WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. I.—No. 48.] SATURDAY, FEBRUARY 15, 1890. [PRICE ONE PENNY.

ENGRAVING ON METAL.

BY NORMAN MACLEAN.

WORK ON SILVER AND GERMAN SILVER.

IT is presumed that the workman on taking up this class of work will have been prepared, by previous practice on the commoner classes of work, to give due effect to the designs he may have to engrave on the better class of work known as hollow ware engraving. The methods of sharpening or whetting the gravers are modified according to the class of work on which the engraver is engaged, as for instance—a cake or card basket, round or oval, has usually a considerable depth, therefore an outlining graver must be "set off" very considerably, and the facility of cutting *towards the right hand* will, in this and other cases, enable an expert workman to engrave an article in about one-half the time that would be taken by another. Therefore, I strongly recommend the workman to practise the cutting from left to right, whether it is absolutely required or otherwise. (See Fig. 1, page 520.) Letters A and B represent a line cut towards the left hand, and which is the natural tendency. The line represented by the letters C and D is to be cut—not as a continuation of the circle, but from the left towards the right hand, commencing at C and finishing at D. There is little to say to the workman as to the way in which he should cut his work, as by this time his work will have developed an individuality quite his own, which may be a good style or a bad one. If it is the latter, he must take every opportunity of comparing his work with that of other engravers, and noting his own shortcomings. I will, however, give the workman a few hints. Remember that you will get a better price and more credit on best work, and, therefore, you can afford to spend more time in proportion than you would if engaged on common work. If the design is a repetition in sections, take great pains in dividing the sections, using the dividers freely. Get your prints on truly, and the shields exactly upright, for nothing looks worse than a shield all awry. Point in the pattern exactly as it is intended to be cut. I am speaking of the outline, and where parallel lines occur rule the second line by the first after outlining. In veining a scroll or leaf, study your pattern, and see that all radiating lines glide imperceptibly into the main vein. In cross shading and blacking out ground, see that no "whites" are left in either, and that the

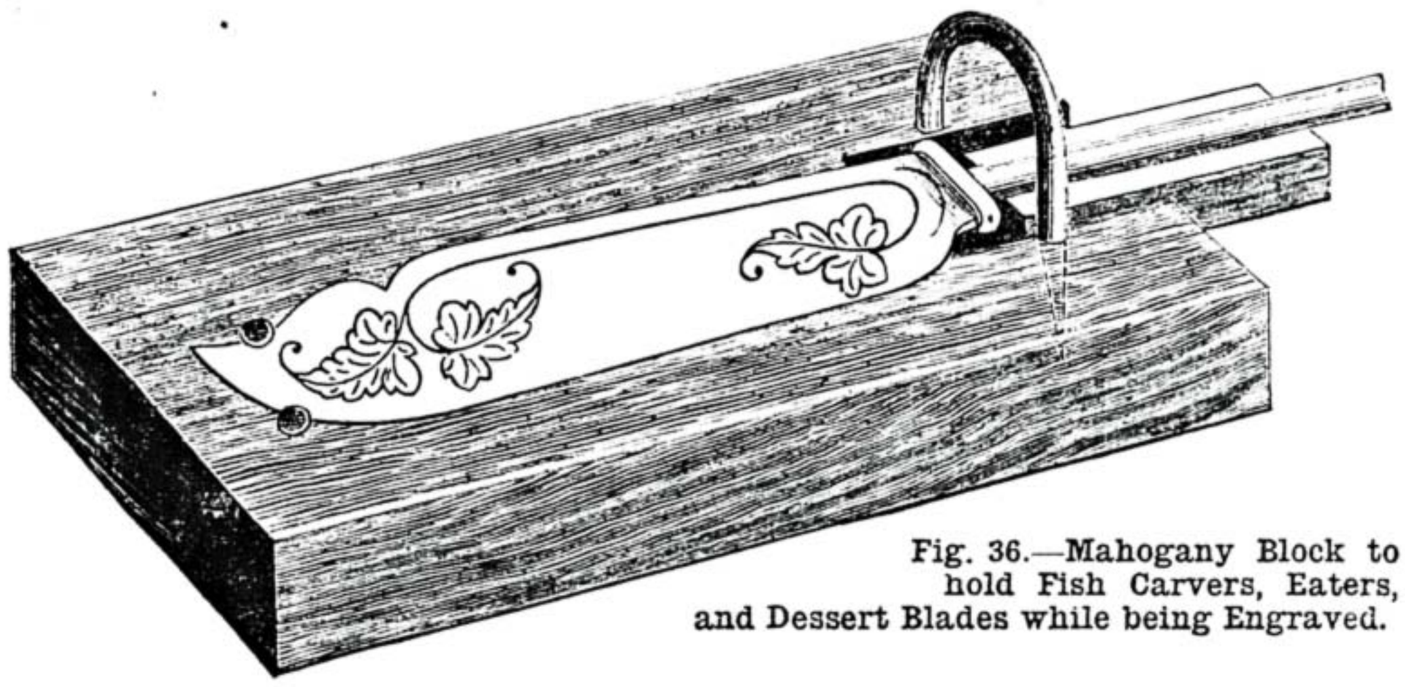


Fig. 36.—Mahogany Block to hold Fish Carvers, Eaters, and Dessert Blades while being Engraved.

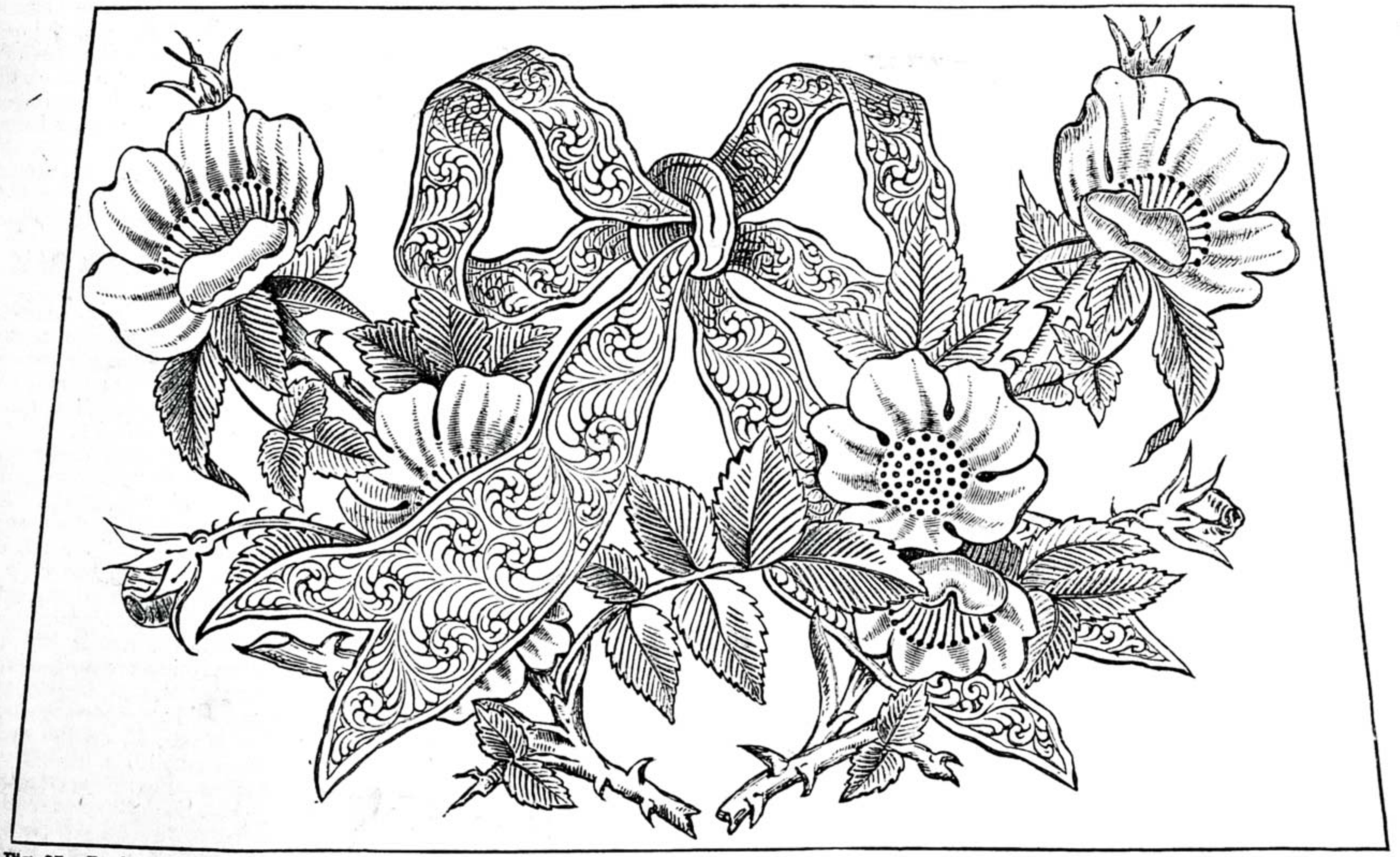


Fig. 37.—Design for a Plain Metal Oval Teapot, suitable for German Silver or Britannia Metal. Subject: Sprays of Wild Roses and Ribbon Knot.

shading is graduated artistically. I may here explain that "whites" appear when the surface of the metal is *not* entirely cut away by the consecutive strokes of the graver. When you have finished your work, give it a nice appearance by dusting it over with the pounce bag and polishing the surface, and removing the dirt from the cuts with a piece of bottle indiarubber. Do not use the vulcanised rubber, as the sulphur used in its manufacture will cause the article cleaned with it to turn black. I have said nothing about the prices of work, because so much difference in price prevails on account of the keen competition for work when there was little work to be done. Now that trade is improving all round, I have no doubt better prices will be paid.

The engraving of fish carvers, fish eaters, and general small work of an ornamental character, is practised by the engraver of small work, and who seldom or never attempts any other description of work. On this account he is much quicker than an engraver who is most used to larger work, who cannot as readily change his hand. But it must not be supposed that there are no engravers who cannot acquit themselves creditably as "all round hands." I admit they are few and far between. In engraving small work, much of it is done without the extra work of pointing in or tracing the pattern from the print. The work is cut from the print, which may be a black one or a white dry one, according as the engraver has been used to either. I prefer the white print for its cleanliness, and also for its lasting properties. A white print only requires renewing occasionally, whereas a black one will only lay down from a dozen to eighteen impressions. A block (Fig. 36) is sometimes used to hold fish carvers, eaters, and dessert blades, which facilitates the engraving of these knives. Other articles are held as best they may be in the left hand, and a few awkward articles are mounted on a cement block.

The workman in this line of business is generally assisted by an apprentice who prepares the work for his master, such as "laying down" the patterns, tracing such parts as are deemed necessary, and, as he advances in the art, cutting such parts as he is capable, leaving the whole to be finished by the workman, who will correct any little error as he finishes the work. The apprentice also runs the errands, thus giving him a little rest from his work, and enabling the master to work the whole of the working hours.

I give in Fig. 37, as promised in a previous paper, a design in the floral style for a plain oval teapot, a rather popular shape on account of its showing off all work to advantage; the lid is flat and "let in," and thus forms a smooth surface to work upon. This pattern is all line work, and as the sketch is for a five-gill teapot it can be traced and waxed down on a teapot of that size, but for any smaller size will require to be redrawn. I propose to leave this design to be dealt with according to the taste of the engraver, only remarking that the ornament on the lid should correspond with that of the body of the teapot.

ENGRAVING ON JEWELLERY.

The operation of engraving jewellery is altogether different to any that I have before described, and since the silver jewellery has had its day, I am at a loss to know to what branch of the profession the immense numbers of engravers of jewellery have turned their attention. But to those workmen who wish to learn something of the way in which it is done, I will attempt a description of the process, commencing with the bench, which is known by the name of "a three-holed bench," and which is also used by the makers of jewellery.

This bench is generally made of stout wood, such as elm; has three semicircular pieces cut out, with arm-rests in between, the object of which is to enable three workmen to work at one window. In the centre of the bench is an upright gas-bracket, an equal distance from each workman, who also has a small gas burner at his right hand, for the purpose of warming the cement on the chucks on which he mounts the articles to be engraved.

Each engraver has suspended just beneath where his work rests a leather apron, to catch all the gold and silver chips from the graver, which become a valuable perquisite. Instead of the ordinary sandbag of the ornamental engraver, the jewellery engraver uses one with a round hole left in the centre of sufficient size to receive a "bullet." This bullet is really a small round cannon ball with a screwed nose fixed firmly in, and on which the little boxwood chucks are quickly screwed. These chucks are round, about 2 in. by 1 in., and carry a female screw of $\frac{5}{8}$ diameter and eight threads to the inch. By means of the hollow pad and bullet, the engraver is enabled to quickly turn the work in any direction and at any angle which may be required during the progress of the work. This class of engraver generally works in sets of three, to facilitate the execution of the work. One engraver will outline, another will "fill in," while a third will shade and finish. A boy is usually kept to run errands and "stick on" and "take off" work from the small chucks. The tools used are the ordinary graver, the shading tool, a small spotting or round-nosed tool, narrow wrigglers and double wrigglers, with a tracing point, burnisher, and hare's foot for sweeping up chips.

A fine oilstone is necessary for this work, as it is nothing if not bright; and in addition to the ordinary oilstone, a stone known as a "black stone" amongst the engravers and engine-turners of Clerkenwell is used for finally polishing the graver before cutting the work. The use of this stone produces a cut on gold and silver of great brilliancy.

I am not geologist enough to tell the nature of this stone; its colour is black, very hard, and very scarce. I have often used it myself, but never had a piece to call my own, and the many inquiries as to its scientific name have left me as wise as before. I have ventured to think that it is iron in some form or other. If I am right, perhaps some of our geological readers will give us the proper name of the stone or metal. The use of the black stone, as I shall continue to call it, is very simple. The graver is sharpened in the usual way, and the black stone is drawn lightly along the cutting edges, which has the effect of removing the slight burr left by the action of the graver on the stone, and thus brightening the cut without taking away any of the sharpness of the graver.

HERALDIC ENGRAVING.

The successful practice of this fine art branch of engraving depends not only on the ability of the engraver to outline and shade well, but also upon the facility with which he can enlarge or reduce the coat of arms, crest, monogram, or cypher to the size suitable to the work in hand. In addition, a study of heraldry is advised. If an old crest book can be purchased in which the arms and crests have been printed by the copper-plate process, such a work will give a capital idea of the shading of crest work, etc. A book of monograms will assist the engraver; there are two or three published, all equally good, which can be seen and compared before purchase at almost any free library.

A book of plain and ornamental capital letters, and an occasional glance at Field and Tuers' "Specimens of Printing," will keep the engraver up to the most modern style of letterings. In addition to his work on metal, the heraldic engraver must be prepared to work on ivory and pearl. The practice of a crest engraver involves more work than that which appears upon the engraved article. We will suppose that the engraver has been invited by a manufacturer to compete for the engraving of the outfit of an ocean-going liner, which consists of many thousands of articles, and of all sizes, from a mustard spoon to a hot water meat dish of thirty inches at its transverse axis. These all have to be engraved with the name of the vessel and the arms and name of the company who own the liner. In the first place, the engraver has to prepare a finished sketch of the work, which is submitted to the company for approval. This is returned, with the usual alterations and final directions as to how the work is to be done, through the manufacturer who has the work in hand. The engraver having secured the order, will now proceed to draw on a piece of German silver, similar to a practice plate, a series of twelve or more sizes, side by side, each size of the subject to be engraved being an exact counterpart of the other. The object of cutting the sizes on a plate is two-fold; in the first place, the sizes for the different articles can be better calculated, and more easily drawn; and secondly, the plate itself furnishes the black prints required for the work on the various articles. In course of time part of the original order is repeated, in order to meet the inevitable losses; the plate again is made use of, thus securing a perfect match with the original work. Crest work is done with a lozenge graver, whose angles are more acute than a square graver. Lozenge gravers are also used for making the flat tools for block letters, the main shanks of Old English, and other letters.

These flat tools are whetted at the usual angles, and flattened on the sharp angle by rubbing on the stone to the required width. A few narrow shading gravers are kept on hand, for blacking out the cheaper forms of lettering, etc. For these I recommend C and D fineness of threads, and Nos. 1, 2, 3, 4, 5, and 6 widths of both C and D.

In sketching in inscriptions due prominence should be given to "Presented," the name of the "recipient," "date," etc. But as these particulars—in fact, as the inscriptions—are generally "set out" for the engraver, he has nothing to do but copy it letter for letter, supplying ornamental capitals and lettering such as his own good taste will suggest. If the article is large, such as a tray, give prominence to the crest or coat of arms, so that it may be seen and recognised at a glance, balancing the whole in an harmonious style. If, on the other hand, the article is a small one, legibility is the first consideration. Engraving crests on pearl and ivory will require considerable determination and practice on the part of the engraver to overcome the natural

difficulty of cutting against the grain of the ivory, and also the peculiar nature of pearl as opposed to that of metal. Otherwise, the work is finished exactly in the same manner as the same subject would be in metal, supposing the subject to be a crest. But with lettering the work has to be cut sufficiently deep to receive the necessary "blacking" to make the engraving prominent on the white substances. This black mixture is made of the very best black sealing wax dissolved in spirits of wine, which must be kept in a tightly stoppered bottle. The mixture when ready for use must "run" freely. To "black" the pearl and ivory already engraved, take a fine camel-hair or sable pencil and carefully fill all cuts with the black mixture, taking care that the ink, as I may call it, is confined to the part engraved. The articles are left for a time—say a whole night—for the ink to thoroughly dry, when the superabundance of ink on the surface of the ivory or pearl is removed by means of a "dolly" in a small lathe. The "dolly" is composed of a number of pieces of linen secured by clamps to the mandrel. This is revolved at great speed in the lathe, which causes the limp linen to take an upright position in the lathe, and the friction is increased by the application of finely powdered whiting, which soon removes the ink from the surface.

In conclusion, there are many articles which might have been engraved which it would have been impossible to describe in this paper. At some future time, however, I shall be glad to direct attention to a few articles which I myself have made and engraved for home use.

A STRAIN CHECK AND EXCESS LOAD ALARM INDICATOR.

BY JOHN CHARLES KING.

THERE is a correlation between moral and physical science in the warnings of one and the index limits of the other to prevent evil. For one, the simple word "Don't" has its counterpart in the other in a check-stop. The intelligent heedfulness of man to either would spare a world of suffering, not only for ourselves and others, but for the animals that serve us so faithfully with their willing toil.

Any invention that, by its simplicity of action, serves as a check-stop to undue strain on machinery or animal draught, and indicates excess, seems to articulate the word "Don't" to our understanding.

"A Stress Alarm and Excess Load Indicator," applicable to hauling machinery, running-gear, and harness of draught-horses, has been patented by the inventor, a Mr. Snellgrove, and is made by W. & T. Avery, of Birmingham and London. Being, for harness, as small as a trace buckle, it is not unsightly; and, for machinery up to fifty tons' pull, only slightly larger in proportion, and in no way interfering with the action of the chains, ropes, or traces. It seems to be the one thing so long sought for by mechanicians and horsemen to aid their judgment, and aid them also in the most important part of their undertakings, where strains from excess loads, sudden jamming, or hitches would strain the machinery or hauling gear unnoticed, and weaken it so that it might afterwards yield to moderate strain unexpectedly from a previous unrecorded strain.

This simple invention has not the word "Don't" on its front, but a dial with indicating hands, showing what maximum strain has been applied; and, for excess beyond the fixed limit, an alarm is sounded, and a red danger-disc covers the dial face till the load is taken quite off. So simple an invention hardly needs illustration. Perhaps its application to harness and carriage draught will be best explained by a diagram showing the defective attempts to arrive at the same result in one point only.

