

thermodynamic point of view, is well shown by comparing their consumption of fuel. In the steam-engine we find in good engines of large size a consumption of 2 lb or 1½ lb of coal per I.H.P. per hour, and by triple expansion this is reduced in large marine engines to about 1½ lb. On the other hand, in small-power engines the consumption is at least 2½ lb, and is generally 3 lb or more. When Mr Dowson's cheap gas,¹ which is produced by passing a mixture of superheated steam and air through red-hot anthracite, is used to drive an Otto engine, the consumption of coal has been found to be only 1.1 lb per I.H.P. per hour, or less than half the amount used by a steam-engine of similar size. What gives this comparison additional interest is the fact that the gas-producer for a 40 or 50 H.P. engine need not take up more space than the boiler of a steam-engine of the same power.

263. In another sense the gas-engine is much less perfect than the steam-engine. The actual efficiency of the latter is about half the ideal efficiency which a perfect engine would show when working through the same range of temperature. In the gas-engine the actual is less than one-fourth of the ideal efficiency. Taking the highest temperature as 1900° C.—a value reached in some of Mr Clerk's experiments—and the lowest temperature as 15° C., the efficiency of a perfect engine would be 0.87, while that of the actual engine is 0.2. This only means that the gas-engine has all the greater margin for future improvement.

264. At present the main causes of waste in gas-engines are the action of the sides of the cylinder and the water-

jacket, and the high temperature of the exhaust gases. The water-jacket absorbs about half the whole heat, only to keep the cylinder cool enough to permit of lubrication. The waste gases are discharged at a temperature of about 420° C., and so carry away a large amount of heat which might in part be saved by having a greater ratio of expansion, or by the use of a regenerator. Another source of thermodynamic imperfection is the after-burning, which gives heat to the working substance at a temperature lower than the maximum.

In an engine constructed by the late Sir William Siemens it was attempted to do away with or reduce the two main causes of loss—(1) by using a separate combustion-chamber, distinct from the cylinder in which the piston worked, and (2) by passing the exhaust gases through a regenerator, which afterwards gave up heat to the incoming air and gas.² The late Prof. Fleeming Jenkin endeavoured to attain the same ends by adapting the Stirling type of engine to internal combustion, a mixture of gas and air being exploded under a displacer like that of fig. 141. Practical difficulties have hitherto prevented regenerative internal-combustion engines from coming into use, but it can scarcely be doubted that their development is only a question of time. With regard to the probable future of heat-engines, it is important to notice that the internal-combustion engine using gaseous fuel, though already much more efficient than the steam-engine, is crude and full of defects which further invention ought to remove, while the steam-engine has been improved so far that little increase in its efficiency can be expected, and more than a little is impossible. (J. A. E.)

² Siemens, "Discussion on the Theory of the Gas-Engine." *Min. Proc. Inst. C.E.*, 1882.

¹ *Min. Proc. Inst. C.E.*, vol. lxxiii. p. 311.

INDEX.

The numerals refer to the sections.

