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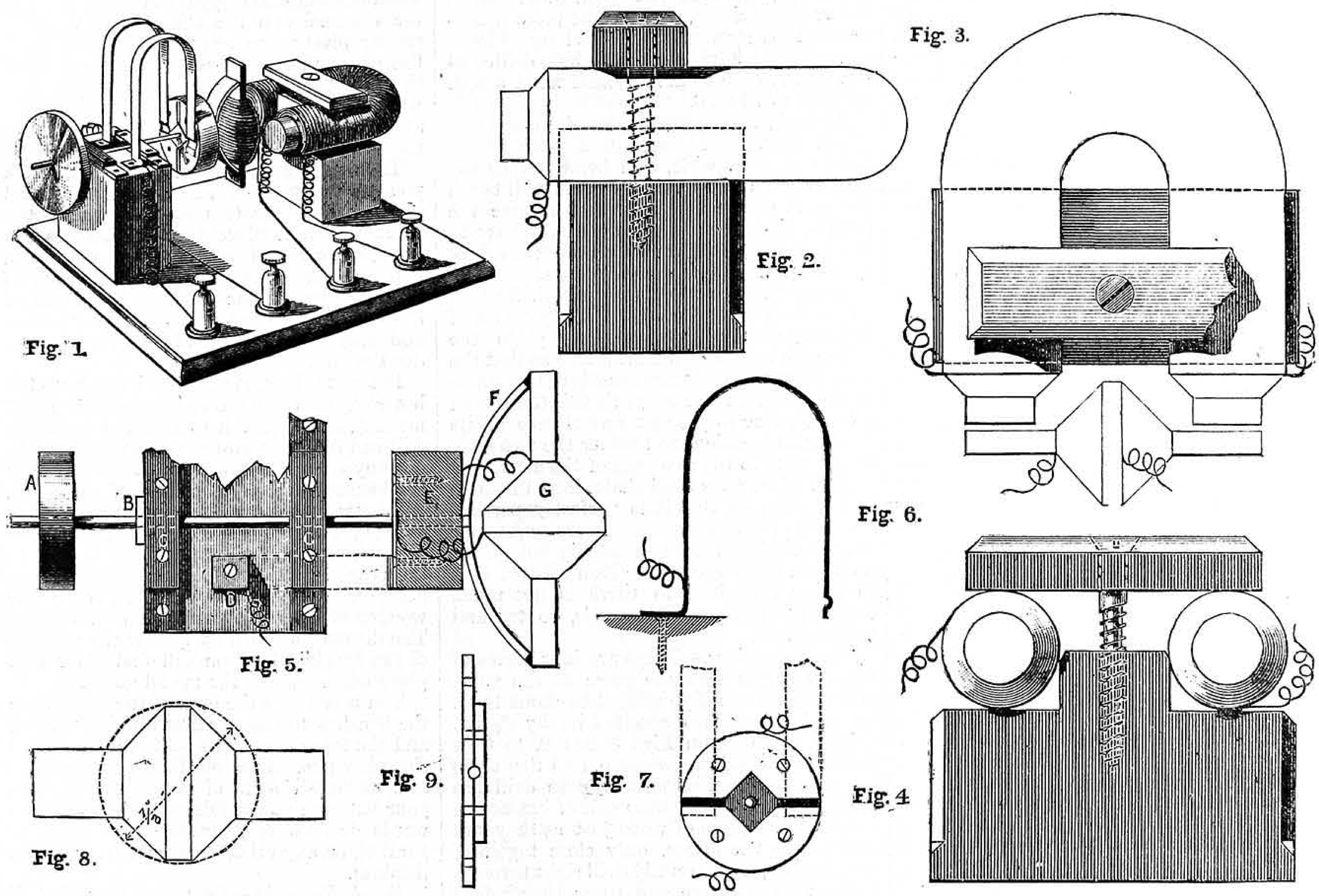


Fig. 1.—Sketch of Small Model Electro-Motor complete. Figs. 2, 3, 4.—Details of Field Magnet and Block. Fig. 5.—Armature Shaft complete—A, Fly-Wheel; B, Bush or Washer; C, Brass Bearings; D, Position of One Brush; E, Commutator; F, Yoke; G, Armature and Coils. Fig. 6.—Shape of Brush. Fig. 7.—Face of Commutator. Fig. 8.—Armature showing ⅞ in. limit. Fig. 9.—Brass Bearing. (Scale for Details, full size.)

SMALL MODEL ELECTRO-MOTOR: SIMPLE AND EASY TO MAKE.

BY J. BROX.

INTRODUCTION—FIELD MAGNET—WINDING—ARMATURE—COMMUTATOR—BRUSHES—YOKE FOR ARMATURE—SHAFT BEARINGS—STAND, BLOCKS, ETC.—FIXING—FINAL REMARKS.

Introduction.—There are many who like to say, after they have made a model, "I made this all myself." This little model, it is hoped, will fulfil this remark as far as possible; there are no castings to be made, and for those who have no lathe, the whole can be made without any turning at all.

It is also within the reach of the younger branch who read this paper, who have any idea of using a few tools, and have a little ingenuity and patience about them. The little thing, when complete and judiciously picked out with such simple things as red sealing-wax varnish and brunswick black, looks a very presentable little article, to say nothing of its use in illustrating the laws of electro-magnetism. Last, but not least, it will go, and go well; this can be vouched for, as I have made one the exact counterpart of this. It can be driven by two small bichromate double carbon cells, or more, if you should be so disposed.

To dispense with any lathe work, the commutator is a little bit novel—at least, I don't remember having ever seen one like it; but that matters not as long as it works, and the words "no lathe" are fulfilled. I trust no one will think that I am against the use of a lathe, but there are so many who have not got one, that I think it may be a help to describe a motor where the use of one is not needed.

