he became archdeacon of Colchester. Two years later he was raised to the bishopric of Chester, and in that position began his career of incessant labour for the advancement of the church. Many reforms were needed in the diocese, and the new bishop's energy and ardour succeeded in effecting much, though not without stirring up enemies. In 1828 he was transferred to a wider sphere of activity, being raised to the bishopric of London. This important office he held for eight-and-twenty years, labouring incessantly in a field where unremitting exertion was absolutely necessary. He gave his whole heart to the endeavour to extend the influence and efficiency of the church, and his strenuous activity was not without result. In all political or social movements which concerned the church the bishop took a prominent part. He was noted as being one of the best debaters on the episcopal bench in the House of Lords; he took a leading position in the action for church reform, which culminated in the Ecclesiastical Commission; and he did much for the extension of the colonial episcopate. His health gave way under his unceasing labours, and in 1856 he was permitted to resign his bishopric, retaining Fulham palace as his residence, along with a pension of £6000 per annum. He died at Fulham on the 5th August 1857. In private life Blomfield was warm-hearted, genial, and kindly; he was fond of travelling and of intellectual society, in which he was well qualified to shine. His published works, exclusive of those above mentioned, consist of charges, sermons, lectures, and pamphlets, and of a *Manual of Private and Family Prayers*. He was a frequent contributor to the quarterly reviews, chiefly on classical subjects. An admirable memoir has been published by the bishop's son, *Memoirs of Charles James Blomfield, D.D., Bishop of London, with Selections from his Correspondence*, edited by his son, Alfred Blomfield, M.A., &c., 1863. See also Biber, *Bishop Blomfield and his Times*, 1857.

BLONDEL, David, a Protestant clergyman, distinguished by his proficiency in ecclesiastical and civil history, was born at Chalons-sur-Marne in 1591, and died in 1665. In 1650 he succeeded G. J. Vossius in the professorship of history at Amsterdam. His works were very numerous, and were remarkable even at that period for obscurity of style. The most celebrated of them was the dissertation on Pope Joan, in which he came to the conclusion that the whole story was a mere myth. Considerable Protestant indignation was excited against him on account of this book.

BLOOD. See Anatomy and Physiology

BLOOD, Thomas, generally known by the appellation of *Colonel Blood*, was a disbanded officer of the Parliamentary army. Bearing a grudge against the duke of Ormond, who had defeated a conspiracy he engaged in to surprise the castle of Dublin, Blood seized the duke one night in his coach in St James's Street, and carried him off a considerable distance, resolving to hang him at Tyburn; but Ormond struggled for his liberty and was rescued by his servants. Soon after, in 1671, Blood formed the design of carrying off the crown and regalia from the Tower,—an attempt which very nearly proved successful. He had bound and wounded Edwards, the keeper of the jewel-office, and had escaped out of the Tower with his prey; but he was overtaken and seized, together with some of his associates. One of these was known to have been concerned in the attempt upon Ormond, and Blood was immediately concluded to be the ringleader. When questioned, he frankly avowed the enterprise, but refused to discover his accomplices. All these extraordinary circumstances induced Charles II. to seek an interview with him, which not only led to his pardon, but to the king's granting him an estate of £500 a year in Ireland, encouraging his attendance about his person, and showing him great favour. He died August 24, 1680.

BLOOMFIELD, Robert, was born of very humble parents at the village of Honington in Suffolk, in 1766. Losing his father at the age of eleven, he was apprenticed to a farmer, and could only cultivate his literary tastes by perusing such books as he could borrow. Thomson seems to have been his favourite author, and *The Seasons* inspired him with the ambition of being a poet. He came to London, and composed *The Farmer's Boy* in a garret in Bell Alley. The manuscript fell into the hands of Capel Lofft, who encouraged him to print it, and it succeeded so well, that above 26,000 copies of it were sold. His reputation was increased by the appearance of his *Rural Tales, Songs and Ballads, News from the Farm, Wild Flowers*, and *The Banks of the Wye*. These are of unequal merit; but all breathe a spirit of purity and enthusiasm for the beauties of nature, that place the name of Bloomfield among the most natural and amiable of our pastoral poets. The extensive sale of *The Farmer's Boy* and *Wild Flowers* seems to have done little for the benefit of the poet, who died in poverty at Shefford in Bedfordshire in 1823. His *Remains in Poetry and Verse*, 2 vols., appeared in 1824, and another edition of his poems in 1866. A selection from his correspondence, edited by Hart, appeared in 1871.

