

goods. The argosies of Venice and Genoa came laden with the produce of the East; ships of every nation took in and discharged their cargoes at the quays; the warehouses were filled with bales of wool from England, and with silk from Persia. Not the least famous of the manufactures was that of tapestry, in which the people of Bruges acquired great skill a century before the looms of Beauvais or the Gobelins were set up. The prosperity of Bruges was undiminished till it passed under the dominion of the house of Hapsburg. For a violation of some of their prerogatives, the inhabitants imprisoned the Archduke Maximilian in 1488, and a terrible vengeance was inflicted upon the town for this outrage. Its trade was transferred to Antwerp, and its ruin was ultimately completed by the religious persecutions of the bloody duke of Alva at the end of the 16th century. Such of the inhabitants as escaped with their lives fled to England and introduced into that country many of the arts and manufactures which they and their forefathers had cultivated with success for many generations. In more modern times the town has frequently suffered from the effects of war. In 1704 it was besieged by the Dutch, and in 1708 and 1745 it was captured by the French. The contrast between the Bruges of the 15th century and the Bruges of recent times is as striking as it is painful. As Wordsworth says—

"In Bruges town is many a street
Whence busy life hath fled,
Where, without hurry, noiseless feet
The grass-grown pavement tread."

The great circumference of the city, its numerous squares and streets, and the number and magnificence of its public buildings, all attest its former importance; while the comparative absence of commercial activity, and the general air of desolation, bear witness to its present insignificance. Its trade has, however, considerably revived during the present century, and its great advantages in canal and railway communication, its spacious docks and excellent quays, and the great fertility of the surrounding country, are once more restoring it to its high place among cities. Of the public buildings of Bruges the most remarkable are the Church of Notre Dame, containing a sculpture of the Virgin and Child, said to be by Michel Angelo, effigies in copper of Charles the Bold and Mary of Burgundy, who are buried in the church; the cathedral of St Sauveur, built of brick, but internally the handsomest church in Bruges, with some fine pictures by Hemling (or, more correctly, Memling,—see *Athenæum*, No. 2513) and Peter Porbus; the hospital of St John, a charitable institution, where sick persons are attended by the sisters of charity; the exchange, which is the oldest in Europe; the courthouse, a fine building, partly on the site of the old palace of the counts of Flanders; and the Hôtel de Ville, a small but handsome edifice, dating from 1377 and restored in the present century, in the niches of which there were formerly statues of the old counts of Flanders, which were destroyed by the French revolutionists in 1792. The belfry-tower in the great square, of which Longfellow sings so finely, is the most beautiful structure of the kind in Europe, and its chimes are the best in Belgium. It was erected at the end of the 14th century, and is still used for communicating the alarm of fire by a flag or a light to all parts of the city. In this same square is a house in which Charles II. resided during his exile from England. Among the conventual establishments the most important are the Béguinage and the English nunnery. The town is likewise well provided with the means of education. There is a medical school, to which is attached a museum of natural history and a botanical garden. For the higher departments of school training there is an excellent atheneum, annually subsidized by Government, besides a

theological seminary, a school of navigation, and an institution for the deaf and dumb and blind. The academy of painting is in a very flourishing condition, and offers many advantages to the student, as instruction is given gratis in drawing and architecture. The public library in the town-hall contains upwards of 15,000 volumes. The charitable institutions of Bruges are both numerous and well organized. They are all the more necessary, that the number of persons in the city requiring support is unusually great. In the poorhouse alone there is accommodation for nearly 600 individuals, and it is almost always completely filled. The most important manufacture in Bruges is that of lace. The other manufactures consist of linens, woollen and cotton goods, soap, leather, tobacco, starch, pottery, and bells. There are also some small breweries and distilleries, and dyeing and bleaching establishments; and ship-building is also carried on. The exports from Bruges comprise the products of the rich agricultural district that surrounds the town; the imports include metals, dyewoods, wines, fruits, oil, cotton, and wool. Despite the number of canals, the inhabitants of Bruges are very ill supplied with water for domestic purposes; every house is accordingly provided with a tank or butt to receive rain-water. The quantity collected in the public tanks is distributed through the city in pipes. Of the canals the largest is that to Ostend, wide and deep enough to allow vessels of 500 tons to pass up from the sea. The ramifications of these canals intersect the city in all directions, and are crossed by upwards of fifty bridges, whence the name of the town is derived. Population in 1838, 44,374; in 1846, 49,308; in 1851, 50,698; in 1866, 49,819.

