WORK

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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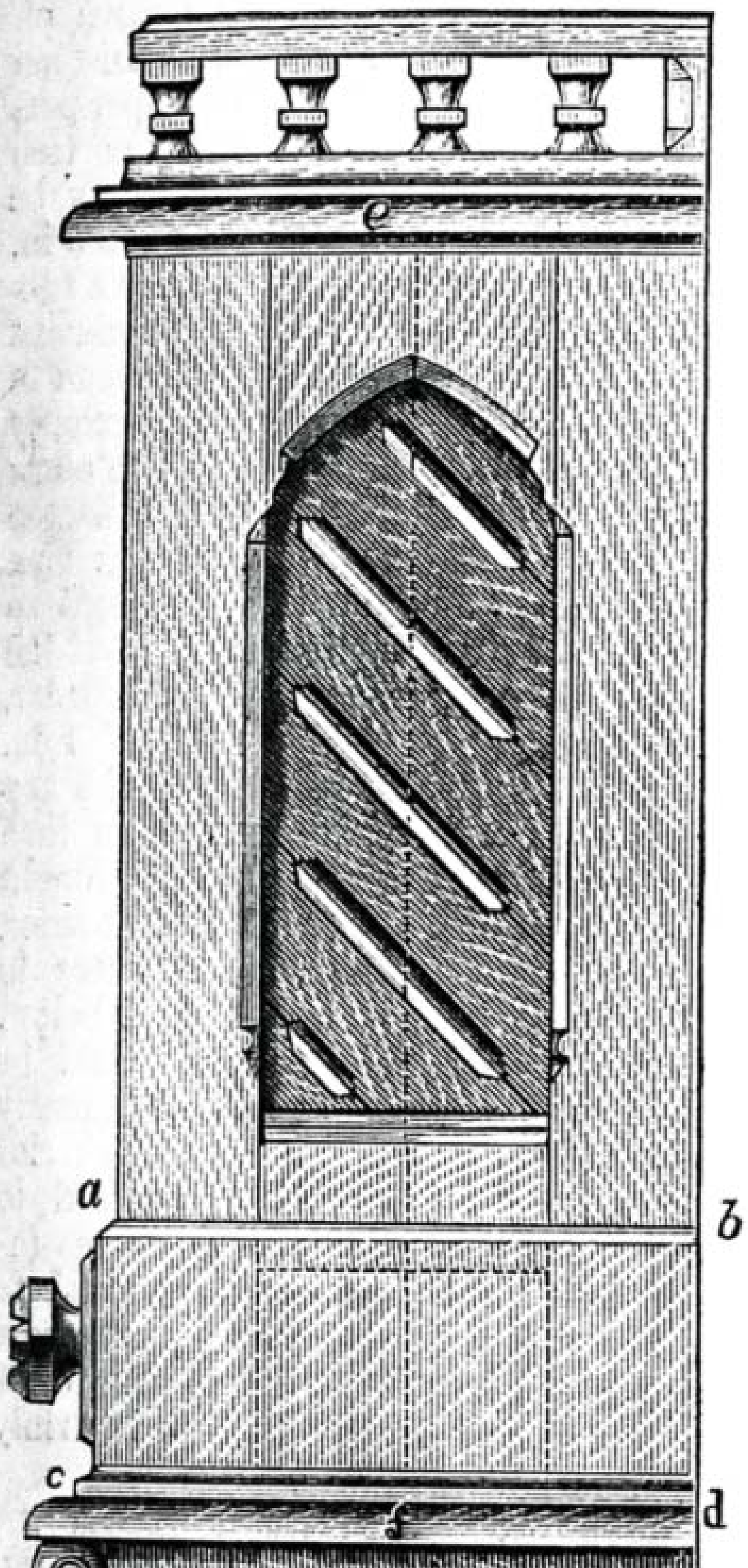


Fig. 2.—Side Elevation.

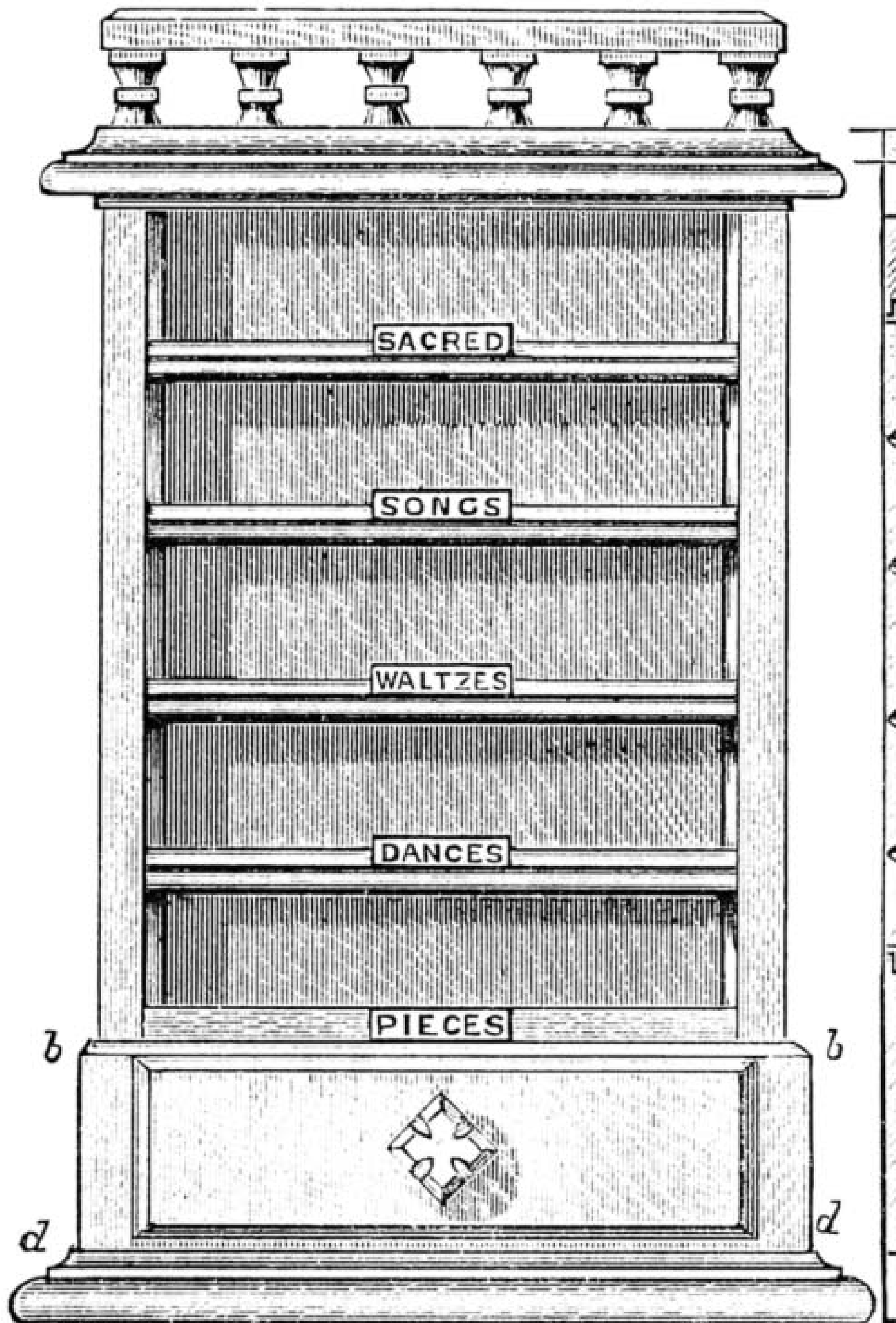


Fig. 1.—Music Cabinet: Front Elevation.

Fig. 4.—Section through *e f*.

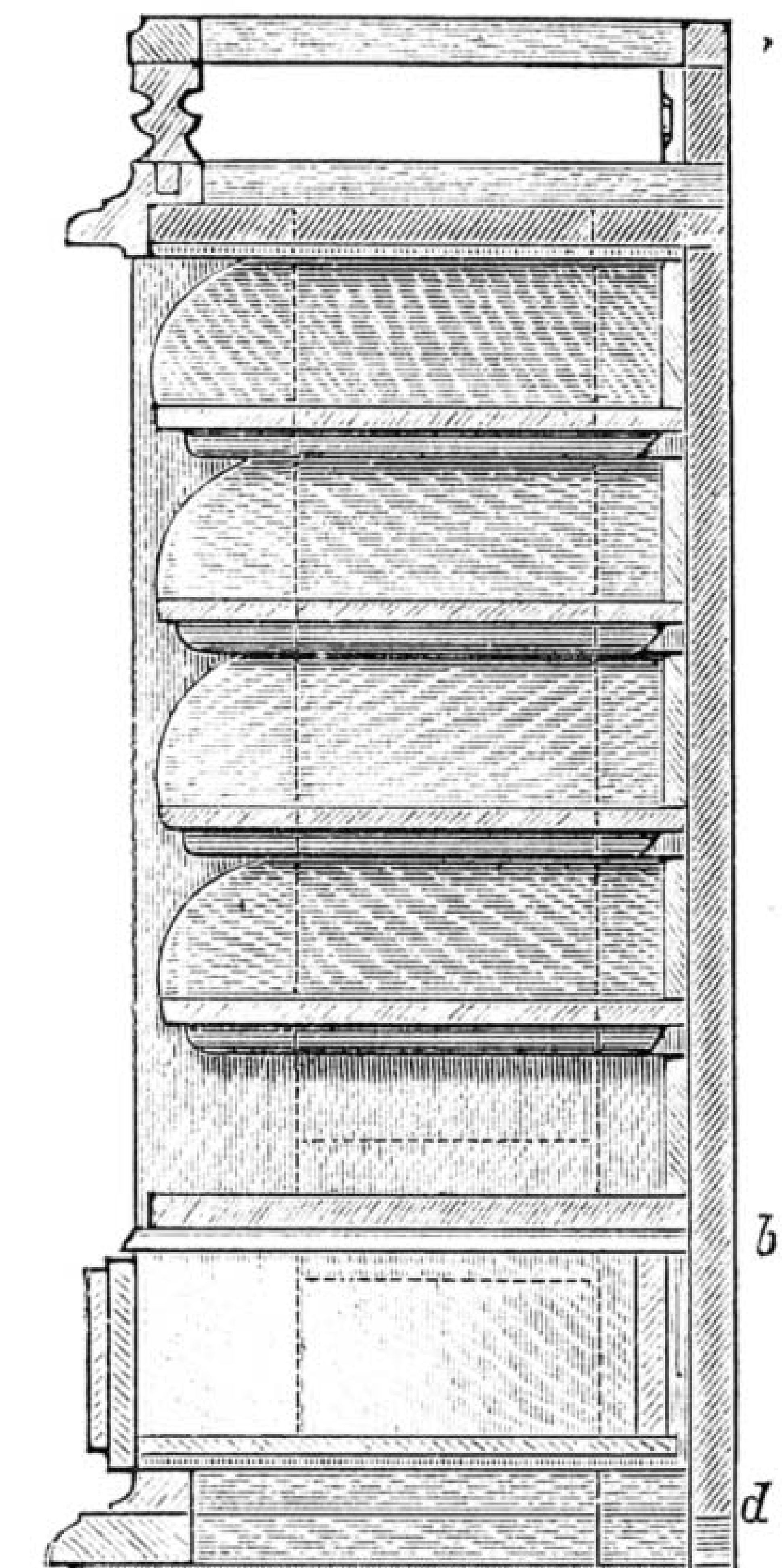


Fig. 3.—Section.

A SEMI-GOTHIC MUSIC CABINET: HOW TO MAKE IT.

BY JOHN W. HARLAND.

EVERY one who has experienced the difficulty of finding any particular piece of music or dance or song that may have been the topic of conversation or the subject of a request to play, must have concluded that instead of piling up a heap of music sheets in dire confusion it would be an infinite improvement to establish and preserve a system whereby any given piece could be instantly found.

The merest reflection will show that some receptacle which would permit of classification, as well as preserve the music clean and intact, alone fulfils these requirements. And here in passing let us record the unfitness of the ordinary paper upon which music is printed to withstand ordinary wear and tear, owing to its want of fibre.

The first governing consideration in planning a cabinet to hold music must of course be the exact size of sheet music, and the space that it will occupy in bulk. Now the average size is found to be very nearly 14½ by 10½ in.; and experiment will show that whilst some editions contain 4, others 6, 8, or 10, and some even 12 pages, that the average number of pieces laid one upon the other is about 30 to one inch in height. The next point to think about is how to classify the different sorts of music—as, *one*, sacred music, waltzes, other dances, songs, operatic music, pieces; or, if preferred, *two*, sacred songs, sacred pieces, waltzes, polkas and mazurkas, quadrilles, gavottes, and other pieces, comic songs, sentimental songs, &c., or any alternative classification, according to the exigencies of individual preference and the preponderance of any particular sorts.

By far the most convenient way of keeping music is to make a series of trays of the above size in which to lay the pieces one above the other—each tray devoted to some specific class, with the generic name on the front conspicuously painted on a slip of ivory or even written on a slip of paper pasted on and varnished.

These trays may be made—according to the taste of the individual or the facilities he or she possesses—of millboard covered with cloth with flaps similar to the cases used in the musicsellers' shops which keep the music free from dust, or of light hard wood such as mahogany or walnut, dovetailed together and polished, either with or without flaps to exclude dust.

Thus amateur bookbinders, apprentices to binding, or those who have relatives in these or similar branches, can more readily carry out our first suggestion; whilst amateur cabinet-makers, carvers and gilders, or other workers in wood, can select wood as their more convenient material.

In any case, the outer receptacle for receiving the trays must be, as it is an article of furniture, either of wood or its alternative papier-mâché.

This opens up an enormous field for originality of design—every conceivable style may be employed, every combination of finish called into requisition. Our province, however, is merely to indicate what we may term the base of construction, and to suggest ideas, leaving to our readers the option of carrying out their own deduced plans therefrom, and to stimulate them to strike out fresh designs on our skeleton models. Nor do we confine those who wish for even greater ingenuity and originality than this to our views, since we believe that the mere interchange of ideas is often, nay generally, "productive of wit in others," as our great and venerated Shakespeare says.

To those who are too immersed in other affairs, who are too young and inexperienced, we feel we are fulfilling our self-imposed duty in giving a comparatively easy design to carry out, suitable rather for the music-room, the school-room or library, reserving for another article the treatment of design suitable for drawing-rooms in the "Queen Anne" style.

Our illustration shows a side elevation, a front elevation, and a section of a semi-Gothic cabinet, severe in its simplicity, which may be easily carried out by any one who can use carpenters' tools, at a minimum cost for material; the more aspiring may go to the expense of walnut, brown oak, mahogany, or even rosewood; whilst those whose self-restraint empowers them to content themselves with plain deal—stained, ebonised or even painted—may do so, and thus economise sufficiently to carry out other projects suggested in WORK, reaping twice the pleasure and double the self-improvement they would secure in lavishing upon one only of our suggestions all their spare cash and labour.

The upper part of our design shows the music cabinet proper, but as it would be extremely inconvenient to place it on the floor, as well as giving a very insignificant appearance to it as a piece of furniture, we place it on a stand or pedestal, utilised as a sort of cupboard for "*bound-up*" music, fitted with a shelf. There are now-a-days several valuable although cheap forms of music of smaller dimensions than ordinary sheet music, printed from type instead of plates, such as the *Musical Budget* and others, and another size termed "Bijou." To provide for these odd sizes—between the upper parts of our cabinet and the lower, or pedestal portion—we place a drawer into which these publications can be put, as also any MSS. sheets (which are invariably smaller than printed plates, averaging 10½in. by 8½in.). Students' music-slates and pencils may also find a convenient resting-place in this drawer. This breaks the elevation into two distinct portions, the drawer symmetrically forming a parallel to the plinth of the lower half, giving coherence to the design.

Any second storey, so to speak, of any construction, should be, of course, not so high as the first storey, but as the most important consideration as to height is governed by the second storey—*i.e.*, the tray-holder—we must now decide the height of the upper portion, which should be made separately so as to lift off the pedestal, being much more portable than if made in one piece. By making it separate we are enabled to make the lower portion wider, and thus add to the general symmetry of the whole, which might otherwise give an appearance of greatly excessive height accompanied by narrowness.

Frame up two frames of 3 in. by 1 in. stuff for styles, and 4½ in. top rails, with 3 in. bottom rails, all grooved ¼ in., ¼ in. deep, also 1 in. thick.

Before gluing, make two panels, diagonal ½ in. matched boarding, rebated ¼ in. to flush at back, so that when in place they may finish ½ in. at reveal. Stop-chamfer 1 in. short of styles and rails, except at top, which, as shown in side elevation, is to be carved to a four-centre arch, taking care that the joint of the second board from the bottom of the panel bisects the angle of the lower back corner of the frame exactly; the rest will follow if the drawings—which are drawn to 1½ in. scale, that is one-eighth full size—are carefully enlarged to full size.

Then proceed to frame up similarly two other frames for the pedestal, 3½ by 1 in. styles, top rail 3½ in. by 1 in., bottom rail 4 in. 1 in. Note that the styles should be left 6 inches longer than where the lower rails' lower edge comes, so as to afford fixing for the plinth, and allowing the mortise to be of the full depth of lower rail (or if preferred made into two mortises) to give superior strength.

This remark also applies to the frames of the upper portion, as the "orms" drop into the upper part of the pedestal, so as to retain it when so placed in its intended position, the upper mortises in both should be gauged at least an inch below the upper ends of the styles, so that the "orms" may be sawn off flush (see dotted lines in section). Instead of leaving the panel so long in the upper part and making the drawer an indistinct portion of it (see *b b* and *d d*) the "orms" may be left 5 in. longer and the panel be made 5 in. shorter, as is done in the drawings, and a sub-plinth planted on them ¾ in. in thickness. The "orms" at top of each, may, instead of being sawn off flush, extend advantageously one inch above the top edge of rail to allow of the moulds being planted on the rails' top edges, instead of their faces, thus giving double strength and concealing the joint so made (see dotted lines in elevations), but the moulds must then be of course 1 in. broader, and be recessed opposite the "orms" 1 in. back. Next make the frame for the top of the pedestal, which should be of inch stuff 2 in. broad, to allow of being wrought into a thumb-mould, at front and at sides, left plain at back except the rebates to receive the back boards above and below. The inner faces of this frame should be left square, the opening to be of exactly the same dimensions as those of the interior of the pedestal; it must be mortised to receive tenons made in the upper orms (as shown) of the side frames of pedestal to be afterwards glued and wedged thereon, and also recessed so that the lower orms of the upper portion may fit into it firmly and securely without shake.

The bottom of the pedestal requires no framing, being glued and screwed to underside of the side frames on under-side of the bottom rails, recessed opposite the lower orms of these, to which the plinth, mitred at front corners, is fixed.

The top of the upper, or cabinet portion, will form sufficient frame, if it be mortised, to receive tenons cut in the upper orms of its side frames, and may be glued and screwed to the upper edges of the top rails of these. It should project at front and sides sufficient to allow it to be "stuck" into the mould shown, and to be thicknessed out by the upper members of the moulding previously got out and mitred, to be afterwards planted on, to form base for the parapet balusters. The bottom of the cabinet proper, which also forms the top of the drawer cell or compartment, need not be framed, but should consist of ½ in. stuff like the top, cut through for the lower orms of side frames, and glued and screwed from below to the lower rails of same, projecting, as shown, in front and at sides, to be worked into a small thumb-mould, and should be thicknessed out to 1 in. at front flush with front face of side-frame styles underneath it, for the front of drawer to close upon.

The two portions, upper and lower, being thus put together, having at the back been rebated ½ in. × ½ in., the backs of the proper size, consisting of ½ in. stuff, may be glued and screwed into the rebates. No stronger construction is possible: when put together, if the glue perishes, the various pieces are held together otherwise by being socketed, as it were, immovably into one another. The plinth at bottom of pedestal, and the sub-plinth of upper part, can now be planted on, glued, and, if desired, further secured by being screwed from inside to the orms against which they are planted. The plinth, as shown in section, however, should, for the sake of saving material, have between itself and the lower orms of the pedestal a piece of wood glued to both, through which the screws, if used, should pass, by which a ½ in. plinth will suffice. Both plinth and sub-plinth should be mitred at front, the sub-plinth only to short ends and to the rail alluded to, so as to leave an opening for the drawer; for which drawer runners should be made and provided, fixed flush at top with lower edge of sub-plinth.

It is advisable now to plant on to the upper part of the music-stand or cabinet the upper members of the moulding, which stands upon the thumb-mould, that forms the top frame of the pedestal. (See section.) The upper edge of this moulding must be flush with the under-side of runners for the drawer—*i.e.*, ⅜ in. above the upper side of the thumb-mould framing which forms the top of pedestal, the join of this moulding effectually concealing the fact that the upper cabinet lifts off the pedestal between the thumb-mould and the upper members. Now make the drawer of the dimensions shown in the drawings, but, of course, modified by possible slight inaccuracies in previous work. It ought to *fit* its receptacle with that workmanlike truth that all good work exhibits, so as to exclude every particle of dust without being too tight to pull out easily, or so loose as to shake as it is pulled out. It should be made of ¾ in. stuff planed true to ⅝ in. sides, dovetail grooved into 1 in. front, finished to ⅞ in., grooved to receive ⅜ in. bottom, ¼ in. by ¼ in. groove, bottom tapered to enter, and slotted to receive ½ in. back, extending from top edges only to the said groove of bottom. It may also be grooved ⅛ in. deep and ¼ in. wide for a partition, if desired to separate "Bijou" from "Bouquet" music; or it may contain a tray for slate, etc., music below.

We now come to the trays for upper portion, which consists of a bottom, ends, and back only. (See section.) These trays should be very accurately made, the sides and backs dovetailed together and planted on the bottoms, well glued on, and screwed from below while the glue is still hot. In the exact centre of the front of the bottom of each tray, glue inlet strip of wood (or ivory, if preferred), to carry the name of the class of music each tray is destined to hold; these trays, like the drawers, sliding in and out easily, but without shake, made so accurately as to ensure a workmanlike fit. Any tray may then be withdrawn, laid upon a table, pieces readily found therein, replaced, and the tray put back in any of the positions made in the cabinet. As shown in the drawing, these trays should be about 2¼ in. in depth, and rests may be inserted, glued and sprigged to the sides, ¼ in. square, to carry them and serve as runners, the under-sides of the runners being chamfered on their lower edges, as shown in drawings.