BLOUNT, Charles, younger son of Sir Henry Blount, was born at Upper Holloway, April 27, 1654, and died 1693. He gained considerable reputation as a politician and man of letters, but his abilities were not great, and his strength lay in scoffing infidelity. His *Anima Mundi, or an Historical Narration of the Opinions of the Ancients concerning Man's Soul after this Life, according to Unenlightened Nature*, gave great offence; and his translation of Philostratus's *Life of Apollonius Tyanæus* was suppressed for the flippancy and impertinence of its attacks on revealed religion. A similar work of his, called *Great is Diana of the Ephesians*, under colour of exposing superstition, struck at revelation. In 1684 he printed a kind of introduction to polite literature, under the title of *Janua Scientiarum*. His *Just Vindication of Learning and of the Liberty of the Press* (1693) is a shameless plagiarism from the *Areopagitica*. The pamphlet which he sent anonymously to Bohun, the censor, entitled *King William and Queen Mary Conquerors*, set all London in a flame, and completely attained its object, the ruin of Bohun. Indirectly it had a good result in directing attention to the folly of the censorship. After the death of his wife, he proposed to marry her sister, and wrote a letter on that subject with great learning and address; but the archbishop of Canterbury and other divines decided against him, and the lady having therefore refused him, he is said to have shot himself, or, according to Pope's account, to have given himself a mortal wound in the arm. A collected edition of his works was published in 1695 by Gildon, with a life by the editor. See Macaulay, *History*, iv. 352, *sqq.*; Lechler, *Ges. d. Englisch. Deismus*, 114–127.

BLOW, John, an English musical composer, was born in 1648 at North Collingham in Nottinghamshire. He was educated at the chapel royal, and distinguished himself by his proficiency in music, having composed several anthems at an unusually early age. In 1673 he was made a gentleman of the chapel royal, and in 1685 was named one of the private musicians of James II. In 1687 he became master of the choir of St Paul's Church; in 1695 he was elected organist of St Margaret's, Westminster, and in 1699 composer to the chapel royal. In 1700 he published his *Amphion Anglicus*, a collection of pieces of music for one, two, three, and four voices, with a figured-bass accompaniment. Doctor Burney says that in the *Amphion*

Anglicus "the union of Scottish melody with the English is first conspicuous." Blow died in 1708, and was buried in the north aisle of Westminster Abbey. None of his compositions, most of which are anthems, attain the highest order of merit.

BLOWPIPE, a tube for directing a jet of air into a fire or into the flame of a lamp or gas jet, for the purpose of producing a high temperature by complete and rapid combustion. The blowpipe has been in common use from the earliest times for soldering metals and working glass; and since 1733, when Anton Swab first applied it to analysis of mineral substances, it has become a valuable auxiliary to the mineralogist and chemist, in the chemical examination and analysis of minerals. Its application has been variously improved at the hands of Cronstedt, Bergmann, Gahn, Berzelius, Plattner, and others, but more especially by the two last-named chemists.

The simplest and oldest form of blowpipe (still used by gasfitters, jewellers, &c.), is a conical brass tube, about 7 inches in length, curved at the small end into a right angle, and terminating in a small round orifice, which is applied to the flame, while the larger end is applied to the mouth. Where the blast has to be kept up for only a few seconds, this instrument is quite serviceable; but in longer chemical operations inconvenience arises from the condensation of moisture exhaled by the lungs in the tube. Hence many blowpipes are made with a cavity for retaining the moisture. Cronstedt placed a bulb in the centre of his blowpipe. Dr Black's convenient instrument consists of a conical tube of tin plate, with a small brass tube, supporting the nozzle, inserted near the wider end, and a mouthpiece at the narrow end. One of the most suitable forms of blowpipe is that shown in fig. 1. It is Gahn's instrument as improved by Plattner. The tube A is ground to fit accurately into a socket at the top of the water-trap B, as is also the jet-pipe C. The nozzle D, of platinum, is fitted in the same manner, so that it can be easily removed and replaced while hot; *e.g.* when it is desired to remove the crust of soot which deposits upon the point when an oil lamp or candle is used. The sizes of orifice recommended by Plattner are 0·4 and 0·5 millim. The trumpet mouthpiece, from the support it gives to the cheeks when inflated, conduces to a more steady and long-continued blast being kept up without fatigue than when the mouthpiece is inserted between the lips. Mr David Forbes has suggested the use of a double jet-pipe in connection with this instrument, so that a large or small orifice may be obtained without stopping the point; but it is doubtful whether the advantage gained is counterbalanced by the extra cost and complication. For the majority of blowpipe workers, there is probably no better instrument than Dr Black's, if provided with a properly-shaped nozzle, if possible of platinum; but where it is much used, the large-sized trumpet-mouthed instrument of Plattner is to be preferred. The instrument should be held with the first and fourth fingers passed round it, and the thumb laid along the side of the tube, the hold being steadied by resting

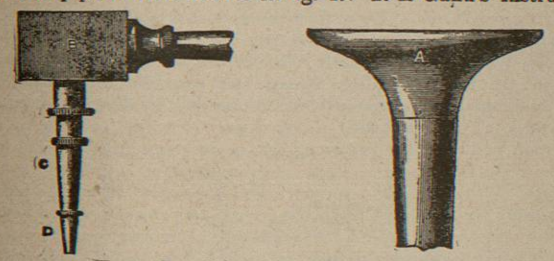

Fig. 1.—Extremities of Gahn's Blowpipe,—ordinary size.

the elbow on the table. The mode of blowing is peculiar, and requires some practice; an uninterrupted blast is kept up by the muscular action of the cheeks, while the ordinary respiration goes on through the nostrils.

