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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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A MITRE BLOCK AND HOW TO MAKE IT.

BY DAVID DENNING.

INDIFFERENTLY known as the mitre trap or mitre block, the useful appliance which forms the subject of the present article is just one of those things which may be made by the user quite as well as by a specialist in tools, if indeed it can be called a tool, for it is rather an aid to the successful use of those things which come under the comprehensive name of tools than one itself. I daresay mitre blocks are to be bought in the ordinary way of trade, but they frequently, I may say generally, are made by those who use them. This is not surprising, as any cabinet maker or joiner can make one if he possesses sufficient ability to work accurately in the way of squaring up, etc., and unless he is able to do this he would be a very poor craftsman indeed. Nor will the advanced amateur experience any great difficulty in constructing a mitre trap when it is described to him. He has not the same opportunity of knowing how to make it as his professional *confrère*, for the latter is sure to have at least some shopmate who can lend him one to copy from, or improve on according to his own ideas. The amateur, however, working mostly alone, is to a great extent dependent on other sources for his information, and I don't think it would be too much to say that a large proportion of amateur wood-workers have never seen or heard of a mitre block. Anyway, its usefulness is so great to any one who has occasion to form mitres, that no apology is necessary for its mention in these pages. It may be an old-fashioned contrivance, but old or new, anything which can in any way facilitate operations is deserving of attention.

With regard to home-made articles, it will generally be found in every appliance, made by a worker for his own use, that there is some character about it—the maker knows what he wants, and has his own ideas about its construction. One man thinks one way best, another fancies that some little alteration will render the thing more convenient or serviceable. Hence, in these appliances which are made with a full comprehension of what is wanted, and an equal amount of facility in manipulating the materials of which they are formed, one finds that they are stamped with an individuality which is not, indeed, cannot be, seen in ordinary purchasable tools. Now, I don't wish you, for whom I specially write, to try and find out some feature in the block described, simply with the intention of impressing your own individuality on it, but if you think you can improve on it in any little detail, and so render it more serviceable for your own special class of work, by all means embody your ideas when making up the block. I tell you how you may make a good useful one of suitable size for ordinary purposes, but do not suppose that any departure from dimensions or even mode of construction will necessarily be a fault. If you are in doubt, or don't know anything about a mitre block, follow the directions as closely as desired, but, of course, incorporate any improvements which may suggest themselves, and if you hit on a good practical idea, pass it on for the benefit of both amateurs and professionals.

As the construction of the mitre block is under consideration at present, its use need only be incidentally alluded to, as those who know what a mitred joint is will require few directions how to use the block when they have made one. Its adaptability for its work will be evident, but in addition to the aid it affords in cutting mitres, or rather in finishing them, it may be said that if made as directed, it will afford a ready means of squaring off ends of pieces, such as door rails and styles. Indeed, to give the thing its full title, one would be justified in describing it as a mitreing and squaring block. The illustrations, Figs. 1, 2, and 3, show the block. Fig. 1 represents it in front elevation, or by merely imagining the ends reversed, as the back, and Figs. 2 and 3 the ends. A and B are two blocks, both precisely alike in size and shape. The one at the left-hand end is fixed to the frame, D, to which the other is so secured, that it can be

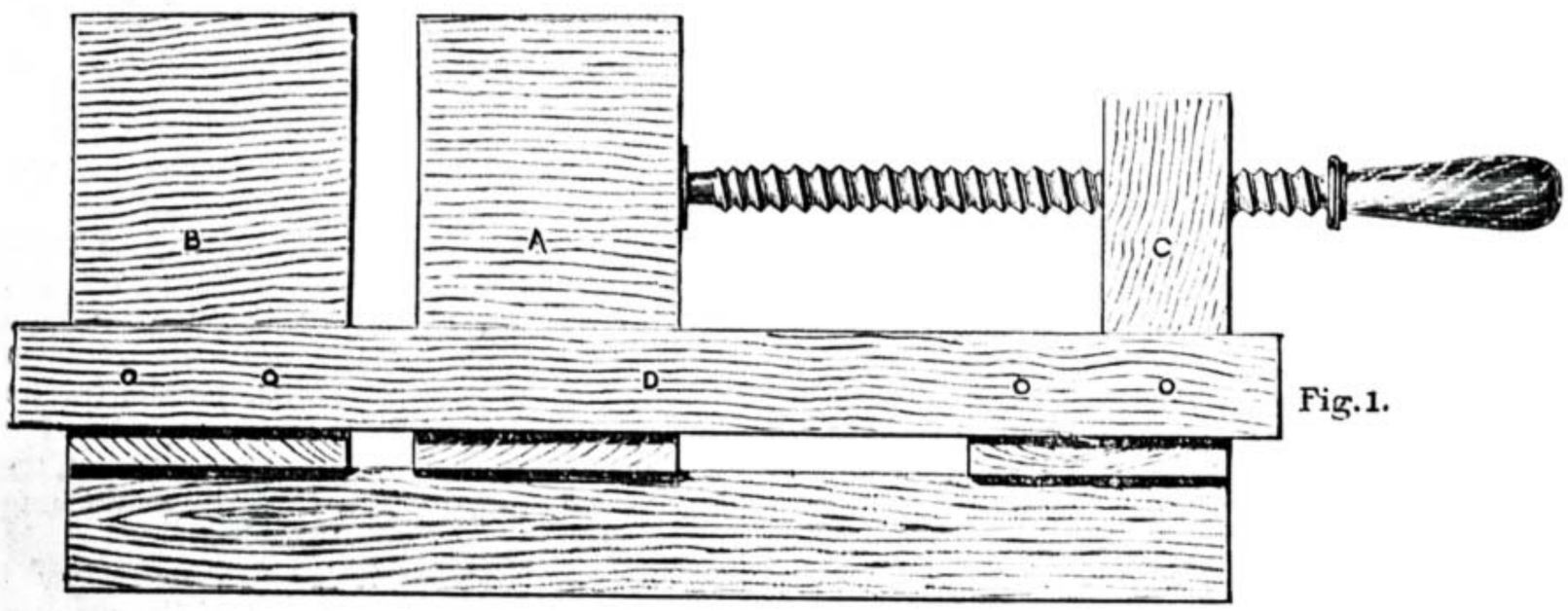


Fig. 1.

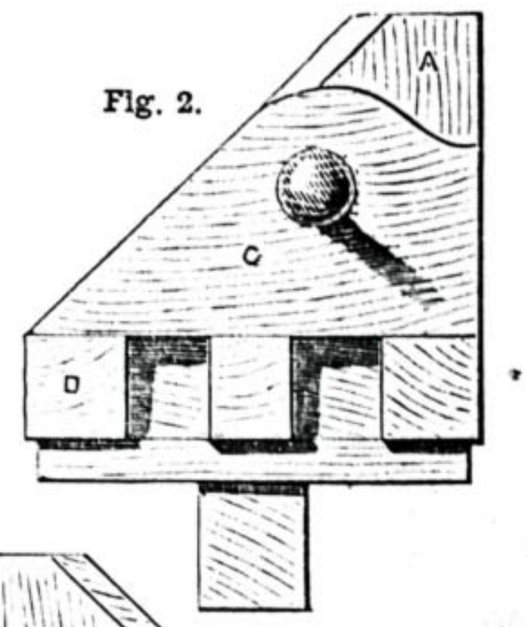


Fig. 2.

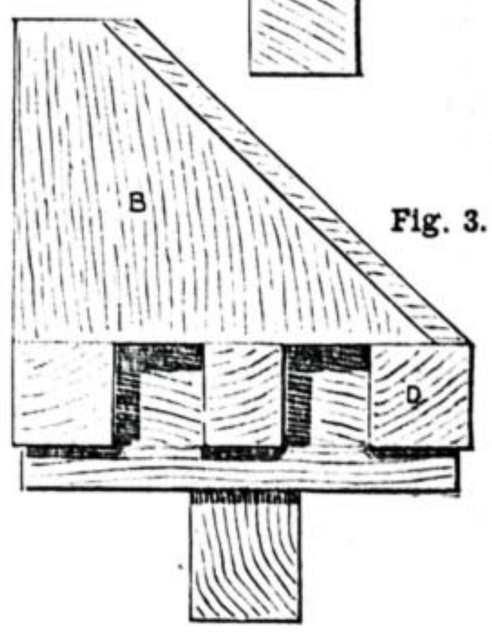


Fig. 3.

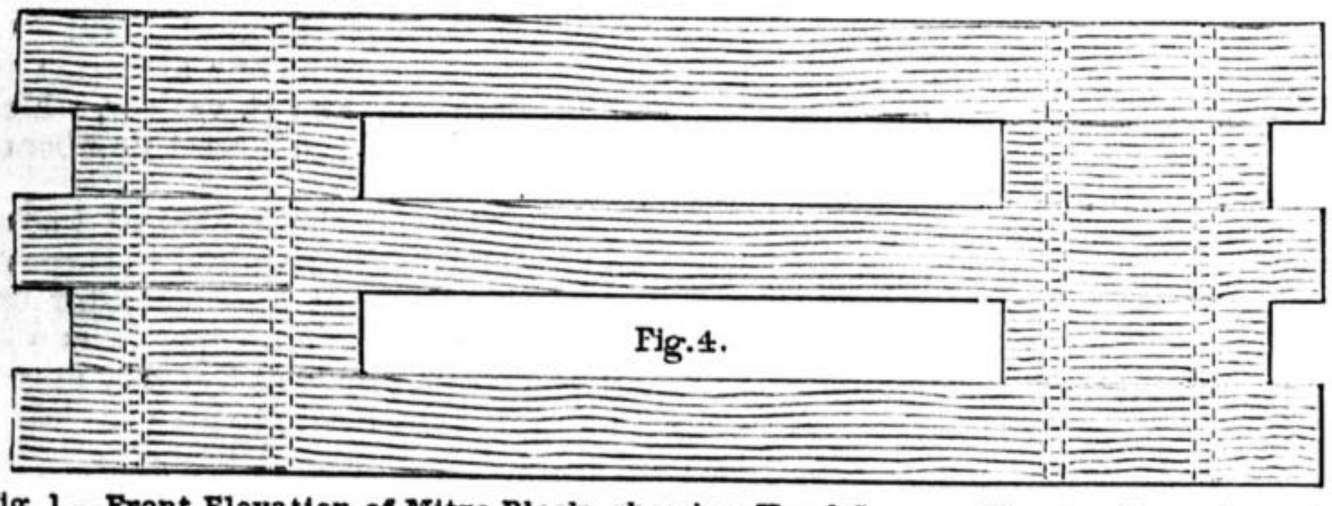


Fig. 4.

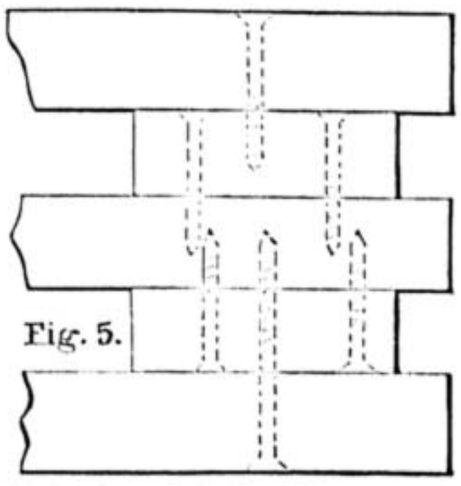


Fig. 5.

Fig. 1.—Front Elevation of Mitre Block, showing Hand Screw. Fig. 2.—Elevation of Right-hand End. Fig. 3.—Elevation of Left-hand End. Fig. 4.—Plan of Frame. Fig. 5.—Alternative Mode of Fastening Parts of Frame together by Screw Nails.

moved by the screw working in C. As will be seen from Figs. 2 and 3, one face, *i.e.*, the front of A and B, slopes at an angle of 45 degrees from the top of D, forming the guide for mitreing, while the back is perpendicular to the top of D, or rather to the triplicate bed of which D is a member.

Having said this much on the outline of a mitre block, let us now consider its construction in detail. In describing this, I take the various parts in the order in which I fancy work may be most readily intelligible, for it can easily be understood that in making the block it is of small consequence which part is made first. Before going any further, let it be said that of whatever kind of wood or woods the thing is made, the material must be perfectly dry, so that there may be no subsequent twisting or casting. If the trap is to be of any use it must be accurately made; something near exactitude will not do, so that it is necessary not only to make and fit it correctly, but to use no wood which will not remain true. If there is the slightest suspicion of the wood being damp, place it in some warm place, and let it remain till all moisture has been got rid of, or to borrow a very expressive word from the workshop, till it is almost "baked," before attempting to finish any of the pieces.

Suppose we start with the frame. I should say perhaps that the measurements and other details are described from a block which lies on the table before me. They may therefore be taken as accurate, but minute fractions are not noted. The frame, or bed, is 16 in. long by $5\frac{1}{4}$ in. wide, and is formed as shown in Fig. 4. It is of birch, but any hard wood will do. The two outside pieces are $1\frac{1}{4}$ in. square, the centre piece $1\frac{1}{4}$ in. by 1 in.; the three of them being connected by four other pieces $1\frac{1}{4}$ in. deep by 1 in. thick, and $3\frac{1}{2}$ in. long. It is most essential that the open spaces which form the guides for the movable block, A, should be perfectly true. It would never do to have them wider at one end than the other, or in any way irregular, and, of course, accuracy will depend on both sides of the centre piece being parallel with each other and the inner edges of the outer rails. If these points are attended to, and the pairs of connecting blocks are equally correct, the result must be satisfactory. These parts may be fastened together by glue, and by wooden pegs running through all of them, as shown by the dotted lines on Fig. 4. If this mode be adopted, it will be more convenient to bore the holes in each piece separately before gluing up, their positions being accurately marked. For the pegs, ordinary dowel stuff will do very well. If on fastening the pieces together it should be found that the top and bottom surfaces are not quite level through the holes not being accurately bored, the inequalities may be reduced by planing.

A somewhat easier and simpler method of joining the pieces together, and one which will probably find more favour with most readers, is simply to screw the pieces together as suggested in Fig. 5. The short pieces are first screwed to the centre rail, and then the outer rails to them. The heads of the nails should be well sunk, especially those into the middle piece, in order that they may not interfere with the glue acting properly. Glue alone might do, but I am inclined to think dependence on it would hardly be advisable, especially as the use of a few screws does not entail much trouble. The frame is further braced with two pieces of $\frac{3}{4}$ stuff fastened on underneath. The width of these is the same as the block, B, which, of course, must be screwed down before the piece at the bottom can be fixed as it is with screws.

The same may be said of the other end piece, but before considering it further, it will be convenient to describe the blocks, A and B. They are of mahogany, faced up on the sloping side with $\frac{1}{2}$-in. rosewood, which is glued to them. If the work of facing should be objected to, it may be dispensed with, though it is advisable to face with some hard wood, if not absolutely necessary. However, whether faced up with another wood or not, too much care cannot be exercised in making the work true as already stated. The fittings of the sliding block, A, are as follows: Two pieces of equal width and thickness with those connecting the main portion of the frame are screwed to the bottom of A, and work within the open spaces of the frame without either stiffness or side play. They must, of course, be so fixed that the sloping face of A is perfectly level with that of B, for if not, the intention of the mitre block will be frustrated. Another piece of rosewood, the same size as the others, must also be screwed under A, but this time instead of fastening it to the frame, it is fastened to the movable block by screws driven into the sliding pieces. By this arrangement, A is free to move backwards and forwards along the frame, but in no other direction.

We may now proceed to consider the screw and block, C, which, however, hardly call for any special remark. The face of C must be on the same slope as those of the other two blocks, to allow of the plane being used, and, of course, the back must be square. The shape of the top of the screw block is merely rounded off as shown, for the sake of appearance. It may be suggested that so long as hand screws are to be obtained as cheaply as now, there is small reason for incurring the expense of having a special screw and block prepared. That, however, is merely a detail which has not been enlarged on, as the great thing is to have a screw with tapped block. Screwing up will force the block, A, towards B, but unless some arrangement be made it will not draw it back. The simplest and most natural way of causing the screw to pull as well as push, is to have a small plate of metal with a hole in it for an ordinary screw nail to revolve freely in it. The nail is driven into the end of the wooden screw, just as if the plate were being fixed to it, but not tightening it up so much that the plate cannot revolve. This plate is then further screwed to A, as indicated in Fig. 1, when, according to the direction in which the wooden screw is turned, the sliding block is either pushed forward to or drawn away from B, so that anything placed between can be gripped as in a vice.

It will now be seen that on a piece of wood being laid on the upper surface of the bed and held fast between the two blocks, the end can either be trimmed off to form a perfect mitred joint, or squared up as the case may be. It will be understood that the block is merely used for the finishing of the surfaces, as it is not a mitre cutter. Consequently, when using the plane, care must be taken not to injure the block itself by taking any shavings from it. The remaining piece of wood at the bottom, which has not yet been mentioned, is merely for the purpose of allowing the trap to be held by the bench screw when mitres are being worked, and for fastening to the top of the bench by hand screws when the trap is wanted for squaring purposes. Though simple in construction, few who have much occasion to use one would care to be without it. If properly made on the lines laid down, and properly used, such a mitre trap as described should last a lifetime, though it may be necessary to true the surfaces now and again.

PRACTICAL HINTS ON MOUNTING OBJECTS FOR THE MICROSCOPE.

BY A. T. SMITH.

THE microscope has of late years rendered such signal help to the cause of science, and the secrets wrested from nature by its aid are so many, varied, and of such vast importance, that almost every scientific worker finds it necessary at some time or other to turn to it for assistance; but apart from those who make use of the microscope simply as a means to an end, there are a large number of workers who make the microscope and microscopic research their special study.

The members of this fraternity are aptly named "microscopists," and the family may be readily divided into two well-marked varieties, easily distinguishable by their special peculiarities.

The first variety, comprising all those who devote their energies to the study of the microscope as a work of art, and confining their attention almost entirely to the invention and perfection of apparatus, with very little regard to the wonders revealed by their favourite instrument, may be briefly described as the "brass and glass" variety.

The second, including those who spend their time roaming the country exploring fields, hedgerows, sandhills, ponds, ditches, etc., etc., in search of fresh objects of interest for examination and preservation, may be briefly described as the "bug and slug" variety.

Though both varieties are necessary to ensure the due perpetuation of the species—the former being more ornamental than the latter, which is, perhaps, the most useful—we will for the present confine our attention to the wants of the B. and S. variety, which also, perhaps, boasts of the largest number of disciples.

The acquisition of the technical knowledge and practical skill required to successfully prepare and mount an object for examination under the microscope, is one of the great desiderata aimed at by every microscopist; and it is my desire to give as clearly as possible a few practical hints gathered from my own experience as to the best methods of preparing and mounting objects for the microscope. I don't pretend to say that all that follows will be absolutely new; on the contrary, I expect that most of what I have to say will probably be old news to expert microscopists, but I live in the hope that what I am writing will at the least repay perusal by novices.

Microscopic objects may be divided into three classes, according to the method of lighting employed in their examinations:

1. Opaque objects, which require to be examined by direct or reflected light.
2. Transparent objects, which are best seen by transmitted light; and,
3. Semi-opaque objects, which may be examined either by transmitted light alone, or in conjunction with reflected or direct light.