At any height preferred in the lower pedestal, a shelf may be fixed by letting it into a groove made to receive it in the sides, and further secured by a couple of screws through the backboard. The height shown in the drawings, however, appears to us to be the most appropriate to the design, as it does not divide it equally, but gradually reduces the interval of the spacing in an artistic ratio.

Crowning the whole piece comes the parapet, consisting of turned balusters (as shown) surmounted by a cap-moulding.

The front of the drawer which shuts against the previously described framing requires as a finish to be chamfered at the edges at an angle of 45°, and fitted with a handle or drawer-pull. The one shown in the drawings, being carved from a piece of 1½ in. wood, accommodates itself to the design better, perhaps, than a bought one.

This completes the construction; it only remains to finish the exterior. To give a bit of artistic colouring corresponding with the other furniture in the room, and also to keep dust from the pedestal's contents, make a curtain of any preferred material and colour, attach six rings to it of brass, electro, or turned of the same wood as the cabinet, and fix (as shown) a rod of same wood, of brass or electro-plated, by similarly recessing the top of the front edges of the styles at each side, and planting on ornamental brackets, similarly recessed, to hold the rods in position, finishing at each side with projecting button, turned of same wood, and at same time concealing ends of rod. Brass tube, either lacquered or plated, can be cheaply obtained from Evered's, Winfield's, or any other gas-chandelier makers; the rings at most ironmongers; and the brackets can be secured with one ornamental-headed screw at each side, enabling the rod to be removed and the curtain renewed, or, in some cases, as in that of chintz, washed, starched and ironed, and replaced.

IRON AND STEEL: ITS ANALYSIS.

BY CHEMICUS.

Determination of Carbon, Manganese, and Copper—Total Carbon.

Carbon may be contained in iron either in chemical combination—combined carbon—or in the free state—graphitic carbon, or graphite; and it is upon the conditions under which it exists, as also the amount present, that the classification of the metal into wrought iron, cast iron, and steel depends. When the metal containing the carbon in the two conditions is treated with a salt, the base of which is reduced or displaced by the iron, both the combined and graphitic carbon are deposited in a state of proximate purity, and may be collected, and the real amount of carbon determined, by combustion. Such forms the principle upon which the methods of determining the "total carbon" are based. The separation of the carbon may be effected by a large number of salts, amongst them a solution of the double chloride of ammonium and copper. The re-agent is prepared by dissolving 500 of the salt in a *litre* (1,000 cubic centimetres) of water.

For the analysis, ten grammes of the sample contained in a beaker are digested in the ammonium-copper chloride solution—twenty-five cubic centimetres of the re-agent to every gramme of the metal—until complete disintegration is effected. Should the liquid become colourless, or nearly so, a further addition of the ammonium-copper chloride solution is made. The action is accelerated by the application of a gentle heat, but care must be exercised that the liquid does not approach boiling, which would result in the silicon acquiring a gelatinous condition, which considerably retards the subsequent operation of filtering. The iron enters into solution as protochloride, while the combined and graphitic carbon, and invariably metallic copper, are deposited. To get rid of the latter, add a small portion of hydrochloric acid, more of the chloride solution, and digest. Complete solution of the copper having been attained, collect the carbonaceous residue on a filter constructed as follows: Take a piece of glass tubing, 1-in. diameter and 6-in. long; contract one end, and loosely plug up this narrowed portion with glass-wool, on the top of which place a layer of finely-divided asbestos, and wash with water, so long as any of the asbestos continues to run through. Wash the contents of the filter with a hot dilute solution of hydrochloric acid, and then with hot water, until the washings, when acidified with nitric acid, give no opalescence with silver nitrate.

For the determination of the real amount of carbon contained in the impure carbonaceous residue obtained as above, either a dry or moist process of combustion may be employed. The former method being the most complicated of the two, we shall employ the moist process due to Ahlgren, the principle of which is that upon treating the carbonaceous residue with sulphuric and chromic acids, carbonic acid gas, CO_2 is formed.

Rig up an apparatus similar to that shown in Fig. 2, and to flask D transfer the carbonaceous residue together with the asbestos filter. This is accomplished by inverting the filter tube in the neck of the flask and gently pushing it out, employing as little water as possible to rinse in the portions adhering to the sides. Having connected the flask with the rest of the apparatus, and closed the pinchcock A, add through the stopcock acid funnel 150 cubic centimetres of dilute sulphuric acid—one part acid to three of water—and 20 grammes of chromic acid crystals dissolved in a little water; close R, and apply a gentle heat. The carbonaceous residue is immediately attacked by the acids, with the production of carbonic acid gas, CO_2, which, as it escapes, is freed from any chlorine and moisture in passing through the tubes E, F, H, and is finally absorbed by the caustic potash solution—one part of the alkali to two of water—contained in the bulb tube K, the weight of which has been carefully determined and noted prior to the commencement of the experiment. As the evolution of the gas diminishes, gradually increase the heat until heavy white fumes make their appearance in the body of the flask, which may be taken as indicating that the operation is at an end. The operation ended, remove the source of heat, open pinchcock and draw a current of air, which, in passing through the tubes B, C, will be deprived of carbonic acid and moisture, through the apparatus by means of the aspirator P. When the apparatus is quite cold, detach the tube K, and weigh. The increase in weight represents the carbonic acid, CO_2, which contains 27·27 per cent. of carbon, on the weight of metal taken for analysis.

The tube M, containing calcium chloride, is attached to collect any water of the caustic potash solution which may be driven off by the heated gas. It is weighed prior to commencement of experiment, and also at conclusion, and any increase in weight deducted from first weight of potash tube.

To test the purity of the re-agents, it is advisable to perform a blank experiment.

COLORIMETRIC DETERMINATION OF COMBINED CARBON.

The carbon in the state of chemical combination—combined carbon, as it is termed—possesses the property of imparting to a nitric acid solution of the metal a brown colour, varying in intensity in accordance with the amount contained in the metal. This forms the principle of Eggertz's colorimetric test: a rapid, easy, and fairly accurate method. As a means, however, of accurately determining the combined carbon the method is very limited, as the results obtained with specimens containing over ·75 per cent., or have been hardened, are untrustworthy. For the execution of the test it is necessary to possess "standard" steels, in which the combined carbon has been accurately determined, and these should be of the same make and contain as near as possible a like amount of carbon (combined) as the samples to be analysed.

The *modus operandi* of the method is as follows:—In a test tube $\frac{1}{2}$-inch in diameter, 6 inches long, place ·2 gramme of the steel to be analysed, and in a similar tube the same weight of the standard steel. To each add 5 cubic centimetres of nitric acid, sp. gr. 1·20 (free from chlorine), and when all action is at an end, immerse the tubes in a vessel containing water maintained at a boiling temperature. After the expiration of from fifteen to twenty minutes, simultaneously withdraw the tubes, dissolving any crust adhering to the insides by causing the hot solution to flow over it, and cool by immersion in a vessel containing cold water. Procure two graduated tubes, of 50 cubic centimetres capacity, divided into $\frac{1}{10}$th, of equal calibre, and pour into one of them the solution of the standard, rinsing in the last portions with cold water,* and dilute until the volume occupied is a power of the carbon contained in the same. Thus, a standard with ·40 per cent. of carbon would be diluted to a volume measuring 8 cubic centimetres, which is the ·05th power. After dilution, thoroughly mix the solution by closing open end of tube with thumb and inverting a few times. The solution of the steel being analysed is now transferred to the other graduated tube, the last portions rinsed in with the least possible quantity of water, and the liquid mixed *without dilution*. Upon comparing the colours of the two solutions by holding them side by side, the standard on the left, with a piece of white unglazed paper behind them, before a window, it will be found that the steel under examination is, in all probability, of a darker colour than the "standard" solution. Should such be the case, to the former water is cautiously added in small quantities at a time, the solution being mixed and the colour compared with each addition, until equality of tints is obtained. The number of cubic centimetres occupied by the solution, when this is obtained, multiplied by the power to which the "standard" is diluted, will equal the per centage of combined carbon.

Should it happen that the "standard" be darker than the solution of the sample under examination, the volume of the former is doubled, the tints made equal as before, and in reading off only half of the volume occupied by the steel under examination taken.

* Throughout the determination *cold water* is employed.

GRAPHITE, OR GRAPHITIC CARBON.

A more accurate method of determining the graphitic carbon than the one described under the estimation of Silicon, is as follows:—Digest four grammes of the sample, contained in a beaker or dish, at a gentle heat for some considerable time with 150 cubic centimetres of dilute hydrochloric acid, and when the metal is nearly dissolved add a large volume of strong hydrochloric acid, and continue digestion. Upon complete solution of the metal, dilute and collect the insoluble matter, graphite, on a tared filter paper, which, together, with contents, wash with hot water, dilute hydrochloric acid, and a solution of potash to remove the silica; lastly, wash with alcohol and ether to remove any hydro-carbons; remove filter paper, etc., to the water oven, dry, and re-weigh to determine the graphite.

A small quantity of silica is invariably contained in the graphite obtained as above. To determine the same, the filter paper and contents, after weighing, contained in a platinum crucible, are ignited at a strong red heat for some time, and when cool the weight of any residue determined, and deducted from the first weight of the graphite.

MANGANESE.

For the determination of this constituent 2 grammes of the sample are dissolved, with the aid of a gentle heat, in 75 cubic centimetres of nitro-hydrochloric acid, the resulting solution transferred without loss to a flask of three litres capacity, and the liquid made up with hot water to a volume measuring two litres. To this solution is then cautiously added a solution of ammonium carbonate (dissolve one part in eight of water), in small quantities at a time, until it remains cloudy after brisk agitation. (Should a decided precipitate make its appearance, it is dissolved by the addition of a few drops of hydrochloric acid.) When this is obtained, add 150 cubic centimetres of hot ammonium acetate, bring the liquid to boiling (but do not boil for any length of time), and allow to stand at rest until the precipitate of basic acetate of iron has completely settled. Pass the clear supernatant liquid through a large English filter paper, receiving the filtrate in a porcelain dish, throw on the precipitate with the last portions, and wash filter and contents* with hot water containing a little ammonium acetate. The filtrate contains the manganese, but on account of the small quantities usually present in iron and steel, it is advisable to considerably reduce, by evaporation, the volume of the same before proceeding with the precipitation (of course any precipitate that may come down during this operation is removed by filtration). This having been done, to the concentrated filtrate contained in a flask, when quite cold, add a sufficient quantity of bromine to cause it to acquire a dark brown colour, and to the brominated solution ammonia until strongly ammoniacal, briskly agitating the containing vessel upon the addition of each re-agent. This results in the precipitation of the manganese as hydrated peroxide. Heat the solution to

* As the complete separation of iron and manganese is a difficult matter, it is advisable to dissolve in the least possible quantity of dilute hydrochloric acid the basic acetate of iron precipitate on the filter, and alter dilution to re-precipitate the iron with ammonium, carbonate, etc., as before. The precipitate collected on a filter, well washed, the filtrate mixed with the first and the combined filtrates concentrated, etc.

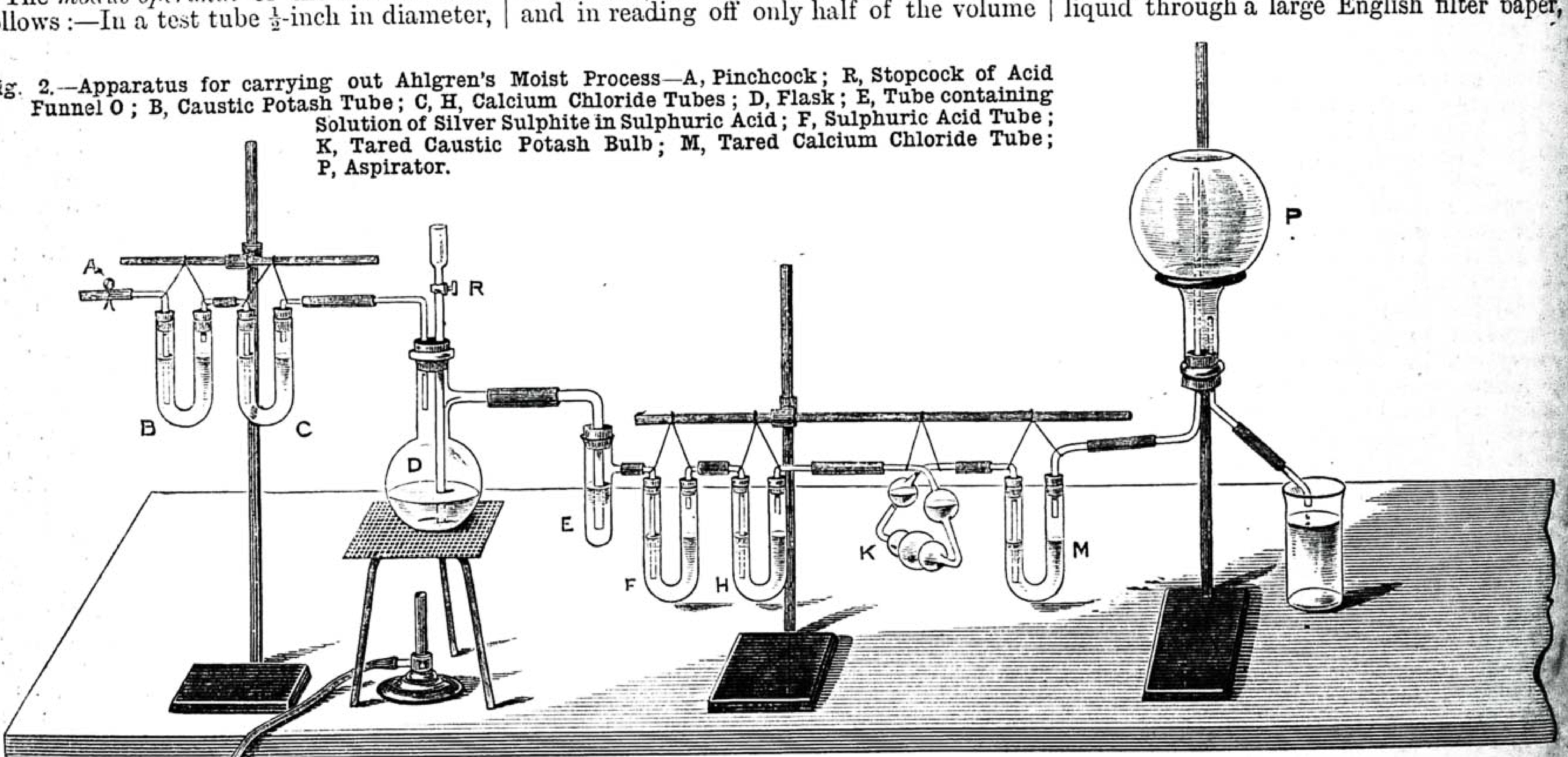


Fig. 2.—Apparatus for carrying out Ahlgren's Moist Process—A, Pinchcock; R, Stopcock of Acid Funnel O; B, Caustic Potash Tube; C, H, Calcium Chloride Tubes; D, Flask; E, Tube containing Solution of Silver Sulphite in Sulphuric Acid; F, Sulphuric Acid Tube; K, Tared Caustic Potash Bulb; M, Tared Calcium Chloride Tube; P, Aspirator.

boiling, collect the precipitate on a filter paper and well wash with hot water. Transfer filter paper and contents to a platinum crucible, ignite at a strong red heat, whereby the precipitate loses water and is converted into tri-manganic-tetra-oxide, Mn_3O_4, every hundred parts of which is equivalent to seventy-two of manganese, and when cold, weigh.

Owing to the large bulk of iron through which the manganese is diffused, and also to the presence of organic matter in the re-agents, a small quantity of iron invariably remains in solution, and is precipitated along with the manganese. It is therefore necessary to test the precipitate for iron. This is done by dissolving it, after weighing, in a small quantity of hydrochloric acid, withdrawing a drop of the liquid at the end of a glass rod, and bringing in contact with a drop of a weak solution of ferrocyanide of potassium, spread on a white porcelain slab, when, if a blue coloration is formed, iron is present. Should such be the case, the remainder of the solution is diluted with the water, made neutral with ammonium carbonate, and the iron precipitated with ammonium acetate; the solution then heated to boiling, the basic acetate of iron collected on a filter, thoroughly washed, converted by ignition, contained in a crucible, into ferric oxide, Fe_2, O_3, and weighed as such. The weight of the ferric oxide thus obtained is deducted from the weight of manganese precipitate.

It is more satisfactory to determine the iron colorimetrically, which is performed as follows:—Prepare a nitric acid solution of iron of such a strength that one cubic centimetre contains ·0014 gramme of ferric oxide, Fe_2, O_3. This may be conveniently done by dissolving 1·004 grammes of pianoforte wire (containing 99·70 per cent. of iron) in nitric and diluting to one litre with water. Dissolve the manganese precipitate to be tested in a small quantity of nitric acid and a few drops of hydrochloric acid; transfer the resulting solution to a Nessler's cylinder, make up with cold water to a volume measuring 50 cubic centimetres, add four drops of a dilute solution of ferro-cyanide of potassium, and thoroughly mix the liquids. In another cylinder place one cubic centimetre of the standard iron solution, dilute to 50 cubic centimetres, add four drops of cyanide solution, and, after mixing, compare the tint with that of the manganese precipitate solution. Should the tints of the two solutions be unequal, a greater or less quantity of the standard iron solution is taken, diluted, etc., until the quantity required to produce equality is obtained.

Copper, if present, would be precipitated along with manganese, and its removal may be effected either previous to the precipitation of the manganese or from the precipitate itself. The former method is treated on under "Copper." If the separation of the copper be effected by the latter method, the manganese precipitate, after weighing, is dissolved in the least possible quantity of dilute sulphuric acid, and to the resulting solution pure metallic zinc added; a mutual exchange takes place, the zinc entering into solution as sulphate, while the copper is deposited in the metallic state. Immediately the zinc has dissolved, decant off the liquid, wash the copper thoroughly (by decantation) with water, dry, and weigh.

COPPER.

Copper being, as a rule, present in such small quantities, a somewhat large quantity of the metal must be taken for the determination.

Dissolve at least ten grammes of the sample in nitro-hydrochloric acid, and separate the silicon by the method already described. Dilute the resulting filtrate to a volume measuring one litre, cool the solution, add sufficient sodium sulphite to reduce the whole of the iron from the ferric to the ferrous state,* and then heat to boiling, until all sulphur dioxide is expelled. Through the solution, while hot, pass a current of sulphuretted hydrogen to saturation, close the mouth of the containing vessel, and allow to stand in a moderately warm place for three or four hours. The copper is precipitated as sulphide, $Cu_2 S$; it is collected on a Swedish filter paper, and washed half a dozen times with water containing sulphuretted hydrogen. The filter paper is then pierced, and the precipitate completely rinsed by means of a fine stream of dilute nitric acid delivered from a wash bottle into a beaker or flask, some strong nitric acid added, and the whole digested at a gentle heat until all has entered into solution with, perhaps, the exception of a little free sulphur, which is removed after dilution of the liquid by filtering. The solution is now heated to boiling, and while at this temperature the copper precipitated, by the addition of a solution of caustic potash, as copper oxide, CuO, which is collected on a filter, well-washed with hot water until free from alkali, ignited, and weighed. Copper oxide contains 79·85 per cent. of copper (metallic).

*To determine whether reduction to the ferrous condition is complete, withdraw a drop of the solution, after the expelling of the sulphur dioxide, at the end of a glass rod, and bring in contact with a drop of sulphocyanide of potassium, when no red coloration will be formed should reduction be complete.

THE WATERBURY WATCH—LONG AND SHORT WIND.

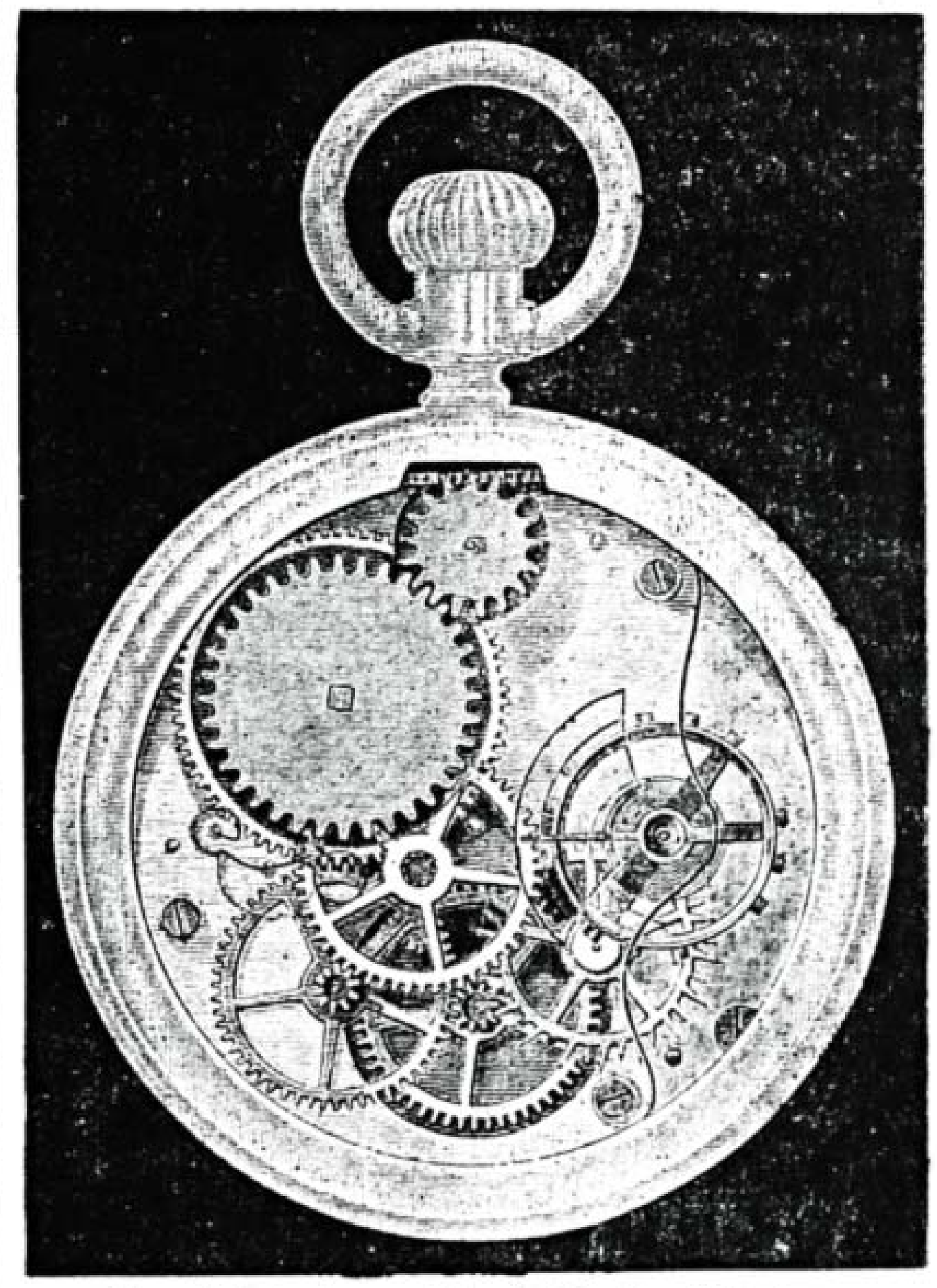
BY A PRACTICAL HAND.