Horsemen who drive seek to avert the sudden strain on the shoulders of horses by putting a swivel-bar to the draught of a gig and dogcart, which means a central pull to the vehicle, whereas the retarding action of the wheels by the road is two and a half feet each side of this centre, forming a corresponding leverage against the horse's draught, which, in ruts, or in turning,

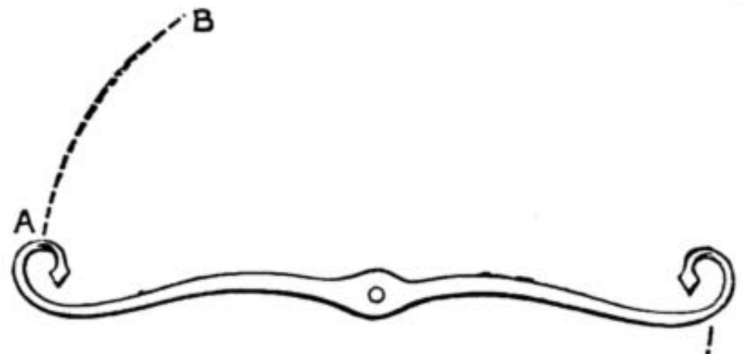


Diagram showing Course of Action of Strain of Trace on Swivel-Bar.

throws the strain on the shafts by the side pressure of the horse against them, which means straining the legs of the horse needlessly by side-pack action, The swivel-bar is a danger also. Should a trace come off or break, the other trace snatches the swivel-bar hook round into the leg of the horse, wounding it, and perhaps causing it to bolt, often with serious or fatal results to the riders in the vehicle. The dotted line A to B shows this action.

This invention serves at once to relieve the shoulders of the horse from concussion by wheel-jerking, and to tell of any wrong by the alarm indicating it, as a "fired" axle or strained wheel-fixing, which would be marked at once by the dial showing excess strain, or the little boss on the trace sounding the alarm; or, for teams, the pull of the free or lagging horses is indicated.

For heavy weights, the fifty ton indicator is tested up to a hundred tons, to allow for sudden enormous strains, and the alarm by fulminating charges of intense loudness of report automatically fed for the fall of the striker.

This invention does not appear to have been forward enough to be exhibited at the Berlin Exhibition of May last for the Prevention of Accidents; but it was shown at the French Universal Exposition, and attracted well-merited notice.

GESSO WORK APPLIED TO THE DECORATION OF ROOMS AND FURNITURE.

BY E. C.

IN the present paper I propose to consider gesso work as a means for the decoration of rooms and furniture.

In selecting the design for a frieze, and also in arranging the scheme of colour, much must necessarily depend upon the interior—upon its size, height, and aspect, and upon its present decorations if they are to remain unaltered. According to the height of a room the frieze may be two or three feet in depth; in low-ceiled rooms one foot will be sufficient. For myself, I prefer, whenever possible, a rather deep frieze of bold design. For the purpose a soft, shadowy grey-blue background is charming; on this the flowers may be done in terra-cotta tints and the leaves and stems gilded; the stamens of the flowers also gilded. In this case the background and blossoms would be done in oils and the leaves in the gold which is sold with the metallic colours. A chaste effect could be obtained by tinting the design in cream and shades of brown only, then laying in a background of bronzy gold. This would make an artistic frieze with blue and cream brocade wall hangings, or with oak panellings. A rich scheme of colour may be desired to suit surrounding decorations. Under such circumstances I should suggest that the lilies should be of tawny orange tints shaded with coppery red; the foliage in greeny-blue tints, with the under part of the leaves of a silvery-blue shade, and the background gilded. The lilies should be outlined with copper red. Many other schemes of colour could be suggested for Fig. 1 of our illustrations, but I have said enough to show that it is easy to paint a frieze to suit any and every room decoration imaginable.

The design I give for the ornamentation of an occasional table top will be sure to prove effective if well executed. It would be charming if carried out in varied tints on a metallic green ground: gold and silver foliage, and flowers and buds of terra-cotta tints with brownish stems. Or the background might be of walnut wood, untouched; the chrysanthemums and buds painted pale yellow, and the foliage in shades of green and silvery grey green. If the table is square, run two circular lines round the design, and add four separate corner decorations. The gesso is laid flat, and is here merely as a foundation for the painting; it would be contrary to the canons of true art that a table top should be decorated with a design in high relief. If liked, the decoration could be carried out entirely in silver and gold on the green lacquer ground. An accomplished worker will find he can secure beautiful effects by laying on a coat of silver, say on a rose, and then tinting the petals with oil colours used very thinly. Pale yellow or blush roses are lovely when treated in this manner. It requires some practice to do it well, but no art work can be successfully learnt without perseverance. A quiet but pleasing harmony might be arranged by painting the chrysanthemums white and the foliage in cream and fawn tints just thrown up with deeper brown in the veining of the leaves: the background to be the wood—walnut or rosewood—left plain. I am fond of these sober decorations myself.

Now we come to Fig. 3, a pretty little cabinet door with two gesso work panels. This design may be modelled slightly. To my mind it does not allow of high relief, although such would be perfectly legitimate on cabinet doors. Here a rich Oriental colouring would be admirable; such as a deep metallic blue ground, copper red and gold for the design with touches of green here and there. This would look well for the door of a black enamelled wood cabinet; the handles should be of silver and the hinges of silver of openwork pattern, such as are general on the lac cabinets sent to us in such quantities from the East.

A second plan is to lay the gesso on, and,

Fig. 1.—Frieze or Border in Gesso Work.

after modelling it, to tint it the same colour as the wood, when it resembles wood carving; I do not greatly recommend this style, because it is a mere imitation of carving, still it is, of course, far easier, not half or a quarter so much practice being required to accomplish a good piece of gesso work as to execute a carved wood panel. A turquoise-blue enamelled cabinet, the design carried out in ivory tints on a gold background, would be very attractive. It might well be accompanied by a settee decorated with gesso work. I give (in Fig. 4) a sketch of the back of such a settee ornamented with foliage in gesso and upholstered with self-coloured *frise* velvet or brocade. Pale gold coloured material (or chestnut shade) would accord well with the ivory and gold gesso work. It would not be at all difficult to enrich a whole suite of furniture in this way and so double its value. Furniture ornamented with garlands of roses and bows after the French style is extremely fashionable at present; this is merely painted, but I cannot doubt that any one who could execute gesso decorations well would have a fine chance of doing a good business with some of the larger furnishing and decorating firms. But they would need to be done in a masterly style, because rival workers soon appear wherever money is to be made; and to keep up with, or distance, such successfully, needs continuous attention and care. New and suitable designs would have to be constantly produced, and the work would have to be rapidly executed, for orders taken must be sent in up to time. Those who are only working for their own pleasure and can set about their self-imposed tasks leisurely will find it a pleasant occupation to decorate a room entirely with gesso work. If they do not wish to go to much expense, they could have a *stained* walnut or oak dado, and ornament the panels with gesso designs done in ivory tint with shading of leaves and flowers in warm brown. The background could be of stained wood; panels of door and shutters of the same; a self-coloured grey blue or terra-cotta wall-paper (or painted wall) with frieze in gesso carried out in soft terra cotta and gold and blue of a greyish tone. An effective interior could be arranged in the same way, but the panels should be grounded with gold; and copper red and silvery blue—toning to greeny blue—might be introduced in the design. Each panel would be decorated on a table or easel, and when all are finished would be inserted in the dado and door, so there is no fatigue in stooping down or sitting on steps to do the work. No end of lovely possibilities present themselves to my mind's eye as I write. I should like to see a dainty boudoir decorated somewhat in this manner. White enamelled wood dado with gesso panels bearing conventional designs in turquoise and ivory tints on an incised gold background. Turquoise satin panelled walls with flat white enamelled wood pilasters (decorated with designs corresponding with those in the dado); these forming the framework of the satin panels. In the centre of each of the satin panels, a figure after the style of Mrs. Wylie's "Dawn" exhibited in the Arts and Crafts Exhibition last autumn—a figure floating in mid air with the sun rising beneath her feet from behind golden-tipped clouds, her soft fleecy draperies fluttering in the gentle breezes. The figure executed in white with reflected sunrise tints, which also fleck the snowy cloudlets. A rich frieze of gold, turquoise and rosy tints, and a white panelled ceiling. I should enjoy describing the furniture and draperies of this ideal lady's sanctum, but I fear being called to account for running miles away from my subject.

Fig. 2.—Table Top in Gesso Work. Chrysanthemum conventionally treated: Design produced in very Low Relief.

There are many other modes and means of rendering gesso work subservient to the decorations of rooms and furniture with good effect, but I have said enough here to show its capabilities for this purpose.

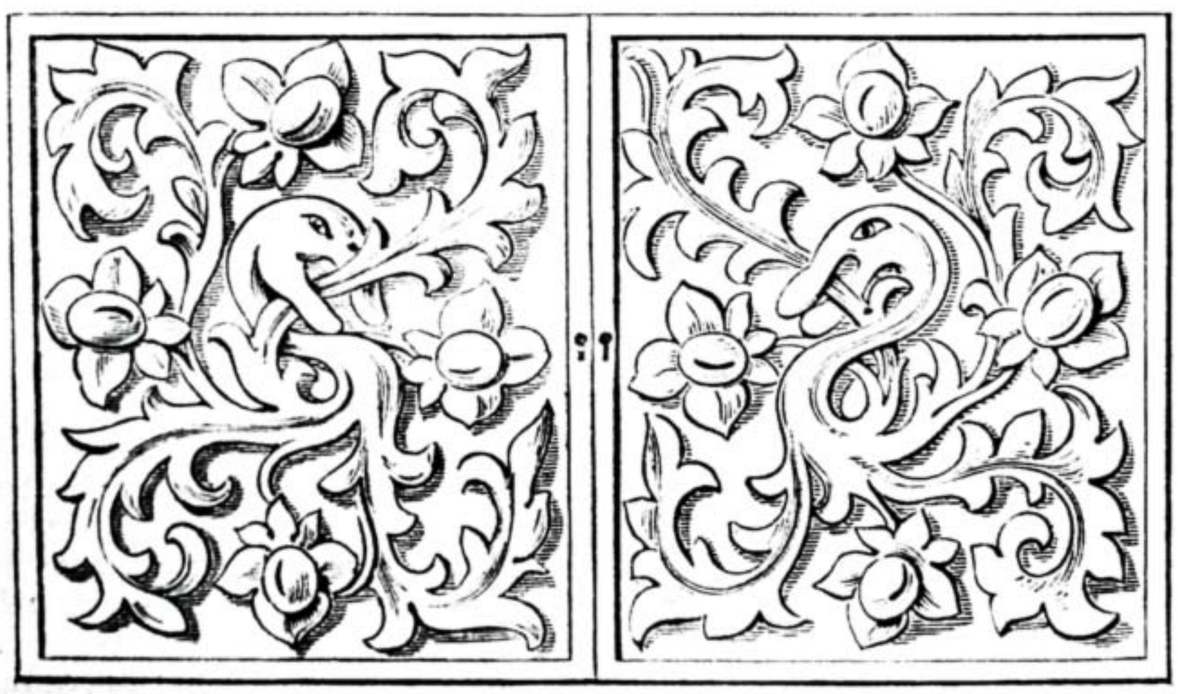


Fig. 3.—Design in Gesso Work for a Pair of Doors for Cabinet.

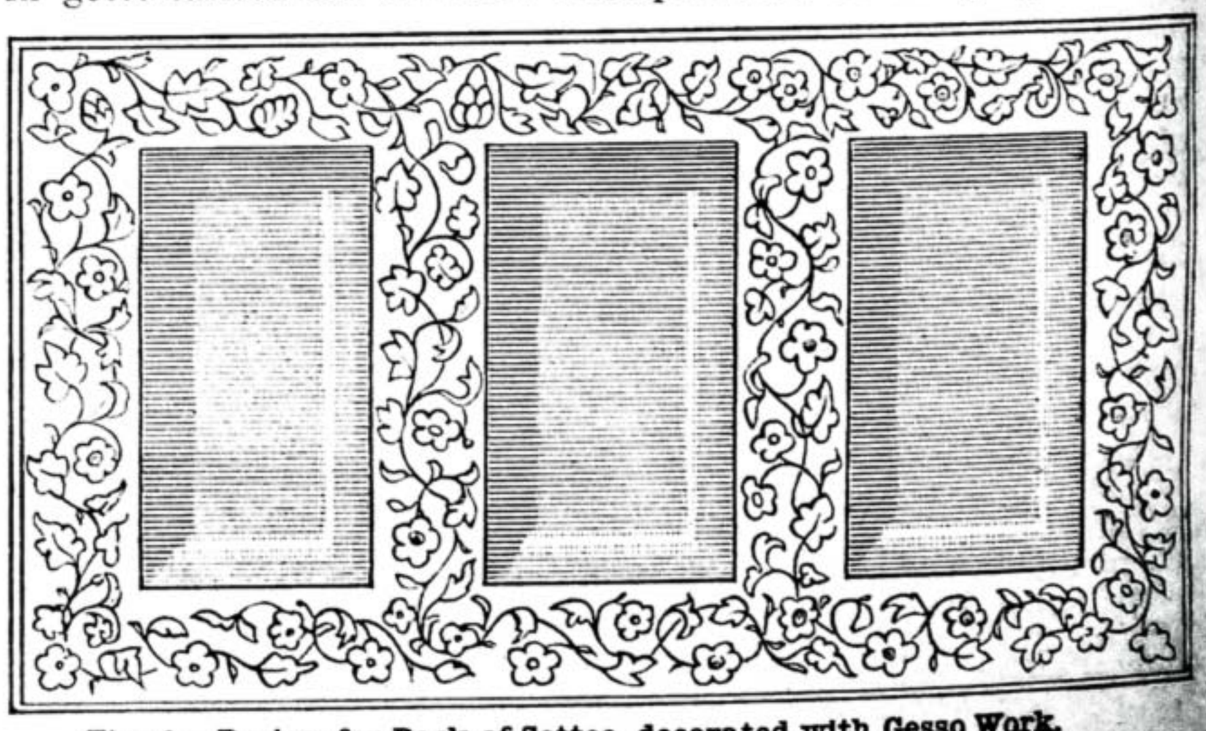


Fig. 4.—Design for Back of Settee, decorated with Gesso Work.

HOME-MADE SQUARES AND CALLIPERS.

BY J. H.

SQUARES.

THE square has much in common with the straight-edge and the surface plate. Like these, a square is made accurately without any reference to an original standard, and to a certain extent the same methods of construction apply to each. Squares are of two forms—the try square (Fig. 3) and the set square (Fig. 2). Each form is made both in wood and in metal, and in almost all possible dimensions.

A square is essentially two straight-edges set at right angles with each other. To test these relations, it is necessary to set the stock or base against an edge known to be straight, and to mark a line along the edge of the blade, or perpendicular. Then, if on reversing the direction in which the stock or base lies, the edge of the blade or perpendicular still coincides with the scribed line, the square is true. If there is any departure from absolute coincidence, half the amount of that departure is the extent to which the square is inaccurate.

To make a square in wood or metal, the first thing is to rough out and straighten the material of the stock and of the blade, and afterwards to work both edges of each perfectly straight, according to the directions given in reference to the making of straight-edges (see p. 500), and then to secure these together firmly and permanently. In the case of wooden squares, thin broad tenons are cut on the blade and fitted neatly into corresponding mortises cut in the stock. Half an inch or more of timber should be left at the end of the end mortise, to be dressed off after the blade or tongue is glued in place. This precaution prevents the splitting out of the end grain by the cutting of the mortise and gluing in of the tenons. While the glue is yet moist the square should be tested, and the blade adjusted thus :—

Select an edge of a drawing or joint board known to be true, and having a clean smooth surface. Lay the stock of the square against that edge, allowing the blade to lie flat upon the surface, and scribe a fine line upon the board exactly along each edge of the blade. Now reverse the direction of the stock (Fig. 1) to the position shown by the dotted lines, and note the coincidence, or otherwise, of the edge of the blade with the lines just scribed. While the glue is yet moist, some very slight adjustment of the blade can be made, so that no subsequent adjustments with the plane need be necessary. Each edge will be thus tried in turn. A steel square is differently made. There are no tenons, but the blade is fitted into a saw kerf cut down into the end of the stock, and when fitted is secured with rivets. The slit is cut with a hack saw, and the blade must therefore be selected, or filed down, to the same thickness as the hack saw, to make a tight fit in the stock. If it is a slack fit it is not likely to remain true for any length of time, as the rivets, though holding the blade in place, are not sufficient to prevent slight disturbance or dislocation of the parts by accidental shocks or falls.

Some slight adjustment of the blade in the stock is possible at the time of making, by following the same method as that employed for a wooden square. The stock should, however, be laid against the edge of a metal marking-off table, or surface plate. First one rivet hole should be drilled, and one rivet inserted to hold the blade pretty firmly; then the blade may be tested and adjusted, and the second rivet hole drilled and the rivet inserted. If the square is small two rivets will be sufficient; if large, three, or even four, will be used. But after two rivets are inserted, no further adjustment of the blade is possible, except that of filing it in a tentative fashion, a necessary practice always when a square, by long service, has become worn more in one locality than another. When filing thus, or in the case of a wooden square, planing, the stock is held against a true edge as already described, and lines marked along the edge of the blade. The linear accuracy will be tested by means of a straight-edge, or by the turning over of the edge of the blade against a line just marked from that edge.

Set squares made in wood or in metal are tested either with a try square, known to be true, or by laying them against the edge of a plate to which a straight-edge is held for the base of the square to lie against. They are then reversed, still being held against the true edge.

Instead of cutting the hypotenuse of a square into some fanciful curve, it is always preferable to give it a definite angle in frequent use, as 45°, or 30° and 60°. A set square may also be utilised as a protractor, by marking out the quadrant into degrees.

Set squares made in wood are apt to warp when of large size. When over 5 in. or 6 in. in length, therefore, they should be grooved and tongued together (Fig. 2). They will then remain true for an indefinite time. The

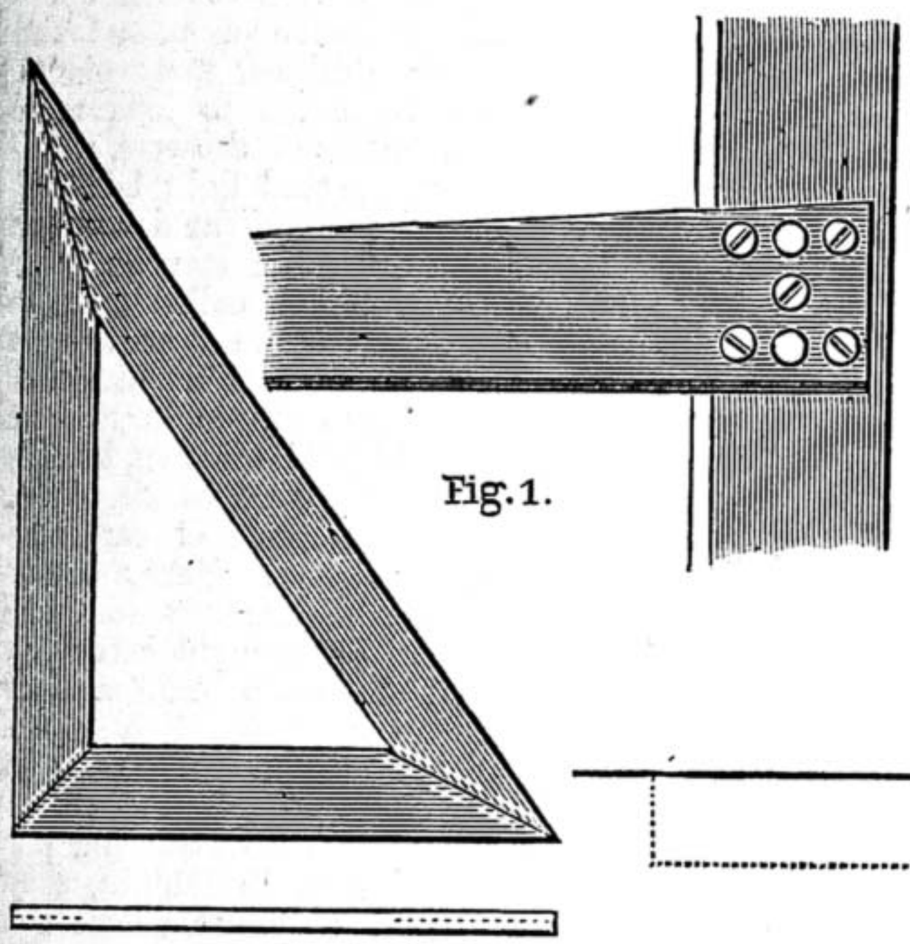


Fig. 1.