Field Magnet.—Get a piece of ⅜ in. round wrought iron 4½ in. long, as soft as possible, and bend it into the form of a horseshoe, with the ends ⅞ in. apart on the inside; go over it with a file to take the rough off it, and then file up the two ends true and square one with the other. Cut a long strip of paper—newspaper does very well—¼ in. wide, and paste it well, and wind it round the horse-shoe until there are three or so thicknesses on all over, except within ⅛ in. from the ends; paste the outside all over, and go over it with your fingers to get it as even as you can; when this is dry give it a coat of brunswick black.

Winding.—As this magnet does not require any bobbins, we can go straight on with the winding. With some No. 28 silk-covered copper wire—don't use larger—begin winding, just short of the edge of the paper cover, with a half hitch, eaving about 6 in. tag; wind the wire on close and even until you come to the other end, just within the edge of the paper, then begin to go back—still winding the same way, of course—over the first coils, but mind it does not slip, or that the second row does not sink down between the first.

When you have gone back about $\frac{1}{4}$ in. or so, hold the end tight, either by giving two or three turns on the opposite end or any other way you can think of, and give the whole magnet another coat of brunswick black; let this get dry (which does not take long), and go ahead again, doing the same when you get to the ends always, which you should turn one coil short each time; if you are careful in turning, and repeat the brunswick black, you will find that there is no slipping.

When you have made the winding, $\frac{5}{8}$ in. about, more or less, in diameter all over, you can stop, finishing off the other end from which you began by tying a piece of thread close up to the finish, leaving another tag, 6 in. or so, and, winding the thread in different directions, and knotting, see that the flat ends are nice and bright, and put it away. (See Figs. 2, 3, and 4.)

Armature.—Take a small piece of soft wrought iron, $1\frac{5}{8}$ in. long, $\frac{1}{8}$ in., or a little more if you like, thick, and $\frac{3}{8}$ in. wide; file it nice and smooth all over, and take off the edges on the sides; then get a short strip of paper, $\frac{3}{8}$ in. wide, and paste it round the exact middle of the iron until you have three or four thicknesses on. Give the paper a coat of brunswick black, and let it dry.

Now begin to wind with fine wire: I used No. 36 silk-covered copper wire; take as much care as you can in winding the armature, turning backwards and forwards as with the field magnet, giving each layer a coat of brunswick black, and wind on as much as ever you can get; the more neatly you do it the more you will get on, and the better the results; finish off the same as the other magnet, which in this case will be in the middle, and don't forget the tags: each about 2 in. will do. You must see that your coils are not more than $\frac{5}{8}$ in. across in front, or the magnet will cut the armature coils. Fig. 8 will show what is meant. You can also, while you are winding the armature, try it in different positions against the magnet, and see that the armature coils are quite clear of everything, for if they touch nothing while the armature is against the magnet, you are quite safe after.

Commutator.—This part of the model is really nothing more than a two-part commutator, the only difference being that the brushes work on one face, and not on the rim. The reason this plan has been adopted is that you are supposed to have no lathe, and that to true up an even face on the flat is easier than on a round surface; in fact, the latter is next door to impossible without a lathe.

For the body of the commutator take any piece of hard wood about $\frac{3}{4}$ in. diameter (not less), and cut off, quite square, $\frac{5}{8}$ in. of it. A piece of an old round ruler does very well indeed; true up both faces, and carefully drill a hole in the exact centre large enough to take tightly a good thick knitting-needle, $2\frac{1}{2}$ in. of which will make you a very good steel shaft.

Out of a piece of sheet copper cut a disc, the size of the wooden body, and screw it on with four small wood screws, and countersink them (see Fig. 7). Cut the copper right through the centre with a file, and saw down through the wood for about $\frac{1}{8}$ in.; the thickness of a saw cut (small) will be quite wide enough for the slits.

There is a proper angle at which to set out the slits, but in such a small model this is not necessary; but if you like to go so far, you will find the angles set out for you in Mr. Bonney's paper in WORK, Vol. II., No. 92, pages 643 and 644; you can apply the same rule for a flat surface as well as a round one.

Having gone so far, take off the two pieces of copper, mark them so that you can put them on again in the same way, and cut a nick out of the middle of each, as in Fig. 7, to prevent any chance of contact with the shaft; screw them on again, and glue into each side of the slot two neat little pieces of boxwood or bone, so that they stand just above the copper; then file up the whole face, bone strips, screw-heads, and all, to a true and even face as smooth as you can, and square to the shaft hole.

Brushes.—These are simply two thin copper strips, 3 in. long and $\frac{3}{16}$ in. wide, bent to the required shape, with a short piece of silk-covered copper wire about 6 in. long soldered to each, and having a small hole drilled at one end of each to take a small wood screw, as shown in Fig. 6.

Yoke for Armature.—Out of some brass sheet, $\frac{1}{16}$ in. thick or so, cut a piece $1\frac{5}{8}$ in. long and $\frac{1}{4}$ in. wide, and bend it into the shape shown in Fig. 5, so that it will touch the ends of the armature and enclose the coils on that side; perhaps you may have to cut it a little longer: it all depends how much wire you managed to get on.

In the exact centre of this yoke drill a hole to fit the end of the steel shaft (your bit of knitting-needle), then carefully place the yoke on one side of the armature so that the hole for the shaft comes *exactly* in the centre of the armature and coils; tie this there with a bit of twine to prevent any chance of its loosing its position, and solder the two ends of the yoke to the two ends of the armature.

Now place your steel shaft into the hole in the yoke, see that it is perfectly perpendicular to the face of the armature, and solder it in, taking care not to drop any hot solder on to the armature coils. Don't forget that in fixing the shaft in there is not much chance of truing up afterwards, so try and get it plumb.

