

position about 4 feet behind the breech of the gun, holding the firing lanyard taut; when the object and the bead of the fore-sight appear to be on the centre of the wire across the H of the hind-sight he fires.

The forms of sights preferred by experts for accurate laying are extremely varied, and nothing but practice can determine the most suitable to individual eyesight. Where the eye can be brought close to the hind-sight, one of the best systems is that adopted for British field-guns, where a fine peep-hole constitutes the hind-sight, and the fore-sight consists of diagonal cross-wires; the first rapid or rough adjustment of the gun is made with the aid of a V-shaped notch on the hind-sight and an acorn point on the fore-sight. Some prefer pointers for the fore-sight, either O-shaped, so that the object appears between the cusps of the O—this is the French method—or placed diagonally like cross-wires with the intersection removed. Silvered vertical lines are preferred by many good shots. If the gun is mounted in a fixed position, say on a siege platform, and, if the relative positions of the target and some other object are known, it may be found convenient to lay the gun on the target by directing the sights at the other object. This is principally done in the case of howitzers dropping shells at high elevation into a work. They fire over a protecting bank and are laid by reversed sights from the muzzle backwards at a steeple, a pole, or other convenient object.

To secure greater accuracy than can be attained by the eye, telescopes are resorted to. It is obviously easy to apply to a match rifle a telescope with sufficient strength to resist the jar of firing, and to provide it with the necessary fittings for elevation, deflexion, &c.; but with ordnance the shock is much greater, and the telescope has to be removed before firing. This renders it difficult to secure a truly accurate attachment; but probably the immediate future will witness a sufficiently satisfactory solution of the problem as regards guns on firm platforms. Efforts have been made from time to time to overcome the necessity for extreme accuracy due to the short bearing of the telescope by bringing the fore-sight into play; this can be done either by great powers of adjustment of focus, so as to view first the fore-sight and then the target, or by adding a half-object lens, and so getting simultaneous images of fore-sight and target.

The application of electricity to the laying and firing of heavy guns has caused a remarkable development of the systems of sighting introduced recently into the forts which protect the shores of the United Kingdom. Suppose a battery of guns to command a channel, and that it is desired to concentrate their fire on a hostile vessel endeavouring to run past. Each detachment lays its gun both for elevation and direction in accordance with the

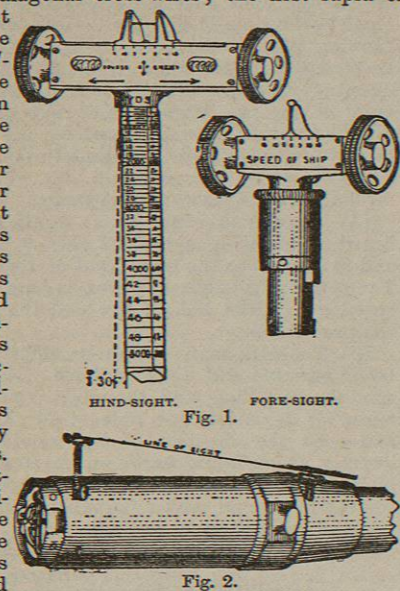


Fig. 2. Speed-sights used in the British navy.

figures which appear on a dial in the emplacement. Each dial is worked by electricity from an observing station away from the smoke and noise of the fort; as the hostile vessel approaches the observing officer follows its course on a chart. The observing station is placed at a considerable height above the water-line, so that a vertical base of calculation is obtained. Hence the angle of depression given by the telescope when pointing at the object indicates the range, and the direction of the telescope indicates the line of fire; these indications are automatically corrected for the positions of the guns. In practice the officer follows the ship's course, signals to the battery the line and distance of a point a little ahead of the vessel, and receives a signal from the battery that the guns are laid and ready. He then fires electrically as the ship is coming into the expected position. (E. M.)

SIGISMUND (1362-1437), German emperor, was born on 14th February 1362. After the death of his father, the emperor Charles IV., he received the margraviate of Brandenburg; and his betrothal with Mary, the daughter and heiress of Louis of Poland and Hungary, gave him a right to look forward to the succession in these two countries. But in 1383, when Louis died, the Poles chose Hedwig, Mary's sister, as their queen; and Sigismund was unable to marry Mary and to secure the crown of Hungary until 1387, as her rights had been seized by Charles of Durazzo, and after his death she had been made prisoner by the ban of Croatia. Sigismund was soon involved in a war with the Turks, and in order to obtain the means of carrying on the struggle he gave Brandenburg in pledge to his cousin Jobst of Moravia. Defeated at Nicopolis in 1396, Sigismund fled to Greece; and in his absence his wife died. When he returned to Hungary the people rose against him, made him prisoner, and gave the crown to Ladislaus of Naples. Sigismund escaped, and having sold the Altmark, which he had inherited from his brother John, he was able to collect an army and to crush the Hungarian rebellion. Meanwhile his brother Wenceslaus, king of the Romans, had been deposed, and Rupert of the Palatinate was chosen as his successor. In 1410 Rupert died, and Sigismund and Jobst of Moravia were both elected to the crown. Jobst died in the following year, and then Sigismund was universally recognized as king. One of the chief events of his reign was the assembling of the council of Constance, which met for the purpose of bringing the great schism in the church to an end. Sigismund marred his services in connexion with the council by assenting to the burning of John Hus, to whom he had granted a safe conduct. For this treachery he had to pay a heavy penalty, for it led indirectly to the Husite War, which raged for about sixteen years. In 1435 peace was restored, and Sigismund obtained possession of Bohemia. In 1415 he gave Brandenburg, which had been restored to him after Jobst's death, in fief to Frederick, burgrave of Nuremberg; and in 1423, in reward for services rendered in the Husite War, Frederick, margrave of Meissen, received the duchy of Saxony with the electoral dignity. Sigismund was crowned emperor in 1433, having obtained the Italian crown two years before. He died at Znaim in Moravia on 9th December 1437. He possessed considerable intellectual ability, but he never did full justice to his powers,—being recklessly extravagant and of a wayward and impulsive temper.