If the flame of a candle or lamp be closely examined, it will be seen to consist of four parts—(*a*) a deep blue ring at the base, (*b*) a dark cone in the centre, (*c*) a luminous portion round this, and (*d*) an exterior pale blue envelope. The blue ring is formed chiefly by combustion of carbonic oxide. In the central cone the combustible vapours from the wick, though heated, are not burned, atmospheric oxygen not reaching it. In the luminous portion the supply of oxygen is not sufficient for complete combustion; the hydrogen takes up all or most of it, and carbon is precipitated in solid particles and ignited. In the exterior envelope, lastly, the temperature is highest, and combustion most complete,—sufficient oxygen being supplied to convert the carbon and hydrogen into water and carbonic acid.

In blowpipe work only two of these four parts are made use of, viz., the pale envelope, for *oxidation*, and the luminous portion, for *reduction*. To obtain a good *oxidizing flame*, the blowpipe is held with its nozzle inserted in the edge of the flame close over the level of the wick, and blown into gently and evenly. A conical jet is thus produced, consisting of an inner cone, with an outer one commencing near its apex:—the former, corresponding to (*a*) in the free flame, blue and well defined; the latter, corresponding to (*d*), pale blue and vague. The heat is greatest just beyond the point of the inner cone, combustion being there most complete. Oxidation is better effected (if a very high temperature be not required) the farther the substance is from the apex of the inner cone, so far as the heat proves sufficient, for the air has thus freer access.

To obtain a good *reducing flame* (in which the combustible matter, very hot, but not yet burned, is disposed to take oxygen from any compound containing it), the nozzle, with smaller orifice, should just touch the flame at a point higher above the wick, and a somewhat weaker current of air should be blown. The flame then appears as a long, narrow, luminous cone,—the end being enveloped by a dimly visible portion of flame corresponding to that which surrounds the free flame, while there is also a dark nucleus about the wick. The substance to be reduced is brought into the luminous portion, where the reducing power is strongest.

The flame of an oil-lamp is the best for blowpipe operations where gas is wanting; candle flame may be used when great heat is not required. The blowpipe lamp of Berzelius, supplied with colza oil, is probably the most suitable. The wick, when in use, should be carefully trimmed and clean, so as to avoid a smoking flame. The general introduction of gas has quite driven out the use of oil-lamps for blowpipe purposes in laboratories.

Various materials are used as supports for substances in the blowpipe flame; the principal are charcoal, platinum, and glass. *Charcoal* is valuable for its infusibility and low conductivity for heat (allowing substances to be strongly heated upon it), and for its powerful reducing agency by the production of carbonic oxide when ignited; so that it is chiefly employed in trying the fusibility of minerals, and in reduction. The best kind of charcoal is that of close-grained pine or alder; it is cut in short prisms, having a flat smooth surface at right angles to the rings of growth. In this a shallow hole is made with a knife or borer, for receiving the substance to be held in the flame. *Platinum* is employed in oxidizing processes, and in fusion of substances with fluxes with a view to try their solubility in them, and note the phenomena of the bead; also in observing the colouring effect of substances on the blowpipe flame (which effect is apt to be somewhat mashed (by charcoal). Most commonly it is used in the form of wire, with a small bend or loop at the end. In flux experiments this loop is dipped when ignited in the powdered flux (*e.g.*, borax), then held in a lamp flame till the powder is fused; and the process is repeated, if necessary, till the loop is quite filled with a bead of the flux; to this is now added a little of the substance to be examined. Platinum is also used in the form of foil and of spoons, and for the points of forceps. Metals and easily reducible oxides, sulphides, or chlorides should not be treated upon platinum, as these substances may combine with and damage it. Tubes of hard German *glass*, 5 to 6 inches long, about $\frac{1}{8}$th inch diameter, and open at both ends, are useful in the examination of substances containing sulphur, selenium, arsenic, antimony, and tellurium; these, when heated with access of air, evolve characteristic fumes. They are put in the tube near one end (which is held slightly depressed), and subjected to the blowpipe flame. The sublimates often condense on the cooler parts of the tube. Small tubes, closed at one end, are used, where it is required to detect the presence of water, mercury, or other bodies which are volatilized by heat without access of air.