Examples of these three classes will readily present themselves to the reader.

It may be well to premise for the

information of absolute tyros, that nearly all microscopic objects are now prepared on slips of glass measuring 3 in. × 1 in., which slips, with the edges ground, may be obtained from most opticians at prices varying from 4d. to 1s. 6d. the dozen, according to thickness and quality. The cheaper slips are cut from pretty thick glass of a coarser quality than the dearer kinds, and they are apt to contain air bubbles or streaks on the surface or in the interior at inconvenient places; however, they answer quite well enough for mounting dry objects.

The edges of the slips are prepared in two ways, ground either perfectly flat or rounded. Those prepared in the latter way are most generally used, but some prefer the former, because having a comparatively sharp upper edge, they are more readily picked up from a flat surface than the rounded ones, and not so liable to accidentally slip out of the fingers and get broken. Covers of exceedingly thin glass, which may also be obtained from the opticians, of different sizes, and either round, square, or oblong, from 1s. 6d. per half-ounce, are used to preserve the objects from contact with the air and from dust.

No workman can work without tools, but in this, as in most other things, the fewer and simpler the tools used, the better the result will be. Everything necessary for present purposes, in addition to slips and cover glasses named above, is comprised in the following list, and of those named very few items need be bought, as will be readily seen :—

Two or three dissecting needles; a small camel's-hair pencil; a pair of tweezers, curved preferably; a few vulcanite or glass rings; a turn-table; a small pair of scissors; a small bottle of japanners' gold size (to be obtained from the oilman); one or two bottles of various coloured varnishes made in accordance with instructions following; a bottle of dull black varnish, and a little marine glue.

The dissecting needles may be made out of wooden pen-holders, as follows: After removing the barrel, wrap tightly round the end a few turns of strong thread or thin bouquet wire to keep the wood from splitting; then take a common sewing needle and push the point into the end as far as it will go, taking care not to split the holder; now pull it out, reverse it, and push the head into the hole just made, and the dissecting needle is completed.

It is well to have the needle pushed in a good way, as it is not advisable for it to have too much spring, and it is also useful, instead of having all your needles perfectly straight, to bend the end of one to a right angle, and of another to an angle of about 45°. This is best done by heating the end red hot, bending it to the required angle, heating it again, and cooling suddenly by plunging in cold water or tallow. This latter operation restores the steel to nearly its original hardness.

The camel's-hair pencil needs no description.

The tweezers and vulcanite rings (cells) should be obtained from the opticians.

A small pair of ordinary scissors will answer present purposes, but if small dissecting scissors are bought, care should be taken in choosing them that they will cut right up to the extreme point, otherwise they will be almost useless for our purpose.

All the remaining articles tabulated can be obtained from the opticians, but if it is preferred to make the varnishes at home, here are the recipes for them.

Sealing-Wax Varnish.—Made by dissolving as much sealing wax (any colour) in methylated spirits as the spirit will take up. If a few shreds of gelatine are put in the bottle as well, it will have the effect of absorbing any water with which the spirit may be adulterated, and will cause the varnish to dry with a good bright surface.

Zinc White Cement.—Dissolve half an ounce of gum damar in one ounce of benzine, and add white oxide of zinc until the mixture is quite opaque.

Japanners' Gold Size.—This may be used either by itself or mixed with various coloured pigments according to taste.

Brunswick Black.—Ordinary Brunswick black makes a very good varnish for finishing slides.

Dull Black Varnish.—Made by mixing lampblack with turpentine. This varnish, if properly mixed, should dry with a perfectly opaque, dull black surface.

The zinc white and gold size varnishes are the most reliable, as the sealing-wax varnish is apt to shell off when it becomes very dry and old, being too brittle, but it looks very nice when newly put on.

The turn-table is used for causing the slide to revolve, and so facilitate the application of the varnish to the edge of the cover glass, and in choosing it you should see that the slide holder runs true and revolves freely. A turn-table will cost from 5s. to 21s., but you cannot very well get on without one, unless you are content to allow your work to look "botchy." Those having an automatic arrangement for centreing the slide are the most convenient.

Having procured the few necessaries mentioned above, let us proceed to work, and as opaque objects are the most easily mounted, and require the least preparation, we will commence with them and suppose we have to mount the wing of a small butterfly or moth.

Opaque objects are, as a rule, best examined in their natural state, and without any preparation except removal of all moisture; and as they are usually of some perceptible thickness, to avoid pressure they nearly always require to be mounted in a raised cell.

To make a cell, choose a ring of vulcanite or glass sufficiently large to enclose the object and of the requisite thickness; after carefully cleaning a 3-in. × 1-in. slip, cement the ring to it at the centre with marine glue, and when the cement has dried make the inside of the cell black by applying to the surface of the glass and the edges of the cell a thin coating of dull black varnish. When this is dry apply evenly to the top edges of the cell a thin coating of japanners' gold size.

The slide should now be put on one side for a few hours, under a glass shade or in a place free from dust, in order to allow the gold size to become "tacky," and when it has reached this stage the cell is ready for the reception of the object.

If the object, which I repeat should be thoroughly dry, is just large enough to touch the edges of the cell and the under side of the cover, well and good, place it carefully in the cell; but if the object is slightly small, the least sensation of gold size, between the object and the bottom of the cell, will have the effect of keeping the former from slipping about and so getting injured after the mount is completed. If gold size has to be applied in this way, it is as well to let it get nearly dry before completing the mount.

When all these instructions have been carried out, select a cover glass sufficiently large to extend about halfway between the inside and outside walls of the cell, and clean it carefully with a fine cambric handkerchief. I say cambric, because if a silk handkerchief or chamois leather is used, electricity is set up on the surface of the glass, and particles of dust are attracted, which is not desirable.

The cover glass, when cleaned, should be taken in the tweezers, warmed, and carefully placed on the top of the cell, care being taken that the edges adhere all round.

The slide should now be placed on the turntable, and a thin coating of gold size applied to the edges of the cover glass, and the whole should be allowed to dry. When dry, another coating may be applied, sufficiently thick to fill up the angle between the edges of the cover glass and the top of the cell walls, and this again may be nicely finished off with coatings of various coloured varnishes, sealing wax, or other fit substance.

All slides should be carefully labelled as soon as mounted, but it is often inconvenient to do this at once on account of the varnish not being dry. A good plan is to write the name of the object in ink on the back of the slide. This can be cleaned off after the varnish is dry, and a neat label affixed at one end to the face of the slide. The label should state the name of the object, where the object was obtained, date of mounting, method of preparation, and name of mounter.

Various modifications of the above method, to suit different objects, will at once suggest themselves to the careful observer; for instance, the object may be too large for any of the cells you have in stock. This difficulty may be met by cutting a cell of a suitable size out of a piece of cardboard of the requisite thickness, and using a square or oblong cover glass, instead of a circular one. Again, the object may be of such a nature that you may wish to have both sides of it displayed. In this case you will, of course, proceed as above, but omit to blacken the interior of the cell, but you must be careful to choose a cell of the exact size required, as you will not be able to use gold size to keep it in its place if it does not fit.

Sometimes the object is so thin that all your rings will be too thick; this difficulty may be met by cutting a cell out of paper with the help of gun wad punches; or a circle of gold size of the requisite width may be described on the surface of a glass slip with the help of the turn-table, and the object mounted in the cell thus formed. In this case, all that is necessary after placing the object in position is to gently warm the cover glass, which will at once adhere, then finish off in usual way.

If you have many objects to mount, the best plan is to prepare a number of slides by cementing cells to them beforehand; but great care should be taken that when the cement is dry the rings adhere at every point, so that there may not be the slightest chance of air penetrating to the interior of the cell.

You can always ensure the success of a dry mount by taking care that everything inside the cell is dry before the cover glass is put on, and making sure that when the slide is finished it is hermetically sealed. If these two rules are carefully adhered to, you need have no fear of mould appearing to spoil your work.

As mounting for the microscope requires great nicety of manipulation, it may be found difficult at first, but this will soon disappear by practice.

AN IRON REBATE PLANE.

BY A FOREMAN PATTERN MAKER.

PURPOSE OF REBATE PLANE—WHY SKEW-MOUTHED—EFFECT OF SKEW-MOUTH—PATTERN FOR REBATE PLANE—CORE BOX—PRINTS—MOUTH—FILLING IN BLOCKS—DIMENSIONS—SPECIAL REBATE PLANES.

HITHERTO I have treated only of those planes which are used for working over broad surfaces, the planes being traversed sideways at will to operate on any portions of these surfaces. In another and larger class of planes the action is entirely localised in the direction of the breadth, so that they remove a narrow zone of material only. These embrace the rebates, rounds, and hollows, fillisters, ploughs, beading, and other planes. They constitute by far the largest portion of the kit of a joiner and cabinet maker, and are mostly made in wood. The simplest of all is the rebate, because it operates only on flat surfaces, the irons of the other planes, the plough excepted, being mostly of various sectional forms. In few of these is the cutting action so good as in the common bench planes; first, because they have single irons only, and second, because in many cases, as for example in the moulding planes, the proper cutting action degenerates into scraping at certain sections towards the sides of the planes, where the angle which the iron makes in relation to the sole, and which should properly be normal at every portion of the curve, cannot be maintained. Moreover, all these irons are very slight in themselves, and apt to chatter on their seats.

It is to obviate somewhat the tendency of the rebate plane to chatter that it is usually made skew-mouthed. The skewing is not great, but it has the effect of causing the iron to sever the grain fibres in detail, in the same way as a chisel when directed obliquely cuts more sweetly than when it is thrust straightforward through the stuff. Making the body of the plane of metal instead of wood extra weight is obtained, and the best results possible from the rebate plane are secured.

A common iron plane is shown in section in Fig. 1, the pattern in Figs. 4 and 5, and the core box in Figs. 2 and 3. In Figs. 4 and 5, the print, A, of the pattern is of the same thickness as the width between the inside faces of the casting. This print is planed to gauged thickness first of all, and upon it the pieces, B, which are of the same thickness as the sides of the castings, are nailed. The thickness of these sides when finished should be $\frac{1}{8}$ in. In the pattern they may be $\frac{3}{16}$ in., or a trifle more if it is intended to plane the sides in preference to filing them.

Before being fastened on, the holes through which the shavings have to escape are cut out, and usually the top edges are shaped to an ornamental outline, somewhat as shown in the figure. Note the great breadth of the print, which is quite double that of the pattern itself, in order to enable it to balance the core properly, the pattern moulding upon its side. Being so shallow it is not necessary to make any taper in the sides of either pattern or print. If made dead square, the rapping will cause it to deliver freely. This is a case where coring out is quite necessary, because the deep and narrow body of sand between the sides would not deliver from a pattern made just like its casting, except by imparting an extravagant amount of taper thereto.

The actual mouth for the iron cannot be cut in the pattern, because it would not mould properly. This must be cut through in the casting, either with a slitting file, or with a hack saw, and finished by filing to the size required.

The core box (Fig. 2) is simply a rectangular open framed box having its ends grooved into the sides in the usual way, and having a piece, A, bridging across it to act as a stop for the wedge, and also a triangular bit, B, forming a bedding for the lower end of the iron which comes just above the bevelled facet.

The filling in blocks shown at A A (Fig. 1), made of any suitable hard wood, are fitted carefully in place, using red lead to test the accuracy, or otherwise, of their contact. Before fitting them, it will be necessary to rough file the inside faces of the casting, and to check their parallelism with internal callipers, to be sure that the width at the upper portion is not less, but of the two slightly greater than the width lower down. As in the previous examples, see that the fit is perfect everywhere, and also that the bedding of the iron on its seat, and of the wedge on its iron, are perfect, in order to diminish risk of choking and chattering. The section (Fig. 1) shows the relative arrangements of blocks, iron, and wedge so clearly that further explanatory remarks are unnecessary.

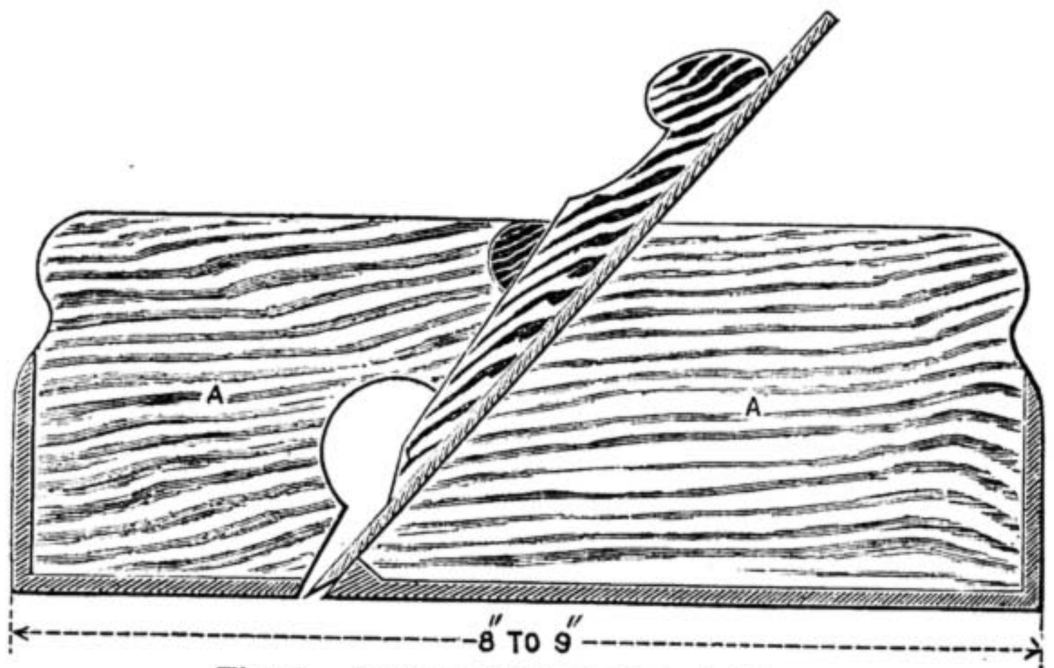


Fig. 1.—Section through Rebate Plane.

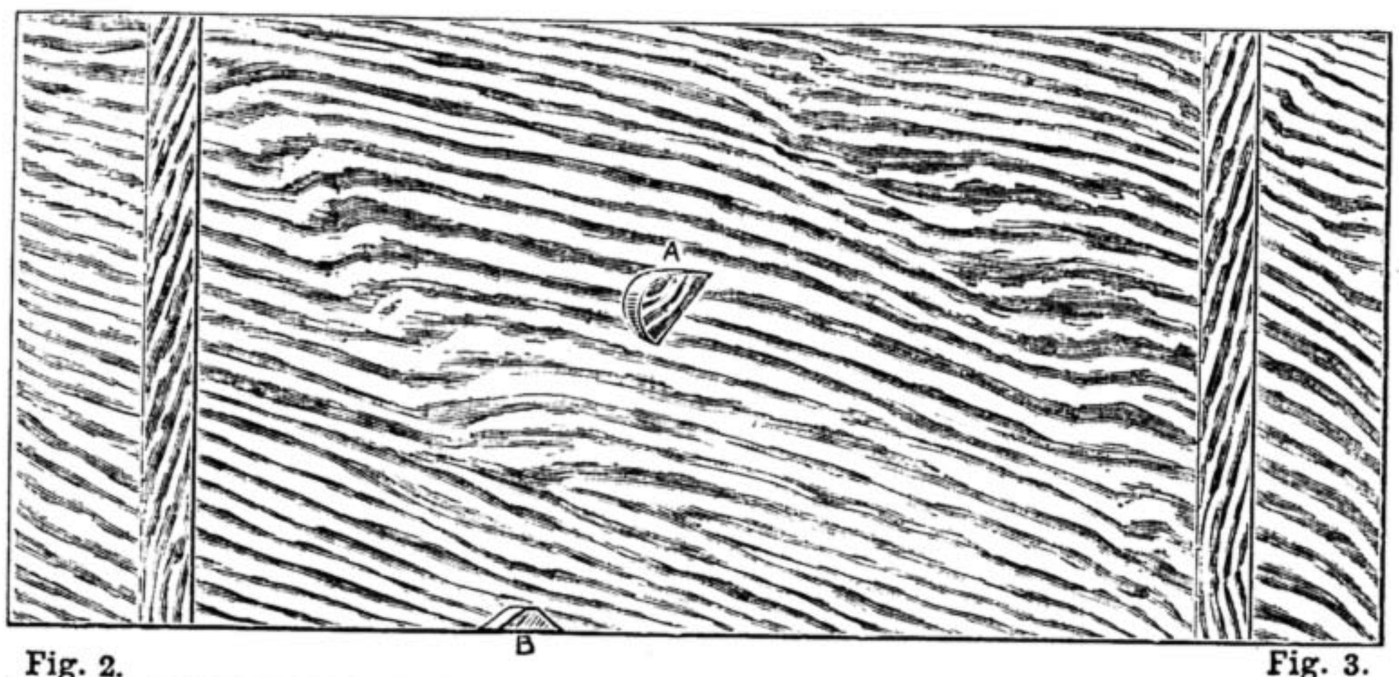


Fig. 2. Fig. 3.

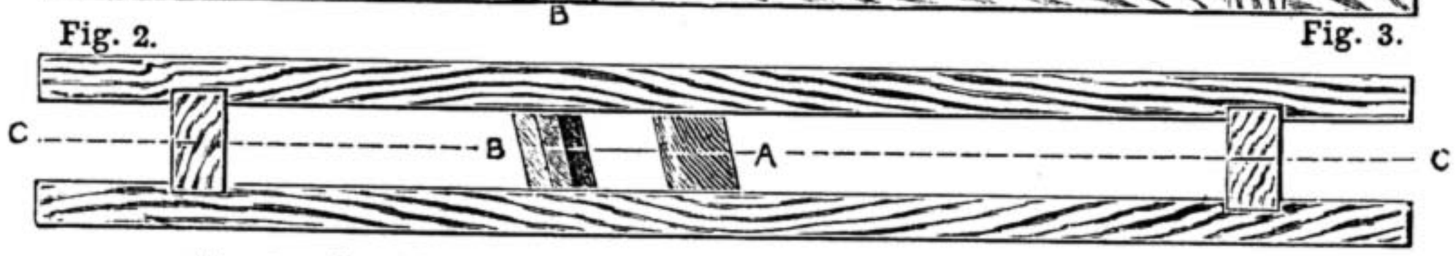


Fig. 2.—Core Box for Rebate Plane: Plan. Fig. 3.—Ditto: Section.