See Aschbach, *Geschichte Kaiser Sigismund's* (1838-45); Schroll, *Die Wahl Sigismund's zum römischen König* (1875); Bezold, *König Sigismund und die Reichskriege gegen die Hussiten* (1872-77); Kerler, *Deutsche Reichstagsakten unter Kaiser Sigismund* (1878).

SIGISMUND, the name of three kings of Poland. See POLAND, vol. xix. pp. 290-291 and 294.

SIGMARINGEN, the seat of government of the Prussian administrative division of the same name, is a small town

on the Danube with (1880) 4154 inhabitants. The division of Sigmaringen is composed of the two formerly sovereign principalities of Hohenzollern-Sigmaringen and Hohenzollern-Hechingen (see HOHENZOLLERN, vol. xii. p. 52) and has an area of 440 square miles, with a population in 1880 of 67,624. The Sigmaringen part of the Hohenzollern lands was the larger of the two (297 square miles) and lay mainly to the south of Hechingen, though the district of Haigerloch on the Neckar also belonged to it. The name of Hohenzollern is used much more frequently than the official Sigmaringen to designate the combined principalities.

SIGNALS, NAVAL. A system of naval signals comprises different methods of conveying orders or information to or from a ship in sight and within hearing, but at a distance too great to permit of hailing,—in other words, beyond the reach of the voice, even when aided by the speaking-trumpet. Signals are divided into classes according to the instruments with which and the circumstances under which they are made. There are sight and sound signals; flag, semaphore, fixed lantern, flashing, firework, horn or steam-whistle, and gun signals; day, night, fog, and distant signals. Besides these, there are other divisions, such as general, vocabulary, evolutionary, &c., which depend upon technical considerations and are matters of arrangement.

The necessity of some plan of rapidly conveying orders or intelligence to a distance was early recognized. Polybius describes two methods, one proposed by Aeneas Tacitus more than three centuries before Christ, and one perfected by himself, which, as any word could be spelled by it, anticipated the underlying principle of recent systems. The signal codes of the ancients are believed to have been elaborate. Generally some kind of flag was used. Shields were also displayed in a preconceived manner, and some have imagined that the reflected rays of the sun were flashed from them as with the modern heliograph (see HELIOGRAPHY). In the Middle Ages flags, banners, and lanterns were used to distinguish particular squadrons, and as marks of rank, as they are at present, also to call officers to the admiral, and to report sighting the enemy and getting into danger. The invention of cannon made an important addition to the means of signalling. In the instructions issued by Don Martin de Padilla in 1597 the use of guns, lights, and fires is mentioned. The introduction of the square rig permitted a further addition, that of letting fall a sail a certain number of times. Before the middle of the 17th century only a few stated orders and reports could be made known by signalling. Flags were used by day, and lights, occasionally with guns, at night. The signification then, and for a long time after, depended upon the position in which the light or flag was displayed. Orders, indeed, were as often as possible communicated by hailing or even by means of boats. As the size of ships increased the inconvenience of both plans became intolerable. Some attribute the first attempt at a regular code to Admiral Penn, but the credit of it is usually given to James II. when duke of York. Notwithstanding the attention paid to the subject by Paul Hoste and others, signals continued strangely imperfect till late in the 18th century. Towards 1780 Admiral Kempenfelt devised a plan of flag-signalling which was the parent of that now in use. Instead of indicating differences of meaning by varying the position of a solitary flag, he combined distinct flags in pairs. About the beginning of the 19th century Sir Home Popham improved a method of conveying messages by flags proposed by Mr Hall Gower, and greatly increased a ship's power of communicating with others. The number of night and fog signals that could be shown was still very restricted. In 1867 an innovation of prodigious importance was made

by the adoption in the British navy of Captain Philip Colomb's flashing system, on which he had been at work since 1858. This is in general use in all fleets, though, oddly enough, on its first trial at sea it was condemned. It is not too much to say that the Colomb system has made it possible to handle, with confidence and safety, in darkness and fog, squadrons composed of the gigantic armour-clads of the day. Its adoption has not only contributed very materially to the increased efficiency of the British fleets but also immensely reduced the risk of accidents; and the saving to the tax-payer since its introduction may probably be estimated in hundreds of thousands of pounds.