Fig. 2.

Fig. 3.

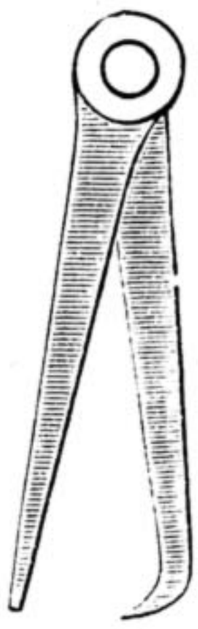


Fig. 4.

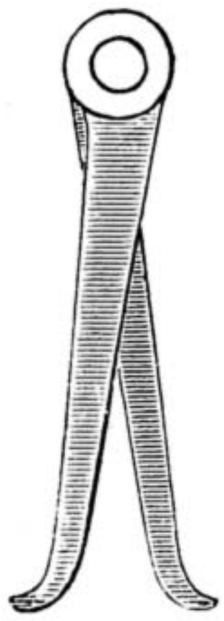


Fig. 5.

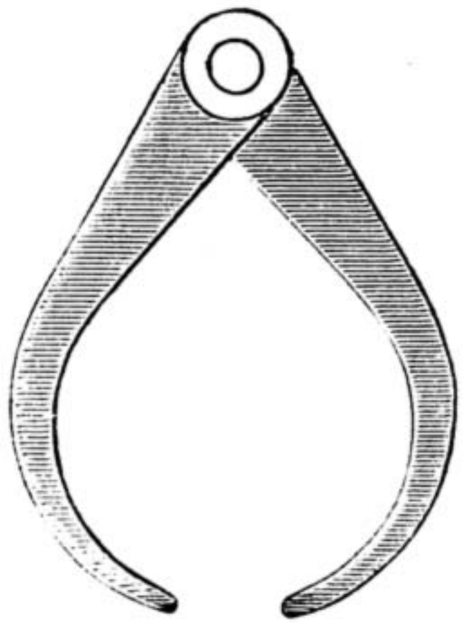


Fig. 6.

Fig. 10.

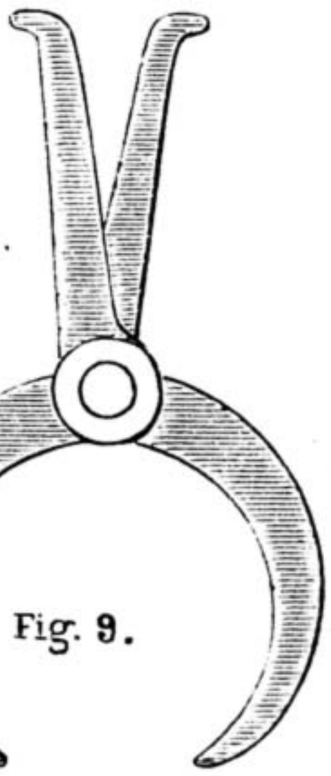


Fig. 9.

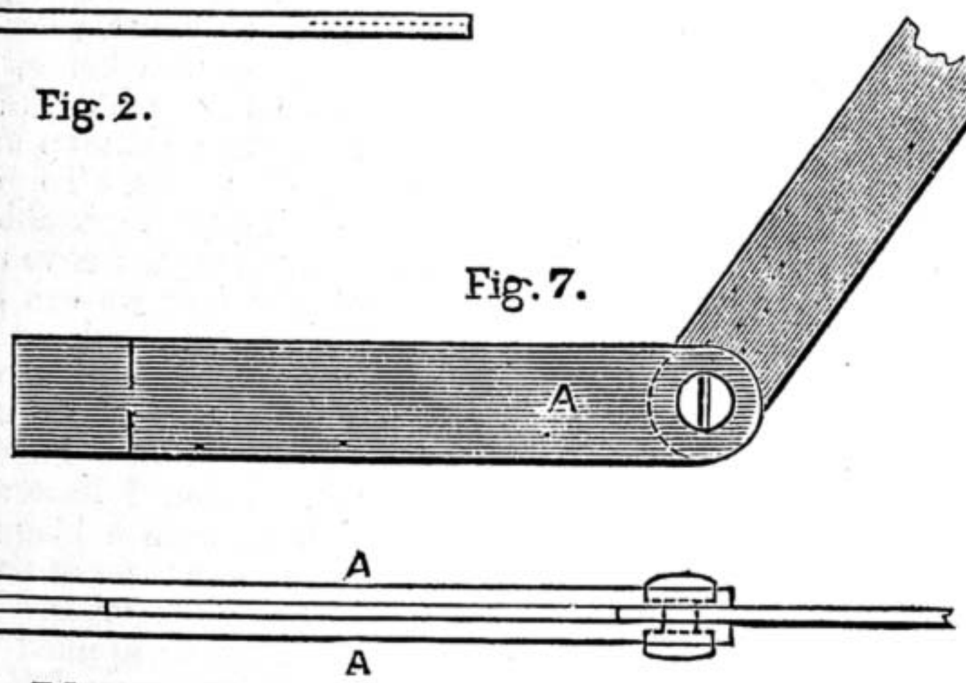


Fig. 7.

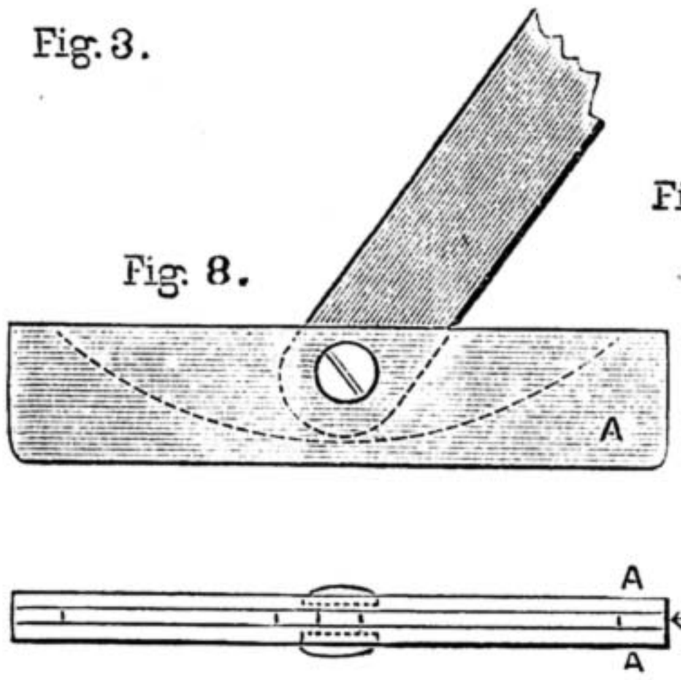


Fig. 8.

Fig. 1.—T Square. Fig. 2.—Set Square. Fig. 3.—Try Square. Fig. 4.—Compass Callipers. Fig. 5.—Internal Callipers. Fig. 6.—External Callipers. Figs. 7 and 8.—Bevels. Fig. 9.—Combination Callipers. Fig. 10.—Section through Rivet.

central portion may be left quite open, or a thin panelling fitted in by tongueing.

Large T squares and bevels are used in workshops for marking out work upon the drawing boards. They are usually made either of mahogany or oak. As the long thin blades are liable to spring, they should be cut out and roughly planed over several months before being finished. Sometimes ebony edges are used. If so, these should be glued on in the rough. The blades of long squares, say those of over 2 ft. in length, are made tapered for purposes of rigidity. One edge only then can be used. The blades are screwed upon the face of the stocks and prevented from dislocation by the insertion of a couple of dowels (Fig. 1). Squares such as these are expensive, yet they can be made very well by a careful workman.

Two useful shop bevels are shown in Figs. 7 and 8, In the case shown in Fig. 8, the stock is formed of two pieces, A A, between which is glued a thickness piece, B, a mere trifle thicker than the blade, and cut to allow the end of the blade to clear when in any position. The three pieces are well glued together and the end of the blade inserted between. The bit hole bored for the screw must be of the exact diameter; if larger, the end of the bevel will slop on the screw.

The other bevel (Fig. 7) is of a rougher type but very servicable in the shop. It consists of two sides, A A, united at one end by the distance piece, B, and receiving the end of the blade at the other, which is pivoted on its screw. If the stock is wide, its side well secured to the distance piece, B, and the screw fitted well into the sides of the stock and the blade, the bevel will be strong and firm.

Callipers.

These tools appear simple enough, and easy to construct and use, yet there are nevertheless some points about them which a workman learns by experience, but which have to be explained to an apprentice. These points are, that the legs should be tolerably free from elasticity, and therefore broad near the joints in proportion to size, thence tapering down towards the ends, that the pins should be large and close-fitting to prevent slop, that the points be slightly spreading, and that callipers should never be forced over the work whose diameter they have to measure, but be simply brought into bare and just perceptible contact therewith.

Is it worth one's while to make callipers? Yes, for more than one reason. A careful apprentice can make better callipers than he can buy, because stiffer and better fitted; and as he wants several pairs, and the material costs a mere trifle, or nothing, there is a saving in doing so. As a matter of fact, all apprentices do make squares, callipers, and scribing blocks, because they like to do so, and are proud of them ever afterwards, and because they afford good practice in their particular handicraft.

Four pairs of callipers are shown: Fig. 6 external, Fig. 5 internal, Fig. 4 compass, and Fig. 9 combination callipers. Only, or chiefly, in the matter of outline do these differ, and therefore a description of the method of making the first will suffice for all.

The blades of callipers can be drawn down from any bit of steel and bent, or they may be cut from steel sheet, the outlines being marked thereon, and centre popped, the severance being effected either by means of a cold chisel, or by the drilling of contiguous holes. This will have the effect of curving and twisting the legs out of shape, and they will accordingly have then to be levelled by means of a hammer upon a plate of metal. After this will follow the filing of the flat faces smooth, the legs being steadied with nails driven at intervals along their edges into a piece of board, as in the filing of the flat faces of straight-edges. Afterwards the outlines will be finished with files and emery cloth, and the legs are ready to be pivoted.

The holes will be drilled, and the rivets and the washers turned and drilled in the lathe. The rivets must fit closely into the holes in both legs and washers (Fig. 10), as there must be no slop in the mutual fitting of these. The rivetting over will be done with the cross pane of a small hammer. Then the semicircular ends of the legs will be filed round flush with the edge of the washer, and the battered ends of the rivets smoothed over with the file and emery cloth.

Observe with regard to the slight spreading of the points that they are thereby less liable to get diagonally across the work than if they are not thus spread. This very slight spreading out becomes to the delicate touch of a careful workman a sufficient indication of the square embracing of the work by the calliper legs. For some special purposes the points are spread to the extent of ¼ in. or more, but not so for common use.

A CHAT WITH FRENCH POLISHERS.

BY "LIFE-BOAT."

French polishing and spirit varnishing, or both in combination, is an art whereby our household furniture and thousands of other things are covered with a lac solution, the object being to give them a polished mirror-like surface. By it the beauty and figure of the various woods are brought out and shown to the best advantage. If we paint them, the figure and beauty of the wood are hid, the article is given a lifeless look, and to a great extent the cabinet-maker's skill has been so much labour in vain. If we leave it alone, we have the appearance of an unfinished, unsaleable article, on which dust and finger-marks will soon accumulate, giving to the same a dirty, loathsome appearance, unless we, like Hollanders, content ourselves with making our household goods strong, massive, and plain, on which the good housewife might use the scrubbing-brush with impunity.

A good polisher who knows his business can stain and match the various pieces of sappy or common woods which, unfortunately, sometimes find a place in our furniture to match its surroundings. The amateur carpenter of to-day, who is having such capital lessons in our pages from the able pens and designs of David Adamson, Alexander Martin, J. W. Gleeson-White, and other able writers, may not be possessed of the needful cash wherewith to buy solid mahogany or walnut, nor yet be an expert at laying on veneers; he may find it to his advantage to do as others have done before him—use the mahogany or walnut at the front, deal or pine for the sides, back, or inside fittings of his cupboard, cabinet, or other article he may be making. To him, a knowledge of how to stain his inferior wood in such a way as to match his best woods may be useful.

True, there are some persons who lay claim to good taste who strongly object to staining, on the ground that things are not what they seem; but as these pages are printed for the British workman—amateur or professional—and they have been educated up to the use of finished articles, stained or not stained, I repeat, a knowledge of how to stain and match various woods cannot but be useful. It is not for me now to tell you how best this can be done—the Editor has kindly promised that this shall be done by other and, I trust, more able pens than mine; suffice for the time that I chat with you on other interesting phrases. To return: The gold incisions to be seen on much of the furniture of to-day gives to the articles thus treated a richer and more artistic appearance. Even these I have seen improved upon by staining inside of two gold lines—say, ¼ in. apart—in imitation of some darker or black wood, thus giving an appearance of inlay; and by suitable stencils, designs, and colours, many articles can be made to look more artistic. Note the chests of drawers, wardrobes, etc., of pitch-pine and light bedroom furniture generally. Most of the decoration of these is done by the aid of stencils.

The polisher of to-day is called upon to do many ticklish jobs. It is not enough for him to be able to put a clear bright polish on anything that may be brought to him. He must, if he would hold his own, be able to match the various coloured woods, giving to the whole an appearance of carefully-selected and joined veneers. Here a knowledge of how to use chemicals, stains, and dyed polishes must be brought into play. Some parts must be made darker, dark parts may have to be made lighter, oak may have to be treated so as to present an appearance of age.

Here I cannot refrain from quoting portions of a lecture given in Dublin, some time ago, by Mr. T. R. Scott, whose able pen puts the subject so well before us:—"It requires some considerable skill and manipulation to turn out a genuine antique 120 years old inside six weeks. To get real good polishing is simply impossible. Of course, others as well as myself have to content ourselves with the best we can get for the want of better; but there is no reason why a better state of things should not be achieved. In my experience, I have come across very few polishers who know anything of chemistry. When I have spoken to them of this, I have seen a bland smile stealing over their countenances at the bare thought of their being chemists. But a knowledge of chemistry, as applied to the preparation of polishing materials, is a desirable advantage to the possessor. They ought to know all about the raw materials, where they come from, whether they are mineral or vegetable substances, how the colours are prepared and extracted for the market, and how these stains, dyes, or polishes are made. In this particular branch our French neighbours are ahead of us; indeed it is, and has been, the admiration of us Britishers to see the beautiful ebonistic work of Paris; and why our polishers should not be able to produce as good work as our Continental neighbours I cannot tell."

The unvarnished and unpainted oak fittings of stables have been noticed to change from their light colour to a rich brown. Observant minds have traced this result to ammoniacal fumes. Acting on this principle, many oak articles are given an appearance of age, or enriched in colour, by shutting them up for a time in a cupboard or air-tight box, on the bottom of which has been placed an open dish of liquid ammonia. Failing the acquisition of a suitable

cupboard in which to do this, chemistry again comes to our aid, and tells us we can get a like result by wiping over with a solution of bichromate of potash, common soda, or even lime-water. Not alone is this useful for oak, but, by careful management, common bay wood or plain mahogany can, by the aid of these and dyed polishes, be made to look equal in colour, etc., to Spanish mahogany.

The coloured stringings, or inlays, found round ladies' work-boxes or on writing-desks, with their many-coloured woods, are not all real. No: the polisher and chemistry have been called upon to play their respective parts; and I have seen musical-boxes, etc., with imitation pearl inlays and stringing, which has been simply bird's-eye maple dyed green, verdigris and vinegar being mostly used for this. And yet, again, it is possible some of you may be able (as is now often done) to paint flowers, birds, etc., on the panels of doors; or, failing one's ability to do this, it is possible to get transfers that look exceedingly well when polished over; or one may even cut out birds, flowers, and such-like from thin paper, and fasten them to the work with thin polish or varnish, giving them, when dry, a coat of white hard varnish, which can be polished, first taking the precaution of sizing the pictures with isinglass.

And here let me advise the embryo polisher, when getting his polishes, gums, etc., to get the best. They are far more satisfactory in the end. There is less waste, they work easier, and give far the best results.

One could but wish most heartily for a return of the good old times of polishing, when the work was done with small rubbers and small circular motion; when "patent fillers" and piece-work at low prices were almost unknown. I ofttimes meet with work now that was done at least twenty years, and some over fifty years, ago, which will put much to shame that has been done by my fellow-countrymen and women and Continental brethren only six months. Especially is this the case of some German goods, which, even in this short time, is covered all over with a greasy, sticky substance and cracked fretful surface, which, in nine cases out of ten, has been brought about by the use of patent filling and adulterated spirits and gums, or a too lavish use of oil. I do not mean to say our Continental friends are alone in this—far from it. I have seen work which has left the polisher's hands only a few weeks running with oil—or, as a master polisher remarked to me, "It's running after the fellows as put it on as fast as it can go." I have seen other work all blister up directly the sun shone on it, from the simple reason that resin had played a too conspicuous part in the preparation of the polish and varnish used.

Do not, for one moment, think that I mean to suggest that good polishing cannot be got for love or money. Give a good polisher a reasonable price for his labour, and then, if he is honest and true to himself, he will give a resultant polish that will bear future inspection.

On the point of brilliancy and transparent polish, *some* of our Continental brethren gain the day. They dispense with the use of fillers, using their polish very thin, and fine pumice pounced on in lieu of these; and, as they work longer—or, more correctly, more hours for a day's work—and receive less wages, they give us a polish we can but admire and envy.

This, then, in conclusion, is the cardinal point I wish to impress on your minds: If you wish to turn out work that shall bear future inspection, use the best of materials, have a clean, warm work-room, be sparing in the use of oil, and unsparing with your patience and labour.

WHY MY GAS-ENGINE WON'T GO.

BY F. A. M.

IGNITION OF GAS-ENGINES—IGNITION VALVE—FLAP VALVE—AIR INLET VALVE—SLIDE VALVE—ACTION OF SLIDE VALVE—CASTINGS: WHERE TO GET THEM—PRESSURE OF GAS ON GAS-ENGINES—HOW TO TEST PRESSURE—OTTO GAS-ENGINE.