Absolute temperature, 29, 49.	Compound engine, 17, 111-122, 191; advantages of, 93, 116.	actual, in steam-engines, 82; incomplete, 74; work done in, 36.	Indicator, 14, 98, 99.	Proell expansion gear, of, 63; wet, 64, 67, 74, 104; isothermal expansion of, 66.
Adiabatic expansion, 38; of steam, 67, 75.	Expansion in steam-engines, 79; in air and gas engines, 245, 249.	Expansion slide-valve, 157-159.	Indicator diagram, 25; examples of, 101; compound, 117-122; in gas-engines, 251, 257, 258.	Pulsometer, 208.
Æolipile, 2.	Condensation, initial, 80-93.	Expansive use of steam, 14, 72.	Inflector, 137.	Pumping engines, 205-208.
Air-engines, 240-247; Stirling's, 54, 244-245; Ericsson's, 246.	Condenser, 71, 196, 225.	Feed-pump, 137, 228.	Internal-combustion engines, 243-264.	Quadruple-expansion engines, 120, 223.
Air-pump, 11, 196, 226.	Corliss gear, 174; engine, 198.	Feed-water-heater, 138, 224.	Internal energy, 34.	Radial axle-box, 230.
Alsatian experiments, 80, 90.	Cornish boiler, 16, 127; engine, 18; valve, 163.	Fly-wheels, theory of, 189.	Isochronism of governors, 170.	Radial valve-gears, 156, 54, 244-245.
American experiments, 80, 90, 93.	Crank-effort, diagram of, 183-188.	Forced draught, 126, 141, 228.	Isothermal expansion, 39.	Rankine, 22, 75; his statement of second law of thermodynamics, 48.
American locomotive, 134, 230.	Crank shaft, torsional vibration of, 190.	Fusible plug, 128.	Joule's equivalent, 23.	Receiver, 112.
Art. priming pipe, 145.	Crosby indicator, 98.	Galloway boiler, 129; tubes, 127.	Joule's law, 36.	Regenerative gas-engines, 264.
Automatic expansion gear, 173-175.	Cut-off, 72; variation of, 159, 173-175.	Gas-engines, 250-264; Lenoir's, 251; Otto and Langen's, 252; Otto's, 253; theory of, 256-264; efficiency of, 262-264.	Lead, 145.	Regenerator, 53.
Barring engines, 198.	Cycle of operations, 26; Carnot's, 40, 68.	Gases permanent, laws of, 23-33.	Leupold, 15.	Regnault's law, 31; his experiments on steam, 57.
Beam-engines, 192.	Cylinder walls, influence of, 80-93.	Governors, 164-181; disengagement, 176; differential, 178; marine, 179, 181.	Liner, 195.	Release, 72.
Bearings, 195.	Dash-pot, 171.	Hackworth valve-gear, 156.	Link motion, 152-155.	Relief rings, 160.
Beighton, 10.	De Caus, 3.	Hallauer, 80, 90.	Liquid fuel, 145.	Reversibility, 43-45; conditions of, 50-52.
Boiler, 230.	Della Porta, 3.	Heat-engine defined, 1; theory of, 23-54; perfect, 46.	Locomotive, 229-240; early, 20; compound, 234-236; tramway, 237-239; fireless, 238; road, 240.	Reversing gear, 152-156.
Boilers, 123-143; Cornish, 16, 127; Lancashire, 127-128; Galloway, 129; tubular, 130; vertical, 131; sectional or tubular, 132; locomotive, 133-134; marine, 135; use of zinc in, 140.	Diagonal engines, 215.	Hero of Alexandria, 2.	Locomotive boiler, 133-134.	Richards's indicator, 98.
Boyle's law, 28.	Dust-fan, 143.	High-speed engines, 197, 202-204.	M'Naught, 19, 98.	Rotary engines, 210.
Branca, 4.	Duty of engines, 18, 95.	Hirn, 22, 80, 92.	Mallet's compound locomotive, 234.	Safety motor (Davey) 209.
Bremme or Marshall gear, 166.	Eccentric, 144.	Historical sketch, 2-22.	Marine engines, 213-228.	Safety-valve, 8, 128.
Brotherhood engine, 203.	Efficiency of a heat-engine, 23, 94; perfect, 46, 69; methods of testing, 97, 102; results of tests of, 95, 96, 103; of boiler and furnace, 95; of mechanism, 110; of gas-engines, 262-264.	Horizontal engine, 195-217.	Mechanical equivalent of heat, 23.	Savery, 6.
Cataract, 163.	Evans, 16.	Hornblower, 17.	Mechanical stokers, 142.	Separator, 139.
Cawley, 9.	Exhaust, 72.	Horse-power, 14; measurement of, 100.	Moscrop recorder, 182.	Side-lever engines, 213.
Charles's law, 29.	Exhaust waste, 108.	Huygens, 7.	Newsomen, 9, 10.	Siemens, 178, 264.
Chimney draught, 125.	Expansion, adiabatic, 38, 61; isothermal, 39;	Hydrokineter, 137.	Oscillating-cylinder engines, 215.	Slide-valve, theory of, 144-150.
Circulating pump, 228.	61; isothermal, 39;		Otto's gas-engine, 253.	Slide-valve, theory of, 144-150.
Clark, D. K., 80.	61; isothermal, 39;		Papin, 8.	Specific heat, 31; of gases, 35; of water, 59.
Clausius, 22, 75.	61; isothermal, 39;		Parallel motion, 193-194.	Stationary engines, 191-212.
Clearance, 73.	61; isothermal, 39;		Petroleum engines, 250.	Steam, properties of, 55-67; latent heat of, 60; saturated, 55; superheated, 55, 65; density of, 58, 75; total heat of, 61; internal energy of, 62; adiabatic expansion of, 67, 76; heat of formation
Clerk's gas-engine, 254; experiments on expander, 262, 264.	61; isothermal, 39;		Piston packing, 195.	of, 63; wet, 64, 67, 74, 104; isothermal expansion of, 66.

STEAM HAMMER. See HAMMER.

STEARINE, in commerce, designates a solid mixture of fatty acids (chiefly palmitic and stearic) which is being produced industrially from animal fats and used largely for the making of candles. In chemistry it is a generic term for the three "esters" derivable from glycerin, C₃H₅(OH)₃, by the replacement of one or more of the three (OH)'s by the residue C₁₇H₃₅O₂, which, in stearic acid, is combined with "H." Of these tri-stearine, C₃H₅(C₁₇H₃₅O₂)₃, is the most important; it occurs in animal fats only, largely in tallow. It crystallizes from ether in white pearly nodules, insoluble in cold but easily soluble in boiling alcohol. It can be distilled undecomposed *in vacuo*. On gradual exposure to higher temperatures it fuses at 55° C.; it then resolidifies, and then fuses again (permanently) at 71° 5 (Heintz). The specific gravity of the liquid is 0.9245 at 65° 5 C. (Duffy).

STEEL. See IRON.

STEELE, SIR RICHARD (1672-1729), one of the most active and prominent men of letters in the reign of Queen Anne, inseparably associated in the history of literature with his personal friend Addison. He cannot be said to have lost in reputation by the partnership, because he was far inferior to Addison in purely literary gift, and it is Addison's literary genius that has floated their joint work above merely journalistic celebrity; but the advantage was not all on Steele's side, inasmuch as his more brilliant coadjutor has usurped not a little of the merit rightly due to him. Steele's often-quoted generous acknowledgment of Addison's services in *The Teller* has proved true in a somewhat different sense from that intended by the writer:—"I fared like a distressed prince, who calls in a powerful neighbour to his aid; I was undone by my auxiliary; when I had once called him in I could not subsist without dependence on him." The truth is that in this happy alliance the one was the complement of the other; and the balance of mutual advantage was much more nearly even than Steele claimed or posterity has generally allowed.