This watch, now so well known, has the merit of cheapness. The long wind (see sketch) Waterbury is an excellent timekeeper—in fact, equal to watches costing ten times the price. The long wind has a peculiar motion; the whole movement turns round inside the cases—the plates, wheels, etc.—its long main spring being fixed in the centre, and the winding whereof is rather tiresome—a performance accomplished by turning the stem within the bow of watch, requiring 80 to 100 turns, unless you wind up several times during the day. But this plan is now surpassed by the short wind, thereby placing them equal to any other. They have a good clear dial, and a very superior style of case in nickel silver, which wears remarkably well if used with ordinary care; but no case will keep smooth if worn, as too many are, in a pocket with small articles, keys, coins, etc. A pocket lined with wash-leather is best—the watch is always bright, and will last years longer. But no one can expect these cheap watches to last like old verges and levers which have seen three and four generations; people now want changes different to their forefathers.

In that case these watches will fill all modern requirements, and they are extensively worn on both sides of the Atlantic.

How to clean and repair them. (Though the public are strictly enjoined on the inner dome "not to remove it by undoing the three screws unless you are a watchmaker"; but still, hundreds will and do look inside, like the lad who cut open the bellows to see where the wind came from.) First thing after the amateur unscrews those screws and raises the inner dome, out flies the immense spring, like a large serpent. This utterly astonishes them; many have been brought to me in this stage, with all tied up in a handkerchief or sheet of paper—they dare go no further; and the parties who sell them, agents in England, put up notices, that no one is authorised to clean or repair them, and, as a rule, will not sell you a duplicate part or spring; but I could always get them.

Well, to commence: unscrew the three screws and lift one side of the plate gradually up until you can slip a thin piece of steel or other article on the spring, holding it firmly down with your thumb; now lift off the dome entirely, and you will see how the centre of spring is adjusted to a notched stud; turn the stem winder to see how the ratchet works by holding the stud firmly and lifting out the click from the ratchet inside; you can now let it down, which is rather a tiresome process. When down, notice particularly how the outer end of the spring is fixed: in fact, just sketch it on a piece of paper, as you may forget, seeing that the extreme end is used to act as a stop in overwinding. Now lift it out and the centre—be very careful, or you may snap the end which hooks on. You have now its simple works before you; few wheels—the long spring saves the use of wheels. Put pressure on the main wheel, and see the duplex escape how it works; every other tooth goes into a detent in the staff of balance, the other tooth holding it until the next is ready, and so on until the thirty hours is complete. Now take off the glass front, and unscrew the screw that holds the stem winder, and the works will now come out. You see the simplicity of arrangement; this has gained it its great popularity, and the few wheels are here which you were cautioned not to look in at, for why? We in the trade know the reason.



New Waterbury Short Wind; J Series.

Give every part a good study, and then proceed to unscrew, and, as in my previous description of the Horizontal, take and brush every wheel and the plates — you cannot injure their plates, for they have none; Of course it cannot be expected; no more can you find jewels, so see to the pivot holes if any are worn oval (this in time will be the drawback to the Waterbury); when all is clean and ready for fitting, examine all the teeth of wheels to see none are bent or grit in betwixt, clean the balance and its spring, as I previously stated (see former chapters), oil the pivot holes, and replace the few wheels. You cannot possibly make a mistake (except in the new Waterbury, which has a going barrel same as the American Lever; the only difference is the escapement.

After replacing wheels, adjust the top plate and balance, try it by pressure on centre wheel if the motion is all right. The class of long wind you can only test inside their cases; so re-fix the movement and pass the centre coil of spring around the hook. I must praise this hook, it is superior to our English small affairs. Now replace cover, hold it on with your thumb to keep spring in or it may bounce out and so trouble you; give it a good many turns with the stem winder, and now you will hear it tick, for they have really a good healthy beat. I remember the first I had; I wore it a week or two to try it. The first night I wound quite two minutes, and a cold night it was; I hung it up where I usually kept my gold centre seconds. But oh, what a row! I could not sleep, nor could my wife; so I placed it in a drawer of the dressing-table, but that helped the sound, so I got out again in the cold and thrust it into my slipper with sock after it, and now it was about equal to centre seconds; so I slept. I was told of one that they threw out of the window in disgust; but I fancy watches better than that.

Replace the three screws, spring on the back, press on the two hands at their proper time, for they do not turn one another. It will require regulating, the regulator you will see under one of the spaces around dial; it changes—you may find it at six or three o'clock, etc., that is through the movement revolving in the cases. The short wind is same as all watches.

SIGN-WRITING AND LETTERING.

BY HENRY L. BENWELL.

COLOURS USED BY THE SIGN-WRITER.

I GAVE in a previous chapter a full list of tube colours as put up by the artists' colourmen, but a great many of these colours are hardly used by the sign-writer, nevertheless he has the list for reference and guide. I now append a short list of the colours which are absolutely in request by the sign-writer, and from which he can get, by mixing, a large assortment of other tints and shades.

THE SIGN-WRITER'S PALETTE.

Raw Sienna.	Gamboge.
Burnt Sienna.	Yellow Lake.
Raw Umber.	Green-Lake, Nos. 1, 2, 3, 4.
Burnt Umber.	Emerald Green.
Vandyke Brown.	Vermilion.
Ultramarine.	Indian Red.
Prussian Blue.	Venetian Red.
Indigo.	Crimson Lake.
Yellow Chrome, Nos. 1, 2, 3, 4.	Scarlet Lake.
Yellow Ochre.	Rose Madder.
Ivory Black.	Flake White.
Vegetable Black.	White Zinc.

There are a few other colours which are best purchased in the dry state, in fact they are not always found in tube colour list. These are Chinese red, Persian red, orange lead, and a few more, and they can frequently be made good use of, and often save the use of some of the more expensive tube colours. It must be distinctly understood that this list of colours is for lettering only, not for painting the surface of sign-boards, and that it refers to tube colours. Of course, the workman can buy some of his colours in the dry state, but those which are most difficult to grind are always found purer and finer when purchased in tubes, than those procured ready ground in bulk. In looking down the above list, the novice must not for one moment suppose that he need purchase a full supply to commence with, in fact, he may only select those most useful to his individual taste and requirements, and add others as he wants them. There are again four shades in chrome yellow and green lake respectively; do not purchase all, however, but start with Nos. 1 and 3. By using discretion and practising economy in this way, may be the means of preventing a good few halfpence being thrown away on plant that cannot become of immediate use to its owner.

As every workman, to be perfect, and able to excel in good workmanship, must not only have a thorough knowledge of his tools, but also of the materials he manipulates, I shall now give a slight analytical description of the most common colours amongst those I have already enumerated, besides a few colours used for ground surfaces, which may be reckoned somewhat dangerous to the permanency of our work.

White Lead.—As this colour is one of the most frequently used colours in all kinds of painting, and also one of the most faulty, it deserves first notice here. It is made by suspending rolls of ordinary thin sheet lead over malt vinegar or pyroligneous acid, in close vessels, the evaporation from the acid being kept up by a steam bath underneath. The lead is thus reduced to a white powder ready for being ground up with linseed oil into a paste. White lead improves by keeping, and I would strongly advise sign-writers and others who undertake particular and delicate work, to stock it for at least twelve months after purchase. Very pale and old linseed oil should also be used in the thinning, otherwise it will probably soon discolour, which is its greatest fault. It is however, about the best pigment we have for preserving wood, etc., from the effects of the weather.

Flake White is a very pure white indeed, and not at all likely to discolour; it is on this account generally used as a finishing coat over previous ones of white lead.

Zinc White is an oxide of zinc, but it does not possess so much covering power as white lead. It however retains its colour, and is a very pure pigment. "Charlton white" manufactured by Messrs. J. B. Orr & Co., London, S.E., is, I believe, a species of zinc white which has the advantage of possessing as much covering power as white lead. This paint has been used with the best results.

Ivory-black is made from ivory turners' dust. This is placed in a covered crucible, and exposed to a great heat, which, after a certain period, turns it to a beautiful jet black. The inexperienced, like myself in such matters, must be cautious to see that they are not put off with a very inferior article when purchasing this pigment. This inferior colour is known in the trade as bone-black, and is made by treating bones in a similar way to the ivory, and it is very often sold as ivory-black by unprincipled tradesman for the sake of a largely increased profit. To make sure, therefore, of obtaining ivory-black, go to a good house, and pay the the best price. Mr. Callingham, a sign-writer of many years' experience, informs us that ivory-black, the deepest and purest of the blacks, being somewhat hard, requires very careful grinding, and that unless ground very fine it will spoil our work. It is best ground in turpentine, and diluted for use with turpentine, gold size, and a little varnish. In drying it will become dull, so that it should not be used unless it has afterwards to be varnished, which will bring it back to its original intensity. It is a difficult pigment to manage, as, if it is thinned down too much with turpentine it will not bind, so that when the varnish is applied it will rub off on to the rest of the work and spoil the whole. Ivory-black, when purchased unground, resembles "drops," and is sometimes called "drop-black," but bone-black is got up in the same way, so great caution is required.

Vegetable-black has now taken the place of lamp-black. It is sold in a very light powder and requires no grinding, being free from any gritty substance. Patent driers may be added for drying purposes, and it may be used on work that has not afterwards to be varnished.

Burnt Sienna is an earth of a very rich transparent red-brown, and is used for glazing over gold leaf and shading. It works well on gold leaf when mixed with a small quantity of ox-gall. It should be thinned with copal varnish, not turpentine; and gold size may be used as a drier; it, however, dries better than raw sienna, and is very permanent, as it is not liable to change by the action of light and oxygen, nor by damp and impure air.

Raw Sienna is rather an impure yellow, but has more body than the ochres and is also more transparent. By burning it becomes deeper, and is then the burnt sienna mentioned above. It has also the same properties as burnt sienna.

Raw Umber is an ochre brought from Italy; it is a good drying colour, and does not injure other colours with which it is mixed. It is used in graining.

Burnt Umber is the former pigment burnt. It is a good drier in oil, and is therefore often used as such. It is very permanent, and is sometimes used instead of Vandyke brown.

Vandyke Brown is a rich deep transparent brown, a colour good for glazing and for "markings" on gold. It is a bog earth, and not a very good drier. It is permanent.

Ultramarine when perfectly pure is about the most expensive colour we have, but the sign-writer uses generally French ultramarine, an inferior product, which will, however, stand pretty fair when protected with oils and varnish. It may be deepened with vegetable-black, and when mixed with white makes a pure tint.

Prussian Blue is a good working and staining colour and a quick drier.

Indigo possesses great body, and is a good glazing colour. It is not very durable, and is injured by impure air.

Lemon and Orange Chrome.—These pigments, when of best quality, are chromates of lead, and are very pure and brilliant; they have good body and covering power, and make good tints when mixed with white. When used in oil they must be protected by varnishing, especially if exposed to impure air, which in time will turn them black. They make the so-called gold colours, but must on no account be intermixed with Prussian and some other blues in making greens, as chromate of lead will destroy these pigments. The yellow chromes are made in three shades, known as Nos. 1, 2, and 3; the No. 4 shade is the orange chrome, a deep rich colour. The shades are varied by increasing the chromate for deep orange, and lessening it for the pale yellows. These colours are injured by damp and impure air, sulphur fumes and hydrogen; but the orange chrome is said to have more lasting qualities than its near neighbour, orange oxide of lead. The chromes are useful colours, but require careful and skilful handling.

Yellow Ochre.—Not a very gay colour, and is best purchased in tubes, otherwise it is not thoroughly ground. It is an earth found in most countries, and of all shades, from the warm yellow of the Oxford ochre to the pale straw yellow of the French earth —the latter often used for "old gold" shades, etc. The ochres are not liable to change through any chemical actions, and may, therefore, be considered permanent.

Green Lakes.—These are very useful and powerful colours, sold in tubes; they are not noted for permanency, so want well protecting. They may also be purchased in bulk ready ground in oil.

Emerald Green is, perhaps, *the* sign-writer's green, the tube colour being the best to work with. It is a copper green upon a terrene base, very useful for brilliant work. It has not much covering power, and is a bad drier in oil, therefore requiring gold size or patent driers. It is a safe pigment for retaining its colour.

Vermilion can be had as a fine dry powder, free from grit, and is a very brilliant colour in oil. The best quality only is permanent, and that is a sulphuret of mercury. Chinese red, or vermilion, is of a deep crimson tone, but with bad covering power, and, unless well protected, will soon fade from the action of light and impure air.

Indian Red.—Peroxide of iron, procured from the iron ore mines of Bengal. It makes pleasant tints with white, is perfectly permanent, and possesses great body. It may also be used as a ground colour, or as a shade tint with vermilion. For a ground colour it may be mixed with turpentine, 4 parts; varnish, 1 part; when it will dry very quickly.

Venetian Red.—This colour is obtained as a native earth or as a bye product from sulphate of iron in the manufacture of acids. It is exceedingly cheap, but permanent, but must be procured ready ground in oil. It is useful as a ground colour.

Purple Brown, although not mentioned in the list, is much used by sign-writers as a ground and shading colour; insist, however, on having purple brown, and not common oxide of iron. It is rather a bad drier in raw oil, and requires the addition of patent driers or a little varnish. It has good covering powers, especially over a slate colour, but has little or no body.

Lakes, Crimson and Scarlet.—These are brilliant transparent colours, chiefly used as glazes. They make beautiful tints with white, such as carnation, and are then, of course, opaque. Strong light, however, soon discolours lake, and also the tints made therefrom. As a protection, a finishing coat of varnish should be given.

Rose Madder is a beautiful, rich, and permanent red, although very expensive. It is used on the very best work, and is procured in the usual tubes. It is a good tint colour.

I have now taken the pains to convey to the workman some idea of the bases and composition of the various pigments he works with. Although this has taken up the whole of a chapter, I feel it will be space well occupied, as unless the workman has a certain amount of knowledge concerning the colours he uses, and their liability to change or fade under certain conditions—or, on the other hand, their power of permanency, and the destructive qualities of some pigments towards others when coming in contact with them—no man can hope to execute permanent and satisfactory work. This subject is far from exhausted here; in fact, a book could be written upon this matter alone, and would prove, indeed, a great boon to the house and general decorator.

Some few years back a friend gave the writer a copy of Field and Davidson's "Grammar of Colouring" (Crosby Lockwood & Co., 2s. 6d.), but, unfortunately, it has, up to now, been hardly looked at by him, partly through pressure of work, and partly through so much other reading matter engaging his attention. In this book appears to be much matter of use and interest to the sign-writer, a very valuable feature being some tables of pigments showing at a glance—(1) Those pigments, the colours of which suffer different degrees of changes, by the action of light, oxygen, and pure air, but are little, or not at all, affected by shade, sulphuretted hydrogen, and foul air; (2) Pigments the colours of which are little, or not at all, changed by light, oxygen, and pure air, but are, more or less, injured by the action of shade, sulphuretted hydrogen, and impure air; (3) Pigments, the colours of which suffer from all of these causes; and (4) Pigments whose colours do not change from any of these actions, nor by the action of lead or iron.

Such information as this, it need hardly be said, is invaluable to the most simple worker in colours, and the sign-writer should certainly possess a copy of these interesting tables.

SOME HINTS ON WOOD-CARVING.

BY D. ADAMSON.

THE suggestive ideas for carved panels, etc. shown by the illustrations will be welcome to many readers of WORK, not only among amateurs, but among professionals who wish to get hold of good workable designs. These are from the clever drawings of Mr. John Law, a Liverpool carver of ability, and without entering into any long description of them or giving minute details of the way to work them up, a few general remarks may not be unappreciated by the younger portion of our readers.

Perhaps at first sight some of those who are not able to draw well may experience some disappointment at not finding the particular design they would like to carve of a suitable size for the panel they wish to decorate. They are hardly likely to want to reproduce it in a smaller size, though for some dainty piece of work in close-grained wood there is much scope for ability, and it must be remembered that the value of carved work does not depend altogether on its size. However, the well-known plan of dividing the design to be copied into sections by ruling lines each way, *i.e.*, from top to bottom and across, and marking the panel, or, the same thing, the paper on which the enlarged drawing is to be made, with an equal number of squares, but proportionally larger or smaller is equally applicable for reductions as for enlargements.

Necessarily the tools must be properly sharpened. Without wishing to find fault with amateurs, it cannot be denied that but few of them keep their tools in proper order, even if they have ever had them so. Carving tools as ground and sent out from ordinary tool-shops, or prepared for work by cabinet-makers, etc., are seldom as they should be. The sharpening of the edges is almost an art by itself, as, altogether apart from the keenness of the edge, the bevel is of the utmost importance. One often sees tools which, though sharp, are certainly not fit for the carver's use, simply because they have been ground and sharpened on the back only instead of being sharpened and bevelled away from the front as well.

Then the size of the tools, both blades and handles, supplied to amateurs is too small. I do not now refer so much to width across, because this must necessarily vary, as to length. Roughly speaking, to obtain proper command of the tool it should measure about 12 in., equally divided between blade and handle.

Another defect with unskilful carvers is the way in which they hold the tools when cutting. It is no use attempting to do good work by holding the tool in one hand only, whittling away the wood as though a penknife were being used. The tool should be firmly, yet freely, held with both hands, the left on the blade and the other on the handle. This should always be done by those who wish to carve the wood only; but if their intention is to spoil the work and test the cutting powers of the steel in their own fingers, let them hold the panel down with one hand, by preference in such a position that if the tool, weakly held in the other one slips it will go straight into the flesh. The design—after sticking-plaster has been used—can then be studied at leisure without a desire to proceed more actively towards its completion. In connection with this, may I caution amateurs against the dangerous practice many of them have of walking about their workroom with a tool in their hands? When the tool is not actually in use it should be be laid on the bench or table, and not be carried about. With a keen edge an accident soon happens, and, instead of, as one sometimes sees in classes where carving is taught, one pupil, perhaps going to speak to a fellow-worker with a tool in his hand, it should be laid down. Carrying a carving tool recklessly is almost as reprehensible as pointing a gun at a person on the chance that it is not loaded.

It is an oft-repeated piece of advice not to use glass-paper, either in preparing the wood to be carved on or for finishing the work; but in spite of all that has been said against it the temptation to smooth up with paper seems too strong to be resisted. I raise here no objection to the novice using as much glass-paper as he likes, only I do not say that it will be without serious detriment, both to the tools that are used subsequently, and to the work itself. Spoil the edges by using paper while the work proceeds, and spoil the work by papering it up after the tools are put away. It is useless to protest against glass-paper any more than it is to urge the necessity of keeping the tools sharp, so I don't attempt to do so just now, but I state what the consequences will be.

That tools should be learned by beginners is perhaps such an axiomatic bit of advice that it may be considered unnecessary. Instances are not wanting, however, that novices sometimes do aspire to carve without knowing anything more about the names and scope of the various tools than that one of them has a red bit of cotton tied round it, and that when they want to make a certain cut they must use the other with the white thread; such pupils don't advance much, unless gifted with an amount of ability which their bad memories seem to deny. Some people seem to find an insurmountable difficulty in distinguishing between a chisel and a gouge, as great as that which some—females chiefly, such as charwomen and domestics—have in knowing that the uses of a chisel and a screwdriver are not identical. Well, in case any would-be carver reading this does not know his tools let him learn them. It may take some time; still, the thing is to be done—with perseverance. As a young sky pilot was told lately when he asked if carving could not be learned without knowing the tools first: "It can't be done, and there is no artificial aid to memory."

I have touched on a few of the difficulties, absurd and commonplace as they may be, which sometimes occur, and in conclusion, I may remind all that wood-carving is an art in which, though the rudiments may be imparted, proficiency can only be acquired by practice.

Although given ostensibly as designs for the carver's use, there is no reason why the repoussé worker should not avail himself of them, if not in their entirety at least by taking them as motives. Fig. 9, if nicely carried out, would make a panel equally as charming in hammered brass as in wood, and the same may be said of Fig. 7. In case the use of these or other designs as motives for other patterns, or, perhaps, shapes and sizes, has not been understood, this last-named (Fig. 7) affords an excellent illustration of what is meant. Let us assume that a drawer front, say one of much greater length in proportion to its breadth than that shown. All we have to do is to elongate the pattern, or perhaps repeat it twice without showing any break between the two, and we at once have what at first sight would appear to the casual observer to be a new design, but which after all is merely the original design treated to meet the exigencies of the case.

Fig. 1.

Fig. 2.

Figs. 1 and 2.—Corners, for Wood-Carving.