The most important fluxes used in blowpipe analysis are carbonate of sodium, borax, and microcosmic salt. The first (which must be anhydrous and quite free from sulphates) serves chiefly in reducing metallic oxides and sulphides on charcoal, decomposing silicates, determining the presence of sulphur, and discriminating between lime and other earthy bases in minerals. Pure *borax*, or acid borate of sodium deprived of its water of crystallization by heating, is used for the purpose of dissolving up metallic oxides, when in a state of fusion at a red heat, such fused masses usually having characteristic colours when cold. In some cases the colour and transparency change on cooling. *Microcosmic salts*, or ammonio-phosphate of sodium, is used on platinum wire in the same way as borax;[1] on heating, water and ammonia are given off. The following are some other reagents for certain cases—nitrate of potash, bisulphate of potash, nitrate of cobalt, silica, fluoride of calcium, oxide or oxalate of nickel, protoxide of copper, tinfoil, fine silver, dry chloride of silver, bone ash, and litmus and Brazil-wood paper.

It may be useful here to pass briefly under review a few of the effects obtained in qualitative examinations with the blowpipe. Beginning with the *closed tube*, organic substances may be revealed by the empyreumatic odour given off, and by charring. Mercury condenses on the tube in minute globules. Selenium gives a reddish-brown, tellurium a grey, arsenic a black sublimate. Oxygen is sometimes given off, and will inflame an incandescent splinter of wood when introduced; while ammonia may be detected by red litmus paper, as also the acid or alkaline reaction of any liquid product. In the *open tube*, sulphur and sulphides give off pungent-smelling sulphurous acid gas. Selenium gives a steel-grey deposit, and an odour resembling that of horse radish. Arsenic, antimony, tellurium, yield their respective acids, forming white sublimates. The deposit from arsenic is crystalline, that from the others amorphous. In examination on *charcoal*, it is useful, in practice, to commence with pure materials and familiarize one's self with their phenomena. Most of the metals fuse in the heat of the blowpipe flame; and in the outer flame they oxidize. The noble metals do not oxidize, but they fuse. The metals platinum, iridium, rhodium, and palladium do not fuse. The incrustations (when such occur) are in each case characteristic, both in aspect and in the effects they give before the blowpipe flame. Among the most common oxides capable of reduction on charcoal alone, in the inner flame, are those of zinc, silver, lead, copper, bismuth, and antimony. The principal minerals that cannot be so reduced are those containing alkalies and alkaline earths, and the oxides of iron, manganese, and chromium. Many substances give a characteristic colour, when held by platinum forceps in the oxidizing flame. For example, arsenic, antimony, lead, colour the flame *blue*; copper, baryta, zinc, *green*; lime, lithia, strontia, *red*; potash, *violet*. Heated with *borax*, some bodies give a clear bead, both while hot and cold, except when heated by the intermittent oxidizing flame, or the flame of reduction, when the bead becomes opalescent, opaque, or milky white. The alkaline earths, tantalic and titanic acids, yttria and zirconia are examples of this. The oxides of most of the heavy metals give coloured glasses with borax, similar to those obtained by their use in glass or enamel painting. Thus oxide of cobalt gives a showy blue, and oxide of nickel a reddish-brownish colour, both being very characteristic and delicate tests of the presence of these metals. Ferric oxide gives a feeble yellow colour, which is darker while hot; but when the bead so coloured is treated in the reducing flame the iron passes into the state of ferrous oxide, giving an intensely green or nearly black colour. This reaction may be more certainly brought about by touching the bead while melted with a fragment of tin, when the ferric oxide is probably reduced at the expense of the metal. With manganese the reverse effect is produced. A bead containing a considerable quantity of manganous oxide, such as is produced by a clean reducing flame, is colourless, but when treated in the oxidizing flame the showy violet colour of the higher oxide is brought out. This reaction is a very delicate one, and is to be recommended to beginners as a test exercise in blowing a clean flame, the bead being rendered alternately coloured and colourless according as the oxidizing or reducing flame is used. Molybdic acid, which gives a black bead in the reducing, and a clear bead in the oxidizing flame, but requires more careful management, was usually recommended by Plattner to his students for this kind of exercise. Copper salts give a green bead in the oxidizing and a deep sealing-wax red in the reducing flame. This latter indication is of value in detecting a trace of copper in the presence of iron, which is done by reducing with tin as already described for iron. The effects obtained with beads of microcosmic salt, or as it is more generally called *salt of phosphorus*, are generally similar to those described for borax, but in certain cases it is to be preferred, especially in the detection of silica, which remains undissolved, and titanic acid, which can be made to assume the form of crystals similar to the natural mineral anatase by particular treatment and microscopic examination. Several new phenomena, due to the crystallization of titanic acid and similar bodies, have been described by Gustav Rose.

