

*Thomas Kelly*  
*THE*  
ENGINEER'S AND MECHANIC'S

# ENCYCLOPÆDIA,

COMPREHENDING

PRACTICAL ILLUSTRATIONS

OF

## THE MACHINERY

AND

PROCESSES EMPLOYED IN EVERY DESCRIPTION OF MANUFACTURE

OF THE

BRITISH EMPIRE.

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**With nearly Two Thousand Engravings.**

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BY LUKE HEBERT,

CIVIL ENGINEER,

EDITOR OF THE HISTORY AND PROGRESS OF THE STEAM ENGINE, REGISTER OF ARTS, AND  
JOURNAL OF PATENT INVENTIONS, ETC.

IN TWO VOLUMES.

VOL. II.

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"How much useful knowledge is lost by the scattered forms in which it is ushered to the world! How many solitary students spend half their lives in making discoveries which had been perfected a century before their time, for want of a condensed exhibition of what is known!"—BUFFON

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upon them in an opaque turpentine varnish; strong nitrous acid is then brushed over the plates repeatedly, until those parts left bare, or undefended by the varnish, are sufficiently corroded, or "eaten away" by the acid. The varnish being now washed off by a little oil of turpentine, the device, which the acid has not touched, is found to be perfectly executed. If the design is to be after the manner of common etching on copper, then the process upon the shell is precisely similar to that already explained under the article ENGRAVING. When a considerable number of ornaments are required of the same size and pattern, a sufficient number of the plates are cemented together by glue, with only one plate, having the device etched upon it, placed on the outside; these are then made fast in a pair of clams, or screwed between the jaws of a vice, and carefully sawn out altogether by a very fine frame-saw: the cemented shells are then thrown into warm water, which softens the glue, and quickly separates the pieces. When several devices upon a plate have been bit in, they may be laid upon a flat surface, and cut through with a knife-edged tool; for thick pieces the saw is put in requisition, and the finishing executed by a variety of sharp gravers and instruments.

**PEARL-WHITE.** An oxide of bismuth. It is employed as a cosmetic, to whiten the skin; but its tendency to become black, by exposure to the action of sulphuretted hydrogen mixed with the atmosphere, renders it a very dangerous expedient to heighen female charms.

**PEAT.** A spongy black earth, combined with decayed vegetable matter: when dried, it forms a valuable fuel.

**PECK.** An English measure; the fourth part of a bushel.

**PEDOMETER**, *foot-measure*, or *way-wiser*, is a machine in the form of a small time-piece, containing a train of toothed wheels, which, by means of a chain or string, fastened to a man's foot, or to the wheel of a carriage, are made to move one notch or tooth at each step, or each revolution of the wheel; and the train thus uniformly moved being connected to an index, points out the distance travelled, on a graduated dial-plate.

A patent for "an improved pedometer for the waistcoat pocket, upon a new and very simple construction," was taken out by Mr. William Payne, of New Bond-street, in 1831. It is of the form, and of the usual size, of a common watch, and consists of a lever or pendulum, one end of which is weighted or inlaid, and the other supported by a delicate spring; by which arrangement, each step of the wearer produces a vibration, and moves a ratchet wheel one tooth, and the latter being geared into a train of wheels (similar to those of a common counting machine) moves indexes or hands over the face of a dial-plate, on which the number of vibrations or steps are indicated. The patentee also attaches his pedometers to an ordinary watch, in which case, the train of wheels and other parts are placed under the dial-plate or face of the watch.

**PEN.** A well-known instrument for writing. In the earliest ages, writing was executed with styles of metal or other hard substance, which, after a time, were superseded by pens and coloured inks. The first pens were made of reeds, or small hard canes, about the size of the largest swan quills, cut and split in the same manner as the pens in present use. According to Isidore, and some other writers, *quill-pens* were first introduced about the year 636; they did not come into general use, however, till the middle of the seventh, and were not common till towards the close of the eighth century. Reed-pens continue to be employed up to the present time, for writing some of the oriental languages, and by artists, for sketching outlines. The greater number of pens now in use, are made from the quills of the goose—those of the swan, turkey, duck, and crow, being occasionally employed—the two latter exclusively for very fine writing or drawing. As the making or mending of quill-pens is to many persons difficult of attainment, and to all, at times, inconvenient, various attempts have been made to render the process less frequently required. One of these methods consisted in arming pens made of turkey-quills with metallic points or nibs, by which their durability was somewhat increased, although at the expense of the natural elasticity of the quill; nor was the durability sufficiently extended to be commensurate with the additional cost. To do away with the