See Weale's *Bruges et ses environs*, 1865; Gilliodts van Severen, *L'Inventaire des archives de la ville de Bruges*, 3 vols.

BRUMATH, or BRUMPT, a town of Lower Alsace, in the circle of Strasburg, on the River Zorn. It has a castle and mineral wells, and occupies the site of the ancient Brucomagus. Population in 1871, 5619.

BRUNCK, RICHARD FRANÇOIS PHILIPPE (1729-1803), a French scholar, was born at Strasburg, 20th December 1729. He was educated at the Jesuits' college at Paris, but having early entered the public service, he soon forgot his Latin and Greek. At the age of thirty he returned to his native town and resumed his studies, paying special attention to Greek. The nature of the office which he held put considerable sums of money at his disposal, which he expended in publishing editions of the Greek classics. The first work which he edited was the *Anthologia Græca*, in which his innovations on the established mode of criticism startled European scholars; for wherever it seemed to him that an obscure or difficult passage might be made intelligible and easy by a change of text, he did not scruple to make the necessary alterations, whether the new reading were supported by manuscript authority or not. With the assistance of Schweighäuser, then an unknown youth, he next brought out editions of the Greek dramatists, characterized by the same peculiarities as the *Anthologia*, and ultimately the *Gnomici Poetæ Græci*. In 1781 he published an edition of *Virgil*, for which he was pensioned by the French king. At the outbreak of the French Revolution, in which he took an active part, he lost his pension, and was reduced to such extremities that he was obliged to sell a portion of his library. In 1802 his pension was restored to him, but too late to prevent the sale of the remainder of his books. He had brought out an edition of *Plautus* in 1788, and was in the act of republishing it when he died, June 12, 1803.

BRUNDISIUM, or BRUNDISIUM. See BRINDISI.
BRUNEL, ISAMBARD KINGDOM (1806-1859), one of the most distinguished civil engineers of the age, was born at Portsmouth, April 9, 1806. He was the only son of Sir

Maré Isambard Brunel, from whom he inherited some rare intellectual gifts, and to whom he owed his first education. From his earliest years he took an eager and intelligent interest in all the plans and undertakings of his father, who had then just completed the construction of the remarkable block machinery at Portsmouth. He displayed in childhood singular powers of mental calculation, great skill and rapidity as a draughtsman, and a true feeling for art. After attending some private schools, he was sent at the age of fourteen to Paris, to study mathematics, and to recover his knowledge of French. From November 1820 to August 1822 he studied at the Collège Henri Quatre; and in holiday intervals he used to visit the engineering works going on in Paris, and send his father drawings and descriptions of them. In 1823 he entered his father's office as assistant-engineer, just at the time when the project of the Thames Tunnel began to occupy the attention of Sir Isambard; and from 1825, when the work was begun, till 1828, when it was stopped by an irruption of the river, he displayed a singular energy, inventiveness, and power of application in that struggle of science against natural obstacles on a vast scale. He had even then the power, which distinguished him in later years, of doing almost without sleep for many nights when work was pressing. During the later part of the contest which ended by a second irruption in January 1828, he was both nominal and actual resident engineer of the Thames Tunnel. Left for nearly two years without regular professional occupation, Brunel employed himself in scientific researches, enjoying intercourse with Babbage, Faraday, and other friends. In November 1829 he sent in designs and plans for the projected Suspension Bridge over the Avon at Clifton. In consequence of objections raised by Telford, the referee of the bridge committee, Brunel's plans were rejected. But on a second competition, early in 1831, he sent in a new design, and this was accepted. Brunel was appointed engineer to the trustees, and the works were begun in 1836. Delay had been caused by want of funds, and from the same cause the works were afterwards suspended for some years, and were not completed during Brunel's lifetime. In March 1833, Brunel, at the age of twenty-seven, attained one of the highest professional positions by his appointment as engineer of the newly-projected Great Western Railway. For several years his energies were taxed to the utmost by the conflict with obstructive landowners and short-sighted critics; but he showed himself equal to the occasion, not only as a professional man, but as a persuasive negotiator. For solidity of construction and for skill and beauty of design the Great Western Railway, though one of the first made in England, holds a very high place. Among the triumphs of the engineer are the Hanwell Viaduct, the Maidenhead Bridge, and the Box Tunnel, at the time the longest in the world; and, on extensions of the line, the great bridges at Chepstow and Saltash. The now notorious "battle of the gauges" took its rise from Brunel's introduction of the broad gauge on this line. In 1846 he resigned his office as engineer of the Great Western Railway. In 1844 he had recommended the adoption of the Atmospheric System on the South Devon Railway, but after a year's trial this system was abandoned. The last and greatest of Brunel's railway works was the Royal Albert Bridge of the Cornwall Railway, crossing the River Tamar at Saltash. This work, sanctioned by parliament in 1845, was constructed between 1853 and 1859. In addition to the arduous labours of railway engineering, Mr Brunel had taken a leading part in the systematic development of ocean steam navigation. As early as October 1835 he had suggested, to the amusement of the directory of the Great Western Railway, that they should "make it longer, and have a steamboat to go from Bristol to New York, and call it the