Shaft Bearings.—These are four pieces of brass cut from the same piece as the yoke, or a little thicker if you like; two about $1\frac{1}{4}$ in. by $\frac{3}{16}$ in., and two about $\frac{3}{4}$ in. by $\frac{3}{16}$ in., drilled, as shown in Figs. 5 and 9, to take four small wood screws each, and drilled to take the shaft. The best way to drill the shaft hole is to fix both pair of brasses on to any spare piece of wood just as they are to go on to the frame, only close together, side by side, and carefully drill right through both at once, square and true; then before you take them off mark them all, so that you may be sure of getting them to fit in their places when they are fixed.

Stand, Blocks, etc.—The stand and blocks you can make of any wood you like, and the form does not so much matter, except the top of the field magnet one, which should be made as shown in Figs. 2, 3, and 4.

The block for the shaft can be a simple square if you like; the only thing is, they must both be of such a height that the centre of the shaft is on a level with the centre line of the field magnet ends. You can glue them on the stand after you have set out their positions, or you can screw them on through the bottom of the stand, or you can do both. You will want four little binding screws for the stand, as in Fig. 1, which is a sketch of the model complete in its simplest form, but to no scale.

Fixing.—You can now slip the commutator on the shaft right up to the yoke, with its copper face away from it, and the line of the slits parallel with the length of the armature; if you drop a little strong glue in on each side, between the yoke and the wooden back of the commutator, you will find that it will hold it quite tight enough, especially if the shaft hole was not too large.

Now bring the ends of the coil, one on one side of the yoke, and the other on the other; cut them just long enough to reach the edge of the copper face of the commutator, but don't let them press against the yoke; bare the ends, and solder them to the rim, one to each segment, taking care that no solder runs on to the copper face.

Having fixed the field magnet in its seat, and screwed it tight by means of the button on top—previously having wound a little silk ribbon round the coils, to prevent the wood cutting them—you can then put the brass bearings on the other block in their proper places, the one farthest away from the magnets being flush with the side of the block, so that a little brass bush or washer can work against it. This is shown at B in Fig. 5, which must be soldered on to the shaft.

Then cut a small disc of stout lead, which you can easily do with a strong pair of steel compasses, solder this on the end of the shaft in such a place that it balances the armature, commutator, etc., and put it on true to prevent any "wobble." This little disc has two uses: it makes the model run easier by means of its balancing power, and also helps the armature over the two dead points.

Put your shaft, etc., on, and screw up the bearings; now unscrew the button of the field magnet, and adjust it so that the armature will run free, as near as you can get it, without any chance of touching. Then screw on the brushes, one on each side of the shaft, and between the bearings; mind they touch nothing but the wood; set the armature opposite the ends of the magnet, and bend the brushes so that the little bends at the other ends each press very gently on the wooden or bone strips of the commutator. The dotted lines in Fig. 7 show the position of the brushes, but you will find their best place when you set the model going.

You now bring the ends of the wires from the brushes to the two first binding screws, and the two ends of the field magnet coil to the other two. With four binding screws you can make all sorts of combinations with your battery: you can drive the model backwards or forwards, connect it in series or parallel, or any other combination you can think of.

Final Remarks.—I am sure, now, that if anyone follows these instructions with a little care, they will have a small model electro-motor, the only expense being the copper wire, four small binding screws, and some small wood screws; you can use almost any kind of wood for the stand, but, of course, a good close-grained wood makes the best job, and you can put into the work any degree of finish you like. All the rest of the stuff you could almost get out of an old scrap heap, such as the iron, odd bits of copper, brass, etc.

I have also endeavoured to use the least number of tools that I should think could turn out a small motor, and have kept my word about the lathe. I have also dispensed with any screwing tackle. Of course, there is the expense of your battery to drive your motor; but if I am allowed to do so, I will at some future time add a short paper to this showing how you can make your own battery, carbons and all, in the easiest and simplest way. But this will depend very much on the desire of readers of WORK to have such a paper as I have mentioned.

WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

HEN-AND-CHICKENS' COOPS: THE FRAMING—PUTTING TOGETHER—FOLDING MERIT—COMPANION BOARD—THE ENTRANCE—DOOR SUPPORT—PEA GUARDS: STAY-WIRES—THE ENDS—PEA HURDLES: THE MESH.

Hen Coops.—The manufacture of hen-and-chickens' coops is, in several wire-working establishments, a source of large profit; and this is hardly a truth to create wonder when it is remembered that the possession of fowls is a fact with so many householders and others.

The pattern shown in Fig. 185 represents the commonest kind of this class of goods, and it is my impression that it is one of the most useful for its special purpose. My amateur aspirants will find their progress a comparatively simple matter if anyone among them should decide to try his hand at making one of these articles—provided, of course, that he is fully acquainted with the practical details of "putting together," "turning over," etc., described in former numbers of WORK.

Why they are constructed of a greater width at the bottom than at the top I am not in a position to reply to satisfactorily; it certainly cannot be to allow the rain to escape when a shower envelops the articles, as is the reason for building sloping roofs to houses; for the most unintelligent of my readers will at once perceive that no resistance would be offered to the rain. The shape of the fowl, too, cannot be tendered as a reason, as I have always understood a fowl to be as wide at the top of its body as at its under part. Perhaps this is the reason: supposing that the articles were made of the same width at the bottom as at the top, the bird would have much less room to pick off the ground than it would, as in the present case, if the bottom were increased in width. If the coops were tall, then I should give it as my opinion that the bottoms were wider than the tops in order that there might exist less chance of them being toppled over. However, let it remain; but it is certainly true that as they are made now they demand the exercise of more troublesome labour than would otherwise be the case.

The Framing.—The top and two sides are usually of exactly the same size as each other in every respect, but the ends are generally an inch or so narrower at the tops than at the bottoms, as before remarked upon. The frames forming the top and the sides are of ordinary construction; each having two stay-bars secured to it, with knuckles inwards. The ends require some touching upon: thus, there are five separate frames.