In the British navy, which is copied by most others, sight-signals are made with flags, the semaphore, "flashes," fixed lanterns, and occasionally with fireworks, and for "distant" signals with flags, balls, and pendants displayed on account of shape but not of colour. Sound-signals are made with horns, steam-whistles, and guns. There are two sets of flags,—one of ten numbered from 1 to 10, and another of twenty-one called after letters of the alphabet. There are also pendants and a few special flags. The numbered flags are used with the general signal book, a kind of dictionary in which figures stand opposite sentences conveying orders or announcements. Opposite 123 might stand "hoist in all boats," which would mean that, when the flag called 1 was hoisted with 2 beneath it and 3 beneath 2, the ship or ships addressed—indicated by a special flag or by pendants—were ordered to hoist all boats in. The lettered flags are used with the vocabulary signal book, in which opposite collections of letters are put single words or small groups of words. Thus, if ABC were opposite the word "admiral" and STO opposite "will sail at noon," when the first three flags were hoisted the signalman on board each ship addressed would note them down with their signification. When all addressed had acknowledged the first "hoist" the flags would be hauled down and STO would be hoisted, to be acknowledged and noted in like manner. The admiral would thus have made known his intention of sailing at a given hour. From this it will appear that the general code is used for words of command and the vocabulary for long communications. The night signal book contains a limited number of definite orders and announcements made known by exhibiting lanterns, never more than four, arranged vertically, horizontally, or in a square. For a few signals some kind of firework is displayed. Fog-signals are made by firing different numbers of guns at fixed intervals. Owing to the slowness of flag-signalling, it is now, especially for the vocabulary and at moderate distances, largely superseded by the semaphore, an upright post with two arms moving in a vertical plane. The changed positions of the arms indicate letters and each word is spelled. Before the adoption of Captain Colomb's system, at night and in fogs only a few announcements could be made by signal, and sending messages was unknown. By a series of symbols formed of dots and short lines, like those of the Morse alphabet, he represents figures, letters, and special words. Thus ... means 3, and — 7. The system can be employed in daylight, at night, and in fogs. In daylight long and short waves of a flag on a staff reproduce the flashes; in fogs long and short blasts on a fog-horn or steam-whistle; and at night the alternate exposure and concealment of the light of a lamp. Every order in the general signal book and every word in the vocabulary—by spelling, indeed, every word in the language—may be communicated by this system. Distant signals, now rarely used, are made by hoisting flags of different shapes at distances at which colours become invisible. The *Army and Navy Signal Book* contains the

code for communications between a ship and its boats or military stations on shore; the *International*, with special flags, is for communicating with merchant vessels. In the British navy there is a corps of signalmen rising in grade from boys to chief petty officers. They are selected from the most intelligent and best educated boys in the training-ships, and go through a course of special instruction in their duties. (C. A. G. B.)

SIGNORELLI, LUCA (c. 1442-c. 1524), one of the greatest of the Italian painters who ushered in the full culmination of the art under Leonardo da Vinci, Michelangelo, and Raphael, was born in Cortona—his full name being Luca d'Egidio di Ventura; he has also been called Luca da Cortona. The precise date of his birth is uncertain; but, as he is said to have died at the age of eighty-two, and as he was certainly alive during some part of 1524, the birth-date of 1442 must be nearly correct. He belongs to the Tuscan school, associated with that of Umbria. His first impressions of art seem to be due to Perugia,—the style of Bonfigli, Fiorenzo, and Pinturicchio. Lazzaro Vasari, the great-grandfather of Giorgio Vasari, the historian of art, was brother to Luca's mother; he got Luca apprenticed to Piero della Francesca. In 1472 the young man was painting at Arezzo, and in 1474 at Città di Castello. He presented to Lorenzo de' Medici a picture which is probably the one named the School of Pan, discovered some years ago in Florence, and now belonging to Marquis Corsi; it is almost the same subject which he painted also on the wall of the Petrucci palace in Siena,—the principal figures being Pan himself, Olympus, Echo, a man reclining on the ground, and two listening shepherds (see *SCHOOLS OF PAINTING*, vol. xxi, p. 434, fig. 8). He executed, moreover, various sacred pictures, showing a study of Botticelli and Lippo Lippi. Pope Sixtus IV. commissioned Signorelli to paint some frescos, now mostly very dim, in the shrine of Loreto,—Angels, Doctors of the Church, Evangelists, Apostles, the Incredulity of Thomas, and the Conversion of St Paul. He also executed a single fresco in the Sistine Chapel in Rome, the Acts of Moses; another, Moses and Zipporah, which has been usually ascribed to Signorelli, is now recognized as the work of Perugino. Luca may have stayed in Rome from 1478 to 1484. In the latter year he returned to his native Cortona, which remained from this time his ordinary home. From 1497 he began some professional excursions. In Siena, in the convent of Chiusuri, he painted eight frescos, forming part of a vast series of the Life of St Benedict; they are at present much injured. In the palace of Pandolfo Petrucci he worked upon various classic or mythological subjects, including the School of Pan already mentioned. From Siena he went to Orvieto, and here he produced the works which, beyond all others, stamp his greatness in art. These are the frescos in the chapel of S. Brizio, in the cathedral, which already contained some pictures on the vaulting by Fra Angelico. The works of Signorelli represent the Last Days of the Mundane Dispensation, with the Pomp and the Fall of Antichrist, and the Eternal Destiny of Man, and occupy three vast lunettes, each of them a single picture. In one of them, Antichrist, after his portents and impious glories, falls headlong from the sky, crashing down into an innumerable crowd of men and women. Paradise, the Elect and the Condemned, Hell, the Resurrection of the Dead, and the Destruction of the Reprobate follow in other compartments. To Angelico's ceiling Signorelli added a section showing figures blowing trumpets, &c.; and in another ceiling he depicted the Madonna, Doctors of the Church, Patriarchs, and Martyrs. There is also a great deal of subsidiary work connected with Dante, and with the poets and legends of antiquity. The daring and terrible invention of the great

compositions, with their powerful treatment of the nude and of the most arduous foreshortenings, and the general mastery over complex grouping and distribution, marked a development of art which had never previously been attained. It has been said that Michelangelo felt so strongly the might of Signorelli's delineations that he borrowed, in his own Last Judgment, some of the figures or combinations which he found at Orvieto; this statement, however, has not been verified by precise instances. The contract for Luca's work is still on record. He undertook on 5th April 1499 to complete the ceiling for 200 ducats, and to paint the walls for 600, along with lodging, and in every month two measures of wine and two quarters of corn. Signorelli's first stay in Orvieto lasted not more than two years. In 1502 he returned to Cortona, and painted a dead Christ, with the Marys and other figures. Two years later he was once more back in Orvieto, and completed the whole of his work in or about that time, i.e., some two years before 1506,—a date famous in the history of the advance of art, when Michelangelo displayed his cartoon of Pisa.