Great Western." The project was taken up, and the "Great Western" steamship was designed by Brunel, and built at Bristol under his superintendence. It was much longer than any steamer of the day, and was the first steamship built to make regular voyages across the Atlantic. While the vessel was building a controversy was raised about the practicability of Brunel's scheme, Dr Lardner asserting dogmatically that the voyage could not be made, and backing his assertion with an array of figures. His view was widely accepted, but the work went on, and the voyage was accomplished in 1838. A greater work was at once undertaken, and the "Great Britain" was built. This was the first large iron steamship, the largest ship afloat at that time, and the first large ship in which the screw-propeller was used. She made her first voyage from Liverpool to New York in August and September 1845; but in the following year was carelessly run upon the rocks in Dundrum Bay on the coast of Ireland. After lying there nearly a year without material damage she was got off and was employed in the Australian trade. Brunel soon after began to meditate a vaster project still, the construction of a vessel large enough to carry all the coal required for a long voyage out, and if coal could not be had at the out port, then to carry enough also for the return voyage. It seemed to him, further, that a great increase of size would give many advantages for navigation. During his connection as engineer with the Australian Mail Company he worked out into a practical shape his conception of a "great ship;" and in 1852 his scheme was laid before the Directors of the Eastern Steam Navigation Company. It was adopted, the projector was appointed their engineer, and after much time occupied about contracts and specifications, the work was begun in December 1853. Immense difficulties in the progress of construction caused delays from time to time. The operations of launching was several times attempted in vain; but at length the gigantic vessel, the now familiar "Great Eastern," was got afloat (31st January 1858). Much remained to be done to complete the ship; and her engineer, overworked and worn out with the worry of the launching processes, broke down and did not live to see her sail on her first voyage. In addition to the great works already described, Brunel was employed in the construction of many docks and piers. The first of these was the Monkwearmouth Docks, for which he made the designs in 1831. The construction, after a new design, was begun in 1834. He was afterwards engaged in works of the same kind at Bristol, Plymouth, Briton Ferry, and Brentford, and on a pier at Milford Haven. He was a zealous promoter of the Great Exhibition of 1851, and was a member of the committee on the section of machinery and of the building committee. He paid much attention to the subject of improvement of large guns, and designed a floating gun-carriage for the attack on Cronstadt in the Russian war (1854); he also designed and superintended the construction of the hospital buildings at Renkioi, on the Dardanelles (1855). The genius, energy, and industry of Brunel in his profession were not more remarkable than the high moral tone which characterized his whole life, and the fascinating qualities which gave him immense personal influence, and made him the delight of the social circle. With single-hearted truthfulness he devoted himself to his chosen work; he was singularly free from professional jealousy, and was always ready to commend and help others. With robust health, which he enjoyed through many years, he had the two invaluable qualities of good spirits and good temper. In his relations with his subordinates he was considerate and kindly, at the same time that he demanded faithful service according to a high standard. He cared nothing for popularity. He enjoyed