necessity of frequent pen-mending, Mr. Bramah took out a patent for an improvement in pens, which consisted in dividing a quill longitudinally, and cutting it into four or six lengths, according to the size of the barrel. Each of these pieces formed a pen—some two, by being cut at each end. The pens thus formed were held in a jointed silver holder, which imparted great firmness to the quill, while it permitted the free action of the nibs. Pens have been made from horn, also from tortoise and other shells; but no useful application has hitherto been made of such pens, as they are more expensive and even less durable than those made from quills. Some successful attempts have been made to form the nibs of pens of precious stones, in order that they may be used a long time without wear or corrosion. The first that we recollect were introduced by Messrs. Hawkins and Mordan, whose specification of 1823 states, that they make use of tortoise-shell or horn, instead of quills; and when the material is cut into nibs, these parts are softened in boiling water, and then small pieces of diamond, ruby, or other precious stones, are imbedded into them by pressure; by this means, it is said pens of great durability as well as elasticity are made. To give stability to the nibs, the patentees proposed to affix to the tortoise-shell, or horn, thin pieces of gold or other metal, and attaching the same by the before-mentioned or any other convenient means, as cement or varnish. It is likewise suggested that springs may be placed on the back of the pen, as shown in the annexed figure, which may be slid backward or forward, to vary the elasticity according to the different hands that may be required in writing. We are informed by a gentleman who had one of these pens many months in constant use, that it had exhibited no signs of deterioration or wear. Mr. Doughty, of Great Ormond-street, has likewise devoted much attention to the construction of pens, the nibs of which are rubies set in fine gold. They are said to write as fine as a crow-quill, and as firm as a swan-quill—to possess considerable elasticity, and produce an uniform manuscript, unattainable by ordinary pens. Mr. Doughty states, that “some of his ruby pens have been in constant use upwards of six years, and continue still perfect; and that if a little care be taken of the nibs, by preventing their being struck against hard substances, and occasionally washing them with soap and water, with a little brushing, they will be found, notwithstanding their first cost, *economic pens*.” The rhodium pens, consisting of two flat strips of gold placed angularly side by side, and tipped with a hard metallic alloy, are very durable, though not equal to the ruby nibbed. Under the head *INKSTAND*, we have given Mr. Doughty’s contrivance to prevent injury to his pen-nibs in dipping for ink.



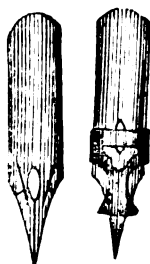
The first decided attempt to introduce *metallic pens* to general use, was made by Mr. Wise, whose “perpetual pens” will doubtless be remembered by many of our readers. The name of Wise was rendered conspicuous in most of our stationers’ shops, some twenty-five or thirty years since, as the original inventor and genuine manufacturer of the steel pens; they consisted of a barrel-pen of steel, mounted in a bone case, for convenience for carrying in the pocket. Notwithstanding his productions possessed but in a very remote degree the requisite properties of a writing instrument, and were extremely dear, he managed to make a scanty livelihood out of the business, by dint of unwearied exertions in promoting their sale. Mr. Donkin subsequently made some excellent steel pens, but the price was high, and the demand inconsiderable. This description of pen has recently been very much improved, especially by Mr. Joseph Gillott, of Birmingham, who is the largest manufacturer of steel pens in the world, converting annually upwards of forty tons of fine steel into writing pens. The improvement has been accomplished by employing metal of a better quality in a thinner and more elastic state—by making the slit shorter, and by more carefully attending to the finish and temper of the pens. These improvements in quality have also been attended with so great a reduction in price, that a *gross* of the improved steel nibs may now be purchased for very little more than was formerly charged for *one* of Wise’s pens. The common three-slit pen, that is, the pen with a slit on each side of the central slit, is with many persons still a favourite, and some of these pens

seem to embody most of the advantages of which metallic pens are susceptible. Their present excellence and extreme cheapness seems to promise the almost entire disuse of quills, although, up to the present time, there has been no falling off in the demand for this article.