With *carbonate of sodium* as flux (a paste of which and the substance to be examined is made with water, and held on charcoal to the flame), three reactions may occur. The substance may fuse with effervescence, or it may be reduced, or the soda may sink into the charcoal, leaving the substance intact on the surface. The first takes place with silica, and with titanic and tungstic acids. The oxides of tungsten, antimony, arsenic, copper, mercury, bismuth, tin, lead, zinc, iron, nickel, and cobalt are reduced. Lead, zinc, antimony, bismuth, cadmium, and tellurium are volatilized partially, and form sublimates on the charcoal. Mercury and arsenic are dissipated as soon as reduced. Silica and titanic acid are the only two substances that produce a clear bead. The bead in which silica is fused is sometimes rendered yellow by the presence of sulphur. Carbonate of soda, with addition of a little nitrate of potassa, is very useful for detecting minute quantities of manganese. The fused mass, when clear, has, from the production of manganate of sodium, a fine green colour. (For particulars of the behaviour of different minerals before the blowpipe, see the detailed description in the article MINERALOGY.) Of late years the spectroscope has been successfully used in connection with blowpipe operations, in the detection of certain of the rarer metallic elements.

[1] In a paper to the Royal Society, Captain Ross points out that it is better to use boric acid and phosphoric acid, instead of borax and microcosmic salts, for various analyses.

The blowpipe was first applied in the quantitative determination of metals by Harkort in 1827, and was brought to a high degree of perfection by Plattner. The methods are substantially those adopted in the assay of ores on the large scale in the wind furnace or muffle, thin capsules of clay or cavities in charcoal blocks being substituted for crucibles, and steel basins faced with bone ash, for cupels, in silver and gold assaying. From the small size of the beads obtained, especially when the ores of the precious metals are operated upon, the results are often such as cannot be weighed, and they are then measured by a tangent scale, and the weight computed from the observed diameter. This method, devised by Harkort, gives very accurate results when carefully used, but owing to the difficulty of sampling the minute quantities operated upon so as to represent the bulk of the mineral fairly, the quantitative blowpipe assay has not made much progress. Perhaps the most useful quantitative application is in the determination of nickel and cobalt. This depends upon the fact that when the compounds of these metals, as well as those of copper and iron, with arsenic, are melted in contact with an oxidizing flux, such as borax or salt of phosphorus, iron is first taken up, then cobalt, and next nickel, and finally copper; and as the oxides of these metals give very different colours to the flux, we are enabled by examining the slag to detect the exact moment at which each is removed. For the details of the process the reader is referred to Plattner's work.

Among the various arrangements which have been contrived for supplying air to the blowpipe otherwise than with the mouth, we may select that represented in the annexed figure (2) as one which is generally sufficient for

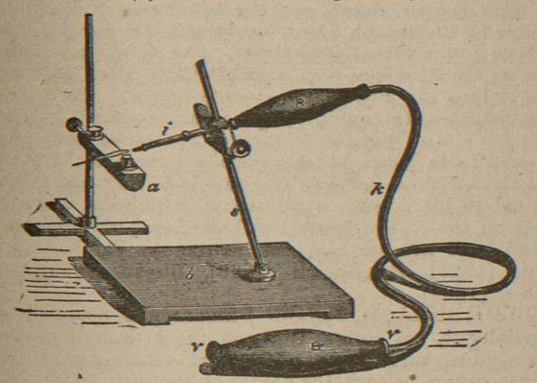

FIG. 2.—Blowpipe with Bellows.

practical purposes It will be seen that the jet *i* is supported on a slide which can be fixed by screwing in any direction and at any height on the rod *s*, which is jointed on the board *b*. The blast can thus be adjusted variously, according to the position given to the blowpipe lamp *a*, which is of the form devised by Berzelius. The bellows B, the tube *k*, and the reservoir R, are of vulcanized india-rubber, *v* and *v′* are valves. The bellows being alternately compressed (with hand or foot) and allowed to expand, air is driven into the reservoir, and a fresh supply admitted into the bellows through *v*. After a few trials a constant blast may thus be maintained through the nozzle

For glass-blowing ordinary coal gas is the best combustible, as the flame can be well controlled by a stopcock, and requires no trimming. The nature of the apparatus will be understood from fig. 3, which shows the burner in horizontal section. The tube *ab* is screwed into another tube which is connected with the gas pipe *ef*. *mn* and *op* are two annular disks which support the pipe *ab*; they have a series of openings round their edges, to admit a uniform flow of gas to the narrow annular mouth between the two tubes where it joins the blast. The stopcock *f* regulates the supply of gas. The wind, supplied by double bellows fixed under the table, is sent through a lead pipe on which brass nozzles of various width can be screwed, opening into *ab*; the finer nozzles being pushed up nearly to the end of this. Elastic tubing may sometimes be used with advantage for the connections. A modified form of the apparatus is suitable for ordinary blowpipe researches of the mineralogist or chemist (see Plattner's work, 4th edition), and the apparatus used in hand-soldering of metals and other operations of the workshop is on the same principle. With suitable trunnions the blowpipe may be made to point in any direction as required.

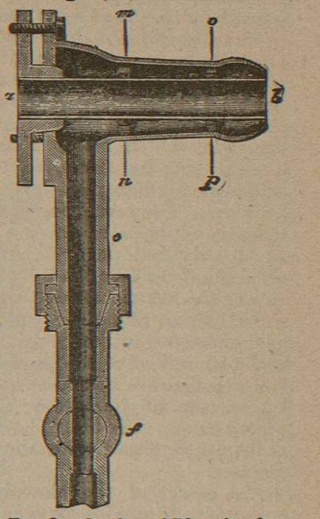

FIG. 3.—Section of Blowpipe for Glassblowing.

