beneficial effect to its fermentative and comminutive action on the soil. In his day farmyard dung was practically the only manure in constant use, and his view was, no doubt, partly correct. The mechanical effect of decaying vegetable and animal matter in dividing and pulverizing soil is fully allowed, as is also the solvent effect of the carbonic acid evolved during decay upon the mineral matter of the soil.

Farmyard manure, when en-

riched by meal and cake residues, is a complete manure, as it contains every constituent removed by crops.

The great value of dung depends largely on its composite nature, but also on its durability and on its cumulative effect when applied at the usual intervals of time. Its slow decay within the soil liberates its mineral and nitrogenous elements gradually; and as its decay is arrested at temperatures approaching freezing-point and is accelerated in summer heat, its materials are most available at those periods of the year when vegetation is most vigorous. Farmers who maintain a large head of live stock are comparatively independent of the so-called artificial manures, and rely principally upon dung.

It was only by the aid of chemistry that the true value and composition of farmyard manure were revealed, and the same knowledge suggested other substances which might be used as additional sources of plant food. Bones were found to contain phosphates and nitrogenous matter, and were crushed and applied to the land early in the 19th century. Lime has always been known as a valuable fertilizer. Liebig discovered the beneficial action of sulphuric acid upon bones in making the phosphoric acid soluble, and gave us the first superphosphate. Sir John Lawes introduced mineral superphosphates manufactured from coprolites, and later from various mineral phosphates. By chemical analysis various substances were found to contain plant food in the form of nitrates, phosphates, potash salts, lime, magnesia, etc., and these became the source of artificial manures. Guano has been imported in enormous quantities; and nitrate of soda, or Chile salt-petre, as it was first called, was found on the western slopes of the Andes, and became an important

fertilizer. At the present time artificial manures are manufactured from many materials, including natural phosphates, fish, blood, basic cinder, bones, potash salts, guano, cotton-seed meal, and many other substances.

All excrements or remains of animals and of plants are valuable manures. Among these may be mentioned town sewage, pou-drette (prepared human excrement), wool, hair, seaweed, and the refuse from slaughter-houses, tanyards, glue-works, and fish-curing establishments.

The value of a manure depends upon its richness in phosphoric acid, nitrogenous matter, and potash. Of these, phosphoric acid and nitrates are in greatest demand, because they are removed from the soil in the forms of bone, flesh, and grain. Nitrates are the more necessary on account of their tendency to wash through the soil, or to sink below the reach of the roots of plants.

Composts of weeds and vegetable refuse, road scrapings, ditch cleanings, and 'dirt' of all kinds, as well as the dead bodies of animals, are all, in different degrees, useful fertilizers. This is also true of green crop manure, and is the reason for the custom of ploughing in vetches, green rye, lupins, mustard, or any other growing crop. Other general manures are oil cakes, such as rape cake, cotton-seed cake, bruised cake; as well as beans, pease, the cereal grains, and other feeding stuffs. Rape cake is often applied directly to the land; but the usual method is to pass these products through the animals of the farm, and to recover the unappropriated portion, or 'food residues,' in the dung.

General or 'complete' manures may also be compounded artificially by mixing salts of phosphoric acid (phosphates), nitrates, sulphates, potash salts, gypsum, etc.,

so as to imitate the composition of farmyard manure. Examples of the growth of crops of wheat, barley, and oats year after year for sixty years by means of artificial manures are recorded in the Rothamsted Memoirs.

Carbonaceous Matter, etc.—Animal and vegetable bodies are composed largely of water and carbohydrates, such as fat, oil, starch, sugar, gum, mucilage, and cellulose. These combinations of carbon and the elements of water, hydrogen and oxygen, are of no direct manurial value in the soil, because growing plants obtain them directly from the air through their leaves. Moreover, carbon accumulates in all soils through the fall and decay of leaves and the death of plants and animals. Fertile soils are rich in carbonaceous matter, but there is abundant evidence to prove that the roots of plants absorb only solutions of mineral salts and of nitrates, and that the carbonaceous matter is entirely derived from the atmosphere. No organic material enters the roots of plants. Decaying matter is, indeed, repugnant to growing roots, and is nutritive only after its complete resolution into pure salts. Plants feed upon watery solutions of salts derived from the decay of organic matter.

Rotation of Crops.—The maintenance of fertility in soils is also secured by proper rotation or succession of crops. The crop residues—that is, the roots, stubble, haulm, and fallen leaves of crops—rank among the most important fertilizers. Thus, the roots of clover are peculiarly rich in nitrogenous matter, which is converted into nitrates of lime and potash, and forms an excellent preparation for wheat. Similarly, root-crop residues furnish a valuable manure for barley, oats, or wheat. Hence the Norfolk four-course rotation of *roots, barley, clover, and wheat* is based upon scientific principles.

Fallowing exposes the soil to atmospheric changes which dissolve the mineral matter in the soil, and encourage nitrification, with great benefit to succeeding crops. The old three-field course of the early Teutons was obligatory in Anglo-Saxon times. In the ancient institution of the 'mark,' or area *marked out* and appropriated by each *gemeinde* or village community, the arable mark was divided into three fields, one of which was fallow, one winter corn (wheat), and one summer corn (oats or barley). This appears to have been the original form of the English rotation of fallow-wheat-oats, or fallow-wheat-beans, which was general at an early period. According to Thorold Rogers, arable land in the 13th century was generally half in fallow and half in corn. The system of bare fallowing once in two or three years continued, especially in the three-course form, until the close of the 17th century, when turnips began to form a regular crop. As turnip husbandry extended, greater attention was devoted to the winter feeding of cattle, and this gave rise to the general improvement in live stock which marked the later portion of the 18th century. The four-course rotation above mentioned became, with modifications, the modern system of cropping. It is varied by allowing the clover or seeds to remain down for two or more years, giving rise to five and six course rotations, and by the introduction of other crops, such as sainfoin or potatoes. The system of sheep-folding on root and fodder crops has proved of the first importance in arable farming on light lands, and has greatly added to the fertility of the soil.

Live Stock.—Originally, cattle, sheep, and other live stock, were associated with natural pastures. It is impossible to regard mountain sheep-walks and uncultivated

plains as agricultural land, and therefore pastoral and agricultural pursuits have been considered as separate from one another, and in some degree as rivals. In order of time pastoral occupation must have preceded agriculture, as more suited to tribal life before property in land was strictly defined. Hunting would come first, and flocks and herds of domesticated animals would naturally follow.

In mixed farming there is always a fair proportion of arable to pasture land, and the two industries are carried on together. In modern agriculture sheep and cattle are kept upon the produce of arable land as much as upon pasture. Live stock forms an essential link in the system of manuring, and becomes the means whereby the land is kept in good condition. Attempts have been made to dispense with live stock, and to keep up the fertility of land by chemical manures; and there appears to be no reason why these should not be successful. A time may come in which the requirements of vastly larger populations may restrict live stock and increase the area of land under corn; but in the present order live stock and corn-growing go well together, and the most successful farmers incline towards live stock, as more profitable than corn-growing.

The high price of meat, and the still higher and more remunerative prices obtained for first-rate breeding animals (both of which are likely to continue), have stimulated the breeding of improved stock, especially in the United Kingdom.

As already pointed out, the improvement in live stock in the first half of the 18th century was in great part a consequence of the extension of turnip husbandry. The second half, and the whole of the 19th century, were marked by extraordinary interest and enthusiasm in

the breeding of improved stock. The prices given for animals of the highest quality have often amounted to thousands of pounds; and good breeding cattle are frequently sold for hundreds, and sheep for sixty, eighty, and a hundred guineas each. In some instances a thousand guineas have been given for one ram. The first great improver of live stock in England was Robert Bakewell of Dishley, Loughborough, in Leicestershire. He improved the old English cart-horse, and established the longhorn race of cattle and the improved Leicester or Dishley sheep. His example was followed by the brothers Colling of Barmpton and Ketton, in the county of Durham, who are regarded as the founders of the shorthorn breed of cattle; by the Culleys, who founded the Border Leicester sheep; and by the Ellmans of Glynde, in Sussex, who were the first breeders of improved Southdown sheep. The movement was continued by numerous intelligent breeders until all kinds of live stock were brought to their present perfection. It would occupy many pages to give even an outline of the rise and progress of Hereford, Devon, Sussex, Norfolk, Highland, Aberdeen-Angus, Ayrshire, and other breeds of cattle. Equally important has been the rise of the improved Lincoln, the Shropshire, Oxford, Suffolk, Hampshire, and several other breeds of sheep, all of which have been developed by judicious crossing and subsequent selection of the best types. The improved races of live stock all arrive earlier at maturity, and that by years, months, or weeks, according to the class of animal. Thus, before the time of Bakewell, the ox was rarely fattened before five years old, whereas well-bred steers will now fatten readily at two years old. 'Four-year-old wether mutton' was the attractive phrase adopted

by butchers even fifty years ago in recommending their joints; now, mutton is killed at from ten to sixteen months old. Pigs, and even poultry, share in the same early maturity. Well-bred cattle will fatten upon a less nutritious diet than badly-bred ones. A shorthorn bull now in possession of the writer is quite fat, although he feeds on nothing but water-meadow hay, which is an inferior fodder. Well-bred sows may easily be too fat for breeding even after having been turned into a straw yard, with nothing but water and what they forage for in the form of stray grains in the straw. Another peculiarity of well-bred animals is their uniformity of type, colour, form, or whatever may be the object of the breed. These qualities weigh enormously in fixing the money value of individuals.

High-bred stock need not be delicate, because it is in the power of breeders to develop constitutional vigour as much as any other quality. Still, it must be allowed that propensity to fatten is inconsistent with great fecundity or with deep milking, and that it would be unreasonable to expose valuable animals to unfavourable conditions of pasturage or weather. On the other hand, many breeders of first-rate shorthorns keep their cows and young stock out of doors both summer and winter.

Farm-Buildings. — Good animals need not be accommodated in luxurious buildings. Some of the best shorthorns have lived under thatch and roughly-timbered sheds, sometimes sadly out of repair. Expensive buildings are no sign of good farming, and do not form a necessary feature of first-rate management. Comfort, ventilation, and drainage are the three essentials, and these may be obtained by the use of cheap and easily available materials. Cattle will do as well in an extemporized

straw yard fenced with hurdles and sheltered by straw ricks as in the most elaborate stalls and yards. Good buildings are certainly an advantage, but it must not be forgotten that they occupy a subsidiary place in comparison with good cultivation and good stock.

See the articles on special agricultural subjects; also *Journals of the Royal Agricultural Society*, the *Highland and Agricultural Society*, and the *Bath and West of England Society*. For treatment of scientific agriculture, *The Rothamsted Memoirs*. For general agriculture (and agricultural chemistry), *The Farm Series*; Wrightson's *Agricultural Text-book, Fallow and Fodder Crops*, and *Principles of Agriculture*. For cattle, horses, and sheep, Vinton's *Live Stock Series*; Cassell's *Downton Series* for soils and manure, crops, and live stock; Curtis's *Estate Management*; Bailey Denton's *Homesteads of England*. J. C. Morton's *Cyclopædia of Agriculture* (1850-2) is still one of the best books of reference. The best agricultural newspapers are the *Agricultural Gazette*, the *Mark Lane Express*, the *Live Stock Journal*, the *North British Agriculturist*, the *Farmer and Stock-keeper*.