The famous literary pair were born in the same year, 1672.—Steele in Dublin, the senior by less than two months. Steele's father, who is said to have been a lawyer, died before he had reached his sixth year, but the boy found a protector in his maternal uncle, Henry Gascoigne, secretary and confidential agent to two successive dukes of Ormonde. Through his influence he was nominated to the Charterhouse in 1684, and there first met with Addison. Five years afterwards he proceeded to Oxford, and was a postmaster at Merton when Addison was a demy at Magdalen. Their schoolboy friendship was continued at the university, and probably helped to give a more serious turn to Steele's mind than his natural temperament would have taken under different companionship. Addison's reverend father also took an interest in the warm-hearted young Irishman; but their combined influence did not steady him sufficiently to keep his impulses within the lines of a regular career; without waiting for a degree he volunteered into the army, and served for some time as a cadet "under the command of the unfortunate duke of Ormonde." This escapade was made without his uncle's consent, and cost him, according to his own account, "the succession to a very good estate in the county of Wexford in Ireland." Still, he did not lack advancement in the profession he had chosen. A poem on the funeral of Queen Mary (1695), dedicated to Lord Cutts, colonel of the Coldstream Guards, brought him under the notice of that nobleman, who took the gentleman trooper into his household as a secretary, made him an officer in his own regiment, and ultimately procured for him a captaincy in Lord Lucas's fusiliers.

His name was noted for promotion by King William, but the king's death took place before anything had been done for Captain Steele. He would seem to have remained in the army, though never on active service, for several years longer.

Steele probably owed the king's favour to honest admiration of the excellent principles of *The Christian Hero*, his first prose treatise, published in 1701. The "reformation of manners" was a cherished purpose with King William and his consort, which they tried to effect by proclamation and Act of Parliament; and a sensible well-written treatise, deploring the irregularity of the military character, and seeking to prove by examples—the king himself among the number—"that no principles but those of religion are sufficient to make a great man," was sure of attention. Steele complained that the reception of *The Christian Hero* by his comrades was not so respectful; they persisted in trying him by his own standard, and would not pass "the least levity in his words and actions" without protest. The sensitive and hot-headed "hero" would seem to have been teased into fighting a duel,—his first and last, for he wounded his antagonist dangerously, and from that time was a staunch opponent of affairs of honour. His uneasiness under the ridicule of his irreverent comrades had another curious result: it moved him to write a comedy. "It was now incumbent upon him," he says, "to enliven his character, for which reason he writ the comedy called *The Funeral*." Although, however, it was Steele's express purpose to free his character from the reproach of solemn dulness, and prove that he could write as smartly as another, he showed greater respect for decency than had for some time been the fashion on the stage. The purpose, afterwards more fully effected in his famous periodicals, of reconciling wit, good humour, and good breeding with virtuous conduct was already deliberately in Steele's mind when he wrote his first comedy. It was produced and published in 1701, was received on the stage with favour, and, owing to its comparative purity helped, along with *The Christian Hero*, to commend its author to King William. In his next comedy, *The Lying Lover, or the Ladies' Friendship*, produced two years afterwards, in 1703, Steele's moral purpose was directly avowed; and the play, according to his own statement, was "damned for its piety." *The Tender Husband*, produced eighteen months later (in April 1705), though not less pure in tone, was more successful; in this play he gave unmistakable evidence of his happy genius for conceiving and embodying humorous types of character, putting on the stage the parents or grandparents of Squire Western, Tony Lumpkin, and Lydia Languish. It was seventeen years before Steele again tried his fortune on the stage with *The Conscious Lovers*, the best and most successful of his comedies, produced in 1722.

Meantime the gallant captain had turned aside to another kind of literary work, in which, with the assistance of his friend Addison, he obtained a more enduring reputation. There never was a time when literary talent was so much sought after and rewarded by statesmen. Addison had already been waited on in "his humble lodgings in the Haymarket," and advanced to office, when his friend the successful dramatist was appointed to the office of gazetteer. This was in May 1707. It was Steele's first connexion with journalism. The periodical was at that time taking the place of the pamphlet as an instrument for working on public opinion. *The Gazette* gave little opening for the play of Steele's lively pen, his main duty, as he says, having been to "keep the paper very innocent and very insipid"; but the position made him familiar with a new field of enterprise in which his inventive mind soon discerned materials for a project of