Mr. James Perry, of London, has contributed, we believe, more than any other individual to the introduction of the modern improved steel pens; he has brought out several steel pens of a very ingenious and original description, and devoted more than ordinary attention to the forming them to suit a variety of hands and tastes, which he regularly classed, advertised, and humorously puffed in rhyme, by which means he acquired a celebrity to which no previous pen-maker had attained. Mr. Perry first overcame the extreme rigidity of the ordinary steel-pen, by the introduction of apertures *between the shoulders and the point*, thereby making them elastic below instead of above the shoulder: this was the subject of his patent of 1830. "The double patent Perryian pen," the merits of which have been so much placarded throughout the kingdom, received its odd cognomen from the circumstance of a second patent taken out by Mr. Perry, in 1832; the pens described in the specification of which are represented as combining the superlative qualities of both inventions. Fig. 1 is a sketch of Mr. Perry's "double patent pen," which distinctly shows the position of the aperture and the lateral slits, by which a great degree of elasticity is obtained. Fig. 2 is Mr. Perry's ingenious "regulating-spring pen," consisting of one of his patent pens, with the addition of a sliding spring, which increases or diminishes the flexibility of the pen, according as it is placed further from, or nearer to the point. In another instance Mr. Perry employs the elasticity of Indian-rubber, by twisting a thread of this material round the nibs of the pen, the yielding of which permits the opening of the points, in proportion to the pressure applied. The care which Mr. Perry takes in the correct manufacture of his pens, has mainly contributed to the general preference given to them; for, however excellent may be the principle of the structure, if the workmanship of the nibs be not nicely performed, the pens will not write well. It is from defects of this kind, we believe, that many apparently excellent metallic pens, that have been successively brought out, have met with a comparatively small sale.

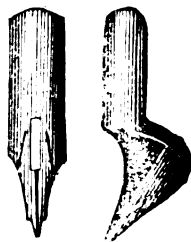
As the extremities of the nibs of metallic pens of the ordinary form become worn, they progressively increase in breadth, until they become useless, unless their original form should be restored by skilful filing, or grinding, upon an oil-stone: these being operations which no economist of time will perform, at the present low prices of the article, Mr. Gillott, of Birmingham, took out a patent in 1831 for an improvement in metal pens, designed to remedy the defect mentioned. This he proposed to effect by making the nibs of his pens parallel sided, that is, an equal breadth to the points for about an eighth of an inch long, the remaining portion or upper part of the nibs being cut either inclined in the usual manner, or terminating with a shoulder next to the parallel nibs. "The whole length of such nibs," says Mr. Gillott, "may of course be worn away, without increasing the breadth of the strokes in writing." This construction, it however appears to us, will not only fail in obtaining the advantages sought, but will entail disadvantages to which the tapered form is comparatively free; namely, a greater tendency to take a set in opening during the downward strokes of the pen, and a deficiency of reacting force in the up-strokes to bring the nibs together; the narrowness of the points also prevents the ink from flowing down in sufficient quantity to give a constant and unfailing supply. Mr. Gillott, although a pen manufacturer, is evidently no great pen-user, for all persons who are in the habit of using steel pens know that in a short time the abrading action of the paper, produces a basil edge on the under side of the nib, converting it into a very efficient chisel, which, catching the paper in the up strokes, renders the pen unfit for further use. With respect to their

Fig. 1. Fig. 2.



wearing away uniformly, this can never be the case, unless the pen be held vertically, that is at right angles to the plane of the paper, in which manner ordinary writing cannot be executed. This will at once show the fallacy of Mr. Gillott's proposition; and it would appear as if Mr. Gillott was himself conscious of the error; for we have never met with any of his pens made in accordance with his patent, that is, with *parallel* points, but as *Fig. 3*, which is one of Mr. Gillott's pens, as now manufactured; otherwise this is a pretty good pen, and ranks with the best of the *three-slit* class.

*Fig. 3.*      *Fig. 4.*



The position in which a pen is usually held causes the wear to take place in an inclined direction, slightly rounded at the edges, and the right hand nib to be more worn than the left. When one nib becomes shorter than the other, the longer nib bears harder than the shorter upon the paper in the up-strokes, and produces thick and blotted writing. It was probably with a view of obviating these effects that the scribes of olden time wrote their letters either upright, or inclining to the left hand, both of which modes are retained by the lawyers. Making due allowance for the obsolescence of many of the characters, we think it must be admitted that such writings possess more clearness and intelligibility of form than our modernized writing.