IT is usually through failure of the ignition that small gas-engines will not go. At Fig. 1 is a drawing of the arrangement for the ignition of the model gas-engine, which has succeeded very well. C is the section of the side of the cylinder, and P is the piston. On the side of the cylinder is cast a round boss, through which is bored a $\frac{1}{2}$-in. hole, so placed that the piston, as it rises, will uncover the hole before reaching the middle of its stroke (see Fig. 1). Into this hole is fitted a kind of gland of brass, the shoulder of which is ground to fit against the boss, and held in close contact by two screws. The gland piece, G, contains the ignition orifice $\frac{3}{16}$ to $\frac{1}{4}$ in. in diameter, and over the inside of the hole hangs a light steel disc as thick as a threepenny piece; this is the ignition valve, V. The inner surface of G is cut slanting, because the object is to make it easy for the flame to get in, and also because there is no doubt of the closing of so light a door by the force of the explosion; the valve then is hung loosely upon a tiny screw, in such a way that it can open a passage underneath it at least $\frac{1}{8}$ in. wide, but not so wide as to touch the piston. In working, it slams to with some force, enough to slightly bruise the surface of G. These two surfaces must, of course, be carefully filed flat, and slightly ground, to make a good fit. Although the valve shuts so quickly, it is not quick enough to prevent a sudden puff getting out, and meeting the igniting flame, I, which is instantly extinguished. To provide for this, the relighting jet, R, is placed underneath, out of reach of the explosion; it strikes across the path of the horizontal igniting jet, and relights it before the eye can see it has been put out. It is possible that if the flame, R, were brought close to the face of G, the flame, I, might not be required; but the ignition is a ticklish thing, and requires every advantage. The flame, I, requires to play pretty strongly against the outside of G, in such a way that no air, but only flame, can be drawn in; if air were drawn in, it would dilute the explosive mixture round the valve inside, and prevent any explosion. Finding that the shutting of the room door would often produce a draught sufficient to deflect the flame, I, and prevent explosion, the sheath, S, was added; this is simply a bit of sheet brass, doubled round to form a cylinder, and sprung on to G; this cylinder has a hole cut through it for the jet, R. The drawing sent with the castings of the model gas-engine showed the ignition orifice $\frac{1}{8}$ in. in diameter, but, suspecting this was too small, I held a plate, having in it holes of different sizes, over a gas flame, when I found the flame would not pass through a hole $\frac{1}{8}$ in. in diameter. It is no wonder gas-engines will not work if the ignition orifice is too small. The flame would pass easily through a $\frac{1}{4}$-in. hole, and less easily through a hole $\frac{3}{16}$ in. in diameter. However small then a gas-engine may be, the ignition orifice must not be less than $\frac{3}{16}$ in. in diameter, and it need never be larger than $\frac{1}{4}$ in., however large the engine may be. The little tap at B is obtainable at the gas-fitters', and is called a "pipe light." The piece, X, is a kind of "cross" made of a bit of brass rod; it screws into the foundation of the cylinder.

This engine is so small I did not find any gas-bag was needed on the pipe which supplies the cylinder, but as the lights, I and R, were supplied from the same source, and close to the intake valve, they used to bob up and down at every stroke when the lights in the room were quite steady. I found a small gas-bag 3 in. in diameter, on the pipe supplying X, sufficient to stop that mischief.

One other caution is needed with regard to the ignition valve. The slightest amount of oil, paraffin, or even of moisture, which may get under the ignition valve, is sufficient to stick it down, and, of course, stop the engine. In first lighting up, the engine being cold and the flame playing upon G, some drops of moisture may appear, and the valve, V, may be bedewed; that would be quite sufficient to overcome the very small suction in the cylinder; the valve, V, being open to begin with, the engine will give one stroke, the valve will slam to, and the moisture will prevent its lifting again. Insert a bit of wire into the hole of G, and feel the valve whether it is slightly adhering to the face; if it be only moisture, the ignition flame will dry it up before long; if the paste with which the cylinder was lubricated was applied too abundantly, some of that may have got under the valve; in that case it would be better to unfix the screws and take out G, with the valve attached, to wipe it clean.

These particulars will show why it is some fail to get their gas-engines to work, and why they are considered uncertain in action.

The flap valve over the gas inlet needs no further remark than that it is like the ignition valve: it prevents the force of the explosion from driving the burnt gas up the gas inlet; this valve is sometimes made of indiarubber, but as it is almost constantly surrounded by gas, this is not a good plan, since gas perishes the rubber. It does not so much injure the gas-bag, still it is well, on stopping work, to press out any remaining gas from it with the hand.

The air inlet valve may be simply a circle of holes covered with a disc of indiarubber: sheet indiarubber for making it can be got from the ironmonger.

The slide valve is different from that of a steam-engine in two respects; and, as my object is chiefly to describe those points of which those who understand the steam-engine may be supposed to be ignorant, I give in Fig. 2 a sketch of a slide valve suitable for a gas-engine. It is, as will be seen, a piston valve; it has the advantage of being balanced, that is, it is not affected by the pressure of the gases which it guides and distributes; they cannot, by their pressure, however great, force it up to the face on which it works; neither does the pressure of the gases tend to move it endways, or to retard its movement. In Fig. 2, C is the cylinder of the gas-engine; D D is a casting containing the piston valve, S; P is the port or opening to the cylinder; A is the air inlet; and *g*, where the dotted circle appears, is the gas inlet; *e* is the exhaust port in the valve

leading to the exhaust orifice, E, into which the exhaust pipe is screwed. The second point of difference with the engine slide valve is that the gas-engine piston valve is arranged for a single-acting engine. It appears in Fig. 2 as in the middle of its stroke. If the dotted circle represents the path of the eccentric, then *a* will be the position of the eccentric, corresponding to the position of the valve: the piston being at the bottom of the cylinder ready to begin the "up" stroke; turning the wheel raises the piston and moves the valve to the right, the eccentric going towards *b*; as soon as the valve moves, the small part, *p*, comes opposite A, *g*, and P, and makes a clear passage for the air and gas to be drawn into the cylinder; just before the eccentric reaches *b*, the explosion should take place, the piston valve being fully open; the flap valve in the gas inlet, and the india-rubber valve in the air inlet, immediately close, as also does the ignition valve, and confine the pressure within the cylinder. While the piston is being driven up to the top of its stroke, the piston valve is closing, and is not shut until the eccentric reaches the point *c*, half round the circle. The valve is now again in its first position, but, as the piston begins to descend, the eccentric moves on towards *d*, and the edge of port *e* opens P to the exhaust, to allow the cylinderful of burnt gas to escape; port *e* remains open during the down stroke, as port *p* does during the up stroke. Placing the piston valve under the cylinder is convenient, though it involves mitre gear and a side shaft; the plan is, I believe, part of the patent of Mr. J. F. Barker (late Dorrington), from whom I obtained the castings of my model gas-engine; it is not at all necessary to have the piston valve in that position; it may be placed parallel with the cylinder, and then the eccentric can drive it direct as in the steam-engine.

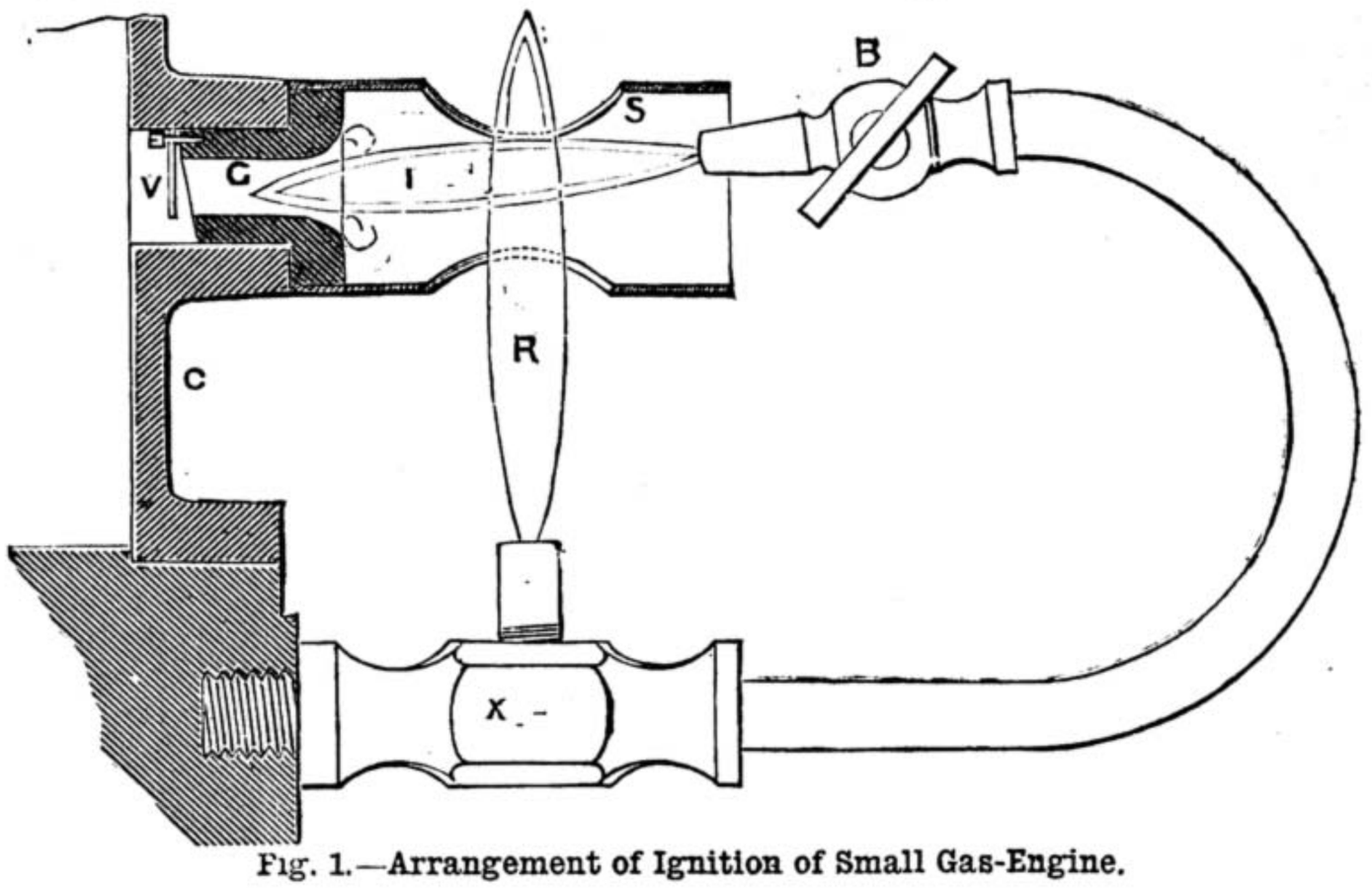


Fig. 1.—Arrangement of Ignition of Small Gas-Engine.

I found Mr. Barker's castings were very soft and easy to work, being perfectly free from hard scale; his address is 15, Dryden Street, Plymouth Grove, Manchester. He supplies castings of a half-man, one-man, two-men power, and other sizes of gas-engines. Were I going to make a one-man power engine, I should get the castings from F. Knoeferl, 100, Bolsover Street, Portland Place, W.; he offers them planed, and cylinder, fly-wheel, and crank, turned, for £5.

The model gas-engine, with cylinder 1½ in. in diameter and 4-in. stroke, can hardly be said to have any power; it might be strong enough to drive a light-running sewing-machine, but the least irregularity in working would cause it to stop; it would drive a fan or a tiny pump. The half-man engine has a 3-in. cylinder. I have not seen it at work; it should drive a sewing-machine, fret saw, overhead motion, etc. The one-man engine will drive a lathe as well as a man at least. These little engines are certainly unpleasant companions in a room or workshop; they smell and they thump. Still, a good stone foundation will lessen the noise, and a chimney over the ignition flame, or, better still, over the whole engine, will carry off the smell. I have not yet tried a governor, but I believe it improves the working of a small gas-engine very much.

I must now mention another possible cause of failure: it has nothing to do with the engine this time, but it caused me more perplexity than anything else. There were times when the engine seemed all right, yet it would not go. I have left it "till to-morrow," but, on the morrow, it would go off perfectly. At last, I discovered that when the gas was lighted in the house the engine would cease to work; this gave the clue: our gas main is rather too small, and when we light up, the pressure falls, and the ignition jet does not impinge with sufficient force upon the ignition orifice.

The pressure of gas can very easily be tested with a bit of bent glass pipe. Get a piece from the chemist, of a size that you can fit on to it your rubber tube; it may be bent like a U, with legs five inches long or more; pour a little water into the bend so as to fill half way up the legs, and fix the pipe upright on a board with wire or against the wall; the water will now stand level in the two legs, and you can mark its position on the board; now fit the indiarubber tube from the gas on to the top of one of the legs, leaving the other open to the air; when the gas is turned on, it will press down the water in one leg and force it up in the other; the difference of height measured vertically, in tenths of an inch, shows the pressure of the gas in height of water. In my own case, the gas is supplied at the works at a pressure of $\frac{15}{10}$ths, or 1½ in. of water, and this pressure is increased by its ascent from the works to this house to $\frac{24}{10}$ths.; but, in the evening, when the gas lights are turned on, the pressure falls to $\frac{17}{10}$ths.

The disagreeables connected with gas-engines, as mentioned above, do not refer to "compression" engines. The little "Otto" is a most beautiful little thing, working merrily away without more noise than a steam-engine, and practically free from smell; it is, naturally, more expensive than the simpler engines, and covered by several patents, besides being far more difficult of construction.

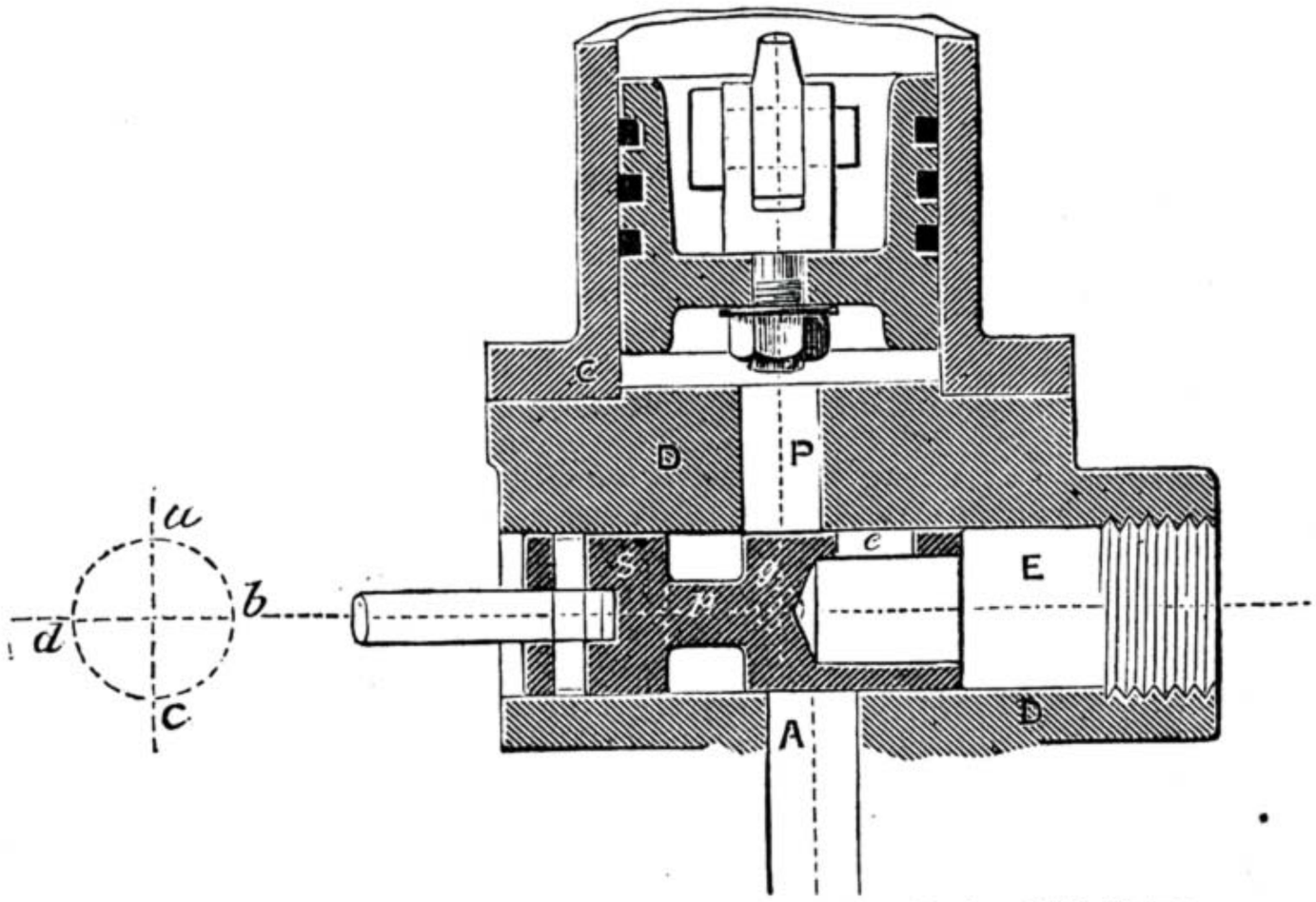


Fig. 2.—Sectional Diagram showing Action of Gas-Engine Slide Valve.

OUR PRIZE BOOKCASES.

II.—A Revolving Bookcase.

For which the Second Prize was awarded.

In a leading article which appeared a short while since in the *Times*, it was remarked "that the multiplication of good and cheap books, such as the masterpieces collected in 'Cassell's National Library,' has had a most powerful effect on the reading of multitudes of workmen, who now show an even greater interest in the problems of literature than in the problems of science." That such an effect has been produced by the publication of this library is a matter for general satisfaction.

It is, perhaps, well known that, at the end of last year, the number of the volumes of this particular series reached two hundred and eight. For those who are ignorant of the sizes, etc., of the books, I may refer them to the announcement of the prize competition in most numbers of Work from No. 16 to No. 23 inclusive.

The bookcase here shown is designed especially to form a repository for the two hundred and eight volumes, and will form both a handy and appropriate article. It will stand with equal effect in the middle of a room, against a wall, in a corner, or, what is better still, in a bay window. In either case, the whole of the books can be turned round, so that a person sitting at it has no need to rise from his seat to obtain a volume

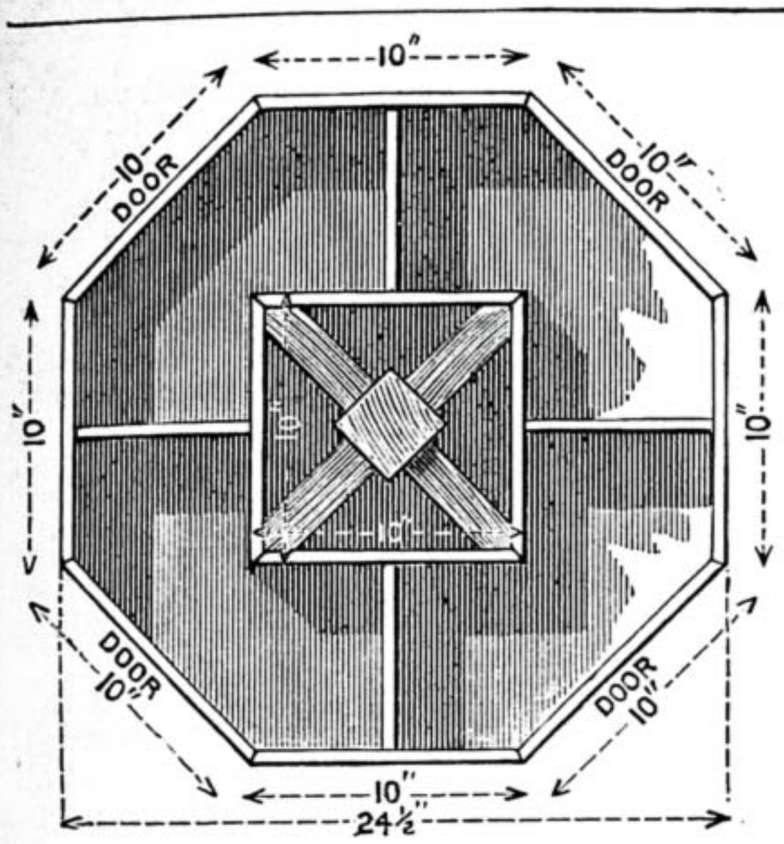


Fig. 3.