AGRICULTURAL EDUCATION. — Although agriculture is the oldest and most important of human occupations, it was not provided with special scientific training until a comparatively recent date. The growing importance of stock-raising and dairy-farming in Denmark led to the creation of a veterinary college at Copenhagen in 1773, which afterwards became the Royal Veterinary and Agricultural College. This was followed by the founding of a chair of agriculture at the University of Edinburgh in 1790, a chair of rural economy at Oxford in 1796, a high-grade agricultural school at Krumman (Austria) in 1799,

another at Möglin (Germany) in 1807, and the first in France at Nancy in 1822, followed by Grignon in 1829 and Grandjouan in 1830.

Though one of the smallest states in Europe, Denmark has promoted the prosperity of her people by providing them with 44 agricultural high schools. All the Scandinavian states, in fact, have shown noteworthy zeal in the promotion of agricultural instruction. Sweden has an Agricultural Institute at Ultuna and an Agricultural and Dairy Institute at Alnarp, founded respectively in 1849 and 1862. Norway has a Higher Agricultural School at Aas, dating from 1859. Finland has an Agricultural and Dairy Institute at Mustiala, founded in 1840. In these four northern countries there are no less than 159 agricultural, horticultural, forestry, and dairy schools of all grades. In addition, the Royal Agricultural Society of Denmark sends out veterinary and dairy experts to assist and instruct the people; while in Sweden and Norway travelling instructors teach agriculture in schools of a lower grade.

In Russia the government sustains 68 agricultural schools or institutes, located in different parts of the empire and affiliated with the universities at Kazan, Kiev, and Moscow.

In Austria-Hungary there are six high-grade agricultural schools, six forestry schools, and over 150 of all grades devoted to general and special instruction in agriculture. Travelling instructors also teach agriculture in the rural primary schools. The first agricultural school in Switzerland was founded at Hopyl in 1806. The republic is now liberally provided with educational facilities in agriculture, dairying, and forestry, and the Federal Polytechnic School at Zürich de-

votes two of its six courses to agriculture and forestry. Italy has made less progress, but still much has been done. There are agricultural colleges at Milan and Portici, and about 30 general and special schools of a secondary grade scattered throughout the kingdom. Holland made a beginning early in the last century by the creation of an agricultural school, but the enterprise did not prove successful. Eventually, in 1876, the government took over a school at Wageningen, and has made a first-class agricultural college of it.

The best-organized systems of agricultural education in Europe are to be found in France and Belgium. At a recent date there were in the republic 16 special farm schools (*fermes-écoles*), 39 practical schools of agriculture, 6 national schools of agriculture and horticulture, 3 veterinary schools, 1 shepherds' school, 1 cheesemaking school, and 1 silk-worm school, besides a school of horse-breeding at Le Pin, a dairy school at Mamirolle, a school of horticulture at Versailles, and a school of agricultural industries at Douai. Above all these is the *Institut National Agronomique* at Paris, where instruction of the highest grade is given. In Belgium agricultural instruction in public schools was inaugurated as an experiment in 1849, and was finally established by law in 1860; but its success was not acknowledged until about twenty years later. Higher instruction in agriculture is given at Gembloux and Louvain, secondary instruction in agriculture at 57 different state and private schools, and in horticulture at 7 schools, in veterinary science at Cureghem, and in forestry at Bouillon.

Although Germany has developed no system like that of France, the empire possesses a large number of farm schools

(*Ackerbau-schulen*) and a number of schools of secondary and higher grade. There are also special courses of agriculture in schools of a secondary grade, and agricultural institutes in connection with many of the universities. The Royal Agricultural High Schools at Berlin and Poppelsdorf are widely and favourably known; while the forestry schools in Germany, some five or six in number, are considered the best in the world.

While some of the agricultural colleges of Great Britain rank high, the progress there has not been commensurate with that in other branches of learning. Something has been done in Scotland and Ireland toward teaching agriculture in the public schools, and of late England has made successful efforts in that direction. Ireland is provided with two excellent institutions in the Albert Institute at Glasnevin (opened 1838) and the Munster Dairy School.

The following institutions in England and Wales are in receipt of government grants:—University College of North Wales; University of Leeds; Armstrong College; University College of Wales, Aberystwyth; University of Cambridge, Agricultural Department; University College, Reading; South-Eastern Agricultural College, Wye; Midland Agricultural College, Kingston; Harper-Adams Agricultural College, Newport, Salop; College of Agriculture, Holmes Chapel; Agricultural College, Uckfield; Essex County Laboratories, Chelmsford; Harris Institute, Preston; British Dairy Institute, Reading; Eastern Counties Dairy Institute, Ipswich; Royal Veterinary College, London; National Fruit and Cider Institute, Bristol; Cumberland and Westmoreland Farm School, Penrith; Hampshire Farm School; Agricultural Institute, Ridgmont.

In Scotland there are the East of Scotland Agricultural College, Edinburgh; the North of Scotland Agricultural College, Aberdeen; and the West of Scotland Agricultural College, Glasgow.

The development of agricultural education in Canada is of comparatively recent date. The best known of her institutions is the Ontario Agricultural College of Guelph, which, with the Ontario Veterinary College of Toronto, is now affiliated with the University of Toronto. There are also a provincial school of agriculture at Truro, a horticultural school at Wolfville, both in Nova Scotia, and a dairy school in New Brunswick. The provinces of Quebec and Nova Scotia both provide instruction in agriculture in some of their secondary schools. Six experimental farms are also in operation in different parts of the Dominion under an Act of 1886.

In the British colonies much has been accomplished, considering their youth. There are seven agricultural colleges in Australia, one in New Zealand, two in Cape Colony, and an excellent veterinary school and forestry school in India.

In the United States the first practical school of agriculture was the Gardiner Lyceum in Maine, which received a grant of money from the state, and was opened in 1823. This institution flourished for many years. In 1846 Yale College was provided with a professor of agricultural chemistry and vegetable and animal physiology.

The state of Michigan provided for an agricultural college in her constitution, and after the selection of an admirable site near Lansing, the new capital, the college was opened in 1857—the first public institution of that character in the United States. Michigan's example was followed in

1859 by the opening of state agricultural colleges in Maryland and Pennsylvania. Upwards of 70 colleges or schools giving agricultural education are now in operation throughout the States.

Japan is making great progress, and an agricultural school was opened in Egypt in 1898. Of the Latin-American countries, Brazil and Chile have done most; but efforts have been made in Mexico, Argentina, and Uruguay to provide instruction in agriculture, though not always with success.

HISTORY OF BRITISH AGRICULTURE.—The issue in 1534, by Sir A. Fitzherbert, of *The Book of Husbandry*, reputed to be the first English treatise on the subject, marked the beginning of a new era of agriculture, the progress of which is chronicled by various subsequent writers, the chief of whom in Queen Elizabeth's reign were Tusser, Googe, and Sir Hugh Platt. Tusser's *Hundred Points of Husbandry* appeared in 1562 (the basis of *The Whole Art of Husbandry*, by Captain G. Markham, 1631), Googe's *Four Books of Husbandry* in 1577, and Platt's *Jewel Houses of Art and Nature* in 1594. From these and other records we learn that in Tudor times enclosures from common lands were numerous in England. These enclosures were associated with two distinct movements:—(1.) The old three-field system, involving scattered strips, common rights, and customary cultivation, gave way to a system of independent, solid holdings, with encouragement for individual energy and initiative. Tusser praises the system of 'severalty,' or enclosed farming, and points out its superiority to the 'champion,' or open-field system. (2.) But simultaneously with this movement there occurred, under the stimulus of the high price of wool, a steady conversion of arable land into pasture, and the fencing of large areas

into sheep-walks, which resulted in rural depopulation and social discontent. Hops were brought in and cultivated early in the 16th century; hemp and flax were common crops; hedges were introduced into Scotland and Ireland, and potatoes into England (1586), but for about two hundred years the latter were only grown in the garden. The union of the crowns of England and Scotland in 1603, and the peace and security which followed, led to the increase of population, and a demand for more and better food. Red clover and turnips (then sown broadcast) were known as field crops in Norfolk about the middle of the 17th century; but it was more than fifty years later before they were grown generally in the northern and distant parts of the country. A great agricultural revival was begun in Britain in the 18th century, chiefly towards the end of the latter half of that period. The Norfolk four-course system of cropping was introduced by Viscount Townshend, who settled at Rainham in 1730; and progressive farmers grew turnip crops in rows, and after 1790 also swedes, as field crops. Drill husbandry and horse-hoeing were introduced, as we have said, by Jethro Tull, who began to practise it in Berwickshire in 1701. He published his book on the subject in 1731. An improved English seed-drill appeared in 1783, a threshing-mill in 1788, a winnower or corn-dresser in 1789, an improvement on the horse-hoe in 1799, a hay and straw press in 1796, and a chaff-cutter won a gold medal of the Society of Arts in 1797. Robert Bakewell (1725-95) introduced, in connection with Leicester sheep and longhorn cattle, the system of consanguineous breeding, which has been employed, and is still practised, although at times in a modified form, in the improvement of all classes of live stock.

The show of the Smithfield Club (1798) and that of the Bath and West of England Society (1777) were established to encourage the breeding of animals of improved quality. The Highland and Agricultural Society of Scotland was formed in 1784, with the object of encouraging Highland industries. The Chair of Agriculture and Rural Economy in Edinburgh University, founded in 1790, draws its students chiefly from the farming and landed classes, and has exercised for more than a century a direct influence on the agriculture of the country.

The formation of the first Board of Agriculture in 1793, with Lord Somerville as president, and Arthur Young as its distinguished secretary and chronicler, gave a great impetus to the development of a higher type of British agriculture. The investigations of that body, and the surveys of the agricultural practices in various counties of England (several vols., 1768-70), together with the accounts of the secretary's tours of inspection in Ireland (1780), in France (1792-4), and in Italy (1788), materially guided the movement which led to many agricultural improvements during the early years of the 19th century. The latter part of the 18th and the first quarter of the 19th century witnessed the enclosure of vast areas of wastes, commons, and open-field farms, on which, on account of the community of rights and diversity of interests, improved agricultural practices had hitherto been impossible. It is said that fully 6,000,000 acres were enclosed between 1760 and 1820. Great landowner pioneers such as Francis, Duke of Bedford (d. 1802), and T. W. Coke of Holkham (created Earl of Leicester in 1837), set examples in improved agriculture and estate management which were followed by smaller landlords, greatly to

their pecuniary advantage, more especially on the advent of the period of famine prices for corn, 1792-1819. Nicholson's *Principles of Political Economy* (vol. iii. bk. 4, ch. v. § 8) shows that the main cause of the rise in prices was adverse seasons, the Napoleonic war being only a minor influence, and the corn laws practically inoperative. For twenty-seven years before this period prices had been maintained above their normal level by unfavourable seasons, with the result that the price of wheat for the 18th century averaged £1, 18s. 7d. per Winchester quarter, an equivalent to the average of the 17th century, which was £1, 18s. 2d. Since the country became more dependent on its imported than on its home supply of grain, the fluctuation of prices due to local climatic influences has been, and is likely to continue, within narrow limits, and the baneful influence of bad seasons will be all the worse for the British farmer. This was acutely experienced during the adverse seasons in the 'seventies of the 19th century.