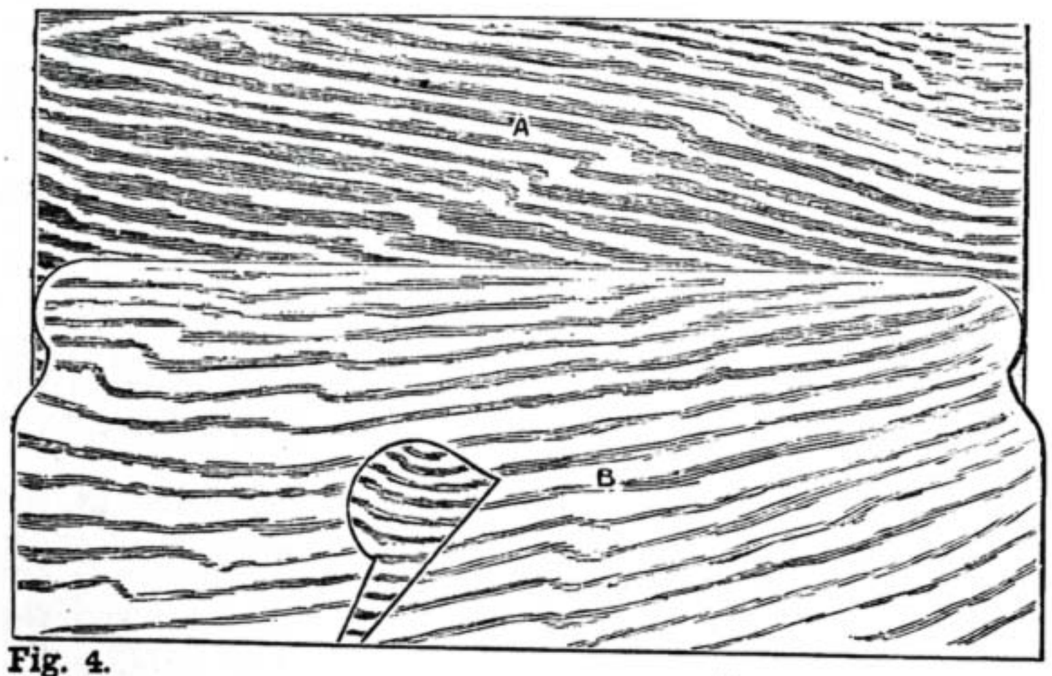


Fig. 4.

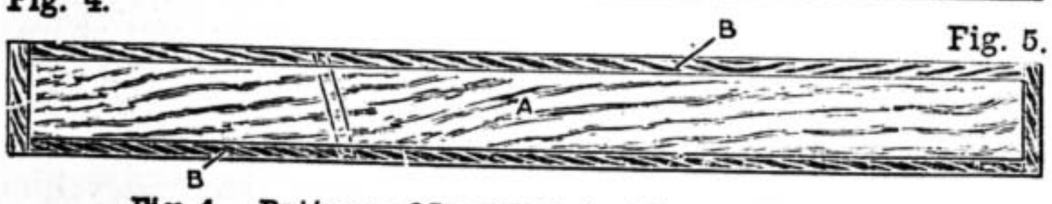


Fig. 5.

Fig. 4.—Pattern of Iron Rebate Plane: Elevation.
Fig. 5.—Ditto: Plan.

I have not given many dimensions in this instance, because the drawings are proportional, and all measurements can be scaled. An ordinary rebate plane is about 9 in or $9\frac{1}{2}$ in. long. The width for an iron plane may range from 1 in. to $1\frac{1}{2}$ in.

It is not advisable to exceed $1\frac{1}{2}$ in., nor is it well to go below 1 in. in an iron plane; though in wood we may go to $\frac{1}{2}$ in. and $\frac{3}{8}$ in.

In rebates, as in smoothing planes, it is often convenient to bring the iron close to the front, for the purpose of working right up to a shouldered end. This cannot be done in a plane made of wood, because of the weakness of the short grain. But such a plane is easily made in metal. The one here figured might be modified in such a way, but usually the tool is made altogether smaller. One of this special type will be described in a future paper.

It has been advanced that no one who can buy a tool will make one; but this is by no means the case, as many a professional workman will be found who will not only make, but even contrive special tools for special purposes. Moreover, the methods of making tools described in this and other papers on the subject are useful as forming a stepping-stone to the art of pattern making, which will eventually be treated in a more comprehensive manner.

SOME LESSONS FROM AN OLD BUREAU.

BY DAVID ADAMSON.

(*Continued from page* 246.)

PREPARATION OF DRAWERS—FITTING DRAWER FRONTS—TREATMENT OF WOOD—DOVETAILING OF PARTS—LAP DOVETAIL—REASONS WHY—IMPROVEMENTS IN WOOD WORKING—FASTENING DRAWER BOTTOMS—PLAIN BOTTOMS—MUNTED DRAWER BOTTOMS—WHY DRAWER BACKS ARE NARROWER THAN FRONTS—COCK BEAD—STOPS—FITTING LOCKS—KEYHOLES—PLATE ESCUTCHEONS—PLINTH—CONNECTION OF END PIECES—CLEATS FOR PLINTH—MOULDINGS—BLOCKS.

THE work, so far as it has gone, may be glued and fitted up now; indeed, it will be better that it should be before preparing the drawers. These will require some degree of expertness, though what may be lacking in this respect may, to a great extent, be made up by carefulness in every detail. Anyhow, a drawer is not the easiest thing to make if it is to work well and satisfactorily; and though it may seem such a simple piece of work, the man who can construct one perfectly may, without vanity, consider himself a skilled mechanic. Let the drawer fronts be fitted very tightly to their places before making the drawers, and in particular see that they are a little too full in width, if there is the smallest doubt about the wood being perfectly well seasoned, for if wood is cut exactly to width, and afterwards shrinks, the drawers will not fit well.

It is by no means a bad plan, in order not to run any risk, to let the wood stand for a day or two in some warm place before it is fitted. I would say that it should be placed near a fire, were it not that other risks are incurred by so doing, unless care be taken, and judgment used in turning the boards about, so that all parts are equally and gradually warmed. If this is not done, the boards, through drying more in one part than another, will probably twist and bend. If carefully watched this should not occur, and, in case of bending, it will be well to know that the hollow will be on the side nearest the fire. This arises from the wood nearest the heat shrinking most, so that the bend, if taken in time, may be counteracted by merely reversing the sides. The sides of the drawers may also be submitted to the same treatment; but whether they are or not they must be cut to fit very tightly; a rub with the glass paper will soon ease them sufficiently afterwards, if they don't run easily enough.

The front, ends, and back of each drawer are dovetailed to each other, in the way that may best be explained by reference to any ordinary drawer. In fitting the sides to the front, what is known as the "lap" dovetail is used. With it the ends are sunk in the drawer front, so that looking at this from the front no joint is perceptible. The back is fitted with the ordinary dovetails into the sides. The question may occur to the mind of the novice in drawer making, whether the pins (the dovetails) are to be formed on the ends, or on the back and front, or even whether it matters which. In this, as in most other construction, there is a right and a wrong way, and we can easily judge for ourselves which is the proper method in the present instance. Of course, the object of the dovetailing is to keep the parts together in the best possible way. The question then is in which direction, or where is the greatest strain on a drawer. The answer can only be that it is on the front, for on opening, it is that which is pulled. If it were loose it would come apart from the remainder. The same applies, though in a less degree, to the back. We therefore discover from theory, why it is that experience has shown the best way to fit a drawer together is by dovetailing the parts so that a backwards and forwards pull will not separate them. A lateral pull on the two sides would soon do so, for there is no resistance offered in this direction, except that caused by glue; but then, again, no great strength is required, for the strain cannot be so great as on the back and front.

Never thought of that! No, perhaps not, for we do so many things correctly by force of habit, that one is apt to lose sight of the fact that some one in far-off times perhaps must have pondered even on the right and the wrong way of making such a matter-of-fact article as a drawer. Did the man who first promulgated the now accepted method of fastening a drawer together meet with opposition from his fellow-workers? Did they look upon him as a dangerous character, who, instead of being content to follow his forefathers, was always bothering after some new-fangled idea? Did the antiquarian of his time think he was not a true "art worker," because he actually had the audacity to fancy that he could improve on old forms? I wonder. Probably he met with much the same kind of reception that one does now from a certain class of patrons, as they like to consider themselves, of art, when one advocates new and modern improvements.

Even in such a venerable handicraft as that of the wood worker, suggestions for improvements may be listened to with respect, unless experience shows them to be faulty in themselves; for though they are not very common, improvements are sometimes made. I saw one the other day in a piece of furniture on which it might fairly have been supposed ingenuity had exhausted itself long ago. No, it is not a patent, and I may tell you some day what it was, but as it has nothing to do with the bureau, it does not concern us at present; not, at least, further than gently reducing the shock it may be to some, when I tell them that the style of fitting the drawer bottoms in the old bureau will not be recommended for the present day workers. In it the drawer bottoms are fastened underneath the sides and back, and against the front. The grain, moreover, runs from back to front. The consequence is, that in several places the bottoms have split, although—think of it, unreasoning admirers of the antiquated—in the "good old times" workmen never—no, never—used anything but seasoned stuff. Nowadays it is considered best to let the grain run from side to side, and to make due allowance for any possible shrinkage. So that if the bottom does contract, it shall do so without detriment to the efficacy of the drawer.

This may easily be managed by fitting the drawer bottom into grooves in the sides, similar to Figs. 10 and 11, but as the groove to a certain extent weakens the drawer side, as well as for other minor considerations, another plan is preferable and commonly adopted. In it the groove is run in a separate piece of wood, which is afterwards glued to the drawer sides, and the drawer bottom subsequently pushed in. Fig. 12 explains this more fully. As in the preceding illustration, A and B represent the side and bottom, while C shows the grooved slip. This may be about 1 in. wide, ½-in. stuff. The edge within the drawer is usually rounded off for the sake of neatness, and the lower edge is level with the bottom of the drawer side. This grooved slip runs the whole length of the end or side. It is a good plan to cut a groove also in the drawer front, into which the front edge of the bottom may be pushed, as otherwise the least contraction will leave an open space between the bottom and the front. Another hint that may be useful in connection with drawer bottoms is this:—Do not cut them off too bare at the back; let them project a little, and don't put any nails through them into the back, at any rate for a time; or if they fit so loosely in the grooves that they must be fastened to the back someway or other, let it be with screws, which can easily be withdrawn, and not with brads hammered in. If this precaution is taken, the groove along the front may be omitted, though it is never objectionable, and may often be serviceable.

Plain bottoms, such as have been described, do very well for short drawers, but when these are of any considerable length, such as the long drawers in the bureau, it is better to have a "muntin," as it is called. I am not sure about the orthography of this word, as it is not a common one in literature, and I have failed to find it in any dictionary, of which I have looked into several for the purpose. It is, however, given phonetically as used in ordinary workshop parlance, and as

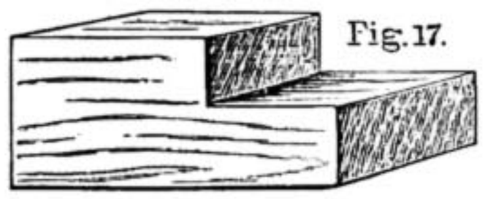


Fig. 17.

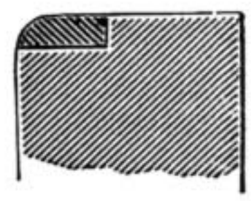


Fig. 16.

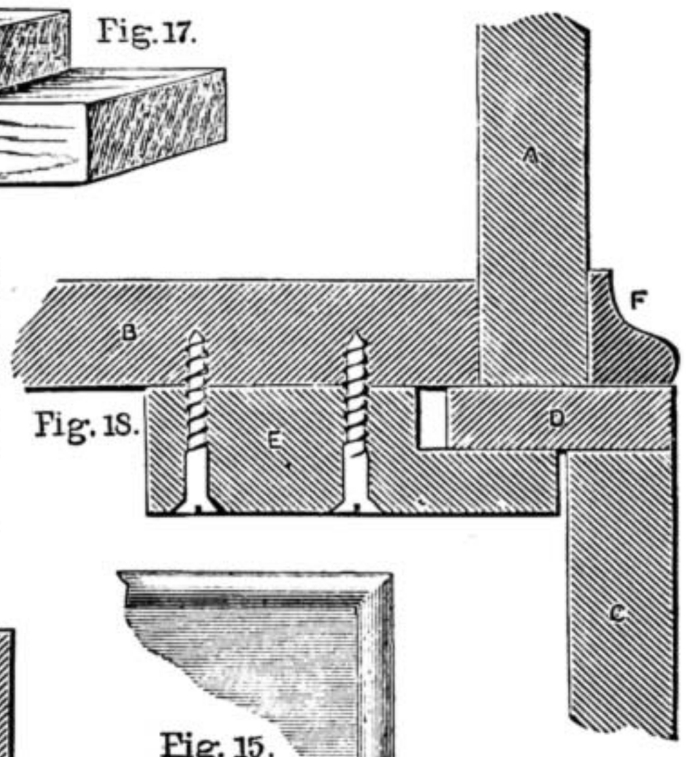


Fig. 18.

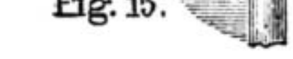


Fig. 15.

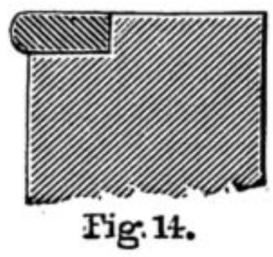


Fig. 14.

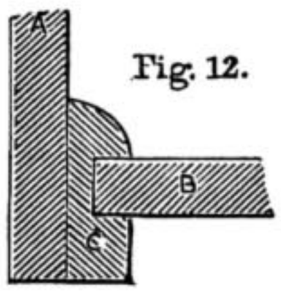


Fig. 12.

Fig. 13.

Fig. 12.—Fitting of Drawer Bottom. Fig. 13.—Back of Drawer. Figs. 14, 15, 16.—Beadings for Drawer Fronts. Fig. 17.—Cleat. Fig. 18.—Section of Plinth Fastening.

spelled by cabinet makers when writing for their craft, so that it will be well understood by those who are familiar with the construction it indicates.

A munted drawer bottom consists of three parts, the muntin itself and two others. The muntin is merely a piece of wood acting as a stay for these, and extending from the front of the drawer, where it is fastened, to beyond the back, underneath which it is secured. Its width may be from 3 in. to 4 in., and its thickness ½ in. Along each side edge a groove of the same width as that in which the drawer slips is to be ploughed. A recess is cut at the bottom of the drawer back, equidistant from each end, for the muntin to lie in, so that the grooves shall be in the same plane with those in the slips and front; or, instead of cutting a space in the drawer back for the muntin, this is cut down or rebated as far as the top of the groove, and then secured underneath the back. Each method has advantages peculiar to it, but the latter is the one generally adopted. The other pieces of wood are of the usual thickness of drawer bottom stuff, and it will be unnecessary to do more than state they are pushed into the grooves as if there had been no muntin.

The reason why the drawer backs (Nos. 34 and 35) are stated in the list to be narrower than the fronts (Nos. 6 and 9), will now be apparent, for the bottoms are fitted under them. Fig. 13 shows a corner of a drawer seen from behind. It will be noticed that the top of the back piece is shown lower than the sides. This generally is so, but it is not of importance that it should be, unless, perhaps, a trifle, just to be sure that it is not above the level of the sides. These, it will also be noticed, are slightly rounded at the top corners for the purpose of giving the drawers an easy entrance. The bottom corners and outside edges may also be rounded for the same reason, though it is not necessary if the upper ones are done. It will, however, be well to rub the upright angle down a little with glass paper, not too much, but just enough to allow the drawer to enter easily. The drawers as described are perfectly plain, without even a pretence at ornamentation, although Fig. 1 indicates a bead round each. This bead is represented on a larger scale in Fig. 14, which shows it to project a little in front. It is known as the "cock" bead, and though rather out of date, there is no reason, except on fashionable grounds, why it should not be as popular as ever it was. It is, indeed, one of those details of finish which, though temporarily neglected, never seem altogether discarded. To make it, a shallow rebate is cut all round the drawer front, usually as far back as the dovetails, on the ends and thickness of the front on top and bottom. In this rebate, and filling it, the piece forming the bead is glued or fastened with glue and a brad or two. The front edge is rounded, as it may easily be with ordinary appliances, for, though there is a specially constructed tool for the purpose it will not be worth any one's while to get it, unless he wants to make a great number of "cock beaded" drawers in the shortest time. The corners of the beads are mitred (see Fig. 15). Another bead, and one perhaps slightly easier to form, equally suitable as the other, though not so often made use of for oak drawers, is shown in Fig. 16. The principal difference is that it does not project beyond the drawer front, and consequently only one edge is rounded. Neither of these beads should be too thick; ⅛ in. is quite enough. There is, of course, no necessity why the beads should be used, their only object being to relieve the drawers from absolute plainness, and, after all, it may be open to question whether they are worth the labour involved by them. Now, to prevent the drawers being pushed too far in, for I assume that they do not extend quite to the back of the bureau, and when quite in they should be level with the rails between them, or the merest trifle within them, unless beaded as in Fig. 16, when they should project a little, just the extent of the rounded wedge, some kind of stop will be wanted. These can easily be made of a thin piece of wood bradded to the rails, so that the fronts of the drawers catch against them. Usually a couple of stops are placed for a drawer—one near each end, and, of course, clear of the drawer sides. Their exact position can easily be ascertained by measurement and experiment. Thus, if the drawer front is exactly 1 in. thick, and it is, when in, to be quite flush with the rail, the front edge of the stops must be just 1 in. back on the bearer.

Locks may be fitted to the drawers any time after the stops have been placed, or, indeed, locks may be fitted as soon as the drawers have been made, only the holes for the bolts cannot be accurately cut till the exact position of the drawers when shut is known. These holes, of course, are cut into the under sides of the bearers; but, perhaps, before mentioning them, I should have said something about fitting the locks. These must be sunk so that their backs and tops are level with the wood to which they are attached. Nothing looks worse than a lock too deeply sunk, especially on the top of the drawer front, and it is a fault that is easily avoided by a little care. If too much wood has been cut away, the lock may easily be got to a proper level by packing with a thin slip glued. Be careful not to make the opening too wide for the lock, though, for this is a mistake not so easily remedied. The best way to do so will be to cut the space out clean, fill with a block glued in, and fit the lock afresh. Now a place for the bolt will have to be cut in the bearer above each lock. Its exact position may be ascertained by measurement, but a simpler plan will be to blacken the top of the bolt with a little gas black and glue say, then, when the drawer is in place, shoot the bolt, of which an imprint will be left where the hole is to be made. Of course, the blacking, or whatever it is, must be wet, or no imprint will be left on the bearer. The hole may be cut with a small chisel of the ordinary shape, though there is a contrivance, a kind of bent chisel, made especially for cutting holes in similar positions. It is, however, not often seen. Perhaps I ought to have mentioned something about cutting the keyholes, though really the only thing to be said about these is that they should be neatly formed if the ordinary thread escutcheons are to be sunk in them. In case, however, this is beyond the skill of the maker, he may be pleased to know that he can hide any unshapely keyholes by plate escutcheons, which are pieces of brass made to screw on to the drawer front, and having an opening to pass the key. The bulk of the bureau is now done, and those who have managed thus far will find the rest comparatively simple, though, in point of time, it may take as long. There still remain the plinth, the writing lid, the small fittings inside, and the back to be attended to. It is immaterial in what order they are done, but perhaps that just given will be as convenient as any.