It will be understood that the width of each side will exceed the depth of the ends, as the latter being wider at the bottom, the side rods thus formed are longer than they would be were they quite vertical; therefore the sides will each be in width equal to the length of a side rod in the ends.

Putting Together.—The top and sides are fastened together first, either by tying or binding. The latter operation consists of twisting a piece of thin wire several times around the bars of the frame where they come in contact with each other, thus embracing two bars or rods, as in Fig. 191. The binding wire must not encircle these bars too loosely, as in this event there would be a liability of a rickety job being constructed. Two or three bindings only will be necessary to keep all frames firmly together. Wherever one touches another, there it might be bound; although, as will be seen, it is really not necessary that more than four pairs of connections be used—or, more properly speaking, two at each of the four sides of the top frame, securing respectively the sides and ends of the article.

Folding Merit.—Wire-workers are in the habit of sending these coops home in a folded state, for obvious reasons; and it is sometimes bombastically claimed by dealers that these articles possess the advantage of being folded: from which customers might be led to suppose that they had been specially designed for the purpose of enabling the owners to stow them away in a small compass; whereas the truth is that the "obvious reasons" are the cause of them being so constructed. As a first reason, they are more conveniently made thus than they could be were the framework in one complete piece; and a second reason to adduce is that the makers themselves prefer that they shall fold, irrespective of this merit being advantageous to anyone else, in order that they may occupy less space while in transit to their buyers' warehouses.

When once rigged up, little necessity will arise for one of them to be folded, for in the event of an owner of many fowls possessing one or more, he will find continual use for one or all; and if a person owns but a few of these creatures, and requires only the occasional use of the coop, he can as well stow it away in its complete condition in the fowls' run or elsewhere, where it will be none the less liable to rust or spoil, or be a source of inconvenience, than would be the case were it in a folded state.

Companion Board.—These are sometimes secured to a board by means of staples driven over the bottom rods, and often they are merely stapled to the ground. Fig. 190 shows a board with staples for use in the former case. It is plainly apparent that a hen which chanced to occupy a coop which was merely stapled to the ground would run an extremely greater risk of catching some complaint from the damp of the space within which it were confined than would be the case if the coop were stapled to a board, when the dangers would be lessened, if not wholly avoided.

The Entrance.—At one end there will be a flap door This is attached to a small frame, the latter of which is fitted on to the meshes, and the wires with which it comes in contact turned over on to it. The end of the coop in which the door is to be placed is at first in all respects the same as the opposite end, but the wires enclosed within the space to be occupied by the frame over which will hang the door must not be turned over, but left free, as in Fig. 186. When the remainder are turned over, the shears must be brought into action by cutting the necessary opening; the result being as in Fig. 187.

There it will be noticed that portion of those wires whose ends are shown protruding in the front of Fig. 186 are severed. It must be borne in mind that the area of the vacant space in Fig. 187 must be rather smaller than the area of the framing which will receive the door. This is in order to give allowance for sufficient length on the ends of the wires around the space to be turned over on to the frame. The frame to fit over this opening is made by bending a piece of wire, as shown in Fig. 188, and forming the ends into small hooks. The knuckles of these wires should be towards the inside of the work.

The Door.—The door is made by bending a wire in a similar manner to the small frame (Fig. 188), of a size large enough to hang conveniently over the latter. Fig. 189 shows the door. When it is fully completed it is fastened at the top of the small frame by having the hooks, which are shown, properly squeezed down.

Door Support.—The door can be kept open by numerous methods, one being that shown in Fig. 185. This is but the simple device of a short chain, with a hook attached to one end. The chain can be permanently fastened to either the door or the end proper of the coop, the hook being at the loose end —whichever may be the course adopted. If thought necessary, the door, when down, could be safely secured with a padlock, or for ordinary purposes a wire button would answer.

Pea Guards. — The articles which are made to protect those delicacies—peas—which are usually associated with other delicacies in the shape of lamb and young ducks, are called pea guards. In Fig. 192 one (or what some would term a portion of one) is shown. As most people may be aware, they are driven into the ground end to end, to cover that particular portion in which are the peas or their seeds, thereby being a preventative against the natural onslaughts of birds and other kinds of life. It is needless in such cases for the hideous scarecrow to despoil the view of human ken, when their eyes travel in that direction, under the plea, useless or otherwise, of frightening the timid but mischievous "dickies." The ends of the combined lengths are then enclosed with end frames (Fig. 193).

The original appearance of each guard is shown in Fig. 194. These frames contain two end rods, each projecting on either side to a distance of a few inches from the main portion of the work; and two side rods turned over on to the latter. The pieces of work secured to these frames are usually of the mesh represented in my diagrams, of which I speak more fully at the beginning of my papers on "Wire-Work"; but it must be obvious that there is no compulsion enacted as regards the particular pattern of the mesh used, as it may with equal efficiency be of the diamond class.

Stay-Wires.—The next operation is the fixing of stay-wires, which tend to strengthen a job, across a guard, as in Fig. 194, turning them over on to the frame, and tying them at their junctions in addition to at short intervals on the under wires. It will be noticed that there are four wires used in relation to my last remarks, each couple of which crosses each other, and have their ends either in direct contact with the end bars of the frame or with the opposite pair of stay-bars. They are then bent around a cylindrical surface.

The Ends.—One end of a pea guard is represented in Fig. 193. It is simply a rod bent half-circular in shape, fastened to a straight one, the latter of which extends at each side beyond the ends of the former, with a piece of work turned over on to them. When they are joined to the main part of the guard, one projection is passed through the guard at one corner from the inside, and the other end through the opposite corner, when they are then bent round towards the front of the end, and finally squeezed flat up against it, the straight rod thus being in reality doubled upon itself, and all superfluous material clipped off. For further security they are tied here and there round the bent portion to the guard frame.