The soldering lamp of tinners is an example of the æolipile, an instrument which deserves some notice here. The spirit lamp *a* (fig. 4) is inserted at the bottom of a sheet-iron cylinder M N, which is open on one side, as shown. The upper part of the cylinder supports a strong cup of hammered metal, with an opening for spirits at the top (closed by a screw or cock), and a bent tube coming down from its upper part, through a slit in the cylinder to the back of the flame. The weak spirits which are put in the cup are caused to boil by the heat of the lamp, and the vapour, escaping through the bent tube, produces a jet of very hot flame. (The cup is shown separately in fig. 5). Similar advantage is gained by causing air to pass through a quantity of some soluble hydrocarbon before it goes to the nozzle of a blowpipe.

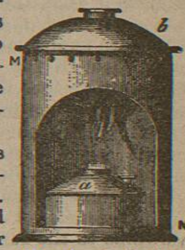

FIG. 4.—Soldering Lamp.

FIG. 5.—Cup of fig. 4.

There are several forms of apparatus in which water-pressure is utilized for supplying a steady blast to the blowpipe. One of these consists of a tin case, with an oblique partition reaching nearly to the bottom. The case is filled nearly three-fourths with water. Air is blown into the compartment which narrows upwards (and with which the nozzle is connected above) by a pipe reaching nearly to the bottom. This air rises through the water and accumulates above it, forcing the water up into the other compartment, which communicates freely with the outer air. The difference of water-level in the two chambers thus sustains a continuous blast through the nozzle. Blowpipes have also been made on the principle of the blowing-machine known as the *trompe*. Again, the blast is sometimes supplied from a chamber in which air is condensed by means of a syringe.

The absorption of heat when an ordinary blast of cold air (with its large proportion of nitrogen) is sent into a flame is considerable; and this has suggested the employment of a hot blast for blowpipe work. Mr T. Fletcher has constructed an apparatus on this principle, which yields a very intense flame, sufficient to fuse platinum wire. The arrangement is represented in fig. 6. It will be observed that the pipe conveying the blast is coiled several times round the gas pipe (for ordinary coal-gas), and that both coil and core are heated by a row of burners placed below. The blast is furnished either with the mouth or with india-rubber bellows.

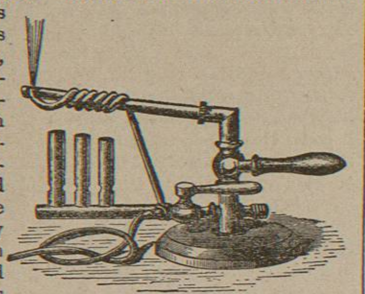

FIG. 6.—Hot-Blast Blowpipe.

The power of the blowpipe flame may be greatly increased by supplying oxygen in the place of atmospheric air; and a still greater heat is obtained by the combination of pure oxygen and hydrogen. In the latter arrangement, which constitutes the oxyhydrogen blowpipe, it is important that the oxygen and hydrogen be kept in separate reservoirs, and be only allowed to mix at the jet, otherwise explosion may occur through the flame running back through the jet to the reservoir of mixed gases. There are various methods of effecting this, which we do not stop to describe. The blue flame produced gives the most intense heat that is obtainable by artificial means, except by the electric current. Thick platinum wires are melted before it like wax in a candle flame; and earths, such as lime, magnesia, or zirconia, are raised to intense incandescence. For the application of the oxyhydrogen blowpipe to the fusion of the more refractory metals, see PLATINUM.

The literature of the blowpipe is very extensive. The earlier notices of the subject will be found in Berzelius's original work, of which there are English translations by Children, published in 1822, and by J. D. Whitney (of a later edition), published in Boston in 1845. The most complete work, however, is Plattner's *Probirkunst mit dem Löthrohre*, of which there are several editions; the fourth or latest, published since the author's death, has been edited by his pupil and successor, Professor Richter of Freiberg. An English translation, by Professor H. B. Cornwall, has been published in New York. For the use of the blowpipe in determining minerals, the best works are Scheerer's *Löthrohrbuch*, translated by Professor H. B. Blanford, and a *Manual of Determinative Mineralogy, with an Introduction to Blowpipe Analysis*, by Professor G. J. Brush of Yale College. In addition to these works, notices, more or less extensive, will be found in most mineralogical handbooks and works on chemical analysis. (A. B. M.)