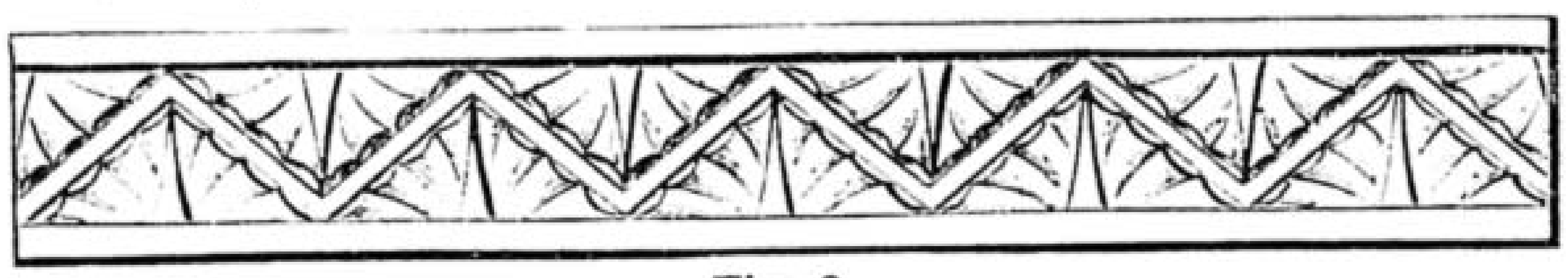


Fig. 3.

Fig. 4.

Figs. 3, 4, 5, and 6.—Borders and Edges in Carved Work.

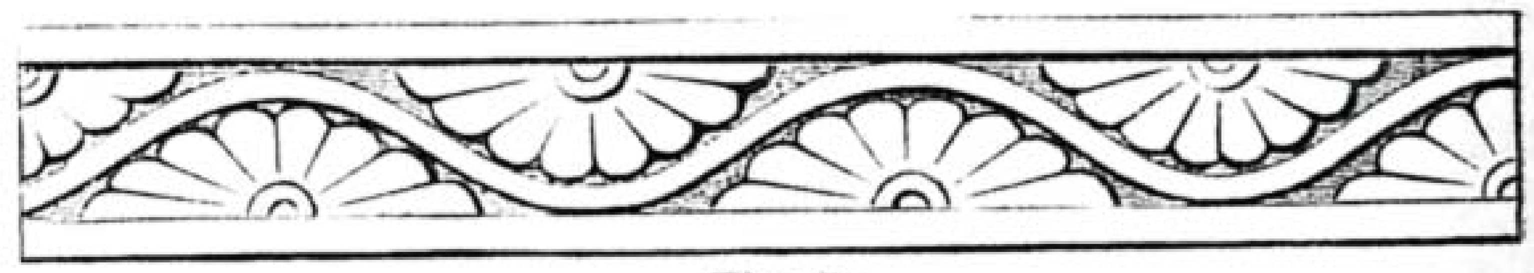


Fig. 5.

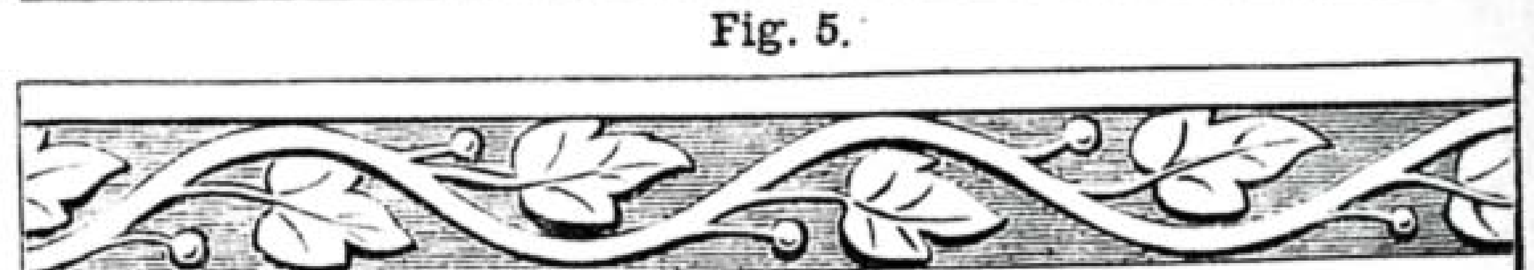


Fig. 6.

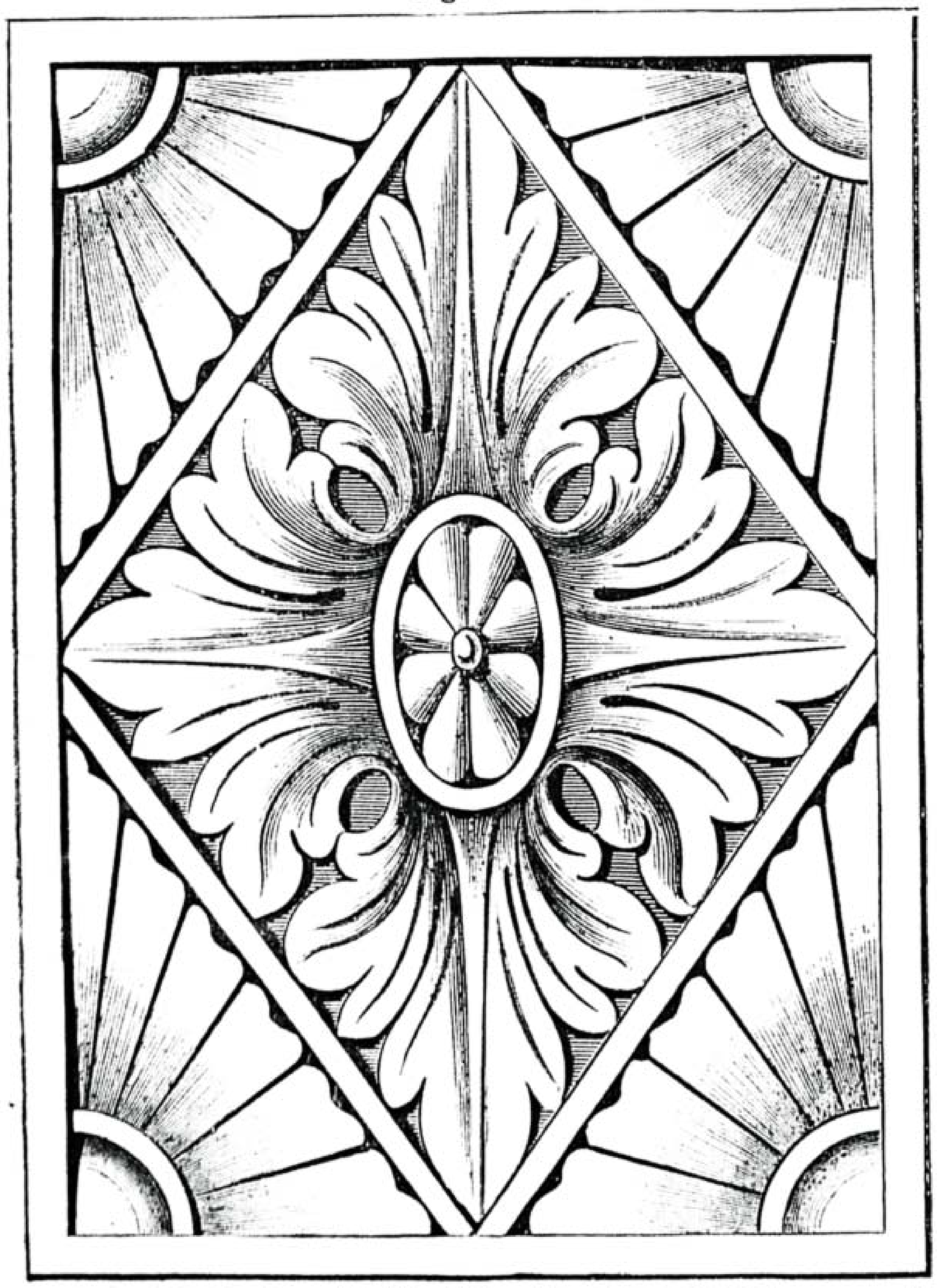


Fig. 7.—Panel in Wood-Carving: Ornamental.

Fig. 8.—Narrow Panel.

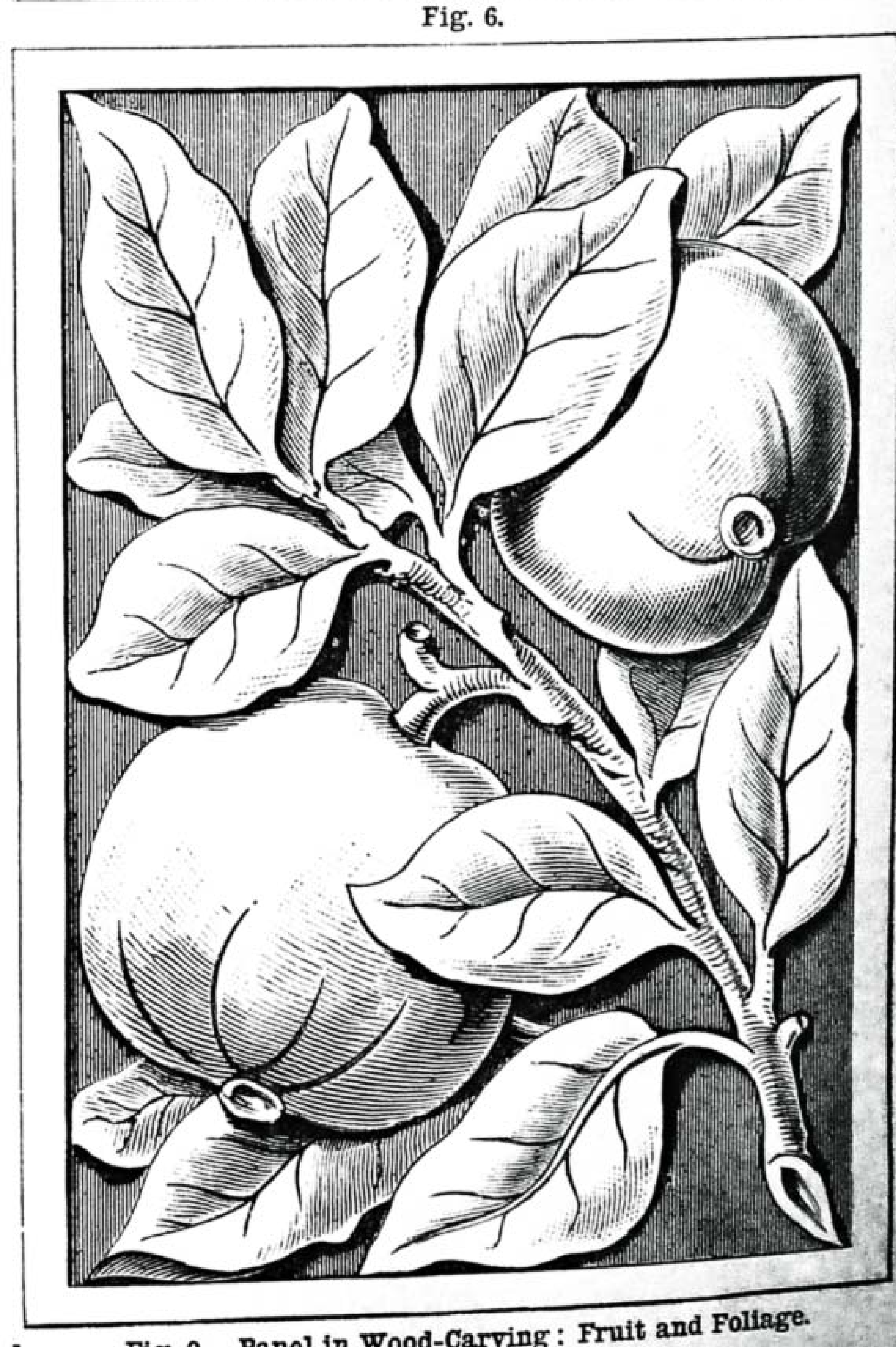


Fig. 9.—Panel in Wood-Carving: Fruit and Foliage.

MILNES' NEW SELF-ACTING SLIDE AND SCREW-CUTTING LATHE FOR FOOT POWER.

BY AN ENGINEER.

Mr. H. Milnes, of Ingleby Works, Brown Royd, Bradford, has been making lathes for about thirty years; he makes for use in engineers' workshops a very sound and serviceable tool, which, for the 5-in. centres size, is £4 lower in price, and which he calls Class B. The lathe herewith illustrated is the 5-in. lathe of Class A; it has extra care bestowed upon it, and appears well worth the £28 charged. The maker's description of his new "Self-Acting Slide and Screw-Cutting Lathe, to be Worked by Foot-Power," is as follows:—Strong bed fitted with removable gap piece, and mounted on strong iron standards; double-geared headstock with eccentric motion to back-gear; steel mandrel of warranted accuracy, with adjustible *hardened* conical bearings running in *hardened* steel bushes; driver chuck, face plate, and cone centres; cylinder poppit-head with steel screw and accurately fitted spindle; strong self-acting sliding saddle with recessed cross-slide; hand surfacing motion, and quick return by rack and pinion; compound slide-rest graduated for turning taper or conical work to any desired angle; Willis' universal tool-holder; steel leading screw, full length of bed; full set of twenty-two machine-cut change wheels; calculated table of pitches for screw-cutting; reversing motion for cutting right and left hand threads; speed cone for gut band; strong turned crank-shaft running on anti-friction centres of hardened steel; chain and roller treadle motion and heavy turned driving wheel; hand rest with eccentric fastener and two top rests; travelling back stay; foot-board; driving band; and all the necessary spanners. The lathe can be used for cutting long spirals; its approximate weight is 8 cwt.

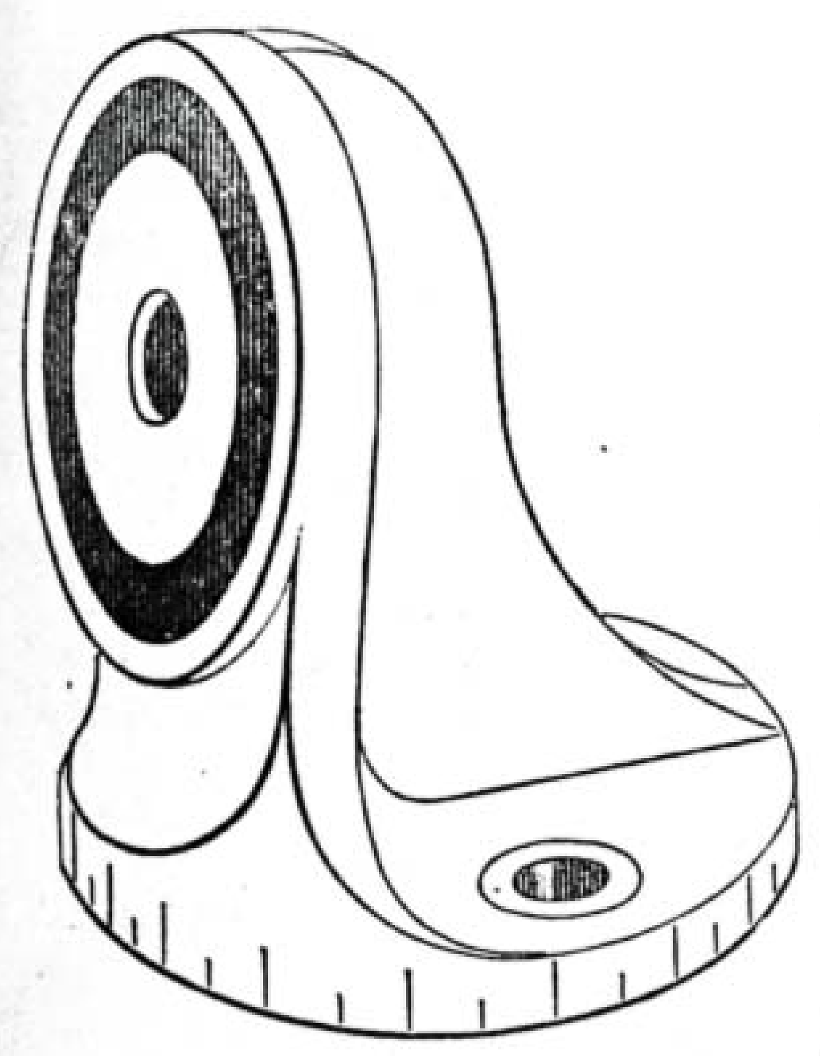


Fig. 2.—Swivelling Bracket for Holding Slide Rest in Vertical Position.

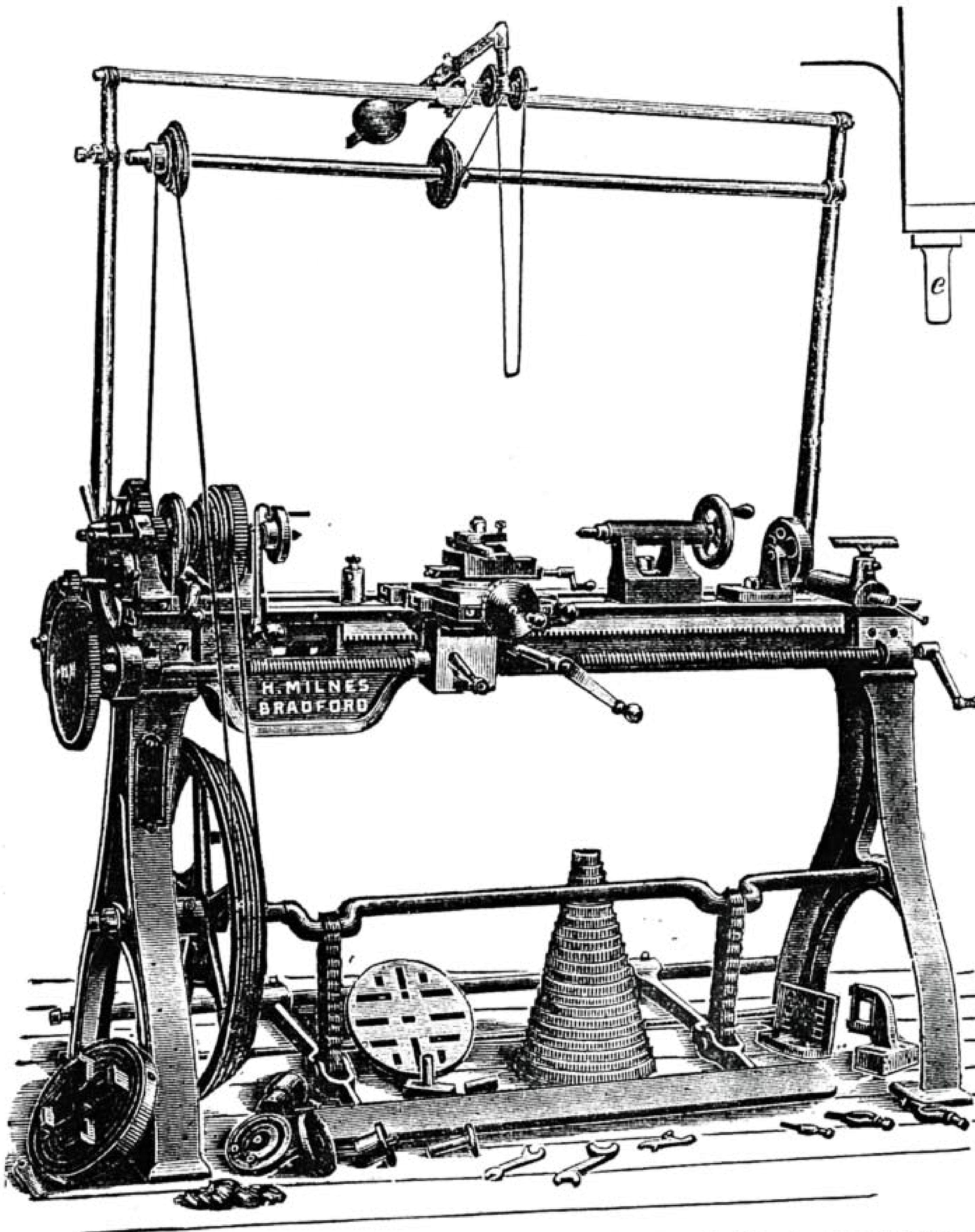


Fig. 1.—Milnes' Self-Acting Slide and Screw-Cutting Lathe for Foot Power.

"These lathes are well proportioned and highly finished, and have been carefully designed and speeded especially for the use of scientific instrument makers, opticians, electricians, and any light engineering business where accuracy and delicacy is required; their parts are carefully balanced, and run easily. The leading and other screws are made of steel, and cut to Whitworth's standard; the sliding parts are got up to true surfaces with the scraping tool; the teeth of the wheels are cut by machine from the solid, and work smoothly, quietly and without tremor; the mandrel bearings being of hardened steel and carefully fitted, the friction is reduced to a minimum, whilst the durability and retention of accuracy is much increased."

The following apparatus can be added if desired:—Overhead for ornamental turning, £5; division plate and spring stop, £1 2s; worm-wheel and tangent screw, with micrometer head and index, £3 5s.; hollow mandrel, 14s.; cone plate or boring collar, £1 2s.; loose head centre, made to move sideways for turning long tapers, £1 15s.; quick withdraw motion (to withdraw tool in screw-cutting before running it back for another cut), with improved feed regulator, £1 12s. 6d.; angular and swivelling bracket for mounting top slide of rest vertically, £1.