his own. *The Tatler* made its first appearance on the 12th of April 1709. It was partly a newspaper, a journal of politics and society, published three times a week. Steele's position as gazetteer furnished him with special advantages for political news, and as a popular habitué of coffee-houses he was at no loss for social gossip. But Steele not only retailed and commented on social news, a function in which he had been anticipated by Defoe and others; he also introduced into *The Tatler* as a special feature essays on general questions of manners and morality. It is not strictly true that Steele was the inventor of the English "essay,"—there were essayists before the 18th century, notably Cowley and Temple; but he was the first to use the essay for periodical purposes, and he and Addison together developed a distinct species, to which they gave a permanent character and in which they had many imitators. As a humbler motive for this fortunate venture Steele had the pinch of impecuniosity, due rather to excess of expenditure than to smallness of income. He had £300 a year from his gazetteership, £100 as gentleman usher to Prince George, £800 from the Barbados estates of his first wife,¹ and some fortune by his second wife—Mrs Mary Scurlock, the "Dear Prue" of his charming letters. But Steele lived in considerable state after this second marriage, and was reduced to the necessity of borrowing before he started *The Tatler*. The assumed name of the editor was Isaac Bickerstaffe, but Addison discovered the real author in the sixth number, and began to contribute in the eighteenth. It is only fair to Steele to state that the success of *The Tatler* was established before Addison joined him, and that Addison contributed to only forty-two of the two hundred and seventy-one numbers that had appeared when the paper was stopped in January 1711.

Only two months elapsed between the stoppage of *The Tatler* and the appearance of *The Spectator*, which was the organ of the two friends from March 1, 1711 till December 6, 1712. Addison was the chief contributor to the new venture, and the history of it belongs more to his life. Nevertheless it is to be remarked as characteristic of the two writers that in this as in *The Tatler* Addison generally follows Steele's lead in the choice of subjects. The first suggestion of Sir Roger de Coverley was Steele's, although it was Addison that filled in the outline of a good-natured country gentleman with the numerous little whimsicalities that convert Sir Roger into an amiable and exquisitely ridiculous provincial oddity. Steele had neither the fineness of touch nor the humorous malice that gives life and distinction to Addison's picture; the Sir Roger of his original hasty sketch has good sense as well as good nature, and the treatment is comparatively commonplace from a literary point of view, though unfortunately not commonplace in its charity. Steele's suggestive vivacity gave many another hint for the elaborating skill of his friend.

The Spectator was followed by *The Guardian*, the first number of which appeared on the 12th of March 1713. It had a much shorter career, extending to only a hundred and seventy-five numbers, of which Steele wrote eighty-two and Addison fifty-three. This was the last of his numerous periodicals in which he had the assistance of the great essayist. But he continued for several years to project journals, under great variety of titles, some of them political, some social in their objects, most of them very short-lived. Steele was a warm partisan of the principles of the Revolution, ardent and earnest in his political as in his other convictions. *The Englishman*

¹ The name of this lady—a widow, Mrs Margaret Stretch—and some facts about her have been ascertained by Mr George A. Aitken. See *Athenæum*, May 1, 1886, and Mr Dobson's *Steele*, pp. 51, 218.

was started in January 1714, immediately after the stoppage of *The Guardian*, to assail the policy of the Tory ministry. *The Lover*, started some six weeks later, was more general in its aims; but it gave place in a month or two to *The Reader*, a direct counterblast to the Tory *Examiner*. *The Englishman* was resuscitated for another volume in 1715; and in the same year he projected in rapid succession three unsuccessful ventures,—*Town Talk*, *The Tea Table*, and *Chit-Chat*. Three years later he started his most famous political paper, *The Plebeian*, rendered memorable by the fact that in it he had to contend against his old ally Addison. The subject of controversy between the two life-long friends was Sunderland's Peerage Bill. Steele's last venture in journalism was *The Theatre*, 1719–20, the immediate occasion of which was the revocation of his patent for Drury Lane. So ready was Steele in this kind of enterprise, which he could always conduct single-handed, that apparently whenever he felt strongly on any subject he at once started a journal to give vent to his feelings. Besides these journals he wrote also several pamphlets on passing questions,—on the disgrace of Marlborough in 1711, on the fortifications of Dunkirk in 1713, on the "crisis" in 1714, *An Apology for himself and his Writings* (important biographically) in the same year, on the South Sea mania in 1720.

The fortunes of Steele as a zealous Whig varied with the fortunes of his party. He lost his gazetteership when the Tories came into power in 1710. Over the Dunkirk question he waxed so hot that he threw up a pension and a commissionership of stamps, and went into parliament as member for Stockbridge to attack the ministry with voice and vote as well as with pen. But he had not sat many weeks when he was expelled from the House for the language of his pamphlet on *The Crisis*, which was stigmatized as seditious. *The Apology* already mentioned was his vindication of himself on this occasion. With the accession of the house of Hanover his fortunes changed. Honours and substantial rewards were showered upon him. He was made a justice of the peace, deputy-lieutenant of Middlesex, surveyor of the royal stables, governor of the royal company of comedians—the last a lucrative post, and was also knighted (1715). After the suppression of the Jacobite rebellion he was appointed one of the commissioners of forfeited estates, and spent some two years in Scotland in that capacity. He obtained a patent for a plan for bringing salmon alive from Ireland. Differing from his friends in power on the question of the Peerage Bill in 1718, he was deprived of some of his offices, but when Walpole became chancellor of the exchequer in 1721 he was reinstated. But with all his emoluments the imprudent, impulsive, ostentatious, and generous Steele could never get clear of financial difficulties, and he was obliged to retire from London in 1724 and live in the country. He spent his last years on his wife's estate of Llangunnor in Wales, and, his health broken down by a paralytic seizure, died on the 1st of September 1729.