the beauties of a fine landscape, and was an enthusiastic lover of the fine arts. In the course of his busy life he several times went to Italy and Switzerland; and in 1847 he bought a small estate in Devonshire, to make his home there. The pressure of business, however, did not allow him to spend much of his time in the country. In 1830 Brunel was elected F.R.S., and he was afterwards a member of many other scientific societies. In 1857 the honorary degree of D.C.L. was conferred on him by the university of Oxford. In July 1836 he married; he left two sons and a daughter surviving him. For the sake of his health he spent the winter of 1858-59 in Egypt, returning to England in May. He was on board his "great ship" on the 5th September 1859, and the same day was attacked with paralysis. The ship sailed on her first voyage on the 7th, and her great projector passed away on the 15th of the month. His remains were interred in Kensal Green Cemetery. In 1870 appeared *The Life of I. K. Brunel, C.E.*, by his son Isambard Brunel, of Lincoln's Inn, chancellor of the diocese of Ely. (W. L. R. C.)

BRUNEL, SIR MARC ISAMBARD (1769-1849), was born at Haqueville, in Normandy. His family had for several centuries held a respectable station in the province, living as farmers and small landowners on the estate on which he was born, and numbering among its members Nicholas Poussin. He was educated at the seminary of St Nicaise at Rouen, with the intention of his entering holy orders; but his predilection for the physical sciences was so strong, and his genius for mathematics and mechanics so decided, that, on the advice of the superior of the establishment, he was removed to follow a more congenial career. His father then destined him for the naval service, which he entered on the appointment of the Marshal de Castries, the minister of marine, and made several voyages to the West Indies. In this position, although only in his seventeenth year, his mechanical talents developed themselves actively on many occasions, and he surprised his captain by the production of a sextant of his manufacture with which he took his observations. On his return to France in 1792, he found the Revolution at its height, and like all who entertained royalist principles, he was compelled to seek safety in emigration. He effected his flight with considerable difficulty, and found refuge in the United States of America, where, driven by necessity to the exercise of his talents as a means of support, he followed the bent of his inclination and became a civil engineer and architect. His first engagement was on the survey of a tract of land near Lake Erie; he then became engaged in cutting canals, and was employed to erect an arsenal and cannon foundry at New York, where he applied several new and ingenious machines. His highly ornamental design for the House of Assembly at Washington was rejected, as being inconsistent with the simplicity of a republic; he was, however, engaged to design and superintend the construction of Bowery Theatre, New York, since destroyed by fire, the roof of which was peculiar and original.

The idea of substituting machinery for manual labour in the making of ships' blocks had long occupied his mind; and, in 1799, having matured his plans, he determined to visit England. Earl St Vincent was at that time at the head of the Admiralty, and after the usual delays and difficulties, which were ultimately overcome chiefly through the powerful influence of his steady friend and patron Earl Spencer, aided by the recommendation of Brigadier-General Sir Samuel Bentham, who at once perceived and appreciated the merit of the machines and the talent of the inventor, the system was adopted, and the machinery erected. The construction of the machines was entrusted to Mr Henry Maudslay, whom Brunel had selected with

true discrimination, and by whom he was ably assisted. The beautiful simplicity of these machines, their perfect adaptation to their various purposes, and, notwithstanding the recent advances in mechanics, their continuing for nearly half a century in active work, without any improvements having ever been suggested, must rank them as among the most complete and ingenious pieces of mechanism ever invented.

The block machinery was completed in 1806, and it was estimated that the economy produced by it in the first year was about £24,000, two-thirds of which sum was awarded to the ingenious inventor, who was soon after engaged by the Government to erect extensive saw-mills, on improved principles, at Chatham and Woolwich. He there suggested modifications of the systems of stacking and seasoning timber, which were afterwards carried into effect. Some time previously, he had invented the ingenious little machine for winding cotton-thread into balls, which, simple as it may at first sight appear, has exercised great influence on the extension of the cotton trade.