Having been a customer of Mr. Milnes, the present writer feels pleasure in testifying to the honesty of his work and the straightforward way in which he conducts his business. One cannot expect to get the polish and high finish of the most expensive work at such a low figure, yet these lathes will do good and accurate work, turning and boring parallel and surfacing flat. The moving headstock fits well between the shears, and the cylinder fits into its place so closely that it is scarcely necessary to clamp it with the pinching screw. The necks of the mandrel, after being hardened, are ground on dead centres by a revolving lap, the thread of screw on mandrel nose is cut by a revolving cutter, and a ⅜-in. hole can be bored through it. The reversing motion is so constructed that the largest change-wheel can be put upon the mandrel as required for cutting spirals of quick pitch; a spiral of one turn in six inches can be cut, and a screw as fine as ninety-six threads per inch. The 5-in. lathe with extras is shown at Fig. 1; it has a cone pulley with five grooves or rises in it, there being five grooves to match them on the fly-wheel; there is another groove in the fly-wheel turned in a ring, which gives a still slower speed, for this, a separate band is required, which runs to the largest speed on the cone pulley; so that there are altogether six speeds without and six speeds with the back-gear. The twelve speed ratios obtained are, from largest groove on wheel to smallest on pulley:—

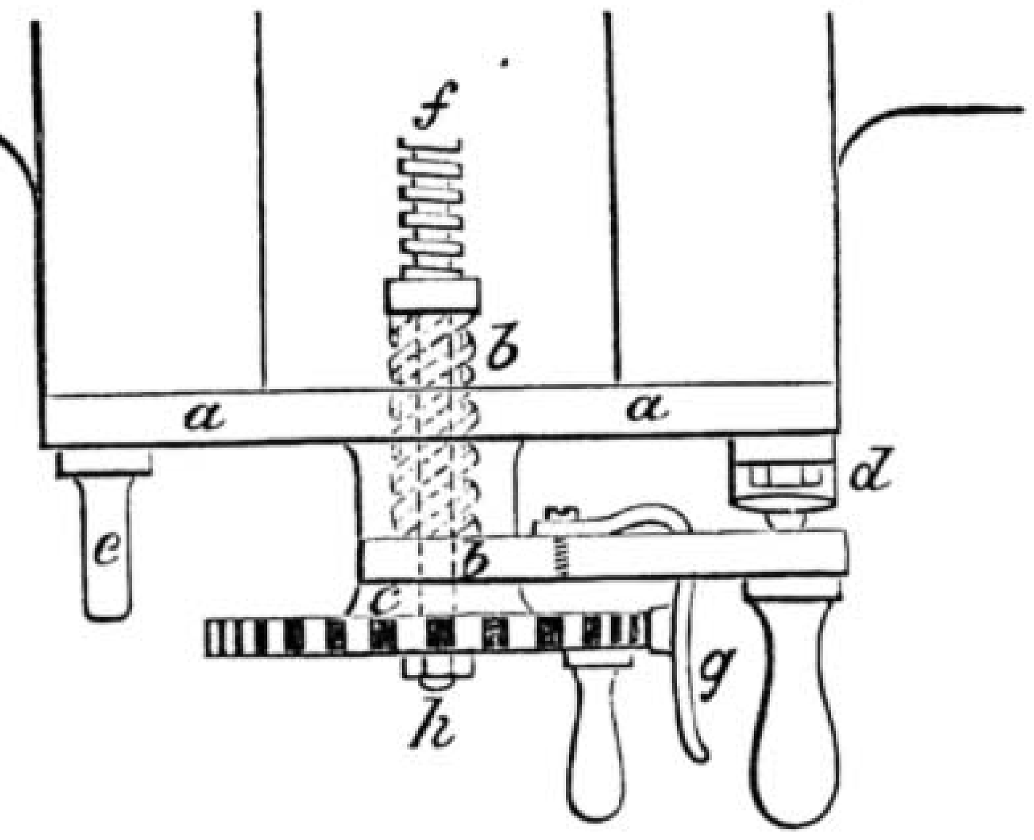


Fig. 3.—Apparatus for Quick Withdrawal and for Regulating Depth of Feed.

1st.	{ 1 revolution of crank }	to 8	of pulley.
2nd,	,, ,, ,,	6½	,,
3rd,	,, ,, ,,	5	,,
4th,	,, ,, ,,	4	,,
5th,	,, ,, ,,	3	,,
6th,	,, ,, ,,	2	,,

If the back gear be thrown in, the speeds are:—

1st,	{ 1 revolution of crank }	to 1	of pulley.
2nd,	1¼ ,, ,,	,, ,,	,,
3rd,	1½ ,, ,,	,, ,,	,,
4th,	2 ,, ,,	,, ,,	,,
5th,	2½ ,, ,,	,, ,,	,,
6th,	5 ,, ,,	,, ,,	,,

Thus the fastest speed gives eight turns of the mandrel for one revolution of the crank, suitable for small work in wood; whilst the slowest requires five treads to make the mandrel turn once. Great care is taken to ensure easy running. The overhead motion adopted is similar to that made by Mr. Evans, and is far superior to the form Mr. Milnes formerly made, with the single tension pulley underneath the drum.

The bracket for mounting the top slide of the rest in a vertical position is a very useful addition; it is shown at Fig. 2. The upper part of the slide-rest having been taken off at the quadrant, it is bolted upon the vertical face of the bracket; the two are then placed upon the lower part of the slide-rest, so that the lower flange of the bracket is fixed where the quadrant flange of the rest was. The upper slide of the rest will now be vertical, and can be swivelled round to any angle in a vertical plane; whilst the bottom flange allows of its being swivelled round in a horizontal plane. Thus mounted, the slide-rest may hold a strong driller taking a slot drill, and drill out the slots in a face-plate, etc. Or, with the bracket turned round to a position parallel with the face-plate, it will hold the driller pointing across the lathe-bed, so that a round-edged milling cutter can be brought down upon a tap or rhymer (fixed between the centres) which it was required to flute; by swivelling round the bottom plate, the cutter might be placed at an angle as for fluting a twist-drill, the feed being given by the lead screw as in screw-cutting. A frame for holding cutters for the teeth of wheels could also be clamped to the slide-rest while in a vertical position, which could then be adjusted for height, or slewed round for bevil or skew gearing.

The quick-withdrawal is the last addition to be noticed. This is useful for two purposes. First, it enables the workman to set in his tool by a known quantity, measured in hundredths of an inch. Second, it enables him when screw-cutting, either outside or inside threads, to withdraw his tool before running it back for another cut, with the certainty of being able to restore it to exactly the same position. The old and clumsy way of making chalk marks on the boss of the screw or handle only admits of an approximation, and the wonder is it prevailed so long. Fig. 3 gives an idea of the arrangement as made by Mr. Milnes. On the front of the saddle is bolted a gun-metal casting *a*, *a*, which forms the foundation of the apparatus, and in the boss in the centre of this casting is cut a quick pitched screw thread; *b b b* is a crank handle, on the long boss of which is cut a screw to fit into this boss; these parts are so arranged that when this screw comes home up to the shoulder, a little half sphere carried by the spring *d* drops into a recess sunk in *b*, and so holds it from accidental displacement; yet not so firmly but that it can be raised by a moderate pressure of the hand. The traverse screw, *f*, passes through the boss of *b*, which forms the collar in which it works; endlong motion is prevented by a solid collar on *f* in one direction; and by the nut *h* in the other. The wheel *c* goes on to *f* and turns with it, being secured by nut *h*; this wheel has thirty notches cut in it, into which takes a tooth or spring *g*. The pitch of screw *f* is $\frac{1}{10}$th of an inch, so that if spring *g* be released, screw *f* can be moved by the handle on *c*; one turn equals $\frac{1}{10}$th-in.; one notch equals $\frac{1}{300}$ths of an inch, etc. To withdraw the tool in screw-cutting, so as to clear the thread before running back for another cut, lift the lever *b b* by means of its handle, and throw it over to the left till it rests on the pillar *e*; rack the saddle back to the beginning of the thread you are cutting, then restore *b b* to its first position, so that spring *d* snaps into its place; withdraw spring *d*, and pass two or three notches to give the depth of the next cut. For inside threads, the arm *d d* would rest on the pillar *e* while the cutting is done, and would be thrown over to the right to withdraw the tool from its cut. Perhaps it might be better to have a spring like *d* on each side.

With regard to the hollow mandrel, as some may not understand its value, it may be well to explain that when short articles, such as screws, are being turned from the end of a rod of iron or steel, if there is a hollow mandrel having a hole bored through it large enough to take the rod, it can be passed in through the chuck and lie in the hollow mandrel whilst only enough for one screw projects from the jaws of the chuck; when one screw is finished and cut off, the rod is simply pulled a little further out and grasped again, thus saving the wasted ends which result when the bar has to be cut into short pieces.

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.*

109.—Stanley's "Odd Jobs."

Stanley's "Odd Jobs," as the curious-looking appliance shown in Fig. 1 is called, is about as useful a *multum-in-parvo* combination tool as a workman can find to add to the tools that he usually carries in his basket when he is sent for to do repairs of a general character in a house, or to the furniture that is found therein. If it be asked—what can be done with it, it may be pointed out that, when used in combination with a carpenter's rule, it embraces in itself no less than ten different tools which are constantly in use day by day and day after day—from Monday morning till noonday on Saturday—in every town in the United Kingdom, inasmuch as it supplies in itself a try square, a mitre square, a T square, a marking gauge, a mortise gauge, a depth gauge, a mitre level, a spirit level and plumb, beam compasses, and an inside square for making boxes and frames, thus performing the functions of ten different tools, as it has been already said. The form and appearance of the appliance will be gathered from the illustration, so there is no occasion to make any remarks on these points here, beyond saying that it is nickel-plated, and as, when thus finished and furnished with a level, as in Fig. 1, is sold in America for 75 cents, so its value on this side of the Atlantic may be set down as being from 3s. to 4s., giving a margin for cost of freight and other charges on its passage from West to East. Its exact price, however, may be ascertained by sending a postcard to Mr. H. A. Hobday (late Hobday and Tovey), Tool Merchant, Cutter, and Hardware Factor, 46, High Street, Chatham, whose house has long been famous as an emporium of tools and appliances for the building trades of all kinds, good and cheap.

To return to the "Odd Jobs," the mode of attachment to a carpenter's rule will be seen from the illustration, the rule working in a broad groove formed in the back for its reception, and in the position shown it will be found to do duty as a try square or as a T square, with a long or short tongue, as may be required. It will be noticed that the top is so formed as to resemble a gable roof, the two sides forming a right angle; thus, when a piece of wood is laid on one or other of the sides, a right-hand or left-hand mitre can be marked on the wood, the tool, and rule, thus together forming a mitre square. The pointed steel rod on the right hand is a scratch awl. It is converted into a marking gauge by setting the point or pencil at any required distance from the square end of the stock. A mortise gauge also is obtained by putting an additional point or pencil in one of the angles on either side of the circular joints at the head of the rule. Thus, by moving the whole along the edge of the wood on which the square end of the stock rests in the illustration, two parallel lines are traced on its surface by the points, as shown. A graduated depth gauge is furnished by extending the rule downwards from the square end of the stock. It will be noticed that there is a steel point projecting from the face of the appliance at the mitred end, this forms a centre from which a circle can be described as with a beam compass ranging from $1\frac{1}{2}$ to 13 inches in diameter. The steel rod in question is shown on the right of the tool. When a small circle is required, this steel rod should be reversed and inserted in the arm bored for its reception the reverse way to that in which it is shown in the engraving; this brings the point or pencil nearer the centre-point. A circle ranging from 13 to 25 inches in diameter can be struck if the rule alone is used as radius with a pencil in the angle at its head. This explains its use as a beam compass. Its utility as a spirit level and plumb, and as an inside square, is too obvious to require explanation. A trial with the tool is the best way to judge of its merits.

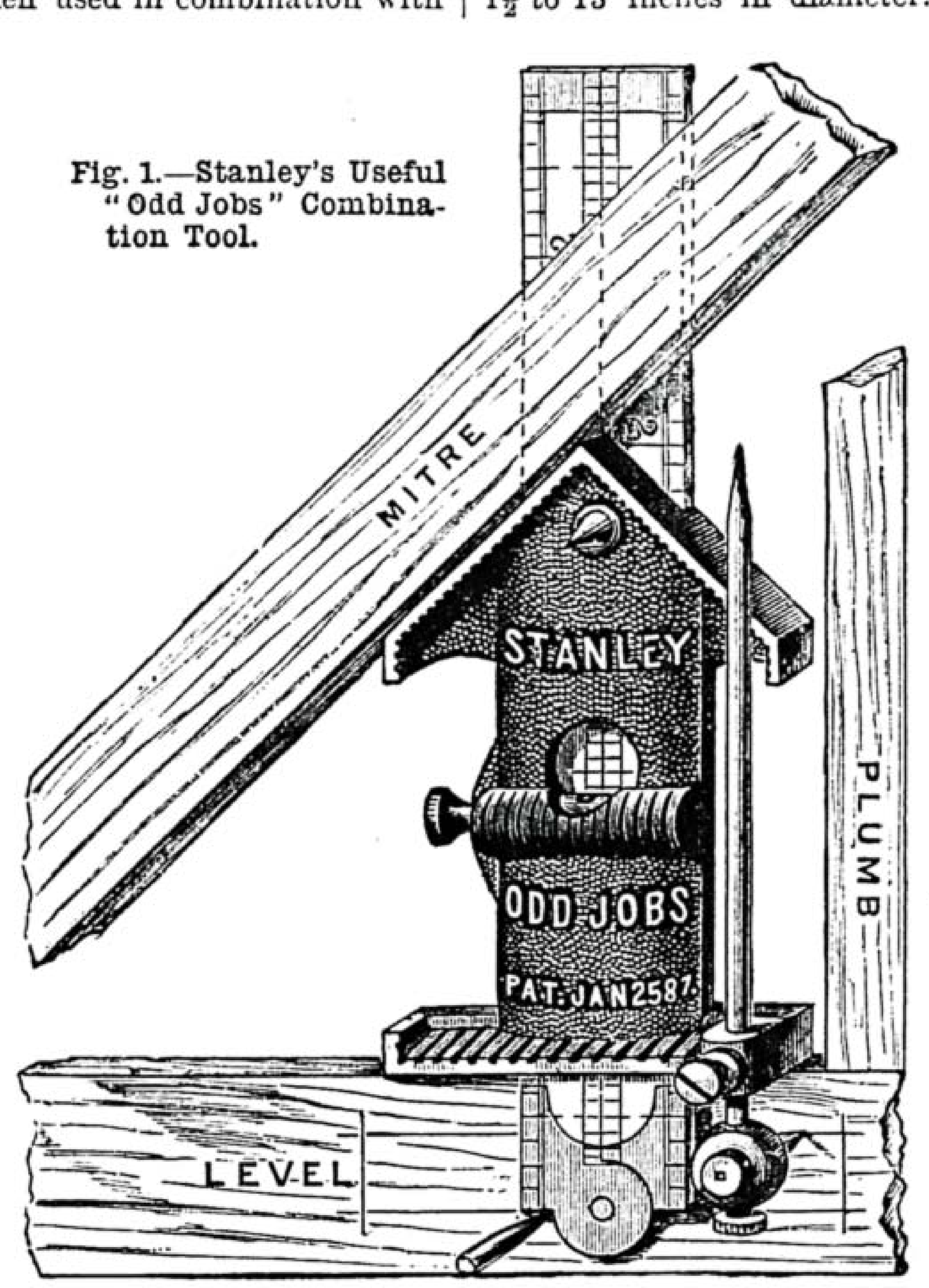


Fig. 1.—Stanley's Useful "Odd Jobs" Combination Tool.

Fig. 2.—Whitehouse's Patent Unbreakable Bits.

110.—Whitehouse's Patent "Unbreakable" Bits.

These bits, which are also supplied by Mr. Hobday, of Chatham, are considered by American workmen to be "a perfect tool," and by English ironmongers to be "the bit of the future." It is said that one "unbreakable" will wear out several of the ordinary bits. The superiority to the latter in point of construction may be seen from Fig. 2, and a trial will soon convince the most sceptical of their value. They will start and finish clear, bore straighter, last longer, are much stronger, and are the only twist bits with which a hole can be enlarged. They are well adapted for boring felloes, and are invaluable for deep boring, as, by giving about two back turns to loosen the screw, they draw out the cut wood, thus saving much time in re-starting. They are made in ten sizes varying from $\frac{1}{4}$ in. to $1\frac{1}{4}$ in. in diameter, ranging in price from 1s. 6d. for the first four sizes to 2s. 10d. for the largest size. If sent by post, an extra charge of 3d. is made. The set of ten complete is supplied for 18s. The Editor.

SHOP:

A Corner for Those who Want to Talk It.

*** Notice to Correspondents.**—*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.

Oxyhydrogen Blowpipe.—Oxygen writes in reply to T. W. B. (*Barnsley*), page 174:—"I note that up to the present no reply has appeared in Work to the above query. No doubt T. W. B. has by now obtained the information he required elsewhere. But allow me, for the benefit of other readers of Work whom it may interest, to say a few words on the subject of the oxyhydrogen blowpipe. As to the arrangement illustrated on page 174, I may simply say I should not care to be anywhere near it when tried. T. W. B. appears to be hardly aware of the dangerously explosive mixture he would get in the small chamber B. An oxyhydrogen blowpipe to be safe must not admit of any possible mixture of the gases before they reach the nozzle. Bad accidents have occurred through the explosion of such a mixture as T. W. B. would get. Readers of Work can hardly improve on the oxyhydrogen blowpipe manufactured by Fletcher, of Warrington, and I do not think it would be possible for any one to make one for double Fletcher's prices. An oxyhydrogen blowpipe is a far more delicate instrument than T. W. B. appears to imagine. It will melt all metals, even platinum, and easily fuses silica, and such like almost infusible substances. To use one satisfactorily, the oxyhydrogen must be compressed in cylinders, as the pressure obtained with the old-fashioned gas bag, etc., is not sufficient. When using the blowpipe, first turn on the hydrogen gas (coal gas does equally well) and light it. Then very carefully turn on the oxygen, taking care not to turn on too much, or whatever is being heated will immediately catch fire, particularly if iron or brass. When heating metal the blowpipe should not be allowed to hiss. The smallest of Fletcher's oxyhydrogen blowpipes can make a piece of thick tool steel white-hot in a few minutes, and—if properly used—on cooling the metal will not be nearly so much burnt as if it had been heated in a forge. Should too much oxygen happen to be turned on, there would immediately be a very fine pyrotechnic display, the steel being on fire. I have seen holes an inch in diameter burnt in quarter-inch steel plate in two minutes, a splendid tool for burglars. From this it will be seen that an oxyhydrogen blowpipe is much different in use to an ordinary blowpipe."

Powerful Rip Saw.—Artist in Wood writes in reply to (*Highbury, N.*), page 411:—"The rod at the corner of the machine is part of the treadle, and is made firm to the cross rocking bar. The top end of this rod moves backward and forward when the machine is in motion. The D rod (for cut see page 348) moves with it and so moves the fly wheel. The treadle is down as shown in the sketch. I use this form of treadle for very heavy work that is a high speed machine. If you want the saw to cut 4-inch deal make the bench low and wide from back to front, so as to give more rise and fall to the treadle. The handle on C wheel should be fixed 3 in. over the edge of the wheel in such a way that it will clear the crank pin to give more leverage. The treadle should be made very strong.

Rubbing Down Oilstones.—A. G. (*Newcastle-on-Tyne*) writes:—"In your issue of October 19th, No. 31, on page 490, W. G. has an article on 'Rubbing Down Oilstones.' I think you will agree with me that it takes a lot of preparing, etc., although it may be very good in its effect, but I have a method which I learnt in dear old Norwich some years ago, which is this:—Get a piece of P. K. P. glass (which is rough on one side) about 12 in. or 14 in. square, which can be got for the asking, then stick 4 nails into the bench, 2 on either side, which will hold the glass while you rub the stone across it, and in five minutes you can rub the hardest stone perfectly level and true. One piece of glass will last for years."

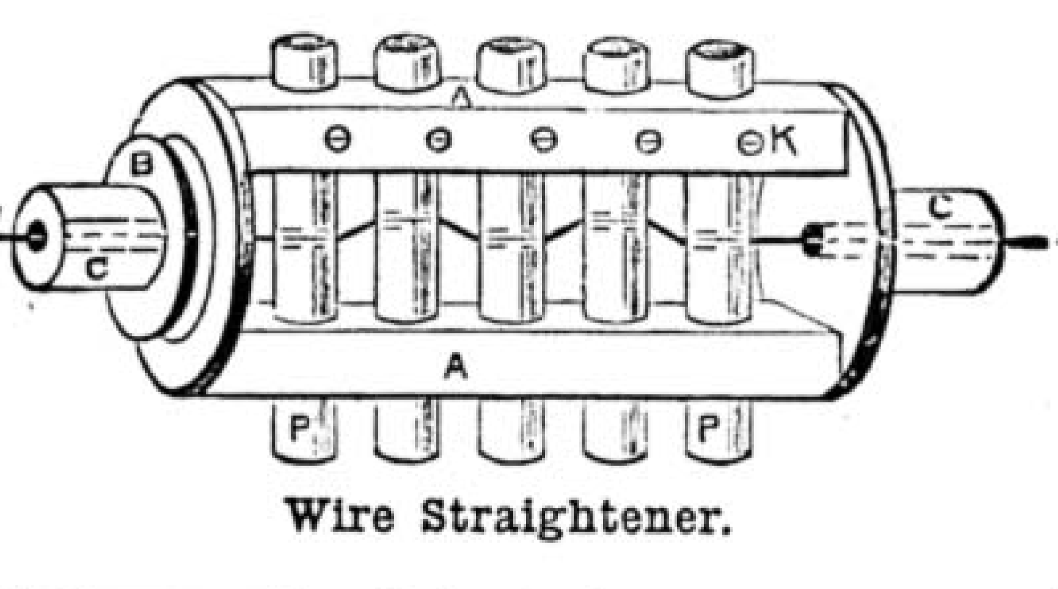
Ear Drums.—Deafness (*Pallasgrean*) writes:—"If any of the readers of Work have used or are using Nicholson's Patent Ear Drums, would they say in your valuable paper Work if they are a success, and if there is any danger in using them? I have read so many cautions against putting anything into the ear that, although I much want a remedy for deafness, I fear to use them, although having them on hand. They are very expensive—£2 11s. 6d. for gold-plated ones."

Wire Thread Fret Saws.—Messrs. Moseley & Son, 323, High Holborn, W.C., write, for the information of all who have been making inquiries respecting them, that they now have them on sale. Inquiries as to sizes and prices must be made of Messrs. Moseley & Son, as they have not furnished me with these particulars.

Hair Spring Fixing.—A. B. C. writes:—"On page 525 (November 2nd), column 3, eleventh line from top, 'stock' should be 'clock.'"

Parts of a Lathe.—P. C. (*Bedfordshire*) writes in reply to S. G. D. (*London*), see page 508:—"I should like to know if fly wheel of lathe by S. G. D. is wood or iron, and if the axle is fixed to bench, and also if it is necessary to provide brass or any bearings for mandrel to run in?"