After finishing off at Orvieto, Signorelli was much in Siena. In 1507 he executed a great altarpiece for S. Medardo at Arcevia in Umbria—the Madonna and Child, with the Massacre of the Innocents and other episodes. In 1508 Pope Julius II. determined to re-adorn the camere of the Vatican, and he summoned to Rome Signorelli, in company with Perugino, Pinturicchio, and Bazzi (Sodoma). They began operations, but were shortly all superseded to make way for Raphael, and their work was taken down. Luca now returned to Siena, living afterwards for the most part in Cortona. He continued constantly at work, but the performances of his closing years were not of special mark. In 1520 he went with one of his pictures to Arezzo. Here he saw Giorgio Vasari, aged eight, and encouraged his father to second the boy's bent for art. Vasari tells a pretty story how the wellnigh octogenarian master said to him "Impara, parentino" ("You must study, my little kinsman"), and clasped a jasper round his neck as a preservative against nose-bleeding, to which the child was subject. He was partially paralytic when he began a fresco of the Baptism of Christ in the chapel of Cardinal Passerini's palace near Cortona, which is the last picture of his that we find specified. Signorelli stood in great repute not only as a painter but also as a citizen. He entered the magistracy of Cortona as early as 1488, and in 1524 held a leading position among the magistrates of his native place, or about the year 1524 he died there.

Signorelli from an early age paid great attention to anatomy, carrying on his studies in burial grounds. He surpassed all his contemporaries in showing the structure and mechanism of the nude in immediate action; and he even went beyond nature in experiments of this kind, trying hypothetical attitudes and combinations. His drawings in the Louvre demonstrate this and bear a close analogy to the method of Michelangelo. He aimed at powerful truth rather than nobility of form; colour was comparatively neglected, and his chiaroscuro exhibits sharp oppositions of lights and shadows. He had a vast influence over the painters of his own and of succeeding times, but had no pupils or assistants of high mark; one of them was a nephew named Francesco. He was a married man with a family; one of his sons died, seemingly through some sudden casualty, and Luca depicted the corpse with sorrowful but steady self-possession. He is described as full of kindness and amiability, sincere, courteous, easy with his art assistants, of fine manners, living and dressing well; indeed, according to Vasari, he always lived more like a nobleman than a painter. The Torrigiani Gallery in Florence contains a grand life-sized portrait by Signorelli of a man in a red cap and vest; this is said to be the likeness of the painter himself, and corresponds with Vasari's observation. The pictorial reputation of Signorelli has revived and ripened very much throughout Europe in recent years. The foregoing account of him is principally founded upon that given by Messrs Crowe and Cavalcaselle. In Great Britain there is no better specimen of his work than the Circumcision of Jesus, a panel letter in Hamilton Palace, near Glasgow. (W. M. R.)

SIKHS. See *INDIA*, vol. xii, p. 808, and *PUNJAB*, vol. xx, p. 110; also *HINDUSTANI*, vol. xi, p. 844.

SIKKIM, a native state of India, in the eastern Himalaya Mountains, between 27° 9' and 27° 58' N. lat., and between 88° 4' and 89° E. long., and bounded on the north and north-east by Tibet, on the south-east by Bhutan, on the south by the British district of Darjiling, and on the west by Nepal. It covers an area of 2600 square miles, with an estimated population of 7000. The Tibetan name for Sikkim is Dingjing or Demo-jong, and for the people Deunjong Maro; the Gurkhas call them Lepchas, but Mr Clements Markham, in his work on Tibet (1879), says that their proper name is Rong. The whole of the state is situated at a considerable elevation within the Himalayan mountain zone. From the level of the sea to an elevation of 12,000 feet, Sikkim is covered with dense forests of tall umbrageous trees. The mountains in the south are generally lower than those of Darjiling district, but north of Tumlung the passes are of great height. Jelap-la, the most southerly of these, rises to 13,000 feet; the two next are the Guaiu-la and Yak-la, leading into the Chumbi valley of Tibet, the latter being 14,000 feet high; further north are the Cho-la (15,000 feet), on the direct road from Tumlung to Chumbi, and the Tankra-la (16,083 feet), the most snowy pass in Sikkim. The state is drained by the Tista and its affluents, and by the Am-machu which rises near Parijong, at the foot of the Chamalhari peak (23,929 feet), and flows through the Chumbi valley into the district of Jalpaiguri under the name of the Torsha. Through Sikkim lie the most promising routes for trade with Tibet. At present, however, the Tibetan passes are closed to ordinary British subjects, though an active trade is maintained in certain articles by Bhuteas and Tibetans.

The capital of Sikkim is Tumlung, where the raja resides during the winter and spring, usually going to his estates at Chumbi in Tibet in summer, in order to avoid the heavy rains. The raja receives a subsidiary allowance of £1200 a year from the British Government, in consideration of his position as former ruler of the hill territory of Darjiling and a submontane tract on the plain called the Morung. Communication with the state is kept up through the deputy commissioner of Darjiling. Sikkim produces rice, Indian corn, millet, oranges, and two or three sorts of Lepcha cloth. Its mineral products are lime and copper.