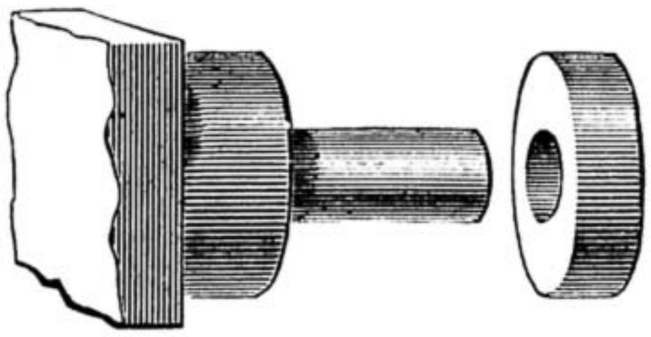


Fig. 6.

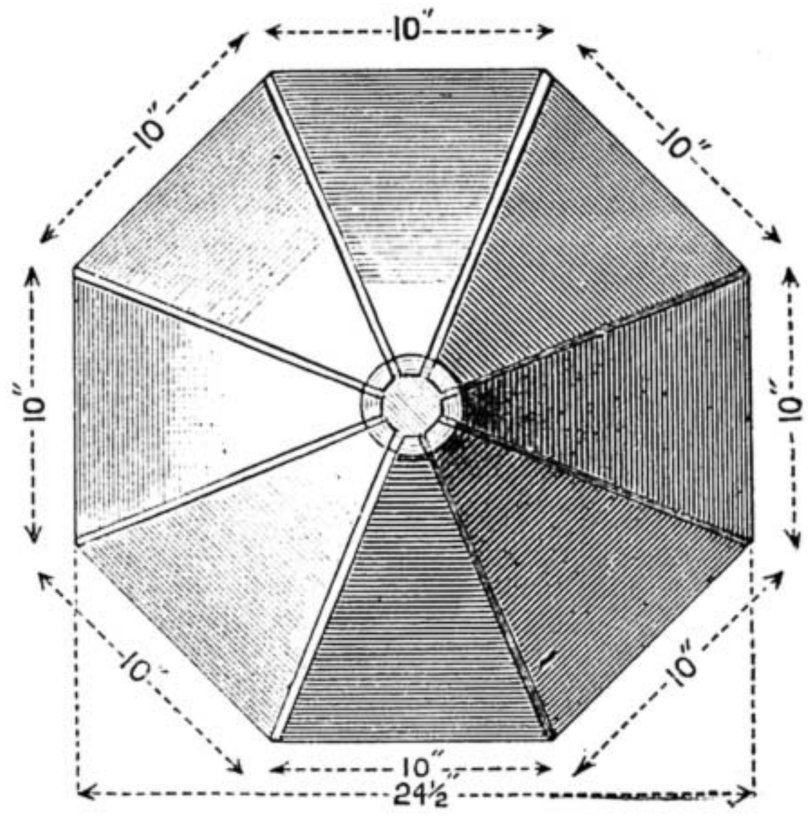


Fig. 4.

which may then be on the other side of the case. I have shown it with castors as well, for moving the whole article from place to place; but, personally, I should not fit it with them, as, when the top part is being moved round, the bottom part will thus become unsteady.

A few hints as to wood, etc., may be acceptable, although it is really a matter of individual choice. In considering the material with which it is preferable to build up any particular article of furniture, the effect to be produced by light and shade should always be studied. Where there is much shaping, and the article is of an open character, dark wood is the best; but, where there are flat sides—as in the present design—and the job has a square appearance, light wood produces the best lights and shadows. Now, I think that if the present design were built up in oak, satin-wood, or some other

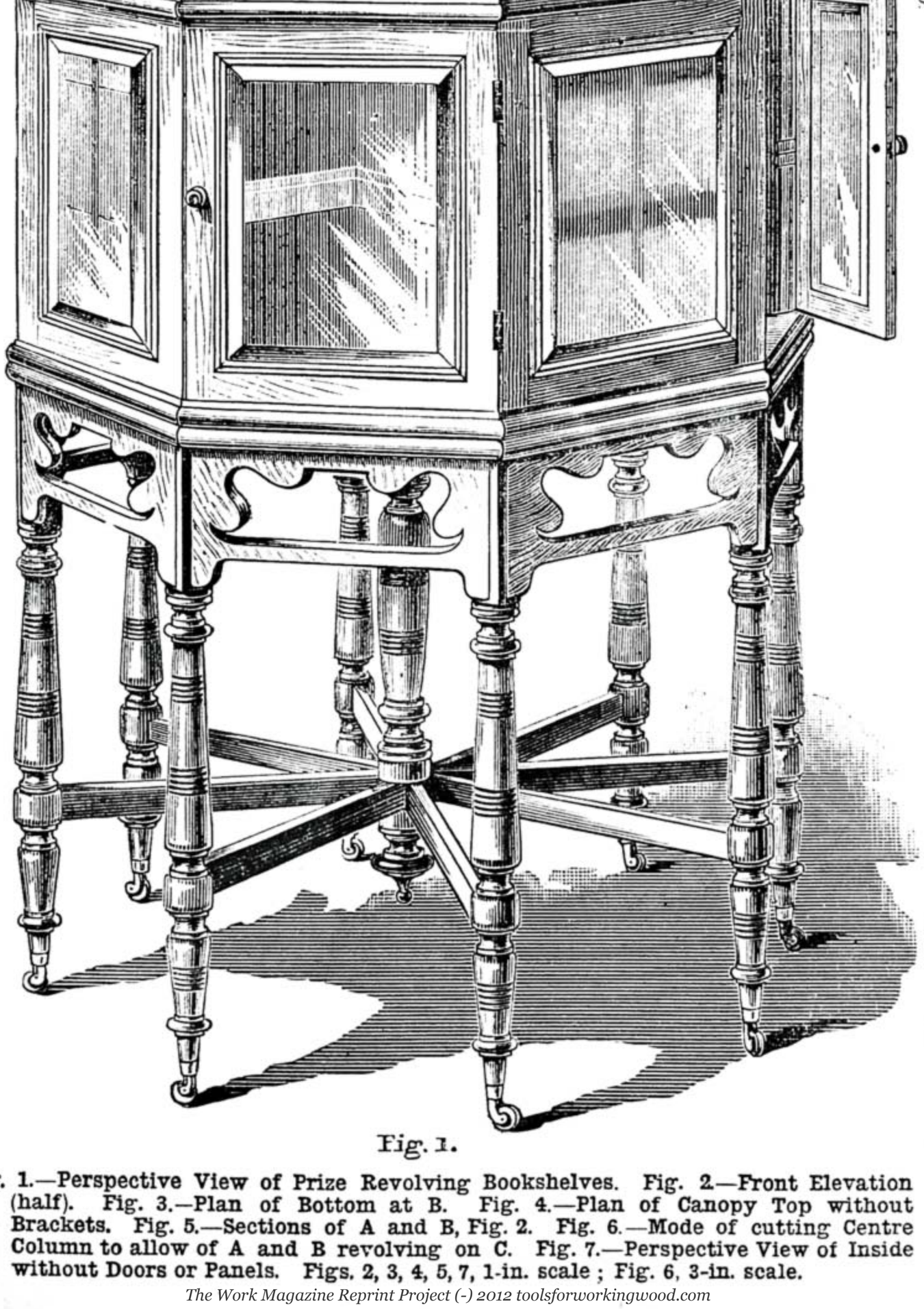


Fig. 1.

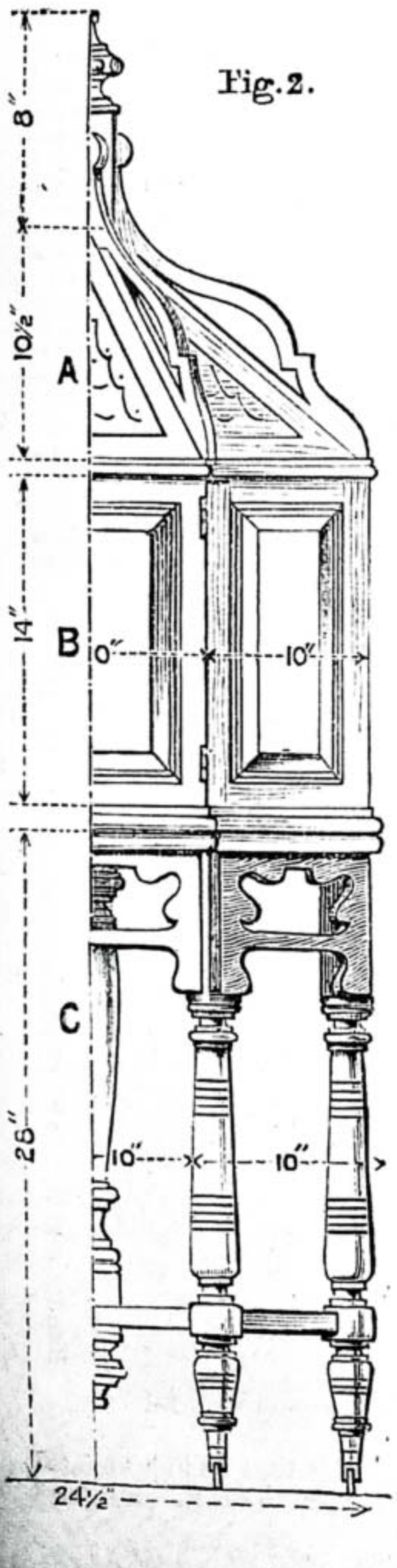


Fig. 2.

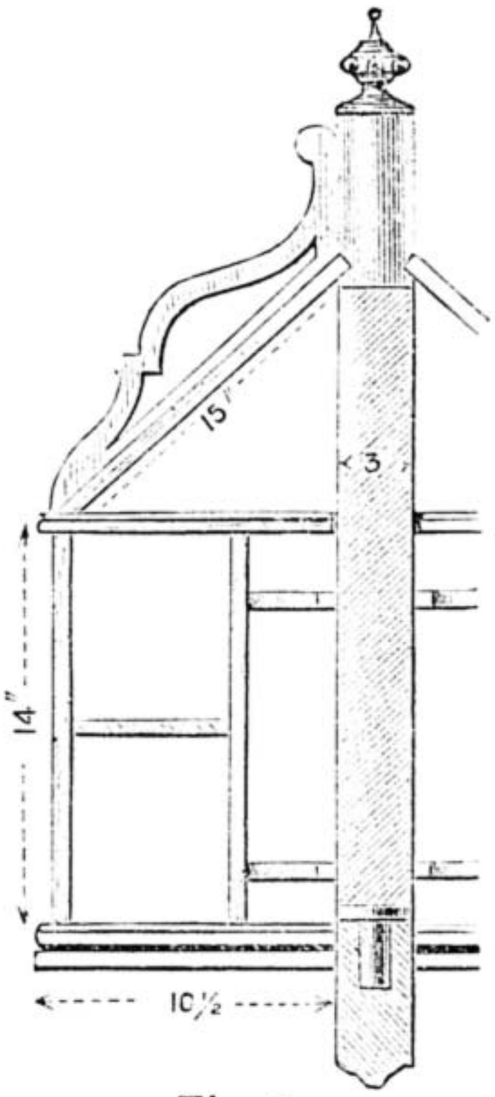


Fig. 5.

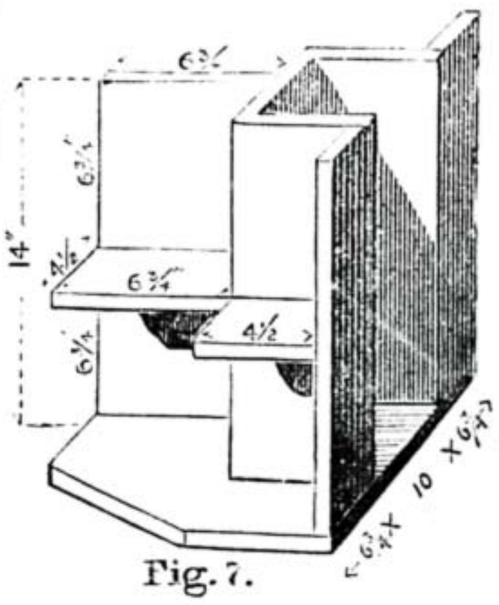


Fig. 7.

Fig. 1.—Perspective View of Prize Revolving Bookshelves. Fig. 2.—Front Elevation (half). Fig. 3.—Plan of Bottom at B. Fig. 4.—Plan of Canopy Top without Brackets. Fig. 5.—Sections of A and B, Fig. 2. Fig. 6.—Mode of cutting Centre Column to allow of A and B revolving on C. Fig. 7.—Perspective View of Inside without Doors or Panels. Figs. 2, 3, 4, 5, 7, 1-in. scale; Fig. 6, 3-in. scale.

good and light wood, with rosewood or mahogany top brackets, pillars, and door and other mouldings, a very effective article should result from the combination; for it must be remembered that, if the doors are glazed with clear glass, the deep shadows inside them will contrast with the lighter shadows on the outside, and the colour of the books will add a warmth to the cooling effects of the light wood. I trust I shall be forgiven if these few remarks are similar to any I have said or shall say; but, in a design of this kind, although strength and accommodation must be considered first, the appearance of the finished article must not be forgotten. Of course, the inside could be made of stained deal.

There are nine pillars supporting the top part, and, as the job is comparatively small, they will come rather close together; but this will add to the effect, and although not entirely necessary for the purpose of strength, I should not advise a less number to be used.

The sizes of this bookcase are: Extreme height, 5 ft. 1½ in.; extreme width, a little more than 2 ft. Taking the top, bottom, and middle boards first, it will be necessary to cut each as an octagon, each side of which shall be about 10¼ in. long. These boards might be ¾ in. thick, but, if they are not quite so thick, they will answer the purpose just as well. As good a method as any to obtain the octagon will be to have a board 25 in. square, and draw two lines upon it so that they cross one another in the middle of the board, and the ends of them are in the middle of each side; then measure off 5⅛ in. each side of the point where the lines meet the edges of the board, and draw a line across each corner, so that it meets the points indicated after the above measurements are marked out.

The inside carcass should next be fitted up. Four boards, each 14 in. long and 10 in. wide, are fixed as shown in Fig. 7. To these, one on each side, and connected perpendicularly, are four other boards, each 14 in. long and 6¾ in. wide. In each angle formed by these boards, and at an equal distance from top and bottom, are small shelves, four in number, each 6¾ in. long and 4½ in. wide. All the inside boards might be ½ in. thick.

Through the centre of the top, bottom, and middle boards must be a hole 2 in. or 3 in. in diameter, according to the stoutness the centre column is desired to be. The centre turned column enters a square column which runs up the inside of the space formed by the four middle carcass boards (see Fig. 5), and which has another pillar joined to it at the top, which pillar is the one that can be seen in Fig. 1, to which the top brackets are joined. The square centre column is kept firm by means of eight pieces, of which one end of each is joined to the angles formed by the four middle boards. Four of these last-named pieces are fitted a few inches from the top of the space, the other four being fitted at a similar distance from the bottom. The turned centre column is cut right through just above where it penetrates the bottom and middle boards, an iron or wooden pin being driven into the top part of it, and fitting loosely into the bottom part, which has been prepared to receive it (Fig. 5). This is the means by which it revolves, and, if all parts are properly fitted and strongly joined together, it should be sufficient for the purpose; but I will give particulars of a method to facilitate a freer movement: Four or six thin long rollers of either wood or metal might be fitted under the middle board by means of a pivot passing through each of them, the ends of it being turned up and fastened to the middle board. The pivots through these rollers must fit neither too tightly nor too loosely, as, in case of their doing so, they will be an impediment rather than an assistance. If these rollers cause much of an opening between the bottom and middle boards, add a deeper moulding round one of them, or else fasten some fine fretwork to one of them.

It will be found that the canopy top will necessitate much labour, and, if it is desired that less labour should be spent upon it, have the top quite flat, with the brackets coming right in contact with the centre column. This will give room for any ornaments to be stood upon it, but I should say, *have the canopy*, as its appearance will compensate for the extra labour, and also the loss of the display of any ornaments. For this canopy eight boards are required; each should be 15 in. long and 9½ in. wide at one end, tapering down to a point at the other end. Eight brackets, each 15 in. long, are also required. The canopy boards and these brackets can be connected by numerous methods. If, after the boards are joined, the outside sloping edges are planed down a little, the under parts of the brackets can be glued to these edges. Another method is to cut the bottoms of the brackets, so that in section they come to a point, and then to cant the edges of the boards inwards, thus forming, when the boards are put together, a triangular groove, into which the bottoms of the brackets fit.

The top centre column will be about 20 in. extreme length, and, of course, the backs of the brackets can fit it in a similar manner to that adopted in fitting them to the canopy boards.

The pillars now claim our attention. I should certainly advise having them not too stout. I think that, if they are turned from 1¼ in. or 1½ in. wood, they will be quite strong enough. The length of them will be 27 in. In fitting them to the bottom board, do not have any side of the blocks come full with the edges of the bottom board, but have a corner of each block pointing to a corner of the board, while each side of the block runs at an equal distance from the corresponding sides of the octagon. Shaped pieces fitted between these pillars will look much better than spindles. The outside pillars are joined to the middle column by means of eight rails, each about 1 in. deep and ¾ in. thick.

The doors and fixed sides come next. There is no need to have any pilasters to run the doors on. The fixed sides and the doors are all the same size, so that it is only necessary to describe one door. This will be 14 in. long and 10 in. wide. The stiles should not be more than 1¼ in. wide. All the side edges of the doors and fixed parts will have to be canted a little to allow one to fit properly against another to obtain the form of the octagon. Clear glass might adorn all doors, etc., or only the doors, while the fixed sides are fitted with inlaid or carved panels. I should certainly say, do not have the doors fitted with either silvered glass or wooden panels, as a lot of the effects of light and shadow will, in that case, be lost, in addition to the heavy appearance it would thus present.

In the above I have given only the bare measurements, and allowance must be made according to the various methods adopted in putting the parts together.

A moulding should either be worked round the edges of the top, bottom, and middle boards, or else one should be glued round them. Along the front of each shelf place some embossed or painted leather.

It will, without doubt, be noticed that, when each of the four doors is opened, four shelves of books, with thirteen volumes in each row, will be exposed; and that the corner space between these answers the purpose of a shelf where one volume can be placed while reference is being made to another.

Fig. 1 is not drawn to scale. All other diagrams, excepting Fig. 6 (which is to 3 in. scale) are drawn to 1 in. scale — that is, 1 in. represents 1 ft.