In order, however, that we may be able to incline our letters in the *right* direction, and yet save our pens from rapid destruction, Messrs. Mordan and Brockedon introduced, and patented in 1831, pens with inclined slits, which they very appropriately designated the "*oblique pen*." It has been stated, as a well-authenticated fact, that ninety-nine persons in every hundred fail to attain, permanently, the art of writing with a pen in the true position; that is, with the hand removed a little to the right, and the tip of the pen pointing to the right shoulder, when the slit of the pen will be in the direction of the writing, and both of the nibs addressed fairly to the paper. *Fig. 4* is a representation of Messrs. Mordan & Co.'s oblique pen. The direction of the slit in this pen being that in which the writing usually slopes at an angle of about thirty-five degrees, both nibs are brought equally down upon the paper—the writer is not confined to any particular position, but at liberty to use the pen freely, without the restraint of attitude, so strongly insisted upon by teachers of writing. The action of the oblique steel pen is altogether remarkably good, and, from the shape of the nibs immediately below the shoulder, it has a most excellent spring, producing a pleasing effect both in the up and down strokes of the writing; it glides smoothly over the paper, and is altogether free from the harshness so much complained of in steel pens. These oblique pens are made of the best steel, in a very thin and highly elastic state; the arched form gives the requisite strength, where it is necessary they should be firm and unyielding, and also enables them to carry more ink than any previous pens. The advantageous property of this particular form, for holding a large quantity of ink, was at once perceived by other manufacturers, and led to the construction of the Lunar, Gonidon, and some other similar pens. Messrs. Mordan & Co.'s specification describes a variety of modifications of pens and pen-holders, illustrated by numerous figures. In the first place are shown quill-pens and portable pens, (the latter implying short pieces,) having inclined slides, and metal pens similarly formed. To apply the principle to pens cut in the usual manner, with straight or longitudinal slits, handles are provided, which have at their lower ends curved metal arms, with clips or holders, which fix the pens at an angle, diverging from thirty to forty degrees out of the line formed by the handles. Some of these pen-holders are furnished with joints and set-screws, to enable the writer to place the pens at such an inclination, with respect to the handle, as will accord with the inclined position of the letters he is making. The latest improvement in steel pens is one by Mr. Gowland, consisting in the introduction of an additional nib. The following engravings represent three pens of this

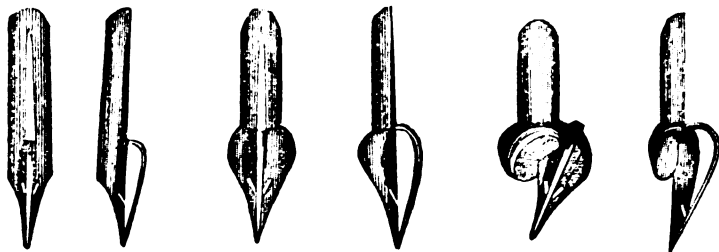
*Mordan*

description, as manufactured by Messrs. Mordan & Co., under a recent patent. Fig. 5 are back and side views of Messrs. Mordan and Co.'s patent three-nibbed

Fig. 5.

Fig. 6.

Fig. 7.



*slip-pen.* Fig. 6 are similar views of their patent three-nibbed *flat-spade*, or, as the Birmingham manufacturers call it, the *lunar pen*. In each of these pens, the additional nib is formed by cutting it out of the stem or shank of the pen, where there is always a superfluity of metal, and turning it back over the other nibs. Fig. 7 are back and side views of Mordan & Co.'s patent three-nibbed *counter-oblique pen*. Many persons having been strongly prejudiced against the one-sided appearance of the original oblique pen, Messrs. Mordan & Co. were induced to attempt an improvement in this respect, and they have fully succeeded. The improvement has been accomplished by the introduction of an additional shoulder, opposed to the former. This novel and curious pen has been very much admired, and it is as useful as curious; it has the advantage of holding a very considerable quantity of ink, and of retaining, from its obliquity, a position adapted to the slope of the writing, while to the eye a perfect equilibrium is preserved. The effect of the third nib in metallic pens, is to enable the pen to carry a larger quantity of ink, and to force it down in uniform and never-failing succession to the paper. Every time such pens are pressed on the down-strokes of the writing, the ink flows in a body towards the point from the effect of capillary attraction, at the precise time when it is most wanted. This result is produced by the third nib forming a conical tube with the other nibs of the pen, with its smallest end downward, and always causes the ink to flow equally, as much on the centre of the down-strokes as the two points of the pen itself. The capillary attraction, which is brought into operation in this ingenious contrivance, completely counteracts the defects existing in other pens, arising from the opening in the slip tapering in the opposite direction to that which is requisite, for the purpose of fairly conveying the ink to the paper; of this any one may convince himself by pressing the points of any ordinary pen on the thumb-nail, until the slit opens wide enough for large-text writing, when the ink will instantly recede from the points towards the upper extremity or angle of the slit. Capillary attraction always causes fluids to flow towards the narrowest part or opening of every conical tube; and, therefore, in three-nibbed pens, the ink is forced down upon the paper, and the thickest ink would be propelled downwards most effectually by the action of the three nibs. Another advantage of the third nib is, that it clears the slit of the pen, removing the fibres as they are gathered from the paper, thereby removing the greatest objection that has hitherto existed to the use of metallic pens.