SILENUS, a personage of Greek mythology, a drunken attendant of Bacchus and closely allied to the satyrs, of whom he appears as the leader. Elderly satyrs were called Sileni. The Sileni belong especially to the legends of Asia Minor, and particularly of Lydia and Phrygia. The stories as to the birth of Silenus were various. Some called him a son of Hermes, others of Pan and a nymph; others said that he sprang from the drops of the blood of Sky. Sometimes he figures as the guardian of Dionysus. In spite of his dissipated habits he possessed a large stock of general information, which however, like Proteus, he only imparted on compulsion. Midas, king of Phrygia, caught him by mixing wine in the spring out of which Silenus, in a moment of weakness, had condescended to drink. The conversation which followed is fully reported by Theopompus and Aristotle (*Ælian, Var. Hist.*, iii, 18; *Plutarch, Consol. ad Apoll.*, 27). Prefacing his remarks with a slight sketch of terrestrial geography and a brief reference to the fauna characteristic of the different continents, Silenus proceeded to draw an edifying picture of the pleasures of true piety as contrasted with the dreadful fate in store for the wicked, winding up with a gloomy reflexion on the vanity of human life and the expression of a wish that he had never been born. Another of his homilies has been preserved by Virgil (*Ecl.*, 6): two shepherds surprise the sage drunk in a cave; they bind him with flowery chains, and he tells them how the world was made, with stories "of remotest eld." Apart from

this gift of sermonizing, the Sileni seem to have resembled the satyrs in their love of music, wine, and women. Indeed, the Greeks appear not to have sharply distinguished between them; for Marsyas, the mythical flute-player, is called sometimes a satyr, sometimes a Silenus. In art Silenus appears as a fat, dumpy old man, with a snub nose and a bald head, riding on an ass and supported by satyrs who keep the jolly toper from tumbling off. Or he is depicted standing or lying with his inseparable companion, a wine-skin, which again he sometimes bestrides. Sometimes he is sitting with his Pan's-pipe or flute in his hand.

SILESIA (Germ. *Schlesien*), a district in the eastern part of Germany, between 49° 28' and 52° 7' N. lat. and 13° 50' and 19° 20' E. long., was formerly united with the kingdom of Bohemia in the form of a duchy (or rather group of duchies), and is now unequally shared between Prussia and Austria. Geographically it is divided into Lower and Upper Silesia, the whole of the former and part of the latter belonging to Prussia. The total area is 17,540 square miles.

It is generally asserted that the original inhabitants of Silesia were the Germanic tribes of the Lygii and Quadi, who retired before the Slavonic immigrations of the 6th century, but this statement is beyond the range of positive proof. The earliest form of the name, Sleenzane or Zlesane, shows a Slavonic origin, and further than this we have no means of penetrating. Various explanations have been given of the name, and one old writer gravely connects it with the prophet Elisha; but there is little doubt that it was first applied to the district round Mount Zlenz (the modern Zobten) and the river Zlenza (Lohe), and thence spread gradually over the whole region now known as Silesia. These early Slavonic inhabitants belonged to the family of Lechs (Poles), and the modern Polish name for the inhabitants is Zlesaki. The history of Silesia consists substantially of the process which has converted it from a Slavonic territory into a predominantly German land.

The earliest notices of Silesia are extremely vague, nor can we exactly define the scope of the name in the first thousand years of our era. It seems to have formed part of the great but short-lived kingdom of MORAVIA (*q.v.*) in the 9th century, and afterwards oscillated between the neighbouring kingdoms of Bohemia and Poland, becoming definitely incorporated with the latter at the end of the 10th century. Christianity was introduced about the year 960, and from 1000 on we have an unbroken list of bishops of Breslau. The first contact of Germany with Silesia was disastrous to the former, as it was on the fastnesses of Silesia that Henry V. squandered his strength in his unsuccessful expedition against Poland in 1109. More fortunate was the intervention of Frederick Barbarossa in 1163 in behalf of the three sons of the dispossessed Ladislaus, a member of the Polish royal family of the Piasts. He succeeded in securing as their share of the Polish dominions the whole of Silesia, though it was not till forty or fifty years later that it could be said to have gained actual independence of Poland. These three princes were the ancestors and founders of the various dual lines that henceforth ruled in Silesia, and their intimate connexion with the German king accounts in great measure for the process of Germanization which Silesia now began to undergo, chiefly through the introduction of German colonists in scantily peopled or desolated districts. The eldest of the three sons of Ladislaus received the town of Breslau and by far the largest portion of territory, so that the history of Silesia for the next two or three generations is practically that of his line. Under his grandson Henry the Bearded (1202–1238) the Germanization of Silesia made rapid pro-

gress, and the duchy at that time may be looked upon as a bulwark or mark against the Slavs in the south-east of Germany, just as the duchy of Prussia was in the north-east. Henry extended his sway much beyond the limits of Silesia, and in fact united under his sceptre nearly three quarters of the old Polish dominions. His son Henry II. (1238-1241) had a short reign with a glorious end, falling in 1241 at the battle of Liegnitz, where his determined resistance turned back from Germany the alarming Mongolian invasion. On his death his territories were shared among his sons, and the series of divisions and subdivisions began which resulted in almost every Silesian town of any importance becoming the capital of an independent prince. At the beginning of the 14th century there were no fewer than 17 principalities of this kind, nearly all held by dukes of the Piast family. It was inevitable that these petty rulers should feel the want of a support against the encroachments of Poland, and it was inevitable, too, that the relation opened in consequence with Bohemia should gradually change from mere protection to feudal supremacy. By 1355 the supremacy of Bohemia was formally recognized as extending over the whole of Silesia, though the Silesians retained a considerable measure of independence, including the right to hold general diets for the settlement of their internal relations. The kings of Bohemia at this time (John, Charles IV.) were members of the German house of Luxemburg, and Silesia under their sway may be looked upon as an entirely German land.