I trust that enough has now been said concerning this case for the volumes resulting from—as the *Athenæum* says—"*the greatest publishing feat of the last quarter of a century.*"

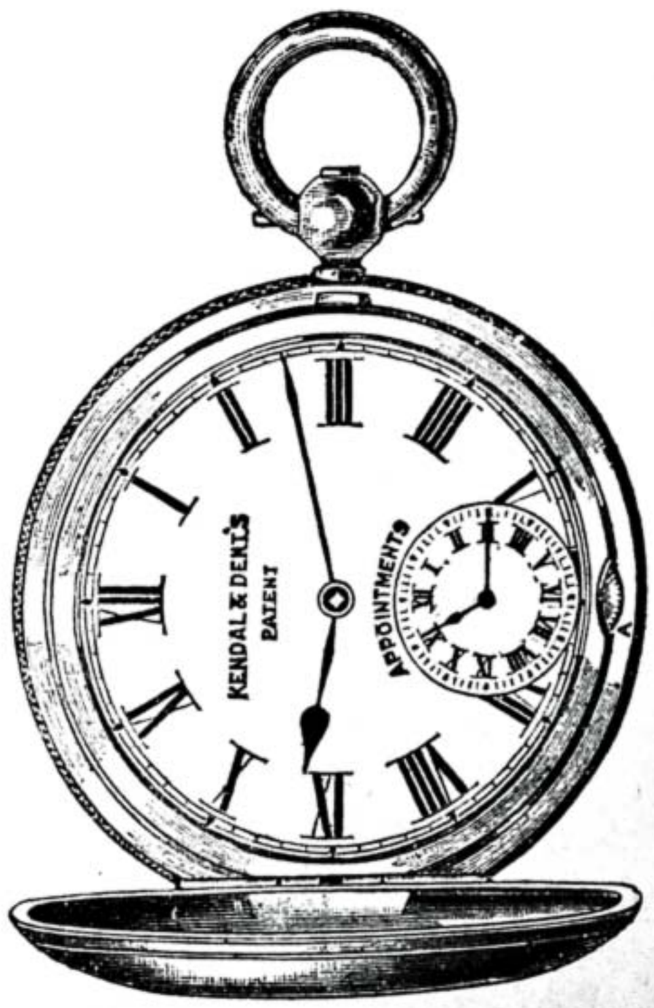
It is one of the most gratifying signs of the times to find that a firm with such a deservedly high reputation as that of Cassell & Company have brought our great authors within reach of all classes of the people by issuing these threepenny volumes. Every well-wisher to the spread of education will hope to see the NATIONAL LIBRARY receive a welcome far in excess of the utmost anticipations of the enterprising publishers. What a boon would be the perusal of these volumes alone to any working man! Here we have two hundred books which constitute in themselves a liberal education in English literature.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

124. — KENDAL AND DENT'S "APPOINTMENT REMINDER" WATCH.

IT is not often that the attention of the public can be called to any decided novelty in watches



Kendal and Dent's "Appointment Reminder" Watch.

which can be readily understood and appreciated by any one who may happen to see it. By this I

mean any addition to, or alteration or improvement in, the external parts of a watch, such as the case, glass, dial-plate, etc., for it is manifest that any change in the parts of the internal mechanism can only commend itself, or otherwise as the case may be, to experts in the art of watchmaking, or those who thoroughly comprehend the construction of a watch. Thus the improvement in the dial-plate of a watch, recently patented and introduced by Messrs. Kendal and Dent, Watchmakers and Jewellers, 106, Cheapside, London, E.C., is a novel feature, the utility of which every one can recognise, and whose practical value may be determined at a glance by any one who has been accustomed to carry a watch. It is shown in the accompanying illustration, and consists in the substitution for the old seconds dial another miniature dial corresponding to the larger dial of the watch itself, and furnished in a similar manner with hour hand and minute hand. Its purpose is indicated by the word "Appointments" above, from which it may be gathered at once that the small dial is to be used to fix the time of any important appointment that the wearer of the watch may have made, and is anxious to keep with the utmost punctuality, by putting the hands to the dial to the time in question in the manner that time is usually indicated by the hands of a watch or clock. It will be naturally asked, how is this effected? If the reader will look at the rim of the watch in the illustration, he will see just below the small dial the projecting segment of a small milled wheel, A. By turning this wheel, the hour and minute hands will be set in motion at the relative speed common to each, and may be kept moving in proper progression until the time fixed for the appointment be denoted. Messrs. Kendal and Dent shall speak for themselves with regard to the utility of their invention. They say, truly enough, that the new dial "occupies the position of the old and useless seconds dial." It is scarcely right, I think, to set down our old friend, the seconds dial, as useless. I can only say myself that I have found it of use at times in measuring speeds, etc., but I am bound to add that I am inclined to believe I should have found the new "appointment reminder" dial of greater use, because it would have been more frequently called into requisition. They continue: "How many of us, after referring to a time-table in the morning, and mentally repeating the exact time a train starts which we have to catch later in the day, have had a feeling of uncertainty as to whether it was, say, five minutes to one or five minutes past one? But possessed of this 'reminder,' we can now calmly set it to the time of departure, and there it will remain for instant reference, and every time the watch is looked at it acts as a reminder. As a train catcher it is really more valuable than the timekeeper itself. Again, to record the duration of a speech, or of a race, a railway journey, or of any process of distillation, cooking, or the like, when the interval of time is pre-arranged, the 'reminder' is at the commencement set so far in advance of the time as the operation should occupy, it will at once denote where the hands of the watch should be when it is concluded. Or, if at the beginning of any similar event of unknown duration the 'reminder' is set to true time, the period that has elapsed is denoted by the difference between the 'reminder' and the hands of the timekeeper."

Messrs. Kendal and Dent, as a matter of course, wish every one to buy a "reminder" watch, but although they may be had in silver from 42s., and in gold cases from £6, many, including myself, would like to be able to buy a "reminder" to be worn as a pendant to the watches we have. Could not Messrs. Kendal and Dent do something in this way, and thus extend their base of operation against the pockets of the purchasing public? The "reminder" pendant could be worked in the same way as the manufacturers have adopted in the case of the watch, and would have the merit of being far more useful and appropriate than the majority of pendants or "charms," as they are sometimes called, or even the spade guinea often worn as such.

THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

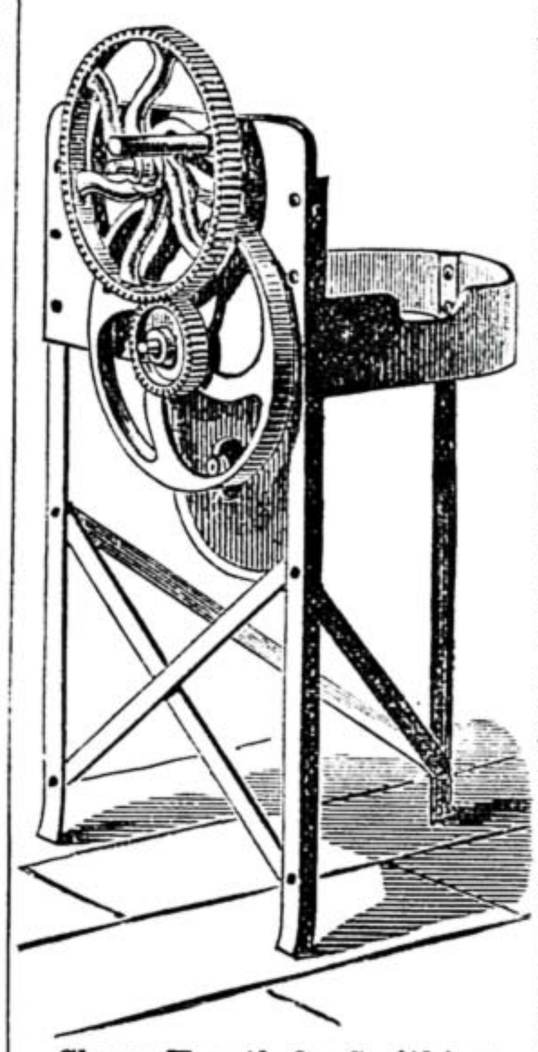
NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

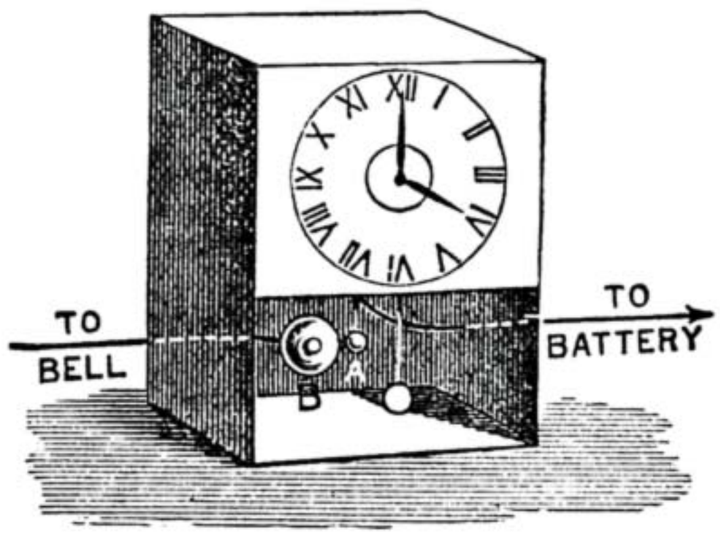
I.—LETTERS FROM CORRESPONDENTS.

Cheap Hearth for Smithing.—J. M. (*Manchester*) writes:—"Your correspondent A. H. (see page 556) gives a fairly good description of a portable forge, which, however, I think can be materially improved in a few of its details:—The plates should be ⅛ in. thick, but anything thinner than 16 B.W.G. would be flimsy. The legs would be sufficiently firm and strong if made ½ in. or even ⅝ in. diameter; but for a fan the discharge pipe is far too small, as shown in sketch. For the further information of A. S. (*Liverpool*), I have seen portable fan forges made by Messrs. R. Clarke & Co., Moira Iron Works, Rochdale Road, Manchester (of which I enclose a sketch), at a cost of £3 5s. complete, and at which I have seen 1½ in. square bar iron welded in a few minutes; the fans are of the Schiele type, and can be easily turned by a very small boy. No doubt this firm would supply the fans, gearing, or other parts separately to any of your readers who might desire to build their own."



Cheap Hearth for Smithing.

Electric Time Alarum.—N. H. B. (*Ardwick*) writes:—"As a reader of your valuable paper from its start, I wish to congratulate you on the success of the paper hitherto, and the admirable way in which it has been managed. Having a slight knowledge of electricity, I thought I would venture, with the assistance of a friend, to fit up an electric time alarum. The clock was an ordinary alarum one with metal dial. We made the connections as shown in figure. One wire was attached to the bell and the other to the hammer. The alarum was 'set' in the usual manner, but not wound up. When the hour to which the alarum was put is reached, the hammer hits the bell and keeps in contact for about an hour, when it flies back. I send you this slight description, hoping it will help some fellow amateur. The bell must not be connected with the works or hammer."



Electric Time Alarum.

Canoe Planks.—W. E. H. (*Bognor*) writes:—"I noticed in WORK advice given about the planks of a canoe, and steaming them where the bends are. Now to have strips of mahogany ¼ in. wide and straight would be absurd for either a canoe or boat planks, as every plank from garboard strake to gunwale strake is a different shape, and must be cut to shape or they will not work in, and no amount of steaming will induce them to either. I have built fishing and pleasure boats, and rarely want to steam the planks after the first one, and not always that, unless it be a boat with a long floor. I shall be pleased to answer questions that I may see on boat work. Do your readers know anything about the North Sea coble? There is no such boat here on this coast, and I want to introduce it, as I feel it will be a boon to the fishermen here on account of their light draught of water. Our boats here draw so much water, and the water is so shallow, that the boats ground so soon."—[Please send a paper describing the coble on approval.—ED.]

Zinc Photo Etching.—O. G. B. J. (*Dover*) writes:—"Seeing some answers in 'Shop' from persons who understand zinc etching, I thought they might help me in a little trouble I have in that kind of work. Some time ago I purchased some photographic bitumen rendered sensitive from a maker who can be relied upon. I followed the directions sent in dissolving it in benzole, but when the plate had been coated and exposed to sunlight for a time, far exceeding the directions given, on placing it in turps the bitumen all washed away except a very little, but I could not get anything like a perfect image. If you could help me by any hints I should be very much pleased."

Combined Music Stand.—J. S. (*London, N.*) writes:—"I would like to make a remark or two about the scale mentioned in my article on Combined Music Stand (see page 552). Some readers may probably get confused, unless I explain. In dealing with feet, when we say a thing is drawn to ¼ in. scale, that means a ¼ in. represents a foot. When our measurements are small and we speak of inches, and say ¼ in. scale, that means ¼ in. to every inch. So that ¼ in. scale, seeing that I speak of inches, is quite correct; so also is 3 in. scale, and ¼ in. scale, although it might probably have been better had I kept to one proportionate scale."

Fret Machine.—FAIR PLAY (*London, E.C.*) writes:—"There is not the slightest doubt that A. A. (*Coventry*) (see page 636) does not understand W. R. S.'s design for fret machine, so he must say that it will not work. Having made one according to W. R. S.'s design, and which I find to work well, I must say that it is rather good of him to condemn it, and then to give an illustration of one which he considers superior. I would like to know how he gets his motion to the crank, E, as he has no fly wheel, so when the treadle is at its lowest there it must remain, as there is nothing to counteract its weight, or, as I said before, to give the motion. I should now like to thank W. R. S. for the design of his machine, and would like to see A. A.'s answer to the above."

WORK'S Museum of Models.—J. BROX writes:—"I would suggest that all who have ideas and are capable of carrying them out should present you with a model, if possible, so that in time WORK would be possessed of a small and growing museum of models, to be seen on some small payment at the gate, the proceeds to be used for WORK and its museum. I shall be happy to start it by sending a model of the chair described in the paper enclosed, should you deem it worth a place in WORK."—[I have much pleasure in accepting both your paper and your proposal as above. I trust that all inventors, makers, patentees, etc., who are readers of WORK will follow in your footsteps, now that you have set them a good and praiseworthy example in going over the hedge first.—ED.]

Levelling Oilstones.—C. A. B. (*London, E.*) gives many thanks to W. H. D. (*Birmingham*) for the way he has adopted in levelling oilstones (see page 636). It is far better than the old-fashioned way, rough flat stone and silver sand. My stone, which I have got nice and flat with emery cloth tacked on a piece of board, was ⅛ in. deep in the middle, and in fact in a very bad state, and in a very short time I could see a difference in the stone."

Etching.—C. A. B. (*London, E.*) writes:—"I shall feel very much obliged to W. J. P. (*Tunbridge Wells*) if he will furnish me with a little idea how to do etching, and the tools that may be required. Thin brass is the material I should require to etch. I am not in a good position at present, and it would be very useful in my business."—[Some papers on etching will appear shortly.—ED].

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Evening Classes for Electrotyping.—W. T. (*Hackney*).—Write to the Hon. Secretaries, City and Guilds of London Institute, Gresham College, London, E.C., and enclose stamped envelope for reply. They will probably direct you to an evening class on the subject you name.—G. E. B.

Electric Bell.—V. J. W. (*Ireland*).—From the fact that your bell has been working satisfactorily for two years with the current from a 2-cell battery, you may infer that the cause of the present failure is due to some fault in the battery itself. As the black japan on the heads of the carbon blocks is chipped off, and the lead heads have the appearance of plaster, it is evident that the ammonia fumes have undermined the lead caps, and destroyed their connection with the carbon. In a word or two, they are worn out, and must be replaced. It will pay you better to get newly charged porous cells than to recharge the old

ones, or attempt to recap the carbons. A little dust or corrosion on the contact parts of bell or pushes might cause fitful working, but the probable cause is in the battery. I do not suspect adulteration in the sal-ammoniac. Thirty feet is not too far from bell to push. This is proved by the past record of your bell, for it would not have worked satisfactorily for two years if the distance had been too great.—G. E. B.

Nickel Plating.—SIMPLEX (*Stamford*).—A small dynamo worked by foot power might be used by a working jeweller to furnish current for gilding and silvering small trinkets, but would be a cause of drudgery if employed to deposit nickel upon parts of bicycles, or to silver-plate large articles. Nickel is deposited from its solutions at the rate of about 16¾ grains per hour for each ampère of current, and it will take from 1 to 1½ hours to get a fairly good coat of metal. It will not be necessary to leave the articles in the bath for a long time if you have power at hand to force the nickel on fast, and only want to put on a flimsy coat of this metal, but such coats would be useless on bicycles, which, of all things, should have a tough, durable coating, put on slowly. You will gain nothing by making up a train of wheels to lift a heavy weight for the purpose of working machinery in its descent. You would require a weight of 5,555 lbs., falling at the rate of 1 foot in 1 minute, to develop the power of one man, estimating this to be ⅓ of a horse-power. If this power has to be applied through a train of wheels to get up speed in the machine, you will have to calculate the friction of the wheels together with that of the machine, and, after estimating the power needed to overcome this friction, deduct the sum from the power obtainable from the falling weight. Then please understand that it will take more power to raise the weight than you will get out of it whilst falling. A dynamo for plating purposes cannot be made to run light, since it must have a large output of current, and this absorbs energy. A series wound machine would be almost useless; it should be either compound or shunt wound. I do not know of a book that will instruct you how to make a plating dynamo. Goods to be nickel-plated must be well polished before being plated, and the coat must be polished afterwards. This may be done by hand, but it is best done with a machine. I should advise you to get Mr. Watt's book on "Electro-deposition," and study what he says about the deposition of nickel, as I have not time or space at my command to give you the necessary instructions here.—G. E. B.

Re-enamelling Clock Dials.—PENDULE.—Try the "Chez-lui" white bath enamel. I am afraid you will not be able to undertake this work in the usual way, as it requires a rather costly outfit, and the work requires to be stoved. You can get all you require from some of the Clerkenwell houses if you make a little inquiry. I can also give you directions for resilvering and regilding dials—easier operations. Do you know that Messrs. Willing, 12 and 13, Clerkenwell Green, E.C., the advertising agents, now sell patent enamelled figures for cementing on watch and clock dials? They are very good; write them for sample and prices.—H. L. B.

Modelling in Clay.—H. T. N. (*Malmesbury*).—Papers on this subject will shortly appear in WORK. The staining and shading of the inlaid portions in marquetry are two distinct operations. The former is done before the pieces are cut, the latter afterwards, whether the veneer is in the natural colour or stained. Shading is done either by engraving lines or by darkening with hot sand. This is the usual plan in such inlays as you describe, and the process may be thus briefly described. A pan or dish containing sand is heated over a fire or by other convenient means, till the sand is sufficiently hot to darken the veneer. The piece to be shaded is then pushed edge downwards into the sand, the gradations being arrived at by judicious manipulation. The process is a tedious one, but a certain amount of success is not difficult to attain even by a novice. Great care must be taken that the sand is not hot enough to burn or char the wood, and the best results are got on light veneers such as box.—D. A.

Camber in Girders.—H. H. W.—The camber is obtained by making the top flange longer than the bottom; in the lattice girder the distance from joint to joint is made longer in the top than the bottom flange, and in plate webbed girders each web plate is wider at the top than the bottom, and the rivet-pitch should be less in the bottom flange than the top, so as to suit the joints. The amount of difference of length depends upon the camber, the length of the top flange being to that of the bottom flange as the radius of the bottom flange plus the depth of girder is to the radius of the bottom flange simply. The rule for determining the radius of the bottom flange in feet: Divide three times the square of the length in feet, by twice the rise in the centre in inches, and add one twenty-fourth of the rise. This matter is thoroughly explained in an article on "Wrought Iron and Steel Girder Work," No. 12, page 186, which we advise our correspondent to read.—F. C.

Steel Colour on Brasswork.—BRONZE.—To produce a bluish or steel-grey bronze on brass fittings for fishing rods, pour about half a pint of water into a gallipot; to this add 1 drachm of hyposulphate of soda, and 3 drachms of sulphate of copper. Place the gallipot with its contents in an old saucepan, and surround it with about 3 inches of water; apply heat until the ingredients are dissolved, when (as you do not specify the desired tint, whether blue or grey) it will be well to introduce a slip of brass as a test. Should it prove too dark, add more sulphate of copper, or if the opposite is the case, then more hyposulphate of soda will produce a deeper tint. When satisfied on this score, and still keeping the mixture heated, immerse the articles to be stained, which, of course, must have been thoroughly cleansed by dipping in dilute nitric acid, from this into clean water, and then dried in sawdust. After staining, heat the articles as hot as the hand can bear, and lacquer with pale clear lacquer. A steel-grey colour may also be produced on brass by immersion in a weak boiling solution of arsenic chloride, but this requires cautious handling as arsenious acid gas is evolved, which is a very powerful poison; it is therefore not advisable to attempt the experiment except in a stink closet, where all probability of inhaling the fumes could be avoided. The first mentioned method I have tried and proved.—T. R.