The plinth may, therefore, be described first. This should be of 1-in. stuff for the ends and front, which may be either shaped, as shown on Fig. 1, or left plain. The advantage of the shaping out is that the feet of the writer do not knock against and bruise the front of the plinth, as they are apt to if it is left solid, and perhaps it is more pleasing to the eye. In length the plinth should measure about 1½ in. more than the extreme length of the bureau above it, and ¾ in. more than the width of the ends; in other words, it will extend ¾ in. beyond the upper portion of the bureau, in front and at each end, the ends of the side pieces being flush with the rest of the job behind. The front and ends may be dovetailed together, the pins being cut in the front pieces. A very much neater way, however, will be to mitre the corners, and fasten them together with the mitre dovetail. This joint, however, as already intimated, may not be convenient, and a plain mitre, though sightly, would not afford the necessary strength. This may, however, be gained without any dovetailing, by simply gluing a block on the inside of the angle. All that is required is that the block should be rectangular on two of its sides, and that these should be glued one to an end, and the other to the front piece of the plinth. The block may be one to two inches wide on each face, and if made triangular in section it will be an easy matter to further strengthen the joint with one or two screw nails driven through it into the plinth. The length of the block, of course, cannot be more than the width of the plinth pieces, and it should not be much shorter.

Somewhere near the back connect the two end pieces by another of the same width. Pine will do very well. It must be slightly shorter, as it is to be dovetailed in the same manner as the drawer bearers were—*i.e.*, a groove shaped to fit it must be cut across the end pieces of the plinth, or it may simply be attached by glued blocks such as those mentioned for the front corners. The result will be a frame, some 4 in. deep, say, with the back three or four inches within the ends. The remainder of the bureau will stand on this, but no provision has been made for fastening the two parts together. There are at least two ways by which this may be done in a thoroughly workmanlike manner, and a good many more, which, though in practice may be found sufficiently efficacious in the hands of skilled workmen, cannot be recommended to the amateur. In one of the two methods which he should adopt if he wishes to avoid all risk of something "going," pieces of oak, or whatever the bureau is of, are laid on the frame of the plinth. The thickness of these does not matter, though they should hardly be less than ¾ in., still if this is not convenient ½ in. will do very well. They should not be less than 2 in. wide, and each piece should be as long as that on which it is placed. The outer edges should be level with the outside of the plinth, so that they hang over on the inside 1 in. or so. The ends should be mitred to fit each other, and when this is done these pieces should be fastened by glue and screws to the other part of the plinth. There is now a rail through which screws may be put into the bottom of the bureau; but remembering what has been said about the undesirability of rigidly binding cross grains together, it will be seen that screws (or screws and glue) can only be used in front, as if the ends of the plinth were to be fixed to the bottom in the same way, this latter would have no freedom in case of shrinkage. Still it is necessary that the ends should be fastened, and it may very simply be managed by a couple of cleats to

each, one near the back rail, and the other midway between the front and it. The exact size of these cleats (Fig. 17), or blocks, is not important, but as some idea 4 in. long × 2 in. wide may be stated. The depth of the piece cut out should be the same as the thickness of the top rails of the plinth, so that when the cleats are screwed to the bottom of the bureau they will hold the plinth to it.

This being done, the moulding also mitred may be laid on and glued to it. In addition the front moulding may be glued to the pine bottom, the edge of which it should cover and hide the joint with the oak bearer above it. Be careful not to glue the end mouldings except to the plinth, and if there is any fear of them being knocked off, or the glue giving way, a screw or two driven in on the slant from below will prevent any injury of this kind. The section of the completed plinth, with its attachment, is shown by Fig. 18; A and B are the end and bottom of the bureau; C, the lower part of plinth; D, the upper part hanging over underneath the bottom, to which it is held by the cleat, E; and F is the moulding planted on to the plinth outside. If desired, a piece similar to D may be fastened on the back rail of the plinth, and if the bureau is made much larger, perhaps it will be as well to do so, securing it to the bottom by cleats, which should allow it, or rather the part above, sufficient play. In a bureau of moderate size, however, such as the present, this extra labour need not be incurred. In the other method alluded to, the pieces, D, may be omitted, and their purpose served by blocks glued inside the plinth, and fastening it to the bottom. Those in front may be glued, but those along the ends should be fastened by the cleats. No object could be served at present by giving other methods, as the latter is as simple as possible, though not quite so good in all respects as the former; it has some advantages to recommend it, and with fair workmanship and sound, dry wood it is reliable enough for ordinary purposes.

BURGLAR ALARUMS:

How to Make, Work, and Maintain.

BY GEORGE EDWINSON BONNEY.

(*Continued from page* 180.)

THE YOKE—THE BOBBINS—THE COILS—THE ARMATURE—THE ARMATURE SPRING—THE CONTACT PILLAR AND SCREW—THE HAMMER—THE GONG AND ITS PILLAR—THE RELAY.

The Yoke.—The yoke of the magnet is the piece of metal to which the cores or legs of the magnet are attached. This should be either made of iron entirely and the legs fixed to it, or the two legs must be connected by a strip of soft iron. A short piece of angle iron of the right dimensions to suit the size of bobbin to be mounted on the legs will make a good yoke, since it will serve as a bracket as well. On reference to Figs. 4 and 5 (page 179), it will be seen that the yoke is attached to the metal frame, and is made to fulfil a double purpose. It forms an angle, one side of which serves the purpose of a yoke, whilst the other forms a lug to which the armature spring is attached. Some magnetic advantages are secured by this arrangement.

The Bobbins.—The bobbins for the cores of electric bell magnets are usually turned out of boxwood or ebonite. They are made as thin as the strength of the material will bear, and special attention is paid to the thinness of the body, the best effects being obtained in an electro-magnet when the insulated coil of wire is as close to the core as it can be brought. This consideration will also determine that the bobbins should fit the cores in every part. Should the workman make a slip and the bobbins go loosely on the cores, the space must be filled with a slip of thin paper wound on the cores and the bobbins fitted on this.

The Coils.—The wire for the coils of an electro-magnet should be of pure soft copper perfectly insulated with a silk coating. The wires generally in use for electric bell magnets are coated with green silk, and thus have an attractive appearance. The silk coating must be without a break in any part, that is, we must not be able to see the copper wire beneath. Should a bare place be seen whilst winding the wire on the bobbin, stop winding, and cover the bare spot with a thread of silk wound around the wire. If this is neglected, and two such bare spots on two different layers come together, the coil will be short circuited, and a portion of the magnetic effect of the current be lost. The bobbins may be wound with wire in a small lathe, but a little experience will be needed before a strange hand can wind the wire on regularly.

If, however, the bobbin, reel, or spool of wire is placed on a piece of iron wire where it is free to run around, and held in one hand at a distance of about a foot from the bobbin to be filled, the wire will go on in coils side by side and almost guide the hand, if this is allowed to follow its course. A fold of white tissue paper between each layer of wire enables the winder to guide the wire with exactitude. The bottom end of the wire placed on each bobbin must first be brought out through a small hole bored in the end of the bobbin, or laid in a small nick made in the edge of the end, and some 8 inches of it coiled around a small rod to form a helix. This will serve as an elastic connection between the two bobbins, or to connect the coils with any other part. The bobbins should be quite filled with wire, and the top ends secured by a string of silk to keep the wire from unwinding, or the ends passed once or twice around the last fold and then drawn tight. The top ends should also be coiled on a rod to form a helix. When this is done, the bobbins may be slipped on tight on the cores, and the two bottom ends of the wires connected together. To do this, lay bare the copper by stripping off half an inch of the silk insulation, clean the bare copper with a bit of emery cloth, and twist the two ends tightly together. These may be soldered to ensure good contact, but this is not always done.

The Armature.—This must be made of a strip of soft iron, as soft and as well annealed as the iron in the cores of the magnet. The size of this strip must be proportioned to the diameter of the magnet coils and their distance apart. It should be long enough to come to the edges of the coils, and wide enough to cover the cores, whilst it should be thick enough to hold the hammer shaft inserted in one end. A good size for a 4-in. bell is 2 in. × $\frac{5}{8}$ in. × $\frac{3}{16}$ in. This piece of iron must be filed up smooth and true. In one end drill a small hole and tap it to take the screwed end of the hammer shaft; at the other end, in the positions shown A, B, in Fig. 16, drill and tap two small holes to receive two small iron set screws. These last are intended to hold the armature spring shown at Fig. 19.

The Armature Spring.—This may be made of spring brass, German silver, or steel. Its length and width are determined by the dimensions of the armature, but it must be long enough to extend from the lug, S, Figs. 2, 3, 4, and 5 (page 180), to the contact or break pillar at P. It should be just stiff enough to bring back the armature to the contact screw sharply after the bell has been struck, but not so stiff as to require a lot of extra battery power to work it. Two holes must be drilled at A, B, to receive screw studs for holding it to the lug, S, and two holes at C, D, to receive screw studs to attach it to the armature. At E, another small hole should be bored to receive the tip of a bit of No. 20 B. W. G. platinum wire to form (when riveted to the spring) the contact speck of the spring. If the armature is intended to be used with the form of relay trigger shown at Fig. 21, two small holes must be drilled and tapped on its upper edge to receive a couple of screw studs to hold the bent strip of brass shown at Fig. 20. In the form of relay trigger shown at Fig. 25, this is not required, since the hammer shaft is made to carry the catch for the trigger of the relay. Neither is it required where the bell is to be used with an indicator relay.

The Contact Pillar and Screw.—This, with its accessories, is shown at Figs. 22, 23, 26, and 27. The pillar should be turned down out of $\frac{1}{2}$-in. brass rod, the top part above the foot should be $\frac{3}{8}$ in., and the lower part $\frac{1}{4}$ in. The lower part, or tang, of the pillar must be screwed to receive the hexagon nut (Fig. 26), or to be screwed into the wood base. Both methods are adopted by makers, but I give the preference to that wherein the pillar is secured to the frame by a nut beneath the base, as this prevents shifting of the pillar. When thus formed, a recess for the nut is cut with a brace bit beneath the base, the connecting wire is carried into this recess through a small hole, and the end secured to the tang of the pillar between the nut (Fig. 26) and the thin brass collar (Fig. 27). As the tang of this pillar will pass through the hole, P, in the metal frame, and the pillar must be insulated from the frame, we must turn a collar to the shape of Fig. 22, out of boxwood or ebonite, and fit this to the tang under the foot of the collar, as shown by the dotted lines at Fig. 23. The upper part of the pillar carries a contact screw to connect the pillar with the armature spring. This screw is made of brass; diameter of screw $\frac{1}{8}$ in., length $\frac{3}{4}$ in., furnished with a milled head. A small hole should be bored in the tip of this screw, into which a platinum wire must be fitted to form contact with the platinum speck on the armature spring. Platinum is used because the electric spark which passes at this point when the bell is ringing has very little effect on this metal, whilst it will corrode or burn away most other metals. A hole must next be bored through the pillar, about $\frac{3}{8}$ in. from the top, and tapped to receive the contact screw. The top of the pillar down to this hole should then be slit with a thin circular saw, a fret saw, or a hack saw. Across this slit, transverse to the contact screw, near the top of the pillar, bore a small hole, and tap it to receive a small steel screw. I will now explain the object of all this. The contact screw must be nicely adjusted to ensure the best ringing action of the armature on the bell. When the exact position of this screw has been obtained by practice, we must secure it there. This may be, and is often, done by using lock nuts on the screw, but as even these shake loose under the intense vibratory action of the armature, it is found best to tighten the screw by clipping it in the slit

by means of a transverse screw. By this means, also, the wear of the threads may be taken up.

The Hammer.—The hammer of an electric bell is merely a small disc of brass, or ball of brass, secured to a shank or shaft made of hard iron or brass wire. The disc shape of hammer is shown at Fig. 17, but there are several other forms, including one in the shape of a small brass marble. A small hole is drilled in the hammer head and tapped to receive the screwed end of the shank, then screwed on tight. It is well to secure the head in its right position with a drop of solder in addition to the screw, to prevent the head shaking loose (as it sometimes does), and so getting this part out of its proper position. The shank is secured to the armature in the same way as it is to the hammer head. Wire of No. 11 or 12 B. W. G. may be used for the shaft. The exact length cannot be given, but must be found by measurement to ensure the head striking the bell in the most advantageous manner.

The Gong and its Pillar.—The bell itself is generally distinguished by the name of gong. Electric bell gongs are now a speciality, and are sold for this purpose nicely polished and plated with nickel, at prices ranging from 1s. 6d. to 7s. each, according to size. The pillar to support the bell may be made out of a 2½ to 3 in. length of ⅜ iron rod, turned at the ends, and screwed as shown at Fig. 18. If made thus, the bottom part may be screwed into the base and metal frame, or secured by a nut beneath the base as the contact pillar is fastened. The top part passes through a hole in the centre of the gong, and is then secured to it by an ornamental brass nut or head (Fig. 24).

The Relay.—This is an important part of a burglar alarum system, since it prevents the intended burglar from stopping the ringing of the bell by cutting the line wire or quickly closing the door. Without a relay the bell might be stopped, but when a relay is in circuit the bell will go on ringing, although all the main line wires are cut, until the local battery is switched off from the bell, and this can only be done close up to the bell itself. Several forms of relays are in use, some attached to the bell base itself and named automatic relays, others on separate bases apart from the bell. Fig. 21 shows a form of trigger employed on a relay attached to the bell base. It is made of brass, exact size and shape of sketch. A hole is drilled at A, and countersunk on both sides. This receives a cord to pull the trigger with when about to set it. Another hole is drilled at B to receive the set screw which attaches the trigger to its pillar, shown full size at Fig. 11. At C a small hole is drilled and countersunk on both sides, to hold the end of the spiral spring which pulls the trigger back when it is released from the catch on the armature. At D another small hole is drilled, and into this is fitted a bit of platinum wire to form contact with another piece of platinum on a contact pillar. I have not sketched this pillar, as it is similar in form to that shown at Fig. 23, only much shorter (⅝ in. from top to base), whilst the collars and nuts are also the same. Fig. 25 shows another form of trigger to be used on the base of a bell as a relay. Further details of this will be given in another paper, together with a sketch explaining its action. It is made of brass, shape and size of sketch, and is fitted at the small end with a steel pin, which engages with a catch soldered to the hammer shaft of the bell.

In my next paper I hope to show how to put the various parts together to form a bell, and also explain the action of the automatic relay employed on this class of electric bells.

Fig. 11.

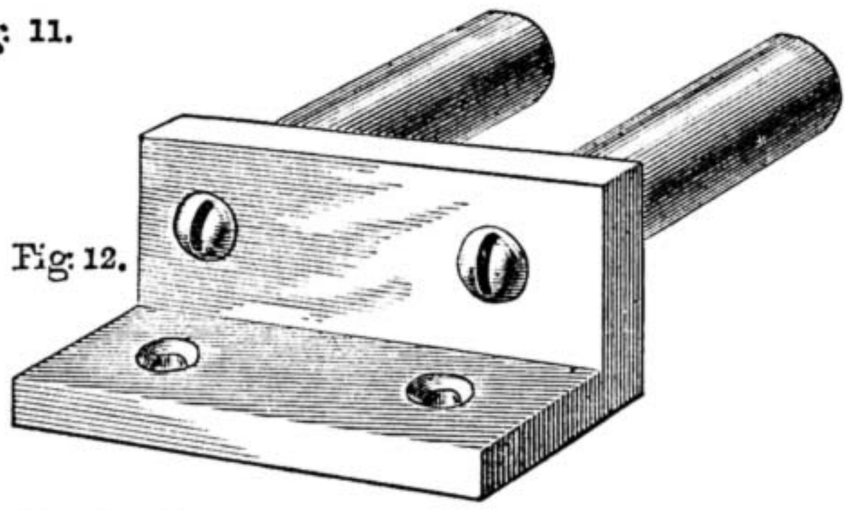


Fig. 12.

Fig. 13.

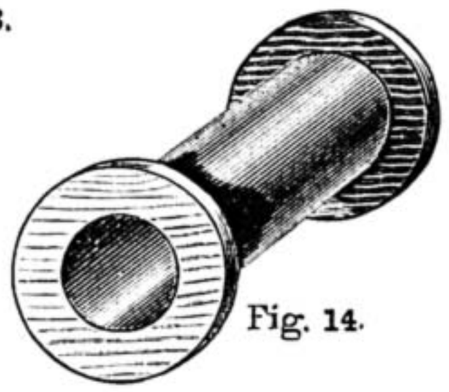


Fig. 14.

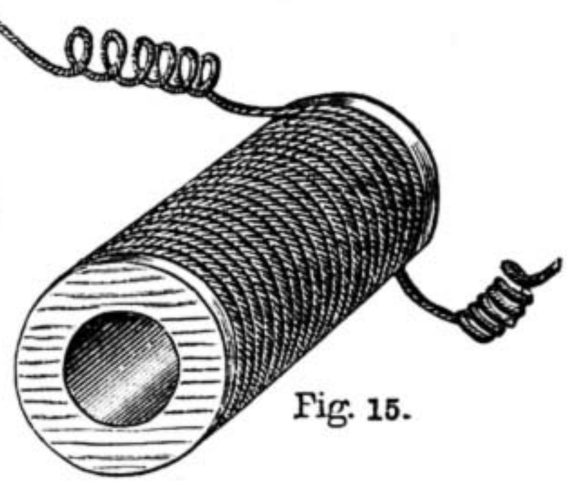


Fig. 15.

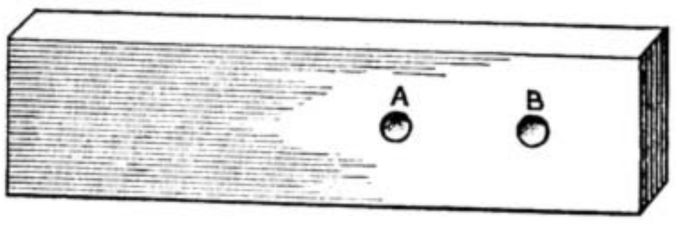


Fig. 16.

Fig. 17.

Fig. 18.

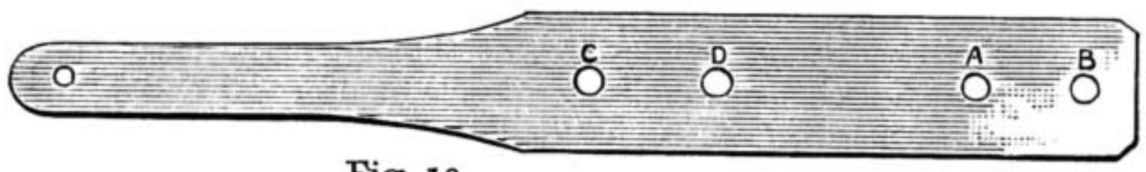


Fig. 19.

Fig. 20.

Fig. 21.

Fig. 22.

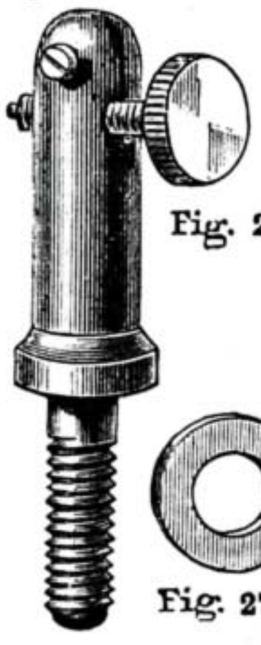


Fig. 23.