During the Hussite wars of the 15th century Silesia, which adhered zealously to the old faith, suffered greatly from Hussite forays. The Luxemburg dominion broke up in 1458, when Hungary and Bohemia elected rulers of their own nationality. Silesia, however, neglected the opportunity to elect a German king for itself, and supported the Bohemian king George Podiebrad. Breslau, still the most powerful of the principalities, threw in its lot with Matthew Corvinus of Hungary, who fought many of his battles on Silesian soil. By the treaty of Olmütz in 1479 Matthew acquired all the tributary lands of the Bohemian crown, including Silesia, which remained attached to Hungary down to 1490. In that year Bohemia and Hungary became once more united under the same king. In 1526 Silesia passed with the rest of the Bohemian inheritance to the house of Hapsburg (see БОГЕМИЯ). The Reformation at first made rapid progress in Silesia, and the native dukes placed little opposition in its way. The Hapsburg princes, however, acted very differently, and the Silesian Protestants suffered much persecution before, during, and after the Thirty Years' War. It was not indeed till the 18th century that they acquired formal recognition and the restoration of some of their confiscated churches.

The First Silesian War between Austria and Prussia, which broke out in 1740, had its ultimate cause (nominally at least) in a compact of mutual succession entered into in 1537 by the elector of Brandenburg on the one side and the duke of Liegnitz on the other. The emperor, as feudal superior of the duke, had indeed refused to recognize this agreement, but the Great Elector did not fail to put in his claim on the death of the last duke in 1675, and Frederick now thought the opportunity too good to be lost. The progress of the three Silesian wars is recounted in the article AUSTRIA (vol. iii. p. 127-129). At the peace of Hubertusburg (1763) Prussia was left in possession of nearly the whole of Silesia, with the frontier as it still exists. Frederick exerted himself to atone for the evils brought upon the district through the ravages of war by introducing colonists and capital, reforming the administration, granting complete religious liberty, and

the like. That this seed did not fall on ungrateful soil seems proved by the modern prosperity of Silesia and the loyalty with which its inhabitants have clung to the Prussian cause. Silesia formed part of the reduced kingdom of Prussia left by the peace of Tilsit in 1806, and it was the centre of the national rising of 1813, when the king issued his celebrated address "To my People" from Breslau. Stein's emancipating edict of 1807 was welcomed with profound satisfaction in Silesia, where the conditions of serfdom had been particularly oppressive, and no doubt contributed materially to the enthusiasm with which the Silesians flocked to the standard a few years later.¹

PRUSSIAN SILESIA, the largest province of Prussia (see vol. xx. plate I.), with an area of 15,560 square miles, forms the south-eastern limb of the kingdom, and is bounded by Brandenburg, Posen, Russian Poland, Galicia, Austrian Silesia, Moravia, Bohemia, and the kingdom and province of Saxony. Besides the bulk of the old duchy of Silesia, it comprises the county of Glatz, a fragment of the Neumark, and part of Upper Lusatia, taken from Saxony in 1815. The province is divided into three governmental districts,—Liegnitz and Breslau corresponding to lower Silesia, while Oppeln takes in the greater part of upper, southern, or mountainous Silesia.

Physiographically Silesia is roughly divided into a flat and a hilly portion by the so-called Silesian Langenthal, which begins on the south-east near the Malapané, and extends across the province in a west-by-north direction to the Black Elster, following in part the valley of the Oder. The south-east part of the province, to the east of the Oder and south of the Malapané, consists of a hilly outpost of the Carpathians (the Tarnowitz plateau), with a mean elevation of about 1000 feet. To the west of the Oder the land rises gradually from the Langenthal towards the southern boundary of the province, which is formed by the central part of the Sudetic system, including the Glatz Mountains and the Riesengebirge (Schneekoppe, 5266 feet). Among the loftier elevations in advance of this southern barrier the most conspicuous is the Zobten (2215 feet), the historical connexion of which with the name of the province has been mentioned above. To the north and north-east of the Oder the province belongs almost entirely to the great North-German plain, though a hilly ridge, rarely attaining a height of 1000 feet, may be traced from east to west, asserting itself most definitely in the Katzegebirge. Nearly the whole of Silesia lies within the basin of the Oder, which flows through it from south-east to north-west, dividing the province into two approximately equal parts. The Vistula touches the province on the south-east, and receives a few small tributaries from it, while on the west the Spree and Black Elster belong to the system of the Elbe. The Iser rises among the mountains on the south. Among the chief feeders of the Oder are the Malapané (right), the Glatzer Neisse (left), the Katzbach (left), and the Bartsch (right); the Bober and Queiss flow through Silesia but join the Oder beyond the frontier. The only lake of any extent is the Schlawa See, 7 miles long, on the north frontier. There is a considerable difference in the climate of Lower and Upper Silesia, and some of the villages in the Riesengebirge have the lowest mean temperature of any inhabited place in Prussia (below 40° Fahr.).