A selection from Steele's essays has been edited by Mr Austin Dobson, who prefixes a careful and sympathetic memoir. Mr Dobson has since written a fuller biography in Mr Lang's series of *English Worthies*. (W. M.)

STEELYARD, MERCHANTS OF THE, were Hanse merchants who settled in London in 1250 at the steelyard on the river side, near Cosin Lane, now Iron Bridge Wharf. Henry III. in 1259, at the request of his brother Richard, earl of Cornwall, conferred on them important privileges, which were renewed and confirmed by Edward I. It was chiefly through their enterprise that the early trade of London was developed, and they continued to flourish till, on the complaint of the Merchant Adventurers in the reign

of Edward VI., they were deprived of their privileges. Though Hamburg and Lübeck sent ambassadors to intercede for them, they were not reinstated in their monopolies, but they succeeded in maintaining a footing in London till expelled by Elizabeth in 1597. Their beautiful guildhall in Thames Street, described by Stow, was made a naval store-house. It contained two famous pictures, painted in distemper by Holbein, representing Poverty and Riches, which were presented by the Hanse merchants to Henry, prince of Wales, and came into the possession of Charles I., but are supposed to have perished in the fire which destroyed Whitehall.

STEEN, JAN HAVICKSZ (1626–1679), subject-painter, was born at Leyden in 1626, the son of a brewer of the place. He studied at Utrecht under Nicholas Knuffer, an historical painter, and about 1644 went to Haarlem, where he worked under Adrian van Ostade and under Jan van Goijen, whose daughter he married in 1649. In the previous year he had joined the painters' guild of the city. In 1667 he is said to have been a brewer at Delft, and in 1672 he received municipal authority to open a tavern. The accounts of his life, however, are very confused and conflicting. Some biographers have asserted that he was a drunkard and of dissolute life, but the number of his works—Van Westreene, in his *Jan Steen, Étude sur l'Art en Holland*, has catalogued nearly five hundred—is sufficient in itself to disprove the charge. His later pictures bear marks of haste and are less carefully finished than those of his earlier period. He died at Leyden in 1679.

The works of Jan Steen are distinguished by correctness of drawing, admirable freedom and spirit of touch, and clearness and transparency of colouring. But their true greatness is due to their intellectual qualities. In the wide range of his subjects, and their dramatic character, he surpasses all the Dutch figure-painters, with the single exception of Rembrandt. His productions range from the stately interiors of grave and wealthy citizens to tavern scenes of jollity and debauch. He painted chemists in their laboratories, doctors at the bedside of their patients, card-parties, marriage feasts, and the festivals of St Nicholas and Twelfth Night,—even religious subjects, though in these he was least successful. His rendering of children is especially delightful. Dealing often with the coarser side of things, his work is full of humour; he depicts the comedy of human life in a spirit of very genial toleration, but now and again there appear keenly telling touches of satire which recall such a pictorial moralist as Hogarth.

The National Gallery contains one picture by Jan Steen,—the Music Master; and other excellent examples of his art are preserved in the Royal, the Bute, the Ashburton, and the Northbrook collections, at Apsley House and Bridgewater House, and in the galleries of The Hague, Amsterdam, and the Hermitage, St Petersburg.

STEFFANI, AGOSTINO (1655–1730), ecclesiastic, diplomatist, and musical composer, was born at Castelfranco in 1655, and at a very early age was admitted as a chorister at St Mark's in Venice. In 1667 the beauty of his voice attracted the attention of Count Tattenbach, by whom he was taken to Munich, where his education was completed at the expense of Ferdinand Maria, elector of Bavaria, who appointed him "Churfürstlicher Kammer- und Hofmusikus," and granted him a liberal salary. After receiving instruction from Johann Kaspar Kerl, and possibly Ercole Bernabei, he was sent in 1673 to study in Rome, where, among other works, he composed six motets, the original MSS. of which are now in the Fitzwilliam Museum at Cambridge. On his return to Munich in 1674 he published his first work, *Psalmodia Vespertina*, a part of which was reprinted in Martini's *Saggio di Contrappunto* in 1674.