Although the great body of the farmers of the country lagged behind, it was during the period of famine prices that British agriculture, in competition with systems of agriculture in other parts of the world, assumed the leading position which it still maintains in spite of foreign competition and other increasing difficulties. The 19th century was divided into six very distinct periods, in which agricultural prosperity and adversity succeeded each other alternately—the total time of prosperity being almost, although not quite, as long as that of adversity.

(1.) During the first period of fourteen years great agricultural activity prevailed, owing to the abnormally high prices of corn just alluded to. Farmers at first

became rapidly rich, wages advanced, yet labour was comparatively cheap. Although poor-rates rose, rents went up enormously, so that the landlords in the end benefited most. Between 1790 and 1812 rents in Great Britain were more than doubled, and 'in many parts of England the rent of arable land per acre rose fivefold.' So rapid were the changes and so unstable the equilibrium of rural matters, that in 1814, a year before peace was declared, Parliament was petitioned to make inquiry into the ruined state of thousands of farmers—notwithstanding the fact that wheat had, while fluctuating between 58s. 10d. and 126s. 6d., averaged for fourteen years 89s. per quarter. The great army of unfortunates contained those who had become extravagant beyond their means in the good times, and also those who, from ignorance or perversity, had not advanced with the times, and had in consequence not benefited by their opportunities. Great advances were made in the improvement of the implements and machines of the farm during this period, and iron ploughs were first introduced. Estate improvements (*i.e.* building farm houses and steadings, reclaiming wastelands, draining, chalking, and marling) were carried on extensively, but under a strong temptation to grow corn too frequently. With the limited means of providing additional manure, much of the cultivated area began to deteriorate. The Board of Agriculture encouraged new inventions and experiments, and offered prizes for essays relating to agricultural questions. Sir Humphry Davy (1778-1829) also introduced, about 1810, by his lectures and experimental demonstrations, the subject of agricultural chemistry.

(2.) The succeeding period of agricultural depression (for the initiation of which a contracted

currency was to some extent responsible) began in 1815, and lasted for over twenty years, until the passing of the Tithe Rent Commutation Act in 1836. Progress was nevertheless being made in perfecting the implements and machines of the farm, in the breeding and management of live stock, and in the practice of manuring, especially by the use of bones. The introduction of railways (Stockton and Darlington 1825, and Liverpool and Manchester 1830), which soon spread to all the populous centres of the country, gave an impetus to general trade which reacted beneficially upon the agricultural industry, although the effect of the inevitable abolition of stage-coaches was fully expected to be detrimental to it, through the reduction in the number of coaching-horses, and of the amount of oats and fodder required for their support.

(3.) The third period (twelve years, 1837-48) was one of prosperity, and of events of great importance to the agriculture of the country. The Royal Agricultural Society of England was established in 1838, and held its first show at Oxford in the following year. Liebig and Lawes had begun to create an interest in the science of chemistry bearing upon agriculture, and the era of concentrated and artificial manures may be said to have opened. The world-renowned experiments at Rothamsted in Hertfordshire, 25 miles from London, were begun in 1843, and have been supported throughout by the private munificence of Sir John Lawes (d. 1900). The Royal Agricultural College, near Cirencester, was organized in 1842, and chartered in 1845; and its students, drawn mostly from the middle classes, have found homes in all parts of the British empire. With a view to the benefit of the general com-

munity, the Corn Laws were repealed in 1846, and the agricultural industry as a whole believed that its ruin was inevitable. But such was not the case.

(4.) The next period of temporary but severe depression (1849-52) began with the sudden drop in the price of wheat per quarter, from 54s. 8d. in 1846, 69s. 9d. in 1847, and 50s. 6d. in 1848, to 44s. 3d. in 1849. Next year, 1850, it reached 40s. 3d., and in 1851, 38s. 6d., the lowest point for a very long period. It was during this time that Caird—afterwards Sir James Caird (d. 1892)—writing in the *Times*, advocated high farming, and made himself prominent as an agricultural authority.

(5.) The succeeding period of twenty-two years (1853-74) was one of great agricultural prosperity; but although the agriculture of the country reached a high state of excellence, it was not practised with the economy and progressive forethought which have been the leading characteristics of recent less prosperous times. The expenditure of government money on the draining of land as an estate improvement, prior to the relative amending Act of 1861, in a vast number of cases did not help matters, as the regulation depth of four feet was at least one foot too deep on heavy land, and expense was incurred and the property saddled with the burden without much or any practical advantage. The following figures, from the 'General Agricultural Returns,' show certain significant changes which took place during the last thirty years of the 19th century:—

Year.	Arable Land.	Permanent Pasture.	Total under Crops and Grass.
	Ac.	Ac.	Ac.
1870	18,335,000	12,073,000	30,408,000
1900	15,707,000	16,729,000	32,437,000

The area of arable land decreased fully 2,600,000 acres, and there was a concurrent increase of over 4,600,000 acres of 'cultivated' permanent pasture.

The rage for the ploughing of land by steam tackle, with which the names of Fowler, Smith, and Fisker have been prominent as inventors, occurred during the prosperous period under notice, and subsided after a career of doubtful success. Steam had been employed as early as 1802 to drive threshing-machines, and was in very general use during the succeeding prosperous period among progressive farmers. Thirty years later it was adapted by Heathcoat and Chatworth to land reclamation, drainage, and cultivation; but its popularity and wide application were not to follow for another generation.

The era of steam-digging, associated with the names of Knight, Darby, Scott, and Proctor, dates from 1873; but it was not until 1898 that Darby, after spending about £100,000 on experiments, introduced his land-digger, which can be fitted to any farm engine.

The success of string-binding reapers dates from 1870. Among numerous early efforts to produce a reaping-machine, those of Smith, of the Deanston Cotton Works, Perthshire, in 1811, Henry Ogle, a Northumberland schoolmaster, 1822, and the Rev. Patrick Bell, 1828, were the most promising. Models of Smith's and Bell's machines are preserved in the agriculture section of the Industrial Museum, Edinburgh. Whether or not the United States of America has a right to claim the invention of the reaper, that country has the chief credit of bringing it to its present high state of perfection. M'Cormick's reaper, which first appeared in England at the great 1851 Exhibition, was much improved when, at the Paris Exhibition in 1855, it met the com-

petition of machines produced by both British and French makers. At the Paris Exhibition in 1900, the M'Cormick Company demonstrated the successful adaptation of a petroleum engine to the work of harvesting, by the trials of one of the last novelties of the expiring century, the automower.

(6.) The last long period of agricultural depression, which bridged over the close of the 19th and the opening of the 20th century, began about 1875, soon after the demonetization of silver by Germany, and the abandonment of its free coinage by the Latin Union in 1873. This baneful influence, by decreasing the metallic basis of the world's currency, and thereby the volume of paper money that, *cæteris paribus*, it would carry, tended to lower the prices of commodities generally.

About the middle of the 'seventies began the steady shrinkage of the wheat-producing area of the country, which, as the following figures show, went on till the last year of the century:—

Quinquennial Periods.	Average Acreage.
1876-80	3,036,519
1881-5	2,715,657
1886-90	2,400,631
1891-5	1,954,017
1896-1900	1,906,269
1901-5	1,636,261
1909	1,823,500

A third adverse influence, a succession of bad seasons, brought the average of wheat in the United Kingdom for the decade beginning 1872 down to 25 bushels per acre, a decrease of 5.6 bushels on the average of the previous ten years. In 1879, the 'black year' in the history of British agriculture, the average went down to 16 bushels per acre, or only one bushel more than half the average yield of the former decade. The

area of wheat was 3,047,000 acres, and the loss to the country was enormous. In this, the coldest year in the meteorological record, live stock also suffered. Owing to the excessive rainfall, there were vast losses among sheep from liver fluke, this parasitic disease extending to pastures which had never before been affected. As a result of the acute crisis, necessarily involving a great fall in agricultural rents, a royal commission of inquiry was appointed, with the Duke of Richmond and Gordon as chairman. The committee reported in 1882, and traced the calamity from which all interests connected with land were suffering to bad seasons and foreign competition. The commission ignored the importance of the great currency influence in lowering the agricultural industry, still the greatest in magnitude and importance, from the first to a second or third rank among the industrial enterprises of the country. Agricultural capital became immensely reduced, and the incomes of both landlords and tenants curtailed, so that many became bankrupt. Much land has been laid down to pasture, as the margin of profit from cropping continued to shrink and to disappear, and many districts have gone back in fertility.

The Agricultural Holdings Acts of 1875 and 1883, the latter the fruit of the 1879 commission, failed to restore prosperity to agriculture; nor need it be anticipated that the Amendment Act of 1900, nor, in fact, any act relating specially to agriculture, will do much to remove the evils which began soon after 1873.

It was in 1880 that John Garton of Newton-le-Willows, Lancashire, initiated the Garton system of plant-breeding by carrying the work of cross-fertilization of crop plants and grasses past the first cross, the point where nature usu-

ally stops short of fertility. He demonstrated for the first time that the flowers of most species of crop plants, conspicuously the Gramineæ, are self-fertilizing, and that the sterile or inert condition which often follows when very divergent varieties, or what are regarded as distinct species, are crossed, can be overcome. This can be accomplished in one, or at times in two generations, by the application of the pollen of one of the original parents to the female organ of the flower of the first cross progeny.

Great advances have been made during the terminal quarter of the last century in the practice of agriculture and in the development of the live-stock industry. It is now the exception, not the rule, to find a breed of farm animals without a corresponding breeders' society and pedigree book. The first volume of the *Thoroughbred Stud Book* appeared in 1793, and of the *Shorthorn Herd Book* in 1822; but it was not till foreign and colonial customers for well-bred stock demonstrated the indispensable character of an accompanying pedigree that the means for public registration of other breeds became general. Cattle-breeders took the lead, and were closely followed by horse-breeders, pig-breeders, and flock-owners.