Straightening Bird-Cage Wire.—Give & Take writes:—"Reading through your editorial on the above in Work, in 'Shop' No. 27, page 429, put me in mind of a simple tool used in America, but apparently not generally known here; and if my very crude sketch (I cannot draw) is deemed sufficiently clear, the following is a description and its use:—AA is cast from a wood pattern, in which B, pulley, and CC, shaft ends, are concluded. Through each end of shaft a ¼-inch hole is bored, which serves as centres upon which to truly turn up ends, so as to run smoothly in hardwood standards. PP are five hard wood round pegs to



Wire Straightener.

fit their respective holes in frame. KK are small screws to tighten on to pegs. Through centres of pegs a $\frac{1}{16}$-in. hole is bored for wire, W, to pass. For working, you commence by threading your wire through the left hand or pulley end of shaft, and on through pegs and right end of shaft (I conclude you have mounted machine in its standards). Gently tap the second, third, and fourth pegs, out of line, opposite directions, and tighten small screws down on pegs to keep in place. Set frame revolving by strap on pulley, whilst you steadily draw with pliers, the wire through pegs. No matter how crooked or kinky wire was previously it comes out perfectly straight. You can use any wire, or thickness, up to $\frac{1}{16}$ inch, I have not tried thicker. I like Work very much, and send this on the chance of being useful to others, as I like to give and take."

Sheet Metal Working. — Rodney (*Newport, Isle of Wight*) writes:—"I have carefully read Work, and find it just what is wanted in these go-ahead times. I have derived a deal of knowledge in years gone by from Cassell's 'Working Man's Friend and Family Instructor.' I consider this quite a boon to the rising generation. Having worked in the sheet metal line myself, I was pleased with the drawings, etc., of various soldering irons in No. 17. We did not learn geometry. In handling our soldering irons we used to get out a small brass plate, thus—with a square hole to fit the shank, and fit this down on the ferrule and rivet, with burr at the bottom. This, of course, being larger than the

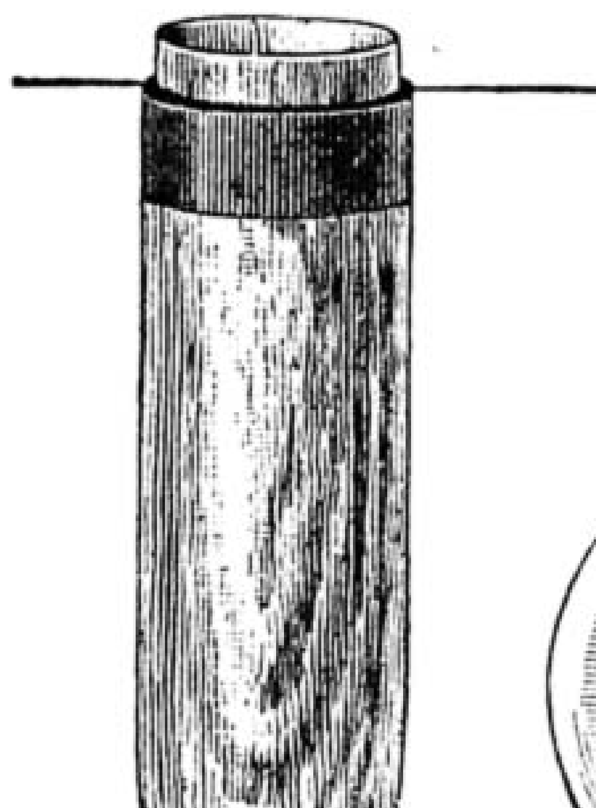


Fig. 1.—Ferrule.

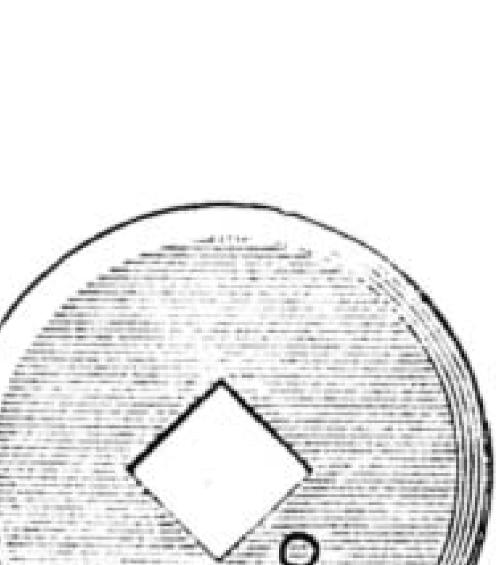


Fig. 2.—Brass Plate.

ferrule, secured it. Another way is to nail on the wooden handle before you drive on the ferrule a tin band, say, ⅛ in. longer than ferrule. After driving on ferrule rivet over on top end the ⅛ in. of tin, and that will secure the ferrule. I see in No. 20 St. Mungo (what's in a name?) wishes for a book that deals exhaustively with sheet metal. The best I know of can be obtained from Mr. R. H. Warn, 54, Marquis Road, Camden Square, N.W. This was the address where I obtained mine some twenty years ago. I may say the price of book is 10s. 6d. (thirty-two plates). I wish you success in this useful Work."

II.—Questions Answered by Editor and Staff.

Tempering Steel.—J. T. (*Manchester*).—To take the temper out of steel, heat it to a low red, and allow it to cool gradually in air. To re-temper it again, heat to a low red, and quench in water; then if the article is small, raise the temperature on a bar of hot iron until it is of the shade of colour required, and quench in water or oil or other special hardening mixture.—J.

Swaging Square Iron into Round.—J. C. (*West Bromwich*).—The art of swaging consists in heating only that portion of the iron which requires to be swaged, and in first roughing to approximate shape with the hammer, and then finishing off between the top and bottom swages. In swaging by steam the shape would be first roughed out under the steam hammer, after which the swage tools would be put under the hammer.—J.

Blackening Zinc and Steel.—W. H. M. (*Accrington*).—Japanning is one mode of blacking which, if done at the right temperature, is very permanent, but it is not a stain. You may stain steel black by getting it hot in the flame of a Bunsen burner and then dipping it in oil. I do not know of any method of staining zinc and should therefore japan it.—J.

Oiling Parts of Watch.—E. B. (*Dartmouth*).—You are rather mixed about the watch, as there is no lever cylinder watch. Each is a separate escapement, the lever having an extra piece between the escape wheel and the staff in the cylinder watch. The escape wheel works directly in and on the part on which the balance is fitted. The scape wheel, too, is different, being of steel, and having the teeth raised on little stalks, so to speak, the lever scape wheel being nearly always of brass, and having radial teeth, or nearly so. But now as to oiling. Oil all pivots, including the barrel, where the barrel works round on the arbor (not where the arbor comes through the plate if a three-quarter plate); likewise the escape wheel teeth whether lever or cylinder (but not the ruby pin if a lever). Keep the hairspring and pins between which it beats perfectly free from oil, or you cannot regulate it. Do not oil the other wheel teeth nor the pinions, and above all do not give too much, especially to the balance staff or cylinder pivots, or to the scape teeth, and use good oil. If you use too much, and it is bad, it will run all over the place and away from the pivots, and then that is as bad as giving none, and if bad it will turn like glue and stick the wheels up that way. Use Ezra Kelley's watch oil. That I find to be best.—A. B. C.

Crests, Monograms, etc., Book for.—R. M. E. (*Sunderland*).—I do not know of any book in which is combined crests, monograms, coats of arms, and decorative border work, but I should recommend you to get Fairbairn's "Crests," published at 50s.; also either Renoir's or Lillie's "Monograms," sold at 9s. 6d. and 6s. respectively, by Rimell of 91, Oxford Street, W., where you can obtain Fairbairn's "Crests" for 30s. Books containing decorative borders are also to be had there. I advise you to try Burke's "Peerage," to be obtained secondhand at about 12s., or some work on "Heraldry," for coats of arms, etc. The best book I know of on water colours is Green's, published by Rowney & Co., Piccadilly, W., at 5s. in one volume (cloth) or in three separate volumes at 1s. each. Noble's is another good book at 1s. by the same publishers.

Anodes of Aluminium Nickel. — J. J. P. (*Malton*).—If you will communicate with the Secretary of the Aluminium Company, Limited, 115, Cannon Street, E.C., he may be able to give you some information respecting this alloy, and where it can be obtained. If you fail to get it there, try Messrs. Henry Wiggins & Co., Metal Refiners, Birmingham.—G. E. B.

Galvanic Battery and Coil.—F. D. (*London, E.C.*).—This subject shall receive my attention in an article or two at an early date.—G. E. B.

Garden Hammock.—Bon Fils (*King's Norton*).—An illustrated paper giving full instructions on making netted hammocks will be forthcoming when room can be found in Work for its publication. G. E. B.

Scale for Stops for Chamber Organ.—J. C. (*Leeds*).—The following would be a fair scale for the stops you mention suitable for a chamber organ:—

	C C.	Tenor C.	Middle C.
Open diapason	4¾ inch.	2⅝ inch.	1⅝ in.
Principal	2⅝ inch.	1⅜ inch.	⅞ in.

Octave couplers, etc., will be fully described in papers on organ building when they appear.—M. W.

Model Yacht Construction.—Spinaker.—It is not possible to commence instructions on this subject yet awhile, but you may rely upon it that when the matter is taken in hand, it will be dealt with in a sufficiently comprehensive manner to embrace the three specialties of construction—hull, rig, and classification.

Wire for Coil.—Coal Mine.—The sample of wire sent is No. 28 B. W. G., equal to ·017 in decimal wire gauge. Two layers of this, if covered with silk, would do for the primary wire of your small coil, and you might then fill up with about 4 ounces of No. 38 B. W. G. silk-covered copper wire. You will not be able to get a very powerful coil on a bobbin only 3½ inches in length. The best results from this size will probably be obtained by using a ⅜ inch core of soft iron wires. Use No. 20 size, straighten them, make up into a compact bundle tied around with string, soak in melted paraffin, cool the bundle, then unwrap the string. For primary, use No. 20 B. W. G. silk-covered copper wire in two layers. For secondary, use from 4 to 6 ounces of No. 36 B. W. G. silk-covered copper wire wound on as a reel of cotton is wound. Insulate each layer with foreign post paper soaked in melted paraffin. The prices of the wires are as follows:—for silk-covered copper wire, No. 20, 5s. per lb.; No. 36, 1s. per oz.; No. 38, 1s. 4d. per oz.—G. E. B.

Indiarubber Stamps.—W. A. W. (*Redditch*).—You will have seen that a paper on Rubber Stamp making by a contributor has been given in No. 38 of WORK.

Pill Boxes—their Prices.—INVENTOR.—Write to Messrs. Maw & Co., Druggists' Sundrymen, Aldersgate Street, London, E.C., stating your requirements, and they will furnish you with prices of boxes in cardboard or in wood. You need not be at all afraid that any reader of WORK will think you are going to set up as a druggist because you want some pill boxes. You have not given me your name and I have not named the town in which you live, as you may see.

Process Blocks.—P. McL. (*Glasgow*).—You will find the method of making process blocks described in "Modern Methods of Illustrating Books" (The Book Lover's Library), published by Elliot Stock, 62, Paternoster Row, London, E.C.

Book, Stationery, and Fancy Goods Business.—CONSTANT READER.—I regret I cannot help you personally or through readers of WORK in the direction indicated.

Plaster Casts from Nature.—OMEGA.—This subject will, I trust, be taken up and effectively dealt with in Vol. II.

Brass Finishing and Relacquering.—PADDY.—I am glad to learn that WORK is so useful to you. The subject you mention will be taken up as soon as opportunity offers. Meanwhile, any question you wish to ask in relation to it shall be answered.

Property Repairing Company.—RANGOON.—I am afraid that neither I nor any of my staff can tell you where to obtain the prospectus of any company so named. The only property repairing companies that I know are building firms.

Lubricating Oil for Bicycle.—F. F. M. (*Edinburgh*).—Yes, neatsfoot oil is rather thick, and not so suitable for your purpose as sperm. To get rid of the sediment you had better try straining or pouring off the clear portion after prolonged exposure to sunlight, for the purification of oil by the ordinary commercial process is beyond an amateur's capability, but surely in such a place as Edinburgh there can be no inducement to prepare your own oil. You will be able to buy it quite as cheaply and far more satisfactorily than you can by refining a small quantity. Were you living in an out-of-the-way district I could understand you wishing to try your skill as an oil refiner, but for an inhabitant of "Auld Reekie" to do so seems as if the old proverb "Time is money" had lost its force. With regard to your remarks on photography I think if you will turn to the back numbers of WORK you will find that you have no occasion to wait either patiently or otherwise for the subject to receive attention. Many important papers connected with it have appeared already. More will be given in due course, meanwhile as you confess to being "photographic mad" I can hardly wonder at your wanting them quickly, but "bide a wee ma frien'" Even the meenister ye ken canna cram a' his sairmon into a wee bittie talk but maun just tak it in three pairts, or aiblins wi' mony subdivisions an' we feel constrainit to dae the same wi' phŏttŏgraffy, which ye will allow is a subject which natterally divides itself, not only into three, but into a muckle number o' heads, sae mony in fac' that ilka ither subject wad hae to be pit aside for lang years to come were it to be "treated exhaustively" the noo. Aye echo as many suggestions as you like—we allow you.—D. A.

Paint for Blackboards.—W. T. (*Padham*).—Although I am not certain of the precise nature and component parts of the mixture used for blacking the boards by the manufacturers of school requisites, I have used the following kind of paint, and it has answered perfectly. Procure ivory drop black, ground in turpentine (retail, about 1s. per lb.), dilute this with japanner's gold size, or copal varnish—preferably the former—and a little turps. Being already ground in turps, you will find the black will not require a large quantity of gold size to reduce it to proper working consistency, which is that of a thin, watery paint. If you prepare the boards from the white wood, give them one good coat glue size, then afterwards two coats of oily, dark, lead-colour paint, or common black, and finish with one or two coats of the drop black as above; spread it quickly and don't let more than 24 hours intervene between the oily ground and the flat, lustreless black. At schools they usually freshen up the boards with writing ink and a cloth, but I have used the black above described for music boards, which had afterwards to be lined out into the five-bar staves. They have, therefore, not been touched or so rubbed up, and as the boards I did have been in use for years, I can recommend the above process and mixture as quite reliable, and such as one professional worker can offer to another. If you can't get drop black, use ordinary lamp-black, well mixing it first with gold size—japanner's, mind!—and then thinning down with turps.—F. P.

French Polishing in Lathe.—LEO.—The probable cause of the ridges of polish in places, and absence of polish in others is over-saturation of the rubber. Do not moisten the rubber so much and you will most likely find the result better. If not, describe your process in detail, that I may be enabled to locate the fault more precisely. At present I can only surmise it.—D. A.

Tool Dealer in Manchester.—H. M. D. (*Silsden*).—You might try Grimshaw, 71, Oxford Street, Manchester. If he has not got the things you want no doubt he would obtain them for you. I am afraid this information is too late to be of use to you on your present visit, but really with every wish to render assistance it is not possible to answer a question written on a Monday, and consequently not received before Tuesday morning, in the same week's issue.—D. A.

Box for Games.—A. F. S.—To give particulars in "Shop" would occupy far too much space, but your suggestion is noted, and in time will be acted on, as no doubt a description of the construction of a box for games would be of use to many readers. Thank you for your good wishes.—D. A.

Child's Cot.—T. L. (*New Brompton*).—This subject cannot be treated of sufficiently fully in "Shop," but it will be a satisfaction to you, and doubtless to many other young family men, to know that a paper on a "child's cot" is receiving the serious consideration it deserves. It is not, however, "similar to the beds in the sick bay on board ship," by which I suppose you mean a "swinging cot," but no doubt will be equally useful.—D. A.

Villa for Fret-cutting.—SEMAPHORE (*Newton St. Boswells*).—I do not remember ever having come across a fretwork design such as you want. I have looked over all the British and foreign design catalogues which I have, but the nearest thing I can find is one described as an "old German house as a cupboard." The size is 18 in. wide by 8 in. deep by 16 in. high. It appears as Nos. 810 and 845 in Zilles' No. 39 catalogue, which, as you go in for fret-cutting I would advise you to get, as you can hardly fail to find something to your taste. Thanks for your nice friendly letter.—D. A.

Inlaying Silver Stringing.—W. A. (*Blackburn*).—Real silver stringing may easily be imitated by using strips of pewter and placing them in lines or grooves cut in the wood foundation. The difficulty consists principally in making these incised lines, which of course, form the pattern. The metal being soft, is hammered till it completely fills and fits tightly within the grooves, a little glue being used to ensure perfect adhesion if necessary. You might also ornament your banjo handle with various coloured stringings of veneer or the so-called mosaic bandings, which I dare say you know are composed of pieces of veneer arranged to form a geometrical pattern. Quite right, continue to purchase WORK, and get the back numbers too. They will well repay you for the trifling outlay.—D. A.

Fixing Tiles in Framing.—MACDUFF.—I should think that the plaster of Paris will stand at least as much heat as the wooden frame and back. The tiles being held by the frame on one side do not require much support, but if you are not satisfied with plaster alone mix it with some size or glue. If the design permits of it being done the best plan is to have a rabbeted rail between the two rows. This, of course, would not look well if you have painted the tiles to form a complete picture, as I imagine you have.—D. A.

Secret Dovetailing.—MECHANIC (*Tue Brook*).—Yes, secret and other varieties of dovetail joint will all be described, and the instructions will doubtless be as useful as those on dowelled, etc., straight joints, which have recently been treated in these pages.—D. A.

Plate Shelf.—SIGNALMAN (*Bebington*).—No directions have yet been given for making a set of plate shelves, but the subject will be treated in due course, as it has been down on my list for some time awaiting a favourable opportunity. Glad to welcome you as a new reader, but why not get the back numbers? you will find them an invaluable aid in your mechanical pastimes.—D. A.

Marble Slab for Washstand.—COPSE (*Lewisham*).—For a single slab you will probably do better by going to a good cabinet maker than by going to a marble merchant, who would probably not care about letting you have one at wholesale price. I am supposing that you want to get it ready polished and finished, as you will hardly find it worth while to attempt this part of the work. If you wish to deal direct with the marble merchant I can recommend Mullis, Scrutton Street, Finsbury, or Wilkins & Sons, Pentonville Road, who both make a specialty of marble tops. Any marble mason in your own neighbourhood would, no doubt, supply you equally well. Price depends a good deal on quality, thickness, etc., but you might take 18s. to 20s. as approximate figures for the ordinary kind. St. Anne's, Rouge Royal, and the fancy varieties, would cost considerably more.—D. A.

Wax Ends.—COPSE (*Lewisham*).—Unless you have seen these being prepared it is not easy to convey the information. The bristles and thread are brought together and then twisted, the thread being of course waxed. Any cobbler will show you, and you will learn more from him in a couple of minutes than from a column here.—D. A.

Template for Bracket.—F. D. (*Liverpool*).—I hardly understand what it is you want to know, and at first was inclined to regard your letter as having been written ironically, for you draw the outlines of a template and then ask how to make and use it. I am, however, constrained to consider that you really do ask for information, and I am only sorry that you, like a good many others, have not put your full address. It is contrary to practice to write direct to correspondents, but in your case I should really like to have made an exception, and seen you when lately in your neighbourhood. I think it will be sufficient to say that to use a template you have only to lay it on the wood or other material of which it is to give the outline and mark round it. Thus a straight edge or flat rule is a template for a straight line. Any material of convenient thickness will do to make the template of—cardboard, thin wood, thin metal, or even stout paper. If you still do not understand give your full address in next letter.—D. A.

Timber Seasoning.—LEO.—In preserving the timber of a tree, as ash or elm, for turning, I should think it would be best to cut first and then stack. Care must be taken in stacking to get all the laths used of even thickness, and placed exactly over each other. Stack in a dry place where the air can pass through the pile. I think it would be better to cut the trunk only into the boards, and not into the squares as required, as it will be better for stacking.—A. J. H.

Electro-plating, etc.—G. R. S. (*Plymouth*).—I shall have much pleasure in giving you advice on all matters relating to electro-plating. On turning to page 31, in our issue for March 30th, you will see an advertisement of the electro-plating and gilding outfit, noticed in "Our Guide to Good Things" of April 20th. It is there advertised as being sold by Richard Melhuish & Sons, Fetter Lane, London, E.C. for 25s., carriage free. You will find Mr. Watts' book on electro-metallurgy, recently noticed in "Our Guide to Good Things," the most practical and cheapest text-book on electro-plating. I do not know the process for enamelling bicycles. Perhaps some of our readers who may know how to do this, will oblige G. R. S.—G. E. B.

Straightening Wire.—G. A. M. (*Walworth*).—To straighten long lengths of steel, iron, brass, or copper wire, draw them between rows of French nails or steel spikes driven into a board as shown by the following zigzag row of dots: ·˙·˙·˙·˙·˙· Pass the wire in and out the spikes and pull it through by means of a pair of pliers. If the wire is tinned, coppered, or plated, it will not stand such treatment. It should then be straightened by rubbing with a piece of canvas. A wire-worker once taught me to straighten wire in this way:—Fasten one end of the wire in a vice or to a firm bench; rub the bends and kinks out of it by rubbing the wire to and fro with a piece of canvas held in the right hand, whilst the wire is held in the left. By the exercise of pressure on one side or other of the wire as it is being rubbed, it may be made quite straight.—G. E. B.

School for Practical Electricity.—DESIRE (*Peckham*).—If you apply to the Secretary of the City and Guilds of London Institute, and tell him exactly what you want, and how you are situated, I think he will be able to advise you respecting the course you should take to get a knowledge of practical electricity and chemistry. A few winters ago I got some very good practical lessons through this source in the metallurgical laboratory at King's College. A course of lessons and lectures will be given there during this winter, but I do not know the fees for the special subjects you name. Information on this subject, however, will be freely given by the Secretary at King's College, Strand. Address him by letter, or see him personally at the office.—G. E. B.

Electrotypes, etc.—F. J. I. (*Bristol*).—1. The specimen of letter sent is not printed from an electrotype, but is reproduced by lithography, that is an impression or a copy of the letter is made on a lithographic stone and printed from this on paper. It could not be done so well or so cheaply by the electrotype process. 2. When taking an impression in wax from a forme of type, it is necessary to employ a machine to obtain equal pressure on all parts of the wax mould at the same time. 3. I use best blacklead or plumbago. I have not tried finely-powdered tin. If you wish to try it, this is the method for its preparation.—Grind up some tin foil very fine in a porcelain mortar with honey. Wash out the honey with boiling water, and collect the fine particles of tin, which must then be dried for use. I have tried with success the metallic mixture employed by bottlers of liquid to cool the corks of their bottles, etc. You cannot smelt pure copper in an ordinary fire. The temperature must be high enough to heat the crucible to a glowing whiteness. Dissolve the granules of pure copper in dilute sulphuric acid by the aid of heat, and continue the heat until all excess acid and water has been driven off in the form of steam. Set aside the liquid to cool, when it will form crystals of sulphate of copper, and you can use these in your coppering solutions. 5. I am not in the secret of how the diagrams that appear in "Shop," are made, but suppose they are drawn and engraved on boxwood blocks and printed from these, or printed from electros taken from those blocks. 6. I shall leave the Editor to deal with you in respect to what you have written about him, and shall not be surprised if you get a bad quarter of an hour. Respecting myself, I never forget that I am writing to amateurs and for amateurs, but I have to remember that professionals read WORK, and I have to write for them also. If I use technical terms not familiar to you I shall be obliged to you by your asking an explanation of them, and this I shall always be most happy to give in "Shop."—G. E. B.