Fig. 24.

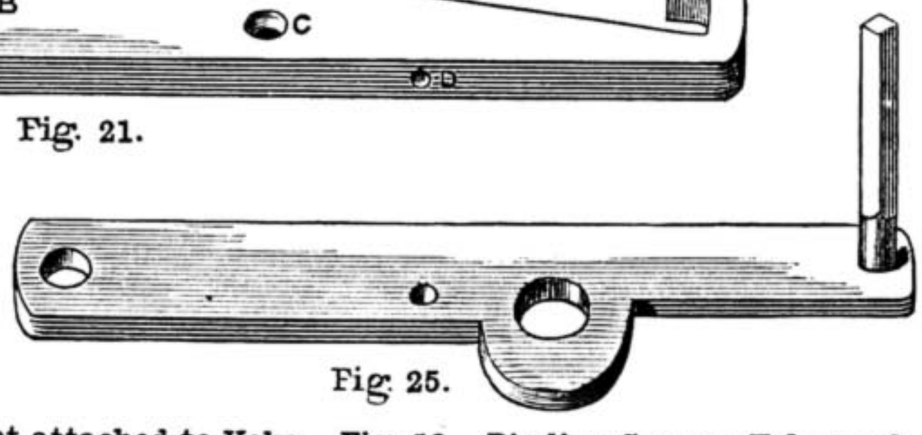


Fig. 25.

Fig. 26.

Fig. 27.

Fig. 11.—Pivot Pillar for Trigger. Fig. 12.—Magnet attached to Yoke. Fig. 13.—Binding Screw: Telegraph Form. Fig. 14.—Wood Bobbin for Electro-Magnet Core. Fig. 15.—Bobbin Wound with Silk-Covered Wire. Fig. 16.—Iron Armature. Fig. 17.—Armature, Spring Hammer, and Shaft Connected. Fig. 18.—Bell Pillar. Fig. 19.—Armature Spring. Fig. 20.—Brass Catch for Trigger of Relay. Fig. 21.—Trigger for Relay. Fig. 22.—Insulating Collar for Pillar. Fig. 23.—Contact or Break Pillar. Fig. 24.—Nut for Top of Bell Pillar. Fig. 25.—Another Form of Relay Trigger. Fig. 26.—Brass Nut. Fig. 27.—Brass Collar.

A FOLDING SCREEN IN EGYPTIAN TRELLIS WORK.

BY C. H. OZANNE.

THOUGH the screen illustrated is scarcely adapted for the usual purpose, that is, to shelter a portion of the room from draughts or observation, it forms a very striking piece of furniture in a drawing-room. To get the full benefit of it, it should be stretched across a large window, so that the light behind it shows up the pattern effectively. If it is desired, a very little trouble will make it useful as a screen. Serge or any

other material desired can be lightly tacked on one side, the colour in harmony with the rest of the furniture of the room.

The workmanship is simple and bold. As is seen in the sketch, it consists of three folds hinged together. Each fold is like the others, with the exception of the centre, which has a recess. This recess generally holds a water-bottle of porous clay, which, by the constant evaporation that goes on upon its surface, keeps the water within cool. As in England thirst is not the continual misery that it is in Oriental climes, a vase would naturally replace the water-jar.

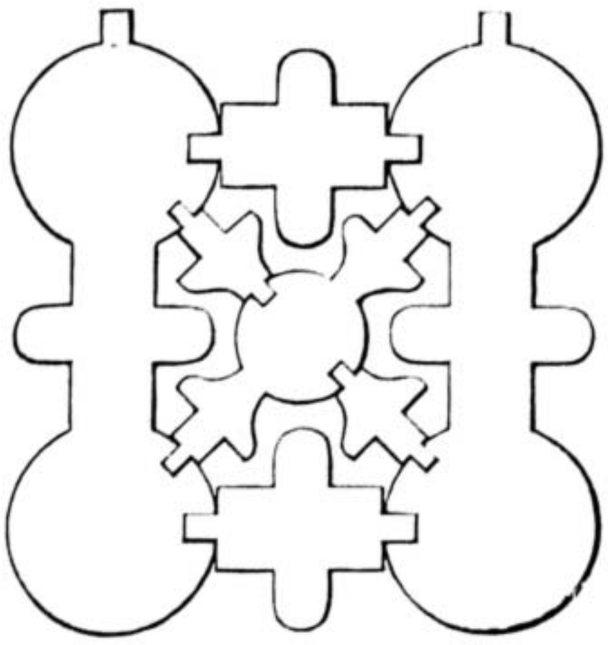


Fig. 1.

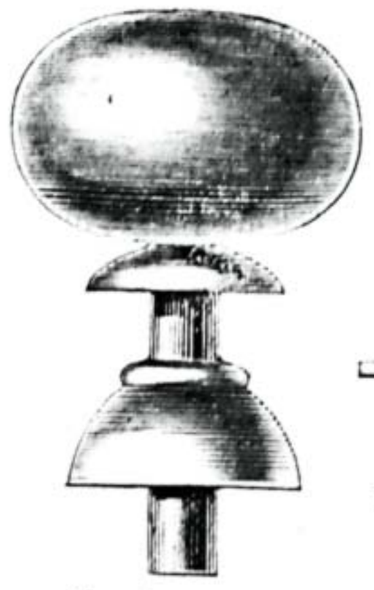


Fig. 2.

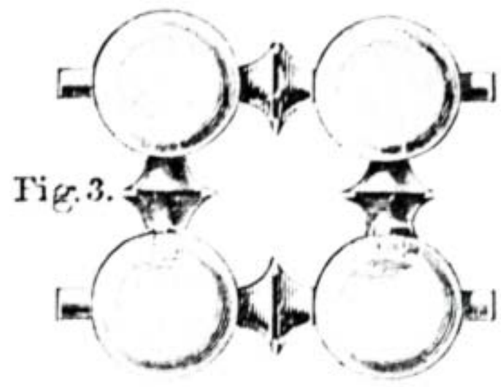


Fig. 3.

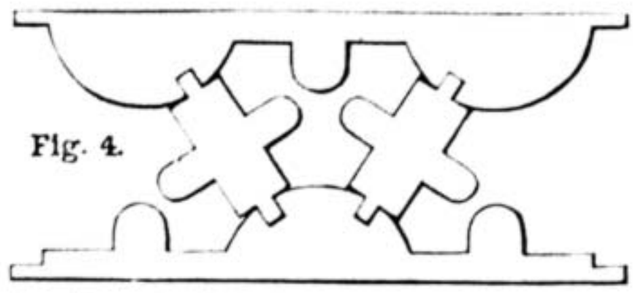


Fig. 4.

Fig. 1.—Details of Work in Lower Half of Body of Screen (half size). Fig. 2.—Knobs at Angles of Recess. Fig. 3.—Details of Work in Upper Half of Body of Screen (half size). Fig. 4.—Small Panels in Back of Recess.

The screen measures 5 ft. 4½ in. in height, and each fold 2 ft. 2 in. in width. I do not think it is necessary to give the dimensions of each panel, as they can be taken off the sketch, Fig. 5; and there is no necessity to keep to any special measurements, as the joinery of the screen is very elementary. Each fold consists of a framework 1¾ in. wide, and a little over 1 in. in thickness. The inner edges have a simple moulding run on them. Within these are the panels shown, made of frames mitred at the corners, and moulded slightly by way of ornament. A brace runs across the fold to strengthen it; it is of the same pattern as the frame of the panels. The general body of the screen is filled up with trellis work shown in Fig. 3, that is, the upper half; the lower half is of a rather coarser pattern, like Fig. 1, only that the intervals between the beads are plain cylindrical strips. The detail of the trellis work in the panels is shown in Fig. 6, in which is given the mode of joining it together. The solid bars on which the beads are turned can run horizontally or vertically across the pattern—the effect is different—and thus give variety to the completed screen. In putting together the trellis work, care should be taken to make the solid bars run the shortest way across any space, so as to give the greatest rigidity to the whole. The trellis is turned out of wood about ½ in. thick, so that the beads have flattened tops as shown in the sketch. It would be far too heavy if the beads were complete globes of the size given.

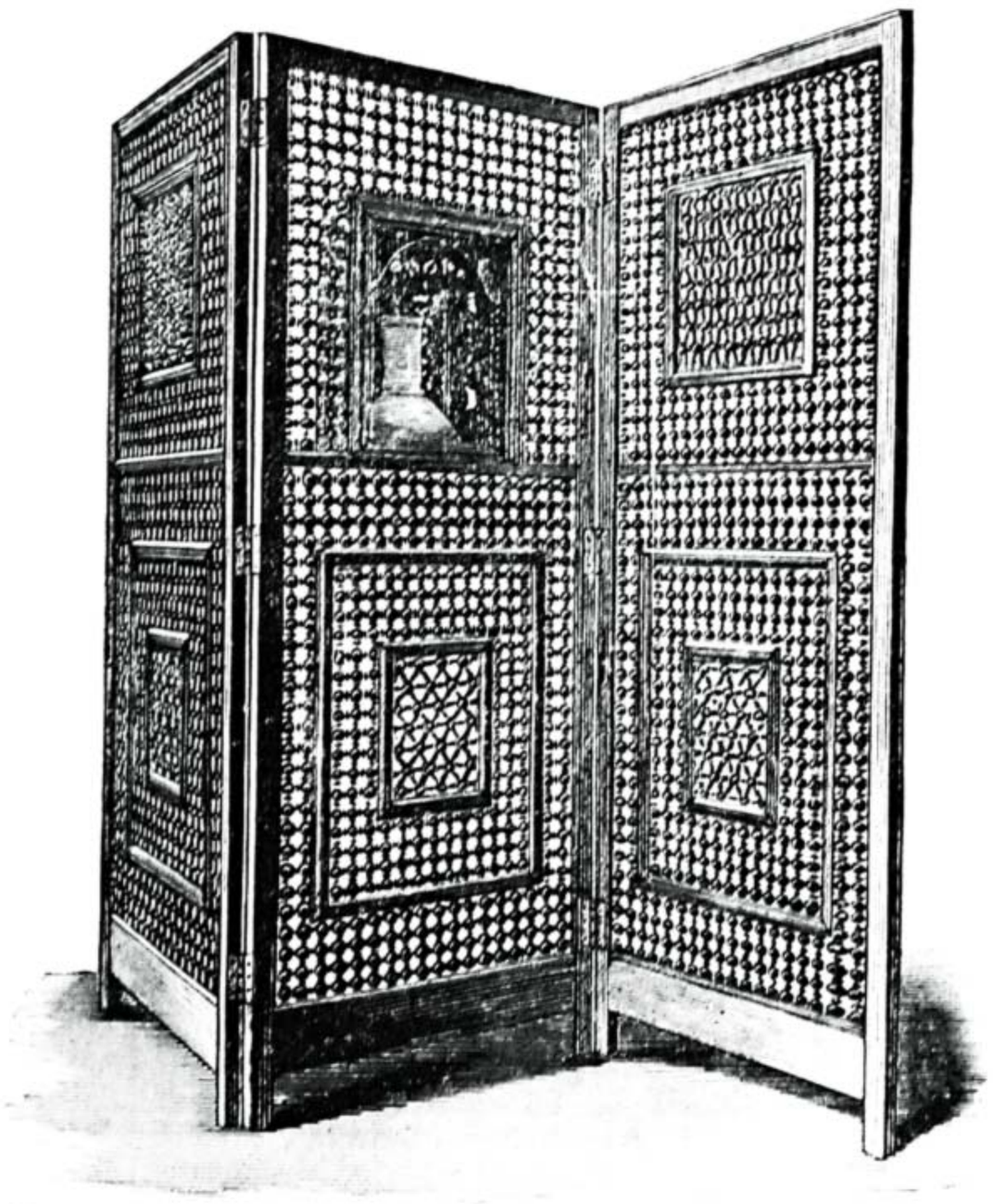


Fig. 5.—Perspective View of Folding Screen in Egyptian Trellis Work.

The panels are held in position simply by the solid bars of the trellis work inserted in the edges of the frames, and running to the framework of the screen in which the other end is inserted.

Before turning a bar into a strip of beads and intervals it should be marked off accurately, so that there may be the required number of beads and intervals. It is not necessary for the ends to be complete beads. Naturally all the bars must be alike.

The folds would each, of course, have to be built up from the centre, beginning with the panels, and finally framing all up in the outside framework, which is mortised together.

The small recess is formed of two pieces as in Fig. 7, which act as top and bottom. On this are fastened strips to form the sides. The length of these sides depends upon the size of the opening which forms the mouth of the recess. Each side is cut out, and panels are let in. In Fig. 1 is shown some of the trellis,

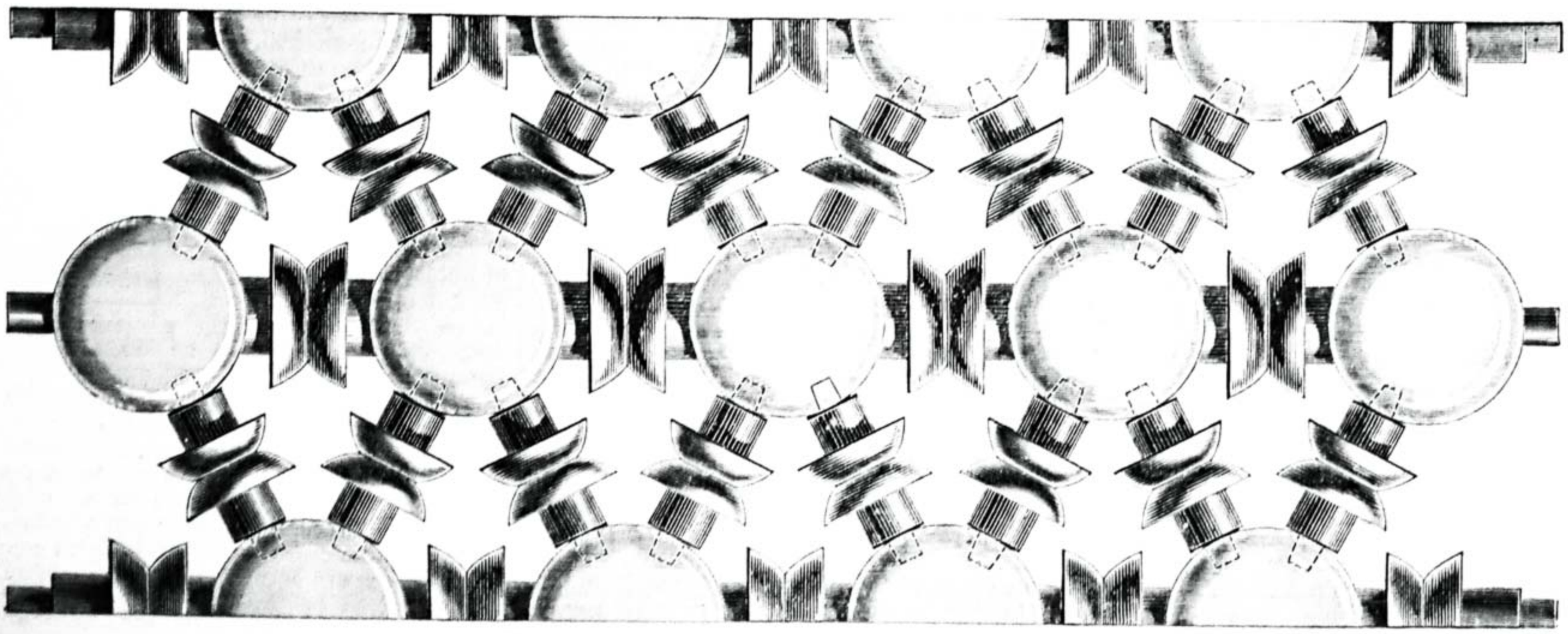


Fig. 6.—Details of Work in Panels of Screen (full size).

which fills in the centre part of the side; above and below are little panels filled in with Fig. 4. The rough sketch in Fig. 8 will explain.

This little cupboard is hung on at the back of the opening by hooks, as it must come off when the screen is folded. In front, the top is ornamented with a piece of wood cut into a dome shape, and on each side is a little turned pillar, and a third at the bottom. The top of the cupboard, as well as the bottom, is finished off by little knobs (Fig. 2) inserted at each angle.

The pattern of trellis work described is of the simplest. It can, of course, be made more ornamental, and more intricate, but in so large a piece of furniture any delicate work would be out of place, and, in the constant moving that it is necessarily subjected to, it would get chipped and shabby.

As for material, stained beech is generally used for the bead work and pine for the

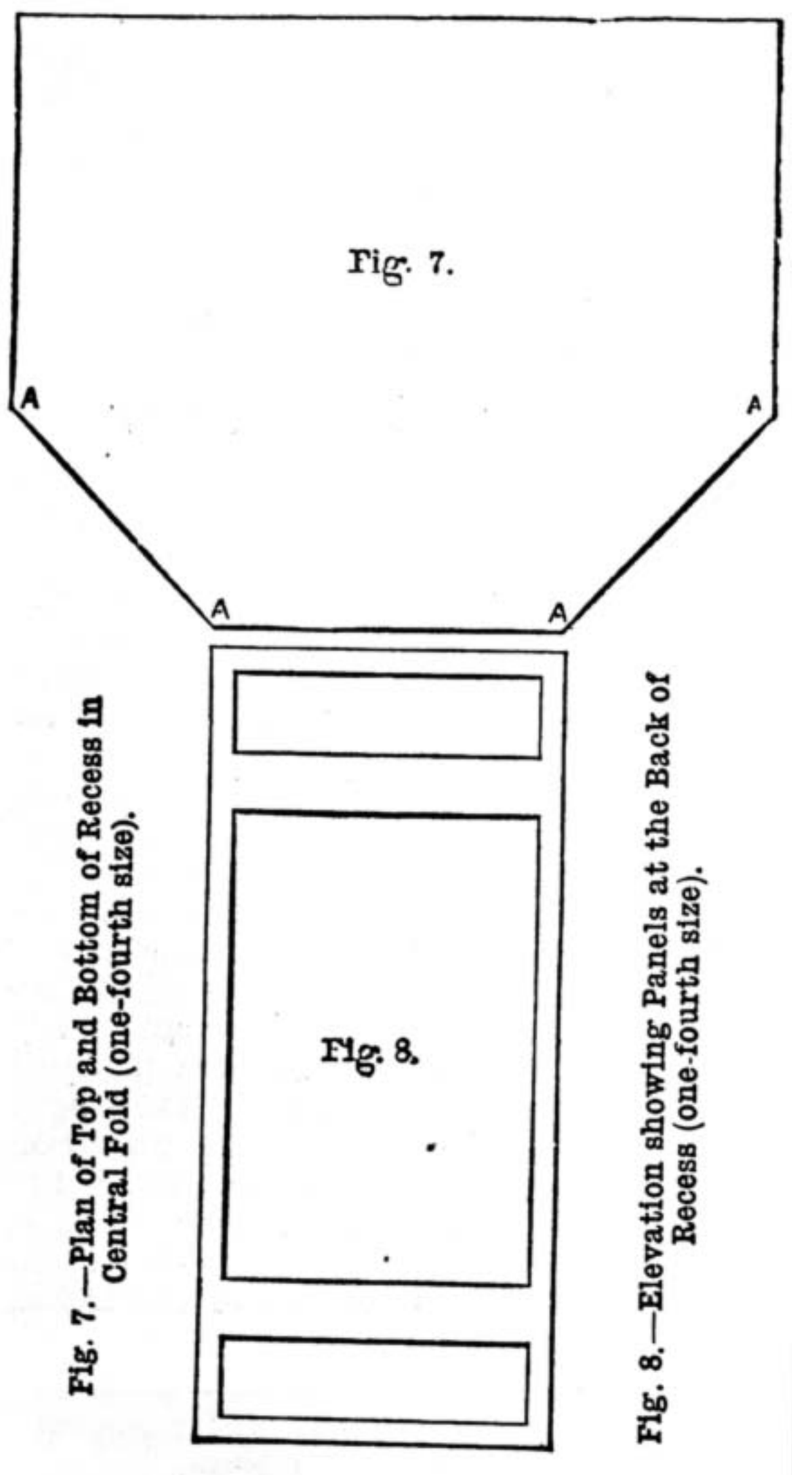


Fig. 7.