BLÜCHER, GEBHARD LEBERECHT VON, field-marshal of the Prussian armies, prince of Wahlstadt in Silesia, was born at Rostock in 1742. In his fourteenth year he entered into the service of Sweden; and in the war between that power and Prussia he was taken prisoner. He afterwards entered into the service of Prussia, in which he became distinguished by his activity; but conceiving himself neglected be the great Frederick, he became a farmer in Silesia, and by his enterprise and perseverance in fifteen years he acquired an honourable independence. On the accession of Frederick-William II. he was recalled to military service, and replaced as major in his old regiment, the Black Hussars, where he distinguished himself in six general actions against the French, rose to the rank of colonel and major-general in 1793–4, and gained a high reputation by his energy, promptitude, and foresight. He was in a subordinate command in the disastrous battle of Jena in 1802; but he made a masterly retreat with his column to Lübeck, and extorted the praises of his adversaries, who testified on his capitulation that it was caused by "want of provisions and ammunition." He was soon exchanged for General Victor, and was actively employed in Pomerania, at Berlin, and at Königsberg, until the conclusion of the war. When Prussia shook off the French yoke in 1813, he first obtained a separate command. At the head of 60,000 troops, chiefly composed of raw militia, he defeated four French marshals at Katsbach, and rapidly crossing the Elbe, materially contributed to the signal victory of Leipsic. In several severe actions he fought his way to Paris, which he entered on 31st March 1814; and there, it has been stated, but for the intervention of the other allied commanders, he was disposed to make a severe retaliation for the calamities that Prussia had suffered from the armies of France. Blowing up the bridge of Jena across the Seine was said to be one of his contemplated acts. When war again broke out in 1815, the veteran was at the head of the Prussian armies in Belgium, and exhibited his wonted enterprise and activity. But partly owing to his own confidence and temerity, partly to the skilful strategy of his celebrated opponent, he was defeated in the severe battle of Ligny on 16th of June; yet, with his characteristic spirit and energy, Blücher rallied his defeated forces, and appeared on the field of Waterloo on the 18th, just as Wellington had repulsed the last attack of Napoleon on the British position. At that critical moment Blücher was seen emerging from the wood of Frichemont on the French right; and the simultaneous irresistible charge of the British forces converted the retreat of the French into a tumultuous flight. The allied commanders met on the Genappes road, near the farm called Maison du Roi, where the British forces were halted. The pursuit was continued through the night by sixteen fresh Prussian regiments with terrible carnage. The allies soon again entered Paris, where Blücher remained for several months; but the health of the aged commander having declined, he retired to his Silesian residence at Kirblowitz, where he died on the 12th September 1819, aged seventy-seven. The life of Blücher has been written by Varnhagen von Ense (1827), Rauschnick (1836), Bieske (1862), and Scherr (1862).

BLUMENBACH, JOHANN FRIEDRICH, a distinguished physiologist, was born at Gotha on the 11th of May 1752. He studied medicine at Jena, and afterwards at Göttingen, where he took the degree of doctor in 1775. His thesis on that occasion *De Generis Humani Varietate Nativa*, published in quarto, was the germ of those craniological researches to which so many of his subsequent inquiries were directed; and such was the opinion entertained of his acquirements, that he was appointed an adjunct or extraordinary professor of medicine in the following year, and ordinary professor in 1778; soon after which period he began to enrich the pages of the *Medicinische Bibliothek*, of which he was editor from 1780 to 1794, with various contributions on medicine, physiology, and anatomy. In physiology he was of the school of Haller, and was in the habit of illustrating his theory by a careful comparison of the animal functions of man with those of the lower animals. His reputation was much extended by

the publication of his excellent *Institutiones Physiologicæ*, a condensed, well-arranged view of the animal functions, expounded without discussion of minute anatomical details. This work appeared in 1787, and between its first publication and 1821 went through many editions in Germany, where it was the general text-book of the science. It was translated into English in America by Caldwell in 1798, and in London by Elliotson in 1807.

Blumenbach was perhaps still more extensively known by his admirable *Handbuch* of comparative anatomy, of which the German editions were numerous, from its appearance in 1805 to 1824. It was translated into English in 1809 by the eminent surgeon Lawrence, and again, with the latest improvements and editions, by Coulson in 1827. This manual of Blumenbach's, though slighter than the subsequent works of Cuvier, Carus, and others, and not to be compared with such recent expositions as that of Gegenbaur, will always be esteemed for the accuracy of the author's own observations, and his just appreciation of the labours of his predecessors.

One of the most extensive of Blumenbach's works was the *Decas Collectionis suæ Craniorum Diversarum Gentium illustrata*, in which accurate though slight delineations of the skulls in his noble collection are given, with brief descriptions of each. It appeared in *fasciculi*, until sixty crania were represented,—exhibiting in a striking manner the peculiarities in form of the skulls of different nations, and justifying the division of the human race into several great varieties or families, of which he enumerated five—the Caucasian or white race, the Mongolian or Tatar, the Malayan or brown race, the Negro or black race, and the American or red race. The classification he thus proposed has been very generally received, and most later schemes have been modifications of it. For these see the article ANTHROPOLOGY, vol. ii. p. 113.