Tempering Chisel.—CHISELLER.—Files ought to make good chisels; your mode of tempering is correct, and the obvious remedy for their softness is to quench at a darker straw approaching a tinge of brown or purple. You cannot get the precise grade of temper required, except by drawing or letting down.—J.

Organ Materials.—F. R. (*Manchester*).—Organ requisites of every description can be obtained of Mr. T. Willis, Tower Organ Works, Minories, London, but probably you could get them in Manchester, and thus save cost of carriage.—M. W.

Hand Power Dynamo.—J. J. P. (*Malton*).—This correspondent asks:—"Is there to be had a small dynamo electric machine equal in E. M. F. to six large cells of Bunsen battery, and which can be driven by hand-power?" I am afraid this question does not convey to me the requirements of the writer. A dynamo may give a current equal in E. M. F. to six Bunsens, and yet be entirely unsuitable to the purpose required, as it may be anything between a small machine for giving shocks, firing a fuse, or working a telegraph instrument, and a large plating dynamo capable of depositing several pounds of nickel per hour. The first might be easily turned by a child, whilst the second would require motive power supplied by a steam engine. The querist must therefore tell me what he wants to do with his machine, or else tell me the volume of current in ampères, as well as the desired E. M. F. of the current required, before I can give him a useful reply. Small dynamo machines to be driven by hand may be had from Mr. Bottone, Carshalton, Surrey, or from Mr. Alfred Crofts, Dover. When ordering, state exactly what you want.—G. E. B.

Electric Work as a Means of Living.—J. C. F.—I fear you would not succeed in getting a living by the proposed means. The prime cost of fitting up a small electric light installation to light up even a very small village would far exceed the resources at your command, although you might obtain water power to drive the dynamos. You would also require more than an amateur's knowledge of electric bells to enable you to master the technical details of electric lighting. My advice to you (and others like you who have an idea that they can get a living by electric work) is, stick to your present employment as a means of living, and supplement this by doing small jobs in spare time, in fitting up electric bells, making and repairing small electrical instruments, and doing little jobs in electro-plating, such as may come to your hand. Get books meanwhile, and study the principles of the science whilst putting these into practice. After some time, if you find that the electric work increases enough to make a living out of it, then throw up the old work, and stick to the new entirely. I am writing a series of articles on this subject likely to be useful to you and others.—G. E. B.

Electric Alarum Clock.—HANDY MAN (*Southwark*).—A paper on this subject is now in the Editor's hands, awaiting space for publication. You will require a 2 inch or 2½ inch electric bell of the continuous ringing type; a switch to connect the bell with the battery at night, and to switch the bell off in the morning; a two-cell Leclanché or Gossner battery; a few yards of cotton-covered No. 18 or 20 copper wire; and a fairly good clock. This last will be most convenient for alteration if enclosed in a wood case. Two types of clock are illustrated in my article, and suggestions are given for fixing the alarum appliance to other types. If you have a system of electric bells already in the house, you may use the same battery to ring the alarum bell, but I advise a separate small bell with sharp tone distinct from that of other bells in the house.—G. E. B.

Enamelled Paper Letters.—JOINER (*Hull*).—If you had read our "Sale" advertisements from week to week you would have found that Beit's Patent Enamelled Adhesive Waterproof Advertising Paper Letters, Figures, etc., are to be obtained at the manufactory, 17, Arthur Street, New Oxford Street, London, W.C.

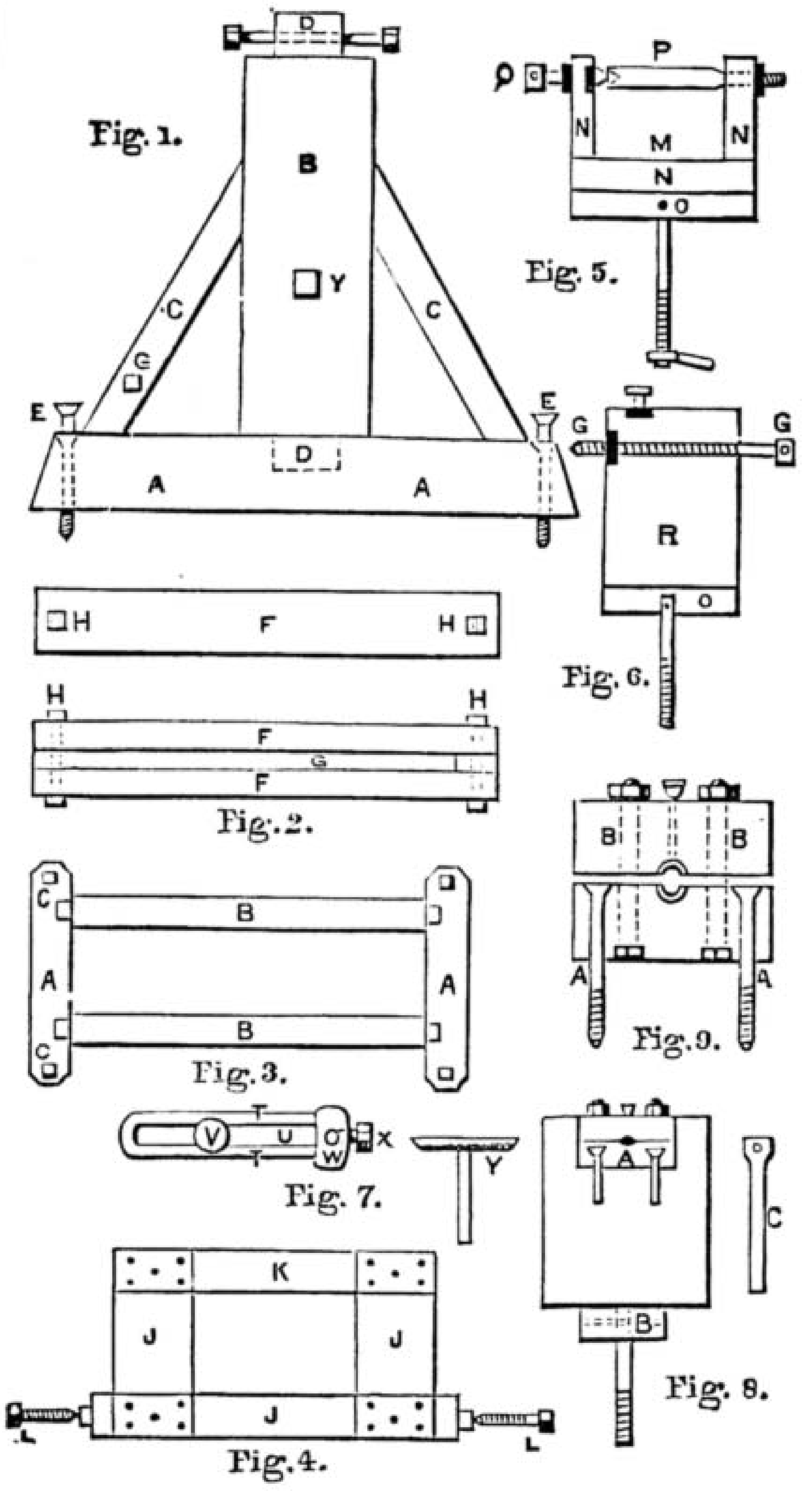
Sign Writing.—A. G. A. (*Primrose Hill, N.W.*).—The paper to which you refer is merely common tissue paper, rubbed over with white wax and pressed on to the gold leaf. I shall describe the method later on in the "Sign Writing" articles. It can be had ready prepared at any colour shop, and is known as "transfer gold leaf."—H. L. B.

Picture Framing Requisites.—J. H. (*Blackburn*).—I regret I do not at present know of any house near your town for picture framing requisites, but you should consult the local directory for the information required, and compare prices.—G. R.

Knife for Mount Cutting.—J. H. (*Blackburn*).—There is a special knife made for mount cutting, which can be obtained, I think, for 1s. the blade, and 1s. 6d. the handle, from the City Frame Company, 29, Basinghall Street, London, E.C. This firm will doubtless forward readers of WORK a set of their moulding and mount samples on application if applicants will pay carriage.—G. R.

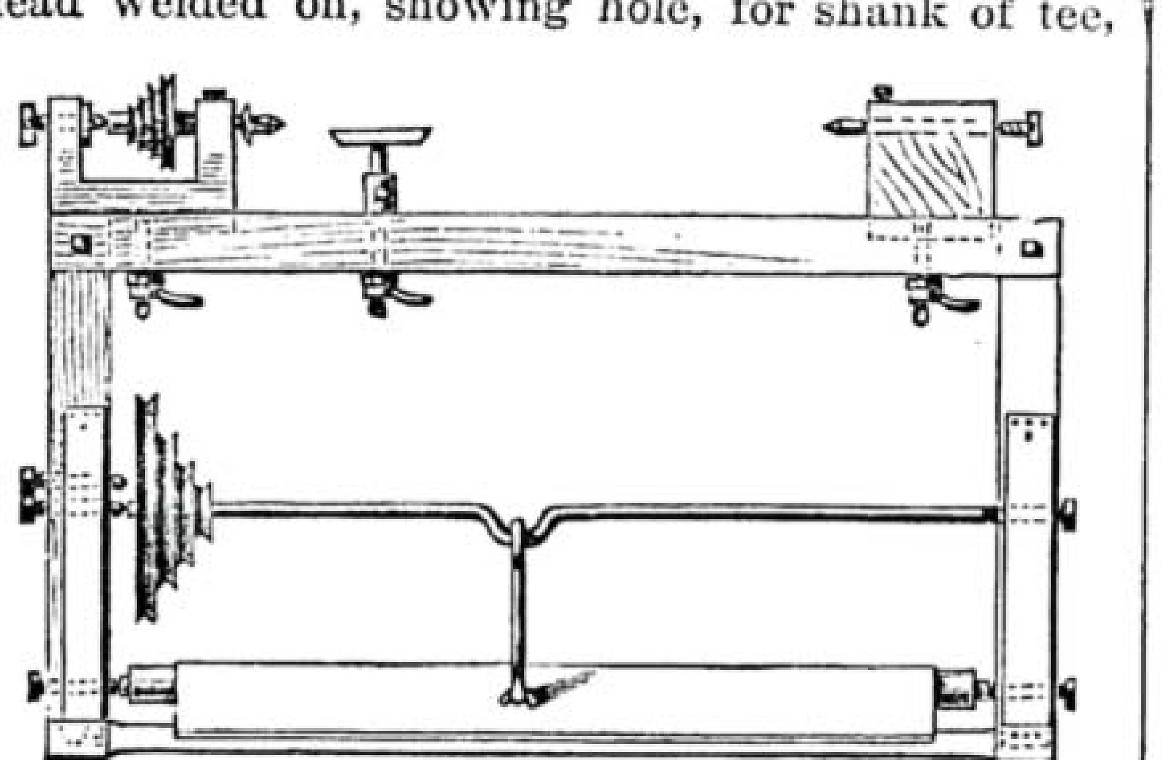
IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

A Rough Lathe.—J. H. N. (*Malvern Wells*) writes in answer to J. K. (*Richmond*) (see page 348):—"I send a few rough drawings of parts which he will understand, being an amateur carpenter. I hope it will not take too much room in 'Shop,' it may be useful to others that want such a thing. Fig. 1, end view of the standard: A, one of the feet; B, upright tenoned into A, at bottom D; D, on top of upright, tenon for bed to bolt to, showing bolt; E, bolts for floor. The two square heads of pins marked in ink—Y, for crank shaft, S, for treadle shaft. Fig. 2. F, bed, top and side view; G, slot between bed for tenons on bottom of headstocks to fit in; H, bolts for bolting bed to tenon, D, on upright, B. Fig. 3, showing stretcher bar: B, mortised into feet, A; C, bolts for floor. Fig. 4. I, treadle shaft; J, connecting pieces; K, footboard, dots showing screws; L, pins for hang-



Parts of Lathe.

ing shaft points into holes, drilled in heads of coachscrews, screwed into ends. Fig. 5. M, wood, cut out of headstock for pulley, pulley not shown; N, showing shape to cut wood; O, tenon for bed, dot showing pin through tenon, and head of holding-down bolt flush with surface; P, mandrel, conical neck into zinc bearing, which you can cast yourself, or you can use yellow metal; Q, tail pin, hardened steel screwed through metal plate marked in ink, locking nut shown at back. Fig. 6, tailstock: R, block of beech; S, capstan screw, threaded whole length through metal plate, marked deep in ink, set screw on top; O, tenon. Fig. 7, T rest, and socket: T, wrought-iron bent round, leaving slot U; V, head of holding down bolt; W, head welded on, showing hole, for shank of tee,


A Rough Lathe.

marked, Y; X, set screw. Fig. 8, front view of headstock: A, metal bearing, coned; B, tenon, dotted lines showing pin through holding-down bolt; C, holding-down bolt, showing hole for pin to fasten into tenon. Fig. 9, bearing for mandrel, in two parts: A, wood screws through bottom piece into headstock, heads countersunk; B, tightening bolts, square heads let into bottom piece, shank up through both bearings nutted at top, oil hole between, showing cup at top. If a slide rest is added, you will be able to do metal turning. There is a die chuck in No. 13 of WORK (page 204), which you can make, it would be useful for metal turning."

Lathe Work.—BRUM (*Keighley*) writes:—"In answer to a READER OF WORK (*London, N.W.*) on 'Lathe Work,' No. 24, page 382, I would say that to set a compound rest for taper turning all he has to do (providing his rest is marked in degrees) is to turn it around from left to right to any angle he wishes for male taper, and the opposite way, to the same angle, for female taper. In cutting 4½ threads to an inch, leading screw ⅕ pitch, the nut will gear right at every 5 inches of the leading screw, stopping lathe at end of cut before taking saddle back. But it would be easier and quicker in the case of short screws to have a reversing belt, and run the lathe backwards without taking the nut out of gear. To cut 7 or any whole number of threads to an inch the nut will close right at every inch of the leading screw, but the lathe must be stopped before taking nut out of gear. To keep the lathe going constant he must put a chalk mark on the leading screw near wheel plate, and one on the face or driving plate when the nut is in gear, and ready to take the first cut up the screw, and then he must take care to drop the nut in gear when the chalk marks are again in the same position. If a READER OF WORK does not understand this, or if his compound rest is not marked in degrees, I will try and make it clear to him if he will ask."

Polishing Vulcanite.—M. A. L. writes in reply to E. R., see page 493:—"First get all coarse marks out with F F emery paper, and then use Oakey's O paper, which will leave the vulcanite dull, but without any marks. Next get a piece of soft felt and glue it on to a piece of wood (the size of which is all according to the work to be done); rub a piece of candle upon the felt, and then sprinkle with powdered rotten-stone, and well rub the vulcanite with it, and a fairly good polish will be the result, which can be improved by again rubbing the vulcanite with a piece of soft cloth, using oil and rouge, which will bring a splendid polish; then rub all grease off with turpentine, using a soft rag, and finish by rubbing with soft part of the hand. Care must be taken not to make the vulcanite too hot by rubbing too hard, or else it will be spoilt."

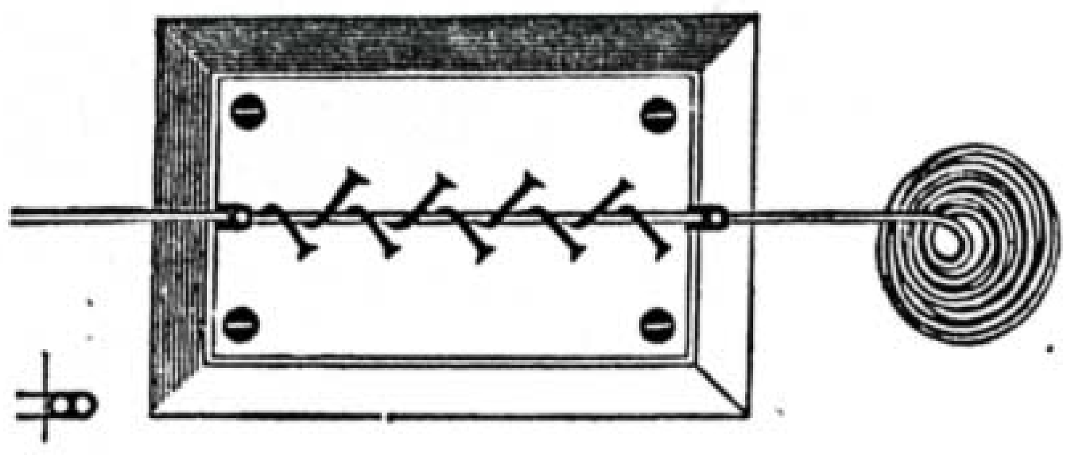
Band Saws.—C. S. B. (*Hoxton*) writes in reply to (*Nottingham*), see page 526:—"The causes of band saws breaking are manifold, the most frequent of which is the improper adjustment of guides, and the tension; also insufficiency of set causing saw to heat, and when no provision is made on the machine to take up the slackness caused by saw expanding, it sags so much above the guides that it is almost certain to go. This kind of breakage is also caused by top wheel overrunning the bottom or driving wheel when the wheels are heavy, but for some years there has been made a machine with built-up wheels similar to a bicycle wheel, being exceedingly light, so reducing this danger to a minimum. It is this cause probably which breaks your saws when finishing a cut, especially in heavy timber, and perhaps fresh also. As to brazing your saws, that is a very simple matter indeed, but one requiring some care to prevent your saw being overheated. I have seen a 30 ft. saw ¾ in. running well with five brazes in it, and the tools used for making the joints were a 1s. pair of bellows, four bricks, and a pennyworth of charcoal for fuel. But more depends upon the workman than the tools for this as many more jobs. The way to start a joint is to thoroughly clean the saw, then, without touching the ends where the braze is to be, lap them one inch, putting a little clean wet borax between, and binding joint firmly with iron wire (using as little as possible to keep the ends in place, as this has to be filed off afterwards). Now wind some brass binding wire over and amongst the iron, and wet all with your borax and water paste. I should have mentioned that you must hammer the set-down of your laps, so that the ends lie perfectly close together. Remember that the less brass you get between joint the stronger it will be. Now for heating your braze: this can be done in many different ways—best by a gas 'injector' blowpipe on charcoal. I find no perceptible difference in the quality of the steel afterwards, though it is said to do steel no good to use gas upon it. Another way is to use a foot blower or small bellows. Get four bricks or pieces of stone or iron, and arrange them thus. Lay two sides down on an iron plate with a space about 3 in. between them. Now lay your saw upon these two with the joint you wish to braze stretching across the space. Put the other bricks upon the saw to keep it in position, and pack charcoal round joint and blow till brass runs; gently draw saw tight, and let cool, take out and scarf down joint. Some recommend scarfing first, but I prefer doing it after brazing, as you stand a chance of getting a thin joint if done previously, and it slips ever so little. By this means you will soften but a very small length of saw beyond the actual braze if you are careful, and it will stand as long as any part of the saw."

Band Saws.—F. C. (*Leytonstone, E.*) writes:—"In reply to S. B. (*Nottingham*) *re* band saws (see page 526) I should think the cause of breaking after cutting through the wood would be contraction in cooling. The friction of cutting makes the saw hot, it lengthens, and the spring tightens it. After cutting it cools and contracts, but the saw breaks, as it is not strong enough to stand the resistance of the spring."

Copying Music.—See page 510.—A number of copies can be done from one copy by means of the autocopyist. The best of these apparatus is made by Fordham & Co., of London.

Fretwork Picture Frame.—W. B. (*Wigan*) writes in reply to AMATEUR (*Belfast*), (see page 510 'Shop'):—"I can inform AMATEUR where he can procure a very elaborate design for a fretwork picture frame, if he wishes to purchase one, size 18½ in. by 22 in., which can be enlarged if desired; price 9d., from J. A. Lambert, Bank Buildings, Carnforth; design No. F 47. I am making the frame now, so thought it might fall in with AMATEUR'S wishes."