In 1675 he was appointed court organist, and in 1680 he was ordained priest, with the title of abbaté of Lepsing. His ecclesiastical status did not, however, prevent him from turning his attention to the stage, for which, at different periods of his life, he composed works which undoubtedly exercised a potent influence upon the dramatic music of the period. Of his first opera, *Marco Aurelio*, produced at Munich in 1681, the only copy known to exist is a MS. score preserved in the royal library at Buckingham palace. It was followed by *Solone* in 1685, *Servio Tullio* in 1686, *Alarico* in 1687, and *Niobe* in 1688; but of these four last-named works no trace can now be discovered. *Niobe* was the last opera Steffani composed at Munich. Notwithstanding the favour shown to him by the elector Maximilian Emanuel, he accepted in 1689 the appointment of kapellmeister at the court of Hanover, where he speedily gained the goodwill of Ernest Augustus, duke of Brunswick-Lüneburg (afterwards raised to the dignity of elector of Hanover), the duchess Sophia Charlotte (afterwards electress of Brandenburg), the philosopher Leibnitz, the abbaté Ortensio Mauro, and many men of letters and intelligence, and where, in 1710, he showed great kindness to Handel, who was then just entering upon his glorious career. He inaugurated a long series of triumphs in Hanover by composing, for the opening of the new opera-house in 1689, an opera called *Enrico il Leone*, which was produced with extraordinary splendour and achieved an immense reputation. For the same theatre he composed *La Lotta d'Ercole con Achilleo* in 1689, *La Superbia d'Alessandro* in 1690, *Orlando Generoso* in 1691, *Le Rivali Concordi* in 1692, *La Libertà Contenta* in 1693, *I Trionfi del Fato* and *I Baccanali* in 1695, and *Briseide* in 1696. The libretto of *Briseide* is by Palmieri. Those of most if not all the others are by the abbaté Mauro. The scores are preserved at Buckingham palace, where, in company with five volumes of songs and three of duets, they form part of the collection brought to England by the elector of Hanover in 1714. But it was not only as a musician that Steffani distinguished himself in his new home. The elevation of Ernest Augustus to the electorate in 1692 led to difficulties, for the arrangement of which it was necessary that an ambassador should visit the various German courts, armed with a considerable amount of diplomatic power. The accomplished abbaté was sent on this delicate mission in 1696, with the title of envoy extraordinary; and he fulfilled his difficult task so well that Pope Innocent XI., in recognition of certain privileges he had secured for the Hanoverian Catholics, consecrated him bishop of Spiga *in partibus infidelium*. In 1698 he was sent as ambassador to Brussels; and after the death of Ernest Augustus in the same year he entered the service of the elector palatine, John William, at Düsseldorf, where he held the offices of privy councillor and protonotary of the holy see. Invested with these high honours, Steffani could scarcely continue to produce dramatic compositions in public without grievous breach of etiquette. But his genius was too real to submit to repression; and in 1709 he ingeniously avoided the difficulty by producing two new operas—*Enea* at Hanover and *Tassilone* at Düsseldorf.—in the name of his secretary and amanuensis Gregorio Piva, whose signature is attached to the scores preserved at Buckingham palace. Another score—that of *Arminio*—in the same collection, dated Düsseldorf, 1707, and evidently the work of Steffani, bears no composer's name.

Steffani did not accompany the elector George to England; but in 1724 the Academy of Antient Musick in London elected him its honorary president for life; and in return for the compliment he sent the association a magnificent *Stabat Mater*, for six voices and orchestra.

and three fine madrigals. The MSS. of these are still in existence; and the British Museum possesses a very fine *Confitebor*, for three voices and orchestra, of about the same period. All these compositions are very much in advance of the age in which they were written; and in his operas Steffani shows an appreciation of the demands of the stage very remarkable indeed at a period at which the musical drama was gradually approaching the character of a mere formal concert, with scenery and dresses. But for the MSS. at Buckingham palace, these operas would be utterly unknown; but Steffani will never cease to be remembered by his beautiful chamber duets, which, like those of his contemporary Carlo Maria Clari (1669-1745), are chiefly written in the form of cantatas for two voices, accompanied by a figured bass. The British Museum possesses more than a hundred of these charming compositions,¹ some of which were published at Munich in 1679. Steffani visited Italy for the last time in 1729, in which year Handel, who always gratefully remembered the kindness he had received from him at Hanover, once more met him at the palace of Cardinal Ottoboni in Rome. This was the last time the two composers were destined to meet. Steffani returned soon afterwards to Hanover, and died in 1730 while engaged in the transaction of some diplomatic business at Frankfurt.

STEIBELT, DANIEL (c. 1760-1823), pianist and composer, was born between the years 1755 and 1765 at Berlin, where he studied, at the expense of the crown prince Frederick William, under Kirnberger. Very little is known of his artistic life before 1790, when he settled in Paris, and attained great popularity as a *virtuoso* by means of a pianoforte sonata called *La Coquette*, which he composed, in conjunction with Hermann, for Queen Marie Antoinette, and almost equal credit as a dramatic composer by an opera entitled *Romeo et Juliette*, produced at the Théâtre Feydeau in 1793. In 1796 Steibelt removed to London, where his pianoforte playing attracted an amount of attention which in 1798 was raised to an absolute *furor* by the production of his concerto (No. 3, in E♭) containing the famous "Storm Rondo"—a work that ensured his popularity, in spite of the far higher claims of Clementi, Dussek, and John Baptist Cramer, whose attainments as *virtuosi*, composers, and thoroughly accomplished artists were infinitely superior to his own. In the following year Steibelt started on a professional tour in Germany; and, after playing with some success in Hamburg, Dresden, Prague, and Berlin, he arrived in May 1800 at Vienna, where, with the arrogance which formed one of the most prominent characteristics of his nature, he challenged Beethoven to a trial of skill, which naturally resulted in his irretrievable discomfiture. His position in Germany being no longer tenable after this pitiful failure, he retired to Paris, and during the next eight years lived alternately in that city and in London, where his reputation continued undiminished. In 1808 he was invited by the emperor Alexander to St Petersburg, and there he resided, in the enjoyment of a lucrative appointment, until his death on September 20, 1823.

Besides his dramatic music, Steibelt left behind him an enormous number of compositions for the pianoforte, many of which exhibit a certain amount of originality, though they can scarcely be regarded as works of genius. His playing, though exceedingly brilliant, was wanting in the higher qualities which so strikingly characterized that of his contemporaries, John Cramer and Muzio Clementi; but he was undoubtedly gifted with talents of a very high order, and the reputation he enjoyed was fairly earned and honourably maintained to the end.