Although the greatest part of Blumenbach's long life was passed at Göttingen, in 1789 he found leisure to visit Switzerland, and gave a curious medical topography of that country in his *Bibliothek*. He was in England in 1788 and 1792. The Prince Regent conferred on him the office of physician to the royal family in Hanover in 1816, and made him knight companion of the Guelphic order in 1821. The Royal Academy of Paris elected him a member in 1831. He died at Göttingen on the 22d of January 1840.

BOA, a name formerly applied to all large Serpents, which, devoid of poison fangs, killed their prey by constriction; but now confined to that section of them occurring in America, the Old World forms being known as Pythons. The true boas are widely distributed throughout tropical America, occurring most abundantly in Guiana and Brazil, where they are found in dry sandy localities, amid forests, on the banks of rivers and lakes, and in the water itself, according to the habits of the various species. They feed chiefly on the smaller quadrupeds, in search of which they often ascend trees, suspending themselves from the branches by the tail, and thus awaiting motionless the approach of their victim. While so hanging they are partly supported by two spine-like hooks, situated one on each side of the vent, which are connected with several small bones concealed beneath the skin and attached to the main skeleton. These bones, terminating thus in an external claw, are characteristic of the family *Boidæ*, and are recognized by anatomists as the rudiments of those which form the hind limbs in all quadrupeds. The size of the boa's prey often seems enormously beyond its apparent capacity for swallowing, a difficulty which disappears on acquaintance with the peculiar structure of the creature's jaws. The bones composing these are not knit together as in Mammals, but are merely connected by ligament which can be distended at pleasure. The mouth of the boa can thus be made to open transversely as well as vertically; and in addition to this the two jaws are not connected directly as in other animals, but by the intervention of a distinct bone, which adds greatly to the extent of its gape. It has also the power of moving one half of the jaw independently of the other, and can thus keep a firm hold of its victim while gradually swallowing it. The boa possesses a double row of solid sharp teeth in the upper jaw, and a single row beneath, all pointing inwards, so that, its prey once caught, it would be well-nigh impossible even for the boa itself to release it. After feeding, boas, like all other reptiles, become inactive, and remain so while the process of digestion is going on, which, in the case of a full meal, may extend over a few weeks, and during this period they are readily killed. All the species are ovoviviparous. The Jiboya or *Boa constrictor*—the latter name having been loosely given to all the species—is an inhabitant of the dry and sandy districts of tropical America, and rarely exceeds 20 feet in length. Its food consists chiefly of the agoutis, capybaras, and ant-bears, which abound in those districts. It seeks to avoid man, and is not feared by the inhabitants, who kill it readily with a sharp blow from a stick. The Water-Boa or Anaconda (*Eunectens murinus*) is a much more formidable creature, attaining, it is said, a length of 40 feet, and being thus probably the largest of living serpents. It inhabits the lakes, rivers, and marshes of Brazil and Guiana, and passes a considerable portion of its existence in the water. It is exceedingly voracious, feeding on fishes and on such animals as may come to the banks of the stream to drink, for which it lies in wait with only a small part of its head above the surface of the water. It also occasionally visits the farmyards, carrying off poultry and young cattle, and it has been known to attack man.

BOADICEA, a British queen in the time of the Emperor Nero. She was wife of Prasutagus, king of the Iceni, a people inhabiting the eastern coast of Britain. On his deathbed, 60 A.D., Prasutagus named the emperor heir to his accumulated treasures conjointly with his own two daughters, in expectation of securing thereby Nero's protection for his family and people; but he was no sooner dead than the emperor's officers seized all. Boadicea's opposition to these unjust proceedings was resented with such cruelty, that orders were given that she should be publicly whipped, and her daughters exposed to the brutality of the soldiers. The Britons took up arms, with Boadicea at their head, to shake off the Roman yoke; the colony of Camalodunum or Colchester was taken, and the Romans were massacred wherever they could be found. The whole province of Britain would have been lost to Rome, if Suetonius Paulinus had not hastened from the Isle of Mona, and at the head of 10,000 men engaged the Britons, who are said to have amounted to 230,000. A great battle was fought, which resulted in the complete defeat of the Britons (62 A.D.) Boadicea, who had displayed extraordinary valour, soon after despatched herself by poison. (Tac. *Ann.* xiv. *Agric.*, 15–16; Dion Cass. lxii.)

BOAR, WILD (*Sus scrofa*), an important species of *Suidæ*, a family of Pachydermatous Mammals, and generally regarded as the original stock of our domestic breeds of swine. In size it is equal to the largest of the domestic kinds, while exceeding them all in strength of body and in ferocity of disposition. It is of a greyish-black colour, covered with short woolly hair, thickly interspersed with coarse stiff bristles, which assume the form of a mane along the spine. The canine teeth are largely developed, forming two pairs of prism-shaped tusks, which thus become formidable weapons. In old age those tusks in the lower jaw gradually curve inwards and upwards over