The following is the process of making steel pens, as witnessed at the extensive and well-conducted manufactory of Messrs. Mordan & Co., Castle-street, Finsbury, whose liberality, condescension, and urbanity to visitors on all occasions, is gratefully acknowledged by many individuals who have in vain endeavoured to obtain a sight of this interesting process elsewhere. A hardened steel punch and matrix, of the exact size and shape of the pen to be made, having been attached to a powerful fly-press, sheet steel of the finest quality, reduced to about  $\frac{1}{100}$  of an inch in thickness, and in strips of two inches and a half wide,

is taken, and every pen is struck out singly, till the metal is exhausted. In this state the pens are called *blanks* or *flats*. After cutting out, the next operation is softening or annealing; this is performed by putting a great number of the *flats* into an iron box, with a small quantity of tallow on the top of them; the box being shut up close, is placed in a furnace, and there kept until the box appears to be equally heated all over. The box is then withdrawn, and the pens emptied out upon some hot ashes, covered with the same, and left to cool gradually. By this means the pens are sufficiently softened for the subsequent process; but as the flats are very rough and scaly from the effects of the fire, they are first cleaned by being placed in a mechanical agitator with sand, ashes, &c., and well shaken for an hour or two, which renders them remarkably clean and smooth. The makers' name having been stamped on the shank of each pen, and the apertures, if any, cut out, they are marked for the slits. This is done with a very sharp chisel, worked by a fly-press, and so exquisitely adjusted as only to cut through two-thirds of the thickness of the metal. This done, the next operation is the dishing. A hardened steel punch, of the precise form to be given to the pen, being attached to a fly-press, a die is placed beneath to receive it; the die being concave, and the punch convex, and both being made so as to fit each other with the greatest accuracy, the *flat* is forced into the cavity of the die, and retains permanently the form thus given to it. The pens being dished are next hardened, by being placed in the iron box, and heated as in the softening process, except that they are now cooled suddenly, by being thrown into a vessel of cold water or oil. When the pens are quite cold, they are taken out of the water, and placed in a cullender to drain. When dry, they are put into the agitator with a quantity of sawdust, and shaken for a considerable time, which cleans and polishes them, giving a degree of smoothness and finish to the nibs unattainable by any other method equally economical. The *agitator* is an ingenious piece of mechanism, invented by Mr. Mordan; it consists of a large tin cylinder, supported horizontally by two cranked axles—one at either end,—upon a strong iron frame; another axle, mounted upon anti-friction wheels, at the end of the machine, carries a winch handle and a heavy fly-wheel; upon this axle is also placed a driving wheel, a rigger-band from which puts the crank in motion, and communicates a very rapid elliptical movement to the cylinder and its contents. By this contrivance the pens are very effectually polished, and made ready for the next process—tempering. This is done by placing the pens, a few at a time, on a stove, heated to the proper temperature; so soon as a bright blue colour is obtained they are removed, this colour denoting the temper best suited to steel pens. The last operation is that of opening the slits, or, as some call it, *cracking* the slits; this singular process is effected by placing about a quarter of an inch of the pen's point between a pair of small nippers, and pinching them suddenly, when the slit, which was only cut two-thirds of the way through, is completed by the giving way of the remainder of the metal. This unique process fits the pen for immediate use; some manufacturers add a coat of lacker, but this is not of much real utility.

It has often been supposed that other materials would be equally, if not more, suitable than steel, for the manufacturing of pens; those persons who have paid most attention to the subject, however, are decidedly of opinion that no kind of metal, however fine its texture may be, or whatever properties it may possess, will ever be able to compete with fine well-tempered steel.