STEIN, HEINRICH FRIEDRICH KARL, BARON VOM UND ZUM (1757-1831), one of the greatest of German statesmen, and perhaps the most influential forerunner of Bismarck in

¹Add. MSS. 5055 &c.

the creation of German unity, was born at Nassau on October 26, 1757. He was a member of the independent noblesse or knighthood of the German empire (Reichsritterschaft), and his ancient family seat, Burg Stein, lies on a hill rising above the Lahn opposite Nassau. In his autobiography he speaks of his parents as "pious and genuinely German," and ascribes to their teaching his own religious and patriotic feelings, his sense of the dignity of his family and order, and his conviction of the duty of devoting his life to the public weal. Though the youngest but one of ten children, Stein was selected by his parents as the "Stammhalter," or representative and maintainer of the family name and dignity, and his elder brothers acquiesced in this arrangement.

From 1773 to 1777 Stein studied political economy, jurisprudence, and history at the university of Göttingen, where he made his first acquaintance with English institutions, his knowledge and appreciation of which are often manifest in his later career. His original intention was to qualify for an appointment in the imperial courts, but this sphere of work was little to his taste, and in 1780 he took the step, somewhat unusual for an imperial knight, of entering the service of Prussia. He became an official in the mining department, and by 1784 had risen to be head of the administration of mines and manufactures for Westphalia. In 1796 he was made supreme president of the provincial chambers of Westphalia, an appointment which gave him opportunity to evince his great administrative talents. In 1785 his administrative career was interrupted for a short time by a diplomatic mission to the elector of Mainz, and in 1786-87 he made a long professional tour in England, chiefly in the mining districts.

In 1804 Stein was created a minister of state, with the portfolio of excise, customs, manufactures, and trade. In this capacity he abolished the internal customs duties throughout Prussia, and effected several other needed reforms; but he was unable to modify the general disastrous tenour of the Prussian policy, which was now ripening for the catastrophe of Jena. Stein's remonstrances with the king and his strictures upon the course of the administration were couched in the most open and unsparring language, and they were specially directed against the system of government through privy cabinet counsellors, who had practically come to supplant the ministers without possessing either an official knowledge of affairs or a ministerial responsibility. He refused to join in the reconstituted ministry after Jena unless this abuse were done away with, and Frederick William III., already wounded by the frankness of Stein's criticism, sent him his dismissal in a most ungracious form (January 3, 1807). When the king, however, found himself left in the lurch by his ally Russia, at the peace of Tilsit (July 9, 1807), he turned in despair to the strong and candid counsellor he had dismissed half a year before, and invited Stein to re-enter his service, practically on his own terms. Curiously enough Stein's appointment as minister president was encouraged by Napoleon, who seems to have seen in him merely the clever organizer and financier, who would most easily put Prussia in a position to pay the enormous war indemnity levied on it. Stein took office on October 4, 1807, and at once began that weighty series of organic reforms with which his name is most indissolubly connected. The emancipation edict appeared on October 9, 1807, a few days after the formal receipt of his powers, and the municipal ordinance was published on November 19, 1808. In the interim he co-operated zealously with Scharnhorst in the reconstitution of the army, carried out a number of important financial and administrative reforms, and prepared the way for a thorough

reconstruction of the whole framework of government, which, however, he himself was not to have an opportunity to effect.

Stein's momentous ministry did not last much more than a year. Napoleon soon awoke to the eminently patriotic and energetic character of the man he had incautiously recommended, and an intercepted letter gave him the opportunity to demand Stein's dismissal. Frederick William had no option but to comply, as he shrank from the only possible alternative of an open breach with the French emperor. Stein was proscribed by Napoleon, his property in Westphalia was confiscated, and he himself had to take refuge in Austria from the French troops.¹

In 1812 the czar Alexander invited Stein to St Petersburg, where he filled the post of unofficial adviser to his imperial majesty on German or rather on anti-Napoleonic affairs; and it would perhaps be difficult to overestimate the influence of the proximity of such a man in keeping Alexander's courage screwed to the sticking-point. When the scene of the campaign of 1812 was transferred to Germany, Stein was entrusted with the administration of the Prussian districts occupied by the Russian troops, and he shares with Yorck the merit of arousing East Prussia to take arms against the French, and so of calling the "Landwehr" into existence for the first time. To Stein also mainly belongs the credit of effecting that union of Russia and Prussia (treaty of Kalisch, February 27, 1813) which was perhaps the main factor in the overthrow of Napoleon. After the battle of Leipsic Stein became supreme president of a central commission appointed to administer the lands occupied by the allied armies, in which post he was indefatigable in providing the men and material necessary for a successful prosecution of the war. When the military struggle was over Stein's work was practically done. The two tendencies of absolutism on the one hand and particularism on the other which determined the tone of the Vienna congress were equally repugnant to him, and he took little part in its deliberations. He also refused the invitations of Austria and Prussia to represent them at the Frankfurt diet, a makeshift in which he had no confidence or hope. The rest of his life he spent in retirement, sharing his time between Frankfurt and his property in Westphalia, and the only office he ever again filled was that of marshal of the provincial estates. In 1819 he founded the society for the publication of the *Monumenta Germaniæ Historica*, which has since done such admirable work. He died on June 29, 1831, in his seventy-fourth year, on his estate of Cappenberg in Westphalia, leaving a family of three daughters. His wife was Countess von Walmoden-Gimborn of Hanover, a granddaughter of George II.