He found time also to invent an instrument for combining the use of several pens, so as to produce simultaneously a number of copies of a manuscript; a simple and portable copying-machine; and a contrivance for making the small boxes used by druggists, which had been previously imported in large quantities from Holland. A nail-making machine also occupied his attention; and he discovered the system of giving the efflorescent appearance to tinfoil, by which it was fitted for ornamental purposes. Among other more important improvements may be mentioned that of cutting veneers by circular saws of large diameter, to which is mainly due the present extensive application of veneers of wood to ornamental furniture. About the year 1812 he had devised a scheme for making shoes by machinery; and, under the countenance of the duke of York, the shoes so manufactured, in consequence of their strength, cheapness, and durability, were introduced for the use of the army; but at the peace in 1815, manual labour becoming cheaper, and the demand for military equipments having ceased, the machines were laid aside.

Steam navigation also attracted his attention, and he became deeply interested in establishing the Ramsgate steam vessels, which were among the first that plied successfully on the River Thames; and on board of them it is believed that the double engines were first used. About this period, after much labour and perseverance, he induced the Admiralty to permit the application of steam for towing vessels to sea, the practicability of which he had strenuously urged. The experiments were tried chiefly at his own expense; a small sum in aid had been promised, but it was eventually withdrawn before the completion of the trials, the Admiralty considering the attempt "too chimerical to be seriously entertained." He introduced various improvements in the steam-engine, and for nearly ten years persevered in the attempt to use liquefied gases as the source of motive power, in which he was ably assisted by his son. The necessary experiments were most laborious, and needed all the persevering energy and resources of a mind determined not to be foiled; in spite, however, of his efforts, after a great sacrifice of time and money, the plan was abandoned.

The whole power of his mind, however, was for many years concentrated on one great object, the construction of the tunnel for communication from shore to shore beneath the bed of the River Thames. It is said that the original idea occurred to him, as applied to the Neva at St Petersburg, in order to avoid the inconvenience arising from the floating ice,—a plan which he offered to the Emperor Alexander, on the occasion of his visit to England in 1814. Undismayed by previous signal failures in the attempt

to construct a tunnel beneath the Thames, Brunel, confident in his own powers, persevered, and in 1824, under the auspices of the duke of Wellington, who always entertained a favourable view of the practicability of the scheme, a company was formed for its execution; and after numerous accidents and suspensions of the works, this great and novel undertaking was successfully accomplished, and the tunnel opened to the public in the year 1843.

In the prosecution of the work he received great assistance from his son, Isambard Kingdom Brunel, and in a scientific point of view the construction of the tunnel will be regarded as displaying, at the same time, the highest professional ability, an amount of energy and skill rarely exceeded, and a fertility of invention and resources, under what were deemed insurmountable difficulties, which will secure to the memory of Sir Isambard Brunel a high position among the engineers of England.

He received the order of the Légion d'Honneur in 1829, and the honour of knighthood in 1841. He was a corresponding member of the French Institute, and a fellow of the Royal Society. He joined the Institution of Civil Engineers in the year 1823, and constantly attended the meetings, took part in the discussions, and promoted the society's interests by every means in his power.

He was unaffected and simple in his habits, and possessed indomitable courage, perseverance, and industry; whilst his benevolence constantly prompted him to kindly and considerate actions. His labours had so seriously impaired his health, that for some years after the completion of the tunnel he was unable to mix in active life. He died on the 12th of December 1849, in his 81st year. (See Richard Beamish, *Memoirs of Sir Marc Isambard Brunel*, 1862.)

BRUNELLESCHI, FILIPPO, (1377-1446), one of the greatest Italian architects, the reviver in Italy of the Roman or Classic style, was born at Florence in 1377. His father, a notary, had destined him for his own profession, but observing the boy's talent for all sorts of mechanism, placed him in the guild of goldsmiths. Filippo quickly became a skilled workman, and, eagerly desirous to excel, perfected himself in the knowledge of sculpture, perspective, and geometry,—whatever, in short, was useful for the architectural art, to which he found himself attracted. He designed some portions of houses in Florence, and in 1401 he was one of the competitors for the design of the gates of the baptistery of San Giovanni. He was unsuccessful, though his work obtained praise, and he soon afterwards set out for Rome. He studied hard, and resolved to do what he could to revive the older classical style, which had died out in Italy. In 1407 he returned to Florence, just at the time when it was resolved to attempt the completion of the cathedral church of Santa Maria del Fiore. Brunelleschi's plan for effecting this by a cupola was approved, but it was not till 1419, and after innumerable disputes, that the work was finally entrusted to him. At first he was hampered by his colleague Ghiberti, of whom he skilfully got rid. He did not live to see the completion of his great work, and the lantern on the summit was put up not altogether in accordance with the instructions and plans left by him. The great cupola, one of the triumphs of architecture, exceeds in some measurements that of St Peter's at Rome, and has a more massive and striking appearance. Besides the masterpiece Brunelleschi executed numerous other works, among the most remarkable of which are the Pitti Palace at Florence, and the churches of San Lorenzo and Spirito Santo, and the still more elegant Capella dei Pazzi. He died in 1446, and was buried in the great church of Santa Maria. See ARCHITECTURE, vol. ii. p. 436.