Many of the steel pens, as now manufactured, we find of excellent quality; many hundred pages of this work have been written with *one* pen, in a uniform clear hand. After writing with it about forty pages, we usually renew, and even much improve the nibs of a new pen by a few touches of a dry Turkey stone, aiding the sight with a pair of magnifying spectacles, in order that the form of the extreme end may be duly perfected; this process will, however, be found difficult of accomplishment, at first, by persons unaccustomed to the pointing of delicate instruments, and, at the present low prices of the article, scarcely worth the trouble; but the ability to perform this operation at pleasure upon steel pens, renders a person very independent of the stationer's shop.

In our brief account of this novel and admirable manufacture, we are sensible of having omitted to notice a variety of excellent steel pens, but our allotted space compels us to proceed to the description of a different class.

*Fountain Pens.* A great number of ingenious attempts have been made to construct pens containing a reservoir of ink, which, by a slight pressure on the handle, or other part, might cause a fresh supply of the fluid to flow to the nibs, and thus supersede the necessity of an ink-stand. Of this kind is the *penograph* of Mr. Scheffer, manufactured by Messrs. Mordan & Co., in which the pressure of the thumb on a projecting stud in the holder causes a continuous supply of ink from the reservoir to flow into the pen.

Mr. Parker's *Hydraulic Pen* is a more recent contrivance for the same purpose. In this machine a piston is made to work up and down in a cylindrical tube by means of a revolving nut acting upon the piston rod, which is tapped with a corresponding screw. The small orifice at the bottom of the holder being immersed in ink, the turning of the upper portion of the holder causes the piston to ascend, and the tube becomes filled with ink; on gradually turning the nut in the opposite direction, the piston descends and forces the ink down into the pen. Mr. Parker has taken out a patent for his invention; but, if we mistake not, Mr. W. Baddeley proposed an apparatus, precisely similar, a long time since; for which see the *Mechanics' Magazine*.

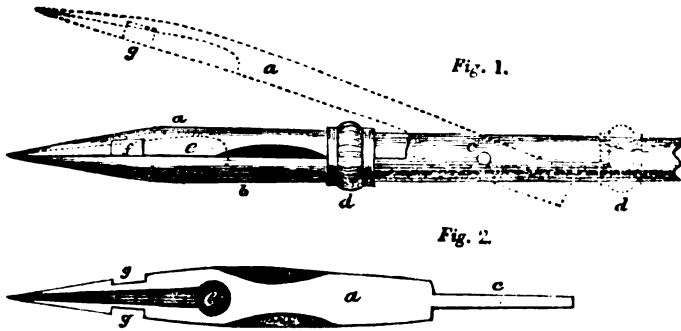
As a description of all the contrivances of this kind, however, would occupy many pages, we shall limit our account to one of a very simple and unexpensive kind, the invention of a correspondent of the *Register of Arts*. "The pen is made of two quills; the top one, which I shall call No. 1, and the other, No. 2. Let the end of No. 1 be made air-tight, by dropping inside, to the bottom, a small piece of cobbler's wax, and then warming it a little: fill this nearly with ink,—say about a quarter of an inch from the brim,—then take a small piece of cambric and cover the top of it, so that the ink may not drop out; join both quills together, by putting No. 1 into No. 2, and the pen is ready for use. When you want to write, take the pen in your right hand, give a gentle shock on your left hand, or on a table, and the ink will run down into the pen immediately; this must be repeated every time ink is wanted. A pen of this kind will be found very useful to reporters and to persons travelling. The pen should be put into a little case to carry it about."

*Pens (drawing).*—By this term is commonly understood the mechanical drawing-pens, consisting of a pair of delicately-formed steel blades, the ends of which are drawn together and adjusted by means of a fine set-screw; these pens are mounted with handles of various materials, but those of ivory or ebony are deservedly preferred. These instruments are manufactured by Mr. Elliott, of High Holborn, in the highest perfection. The extremities of the steel blades which form the pen should be very narrow ellipses, and should perfectly meet, without the minutest projection of one piece over the other. The outside of the elliptical end should be rubbed on a hone until it is as thin as the edge of a knife: in this state the points would cut the paper; but the sharpness must be taken off by gently drawing them over the stone upon their edges, and finishing them upon a soft polishing-stone. A smoothness is thus given to their edges, which makes them glide over the paper, although they will still be left so thin that their edges can scarcely be discerned. By this management, lines may be drawn while the points of the pen are at a distance from each other, not perceptibly exceeding the breadth of the lines produced, which is of consequence, not only to the equable flow of so viscid a fluid as Indian ink, but to obtaining a well-defined stroke.