In England and Wales the gross assessment of lands under Schedule A for income tax for 1908-9 was £36,384,362, and for Scotland was £5,772,165. 'Land' here excludes gardens and plots less than one acre in extent, but includes buildings and all land-owners' property on the land. A rise in farm rents began in 1852-3, and they tended upwards until 1879-80. For several years, even after the prices of produce began to fall, farmers continued to take farms at high and impossible rents, in the mistaken

belief that a period of prosperity was near at hand, and that the swing of the pendulum would be in their favour. The trend of values up and down is seen from the following figures:—

	England and Wales.	Scotland.
1879-80	£51,798,950	£7,769,303
1852-3	41,086,269	5,499,404
Increase up to 1879-80	<u>£10,712,681</u>	<u>£2,269,899</u>
Increase per cent.	26.1	41.3
1879-80	£51,798,950	£7,769,303
1898-9	37,296,350	5,967,345
Decrease up to 1898-9	<u>£14,502,600</u>	<u>£1,801,958</u>
Decrease per cent.	28.2	23.2

The method of preserving green fodder known as ensilage had its period of attention, which was at its flow in the early eighties; and its position was focussed in a report by Jenkins, secretary of the Royal Agricultural Society (*Journal*, 1884).

What is known as the 'rural exodus' became increasingly active towards the end of the 'seventies, a natural result of the decrease of employment in rural districts, but also in sympathy with a general movement taking place over a large section of the civilized world, tending to the depletion of the country population and to the accumulation of people in towns. Legislature has endeavoured to arrest rural depopulation by offering inducements to agricultural labourers to remain on the land.

The Board of Agriculture for Great Britain was created by Act of Parliament in 1889, and in the same year the first county councils were elected in England under the Local Government Act of 1888, Scotland following suit in 1890 under the corresponding Scottish statute of 1889. The Local Taxation (Customs and Excise) Act of 1890 provided funds which, subject to an anomalous first charge for the suppression of contagious diseases among live stock, are available at the dis-

cretion of the local authority for agricultural education; and in the Local Taxation Account (Scotland) Act of 1898, which was passed to place the Local Taxation Account of Scotland on the same footing as that of England as regards the supplementing of deficiencies created by the Agricultural Rates Acts, the claims of 'technical (including agricultural) education in Scotland' to participate in the further imperial grant which the act authorized receive recognition. The Board has confided to it the general supervision of agriculture in the United Kingdom, and by regulations which it issues under various statutes, by its experimental investigations, and by other means, controls and assists the agricultural industry. There is also a Department of Agriculture and Technical Instruction in Ireland.

The introduction of basic slag or Thomas's phosphate powder in 1883, after its value as a manure had been fully proved in Germany, opened a new era for the improvement of permanent pasture lands in Britain. On certain soils it confers no noticeable benefit; but where conditions are suitable, including most black-topped or peaty land, a dressing of 5 to 10 cwt. per acre encourages the growth of white clover in a remarkable way, and the general improvement of the pasture follows as a natural consequence.

The *bouilli Bordelaise* or Bordeaux mixture (24 lbs. sulphate of copper or blue vitriol and 12 lbs. of quicklime in 120 gals. of water per acre) came into use about 1890, for the protection of the potato crop against the ravages of the parasitic fungus *Phytophthora infestans*, by spraying the haulms and leaves, especially on the under surfaces. Experience has shown that if this be regularly practised in the first half of July and again early in August, in seasons when

the disease appears, it is most successful, saving probably two tons per acre of good potatoes. There are virtually no results when there is no disease. The Strawson sprayer is one of the best-known implements used in applying the dressing, and 'strawsonite' is a convenient form of it—2 lbs. of powder going to 10 gals. of water. Ten years after the introduction of the Bordeaux mixture the Burgundy mixture came into favour. In it 30 lbs. of washing soda take the place of the 12 lbs. of quicklime. Farmers are slow to adopt the practice of spraying, and too often wait until the brown spots with white margins, characteristic of the disease, appear on the leaves. Then it is too late to save the crop.

The successful means of destroying charlock or wild mustard (*Sinapis arvensis*), when it is about 2 to 3 in. high, by spraying an acre of affected crop with 50 gals. of a 3 per cent. solution of sulphate of copper, did not come into general notice till 1898–1900. To make the work complete, a second dressing should be given two weeks later. The jointed charlock or wild radish (*Raphanus raphanistrum*), and the wild rape (*Brassica campestris*), with less hairy surfaces, are not destroyed like the wild mustard, which they closely resemble in general appearance. This has led to some confusion in the statements of the results of spraying experiments.

Towards the end of the 'eighties corn-growers fared badly, and their condition was only a presage of what was to come. The importation of hay—timothy from Canada, and lucerne (*alfalfa*) from the United States and Argentina—began to assume large proportions in 1893. The original difficulty of the bulk, especially when freights were high, has been overcome by means of the hydraulic press. The deepening agricultural distress, which

was aggravated by the drought of 1893, led to the appointment of the 1893 royal commission, under the presidency of Shaw Lefevre, only fourteen years after the Duke of Richmond's commission. The report was issued in 1896, but no great discovery of the cause or method of alleviating the distress resulted.

The last decade of the 19th century was fruitful of legislation which has directly or indirectly affected the agricultural interests. The Pleuro-pneumonia Act of 1890 has proved most effective in protecting flocks and herds from the ravages of this disease. The Tithe Act of 1891 transferred the liability for payment of this peculiarly English impost from the occupier to the owner of land. The Markets and Fairs (Weighing of Cattle) Acts, 1887 and 1891, bear fruit but slowly, although passed with the best intention to aid the farmer in the sale of his cattle against the more experienced dealer or butcher. The Act of 1891 provides for the return of market statistics to the Board of Agriculture. The Allotments Acts, 1887 and 1890, provide a system, which any six electors may set in motion, for the acquisition of land by the local authority for the purpose of letting it out, in allotments which may extend to one acre, to persons belonging to the labouring population. The corresponding Scottish Act of 1892 follows the same general lines as the English statutes.

The Small Holdings Act, 1892, gave county councils power to acquire land with a view to providing small holdings for workmen who were desirous of employing their leisure time in small culture.

The Fertilizers and Feeding Stuffs Act, 1873, protects the purchaser of fertilizers and feeding stuffs by requiring, *inter alia*, their composition to be stated in the invoice, and directing that

such statement shall have effect as a warranty. The Act of 1906 obliges the seller of any quantity, however small, to state the percentages of the composition, and any statement in invoice, circular, advertisement, or letter, is a guarantee.

The Chaff-Cutting Machines (Accidents) Act, 1897, provided for automatic protective means being employed in the construction of machines which were a fruitful source of accident on the farm. The Threshing-Machines Act of 1878 had a similar object in view. And now, with the extension in 1901 of the Workmen's Compensation Act to farm servants employed by persons who habitually employ one or more agricultural labourers, the position of farm labourers in regard to accidents occurring in the natural course of their duty leaves little to be desired. The Sale of Food and Drugs Acts, 1875-99, cover dairy produce and margarine.

The Diseases of Animals Act, 1896, is designed to prevent the importation of diseased animals into the United Kingdom, and in this way has done much to protect and encourage stock-breeders. One of the most important agricultural measures of recent times is the Agricultural Holdings Act of 1900, which amends the English and Scottish Acts of 1883.

The Small Holdings and Allotments Act, 1908, defines an allotment as any quantity of land up to 5 acres, and a small holding as a piece of land not exceeding 50 acres in extent or £50 in value, income-tax assessment. This act considerably extends the powers for the acquisition of land for cultivation in small parcels.

By the Merchandise Marks (Prosecution) Act, 1894, the Board of Agriculture may undertake prosecutions for the contravention of the Merchandise Marks Act of

1891 in cases relating to agricultural or horticultural produce; and British agriculture is in this way enabled to protect itself against injury through fraudulent misrepresentations of the place of origin of imported produce.

The four-course system of rotation of crops—*viz.* wheat or oats, roots, barley, clover—which at first did so much to advance British agriculture by providing food for winter as well as for summer for the fattening of live stock, to the end that fresh beef and mutton should be available all the year round, has practically broken down. This is mainly due to the increase of anbury, commonly called 'finger-and-toe,' in turnips, and to clover sickness, both of which conditions are aggravated by the frequent recurrence of these crops on the same land, and to the brewers' demand for barley of a better quality than can be grown after turnips. Although the leading principles of the old arrangement are maintained, it is extended in various ways to cover a greater period of time. The judicious use of concentrated mineral manures makes it possible to grow barley after wheat without incurring injurious consequences. Catch crops are thrown in either before or after the green crop, which add to the richness of the soil, and increase the food available for live stock.

For advances connected with machinery and tools we are primarily indebted to the American manufacturers, who, by enterprise and healthy competition, have encouraged our home manufacturers to advance with the times. The Oliver chilled ploughs, followed by British-made ploughs of a similar type, have, in spite of the early opposition of the ploughmen, superseded, in many districts where the soil is not too heavy for their successful employment, the iron ploughs with long and

sweeping mould-board. Three short-boarded and short-stilted chilled ploughs do as much work as four of the iron ploughs, and accomplish a saving of one-fourth of the expenditure on animal power and supervision. The steel spring-tined cultivator, which the Massey-Harris Co. of Canada did so much to introduce, but which in various forms is now made by the large English implement-makers, has revolutionized the working of fallow land in this country.

Certain crops have recently come into greater favour, in some cases through their intrinsic merits having been more widely recognized, and in others because of changes in systems of rotation or general farm management. Lucerne is extending on soils containing abundance of lime. Thousand-headed kale has grown much in favour with flock-masters for green winter and spring food, and field cabbages for autumn consumption. Mangels have been on the increase in all of the three kingdoms. Scotland, which is often too sunless for extensive mangel cultivation, now grows satisfactory crops in certain districts in bright and favourable seasons. The simultaneous shrinkage of the area under turnips and swedes is to some extent due to the increasing prevalence of anbury in these crops. The future of the turnip and swede crops is likely to be affected by a comparatively recent turnip disease, which has been traced by William Carruthers, for the Royal Agricultural Society, to bacteria which attack the plant injuriously about the crown of the bulb, or at its junction with the leaves, the upper parts of which also become puckered. During the wet and cloudy season of 1900 it injured a large area of the crop in the south of Scotland and north of England soon after hoeing, and in many cases a loss of one-third of the yield was

sustained. The remainder, which overcame the attack towards the end of the growing season, proved to be inferior in feeding quality. The first serious outbreak was reported in 1897, but at a later stage of the growth of the plant. It is believed to have appeared sporadically, and to have been distributed at least ten years earlier by a consignment of bad seed. The Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland have each a scientific expert, who may be consulted by their members in cases of parasitic injury to crops.