Fig. 8.

Fig. 7.—Plan of Top and Bottom of Recess in Central Fold (one-fourth size).

Fig. 8.—Elevation showing Panels at the Back of Recess (one-fourth size).

frames. Walnut would, of course, be more expensive, but would make a handsomer article.

It will be found necessary to dust the screen frequently, and, as the domestic duster will not reach the interstices of the trellis work, a tooth brush will be found convenient. If walnut is used, it can be polished with a paste of beeswax and turpentine, and can be kept bright with a stiff brush and the addition of a little of the paste occasionally.

This screen is much admired, and fills up the room conveniently, for it can be fitted into any unoccupied part, and when necessary folded up out of the way. It hides any great expanse of bare wall, without appearing to do so, for you can see through it; but, as a matter of fact, the eye is arrested by the pattern, and does not travel beyond the screen. It is not so high as to hide pictures hung at the ordinary height.

HINTS ON HOLLOW WORK IN SHEET METAL.

BY OPIFEX.

THE making of cups and other vessels, and the forming of hollow work of any kind, is a most useful and interesting branch of sheet metal working; the silversmith and the plumber are equally interested in it, and the irrepressible amateur, who is anxious and ready to attempt anything and everything, should know how it is done.

Suppose it is required to form a cup- or saucer-shaped article, *e.g.*, such a thing as the copper cup in an ordinary pair of scales, or the hemispheres which, joined together, form the ball of a cistern cock, there are three methods to choose from. 1st, the article may be stamped "at one fell swoop" by machinery, involving considerable power, and, therefore, much expense; 2nd, it may be "spun" in a lathe; and 3rd, you may do what you want with a hammer.

I take it for granted that the reader will elect the third and simplest method, which is also the most artistic.

The tools and appliances required are a hammer, a vice, and a round surfaced anvil, with shank; the hammer should be rather heavy, but at the same time small on the face, so that it will be capable of inflicting a "dead blow" of considerable force, which shall not, however, affect too much of the surface of the metal; a piece of round or octagonal $\frac{3}{4}$-in. steel about $2\frac{1}{2}$ in. long, made into a hammer by having the centre slightly flattened and bored for a light, strong handle, will be found to suit this work admirably (Fig. 1); or in the absence of a special tool, an upholsterer's hammer will be effective.

The round anvil belongs to a class of tool sometimes called "stakes," which are of various shapes and sizes according to the work for which they are intended.

Fig. 2 shows a mushroom-shaped tool, with nicks or grooves in the shank, by which the height of the tool may be regulated in the vice.

There are various other tools of the same character used by sheet metal workers, but this one will be sufficient for our present purpose, which is to show how a hemisphere of copper or brass may be formed by means of the hammer.

But, first, it may be well to add a word which may encourage some reader who may not be able to procure this "mushroom" stake by pointing out that it is not absolutely necessary, and at the risk of being the innocent cause of "raising a row" in some peaceful household, I would whisper in the ears of such a one, that a poker which possesses a fairly round, smooth, polished knob makes a capital substitute.

First cut out a disc of sheet copper, say five inches in diameter, and with the compass describe several concentric circles, marking the metal very slightly, as these circles are merely meant as guides in the process of hammering; now holding the disc in the left hand, and laying the centre of it upon the centre of the "stake," proceed to hammer it firmly and evenly in a circle round the centre, gradually working in larger circles in such a manner that every part of the metal is subjected to the action of the hammer.

The worker must bear in mind that he is not to endeavour to make the metal take the shape of the rounded tool which underlies his work, but that it only serves to resist the hammer blow at the point immediately beneath, or opposite to where the blow falls, the effect of which is to strike another blow, as it were, upon the other side, and thus cause the metal to stretch, or expand, at that point.

Thus working gradually outwards from the centre the metal will be found to assume a convex form upon the hammered surface, and the hammering being continued in the

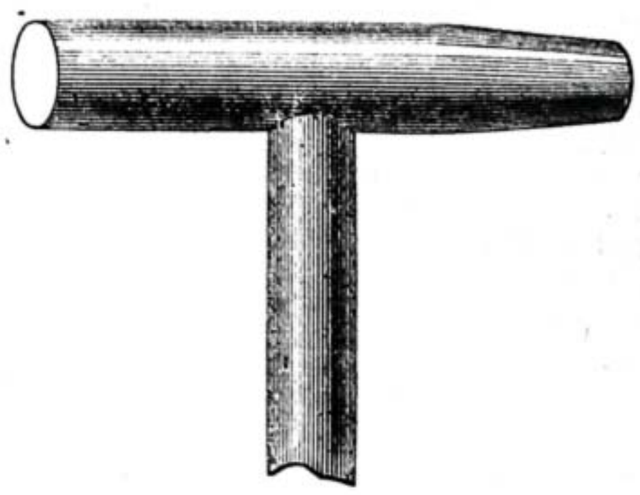


Fig. 1.—Anvil.

same way to the circumference, the result should be that the metal disc is transformed into a saucer shape nearly an inch deep at the centre; and if the direction, that the hammering be carried out in perfect circles from the centre, has been attended to, and if the force of the hammer blows has been fairly equal throughout, the work will be uniform in curve.

During the process of hammering the metal will have become hard, and, in order to restore its ductility, it should now be annealed. This is done in the case of brass or copper by heating the metal to a dull red over a clear fire, or with a blowpipe, etc., and then plunging in cold water.

The operation of hammering in circles from the centre is now repeated several times until the metal assumes the required shape; but the reader must not be disappointed if absolute success does not attend his first attempt. With a little practice, however, the work will be found comparatively easy, and most effectual in the forming of innumerable articles both useful and ornamental.

Surfaces raised in this way may be worked in repoussé and chased, the metal being first annealed.

Sheet brass, copper, etc., of considerable thickness may be worked by this method, and by employing anvils of different shapes, coupled with judicious hammering, it is surprising what the practised workman can produce.

The bowls and bases of goblets, ornamental cups, teapots, kettles, lamps, candlesticks, etc., etc., etc., are wrought in this way in the first instance, being afterwards chased and otherwise ornamented.

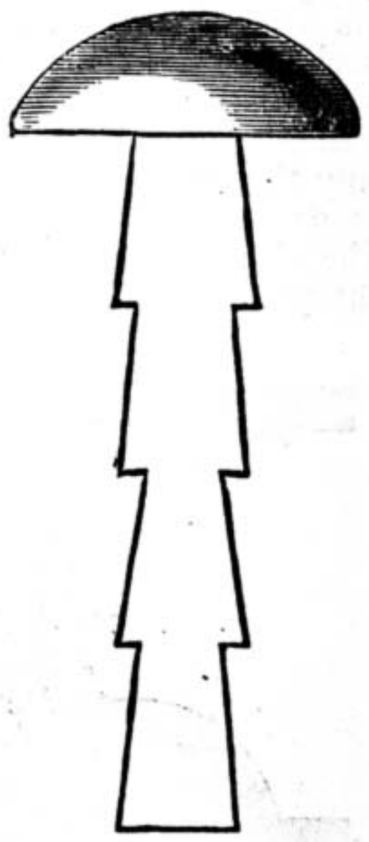


Fig. 2.—Mushroom Stake.

I have pointed out that there are other means of forming hollow work in sheet metal—namely, stamping and metal spinning in the lathe. I am in no way alluding to the manufacture of hollow balls in one piece, which are formed by the action of machinery, to be described at no distant time by another writer.

OUR GUIDE TO GOOD THINGS.

65.—Macnaughton's New Spring Ferret Muzzle.

The readers of Work, I am pleased to know, are to be found in all classes and grades of society, and the workmen who take "ours" may be somewhat surprised to learn that a great many country gentlemen, who naturally take considerable interest in field sports and outdoor amusements, are to be found among them. Even if direct and personal evidence in support of this were wanting, which it is not, there is yet indirect testimony to the fact in much that appears in the pages of the Magazine itself. Some little time ago, for example, our friend Opifex, who clearly indulges at times in a little congenial rabbiting, and perhaps ratting, mentioned in his "Tips for Tyros" (see page 90) a muzzle for ferrets which he had found to be very useful in the field. This catches the eye of Fal, another valued contributor and reader, who gives us his ideas and experience on the subject in page 189. And this metaphorically brings Mr. Macnaughton, gunmaker, Edinburgh, to his feet, and he sends me specimens of his New Spring Ferret Muzzle (Registered, No. 24326), which is made in four sizes, numbered 1, 2, 3, and 4, sold at a uniform price of 1s. each. Thus it is plainly shown how action and reaction, with regard to any particular subject, takes place; and how the thoughts and words of one elicit the views and opinions of another, confirming a remarkable assertion in Holy Writ: "Iron sharpeneth iron; so a man sharpeneth the countenance of his friend." Even in this way may we long continue to sharpen the countenances of one another by that which is set forth in the pages of Work.

The value of the ferret muzzles to which reference is made may be ascertained from the illustrations afforded of it in Figs. 1, 2, 3, in the first of which the muzzle itself is shown. This consists of a brass ring, concave in form on the outer side, and carrying in its concavity a spring bowed at the top, and carrying at each end a short iron spike, which enters through the brass in holes specially contrived to take them. In Fig. 3 is shown the method of pressing the spring and withdrawing the spikes when it is desired to pass the ring over the muzzle of a ferret; and in Fig 3, the muzzle when placed over the ferret's mouth. "To fix the muzzle," says the inventor, "hold the ferret round the shoulders with the left hand, compress the arch of the spring with the thumb of the right, slip the muzzle on wide side first, to suit the taper of the ferret's jaw; the muzzle should fit just over the tusks; when there, ease the spring and the pins will slide in behind the tusks. The spring muzzle cannot fall off if the suitable size be used, and the ferret's tusks are all right. A ferret unaccustomed to a metal muzzle, should have this put on once or twice for a short time before being hunted. A ferret, when systematically muzzled, will hunt a whole day; as without a muzzle, he spends his strength in worrying at sulky rabbits; with a muzzle he soon learns to bolt those rabbits that will bolt, and to leave the sulky ones, as he cannot lay hold."

Fig. 1.—Form of Ferret Muzzle.

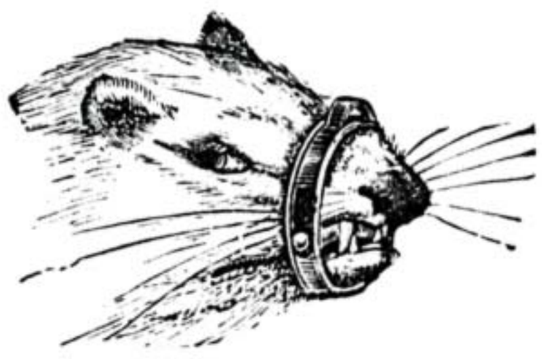


Fig. 2.—Muzzle Placed on Ferret.

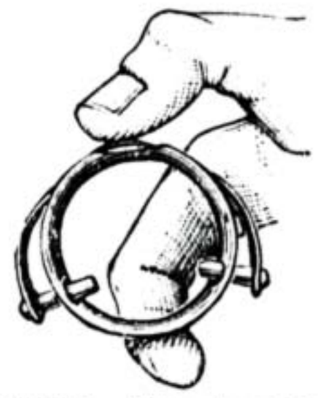


Fig 3.—Muzzle with Spikes Withdrawn.

66.—The Lingham Sash Fastener.

This excellent sash fastener is manufactured and supplied by its inventors, Messrs. Lingham Brothers, locksmiths, makers of fireproof safes, brass-founders, etc., 22, Great Hampton Street, Birmingham, its price being 12s. 9d. per dozen, net. It serves two purposes, for it not only affords a simple mechanical arrangement of easy action for fastening window sashes with perfect security, but it also prevents any unpleasant rattling of the sashes, which often occurs in stormy weather. On the outer sash is screwed the socket piece, shown in the upper part of Fig. 4, lettered A; and on the inner sash is attached the catch piece of the fastener, marked B. From the upper side of A rises a square socket, in which is inserted the square end of the barrel, also marked A in the illustration. The connection between barrel and socket is made by an iron pin, which passes through socket and end piece from side to side, and is securely riveted. This pin is not shown, as it should have been in the engraving. In the barrel is a helical spring of considerable strength, which acts on a disc formed on the inner end of a small spindle, square in form, which projects from the end of the barrel, and carries a winged finger-piece which abuts on a knob forming a termination to the spindle. From the plate on the inner sash rises a double catch, B, and when it is desired to secure the fastener, the object is attained by pressing the finger-piece down over the inclined surfaces of the catch. This causes the spring in the barrel to be compressed, and the square portion of the finger-piece slips under the notched portion of the catch, where it is securely held by the pressure of the helical spring against the disc of the finger-piece. The release of the fastener is accomplished in a moment, whenever necessary, by placing two fingers against the curved ends of the finger-piece and drawing it towards the operator, so as to compress the helical spring to a greater extent, the compression affecting the release. Below the square end-piece of the barrel is a movable plate, which is pressed upwards by a spring fastened to the inner surface of the socket-piece, A. This spring is necessarily hidden, and is not shown in Fig. 4, by reason of its position. This plate serves to retain the movable part of the fastener in a vertical position when thrown back. The Lingham Sash Fastener is well made in brass, with the exception of the pin, spindle, plate, and spring. It has a much better appearance than the ordinary sash fastener when placed in position on the sash, and as I have been enabled to test it practically by placing a specimen on one of my own windows, I can bear testimony to its utility and manifest superiority to the old-fashioned regulation spring catch which has held its own for many years.

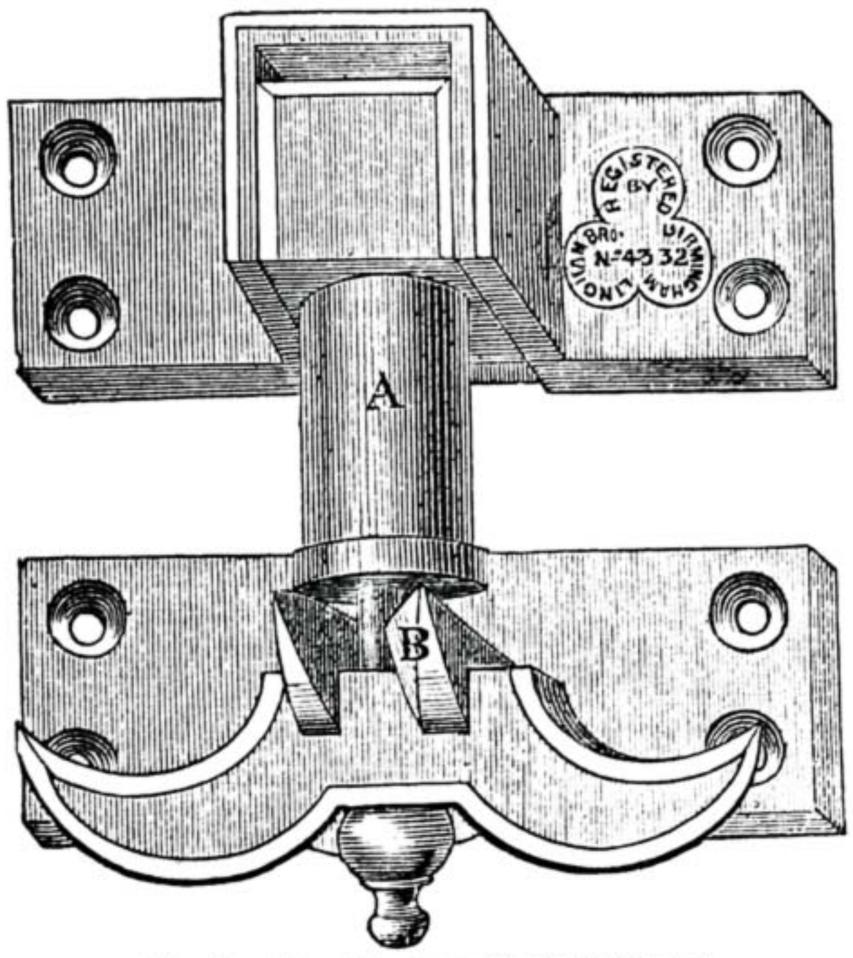


Fig. 4.—The Lingham Sash Fastener.

67.—Broadway's Patent "Eccentric" Casement or Fanlight Stay.

These casement or fanlight stays are also manufactured by Messrs. Lingham Brothers, Birmingham, and are supplied in two patterns, namely, that which is shown in Fig. 4; and another, in which at the end of the stay, a stud or button is substituted for the turned end which appears in the illustration. All the stays are 12 in. in length, without reckoning the knob at the end. Those with the knob are sold in brass, polished, at 27s. per dozen, net; and in brass, sanded, at 25s. 6d. per dozen. Those with the button are of iron bronzed, with brass fittings, and are sold at 13s. 6d. per dozen, or 9s., according to quality. All prices quoted are net. They can be made in any length. The stay itself is similar in form and arrangement to ordinary casement stays, with this difference, that the patent stay is solid throughout, while the ordinary stay is pierced with holes, to be passed over a peg rising from the plate, over which the stay is caused to move. Thus, it can only be secured at certain points in its length; but the "Eccentric" Stay can be secured at any point throughout its length, as it runs in a socket rising from the plate which carries the locking arrangement, and by which it can be fastened at any point at which it may be desired

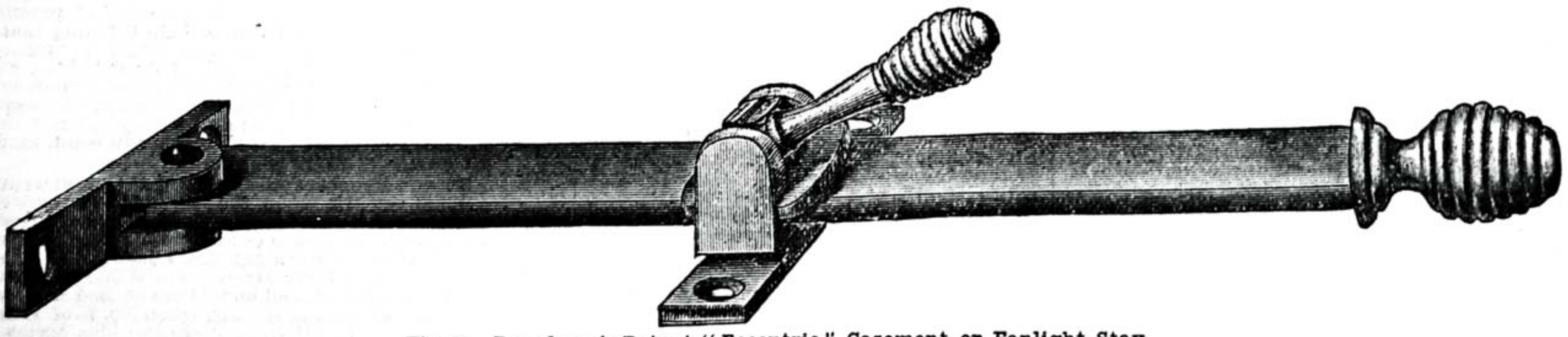


Fig. 5.—Broadway's Patent "Eccentric" Casement or Fanlight Stay.

to do so. The principle of the locking arrangement, shown in the centre of Fig. 5, is simply that of an eccentric or cam, actuated by the short handle that proceeds from it. Thus, supposing the stay to be fastened, it is only necessary to raise the handle, which liberates the plate resting on the stay, and sets free the stay itself. Again, to fasten the stay it is only necessary to press down the handle as shown in the illustration. This immediately locks the stay, making it quite secure. At the same time the eccentric acts as a fastener when the casement is closed, making it impossible to open it from the outside. Moreover, being perfectly tight all rattling of the casement is prevented, which occurs, more or less, with all stays in which pegs, screws, or springs form part of the construction. The advantages to be derived from the use of the Broadway's Patent "Eccentric" Stay are perfect security, extreme simplicity of action, and rapidity of adjustment. THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *All Communications will be acknowledged, but 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.