Of the total area of the province 56 per cent. is occupied by arable land, 10·8 per cent. by pasture and meadow, and nearly 29 per cent. by forests. The soil along the foot of the mountains is generally good, and the district between Ratibor and Liegnitz, where 70 to 80 per cent. of the surface is under the plough, is reckoned one of the most fertile in Germany. The parts of lower Silesia adjoining Brandenburg, and also the district to the east of the Oder, are sandy and comparatively unproductive. The different cereals are all grown with success, wheat and rye sometimes in quantity enough for exportation. Flax is still a frequent crop in the hilly districts, and more sugar-beets are raised in Silesia than in any other Prussian province except Saxony. Tobacco, oil-seeds, chicory, and hops may also be specified, while a little wine, of an inferior quality is produced near Grünberg. Mulberry trees for the silk-culture have been introduced and thrive fairly. Large estates are the rule in Silesia, where 35 per cent. of the land is in the hands of owners possessing at least 250 acres, while properties of 50,000 to 100,000 acres are common. The districts of Oppeln and Liegnitz are among the most richly wooded parts of Prussia. According to the live-stock census for 1883, Silesia contains 275,122 horses, 1,397,130 cows, 1,309,495 sheep, 518,612 pigs, 175,283 goats, and 128,828 bee-hives. The merino sheep was introduced by Frederick the Great, and since then the Silesian

¹ Compare Grünhagen, *Geschichte Schlesiens* (Gotha, 1884 sq.). An account of the poetical schools of Silesia is given under the heading GERMANY (vol. x. pp. 580-1).

breed of sheep has been greatly improved. The woods and mountains harbour large quantities of game, such as red deer, roe deer, wild boars, and hares, while an occasional wolf finds its way into the province from the Carpathians. The fishery includes salmon in the Oder, trout in the mountain-streams, and carp in the small lakes or ponds with which the province is sprinkled. Compare the tables in PRUSSIA (vol. xx. p. 14).

The great wealth of Silesia, however, lies underground, in the shape of large stores of coal and other minerals, and its mining records go back to the 12th century. The coal-measures of Upper Silesia, in the south-east part of the province, are among the most extensive in continental Europe, and there is another large field near Waldenburg. The annual output, ranging between twelve and fifteen millions of tons, valued at nearly £3,000,000 sterling, is equal to more than a quarter of the entire yield of Germany. The district of Oppeln also contains a great quantity of iron (annual produce 750,000 to 800,000 tons, value about £1,000,000). The deposits of zinc in the vicinity of Beuthen are perhaps the richest in the world, and produce four-fifths of the zinc of Germany (550,000 tons). The remaining mineral products include lead (from which a considerable quantity of silver is extracted), copper, cobalt, arsenic, the rare metal cadmium, alum, brown coal, marble, and a few of the commoner precious stones (jaspers, agates, amethysts, &c.). The province contains practically no salt or brine springs, but there are well-known mineral springs at Warmbrunn, Salzbrunn, and several other places.

A busy manufacturing activity has long been united with the underground industries of Silesia, and the province in this respect yields the palm to no other part of Prussia except districts in the Rhineland and Westphalia. On the plateau of Tarnowitz the working and smelting of metals is naturally the predominant industry, and in the neighbourhood of Beuthen, Königshütte, and Gleiwitz there seems an almost endless succession of iron-works, zinc-foundries, machine-shops, and the like. In 1881 the total value of the metals produced in the various foundries of the province was £2,376,250. At the foot of the Riesengebirge, and along the southern mountain line generally, the textile industries prevail. Weaving has been practised in Silesia, on a large scale, since the 14th century; and Silesian linen still maintains its reputation, though the conditions of production have greatly changed. Cotton and woollen goods of all kinds are also made in large quantities, and among the other industrial products are beetroot sugar (157,000 tons in 1883-84), spirits, chemicals, tobacco, starch, paper, pottery, and "Bohemian glass." Lace, somewhat resembling that of Brussels, is made by the women of the mountainous districts. The trade of Silesia is scarcely so extensive as might be expected from its important industrial activity. On the east it is hampered by the stringent regulations of the Russian frontier, and the great waterway of the Oder is sometimes too low in summer for navigation. The extension of the railway system has, however, had its usual effect in fostering commerce, and the mineral and manufactured products of the province are freely exported.

At the census of 1880 the population of Silesia was 4,007,925, of whom 2,082,084 were Roman Catholics, 1,867,489 Protestants, and 52,682 Jews. About 35 per cent. of the population is urban and 65 per cent. rural. The density is 257 per square mile, less than that of Westphalia (262) and the Rhineland (390); but the average is of course very greatly exceeded in the industrial districts, such as Beuthen. The occupation census of 1883 shows that 44 per cent. of the population are supported by agriculture, 36 per cent. by industries, 8·4 per cent. by trade, and 2·2 per cent. by daily labour and domestic service, while 4 per cent. belong to the official and 5 per cent. to the unemployed classes. Nearly three-fourths of the inhabitants and territory are German, but to the east of the Oder the Poles (nearly 1,000,000) form the bulk of the population, while there are about 50,000 Czechs in the south part of the province and 30,000 Wends near Liegnitz. The Roman Catholics, most of whom are under the ecclesiastical sway of the prince-bishop of Breslau, are predominant in Upper Silesia and Glatz; the Protestants prevail in Lower Silesia, to the west of the Oder, and in Lusatia. The noblesse is very numerous in Silesia, chiefly in consequence of the Polish districts it includes. The educational institutions of the province are headed by the university of Breslau. In 1883-84 the percentage of illiterate recruits, in spite of the large Polish-speaking contingent, was only 1·70. The capital and seat of the provincial diet is Breslau, which is also by far the largest and most important town (298,893 inhabitants in 1885). The towns next in point of size are Görlitz (55,120 inhabitants), Liegnitz (43,351), Königshütte (31,831), Beuthen (26,478), Schweidnitz (23,775), Neisse (21,444), and Glogau (20,003). The province sends thirty-five members to the reichstag and sixty-five to the Prussian chamber of deputies. The government divisions of Breslau and Oppeln together form the district of the 6th army corps (seat, Breslau), while Liegnitz belongs to that of the 5th army corps, the headquarters of which are at Posen. Glogau, Glatz, Neisse, and Cosel are fortresses.