It is not such a difficult task as it may at first sight appear to fasten an end to the adjacent portions of a guard, and no illustrations nor further written details will be in any way helpful.

The projections at the ends of the rods on the main frame are, as lately told, for the even more ends to such a number, or may be less.

Pea Hurdles.—Pea hurdles, as perhaps all are aware, are used as guides and supports for the plants when they show above couples of hurdles which meet at those points when placed in a row consecutively. The side rods of these articles might be carried in length to an extent of several inches beyond the bottom bar of each; but

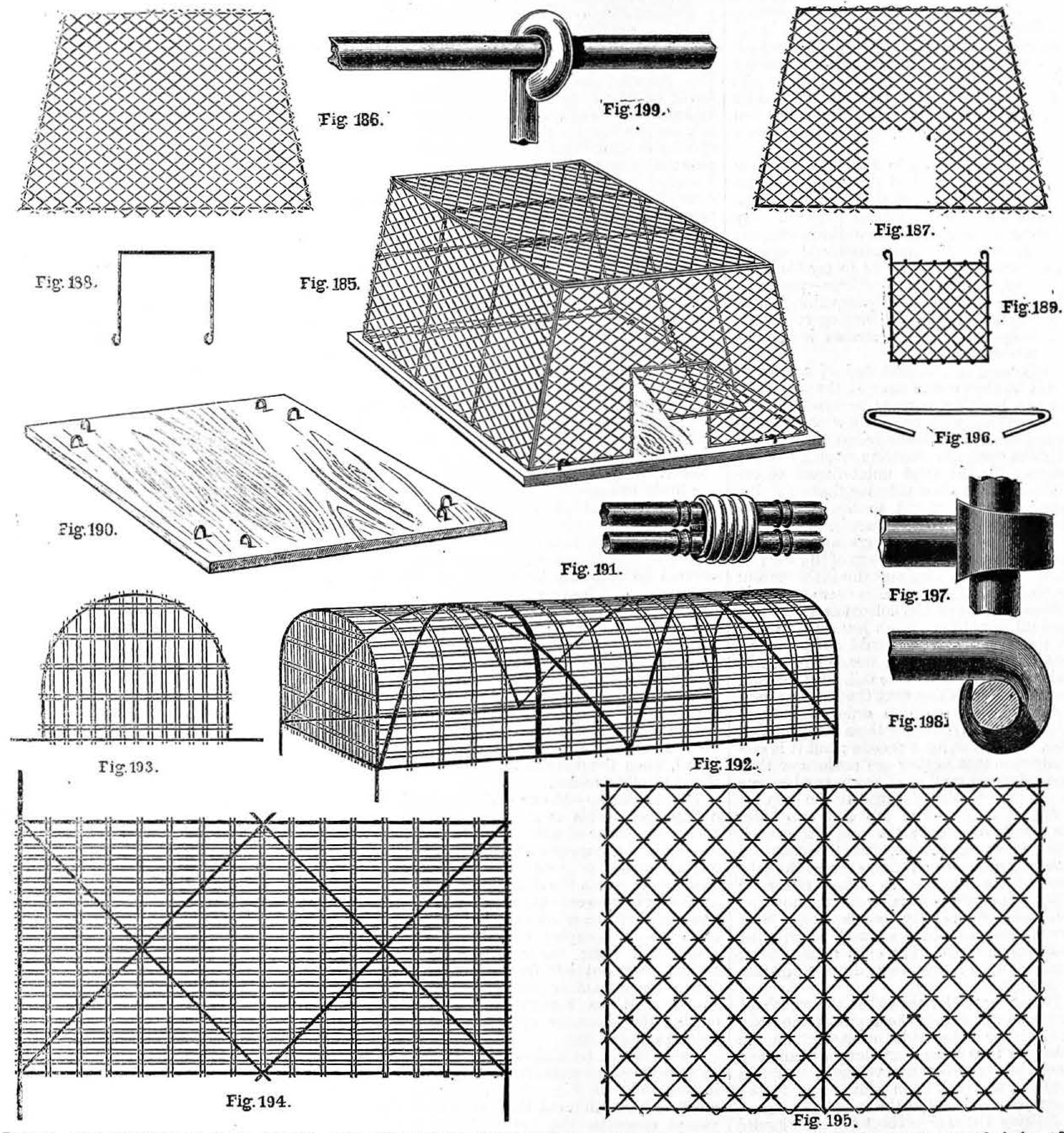


Fig. 185.—Hen-and-Chickens' Coop. Fig. 186.—Door End with some Wires left free. Fig. 187.—Door with aforesaid Wires cut free for admission of Frame, shown in Fig. 188. Fig. 188.—Frame for Door. Fig. 189.—Door. Fig. 190.—Companion Board for Coop. Fig. 191.—Coop Hinge. Fig. 192.—Pea Guard. Fig. 193.—Pea Guard End. Fig. 194.—Original appearance of Pea Guard. Fig. 195.—Pea Hurdle. Fig. 196.—Plan of Bottom Wire in Fig. 193 when turned round upon Guard, when fitted as in Fig. 192, superfluous Material to be clipped off, allowing but sufficient to hold fast. Figs. 197, 198.—Plan and Elevation of Shorter Rod Ends, Fig. 195, which are drawn to smaller scale than other Diagrams, except Figs. 197, 198, and 199. Fig. 199.—Diagram showing Mode of turning End of Vertical Rod over Horizontal Rod.

purpose of enabling the guard to be fixed to the earth. It must be apparent that when the article is bent these points are protruding downwards.

It is usual to supply two ends with every dozen of the individual guards, but, of course, personal requirements may demand ground. One is shown in Fig. 195. It is usual, I believe, to drive stakes deeply into the ground, at distances apart equal to the separate lengths of the hurdles, allowing a sufficiently long portion of each to protrude to nearly the height of a hurdle, and to attach to them the ends of the various so secure and firm a hold is not to be obtained by these means as by driving stakes into the soil at various points, as is customarily done. Again, if merely the extended side rods are adopted, each hurdle will have to be bound to the next one at the end which touches it, thereby necessitating equally as much labour as would be entailed by fastening them to stakes.