Circular Saw Rigs.—G. E. writes:—"In No. 11 (see page 172) I regret to see FOREMAN PATTERN MAKER'S failure to understand me, but will try to be more explicit. Respecting Fig. 1, very few amateurs are capable of making it as drawn, because it requires to be centred and boxed up in a collar plate, tapped between centres, faced, and the recess turned out to clear thread—therefore, superfluous work with small results. I must always take exception to cutting a thread in a saw spindle, because (according to the law of mechanics applied) the action (if possible) should always be between centres, and certainly possesses the advantage of being the simplest form. Again, if the spindle be made from cast brass to pattern, it will be too soft to be of much practical use. Bessemer steel is best. The fitting of chucks to a lathe is different in every respect (without exception); to cut and fit a chuck is one thing, but to screw a 6-inch brass spindle is another; and if you expect the same results, I am afraid you will be very disappointed. Wood turners mostly use wood, where possible, in all appliances for their lathe; but I must say (after thirty years' experience) I never knew of a piece of wood (hard or soft) that kept true for several years. Then what about the saw? The mandrel nose terminates at the face of collar fitting. Yes; then the amount of steadiness given to chuck depends on whether the face is true and ground flat, and how the mandrel fits in the collar. The table in T-rest socket is preferable because simple, easily fitted with angle metal fence, and fixed with bolt, nut, and slot; therefore adapted equally to amateur and professional. I must object to complicated appliances for amateurs, as productive of unfavourable impressions, rather than an incentive to work."

Small Cabinet Fittings.—C. C. (*Chippenham*) writes:—"On going for my magazines last month I chanced to see Part 1 of WORK, which I purchased, and was fairly astonished at the contents; it is, indeed, a splendid work, just what was wanted. That overmantel, by David Adamson, is a capital thing for amateurs, and those who couldn't see how to do it after reading the description should never touch a tool again, as they would never make much use of it. Could you inform me, through the medium of 'Shop,' the cheapest place to get small cabinet fittings? They must be produced very cheap somewhere. I have a list of Mr. Zilles, but if the makers of the small articles you see in fancy shops gave the price for their fittings that he charges, that alone would be more money than the article is sold at. As I think the greater part of amateurs are wood workers, I think a fair proportion of the contents should be devoted to that trade."—[For small cabinet fittings you may apply to Harger Bros., Settle, Yorkshire; Skinner & Co., East Dereham, Norfolk; G. Busschots, Park Lane, Liverpool; Fritz Collins, Bath; and others, who deal in these articles. R. Melhuish and Sons, Fetter Lane, London, E.C., have some, without doubt, although the fittings principally kept there are for full size furniture. The hinges and connecting hooks, etc., used by "the makers of the small articles you see in fancy shops," are the cheapest possible, and of necessity must be. They are sold in large quantities—at per gross, very likely. They would not suit you, and I strongly recommend you to use such fittings as are supplied by Mr. Zilles, for your own work, which I have no doubt as much surpasses the cheap wares of the shops as the fittings sold by Mr. Zilles excels the fittings that are put on them. There is a passion for cheapness in the air at the present day, I know, but there is something too often bracketed with cheapness which always hangs about very cheap goods, and of which they can never be purged.—ED.]

About WORK.—PRO BONO PUBLICO writes:—"Allow me a short space in what I am pleased to call 'ours,' to add my testimony to what I consider the value of such a well got-up paper for such a nominal sum, although the high compliments paid to you and your organised staff by previous correspondents leaves but little to be said by me. My opinion is this, were I to write a volume in praise of WORK it would not express my satisfaction with which I read each number. (1) Pray keep from technical terms, or, if used, use them sparingly and with an elucidation, as this is, in my opinion (and I speak from practical experience), a shoal whereon amateurs get metaphorically shipwrecked. (2) I would also, wherever practicable, like to see working drawings, when reduced, given as ¼ in. to the foot, leaving other fractional scales till an amateur has gained some experience with the rule, bevel square, etc. (3) I would, as an amateur worker having a number of hours each day at my disposal, and sitting amongst a multitude of different articles of my own make, like to give a little of my own experiences to others, whereby home may be made attractive and the pot-house kept in the distance (I am not teetotal), and if acceptable, a few designs of artistic articles, and also as many difficulties surmounted as you advise this week. Buy tools wherever you see them cheap. This course I have adopted for some years, and I am convinced the pawnbrokers' shops have a good stock, where, if an amateur is short of cash at the time, an article can be secured for a deposit, and got at some more convenient time. (4) Surely each amateur has amongst his acquaintances a friendly joiner or one meeting his requirements according to his hobby, and to him I would go for a few practical lessons, getting to know, above all, something of the fundamental principles of geometry, a few problems only being worth a gold-mine to an amateur."—[(1) WORK is for professionals as well as amateurs, and technical terms cannot be excluded. But why object to technical terms at all? After all they are the right terms, and terms that are recognised by the trades. Any term you do not understand can be explained to you in "Shop," if you will ask the question. (2) No object can be gained by bringing all working drawings to a scale of ¼ in. to a foot. There is nothing, or ought to be nothing, puzzling in the proportions for working drawings, but if you cannot understand them a paper shall be given in explanation. (3) You are always at liberty to communicate the results of your experience with designs, working drawings, etc., and papers on any subjects on approval. (4) By all means go to the "friendly joiner" for practical lessons in carpentry, but the "fundamental principles of geometry" will be best gathered from a text book, such as the "Lessons in Geometry" in the "Popular Educator."—ED.]

Overmantel with Cupboards.—KILDONAN writes:—"Having procured the glass and some narrow moulding, I found myself face to face with a difficulty—namely, how was I to secure the three glasses at the bottom, so that when the overmantel was lifted they would not slip out between the back and the moulding, and come to grief? This required a smoke. I offer my plan for what it is worth to any novice in a similar quandary. Ferreting out some pieces of sheet brass and an old file, I proceeded to shape six strips, each 1¼ in. by ½ in., and then to bend them at right angles ½ in. from the end, as in Fig. 1. The dimensions are probably

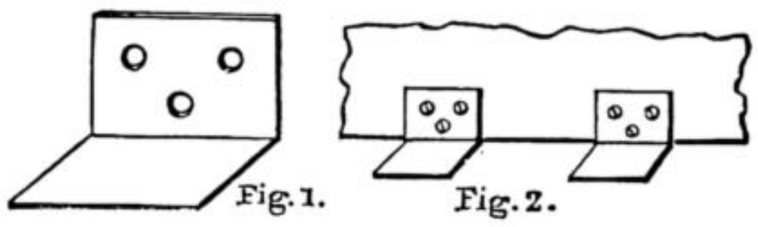


Fig. 1. Fig. 2.

Fig. 1.—Glass Support. Fig 2.—Method of Securing Glass Supports to Back.

a little larger. As they are not seen I was not particular about their appearance. Using two of these brackets to each sheet of glass, I screwed them to the inside of the bottom of the back, as in Fig. 2, with the sole projecting under the edge of the bottom moulding, in which I cut shallow grooves, so that the whole would be flush throughout its entire length, and thus allow the article to stand straight, and not on tiptoe. I borrowed a brace and countersinker to make the holes. I may say that I have as yet completely failed to gild the panels according to OPIFEX'S directions, and have consequently handed the panels over to a painter friend."

Weight of Fly-Wheel.—MR. F. CAMPIN writes:—"The formula from Molesworth for above $W=\frac{\cdot 6366\ P\ S\ C}{D}\left(\frac{N}{60}\right)$ is wrong (you quote it page 189). The weight varies *inversely*, as N, as shown in the remark—'A slow-running engine will require a greater reserve of energy than a fast-running one.' The fallacy of the above formula has previously been exposed in the *English Mechanic* and elsewhere. The theory of the fly-wheel is perfectly clear, and leads to the expression—

$W=\frac{10648\ E}{V\ d^2\ N^2}$—where W=weight of fly-wheel in cwts.

d =mean diameter of rim in feet.
N =number of revolutions per minute.
V =total variation in per cent. of mean speed.

As my name is on my article, I am sorry this error occurs over initials the same as mine—F. C.—as it might naturally be attributed to me."—[The initials F. C. were appended in error. The reply in question should have been signed J.—ED.]

Metal Ball Making.—B. W. R. (*Walkley*) writes:—"The balls mentioned by your correspondent, on page 172 of WORK, are not made as you suggest, by soldering two halves together, but in this wise: A piece of metal is cut round and put under a press called a 'fly,' and in the bottom is a hollow cup; in the fly nose is a punch. The metal is put over the cup or hollow, and forced down by the top punch, not all at once, as a set of dies or cup are used to bring it down gradually so as not to crack the metal. When got to semi-spherical shape, they are put in a furnace until red hot, or, as it is called, 'annealed.' When cold they are put into the cups, round parts uppermost, and instead of round punches cup punches are used, with small hole in centre to allow of air escaping, so as not to burst them, granitoid punches being used in doing them; they must be annealed two or three times, or cracked balls are usual. I make mine by using a machine with graduated grooves in its top and bottom table, allowing them to work in quite opposite directions by cross bands working from pulley on main shaft, the balls being half cupped first in the hand fly. Plenty of oil must be used in the machine so as to keep balls cool, or they would clog. If you would like one ball I will forward you a specimen, or you can see them in any silver plate show rooms as feet for frames, etc. They are made plain, fluted, and with a ridge round them, so that a bead can be turned on them, and in all sizes, from $\frac{1}{16}$ of an inch to 3 in. diameter."

A Rejoinder about WORK.—PHAETON (*Ipswich*) writes:—"In respect to the strictures so thoughtlessly (I had almost said ignorantly) expressed by J. P. A. on the various and most useful articles treated so ably in your, or, rather, our, valuable and most interesting weekly magazine, WORK, I am surprised to find a man so thoroughly practical as he represents himself to be calling a space devoted to so important a subject as 'Hinges, and how to Fix Them,' 'wasted.' Is it possible that any man practical at anything can be so shortsighted as to call those valuable hints and suggestions on that subject 'wasted?' Truly, I can scarcely credit it. I, sir, am engaged in carriage building, and have had considerable and long practised experience in the different forms and methods of fixing hinges; and yet I feel bound to offer my most grateful thanks to Mr. David Adamson for valuable information I have imbibed from his able pen; and I would ask, does J. P. A. really understand the full meaning of the word 'trifles?' I cannot think he does, or he would not so distort the real name that belongs to any act that has for its object the benefit, improvement, or pleasure of his fellow-men; and judging him by the 'spirit' of his remarks, am inclined to consider him one of those individuals whom we are told 'rush in where angels fear to tread.' Although a coachmaker, and in respect to which trade I have not yet seen any reference (excepting Mr. Adamson's too brief notices in his article on hinges), I am bound to say that I not only feel some impatience for the appearance of WORK from week to week, but I read and thoroughly enjoy every article treated therein, and then take a good look through the advertisements, as a likely means of 'dropping' upon something, either necessary or desirable of possession. If J. P. A. possesses a sawing machine of such unrivalled merits, surely he could tell us about it without this tirade of objections; and his wonderful saw must lack lustre indeed, if to make it shine visible at all necessitates the total extinguishing of every other object of note or importance. It is just possible, sir, that if you could arrange the sale of a few of J. P. A.'s Elizabethan twists for him, it might tend to remove somewhat of the jaundice with which he seems to view the wants and necessities of his more grateful and appreciative fellows; and in respect of the prophesied exodus of practical men as subscribers, I cannot help thinking that it is only such as J. P. A. who would be 'missed,' but not 'wanted.' Personally I am delighted with WORK, of which I take and dispose of a dozen or so every week; and I offer my humble, but warm, thanks to all concerned; and if I can at any time be useful in 'Shop' to any brother in want, kindly do me the favour to apply to me."

Screen Secretary.—C. H. O. (*Alderney*) writes:—"You remark upon the resemblance between Mr. Adamson's screen secretary and Mr. Gleeson-White's cheval screen escritoire. I was also struck by it, as not a fortnight ago I had just finished a secretary similar to Mr. Gleeson-White's. Yesterday I met a friend, and he told me he had also just designed something similar, when No. 13 of WORK was issued. In all these cases the idea seems to have occurred simultaneously to different people. My secretary is of a portable character, and not of the ornamental style of Mr. Gleeson-White's handsome design. That gentleman says he is doubtful whether the projections in Fig. 3 would not be needful. I took off mine, which are almost exactly the same as his, and are fastened on by a keyhole and screw arrangement, and I found that the secretary rocked very much. My base is 1 foot deep without the projections. I have the projections only under the writing flap, and about 3 in. on the other side. This is sufficient. The height of mine is 4 ft. 5 in., and it is 2 ft. 6 in. across."

Boot and Shoe Making.—BOOTS AND SHOES (*Farnworth*) writes:—"I would be pleased to know if you intend to give papers in WORK on

boot and shoe making and repairing, with all particulars as to the tools required, etc., with drawings, as I am sure many fathers with large families would gladly welcome such a subject. In the meantime will you please give me the names of the tools required for finishing a pair of old boots, after being resoled, so as to make them look well? I have a little knowledge how to repair, but that's all. I may state I am very well pleased with WORK, as it is just the thing I've wanted a long time, and I hope you will have great success with it."—[At present I cannot promise the papers you ask for, because there is so much in hand which must be dealt with first. I have given publicity to your question about repairing by inserting your letter, and possibly some reader of WORK will reply to it.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Particulars for Intending Frame Makers.—W. L. (*Wigan*).—(1) Best shops for tools that I know of, and are generally acknowledged for good tools, are—Buck's, Whitechapel; Tyzack's, next Shoreditch Station, L. and N. W. Railway. (2) We do not in trade use any cramp; we use cutting blocks, stinting block and plane, and vice and hammer. (3) No books that I have heard of give any practical hints or information of any value to trade. (4) There was a trade paper recently started. I do not know if it is now in vogue, but it gave no simple information, as it was a trade paper, and naturally assumed its position amongst practical men who had served their apprenticeship.—G. R.

Spiral Springs.—VULCAN (*Wakefield*).—Here is one method. Mix of sperm oil, 1 gall.; melted suet, 1 lb.; neatsfoot oil, 1 gill; resin, ¼ lb., and smear the spring all over. Place the spring—if a long one—on a mandrel and hold it inside a red-hot pipe until the composition burns uniformly all over and with a blaze, when it must be quenched in oil. An even blue temper is required. If any part blazes before another, it must be cooled with grease and blazed afresh. Thick springs require repeated applications and blazing. A few trials will give the necessary confidence.—OLLA PODRIDA.

Annealing Cast Steel.—B. P.—Heat the steel to a low red heat and bury in quicklime until cool. Another method is to pack the steel in an iron box filled with lime or whiting and covered tightly with clay; then heat the whole to a red heat and allow it and the fire to die out until cool. By either method the steel should be soft enough for any purpose.—OLLA PODRIDA.

Small Fan.—DA CAPO (*Grosvenor Park*).—One about 3 in. in diameter would suit you, running at about 1,000 revolutions per minute. Any handy tinman could make you one. The body of fan should consist of a disc of tin with four blades or vanes soldered on each side, the whole soldered to a brass spindle and cased in a tin box, the bearings for spindle soldered to sides of case. Spindle to carry a small grooved pulley at one end for gut or leather band. If you require a sketch, please say so, and I will try and furnish you. It will save talk, and I am rather overweighted with work at present.—OLLA PODRIDA.

Circular Saws.—A READER.—I gave the power with working margin for hard wood and heavy work. This would be the practical way to meet light work of any description under. I regret that I have no data by me with which I can meet the theoretical expenditure of power, and I doubt very much if such can be obtained in reliable form dealing with different gauges.—OLLA PODRIDA.

Injector for Small Engine.—P. A. (*Girvan*).—To make a small injector of the size you want is not so difficult as the getting of it to work satisfactorily is. The writer regrets that pressure has prevented him replying earlier, and also getting a design prepared to meet your case, but hopes to forward a sketch in a few days.—OLLA PODRIDA.

Fret Saw for Small Lathe.—E. A. P. (*Co. Carlow*).—Your idea for fret saw is all right, except that the motion slot should be in *lower* arm, so that the saw blade may be held in tension both ways. As made by you, the saws have no chance but to break directly a cut is made. Raise the table and shift the driving point, and the saws will stand with fair play.—OLLA PODRIDA.

Valve Gear.—E. C. M. (*Ipswich*).—Your drawings duly to hand, but I have not seen the copy of *English Mechanic* referred to, and this is necessary for complete reference. The design is very ingenious; but there are several gears in the field already so closely resembling yours. In the face of this, therefore, I would not advise you to risk money upon it. When I see the *English Mechanic* I may be able to give you further opinion.—OLLA PODRIDA.

Lettering Watch Dials.—W. F. B. (*New Wandsworth*).—I am sorry to say I know nothing of the subject, and cannot refer you to any one, unless the editor of the *Horological Journal*, Northampton Square, Clerkenwell; he could, perhaps, through his paper. I will send the query to him if you like; but that is a monthly, and published on the first, so I should have to wait a month.—A. B. C.