Straightening Wire.—W. J. W. (*Whetstone*) writes:—"In answer to query of G. C. in No. 27 of WORK, if he does not wish to go to the expense of a set of rollers, the enclosed sketch is a simple method of straightening wire, and can be made in a few moments. All that is required is a piece of mahogany or oak, 12 in. long by 6 in. wide, and about an inch thick, two staples (the exact width



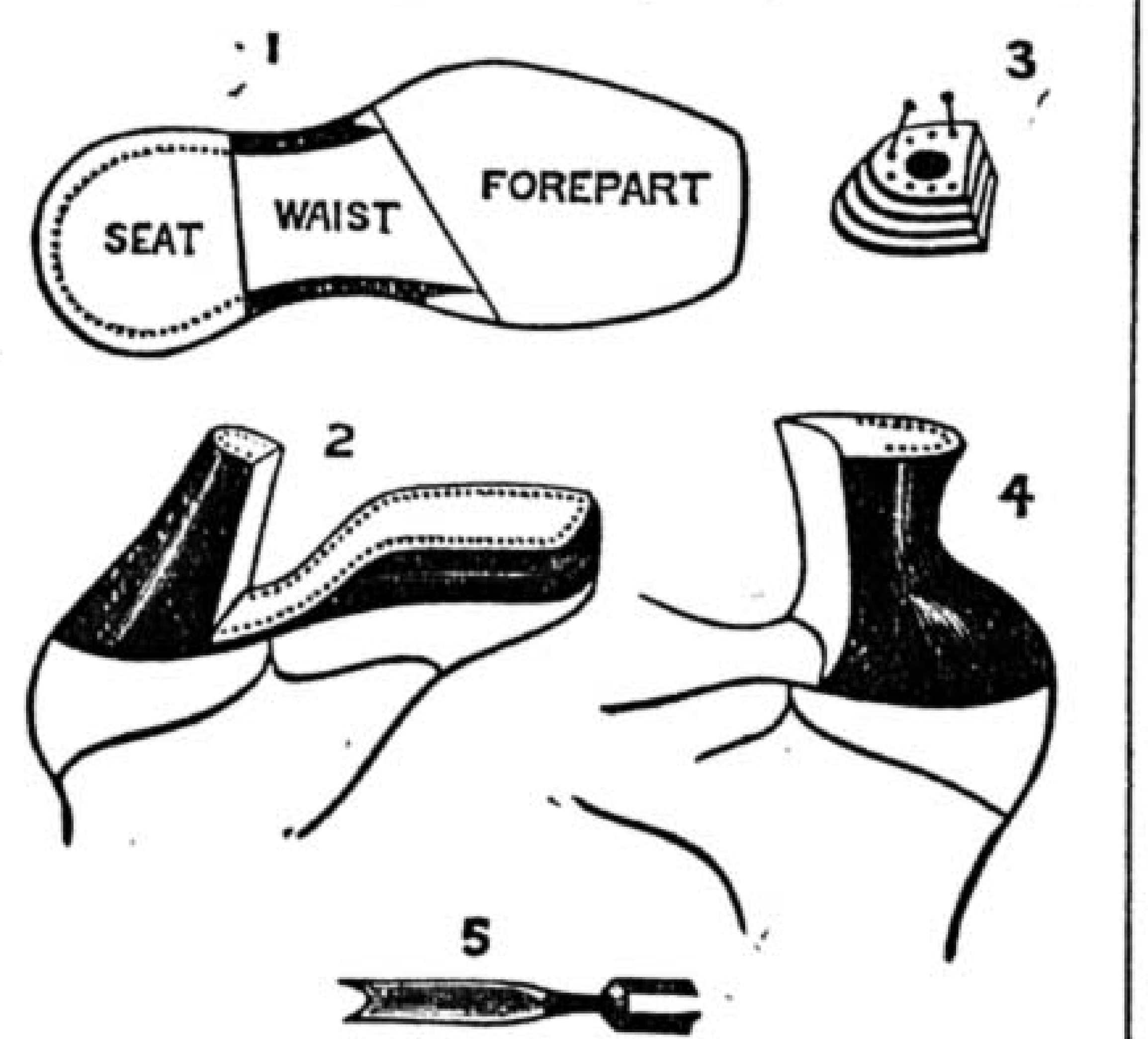
Wire Straightener.

of wire to be straightened) and some French nails, the staples to hold two pieces of wire, as per sketch. A staple is then fixed in each end of the board, and a piece of wire stretched between them and fixed at each end. This is a fixture (the wire to be straightened runs along the top of this). The nails can now be fixed each side of the fixed wire alternately, the board screwed to bench, and it is complete.

Attachment of Seams in Waterproof.—C. S. B. (*Hoxton*), see page 526, writes in reply to A CONSTANT READER:—"This is simply done by means of a solution of india rubber cuttings in naphtha or bisulphide of carbon. You can obtain it ready for use at any rubber dealers, if a small quantity only is required, cheaper than making it yourself."

Aquarium.—W. H. D. (*Bromley-by-Bow*).—See No. 31 of WORK. Alter measurements, and discard such details as you do not require.—C. M. W.

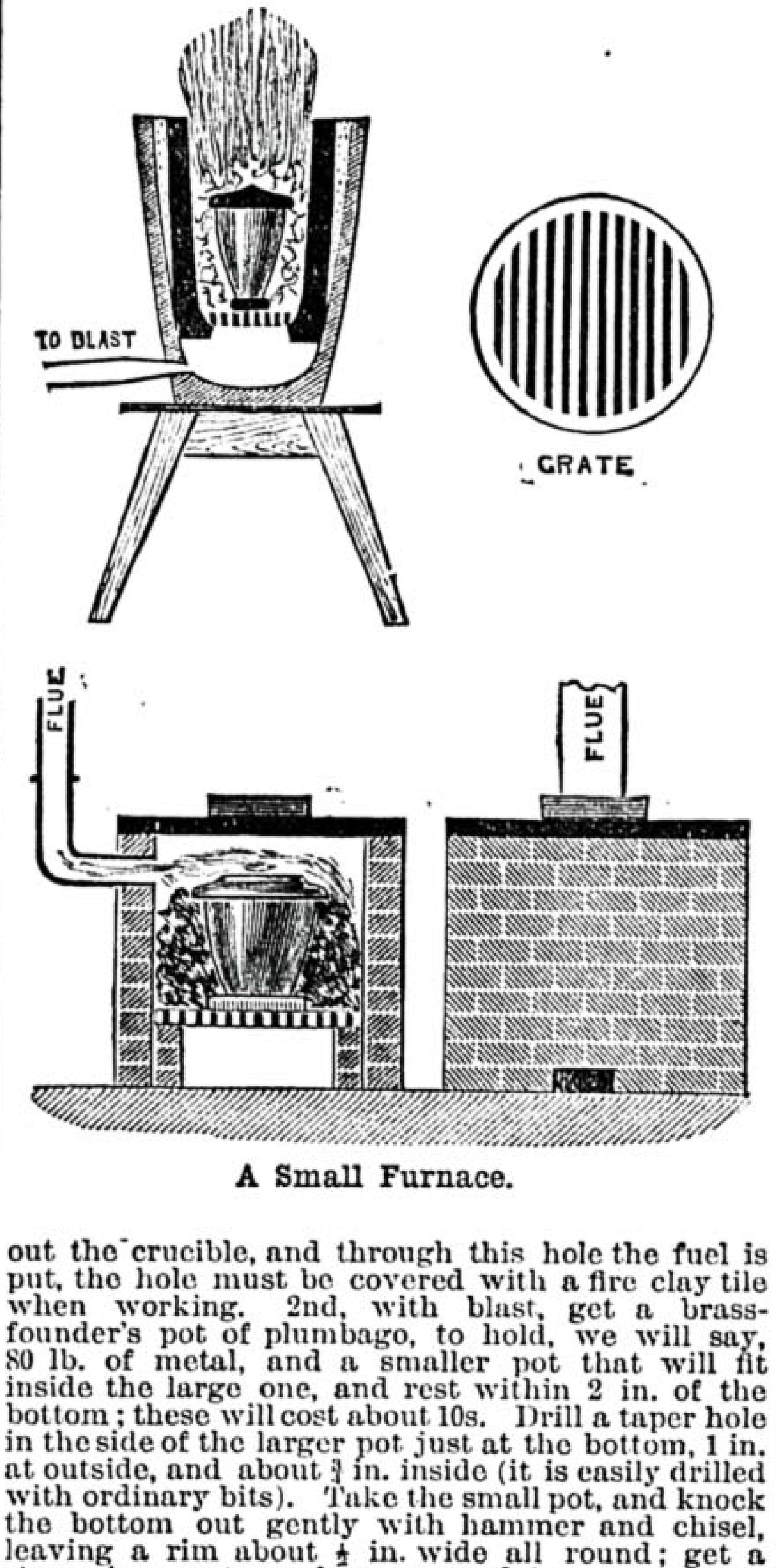
Cork Heel, etc.—H. G. (*Bishopsgate*) writes in reply to J. R., see page 526:—"J. R. does not state what description of boot he wants heel for. If it is for a person with a deformed foot, it would have to be made in proportion to the substance of the sole. If he is not in the trade, he will find it very difficult to make. I will give him the idea. Fig. 1 shows the sole, the dotted lines where the heel is to be built; the first lift should be the same size as the seat, and each succeeding lift should run gradually smaller. Supposing Fig. 2 is the heel desired, which is for a person with one foot shorter than the other—we will say shorter by 3 inches—then the heel would have to be built that height, that is 3 inches. By looking at the diagram you will see the



Cork Heel, etc.

shape required. Put on one split lift only. Fig. 3 shows 4 lifts in position, and the way the nails should be driven in. The breast of the heel should be slanted towards the forepart in proportion to the height. Should the heel be wanted light, punch through the lifts after the heel is built with a half round chisel (Fig. 5) and fill in with cork. Fig. 4 is a Wurtemberg heel. If you are to make the heel on wood lasts, put the first two lifts on with ⅜ pegs, next 4 lifts with inch heel-screws. Should the lifts be stout put three on with inch, and so on. Explain in next number what you mean by the draught of shank irons."

A Small Furnace.—H. B. S. (*Liverpool*) writes in reply to G. T. M. (*Liverpool*) (see page 253), and D. C. (*Huddersfield*) (see page 476):—"You wish to have a small furnace to melt iron and steel. If you can afford it, one of Fletcher's injector furnaces would be the best thing you could use, as it requires no fixing, would stand on any table or on an iron plate, and is connected to a gas bracket; the fuel is gas, and air is blown into it by means of a foot-blower giving constant blast. The cost of small size is 11s. 6d. for furnace and 21s. for foot blower. But supposing you want to make your own furnace, there are two plans open to you. 1st, with draft; 2nd, with blast. 1st, with draft, you will require a cellar or outhouse of some kind to build your furnace, as it is not removable, and likewise you must have some means of putting up a long flue, and carrying it into the open air; your furnace will be one similar to those used by brass founders, only need not be sunk into the ground. You have not given me the amount of metal you want to melt, so that I cannot give you sizes; but you can, perhaps, make your own sizes. Build the furnace of fireclay bricks, and perfectly square is a good shape. Leave one brick out at the bottom for draft hole. Cement the bricks together with fireclay instead of mortar, build up a little inside the furnace on opposite sides only, to support the grate. The grate may simply rest on this. It should be a square grate and of strong make to withstand the heat. The flue will have to be of wrought iron for some distance up, but sheet iron will do for the most of it. The flue must be long enough to get up sufficient draft for a white heat. The top of the furnace may be made of a fireclay tile made in one piece with a square hole in the centre large enough to put in and take



A Small Furnace.

out the crucible, and through this hole the fuel is put, the hole must be covered with a fire clay tile when working. 2nd, with blast, get a brass-founder's pot of plumbago, to hold, we will say, 80 lb. of metal, and a smaller pot that will fit inside the large one, and rest within 2 in. of the bottom; these will cost about 10s. Drill a taper hole in the side of the larger pot just at the bottom, 1 in. at outside, and about ¾ in. inside (it is easily drilled with ordinary bits). Take the small pot, and knock the bottom out gently with hammer and chisel, leaving a rim about ½ in. wide all round; get a strong iron grate, such as are used for sewers, to fit the bottom, and rest on the rim. Place the small pot inside the larger one, and pour sand in between. Rest them on a stool covered with an iron plate or stone. All you want now is the bellows, which may be one of Fletcher's, a blacksmith's bellows, or a fan machine as figured in 'Shop' three or four times, and a nozzle tapered to fit the hole. By this arrangement the outer pot may last for ever practically, the inner one will require replacing now and again. I have used a furnace similar to the one last described, and I found that with sufficient draft, I could melt the fireclay crucibles easily. Plumbago crucibles are best, and one of the latter furnaces will melt 4 or 5 lbs. of metal at a time. Put a small fireclay tile on the bars to rest the crucible on, or it will be cooled down by the blast, and ironfounder's coke is the best to use. The latter is the better furnace, as you can get almost any heat by increasing the blast; besides, it is portable, and requires no chimney."

Band Saws.—F. C. (*Leytonstone*) wishes to add to his reply to S. B. (*Nottingham*) in page 621:—"I should judge your machine is of bad construction, saws of inferior quality, and your speed very limited, as your saws break so quickly. Have you an appliance for canting the top wheel transversely? Saws may be tight on the back or on the tooth edge, when the strain will be greatest on the tight edge. Cant the wheel if possible so as to get equal strain the whole width of saw. This is a very important point in the working of band saws. I hope remarks on band saws, which may reach your eye before this appears in 'Shop,' will be useful to you and many others of our readers."

Trade Notes and Memoranda.

ONE of the most popular features of the meeting of the British Association was Mr. Baker's description of the Forth Bridge, a triumph of engineering skill, before which the Eiffel Tower almost sinks into insignificance. As a measure of its strength, Mr. Baker mentioned that six of the largest ironclads yet built, weighing each from 12,000 to 14,000 tons, might be safely suspended from its six great cantilevers, while the size of its spans is so great that two Eiffel Towers laid horizontally and joined together at the centre would just span one of its openings. This great work, we may add, is now complete.

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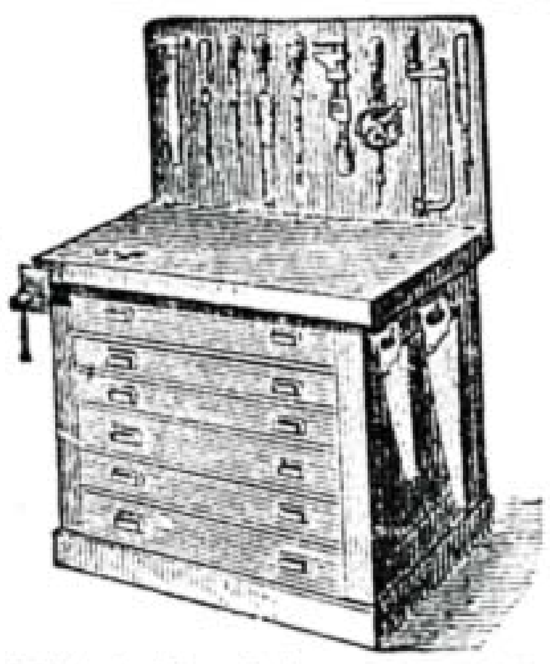

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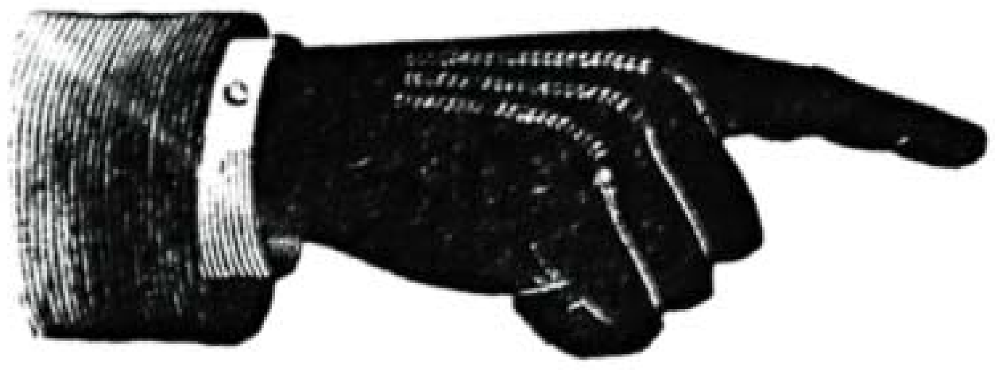

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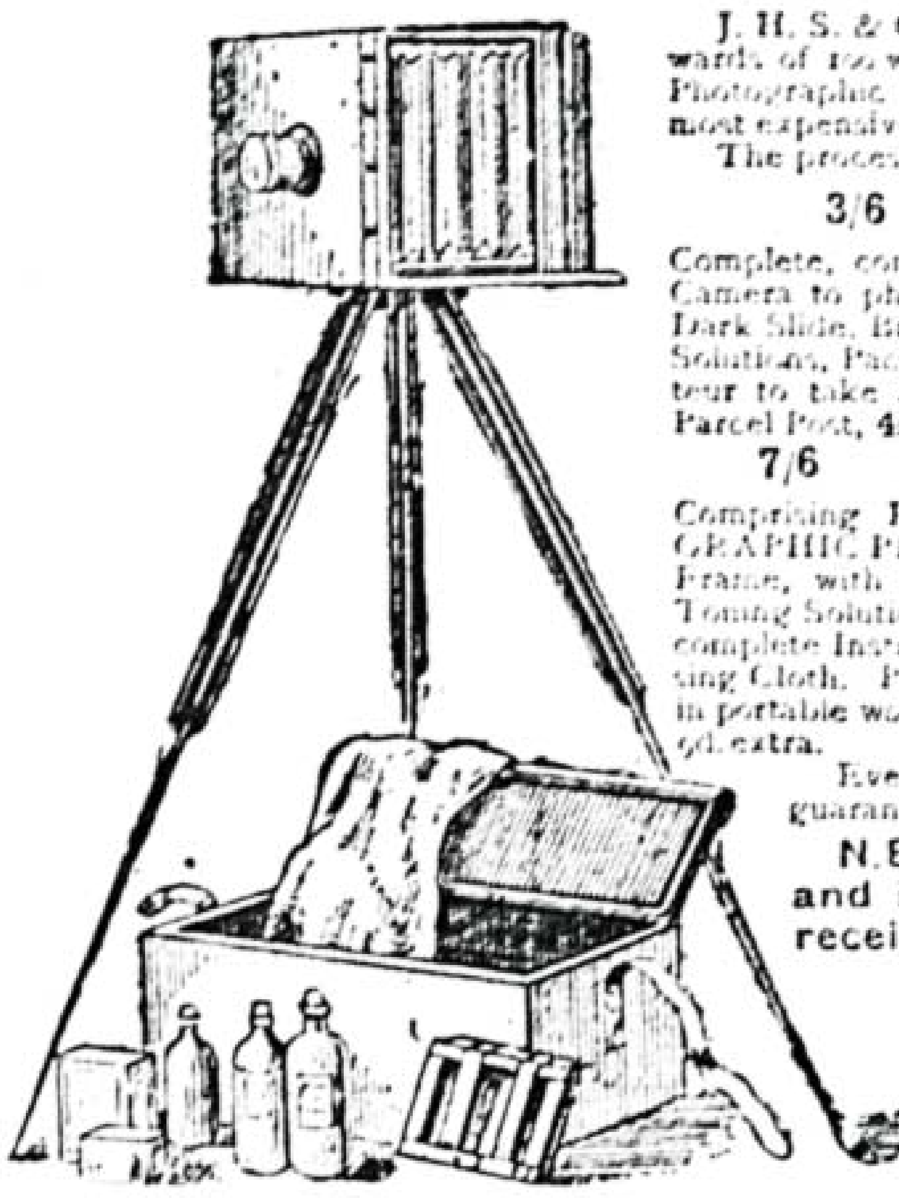

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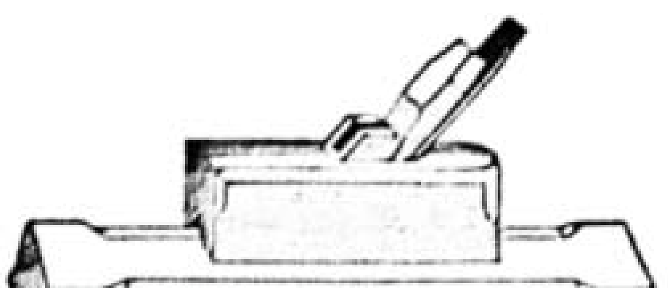

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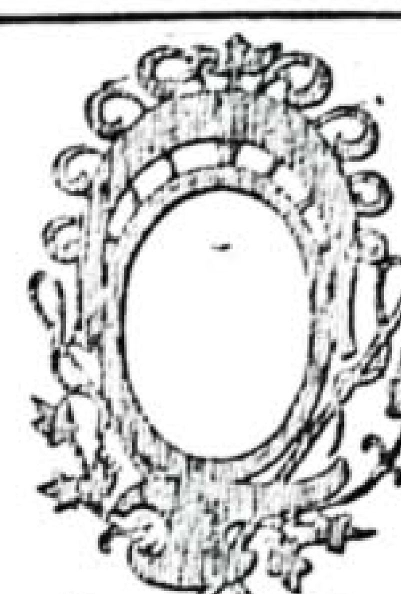

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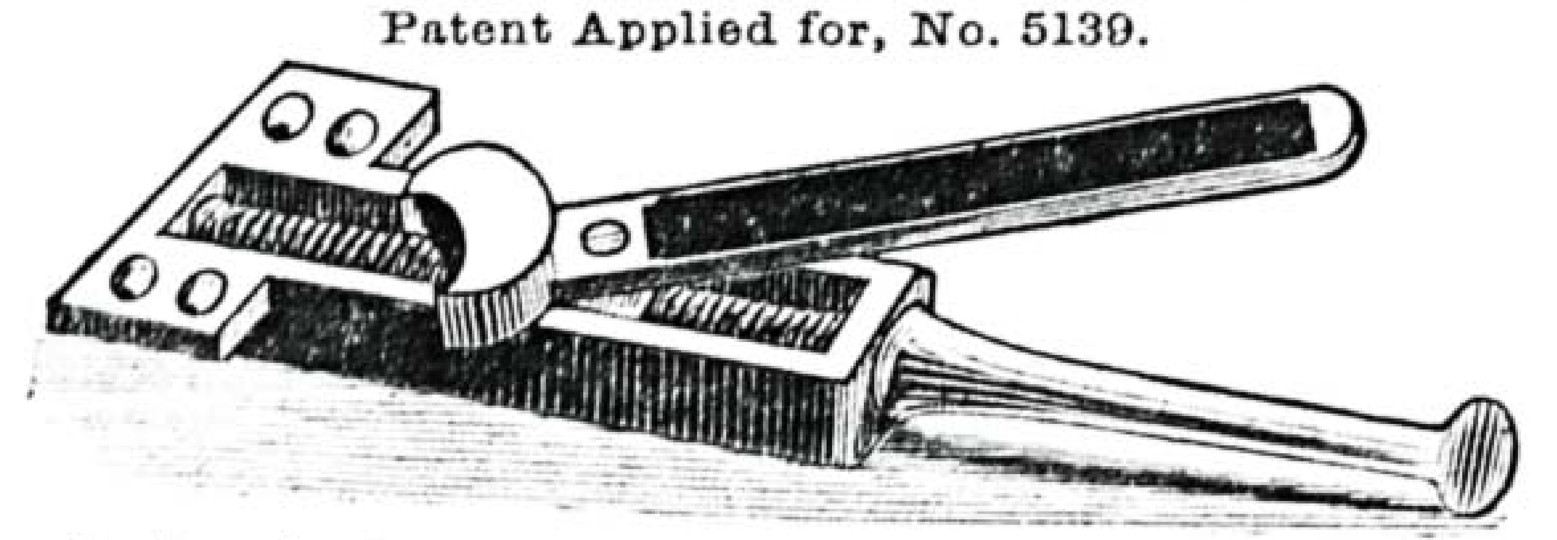

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