The chief cause of anxiety to the agricultural industry during the closing years of the 19th and the opening years of the 20th century has been the unsettled condition of the labour market, with a rapidly-growing tendency to scarcity and incompetency of farm labour. The growth of the mining industry, the prosperity of trade in general, and the great development of the railway systems of the country, with associated higher remuneration for work, withdraw many of the young and energetic from rural employment, leaving the old men and the least competent of the younger generation to compete for the higher wages which the rural exodus makes it possible for them to secure, in spite of the lower degree of efficiency. The great increase in the demand for women in domestic service, in factories, shops, post offices, etc., has depleted the country places of an important class of labour; and this emigration to the towns of the more capable and qualified young women has again reacted on the young and unmarried male population. From 1871 to 1881 there was a decrease of 5.3 per cent. of males, and 28.5 of females, working on the land; and from 1881 to 1891 the corresponding

figures were 7·4 and 33·5 per cent. The cottage accommodation in the country has not kept pace with the progress of the requirements of the labouring classes, whose standard of living has risen very much in recent years. See Stephen's *Book of the Farm* (1887); Louden's *Encyclopædia of Agriculture*; American *Encyclopædia of Agriculture*; Burn's *Outlines of Modern Farming* (1883); Wrightson's *Principles of Agricultural Practice* (1888); MacConnell's *Elements of Farming* (1896); Bailey's *Principles of Agriculture* (1908); Hall's *Fertilizers and Manures* (1909).

Agriculture and Fisheries, BOARD OF, for Great Britain, a department of state established in 1889, though it had predecessors, the first of which was created in 1793. Its chief functions are the collection of statistics and other information relating to agriculture, horticulture, and forestry, the analysis of fertilizers and feeding stuffs, and the inspection and reporting on technical instruction in agricultural subjects. The powers and duties of the Privy Council under the Contagious Diseases (Animals) Acts, of the Land Commissioners (England) under the Tithe Acts, the Copyhold Acts, the Enclosure Acts, the Metropolitan Commons Acts, the Drainage and Improvement of Lands Acts, or under any other act, and the Commissioners of Works under the Survey Act, 1870, have been transferred to the Board. This department is responsible for orders for muzzling dogs to prevent rabies, and for the destruction of animals and the proclamation of districts in epidemics of pleuropneumonia and swine fever. Upon it depends the Ordnance Survey. In 1903 fisheries were also placed under its control. It consists of the Lord President of the Council, His Majesty's principal Secretaries of State, the First Commis-

sioner of the Treasury, the Chancellor of the Exchequer, the Chancellor of the Duchy of Lancaster, and the Secretary for Scotland, together with other persons whom His Majesty may from time to time appoint during his pleasure. Offices, 4 Whitehall Place and 3 St. James's Square, S. W. The department issues an official journal quarterly, and annual returns of agricultural produce, etc.

Agricultural Gangs Act, 1867. This act, which does not apply to Scotland or to Ireland, defines an agricultural gang as a body of children (under 13), young persons (between 13 and 18), or women, under the control of a gangmaster, who hires them to work as agricultural labourers on land not in his own occupation. Every gangmaster must be licensed, under a penalty of 20s. a day, by a district council in a district, or by the council in a county borough, for six months only, on payment of a fee of 1s. and proof of good character. If the license is refused, there is an appeal to quarter sessions. Females may not be employed in the same gang with males, nor under a male gangmaster unless there is also a licensed female gangmaster. Fines are imposed for offences.

Agricultural Holdings Act. The Act of 1908 consolidates the English enactments on the subject, and alters the common law by providing a simple, effectual code under which the outgoing tenant is entitled to compensation from his landlord for all improvements effected on the holding, and all outlays made which will benefit future holders, always providing that these improvements and outlays fall within the schedules of the act. He is also entitled to compensation for damage by game, and for unreasonable disturbance. The Agricultural Holdings (Scotland) Act, 1908, provides a similar code for Scotland.

Agrigentum (Gr. *Akragas*), ancient tn. of Sicily. See GIRGENTI.

Agrimony, a general name for plants of the genus *Agrimonia*. *A. eupatoria*, the common agrimony, is a perennial herbaceous wayside plant, with an inflorescence about two feet high, bearing small yellow flowers and much-divided leaves. The underground stem yields a yellow dye.

Agrinion or VRAKHORI, tn., Greece, prov. of Acarnania and Ætolia, 18 m. N. of Missolonghi. Pop. 7,000.

Agrippa I. and II. See HEROD.

Agrippa, HEINRICH CORNELIUS, called also AGRIPPA VON NETTESHEIM (1486-1535), an eccentric German philosopher who professed alchemy and magic; author of *De Incertitudine et Vanitate Scientiarum* (1527) and *De Occulta Philosophia* (1531). See Henry Morley's *Life of C. Agrippa* (1856).

Agrippa, MARCUS VIPSANIUS (63-12 B.C.), a man of obscure family, but raised to the highest position by his friend Octavius, afterwards the Emperor Augustus. He married Julia, Augustus's daughter, and had by her five children, one of whom, Agrippina, became the wife of Germanicus. He pacified Gaul in 38 B.C.; beat Sextus Pompeius in the naval battle at Naulochos, Sicily; was in command of Octavian's naval forces at Actium. After Octavian became emperor he did much for the beautifying of Rome. Pacified afterwards the revolted provinces, Gaul, Spain, and Pannonia. He was also a great patron of arts, literature, and science.

Agrippa, MENENIUS, Roman consul (B.C. 502), conqueror of the Sabines and Samnites, reputed author of the fable of the *Stomach and the Members* (see Shakespeare's *Coriolanus*). He obtained certain modifications of the laws in favour of the *plebs*, and died in poverty after a life of public service (Livy, ii. 16, 32, 33).

Agrippina, THE ELDER, daughter of M. Vipsanius Agrippa and Julia, daughter of Augustus; wife of Germanicus, and mother of Caligula and the younger Agrippina. She was renowned for her bravery, but also for her violent temper, under which the Emperor Tiberius suffered severely. Sejanus did his best to aggravate these two into a quarrel, till at last Agrippina was exiled by Tiberius to the island of Pandataria, where she died in 33 A.D. from suicide by starvation. Her statue in the Capitol Museum of Rome is one of the masterpieces of Roman sculpture. See Tacitus, *Annals*, i.-vi., *passim*; J. B. Bury's *Roman Empire* (1893); Baring-Gould's *Tragedy of the Casars* (1895).

Agrippina, THE YOUNGER, daughter of the above and Germanicus; married first to C. Domitius Ahenobarbus, by whom she had a son, afterwards the Emperor Nero, and then to the Emperor Claudius, whom she persuaded to adopt her son Nero, to the injury of his own son Britannicus, in 54 A.D. She had the emperor poisoned, and Nero succeeded to the throne. But he, to rid himself of her influence, caused her to be murdered in 59 A.D. See Merivale's *Romans under the Empire* (1859-62), Baring-Gould's *Tragedy of the Casars* (1895), and J. B. Bury's *Roman Empire* (1893).

Agro Romano, the territory subject administratively to the municipality of Rome, lies on both sides of the Tiber, and along the Mediterranean from the Alban to the Sabine Hills. It consists of pasturage (from October to May), scrub and forest (oak, elm, ash, beech, maple), arable land, vineyards, and marshes. In summer the district is extremely unhealthy, being one of the worst malaria-infected regions of Italy; and it was, and is, a menace to the health of the capital. Hence in 1878 and 1883, and subsequently,

the Italian government has legislated for the purpose of compelling the owners to drain and till the soil. These measures have been attended with considerable success; and malaria is being further combated by the planting of eucalyptus trees, and by supplying the inhabitants with wire nets for doorways and windows, to keep out the mosquitoes. The numbers suffering from malaria in 1888 was 21.46 per cent.; in 1899 it was 6.22 per cent. See CAMPAGNA.

Agtelek. See AGGTELEK.

Aguada, tn., Porto Rico, near Bay of Aguadilla, 5 m. s.e. by s. of that town; said to have been the first landing-place of Columbus in 1493. Pop. 6,500.

Aguadas, tn., Colombia, 50 m. s. of Medellin. Pop. 13,000.

Aguadilla, seapt. tn., Porto Rico, 30 m. n. of Magayuez; exports coffee, sugar, and tobacco. Pop. 17,000.

Aguado, ALEXANDRE MARIE (1784-1842), a wealthy Parisian banker of Jewish origin, native of Seville; served with Soult in the Spanish war of independence. His business, founded 1815, soon rose to the first rank, and he negotiated several Spanish loans and the Greek loan of 1834. Ferdinand VII. created him Marques de las Marismas del Guadalquivir. He died worth over £2,500,000.

Aguardiente ('burning water'), a Spanish brandy.

Aguas Calientes ('warm waters'). (1.) State, Anahuac plateau, Mexico; mountainous in w., with wide plains in e., on which grow wheat, barley, beans, etc. It produces also good building-stones and precious metals. Area 2,950 sq. m.; pop. 102,000. (2.) Town, Mexico, cap. of state Aguas Calientes, 270 m. n.w. of Mexico city; alt. 6,400 ft.; has many churches, convents, and a hospital; is surrounded by fruit gardens. In the vicinity are warm springs. Pop. 35,000.

Ague. See MALARIA.

Aguesseau, HENRI FRANÇOIS D' (1668-1751), chancellor of France; born at Limoges; became advocate-general in 1690, and procurator-general in 1700. During the regency of the Duke of Orleans he was made chancellor of France, but fell into disgrace in 1718 by opposing Law's system of finance. Reinstated in 1720, he was again dismissed in 1722, and was not restored till 1737. He resigned office in 1750. Aguesseau was one of the most learned of French statesmen. His works were published (13 vols. 1759-89, 2 vols. 1865). See *Lives* by Boullée (1849) and Monier (1864).

Aguilar, GRACE (1816-47), author, born of Jewish parents in Hackney, London; published *Spirit of Judaism* (1841), *Women of Israel* (1845), *The Jewish Faith* (1846). After her death appeared also her *Home Influence* (1847), *A Mother's Recompense* (1850), and *The Vale of Cedars* (1850).

Aguilar de la Frontera, tn., Andalusia, Spain, 22 m. s.s.e. of Cordova, on the Cabra; has a dismantled Moorish castle. Pop. 13,000.

Aguilas, tn., prov. Murcia, Spain, 38 m. s.w. of Cartagena, on railway from Murcia to Granada; a busy port and bathing resort on Mediterranean; has large export of iron ore and esparto grass. Pop. 16,000.

Aguilera, VENTURA RUIZ (1820-81), Spanish poet, lived an active life at Madrid, filling several posts under the progressive governments, and carrying on journalistic work. He was ultimately placed at the head of the museum of antiquities. His poetical works include *Ecos nacionales*; *Elegias* (1862); the collections entitled *Armonias y Cantares* (1865); *El Libro de la Patria* (1869); *La Arcadia Moderna*; and *Legenda de Noche-Buena* (1872). A complete edition appeared in 1873.

Aguinaldo, EMILIO (1870), Filipino patriot, born in the province of Cavite in Luzon, fought against the Spaniards as leader of the Filipinos, and latterly as ally of the Americans in their war with Spain. But the announcement (Nov. 1, 1898) by the Americans that they intended to annex the Philippine Is, and their subsequent purchase of the archipelago from Spain (Dec. 10, 1898), led to a rupture between the allies, and a war of subjugation on the part of the United States. On Mar. 28, 1901, Aguinaldo was captured by the Americans, and on April 25 he took the oath of allegiance.