Lithographic.—P. BROUGH (*Glasgow*).—The paper for lithographic writing is a good printing paper—not too stout—brushed over with a preparation which may vary with the fancy or requirement of the operator; ordinary flour paste, or even starch, tinted with dark chrome, may be mentioned as simple formulæ; and there are more complicated recipes, numbering isinglass and plaster of Paris among their ingredients. The coated paper is then finished by rolling between metal plates or by being pulled through the litho press over a clean and dry stone to obtain a smooth surface. I would scarcely advise you, however, to take all this trouble. The paper may be obtained ready prepared of any lithographic sundriesman. Cornellissen, 22, Great Queen Street, London, W.C., or Winstone, Shoe Lane, London, E.C., would doubtless supply you. The price is about from 3s. per quire demy. Writing on stone for printing purposes is, of course, done backwards; an exceedingly minute sable brush is the tool employed, and a large amount of practice is necessary before the tyro can command this tool sufficiently to produce legible work; but application and perseverance in this process, as in all others, will work wonders.—J. H. M.

Advertisement Pages in WORK.—R. T. (*Bolton*).—You should write to the publishers, and not to the editor, of a magazine with respect to wrappers for weekly numbers, the numbering of advertisement pages, etc. The editor's business does not include any of these matters. It is no use writing to the captain of a ship about the manner in which she is fitted up and the provisions that are put on board for the crew and passengers; but if you have any cause of complaint, you must write to the owners. Nor is it a step in the right direction to take the driver of a coach to task if you do not exactly approve of the team he drives. Men think differently about different things, and an article which one does not like may be highly approved of by another. I can assure you that advertisements are not put in for the sake of filling up the paper; their mission is a far higher one than this. It is true that this is an advertising age, or, as you aptly put it, "the public can get such information by the ton." True, the public could, if it bought serial publications by the ton. It does do so, in point of fact, collectively, but as the public is an aggregation of units, each unit gets just a small share of information about the things that are selling and offered for sale from year to year and all the year round, by the two or three serials and papers, more or less, that he may happen to purchase; and so individually the public only gets such information by the ounce. You continue—"Excuse me, I have no intention of hurting your feelings, though I have seen it doubted whether editors had any." It is very good of you to say this; but say what you will, you will never hurt *my* feelings, for, editorially speaking, I have not got any. Ah! you wind up your letter by saying—"Believe me a hearty well-wisher for the success of your paper." Well, that is just the termination I like to find to all letters—a burst of sunshine after a little wind and storm. *Pax vobiscum.*

Buckram for Bookbinding.—J. H. B. (*Pendleton*).—The buckram enclosed is quite a distinct material. When I tell you I had to tear one slip of white cardboard to find out if it were buckram, you will understand what it should be in appearance—fine, thick, and white, pasting perfectly. The parchment is rather thin, and not so glossy and ivory-like on surface as it should be. The covers should certainly be folded before the material is pasted on, and the pasting done in the final position they are to occupy, even if they are opened flat to press afterwards.—E. B. S.

Wood Colouring.—OX GALL.—One of the simplest methods of staining deal and obtaining the dull polish seen on very dark oak is to stain it first, and then varnish with flatting varnish. The way to proceed is as follows:—First see that your work is entirely free from glue, grease, or rough places, and then twice stain with dark oak stain (Stephens', for instance), softening the work down between each coat with a soft brush, called a badger, before the stain dries, which will take out all marks, etc., left by brush in staining, particular notice being taken that this is done very thoroughly and expeditiously, as any touching up is almost sure to show. When the stain is properly dry, rub it down with a piece of canvas, not glass-paper, as the latter is very liable to leave white marks, and the canvas can be got more easily into the members of columns, mouldings, etc. (The less glass-paper is used in all stained work, even in preparing, the better, and in no case paper across the grain, as it is sure to show.) Then twice size with best clear size, rubbing down between each coat as explained for staining. If the work is now varnished with good flatting varnish, and when hard rubbed with a soft rag or piece of silk, it will be found that the surface has a nice dull gloss. A cheap substitute for dark oak stain can be obtained by thinning down good Brunswick black to the shade required with turpentine; but unless one thoroughly knows the nature of these materials, this plan had better not be adopted.—E. D.

Stretching and Priming Canvas.—WAITING.—Canvas, like other fabrics, is best stretched by first tacking loosely all round the stretcher, then tacking firmly at one corner, tightening across (diagonally) to the opposite corner, and then treating the two other corners in the same way; lastly, by pulling level and tacking the intermediate spaces. A pair of pincers with flat tips 2 or 3 in. broad is used for stretching canvas. A bought canvas will show how the wedges are adjusted at the corners of the stretcher for further tightening after tacking down. Calico for tempera or other rough painting may be strained by tacking laths to its top and bottom, hanging it against a wall, sizing it, and, whilst it is wet, by hanging weights to the bottom lath. This will pull the cloth taut, and the size will keep it so. Bought canvas appears to be sized and heavily coated with paint, which is scraped smoothly off by some apparatus which, acting like a huge palette knife, sweeps its entire width. This could scarcely be imitated at home. WAITING is advised, after sizing, to give his canvas a not very free coat of paint, to level this with a broad, flat camel-hair varnishing brush. When dry, to give a second coat of white paint warmed with a tint of burnt sienna or light red, and smooth as before. Then after laying in his sky (from his remarks it is concluded that he paints landscape), to stipple it with a badger-hair brush. Indeed, the granulated surface produced by this latter process is always pleasant for painting upon; the better canvas that one buys has a tooth given to it by mixing finely ground rottenstone or Bath brick in the priming colour.—S. W.

Fret-cutting Machine.—A READER.—A capable and competent writer on the staff of WORK has been commissioned to write on this subject.

Lathes and Turning Appliances.—A READER (*Huddersfield*).—You will have noticed that this subject has been brought to a close. You must remember, however, that although "lathe work is the first thing an apprentice is put to in the engineering line," he is certainly not put to it first, if at all, in other trades, to which the majority of the readers of WORK belong. Plans and specifications will appear in due time.

Mists in Painting.—The art of painting mists is by what artists call "scumbling"—that is, taking a brush filled with colour, and rubbing thinly over any part that has been distinctly painted up, which must partially appear through. It can be done with any colour mixed with white according to the local colour of the mists.—J. A. F.

Preparing and Mounting Photographic Views.—G. A. C. (*Nunhead.*)—It is imperative that a lantern transparency should possess qualities that are peculiar to itself, and unnecessary in any other kind of transparency. They must have absolutely clear glass in the high lights, be thin, and have a good colour. In your case, the prints had better be placed in optical contact with glass. This is done in the following manner:—A piece of thin patent plate glass, rather larger than the print, and free from defects—scratches, stria, etc.—is selected. The print is placed in clean cold water for a few minutes; the glass is also put in the water, the print being adjusted face down on the glass, the glass and one edge of the print being grasped; both are slowly lifted out of the water together; this is in order to avoid air bubbles, which would produce imperfections on the transparency, being imprisoned between the glass and print. A squeegee is then lightly passed over the back to get rid of much of the moisture, and to press the print into close contact with the glass. Now carefully examine it, and if there are any air-bubbles not easily pressed out, repeat the process until the print shows a perfectly bright and even surface. Now place three or four folds of white paper, also wet, at the back of the print, and, with another piece of glass of the same size laid over, press together, and carefully wipe the front glass dry and clean; the advantage of this proceeding is that the print is kept uniformly moist during the time occupied in copying, and can be easily removed and dried afterwards. Now set the prepared print as sandwiched between the glasses upright against a board, to which it can be attached by a tack or two to keep it from falling forward, and photograph it in a strong side light, taking care there are no reflections to interfere with the definition. The exposure must be carefully timed, rather under than over, and the development conducted as much in the dark as possible. The high light must be perfectly clean glass; any deposit on them will spoil it for lantern work. A development made with one of the fixed alkalies is preferable to ammonia; the following is a very good one:—Solution A—pyrogallic acid, 3 gr.; sulphate of soda, 12 gr.; bromide of potassium, 6 gr.; water, 1 oz. Solution B—carbonate of potash, 20 gr.; water, 1 oz. Use equal parts of the two solutions, and fix in a bath of hypo, one to five, freshly made, to which about 10 per cent. of sulphate of iron has been added. Wash well, and then place the transparency in a bath of alum and citric acid. Wash again well for a few hours, and dry: the slide is now ready for mounting. A number of masks of different shapes being at hand, choose the most suitable, lay it on the transparency film side, and cover with a piece of thin clear glass; bind them together with gummed paper. Write on the title, and place two white spots on the top front edge as a guide to placing it in the lantern for exhibition, and the slide is complete. After development we have a negative from which any number of lantern slides may be made. To do so, we carefully place the negative in contact with a sensitive plate (plates are specially made for this purpose), in an ordinary pressure frame, and expose to weak diffused daylight, or a gas burner, according to the sensitiveness of the plate used, and which vary greatly. A slow plate is to be preferred, giving a finer image than a rapid one. The size of the slide must not exceed 3¼ in. square. Masks and gummed paper may be purchased at photographic warehouses.—D.

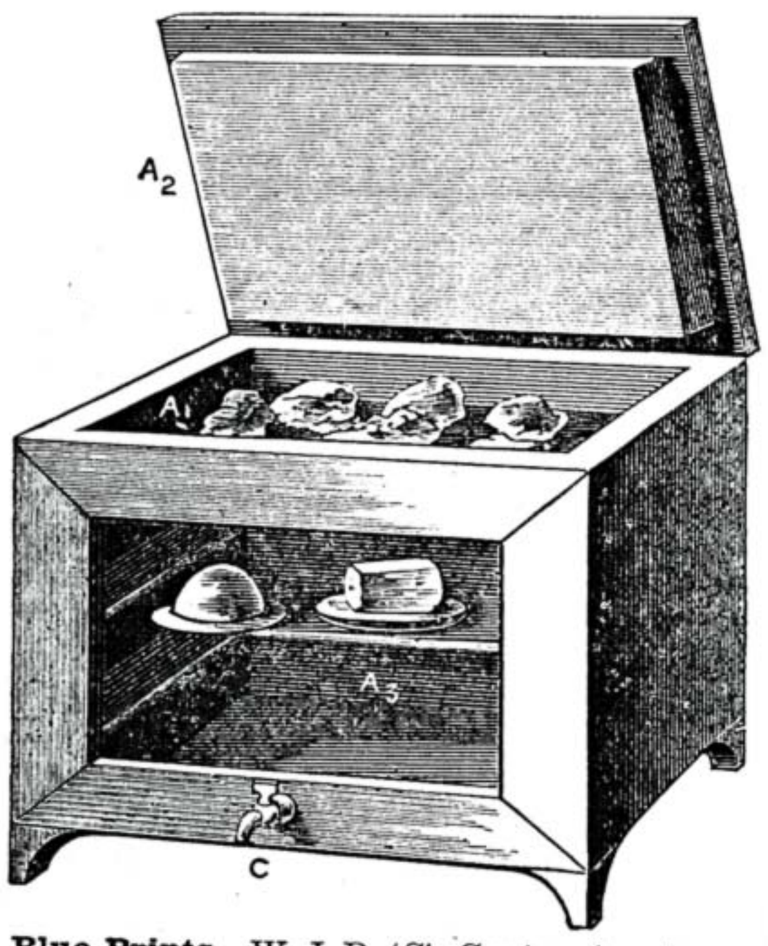
Erratum.—MR. G. E. BONNEY wishes to call attention to an error in page 70, col. 1, in which read "mindererus" for "minderus."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Joiners' Composition.—W. M. (*Market Drayton*) writes in reply to F. B. (*Guernsey*) (see page 158):—"The composition is made of beeswax and resin mixed with colour to match whatever your work may be; it can be melted in an iron spoon, and poured into the defects while hot; it sets directly, and when sandpapered down could not be detected. I have enclosed you a specimen. This is mixed with venetian red; it is a little darker than the wood, so that you might see the way it is done."

Making a Xylophone.—ELECTRON writes in answer to CORRESPONDENT (see page 206, No. 13):—"The xylophone is made of pieces of wood about 1 in. square, the upper side of which is rounded; a hole is bored near each end, through which cords are passed, and knots made to keep the pieces apart—pine may be used, but rosewood is considered better; when played they are laid on two straw ropes and struck with small wood hammers; the compass is from twenty-eight to thirty-six notes; the length may be from 1 foot; they are tuned by cutting the pieces shorter."

Refrigerator.—J. M. (*Newhaven*) writes in reply to URGENT (see page 174):—"As you wish to know how to make a refrigerator, I send a sketch of an American one. The drawing is as plain as I am able to make it, as I never learnt that art. A 1 is a zinc tray to hold the lumps of ice; A 2, lid, is zinc lined; A 3, interior lined entirely with zinc, with small pipe at back from tray above, to let the water trickle down the back and run out by the tap. The door when put on also lined with zinc. The top tray slightly deepening to the back, and bottom one deepening to front to the tap. The dimensions as regards width, depth, and length can be of any size, according to the wants of URGENT."



Blue Prints.—W. J. R. (*St. Germans*) writes:—"May I be allowed to supplement Mr. Poole's excellent article on 'Cyanotypes' (see page 194), which appeared in No. 13, by stating one or two simple methods of improving the colour of these blue prints? To produce a green tone, immerse in sulphuric acid, 1 dram, water, 16 oz. Brown tones may be obtained by immersing the prints in water, in which about 10 gr. to the ounce of caustic soda or potash has been dissolved, then washed and transferred to a 6-gr. solution of tannin. A sepia tone may be produced by taking the print, when arrived at the stage last indicated, and immersing in a bath of plain soda and water, taking care not to let it act too long. The original blue colour may be intensified by immersing in sulphuric acid, 1 oz.; saturated solution of protosulphate of iron, 1 oz.; water, 1 oz."

Saws Running out of Truth.—ALPHA (*Grangemouth*) writes in reply to A. R. (*Scorrier*) (see page 204):—"I have read A. R.'s (*Scorrier*) remarks in your issue of date about saws running out of truth, and hope to derive some benefit from same. Would he kindly say the gauge of a swedge saw at centre and point he would consider most suitable to cut three boards $\frac{6}{8}$ in., and one board $\frac{7}{8}$ in. out of a 7×3 deal. The boards to stand that thickness after being dressed into lining."

Joiners' Composition, or Beaumontague.—H. M. B. (*Edinburgh*) writes in reply to F. B. (*Guernsey*) (see page 158):—"Required beeswax, resin, colour. For mahogany, mix yellow ochre and Spanish brown; for ash and light oak, ochre and chalk; for walnut and dark oak, brown umber and chalk. Rub the colours very fine, and use common sense in mixing them and the various materials together. Melt the wax in a large spoon, add the colour till pretty thick, add a small quantity of ground resin, just enough to harden the wax. When partly cold roll it between the palms so as to form a stick handy for the pocket. To use it light a match, or heat a small poker, and melt it, dropping some on the defect, then with wet finger point press it home, and in a minute or so the surplus will sandpaper off."

IMPORTANT PRIZE COMPETITION.

THE Editor of WORK has the pleasure of informing his readers that Messrs. CASSELL & COMPANY, LIMITED, have placed at his disposal the sum of

THREE GUINEAS,

to be distributed in Prizes for Competition for Designs for a small Bookcase, to contain the Volumes of

CASSELL'S NATIONAL LIBRARY,

which, at the close of the present year, will have attained the aggregate number of TWO HUNDRED AND EIGHT. The books are in themselves of world-wide interest, and may be regarded as forming the front rank of our British classics.

In order to give a fair and proper idea of the space or accommodation that will be required in the Bookcase for the whole of the volumes up to the close of 1889—two hundred and eight in number, as already stated—it is desirable to say that each volume, bound in cloth, is $5\frac{7}{8}$ inches long, 4 inches wide, and about $\frac{1}{2}$ inch thick; or, to be more precise, the linear space filled by thirteen volumes is $6\frac{3}{4}$ inches in length, which admits of the volumes being placed on the shelves without any possibility of being crowded too closely together, to prevent easy withdrawal of any single volume at pleasure. As 13 is the sixteenth of 208, the space required for this number of volumes can be easily calculated.

In order to give satisfaction to as many competitors as possible, the Editor of WORK thinks it desirable to divide the sum offered by Messrs. CASSELL & COMPANY into Three Prizes, as follows:—

FIRST PRIZE	...	One Guinea and a Half.
SECOND PRIZE	...	One Guinea.
THIRD PRIZE	...	Half a Guinea.

Intending Competitors are placed under no restriction as to Form, Arrangement, or Ornamentation, as it is the Company's desire to elicit from the readers of WORK an Original Design for a Repository for the Four Years' Issue of the National Library up to the close of the year 1889 that may be regarded as the most convenient and desirable for the purpose indicated.

Competitors should send in WORKING DRAWINGS to SCALE not later than August 31, 1889, and addressed, carriage paid, to

MESSRS. CASSELL & COMPANY, LIMITED,
LA BELLE SAUVAGE,
LUDGATE HILL,
Prize Competition. LONDON, E.C.
Cassell's National Library.

A motto must be affixed to each set of Drawings, and the name of the sender, etc., enclosed in a sealed envelope bearing *the same motto*, which must be transmitted by post, under cover, to the Editor of WORK.

The Drawings sent in Competition will be submitted for adjudication to Three Competent Practical Men, who will select those that are deemed worthy of prizes.

The Prize Drawings selected will become the property of Messrs. CASSELL & COMPANY, LIMITED, who will return all Designs made by unsuccessful competitors to their respective owners, carriage paid.

The Awards, with the names and addresses of the successful competitors, will be announced and engravings of the Prize Bookcases given in No. 30 of WORK, published Oct. 9th.

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 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.

Trade Notes and Memoranda.

MESSRS. CROSSLEY BROTHERS have just completed two pairs of double cylinder gas engines for a paper works at Godalming, which are the largest yet constructed. Each pair is of 100 h.p. Dowson gas is to be used, and the consumption is guaranteed not to exceed 1½ lb. per h.p. per hour.

RECENTLY, an examination of plumbers for registration was held at the Guilds' Institute, the examination embracing joint making, lead laying, etc., and various questions relating to the trade. Applicants came from London, Kent, Hants, and Devon, and rather over three-fourths of the number failed to pass. The examiners were Messrs. Charles Hudson, W. H. Webb, G. Taylor, H. B. Lobb, C. T. Millis, and R. J. Lyne.

TWO instances of rapid work in marine engineering have just been recorded. The ss. *Khio* was launched from the ship-building yard of Messrs. E. Withy & Co. on Friday the 5th at 5 p.m., and went into the Victoria Dock that evening to receive her engines, by Messrs. Richardson & Sons, Hartlepool. The work was begun on Monday morning, and the engines were tested under steam on the Thursday following at 11 a.m. The engines (triple expansion) had cylinders of 22 in., 37 in., and 61 in. diameter respectively. The other case is that of a crank shaft of steel, having a double throw, which was commenced on a Monday, forged from the ingot, finished, keyways cut, and despatched on the forenoon of the following Thursday.

THE late Mr. Warren de la Rue was a splendid illustration of the fact that a commercial career by no means unfits a man for original scientific research. He did not retire from business until 1880, and the bulk of his scientific work was also accomplished, and his reputation made previous to that date. It is quite impossible to enumerate the work of his life. He held office in many societies, was a corresponding member of the principal foreign academies and societies, was a voluminous contributor to the transactions of many learned bodies, and was an accurate experimentalist, astronomer, photographer, chemist, electrician, and physicist.

WORK

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*** Advertisements should reach the Office fourteen days in advance of the date of issue.

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