The Mesh.—A small mesh is not required for such articles as are receiving attention; therefore it is needless to use more material than is essential to obtaining the necessary strength. As this is the case, crimped or corrugated wire may or may not be used, although it is far preferable, on many accounts, to use perfectly straight stuff, and tie it at its various junctions, as in the manner shown in my introductory remarks in my first paper on Wire-work (Vol. III., No. 105, page 8).

For the frame five rods will be required. It is preferable to have the shorter (*i.e.*, the end and middle) ones with forged or flattened ends. This can be understood from Figs. 197 and 198. The longer rods are severed at points flush with the outsides of the ends of the work when completed, over which ends are squeezed the flattened parts of the end rods, while the ends of the middle rods are also turned over them in a similar manner, in contrast to the method shown in Fig. 199 in relation to hen-and-chickens' coops.

The wires in this instance will be turned over on to the frame in precisely the same way as they are in any and every other case.

With this I must bring my instructions on Wire-work to a close. I am obliged to leave much unsaid that might be said, but I have no more space at my command, and I am therefore reluctantly compelled to take leave of my readers at this point.

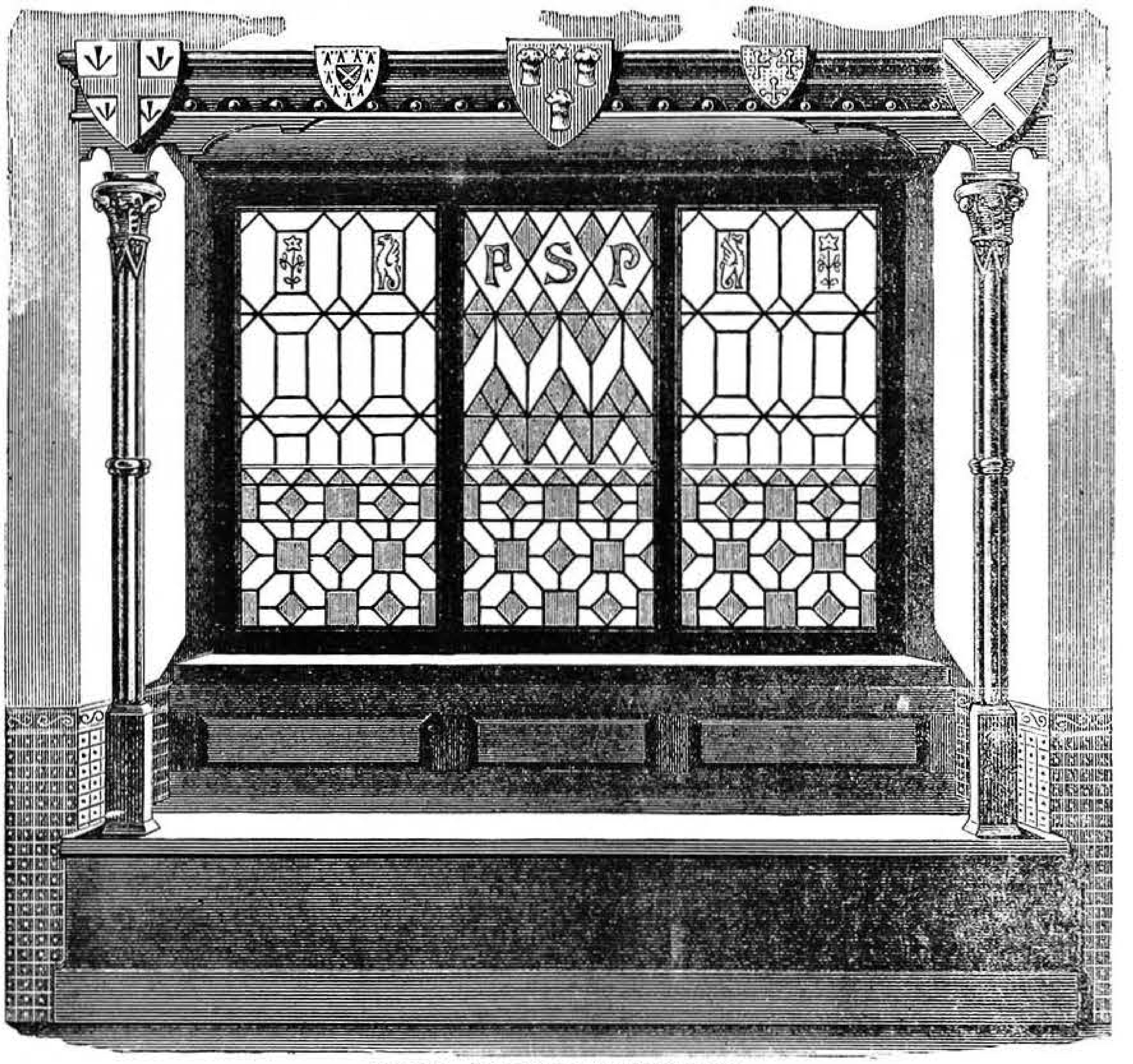


Fig. 19.—Window of Dining-Room.