Agulhas, CAPE, or 'The Needles,' so named by the Portuguese on account of its sharp, jagged rocks, is the southernmost point of Africa; it is noted for its storms. A lighthouse stands on the cape.—AGULHAS BANK extends eastward from the cape to the mouth of the Great Fish R., a distance of 550 m.

Agur, a Hebrew sage, to whom is attributed the collection of wise sayings in Prov. 30. See PROV-ERBS.

Agustina (d. 1857), the Maid of Saragossa, who encouraged the Spaniards to maintain the defence of Saragossa against the French during the sieges of 1808-9. See Byron's *Childe Harold*, i. 54-56; and Southey's *Hist. of Peninsular War*. Her portrait was painted by Wilkie.

A.H. (*anno Hegiræ*, i.e. 'in the year of Hegira; more correctly, *Hijra*), the recognized symbol for the Moslem era, as A.D. is for the Christian era. Mohammedanism is taken as dating from Mohammed's flight to Medina (see MOHAMMED), which took place in A.D. 622.

Ahab, king of Israel (875-853 B.C.), was the son and successor of Omri, and the contemporary and ally of Jehoshaphat, king of Judah. A man of undoubted

patriotism and courage, Ahab joined these virtues to an unfortunate moral indifference or weakness. His marriage with Jezebel, daughter of Ethbaal, king of Tyre, cemented an alliance designed to act as a countercheck to the ambition of Benhadad II., king of Syria; but it fixed the worship of Baal upon Israel, and so brought the king into conflict with the prophet Elijah. Twice Ahab discomfited the Syrians, but in a third battle, at Ramoth-gilead, he was mortally wounded by a random arrow (1 Kings 16:29-33; 22:34-40). See Kittel's *Hist. of the Hebrews*, ii. 214 ff.

Ahasuerus. (1.) A king of Persia, prominent in the Book of Esther, whom he made his queen; identified with Xerxes. The Ahasuerus of Dan. 9:1 cannot be identified, as no Ahasuerus (or similar name) appears in the list of Median kings. See Sayce's *Higher Criticism and the Monuments* (1894). (2.) The name in legend of the Wandering Jew.

Ahaz, king of Judah (c. 735-719 B.C.), the *Jauhazi* of the inscriptions, was the son and successor of Jotham. Being threatened by Rezin, king of Syria, and Pekah, king of Israel, he sought the protection of Assyria—an act denounced by Isaiah—and ultimately became tributary to that power. (See 2 Kings 16; Isa. 7.)

Ahaziah. (1.) King of Israel (c. 853-852 B.C.), the son and successor of Ahab. He died in consequence of a fall from an upper window. (See 1 Kings 22:40-2 Kings 1.) (2.) King of Judah (c. 843-842 B.C.), the son of Jehoram (of Judah) and Athaliah, and thus the nephew of the foregoing. In alliance with Jehoram (of Israel) he made an unsuccessful expedition against Hazael of Damascus; and afterwards, while Ahaziah was on a visit to his wounded kinsman at Jezreel,

an insurrection broke out under Jehu, in which Jehoram was killed and Ahaziah mortally wounded. (See 2 Kings 8:25-9; 2 Chron. 22:9.)

Ahimelech, high priest of Israel, who at Nob fed David with the shewbread, and gave him the sword of Goliath (1 Sam. 21:1-10).

Ahithophel, a Gilonite, one of King David's ablest and most trusted counsellors, who nevertheless joined the revolt of Absalom. When a proposal which he had made for the procuring of David's death was rejected on the advice of Hushai, he rode home to Giloh and strangled himself. (2 Sam. 15-17.)

Ahlen, tn., Westphalia, Prussia, on the Werse, 20 m. S.E. of Münster; manufactures linen and enamels. Pop. 8,000.

Ahlqvist, AUGUST ENGELBERT (1826-89), professor of Finnish language and literature at Helsingfors (1863); published works on the languages of the Wotjaks, Mordvins, and W. Finnish dialects; wrote on the structure of the Finnish language (1877), an inquiry into the origin of the Kalewala (1887), an account of his travels, and a volume of poetry.

Ahlwardt, THEODOR WILHELM (1828), Orientalist; born at Greifswald; became professor of Oriental languages there in 1861. His works, chiefly on ancient Arabic poetry and Saracen history, are: *Ueber Poesie und Poetik der Araber* (1856); *Diwan des Abu-Nowas* (1861); *Divans of the Six Ancient Arabic Poets* (1870); *Bemerkungen über die Echtheit der altarabischen Gedichte* (1872); *Anonymearabische Chronik* (1883); *Sammlung alter Arab. Dichter* (1902-3); *Ruba's Diwan* (1904); and a Catalogue of Arabic MSS., Royal Library, Berlin (1887-99).

Ahmed I., or ACHMET, Sultan of Turkey (1589-1617), son of Mohammed III., whom he succeeded in 1603. In 1606 he concluded the peace of Sitvatorok with Austria,

and in 1612 terminated an unsuccessful war with Persia.

Ahmed II., or ACHMET (1642-95), Sultan of Turkey, succeeded his brother Solyman II. in 1691. His forces, led by Kiuprili, were expelled from Hungary after their crushing defeat at Salankeman in 1691, when Kiuprili was slain.

Ahmed III., or ACHMET (1673-1736), Sultan of Turkey, a brother of Mustapha II., whom he succeeded. His campaign against Russia was concluded by the peace of the Pruth (1711). He regained the Morea from the Venetians in 1715, but was defeated by the Austrians at Peterwardein in 1716, and at Belgrade in 1717. His ineptitude as a ruler led to his dethronement in 1730.

Ahmed IV. See ABDUL HAMID I.

Ahmedabad, or AHMADABAD, an ancient city of India, Presidency of Bombay, on the Sabarmati R., 300 m. N. of Bombay. It was founded in 1412, and was long a splendid city of the Mogul empire, but has now fallen into utter decay. The British, under General Goddard, stormed the city in 1780; but it continued in the possession of the Mahrattas till 1818, when it was ceded to the East India Company. The great earthquake of 1819 destroyed a large part of the city and some of its finest edifices. Its architectural remains, however, are even now splendid, and often exhibit striking combinations of Jain and Saracenic characteristics. The most important buildings are the Jama Masjid, or Great Mosque (1824), remarkable for its wonderfully decorated minarets; and the Ivory Mosque, so called because, though a white marble structure, it is lined with ivory inlaid with gems. There is also a very beautiful modern Jain temple. The manufactures include gold-brocaded silks, pottery, paper, tin, electro-plating, cotton spin-

ning, and weaving. Pop. 186,000. See Hope and Fergusson's *Architecture of Ahmadabad* (1866).

Ahmednagar, or AHMADNAGAR. (1.) District, Deccan, Presidency of Bombay. Area, 6,647 sq. m. Spurs from the Sahyadri Hills, which bound it on the w., run into the district. Wheat, Indian millet, and grain are its chief agricultural products. Pop. 840,000. (2.) The cap. of the district, on l. bk. of the Sina (Seena), and about 126 m. E. of Bombay. The fort stands about half a mile to the E. of the city. The chief manufactures are the weaving of saris (women's dresses) and carpets, and the making of copper and brass vessels. Pop. 42,000.

Ahmedpur, or AHMADPUR, tn., W. India, native state of Bahawalpur, 30 m. w.s.w. of town of the same name; manufactures of matchlocks, gunpowder, cotton, and silks. Pop. 10,000.

Ahmed Shah (c. 1724-73), founder of the Afghan or Durani dynasty, was the son of Sammaun Khan, hereditary chief of the Abdali tribe. On the assassination (1747) of Nadir Shah, in whose bodyguard he had served, Ahmed retreated to Afghanistan, where he was chosen sovereign, and was crowned at Kandahar the same year.

Ahn, JOHANN FRANZ (1796-1865), educationist, was born at Aachen. His chief work, *Praktischer Lehrgang zur schnellen und leichten Erlernung der französischen Sprache* (1834 and 1840), was published in over two hundred editions, and was followed by similar text-books in English, Dutch, and Italian. He advocated a natural method of language teaching.

Ahnachapan, tn., cap. of Ahnachapan, dep. Salvador, Central America, 20 m. s.w. of Sta. Ana; has hot sulphur springs. Pop. 14,000. The dep. borders Guatemala on the w. It exports sugar, coffee, and tobacco. Pop. 60,000.

Ahriman, or ARIMANES, known to the general reader by the splendid invocation chanted by Saladin in Scott's *Talisman*, was the supreme evil spirit of the ancient Persian religion (Zoroastrianism). Coeval with Ormuzd, the Supreme Good, with whom he was ever in conflict, this 'Dark Spirit' inevitably suggests the Jewish Satan. The *Zendavesta* makes him the creator of all poisonous snakes, beasts of prey, obnoxious parasites, etc. See J. Darmesteter's *Ormazd et Ahriman* (1877).

Ahwaz, AHWUZ, or AHWAS, vil., prov. Khuzistan, Persia, 70 m. N.E. of Bassora; notable for its ruins of the capital of Artabanus, last king of Parthia. Pop. 3,000.

Ai, also HAI, AIJA, AIATH, a Canaanite royal city, situated to the E. of Bethel. It is mentioned in connection with Abraham (Gen. 12:8), but is remembered chiefly by its capture and destruction by Joshua, after the severe reverse of the Israelites on account of the sin of Achan (Josh. 7:2-8:29).

A.I.A., the abbreviation used to denote Associate of the Institute of Actuaries.

Aicard, JEAN FRANÇOIS VICTOR, French poet (1848), born at Toulon, has published several volumes of verse—e.g. *Les Poèmes de Provence* (1874); *La Chanson de l'Enfant* (1876); *Miette et Noré* (1880), an idyll of Provence; *Lamartine* (1883); and *Jésus* (1896). He has also written novels, as *Le Roi de la Camargue* (1891), *L'Âme d'un Enfant* (1898), and *Tata* (1901). His dramatic works comprise *Au Clair de la Lune* (1870); *Othello, ou le More de Venise* (1882); and *Le Père Lebonnard* (1889); *Le Manteau du Roi* (1907); *Maurin des Maures* and *L'Illustré Maurin* (1908).

Aidan (d. 606), king of the Scottish Dalriada (the modern Argyllshire), a Gaelic kingdom, founded in the 5th century by Fergus Môr. Crowned by St. Columba at Iona,

he completed the separation of the Scottish Dalriada from the parent kingdom in Ireland, and in 588 conquered the Isle of Man. Aidan attempted to extend his kingdom southward by attacking Ethelfrith, king of Bernicia, but met with defeat (603). See Skene's *Celtic Scotland* (3 vols. 2nd ed. 1886-90), and his *Chronicles of the Picts and Scots* (1867).