Stein's distinguishing merit as a statesman is that he was practically the first to see the urgent necessity of German unity, to contemplate its realization as possible, and to inaugurate a policy likely to bring it about. That which, now that it has been accomplished by Stein's great successor, seems to us almost a matter of course, was a mere chimera to most of our forefathers, and it required the faculty of a political seer to attain Stein's clear views of future possibilities. Stein saw, too, that the only hope of salvation lay in the people as such,—that he must enlist the sympathies of the nation and raise its moral tone. To this end a series of great and just reforms was necessary. If a deep national sentiment was to be evoked, the people must be freed from feudal burdens; if they were to carry on an effective struggle for independence, they must first acquire personal liberty. His emancipation edict, therefore, which has been called the *habeas corpus* act of Prussia, abolished serfdom, did away with the distinctions of caste, and abrogated the feudal restrictions upon the free disposition of person and property (compare PRUSSIA, vol. xx.

¹The belief that Stein occupied himself during his retirement in propagating his opinions through the "Tugendbund" seems from recent investigations to be erroneous. He had no sympathy with secret societies, and all indications go to show that he rather disapproved of the league than otherwise.

pp. 11, 12). This reform, however, Stein found, in a sense, ready to his hand; it was demanded by the spirit of the times, and can hardly be looked on as a purely individual achievement. His most distinctive work was a great scheme of political reform, in which he contemplated the conversion of the absolute monarchy of Prussia into a free representative state. He wisely began the process by introducing the principle of free local government in his Städte-Ordnung, or municipal ordinance. The people had to be roused to take an interest in governing themselves, and it was easier to expand this interest from the local to the national than to work down from the national to the local. Stein did not see much more than this beginning of his plans, but the famous "Political Testament" he drew up on leaving office shows how wide-sweeping were the reforms he contemplated. The right of self-government was to be extended to the rural communes, and a thorough reform of every branch of the administration was to be effected, while the coping-stone of the new edifice was to take the form of a free representative parliament. Time, however, has been on his side, and it is not too much to say with Prof. Von Treitschke that every advance Germany has since made in political life has brought it nearer the ideals of Stein.

The standard work on Stein is the biography by G. H. Pertz, 6 vols., 1849-55, but few English readers will feel the need of going beyond Prof. Seelye's admirable *Life and Times of Stein*, London, 1879, which also contains a full bibliography. (J. F. M.)

STEINAMANGER (Hung. *Szombathely*; Lat. *Sabaria*), the chief town of the trans-Danubian county of Vas, Hungary, is an old place of some interest. Though it has only 12,000 inhabitants, it is the seat of a Roman Catholic bishop, and has a Dominican convent, a seminary, gymnasium, chamber of advocates, large orphanage, fine theatre, and a number of superior Government offices. The interior of the cathedral is of great beauty, in the Italian style. The town is at the junction of four different railways, and is rapidly rising in importance.

STEINER, JAKOB (1796-1863), one of the greatest geometers of all ages, was born on the 18th of March 1796 at the Swiss village of Utzendorf (canton Bern). Here he grew up helping his father in his agricultural pursuits, learning to write only at the age of fourteen. At eighteen he became a pupil of Pestalozzi, and afterwards studied at Heidelberg. Thence he went to Berlin, earning a livelihood here as in Heidelberg by giving private lessons. Here he became acquainted with Crelle, who, encouraged by his ability and by that of Abel, then also staying at Berlin, founded his famous *Journal* (1826). After Steiner's publication (1832) of his *Systematische Entwicklungen* he got, through Jacobi's exertions, who was then professor at Königsberg, an honorary degree of that university; and through the influence of Jacobi and of the brothers Alexander and Wilhelm von Humboldt a new chair of geometry was founded for him at Berlin (1834). This he occupied till his death, which took place in Bern on April 1, 1863, after years of bad health.

Steiner's mathematical work was confined to geometry. This he treated synthetically, to the total exclusion of analysis, which he hated, and he is said to have considered it a disgrace to synthetical geometry if equal or higher results were obtained by analytical methods. In his own field he surpassed all his contemporaries. His investigations are distinguished by their great generality, by the fertility of his resources, and by a rigour in his proofs which rivals that of the ancients, so that he has been considered the greatest geometrical genius since the time of Apollonius.

In his *Systematische Entwicklung der Abhängigkeit geometrischer Gestalten von einander* he laid the foundation on which synthetic geometry in its present form rests. He introduces what are now called the geometrical forms (the row, flat pencil, &c.), and establishes between their elements a one-one correspondence, or, as he calls it, makes them projective. He next gives by aid of these projective rows and pencils a new generation of conics and ruled quadric surfaces, "which leads quicker and more directly than former methods into the inner nature of conics and reveals to us the organic connexion of their innumerable properties and mysteries." In this work also, of which unfortunately only one volume appeared instead of the projected five, we see for the first time the