AUSTRIAN SILESIA, the part of the duchy that remained to

Austria after the Seven Years' War, is a mere fraction of the whole, its area being only 1980 square miles, or about one-eighth of that of Prussian Silesia. It falls into two small portions of territory, separated by a projecting limb of Moravia and surrounded by Prussian Silesia, Moravia, Hungary, and Galicia. Until 1849 it was for administrative purposes reckoned a part of Moravia, but since that year it has been a crownland of the Austrian empire (the smallest of all), with the style of duchy. The Troppau or western division of the crownland is flanked by the Sudetic Mountains (Altvater, 4678 feet), and the Teschen of eastern half by the Carpathians (Lissahorn, 4330 feet), and a great proportion of the surface is occupied by offshoots of these ranges. The Vistula rises on the Carpathians, within Austrian Silesia, while the western part of the crownland is close to the headwaters of the Oder, which rises near at hand in Moravia. Owing to its mountainous character and its slope towards the north and north-east the crownland has a somewhat severe climate for its latitude, the mean temperature being only 50° Fahr., while the annual rainfall varies from 20 to 30 inches. Upwards of 45 per cent. of the surface is occupied by arable land, 7½ per cent. by meadows and gardens, 10½ per cent. by pastures, and 32 per cent. by forests, while 4½ per cent. is unproductive ground. The soil cannot as a rule be termed rich, though some of the valleys are fertile. The chief crops are oats, rye, barley, potatoes, clover, and flax. Dairy-farming is carried on in the mountains after the Alpine fashion, and sheep are fairly numerous. Geese and pigeons are reared in great quantities, and the hunting and fishing are both very prolific. The principal mineral resources are coal (Silesia producing 13 per cent. of the produce of Austria-Hungary), iron, marble, and slate. Like its Prussian neighbour, the crownland boasts a very busy industrial activity, the chief products of which are its iron and steel goods, textile fabrics (linen, woollen, cotton, velvet, silk), chemicals, liqueurs, and beetroot sugar. The trade is chiefly a transit one, though the manufactures and agricultural produce of the province are exported in considerable quantity. Troppau, the capital of the duchy, contains large cloth manufactories, while Teschen, Bielitz, and Jägerndorf are also busy places. The population in 1885 was 577,593, of whom 81,000 were Protestants and 9000 Jews. About 48 per cent. of the population is supported by agriculture and 27·5 per cent. by industry. Divided according to nationalities, there are 275,000 Germans, 130,000 Czechs, and 158,000 Poles. The German element is predominant in the towns, the Polish in the eastern or Teschen division. The duchy sends ten members to the Austrian house of representatives and has a provincial diet of thirty-one members. (J. F. M.)

SILICA, the only known oxide of silicon (see CHEMISTRY, vol. v. pp. 521-524), occurs native in a great variety of forms, which, however, correspond to only the four distinct species of QUARTZ (*q.v.*; see also MINERALOGY, vol. xvi. p. 389), tridymite, OPAL (*q.v.*, and compare vol. xvi. p. 390), and siliceous earth. Ordinary quartz-rock and sand are more impure forms of quartz. Tridymite differs from quartz only by a lower specific gravity, and in crystallographic details; the crystals are as a rule arranged in triplets—hence the name (see vol. xvi. p. 389). Siliceous earth when dry forms a very voluminous, soft, fine powder; it consists of the shells of *Infusoria*. As a chemical species it differs little from opal. Siliceous earth, having a very low rate of thermal conductivity, serves well as a stuffing for the hollow walls of ice-chests, fire-proof safes, &c. It is used besides for the making of DYNAMITE (*q.v.*). Silica of any kind is absolutely non-volatile, and is fusible only at the temperature of the oxy-hydrogen flame; a slight admixture of base (potash, lime, &c.), however, suffices to cause it to "frit" at a red heat. It is absolutely proof against the action of water and ordinary mineral acids; hydrofluoric acid acts on it energetically, as explained in CHEMISTRY, vol. v. p. 522.

Alkaline Silicates.—Silica readily dissolves at a red heat in fused alkaline carbonates, with evolution of carbonic acid and formation of alkaline silicates. In this process one molecule SiO₂ of silica is capable of decomposing at most 2R₂OCO₂ (where R = K or Na). The compound SiO₂·2R₂O, "orthosilicate" of alkali, freezes into a compact non-transparent mass, readily soluble in water, with formation of an intensely alkaline solution. It does not unite with any additional alkali, but readily fuses up with more silica. Without going beyond a red heat it is easy to produce thus homogeneous masses of any composition, Na₂O·xSiO₂, from x = ½ up to x = (at least) 4.

Compounds approximating to x = 4 are known as *water glasses*. Potash water glass, K₂O·4SiO₂, was discovered in 1825 by Fuchs in