Aidan, St. (d. 651), a Columban monk of Iona, where he was consecrated bishop about 635, in which year he began his work of Christianizing Northumbria, in response to the invitation of Oswald, king of Bernicia. Fixing his see at Lindisfarne (the Holy Isle), Aidan founded there the church afterwards associated with St. Cuthbert. King Oswy, brother and successor of Oswald, continued to act as Aidan's patron until the latter's death. Bede testifies to the piety, humility, and fervour of this apostle of Northumbria. See Bede's *Ecclesiastical History*; M'Lauchlan's *Early Scottish Church* (1865).

Aidé, CHARLES HAMILTON (1830-1907), English song-writer, novelist, and dramatist, born at Paris; served from 1845-52 in the army. Among his works are *Eleonore, and other Poems* (1856); *Songs without Music* (1882). His novels and romances include *Rita* (1859); *Penruddocke* (1873); *Poet and Peer* (1880); *Jane Treachel* (1899); *Snares of the World* (1901); and *Past and Present* (poems, 1903). His plays were *Philip* (1872); *Nine Days' Wonder* (1874); and the farcical comedy *Dr. Bill* (1898). He was the author of the well-known songs *Remember or Forget* and *The Danube River*.

Aide-de-camp, an officer attendant on a general, theoretically to carry his orders to commanders in the field, but practically to act as his secretary, superintend his establishment, and generally facilitate his business

and social engagements. He may be of any rank, but it is rare that field officers are appointed. In time of peace few general officers are allowed more than one aide-de-camp. In time of war the officer commanding a division has two, the officer commanding a brigade one.

Aidin, tn. (*Guzel-Hissar*), Asia Minor, in the valley of the Menderez, 60 m. s.e. of Smyrna. Morocco leather, cotton, figs, olives, and grapes are exported. Pop. 36,000.

Aidone, tn., Sicily, prov. of Caltanissetta, 40 m. w. of Catania; has mineral springs. Pop. 8,500.

Aids. Under the feudal system a vassal was obliged to grant a sum of money, called 'an aid,' to enable his lord to ransom his person, pay a relief to his overlord, to knight his eldest son or marry his eldest daughter. The king, in addition to the two last-mentioned aids, could claim one to ransom his person from captivity. Aids were restricted by *Magna Charta*, and abolished in 1660. See Digby's *History of the Law of Real Property*.

Aigina. See ÆGINA.

Aigle (Ger. *Aelen*), tn., Switzerland, canton Vaud, 6 m. from the s. end of the Lake of Geneva. Pop. 4,000.

Aiguesmortes, or AIGUES-MORTES ('dead waters'), tn., dep. Gard, France, 20 m. s. by w. of Nîmes, and on extreme w. of the Rhone delta. Its ramparts, constructed about 1280 by Boccanegra, are well preserved. Pop. 4,000.

Aigun, AIKHUN, or SAKHALIN ULA, tn., Manchuria, on river Amur. The treaty which gave Russia the Amur region was concluded here in 1858. Pop. 20,000.

Aikawa, tn., Japan, prov. and island of Sado, 40 m. from Niigata. Gold and silver mines are in the vicinity. Pop. 12,000.

Aikenhead, THOMAS (c. 1678-1697), an Edinburgh apothecary's son, who was hanged for blasphemy and heterodox opinions. His execution was strongly condemned, among others, by John Locke. See Macaulay's *History*; and for Locke's letter to the king, *State Trials*, vol. xiii. pp. 917-39.

Aikin, JOHN (1747-1822), physician and author, was educated at Warrington Academy—'the cradle of Unitarianism'—in Edinburgh, and in London. He had little professional success at Great Yarmouth, but afterwards did well in London. He wrote *Lives of Howard, Selden, and Ussher*; *General Biography* (1799-1815); and, with his sister, Mrs. Barbauld, *Evenings at Home* (1792-5).

Aikin, LUCY (1781-1864), daughter of the above, author of a *Life of Addison* (1843), on which Macaulay has an essay; and of memoirs of the courts of Elizabeth (1818), James I. (1822), and Charles I. (1833). See *Lucy Aikin: Memoirs, Miscellanies, and Letters*, ed. by Le Breton (1864).

Aikins, JAMES COX (1823-1904), Canadian politician, born in co. Peel, W. Canada; was elected to the Assembly in 1854 and to the Legislative Council in 1862, where he sat till the confederation (1867). He was then called to the Senate by proclamation, and became secretary of state in 1869, and later minister of inland revenue. His chief work was the acquisition of the North-West Territories and organization of the Dominion Lands Bureau. He was lieutenant-governor of Manitoba (1882-96).

Ailanthus, a small genus of plants of the natural order Simarubaceæ (the Quassia order). Three species occur in China and the E. Indies; one, *A. glandulosa*, 'the tree of heaven,' introduced from China in 1751, is cultivated as an ornamental tree. Its leaves form the food of a kind of silkworm.

Ailly, PIERRE D' (1350-1419), theologian, philosopher, and prelate, born at Compiègne, France. He became cardinal, and Pope's legate in Germany and at Avignon. A determined opponent of Huss, he was designated 'The Hammer of the Heretics.'

Ailsa Craig, a rocky islet of gray trap, rising to 1,114 ft. in the Firth of Clyde, 10 m. w. of Girvan. The island gives the title of baron and marquis to the earls of Cassilis. See Lawson's *Ailsa Craig* (1888).

Aimak, a Mongol tribe which, with the Hazara, occupies the N.E. of Afghanistan, between Herat and Kabul. They number about 650,000 with the Hazara, and are an agricultural and warlike people.

Aimard, GUSTAVE (1818-83), French novelist. His best-known novels of adventure are *Les Trappeurs de l'Arkansas* (1858), *Les Pirates de la Prairie* (1859), *Les Scalpeurs Blancs* (1873).

Ain, dep. of E. France, limited E. and S. by the Rhone, W. by the Saône; Bourg, cap. of dep., is 227 m. S.E. of Paris. Area of dep., 2,248 sq. m. The river Ain, which rises in the Jura Mountains, and after a course of 120 m. falls into the Rhone 18 m. above Lyons, divides it into two nearly equal parts. The dep. is agricultural and pastoral. Pop. 345,000.

Ainger, ALFRED (1837-1904), reader at the Temple Church, London (1866-92), and master of the Temple (1894-1904), was born in London; curate of Alrewas, Lichfield (1860-4). He published *Sermons Preached in the Temple Church*, *Memoir of Charles Lamb*, and (Eng. Men of Letters) an edition of Lamb's works, and the volumes on *Lamb* (ed. 1888) and *Crabbe* in Eng. Men of Letters (1903); *Lectures and Essays* (1905). He contributed to the *Dict. Nat. Biog.* (Tennyson, Du Maurier, etc.). See E. Sichel's *Life and Letters of Alfred Ainger* (1906).

Ainhum, a disease, afflicting only African peoples and their descendants, in which the little toe is gradually cut off by a tightening band of hard skin. It is of the nature of a local scleroderma.

Ainmiller, or AINMULLER, MAX EMANUEL (1807-70), reviver of the art of glass-staining; a native of Munich. The new windows in Ratisbon cathedral, and others at Munich, Cologne, and in St. Paul's, London, are by him.

Aïnos, or AÏNUS (signifying 'men'), the name given to themselves by a primitive people inhabiting Yezo, the s. parts of Sakhalin, and the Kurile Is. as far as 48° N. lat. In former times they also occupied a large territory in Hondo, the main island of Japan, where, indeed, their mixed descendants form part of the present population. European in type, and aptly compared to the Russian *moujiks*, their most striking physical characteristic is their excessive hairiness of skin. Against the Japanese—to whom they are known as Ebisu, Yebisu, or Yemishi—they made a most obstinate resistance during a period of fully one thousand years.

The Aïnos are polygamous, and live in huts, under their own chiefs. They are a race of hunters and fishers. Shamans in religion, they worship the sky, earth, fire, wind, and water, and in their worship employ idols or *inao* made of willow shavings. The great annual bear feast is also, in some sense, a religious ceremony; and then, and at every opportunity, they intoxicate themselves with rice beer. They are afflicted with various skin diseases, the result of their dirty habits. They have affinities in speech and blood with the people of Kamchatka and the Amur district. The number of true Aïnos does not probably exceed 12,000 (another account gave them as 17,500 in 1896). Nearly all

the scientific works on the Aïnos are included by Von Wenckstern in his *Bibliography of Japan* (1895); and see also Baelz, in *Verh. d. Berliner Gesellsch. f. Anthropologie* (1901). The fullest English accounts are Romyn Hitchcock's *Aïnos of Yezo* (Smithsonian Institution Report for 1890), and MacRitchie's *Aïnos* (1892). See also Savage Landor's *Alone with the Hairy Aïnu* (1893), and Bird's (Bishop's) *Unbeaten Tracts in Japan* (1880).

Aïn Sefra, terr. and comm. prov. of and 65 m. s. of Oran, Southern Algeria. Pop.: terr. 100,000; comm. 14,000 (2,000 Europeans).

Ainsworth, HENRY (1571-1622), forced to leave his native country (England) in 1593, became pastor of Brownist congregation at Amsterdam, and a leading Orientalist; left many controversial and other works. See Dexter's *Congregationalism of the last Three Hundred Years* (1880).

Ainsworth, WILLIAM HARRISON (1805-82), historical novelist, born at Manchester; in 1826 abandoned law, married a publisher's daughter, and for a year and a half followed his father-in-law's occupation. His first novel was *Rookwood* (1834), containing a spirited account of Dick Turpin's ride to York. Between 1834 and 1881 he wrote some forty novels, a few of them appearing originally in *Bentley's Miscellany*, *Ainsworth's Magazine*, and the *New Monthly*, during his editorship of these periodicals. His work is vivid and readable, and, notably in *Crichton* (1837), *Jack Sheppard* (1839), *Tower of London* (1840), *Old St. Paul's* (1841), and *Lancashire Witches* (1841), shows some literary merit. See *William Harrison Ainsworth and His Friends*, by S. M. Ellis (1910).

Ainsworth, WILLIAM FRANCIS (1807-96), geographer, was born at Exeter. In 1835 he was appointed surgeon and geologist to the Ches-



The Ainos of Japan—Great Annual Bear Feast.

ney expedition to the Euphrates, and in 1838 was in command of an expedition to Asia Minor and Kurdistan. He published *Researches in Assyria, Babylonia, and Chaldæa* (1838); *Travels and Researches in Asia Minor, Mesopotamia, Chaldæa, and Armenia* (2 vols. 1842); *Illustrated Universal Gazetteer* (1863); *A Personal Narrative of the Euphrates Expedition* (1888), etc.

Ain-Tab, tn., Turkey in Asia, on the s. slope of Mt. Taurus, 60 m. N.N.E. of Aleppo, on the reputed site of the ancient *Antiochia ad Taurum*. There are manufactures of leather and a trade in hides; numerous vineyards. Pop. 40,000.

Air. See ATMOSPHERE. In Music, see ARIA.

Air, or ASBEN (21,000 sq. m.), an oasis of Central Sahara, in lat. 16°-20° N. and long. 6°-9° E. Its mountains (4,000 to 5,000 ft.) have a beneficial effect on rainfall. The climate is healthy; date-palms grow in the valleys. Pop. 60,000, mainly of Tuareg tribes. The cap. is Agades or Agadez. The town of Asben, in the s., is an important caravan centre between Central and N. Africa, fifty days from Tripoli.