Magnetising Telephone Bars.—T. A. L. (*Reading*).—You ask for the simplest way of magnetising bars of steel for telephone purposes. Well, if you can get access to a dynamo, the simplest plan will be to draw the bars carefully across the pole piece, taking care to draw the bar always in the same direction. By doing so ten or twelve times the bars should be sufficiently magnetised for your purpose. Failing the dynamo, if you have a horse-shoe magnet (the larger the better), you can use it for magnetising your bars. Proceed in this manner:—Lay one of your bars upon the table, and bring the horse-shoe magnet over it with the north or marked end nearest the bar, and draw the magnet slowly from left to right. Do this patiently

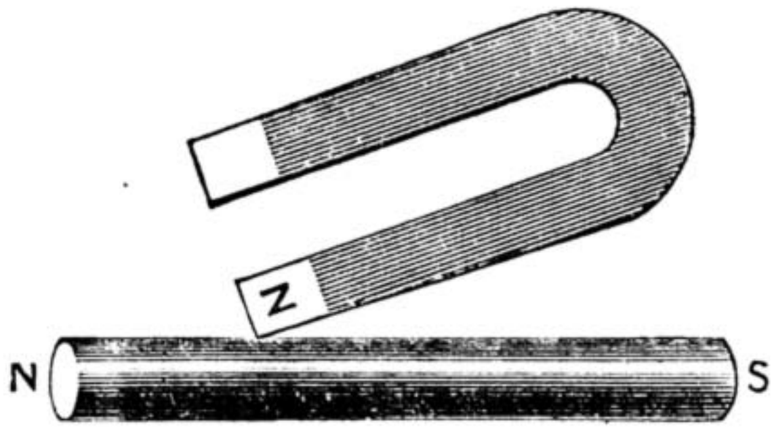


Fig. 1.

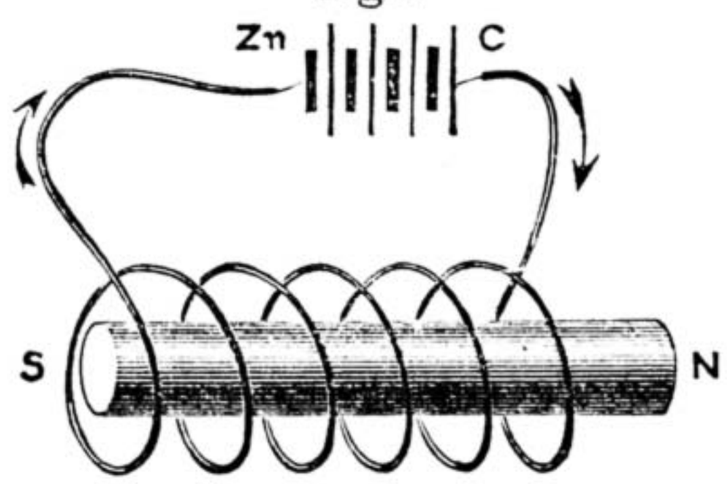


Fig. 2.

Magnetising Telephone Bars. Fig. 1.—Magnetising a Bar of Steel with a Horse-shoe Magnet. Fig. 2.—Magnetising by Means of the Electric Current.

for about twenty times, always commencing and leaving at the same ends. Turn the bar longitudinally during the process, and when bringing back the magnet for the next stroke raise the hand well above the table. The other bar is magnetised in the same manner. Fig. 1 shows the process, and gives also the names of the poles. You may turn your magnet and draw the south end across the bar, but you will require to turn the bar also. This will, however, be of no advantage, so rather than get mixed up keep to the method described. It may seem strange that by rubbing a piece of steel with one pole of a magnet you convert it into a magnet with two poles. Such is indeed the case. We cannot get a magnet with one pole; if there is south magnetism at one end of the bar there will be north magnetism at the other end. You will notice in Fig. 1 that the end of the bar where the rubbing stops is marked s or south. I cannot take up space in giving the reason of this. I merely draw your attention to the fact. In magnetism the law stands, "Like poles repel, unlike poles attract"—*i.e.*, a north pole repels a north but attracts a south, and a south pole repels a south but attracts a north. This by the way. Here is another method of magnetising your bars. Make a coil of No. 24 wire, using several hundred yards about the length of your bar, and pass a current from a battery or dynamo, giving about 2 ampères through it while your bar lies inside the coil. If you can arrange a make and brake like a Morse key in the circuit, and keep tapping now and again, it will be an improvement. If you look at Fig. 2 you will see the way to wind your coil and the method of joining up the battery so as to get the poles where you want them. I might give you other methods, but I hope you will succeed in getting your magnets the required strength by one or other of these methods. If you were not so far away from me I would do them for you with pleasure. As for the cost of magnetising such bars, I do not think any one could make a charge for it with the apparatus already at hand. A few minutes is all that is required for the process. Messrs. King, Mendham & Co., Western Electrical Works, Bristol, sell round bar magnets 5 in. by ⅜ in. (which is your size) at 10d. each. Write again and let me know how you succeed.—W. D.

Cycle Work: How to Braze.—CYCLE BRAZER.—You require, first of all, a small forge, or a blow-pipe. The materials used in brazing are spelter and borax. The joints to be brazed must be well fitted and filed clean. Mix some of the borax with water into a thick paste, heat the joint to be brazed over a clear charcoal fire, sufficiently to make the wet borax fizzle when it is put on, and it will penetrate into all parts of the joint. If the part to be brazed is a solid fitted into a tube, put some borax inside the tube, allowing it to saturate the joint. Now put in some spelter, allowing it to rest on the solid in the tube; bend a piece of soft brass wire round the joint on the outside, and place on the fire if a fire is used. The fire should be clear and without smoke, and the blast kept up with a fan blower. Place a piece of wood over the joint on the fire; the heat from the burning wood will fall on the upper side of the joint. When the metal begins to get a good yellow heat the wire will disappear. Throw on a little dry borax over the joint and remove carefully from the fire. With a piece of iron clean off any cinder or scale on the still red hot metal, and lay aside to cool. If it is cooled in water the steel tube will become hard and brittle. Many joints may be made with spelter only, but in the case of tubes it does not lie well on the outside, hence the use of wire. All joints are brazed by running liquid brass into them, and the borax acts as a flux or penetrator.

Tempering Taps.—CYCLE BRAZER.—Heat the tap in a fire or gas flame to a dull red, and plunge into cold water. This will make it too hard. To bring it back, brighten one side on a bit of sandstone, and heat it in the middle through a gas flame. If you watch the brightened side you will see a yellow tinge travel slowly to the point, then cool in oil. It requires some experience to do it always with success.

Three-Inch Screw-Cutting Lathe.—F. W. (*Hitchin*).—To give you all the dimensions you ask it would be necessary to make complete working drawings, as it would not be easy to find details of a complete lathe on such a small scale. I most strongly advise you to make your lathe 3½ in. centres, because that is a size these lathes are often made, and for this you can easily buy a set of castings—say, from the Britannia Company, who will supply them with all machine work done. You can, of course, sit to work at it, if you use a high stool, and that is better than having the standards lowered, because then you can stand where you wish. If you follow my advice you will get all the main dimensions from the castings; you may, however, get the proportions and much useful information from the numbers of the *English Mechanic* mentioned in my reply to J. A. (*Preston*).—F. A. M.

Removing Varnish from Painting on Zinc.—J. M. G. (*Leeds*).—Your picture could be cleaned by any process which can be successfully applied to an oil painting on canvas, but more care will be necessary in handling and manipulation, since the colour would be more liable to peel and cake off from zinc than from the former. As you have apparently, a picture of some value, it would be the wisest plan to hand it over to an experienced cleaner and restorer of paintings. If you are, however, determined to try the task yourself, the following may help you. The varnish which you wish to remove is a preparation of oil and resin, and can be removed, with more or less success according to the care and experience of the manipulator, by two methods—friction, or by dissolving the varnish with oil (mis-named spirits) of turpentine. In No. 26, p. 414, H. G. (*Liverpool*) gives a very reliable and commendable treatment for cleaning an oil painting, which will repay your turning up. This, however, may not be so suitable for your purpose of removing old oil varnish, which is of a much tougher nature than mastic (spirit) varnish. Try this:—Procure raw potatoes, and grate into some cold water until of the consistency of cream, then purchase at the chemist, if no large colourman's store is convenient, a little finely levigated pumice-stone. Mix well together, and then with a penny piece of sponge rub carefully and patiently. If the painting itself is carefully laid, or rather lays, evenly upon the zinc, this friction should safely remove the bulk of the old varnish. You might then try an equal mixture of methylated spirit and raw linseed oil: use with cotton wool, and carefully watch for the least sign of colour. Turpentine alone applied with cotton wool would dissolve the old varnish, but would require a very careful hand to use it. Friction of the hand alone will sometimes remove mastic varnish, but I am afraid it would only polish the face of your picture. In using the pumice mixture, this would require well rinsing off with sponge and cold water; then dry with a soft cloth. Messrs. Brodie & Middleton, Long Acre, are sole agents for a mixture called "Anadeiktine," by means of which they claim that any intelligent person can clean any valuable painting. You can get a sample bottle for a shilling, and it would pay you to try it, I think.—H. P.

Design for Safety Bicycle.—W. G. (*Bolton, N.B.*)—Yes, the probability is that your contrivance would be practicable, for so far as can be gathered from your rough sketch, it is on much the same principle as that of the "Facile" and "'Xtraordinary," which were introduced some years ago. If, however, you know that yours embodies improvements on these, in my opinion the best thing you can do is to submit the design to some good manufacturer, and see whether he will take it up. If patentable—which you will understand I do not think it is—you should, of course, protect it before submitting it to any one whom you cannot thoroughly rely on. I am sorry to have to throw cold water on your plan, especially as you are an invalid, and no one would be more pleased than I to learn that through the indistinctness of your sketch I am mistaken in supposing it to be a revival of an old form.—D. A.

Circular Saw Bench.—C. W. T. (*Leicester*).—I am sorry to say I have read your letter over several times without being able to get your meaning as clearly as would be necessary before I could help you, but from what I can make out I have no hesitation in saying that you could not cut anything like the thickness you name. Without more knowledge than you have of the fitting up of such a machine you will do better to leave it alone; or, if you are determined to make a circular saw table, try one according to the directions already given in WORK. I think your intention is to use hand power only, in which case I do not see the object of the two large wooden wheels. It is possible you contemplate availing yourself of steam power, but in this case you would hardly have asked the questions you do. Without going into calculations, for which there is no reliable basis to start from, the probable cost cannot be estimated. With regard to sharpening saws, your inquiry will be sufficiently answered by saying that the practice varies, some sharpening from one, others from both sides. Each method has its advocates.—D. A.

Lathe: Fitting Fast Headstock.—J. A. (*Preston*).—The proportions shown in your tracing are good, except the inside cone in the mandrel nose, which looks too steep. Set your slide rest over 2¾ degrees, to turn out that hole; and if the hole be ⅛ in. at the mouth, it will be about ⅜ in. diameter, at 1½ in. deep, not ¼ in. as you have it. You will find all the details you require, given for a 4-in. lathe, in Nos. 1,117, 1,121, 1,123, 1,125, and 1,128, of the *English Mechanic*. You can easily reduce in proportion.—F. A. M.

Index to WORK.—F. R. (*Sutton Coldfield*).—When Volume I. is complete, an index to its contents will be issued.

Dovetailing.—F. R. (*Sutton Coldfield*).—Papers on this subject are in preparation, as I have said more than once already. Articles cannot be written and printed directly they are asked for.

Safety Bicycle Making.—J. T. H. (*Neath*).—As far as I am aware, no book has yet appeared on the subject of safety bicycle making.

Bicycle Wheels, Where to Buy.—J. T. H. (*Neath*).—You can buy bicycle wheels 30 inches high of any maker of bicycles. If the precise size is not in stock, a pair will be made for you.

Coloured Glass Windows.—JAY BEE.—Papers on this subject will appear in WORK, but when I cannot say. All particulars relative to tools and materials and their cost will be given in them.

Fret Machine and Lathe to Sewing Machine Stand.—AN AMATEUR.—It is quite impossible in the limited space of "Shop" to give directions which would occupy several pages, and then only be useful to readers who might happen to want to use up a stand exactly the same as the one you have. As you reside in Clerkenwell, why not keep your eyes open and hunt about the iron shops which abound in that neighbourhood? You would, probably, be able to pick up a second-hand lathe, etc., or such parts as would enable you to complete one at far less cost than you could make. The stand might do for a fairly serviceable fret saw, but the lathe would only be capable of doing very small work, and I cannot recommend you to waste your energy over it. You will, no doubt, agree with me that when cost is the main consideration in inducing one to make anything, that it is foolish policy to go to as much or even more expense for materials, not to mention labour, than would be involved in the purchase of an appliance of a more reliable and satisfactory kind.—D. A.

Re-magnetising Bar Magnets.—V. R. (*Liverpool*).—(1) If a steel magnet is made red hot, it becomes demagnetised, however it may be afterwards cooled. (2) Steel bars for magnets should be made as hard as fire and water can make them—viz., by heating the steel and cooling in water in the usual way for hardening steel. (3) Any number of Bunsen cells from 1 to 6 may be used in the process of magnetisation. (4) The cells must be arranged in series if you use a long coil of fine wire, or in parallel if you employ a short coil of thick wire. (5) Any gauge of wire may be used, but it must be of copper, and insulated with silk or with cotton. If for use with a large battery, with the cells coupled in parallel, use from 3 to 5 or 7 layers of No. 16 or 18 wire. (6) It will take nearly 24 yards of No. 16 cotton-covered copper wire to envelop one of your bar magnets with 3 layers of wire, and this will weigh 1 lb. It will take over 45 yards of No. 18 cotton-covered copper wire to envelop one of your bar magnets with 5 layers of wire, and this will weigh over 1 lb. You will only need to magnetise one bar at a time. (7) Begin winding at the end marked N, and wind from right to left. This will give the required polarity to the magnet if the current is made to traverse the coil in this direction. (8) The wires should go to within half an inch of each end. (9) The end of the coil should be at the opposite end from the starting point. (10) The position of the bar need not coincide with the magnetic meridian of the earth whilst being magnetised. (11) When coupling up the coil to the battery, connect the carbon element with the commencing end of the coil. (12) It should only take a few minutes to fully saturate the bars, but the process can be hastened and the effect intensified by lightly tapping the bars, or interrupting the current by drawing the connecting wires over a file during the time. (13) Bar magnets may be made of any size and length you may desire. (14) Old files may be used, but they should be first forged to proper shape, smoothed, and hardened. (15) Very large magnets will require more layers of wire or a stronger current to properly magnetise them. Are you satisfied with the replies to your fifteen questions?—G. E. B.

Bicycle Cone.—G. S. (*Liverpool Road, N.*).—It would be hard to say what is the matter and how to cure it without having seen the bicycle head. Your correspondent speaks of a cone. Does he mean the cone pin that screws down from top of head, and on which the backbone swivels? This pin usually has a jam nut to screw down hard on the head after the pin is adjusted. If his has no jam nut, let him have one put on by a repairer, or blacksmith, or mechanic. As to a bent or buckled wheel, it would be better and cheaper to put it into the hands of a repairer.—A. S.

Watch and Clock Tools.—WOULD-BE WATCH CLEANER (*Slaugham*).—The broken jewel hole is quite sufficient to stop it. Take the watch to pieces, and send plate, scape wheel bar, and scape wheel to Grimshaw & Co., 35, Goswell Road, Clerkenwell, or J. Hunt, 21, Ironmonger Street, St. Luke's. They will put a new jewel for a shilling or two, and from either you can get any and every watch and clock tools you may require.—A. B. C.

Something To Do.—PLEASURE AND PROFIT (*London, W.*)—Your question is a puzzler to answer. You might take up any of the subjects which are treated of in WORK, and having now told you of something to be done I want to give you a bit of "straight" talk. Does it not strike you that you are the best judge of what you can do in your spare time? Though your letter shows you to have proper ambition and a desire not to waste time, I cannot know your capacity, amount of spare time, and fifty other matters which it would be necessary for any one to be acquainted with before he could advise you in such a manner as to be helpful to you. Your question about work that will be pleasant must also be dismissed in the same way, for "pleasant" work depends altogether on a man's taste. For example, mine leads me to prefer working in wood to working in iron, but plenty of our readers like the latter, and do not care for the former. As for profit, it may almost be said that any work is profitable, though perhaps not from a monetary point of view. Whether you can make it so must depend entirely on your own energy. As you are still a youngster, if you have mechanical abilities, why not learn some handicraft as a means of livelihood? Anyway, if you will write and let me know what you have done in the way of work, possibly I might be able to suggest something to your taste. Remember, however, that unless you show skill which, for one so young, will be quite exceptional, you are hardly likely to be able to earn money yet awhile by making things on your own account, as you will have to compete against older and more experienced workers.—D. D.

Finishing Fretwork.—F. S. B. (*Guernsey*).—The best method of finishing fretwork is to French polish the wood before cutting, and afterwards just to touch up with the rubber. Another way, and almost as good, perhaps giving better results with an amateur, is simply to body up before cutting—*i.e.*, do all the polishing except spiriting off. When the fret is cut, instead of spiriting finish with glaze. This is made with equal quantities (more or less) of gum benzoin and methylated spirits. Allow the mixture to stand till the gum is dissolved, then strain to remove impurities. It is applied by rubbing or wiping on with a soft rubber. You are quite correct in supposing glaze gives a finish superior in appearance to varnish. Varnishing, however, is easier and quicker in application. Perhaps your fretwork is dull because the varnish has sunk, and if so, give the work another coating. You don't say what kind of varnish you have used, but you may easily make a good spirit varnish by dissolving resin in French polish or methylated spirits. French polish, you know, is nothing but a thin varnish of spirits and shellac. Resin, or more shellac, added makes the mixture thicker, and you have what is commonly known as "varnish." Au revoir, m'sieur.—D. D.

Drawing-Room Chair Repairs.—PHOSPHOR (*Plaistow*).—The chairs have not gone wrong "through being very straight-backed," but through being badly made. You will seldom find the joints at back work loose in a really good chair. Without seeing them or knowing more about yours than I do, it is impossible to tell you the best way to repair them. You might manage to fix in angle blocks between the back feet and side rails of seat, but this would be a very unworkmanlike way of doing. The only really effective way is to rejoint, but if your chairs are stuffed, I can hardly advise you to attempt the job yourself. It is not one for an amateur, as the upholstery must be partly undone if not altogether ripped off, and you will find it a difficult matter to replace it. The screws you mention might have answered. If you bored holes for them I cannot understand how they broke before you could get them in. If you like to run the risk of spoiling the back feet of the chairs altogether you might bore through them into the framing, and insert a glued peg which must fit tightly.—D. A.

Patent in Boxes.—H. H. T. (*Barnsley*).—Pray do not regard any question coming within our scope as a liberty, for it is not regarded as such. The services of both Editor and staff are freely at the disposal of readers of WORK in helping to remove the little difficulties which crop up or, as in your case, by giving advice to the best of their ability and judgment. You and other intending patentees may also rest assured that you may with perfect safety, using your own words, trust to our good faith in not divulging schemes which are naturally communicated in confidence. As a general principle it is not wise to communicate particulars of anything which is intended to be patented before provisional protection, at least, is secured, and they are not invited; but when they are sent the trust is not violated, and it is a gratifying proof of the esteem in which WORK is held that so many inventors apply to it. As for your own idea I may say that it seems feasible, though there are one or two points in the construction which I do not see can very well be managed. It is, of course, impossible for me to write so openly as I would wish about these, for fear of giving any one else a clue to the construction you suggest, but if you will "read between the lines" I think you will understand. First the "boring." How are you going to manage that? or, as I don't want to be inquisitive, let me rather say that this appears as if it would be sometimes impracticable. I don't think you need go to the trouble of clenching. If you do not see how this is to be avoided, I may be able to give you a wrinkle. Before spending any money on patenting your idea, you will, of course, see that it has not been forestalled, and you should also consider whether it is likely to be commercially a success. For instance, if the cost of making a box by your method is more than by the one you allude to, without preponderating advantages you could not reasonably expect to profit by your invention. Yours may be a novelty, but unless it is also an improvement on existing methods of construction in someway, novelty alone is not sufficient to make it pay. It is from a disregard of these plain business considerations that so many abortive patents are taken out. I don't want to throw cold water on your hopes, and it would undoubtedly seem more pleasant, and possibly more in accordance with your own views, to tell you that your plan is everything that could be desired, sure to be a success, and all that kind of thing, but it is only right as you ask for "opinion and advice" to put the business aspect before you as fairly as I can. I sincerely wish you success, and shall be pleased to hear of your progress.—D. D.