A drawing-pen was lately presented to the Society of Arts, by Mr. Bryan Donkin, which he had brought from France. It is calculated to make lines of only one uniform thickness: the cavity which contains the ink being enclosed all round, keeps it free from dust, and prevents it from drying, and clogging the drawing-point so quickly as those of the ordinary construction. *Fig. 1* (in the following page) shows the pen, with the handle broken off; *a* and *b* are the two limbs, jointed at *c*, and held close by the sliding ring *d*; the dotted lines represent the upper portion *a* as opened, to receive the ink, with the ring *d*



slidden back beyond the joint. *Fig. 2* shows the underside of the limb *a*, in a separate state; at *c* is the hole to receive the centre-pin; *e* is the cavity for



the ink; *g g*, notches for receiving two projecting pieces, as shown at *f* in *Fig. 1*.

An extremely simple and ingenious mode of making a drawing-pen of the last-mentioned kind (that is, to make a line of only one thickness,) was invented by Mr. Robert Christie; and having made several according to his instructions, which answer very well for tracing, as it moves with equal facility in any direction, we insert a notice of it in this place. The annexed cut represents one of these pens, in a neatly-turned handle; but we made them at the solid end of black-lead pencils, for the convenience of readily using either lead or ink. The process, as directed by Mr. Christie, is as follows:—A piece of sealing-wax, about the size of a marrowfat pea, is to be stuck upon the end of the pencil, by melting it, forming thereby a bulb, into which are to be inserted three darning-needles, by warming their eyes in the flame of a candle, and then burying them in the wax, at equal distances apart, around the circumference of the pencil, with their points extending about three-quarters of an inch beyond the end of it; but brought together so as to meet as accurately as possible at a common focus, forming the outline of a triangular pyramid: to secure them, another piece of wax, about the size of a grain of wheat, is to be placed midway between the bulb and the points, and secured there by melting it. The very acute points of the needles are to be taken off by light rolling touches upon an oil-stone, and the raggedness, by a little fine emery-paper, so as to produce an obtuse, conical end; the pen, when thus completed, has of course a very fine triangular hole between the needle-points, through which the ink uniformly flows. We have seen some of these pens made by inserting the needles into drilled holes, made in metal, at the end of neat handles, in which the needles were so nearly brought together where they are inserted, as not to need the smaller bulb nearest to the points. The ink flows freely in them, and there is the same facility in using them as a finely-pointed H H H black-lead pencil. They answer well for tracing, as before observed; but we do not think them equal to the common forceps-formed drawing-pen for ruling clear lines.

*Ruling-pens*, for common use, are made by doubling a piece of tin-plate together, and rounding the ends, the middle being bellied for the reception of ink. Pens of this description were constantly used for ruling account-books, &c., previous to the introduction of the ruling-machine, which entirely superseded hand-ruling.



Ruling-pens for the machine are made of thin sheet-brass or latten, in long strips, the pens being cut on the edge, and folded together at various distances, according to the pattern to be executed.

*Music-pens* are made for ruling the five staves of music at once; they consist of a parallelogram of brass, terminating in five slit points, communicating with a small reservoir above, in which the ink is placed. They are fitted with a handle, in the hollow of which a small piece of brass is carried for cleaning out the ink passages of the pen. The accompanying engraving shows the construction of this very useful and ingenious apparatus.



*Dotting-pens*, for writing music, consist of a small brass cylinder, in which a pin of the same material works vertically, being kept down, and projecting about the tenth of an inch, by a spiral spring in the upper part of the pen. An elliptical opening, about halfway up the pen, receives the ink. When placed upon the paper, the brass pin recedes, and causes the ink to make a round black spot on the paper, forming a note,—the tail being supplied afterwards with a common pen.

**PENCIL.** An instrument used by painters for laying on their colours; they are of various kinds. The larger sorts are made of boars' bristles, the thick ends of which are bound to a stick, large or small, according to the uses they are designed for; these, when large, are termed brushes. The finer sorts of pencils are made of camels' hair, also badgers' and squirrels' hair, and of the down of swans; these are tied at the ends by a piece of thread to keep the hair from spreading, and the other ends are enclosed in the barrels of quills of various sizes, suited to the pencil, some of which are of small birds, as those used for drawing lines, and in miniature painting. The usual test of a good pencil is to draw it between the lips, when it should come out with a sharp, conical, and, as it were, solid point.