Aira. See HAIR-GRASS.

Air-bladder, or SWIM-BLADDER, a structure of much morphological interest, present in most, though not all, fishes. Like the lungs of air-breathing vertebrates, it arises as an outgrowth from the alimentary canal, and may either retain this connection throughout life (physostomatous), as in the herring, or become entirely shut off from the gut (physoclystous), as in the haddock. In the Dipnoi it functions as a lung; in other fish its function is hydrostatic, though it may also serve as an accessory organ of respiration. There is often a connection between the ear and the swim-bladder. Though the air-bladder arises dorsally instead of ventrally, and is usually

single, it is entirely homologous with the lungs of the higher vertebrates.

Aird, riv. on s. coast of British New Guinea, one of the mouths of the river Philp. Owing to a bar at the mouth it is not navigable.

Airdrie, a parl. and munic. bur. of Lanarkshire, Scotland, 11 m. E. of Glasgow. It was made one of the five Falkirk burghs in 1832. In the neighbourhood are over forty collieries, as well as iron mines. The town owes its importance to its brass and iron foundries, engineering works, fire-clay factories, paper and soft goods manufactures. Pop. 22,300.

Airedale, in the W. Riding of Yorkshire, England, comprises the upper valley of the Aire from its source in Malham Cove to Leeds, a length of about 35 m. Factories and iron-works have sprung up along its banks. See Nicholson ('the Airedale poet'), *Airedale in Ancient Times* (1825), and Gray's *Through Airedale* (1891).

Airedale Terrier. There are nearly twenty varieties in Britain, but they may be classified in two divisions—the smooth and the rough or broken-haired, the latter being of Scotch descent, developed in some cases by crossing with the Maltese. The Airedale terrier is one of the largest and tallest of terriers, and weighs from 40 to 45 lbs. He will retrieve, and takes readily to water. Points:—Head long, with flat skull, not too broad between the ears, and narrowing slightly to eyes, but free from wrinkle; stop hardly visible, and cheeks free from fullness; jaw deep and powerful, well filled up under the eyes; lips tight; ears shaped like the letter V, with a side carriage, small, but not out of proportion to the size of the dog; nose black; eyes small, dark in colour, and full of 'terrier' expression; teeth strong and level;

neck of moderate length and thickness, gradually widening towards the shoulders, and free from 'throatiness;' shoulders long, and sloping well into the back; shoulder-blades flat; chest deep, but not broad; back short, strong, and straight; ribs well sprung; hind quarters strong and muscular, with no drop; hocks well let down; tail set on high and carried gaily, but not curled; legs perfectly straight, with plenty of bone; feet small and round, with good depth of pad; coat hard and wiry, not ragged, lying straight and close; head and ears should be tan, with the exception of dark shadings on each side of the skull; the legs, up to the elbows and thighs, tan, and the rest of the body black or dark grizzle. The tail should be docked to about a third of its original length.

Air-engines. In engines of this type, generally single-acting, the motive power is obtained by the alternate heating and cooling of a quantity of air within a closed vessel, part of which may form the motor cylinder. The expansion of the air drives a piston, which does the work, as in an ordinary steam-engine. In an air-engine it is possible to use very high temperatures without being inconvenienced by correspondingly high pressures; in this respect air differs from steam and other saturated vapours. An air-engine should therefore have a high thermal efficiency; but in practice the actual efficiency is in most cases less than in an ordinary steam-engine. An air-engine, with one or two exceptions, may be termed an *external-combustion* engine, since, like the steam-engine, it receives its heat by conduction from an external source. On the other hand, in gas and oil engines the heat is evolved within a closed cylinder containing the working substance: en-

gines belonging to this latter class are called *internal-combustion* engines. In an external-combustion engine there must necessarily be a considerable loss of heat between the furnace and the working fluid; consequently the actual thermal efficiency of such engines is very low.

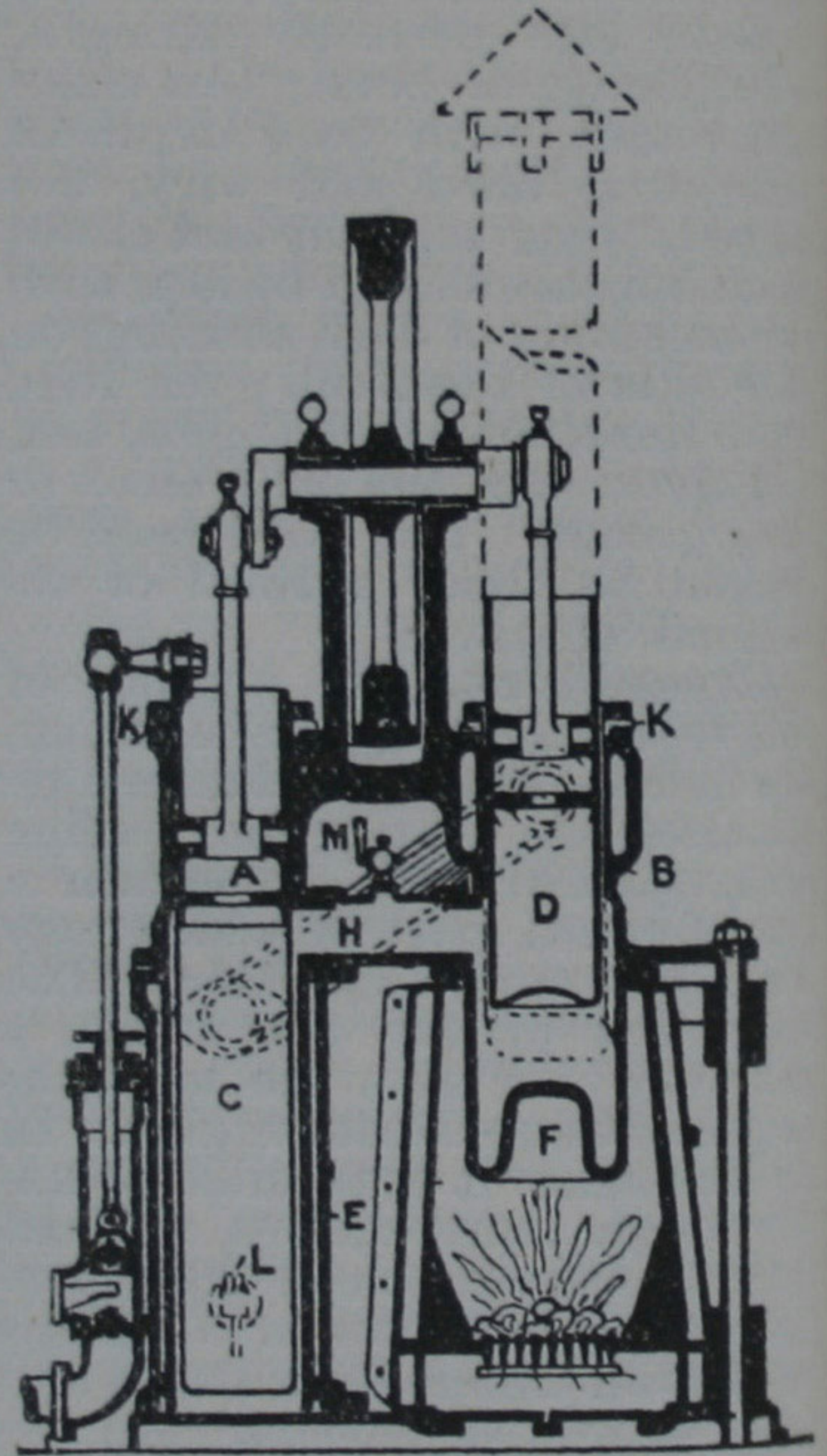
Most air-engines work with very low pressures, and are therefore bulky for the power they develop. Difficulty is also experienced in heating satisfactorily large quantities of air; and, in addition, that part of the air-vessel which is in immediate contact with the furnace is rapidly burnt away, on account of the high temperature to which it is subjected. Air-engines are seldom suitable to replace steam, gas, or oil engines, except for very small powers; but, at the same time, they are absolutely safe, easy to work, and do not require skilled or constant attention. Small-power air-engines are very suitable for pumping purposes in connection with the supply of water to country mansions, hotels, etc. Almost any form of cheap fuel may be used, such as coke, coal, peat, wood, sawdust, etc., and the cost of raising water is thus comparatively small.

The earliest hot-air engine was invented by Sir George Cayley in 1807, afterwards improved and modernized by Buckett. This engine is practically on the internal-combustion principle, as the coal or coke is burnt under pressure in a chamber which communicates through a valve-controlled passage with the motor cylinder, so that both the products of combustion from the furnace and the heated air come into contact with the working piston. Air for combustion is supplied by a compressing pump placed immediately over the motor cylinder, and worked from the same piston rod. The admission of the compressed air to the furnace is con-

trolled by a valve, which allows part of the air to enter below the furnace bars, while the rest of the air mixes with the products of combustion as they come from the fuel; the proportion which goes to each is regulated by a governor through the above-mentioned valve. The products of combustion, together with the heated air, pass into the motor cylinder, the supply being stopped after a fraction of the stroke has been made. The gases then expand, doing more work, and are reduced in temperature. On the return stroke they are discharged into the atmosphere, and the pump takes in a fresh supply of air. The fuel is contained in a closed hopper over the furnace, and connected therewith by means of a double valve. Before the latter is lowered to admit fresh fuel to the furnace, the pressure in the hopper is equalized by making communication with the furnace chamber; the valve is then lowered, and the fuel falls into the furnace. The mechanical efficiency is low, and the actual thermal efficiency in the best cases is not more than eight per cent.

Of the true external-combustion engine, that invented by Robert Stirling of Edinburgh in 1827, and afterwards improved by his brother, James Stirling, is no doubt the pioneer. Although in its original form the Stirling engine is obsolete, it is represented in principle by several modern engines which work with more or less success. A very successful type of hot-air engine, in which the Stirling principle is carried out, is the 'Rider' engine, made by Messrs. Hayward-Tyler and Co. A sectional view of this engine is here shown. There are two cylinders, A and B, open at the top, and fitted with plunger pistons, C and D, which are connected to cranks nearly at right angles. The two cylinders are connected by

means of a passage H, filled with very thin iron plates, and called a 'regenerator.' The heated air, in passing through the regenerator, gives up the greater portion of its heat to the iron plates, to be picked up and utilized on the return of the air through the heater. The same air is used continuously, and is passed alternately from one cylinder to the



'Rider' Air-engine—section.

other. The piston C first compresses the cool air in the cylinder A into about one-third of its normal volume, when, on the up-stroke of the power piston D, and the completion of the down-stroke of the piston C, the air is transferred from the cylinder A, through the regenerator H, to the heater F, without appreciable change of volume. The result is a considerable increase of pressure