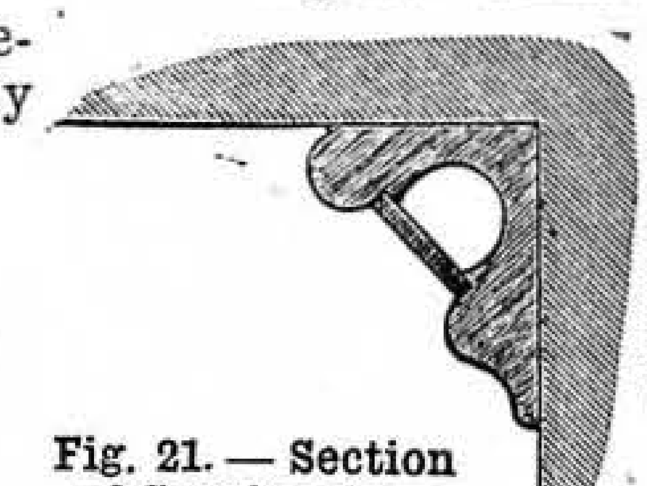


Fig. 21.—Section of Cornice showing Dog-Tooth Ornament.

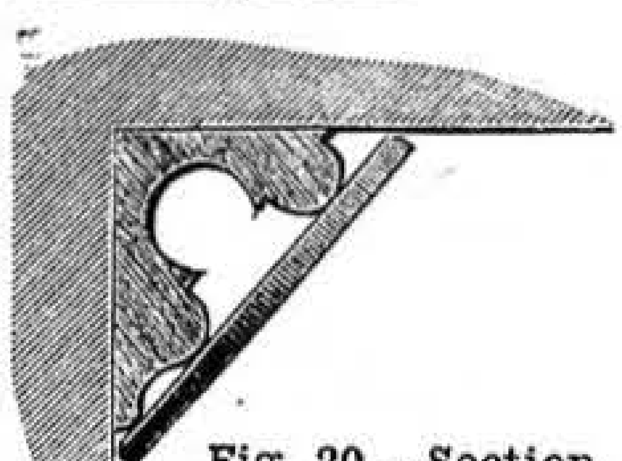


Fig. 20.—Section of Cornice showing Shield.

MAKING THE BEST OF A BAD HOUSE.

BY MARK MALLETT.

THE DINING-ROOM: THE WINDOW—THE WINDOW CORNICE—THE CORNICE ROUND CEILING—PAINTING AND PAPERING—CONCLUSION.

The Dining-Room: The Window.—This room had but a single window, but it was of such a size as to admit abundance of light. It had originally been divided into three lights by handsomely wrought stone mullions, but these had disappeared, and square wooden uprights, 2 in. wide, had taken their places. They were in the right situations, so I did not remove them as I had those in the study, but used them on the centres of the handsome mullions which appear in the illustration (Fig. 19). The leaded lights were of much the same character as those in the study, and by no means worth preserving. I proposed to put in new ones, and, as I was not now compelled to economise every ray of daylight, I indulged in more ornamental glass than in the former room.

This window looked directly into the village street, and it was desirable that the glass in its lower portion should form a screen. In designing my lights, therefore, I arranged that the lower third should be entirely in coloured cathedral glass, but of a very low and quiet tone—the prevailing tint being green, varied with faint reds and yellows. No glaring colour was admitted. The illustration in which I can convey the arrangement of the lead lines, and merely hint at variations in tone, does not, unfortunately, enable me to show the pleasing effect of colour produced.

As regards the two outside lights, their upper two-thirds were of plain white glass, except the two plaques bearing heraldic badges near the top. These plaques were of white cathedral, the charges on them drawn in brown matting colour, and the background, or "field," washed in with gold-stain.

In the central light, as is indicated, the plain white glass is arranged in combination with low-toned coloured glass of the same kind and tints as below; and instead of the plaques at top I introduced panes bearing my initials, brought out in the same manner with gold-stain.

This window is about 6 ft. broad by 3½ ft. high. The leaded lights, with ties, bars, etc., all ready for fixing, cost me, if I remember rightly, about 45s. I fixed them myself. I took the precaution to draw a full-sized cartoon of the lead lines of the central and of one of the side lights, for the guidance of the workman. Also I drew out to full size on tracing paper the initials and one of each of the badges (the wyvern and the columbine) for the use of the glass-painter. For the tinted portion I selected patterns of the glass, numbered them, and indicated all such panes as were to be of those tints by corresponding numbers on the cartoon. All possibility of mistakes in colour was thus guarded against. The subdued and harmonious effect of this window has, I think, been praised by all judges in matters of taste who have seen it. The only positive colour contained in it—if that can so be called—is the gold ground of the plaques, etc. There are no strong reds or greens, and no blue whatever.

The Window Cornice.—The opening to this window was bare and ugly, there being no woodwork round it. Most persons would, I suppose, have masked it by a large curtain pole and heavy curtains; but this would not have agreed with my scheme of decoration. The illustration (Fig. 19) gives a fair idea of the plan adopted. The carved pillars which flank it are the footposts of that same demolished four-post bedstead of the old school of which mention has already been made on more than one occasion. They have clustered shafts, and are beautifully carved in dark mahogany, in the style of a hundred years since. The complete bedstead cost me, at an auction sale, 20s. These pillars were indeed so good in their way that I was glad to bring them into a position where they would be more seen than in a bedroom. The cornice itself is of ebonised pine; the shields which decorate it are emblazoned in their proper heraldic tinctures.

The Ceiling Cornice.—The upper portion of this window cornice is of the same moulding as that used over the door in the hall; in the present case it is continued as a ceiling cornice round the entire room. It is seen in section in Figs. 20 and 21. Its projection is 2 in., and its depth may be slightly more. It has an effective hollow in its middle. By the hundred feet run it cost me, I think, about 23s. 6d. Of course, I had to ebonise and polish it myself. Having fixed it round the room, I attached to it a series of shields, as in the section, Fig. 20. They were of the same size as the smaller ones on the window cornice (Fig. 19), namely, 5½ in. high. They were cut from

½ in. pine board, and emblazoned with proper heraldic tinctures, their sides being ebonised like the moulding on which they lie. At the corners of the room the upper portions of the shields touch; at other places there is a space of about 2 ft. between each two shields, and in the centre of this space is a square dog-tooth ornament, cut from ½ in. pine and gilded. How this is arranged is seen in section in Fig. 21. Thus the shields and ornaments alternate.