**PENCIL** is also an instrument used for drawing and writing, made of long slips of black-lead, chalk, or crayon, placed in a groove made in the centre of a stick of wood, usually cedar, on account of the facility of cutting it. The very common black-lead pencils that are hawked about are a composition of powdered black-lead and melted sulphur. Their melting, or softening, or yielding a bluish flame, on application to the flame of a candle, betrays their composition. The genuine black-lead pencils are made of the fine Cumberland plumbago, sawed into slips, fitted into the grooves, and having another piece glued over them. The pure plumbago is, it is said, too soft to enable an artist to make a fine line; to produce this effect, a hard resinous matter is intimately combined with the lead in the following way, which is said to be the invention of Mr. Cornelius Varley. Fine Cumberland lead, in powder, and shell-lac are first melted together by a gentle heat. This compound is then reduced to powder again and re-melted; then powdered again and re-melted, until both substances are perfectly incorporated, and it has acquired a perfectly uniform consistence. The mass is then sawed into slips, and glued into the cedar mountings in the usual manner of making other black-lead pencils. To render them of various degrees of hardness, the materials are differently proportioned; the hardest having the most shell-lac, the softer but very little, and the softest none; and their blackness is increased in proportion to their softness.

Mordan's "ever-pointed pencils" were the subject of a patent granted to Hawkins & Mordan, in 1823. The pencil-case has a slider, actuated by a screw for the purpose of projecting forward a little cylinder of black-lead, as it wears away, which is done by holding the nozzle in one hand, and turning round the pencil-case with the other, the thickness of the lead being so small as not

to need cutting for the ordinary purposes of a pocket-pencil. *Fig 1* is a section of the pencil-case; A the black-lead or crayon, encompassed by the nozzle, which, with the whole of the case, is made of metal, usually silver. B is the driver, being a hollow cylinder with a screw-thread round a part of it;



at the end of this screw the black-lead is inserted and held fast; C is the elongated part of the driver, which passes through the guide D; at E, within the outer case, is another cylindrical piece, connected to the nozzle at one end, and having at the other a hollow screw that works round on the thread of the driver B, and, as it turns, causes the projector to advance or recede, as may be required. These pencil-cases have had an immense sale, and have been improved upon in a variety of ways during the last ten years.

**PENDULUM.** A vibrating lever or suspended weight. See **HOROLOGY**.

**PENSTOCK.** A sluice or floodgate, serving to retain or let go at pleasure the water of a mill-pond.

**PEPPER.** A well-known spice, of which there are three kinds,—the *black*, the *white*, and the *long* pepper; to these we may now add a fourth, *bleached* pepper, a patent process which the black pepper undergoes in this country to render it white.

Black pepper is cultivated with such success at Malacca, Java, and especially at Sumatra, that from these islands pepper is exported to every part of the world where a regular commerce has been established. The ground chosen for a pepper garden is marked out into regular squares of six feet, the intended distance of the plants, of which there are usually a thousand in each garden. The pepper vines are supported by chinkareens, which are cuttings of a tree of that name planted on purpose. Two pepper vines are usually planted to one chinkareen, round which the vines twist for support. After being suffered to grow for three years, they are cut off about three feet from the ground, and, being loosened from the prop, are bent into the earth in such a manner that the upper end is returned to the root. The fruit, which is produced in long spikes, is four or five months in coming to maturity: the berries are at first green, turn to a bright red when ripe and in perfection, and soon fall off if not gathered in proper time. By drying they become black, and more or less shrivelled, according to their degree of maturity.

The common white pepper is the fruit of the same plant, differently prepared. It is steeped in water, and then exposed to the heat of the sun for several days, till the rind or outer bark loosens; it is then taken out, and when it is half dry rubbed till the rind falls off; and the white fruit remaining is dried in the sun. A great deal of the heat of the pepper is taken off by this process, so that the white kind is more fit for many purposes than the black.

The long pepper is a dried fruit, of an inch or an inch and a half in length, and about the thickness of a large goose-quill; it is of a brownish grey colour, cylindrical in figure, and said to be produced on a plant of the same genus. It is a native of the East Indies, especially Java, Malabar, and Bengal. This fruit is hottest to the taste in its immature state, and is therefore gathered while green, and dried by the heat of the sun, when it changes to a blackish or dark grey colour. Dr. Cullen observes, that long pepper has precisely the same qualities with those of black, but in a weaker degree.

The method of preparing the bleached pepper appears to be engrossed by Mr. Fulton, of London, who has taken out two patents, one in 1828, the other in 1830. By the specification of the first we are informed that the common black pepper is steeped in water for a day or two, then laid in heaps, and occa-