BRUNET, JACQUES CHARLES, the eminent bibliographer, was born at Paris in 1780, and died in 1867. He was the

son of a bookseller, and at an early age began the study which occupied the whole of his after life. In 1802 he printed a supplement to the *Dictionnaire Bibliographique* of Duclos and Cailleau, and in 1810 there appeared the first edition of his *chef-d'œuvre*, the *Manuel du Libraire*. With the exception of a few pamphlets and mirror dissertations, Brunel published nothing beyond successive editions of his great bibliographical dictionary, which had come to be recognized as the first book of its class in European literature. The last (fifth) edition in six volumes was completed in 1865.

BRUNI, LEONARDO (1369-1444), author of the *History of Florence*, was an eminent scholar of the 15th century. He was born at Arezzo, and is generally known as L. Aretino. He was secretary to the papal chancery under Innocent VII. and John XXII. From 1427 to his death in 1444 he was chancellor to the republic of Florence. He was buried at the expense of the state in Sta. Croce, where his laurelled statue is still to be seen. His *History of Florence* comes down to 1404.

BRÜNN, the capital of the Austrian margraviate of Moravia, is situated for the most part between two hills at the confluence of the Schwarza and the Zwittawa, 69 miles N. of Vienna and 115 W.S.W. of Prague, with both of which it is connected by railway. Lat. 49° 11' 39" N., long. 16° 39' 35" E. On one of the hills known as the Spielberg stands the castle of the same name, which has long been used as a prison, and is famous for its connection with the patriotic Silvio Pellico, who was confined within its walls for about eight years. The old town, which is comparatively small, still retains some of its fortifications, but most of them have given place to promenades. Its streets are narrow and crooked but well-paved, and it contains many of the most important buildings in the city. Extensive suburbs have grown up around it, and since 1849 form portions of the same commune. There are fine public gardens and a large park known as the Augarten, presented to the town by the Emperor Joseph II. The Rathaus, which dates from 1511, has a fine Gothic portal, and contains several interesting antiquities. The ecclesiastical buildings comprise the cathedral of St Peter's, situated on the lower hill; the fine Gothic church of St James, built in the 15th century, with its iron tower added in 1845, and a remarkable collection of early typography; the church of the Augustine friars, dating from the 14th century; that of the Minorites with its frescoes, its holy stair, and its Loretto-house; the bishop's palace; a splendid Jewish synagogue; and several monastic establishments. As the capital of the province Brünn is the seat of the chief legal and military courts, and thus possesses various official edifices, the old Jesuit convent having been turned into barracks. It is also the seat of a Roman Catholic bishop and of a Protestant consistory. Its educational and benevolent institutions comprise a theological seminary, a gymnasium, several academies and schools, an agricultural society, a botanic garden, an infirmary, an orphanage, a blind asylum, a deaf-mute institution, a lunatic asylum, and several hospitals, of which the most important is the great hospital of St Anna. The national museum for Moravia and Silesia, though comparatively poor, must also be mentioned. Brünn is one of the chief seats of the woollen manufacture in the Austrian dominions, and the centre of a large miscellaneous trade. Considerable quantities of silk and cotton goods are manufactured, as also leather, paper, tobacco, oil, and sugar. There are also steam-flour-mills, engineering works, and breweries. There is a remarkable viaduct in the immediate neighbourhood of the town. Brünn probably dates from the 9th century. In the 11th it was bestowed by Duke Wratiaslas II. on his son Otto. Brünn is a place of great