Clock Design in Keen's Cement.—C. R. H. (*Kilburn*).—It will be impossible to promise a paper on this subject at any very early date.

Varnishing Picture Frames.—A. L. D. S. (*Leicester*).—Before revarnishing your maple frames you must be sure they are quite clean and free from grease. I should advise cleaning them with a piece of flannel or sponge, and warm water with dry soap dissolved in it, afterwards rinsing with cold; don't let them get too wet, however. If they are very dirty try Brooke's Monkey Brand Soap, which combines the effects of soap and friction. The best varnish, I think, would be brown hard spirit varnish, applied with a camel-hair brush, such as polishers use. Copal varnish, applied with an ordinary hog's-hair brush, would do, but the former is preferable by reason of quick drying and hardening qualities, and looks more like polish. As to staining, unless all the old varnish were removed, this must be done in oil or varnish stain. A spirit and shellac mixture is sold in 6d. bottles called "Varnish Stain," or some fancy name. It is merely spirit varnish stained to match walnut, rosewood, oak, etc. This would probably suit as well as anything for you. The *Furniture Gazette* is the only one of two mentioned that I can get knowledge of. It is 4d. monthly. Order through newsagent or W. H. Smith's bookstall.—F. P.

Books on Graining and Coach Painting.—R. C. (*Chertsey*).—Coach painting is quite a distinct trade, and although I have known coach painters to turn house painters with some success, it is not often that a house painter changes over. It requires a thorough practical knowledge of the particular preparation and materials used to get up the body of a carriage, or so forth, in first-class style, and the time so necessarily expended wouldn't do in house painting, or at least on anything but the finest "hand-polishing" work. Otherwise, any painter who understands his business could paint a cart or cab in a serviceable and passable manner. I am not acquainted with any "manual" teaching purely coach painting, and do not think such exists. Respecting your second paragraph, you will find all you want in the articles now running on painting, graining, marbling, and general decorating. Cultivate patience and persistent application, or in your general desire—which is otherwise a very commendable one—to master every branch you may

get but a smattering of them all. There are several works on such matters published, but no single one, I believe, treats the plain, the imitative, and also the advanced decorative branches of house painting. This the articles in WORK will make a point of doing, therefore work on at writing, and take the others as they come, and save your cash.—F. P.

Ink Drying. — LITHO (*Burnley*).—At first, in reply to our correspondent, we were about to reply very curtly that we had never had any such experience similar to his, for we always used good inks and paid a fair price for them, instead of purchasing low-priced inks, deluding ourselves into the belief that they were cheaper. As if an ink manufacturer could afford to supply an under-priced article of the same value as the best-priced article, or in other words give something away. Without seeing a sample of the bronze blue ink our correspondent refers to, we can only conjecture that it is made of inferior materials, such as varnish adulterated with resin, instead of consisting solely of boiled linseed oil, or acid added in excess to throw up the bronziness, or perhaps only half ground, and too much driers added to conceal it. Our correspondent does not say what rollers he used, whether varnished rollers or black rollers—viz., rollers having the "nap" properly "up." We have, however, taken counsel with several of the best litho printers we know, and our opinion as above is confirmed. One recommends adding a little Russian tallow to the ink, another says a little palm oil is a good thing to "feed the job," and prevent its being pulled off the stone. We think, therefore, that our correspondent should well wash his rollers with "turps" or "terebine," and then, if "nap" rollers, well scrape them so as to bring them up, and then with clean linen rag wipe them with "methylated spirits of wine." The stone should be put on to a hand press, be washed out, rubbed up well to feed it, rolled up with the hand roller in black, pounced and well etched, and again washed out, and put into full ink with the press roller by hand in bronze blue. Add to each pound of ink in the duct, a piece of palm oil the size of a haricot bean, and a piece of tallow of the size of a hazel nut. Rub well in on a slab with a muller, and add enough really good "middle" litho varnish to suit the fineness or boldness of the job. There is yet another possible cause of the trouble—namely, the paper. Paper is now so much adulterated with china clay or kaolin (silicate of alumina), especially cheap foreign kinds, that it actually falls out on to the stone in going round the cylinder, and there mixes with the water, which weakens the job on the stone, soaks into the rollers, and forms into a nasty paste, utterly subversive of good printing. In conclusion, our correspondent should learn that a just retribution will surely fall on all who are illogical enough to suppose that, by buying rubbishy materials because they are low-priced, they can take work in to do below the market value.—J. W. H.

Fretwork Designs. — H. B. (*Leeds*). — The American designs you name would most probably be obtainable of Messrs. Harger Bros., Settle. Or if they had not got them they would be able, no doubt, to indicate their whereabouts to you.—E. B. S.

Bronzing Goods. — MAC (*Wandsworth*).—Glad to hear that you were successful with the silvering solution. With respect to the urn that you wish to make look like new, I fear that will be beyond your power. If it is simply dirty, procure at an ironmonger's some urn powder, a speciality for cleaning urns; this will clean it and make it look well if the bronze has not worn off, but if it has I should not meddle farther with it, but send it to be done properly.—R. A.

Blowpipe for Soldering.—W. H. (*Birmingham*).—The blowpipe you mention can be had from Rhodes & Sons, Wakefield. It is slightly different in form to the sketch, Fig. 11 (see page 504), as it has no wood handle, and the price, I believe, is 4s. 6d. or 5s. It is just the thing for the work you specify, and for smaller pipes, but not larger.—R. A.

Brass Labels.—J. N. (*Sunderland*). — Messrs. Rhodes & Son, Grove Iron Works, Wakefield, supply the labels you ask about, and also dies for making them. Prices as under;—

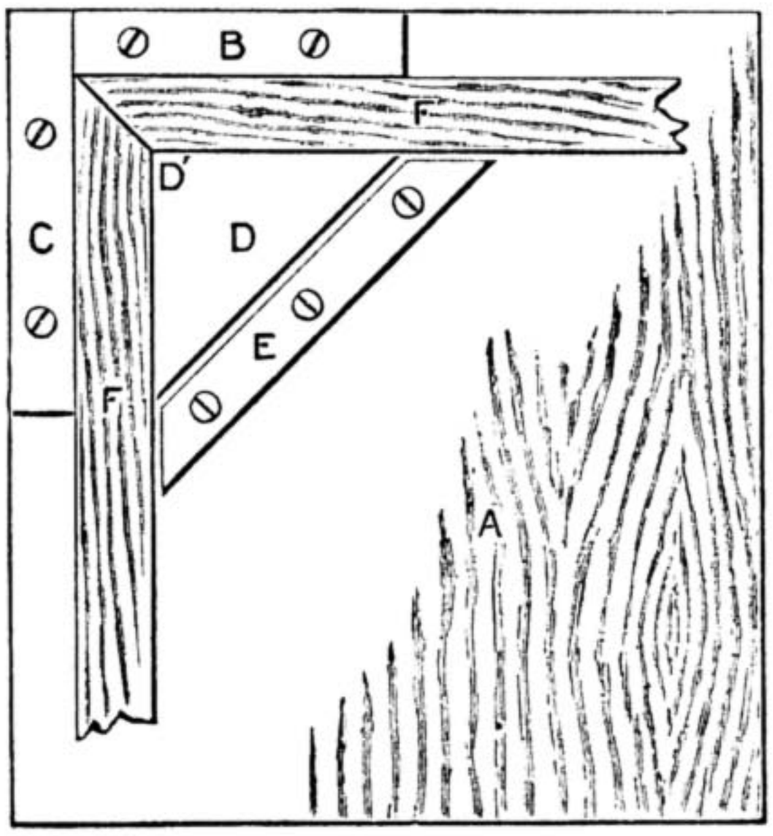
No.	Size.	Die.	Labels per 1,000.	Labels per Gross.
	in.	s. d.	s.	s. d.
1	1×¾	13 6	20	3 9
2	1¼×⅞	14 0	23	4 0
3	1½×1	16 0	26	4 3

Larger sizes at proportionate prices.—R. A.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Patent. —LOCO (*Finsbury Park*) writes in sequence to PATENTEE (see page 574):—"I should like to show that the remarks made by MINERVA (see page 446) were quite right. In the 'Patentee's Manual,' by Johnson, published by Longmans, Green & Co., which is one of the best authorities on Patent Law, the author, in speaking of provisional protection, on page 109, says:—'This protection, however, gives the applicant no right against the public. He is only protected against the consequences of his own publication in case of his employing workmen, making experiments, or exercising the invention—that is to say, he will not thereby prejudice the patent afterwards granted to him. He must not forget, however, that as he cannot take any legal proceedings for infringements committed before the publication of the complete specification (Sect. 13), his proceedings even under protection should be conducted with due caution.'"

Wood Mitre Cramp.—H. J. L. J. M. (*Ealing*) writes:—"Perhaps this may suit J. H. (*Blackburn*) (see page 605). A very good way to join up mitres is to take a stout board, A, and after planing it quite true screw on two pieces, B, C, of hard wood (such as solid oak moulding), lined on one surface and one edge, in such a way that they form a perfectly true right angle. Then prepare a triangular piece (with one angle a right angle) of similarly hard wood, and a slip similar in size to B or C, with two or three holes bored through it. When the pieces are cut and ready for gluing up, glue them and place them (F, F) in position on the board A. Next put D in its place, so that the right-angled corner, D, may press well into the mitre joint.



Wood Mitre Cramp.

Then screw down the strip E, leaving room to insert a few thin wedges, with which D may be forced more tightly into F, F if required. In the case of larger mouldings E might be fitted with two large sash screws, the points of which could unhinge on the hypotenuse of the triangle-shaped piece, D; a small stud of metal, such as a screw, being first fixed into D where the sash screw points would exert their pressure. This idea of mine answers very well for gluing up frames, and was thought out long before a somewhat similar but more expensive one in iron was introduced into use. As the apparatus can be made of any size as required and so very inexpensively, I have not given any measurements or dimensions. For the making of small picture frames a board might be made with all the four corners similarly fitted, and thus the four mitres of the frame could be glued at the same time."

Cab Drawings. — G. W. writes in reply to W. M. C (see page 631):—"Working drawings of Forder, Showful, or four-wheel cabs, regulation sizes (London), and all details, may be had on application to me, Spring Road, Bournemouth."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—A. C. (*Leeds*); J. KENNEDY; H. D. (*Blairgowrie*); J. C. (*Cork*); WINDMILL; J. D. N. (*Glasgow*); TIM BOBBIN; SALE MOOR; J. M. (*Nottingham*); J. S. A. (*Manchester*); E. B. (*South Shields*); Dr. H. (*Ireland*); J. P. (*Byker-on-Tyne*); J. R. (*Truro*); P. P. (*Withington*); ELECTRIC NIGHT; A. R. (*Saltaire*); J. R.; SPAH; W. M. (*Hairwain*); OXON; TANCRED; THETA; CLOCK; F. N. M. (*Keighley*); A. H. (*Ashton-under-Lyne*); SPOKES; HEXHAM; P. W. (*Bradford*); VAN BUILDER; J. T. R. (*Newcastle*); WORKER BEE; V. R. (*Liverpool*); G. J. P. (*Manchester*); B. F. E. (*Carlisle*); AMATEUR; STAUNCH; G. H. G. (*Bishopsgate*); J. R. (*Spilsby*); A. P. (*Hoxton*); MANDOLIN (*E.C.*); G. D. (*Sheffield*); E. D. (*Clapham*); GLACIER; W. S. (*Upper Clapton*); A. G. (*Leicester*); F. J. S. S. (*Birmingham*); A. H. (*Manchester*); POO BAH; W. W. (*Dublin*); A. W. (*Manchester*); GALVANUM; C. W. B. (*Plymouth*); H. A. B. (*Tunbridge*); H. B. (*Kettering*); CLOCK; T. R. (*Belford*); H. E. A. (*Hackney, E.*); W. H. P. (*Loughboro'*); J. L. (*Wandsworth*); W. F. H. (*Dartford*); J. A. (*Liverpool*); CLERICUS; M. H. (*Bristol*); U. G. (*Hitchin*); B. E. C. (*Stepney*); C. B. (*Highbury*); B. W. (*Bridport*); J. W. Y. (*Loughboro' Junction*); NEMO; A. C. (*Grimsby*); BIRKENHEAD; M. S. (*Gateshead*); J. S. (*Coseboc*); F. W. (*Doncaster*); A LOVER OF "WORK"; CHIP; PERPLEXED ONE (*S.E.*); THREE LEGS; R. S. S. (*Trevil*); YOUNG GRAINER; E. H. P. (*Manchester*); H. H. (*Sidcup*); R. A. S. (*Staines*); QUEEN ANNE SIDEBOARD; W. B. (*Inchimann*); DRAPER; J. McG. (*Salford*); HOMO; D. S. (*Auchenheath*); W. R. H. (*Leeds*); R. W. S. (*Godalming*); A. E. B. (*Cromer*); J. P. (*Belfast*); W. G. (*Exeter*); A. M. L. (*Nottingham*); A. S. G. (*Hull*); V. B. (*Smethwick*); TO-PO; ARTISAN; PATRAS; GRAINER; J. F. K. (*Doncaster*); G. H. R. (*Saltley*); J. W. W. (*Hull*); V. R. (*Liverpool*); YOUNG BRASSFINISHER; P. W. F. (*Falmouth*); W. S. T. (*Edinburgh*); NEMO; P. P. C. (*Dudley*); F. W. T. (*Ipswich*); W. B. (*Leith*).

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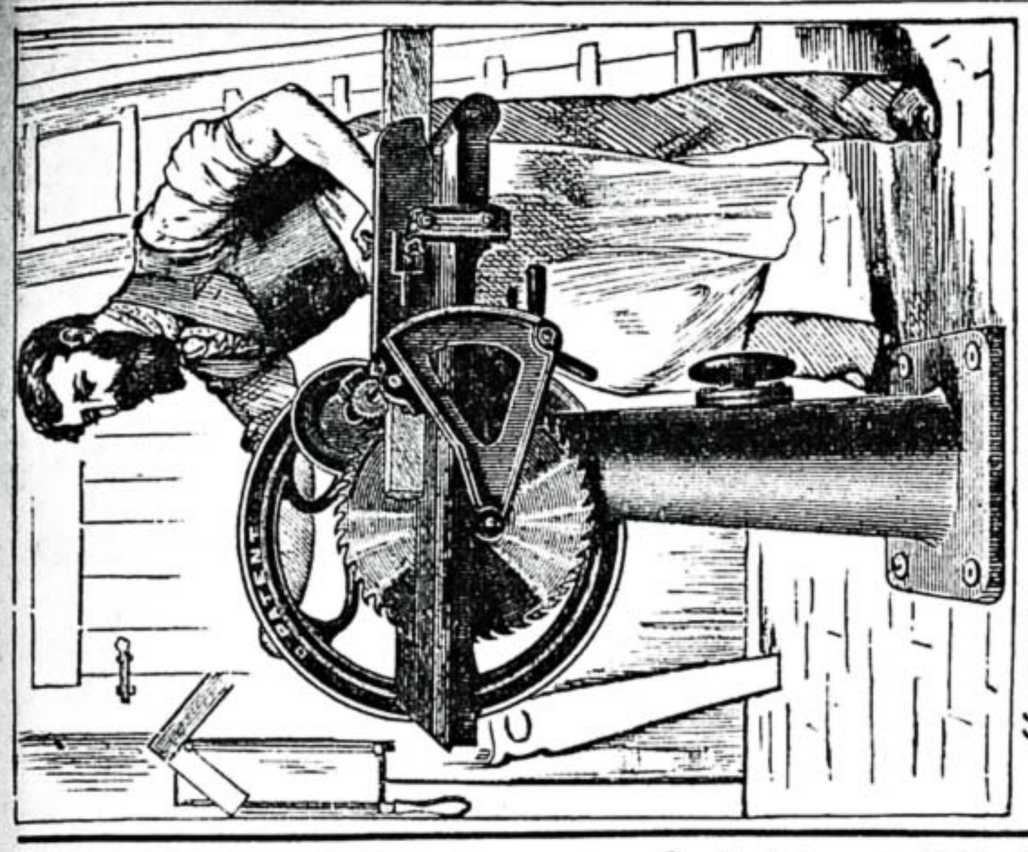

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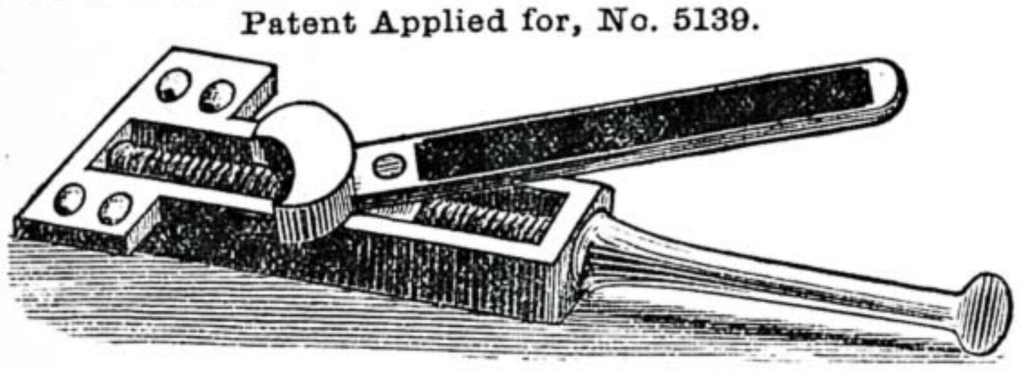

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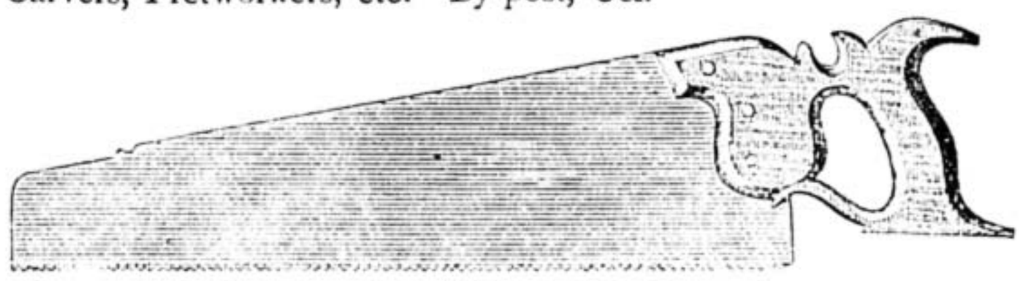

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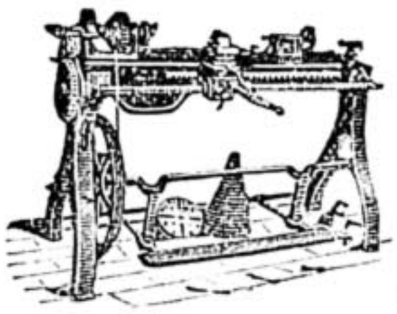

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