Being something of the genealogist and herald, I charged these shields with the arms of as many different families as I have reasons for supposing to be connected with my own, by blood or marriage. They thus form a sort of family history in brief, as well as tending to brighten up my walls with their gilding and brilliant colours.

Painting and Papering.—The skirting boards, the door frames and architraves, and the doors themselves, their panels only excepted, I painted of a dead black; the panels I coloured of a deep Pompeian red. Much the same system of colouring was also adopted throughout the hall and study. I am much of Mr. Ruskin's opinion as to the superior artistic effect of self-colours over graining, if arranged with judgment. Certainly for the amateur they are much to be preferred. Anyone of ordinary intelligence can soon pick up the knack of laying on self-colours properly, whereas graining demands very considerable skill. There is no graining in my house. The papers used on my dining-room walls were such as showed only different shades of brown.

At this point I may fairly bring my remarks on this subject to a close, having brought under the reader's notice the most prominent of the various steps I took in "making the best of a bad house," or, in other words, what I did to convert bald, bare-looking, and unpromising premises into a place which at least had the merit of satisfying the eye, even of a hypercritical observer, in general arrangement, form, and colour.

COPYRIGHT IN SCULPTURE.

BY CHARLES KELSEY.

INTRODUCTION—THE SCULPTURE COPYRIGHT ACT—DEFINITION OF SCULPTURE—WORKS MUST BE ORIGINAL—HOW TO SECURE COPYRIGHT—DEFINITION OF PUBLICATION—DURATION OF COPYRIGHT—ACTION FOR OFFENCES—CONCLUSION.

Introduction.—This paper is written as a sequel to the articles on the Registration of Designs, which have recently appeared in WORK. It was noted in those articles that sculpture was expressly excluded from the operation of the Act which governs the registration of designs; and as in some cases—such, for instance, as small statuettes—it is difficult, when protection is required, to decide which is the better course to pursue, this brief statement of the law as to sculpture copyright has been written.

The Sculpture Copyright Act.—Copyright in sculpture is governed and regulated by the provisions of the Act of Parliament known as the 54 Geo. III., cap. 56.

This Act was passed in A.D. 1814, taking the place of an older Act (38 Geo. III., cap. 71) passed in A.D. 1798, which was found faulty in practice and required amendment.

This existing Act, then, must be examined for information and guidance.

Definition of Sculpture.—The first point to determine is the definition, for copyright purposes, of the term "sculpture."

The term, as generally used, means statues and the like, carved in marble or stone. Cast statues in bronze and similar metals, carvings or castings in alto- and basso-relievo, are also included. The Act covers all these, and also takes in other things which are not now usually considered as being sculpture.

The term "sculpture," for the purposes of this Act, includes:—

Sculptures, models, copies, or casts of the human figure, whether treated singly or in groups, whether nude or draped, combined with animals or otherwise. Also portions of the human figure, including busts.

Also sculptures, models, copies, or casts of animals, or portions of animals, whether treated singly or in groups, in combination with the human figure or otherwise.

Also any carvings or castings, or models in alto- or basso-relievo—*i.e.*, high or low relief—and any other subject, being matter of invention in sculpture.

Also casts taken from Nature—such as casts of the human figure, or animals, or portions of either of them, and casts taken from any other natural object.

This definition is wide enough to cover works in marble, stone, plaster, metal, wood, ivory, bone, pottery, terra-cotta, earthenware, clay, wax, or any other material in which such works can be, or usually are, executed.

Works must be Original.—It should be noted that these works, to be entitled to protection, must be "new or original," meaning, evidently, thereby the original emanations of the brain and art of the sculptor, and not mere copies taken from previously existing works.

In my first paper on the Registration of Designs (Vol. III., p. 564), I dealt with the same terms, which appear also in that Act, and those remarks may usefully be referred to, as further illustrative of this point.

How to secure the Copyright.—The process of securing the copyright in any such work is a very simple one. No registration or payment of fees, as is the case in designs, is required; the sculptor is only required to put upon all and every such sculpture, model, cast, etc., issued by him, his name or names, and the date of publication.

Definition of Publication.—"Date of publication" would appear to be the date on which such sculpture is issued, sold, or exhibited in public. It does not necessarily mean the date of completion of the work, for it may remain in the private studio of the sculptor for a considerable time before it is exhibited to the public. This same term has been dealt with in the papers relating to designs, previously mentioned; and in the case of designs the term "publication" has been held to include such an act as showing it to persons for the purpose of securing orders. Probably a similar meaning would be held to apply to the term as used in reference to sculpture.

Duration of Copyright.—The copyright so acquired lasts for a period of fourteen years from the date of publication; during that period the sole right and property in such a work is vested in the proprietor. He can sell, or assign, this right to any other person at his pleasure.

If the original sculptor is still living at the expiration of the first term of fourteen years, a further term of copyright for another fourteen years is vested in him. If he is dead at the expiration of the first term, the private copyright ceases, and it becomes public property.

Actions for Offences.—The Act also says that any action for any offence against this Act must be brought within the period of six months next after the discovery of such offence, and not afterwards.

Conclusion.—Such, in brief, are the provisions of the law regulating copyright in sculpture; and this information will be interesting and valuable to those readers of WORK who practise the arts of carving, modelling, and plaster-cast making, as showing them how to secure copyright in their works.

AN ANTIQUE DUTCH CHAIR.

BY REX MAGNUS.

IN the tumble-down hut at Zaandam, in Holland, which is shown to tourists as the resting-place of Peter the Great, while resident in that town for the purpose of learning the "schipmaaker's geschaft," there is no furniture to be seen other than a table and two or three old chairs. These latter are of little artistic merit, but are eminently quaint, and, in the opinion of the writer, are very suggestive to the amateur cabinet-maker, offering great scope for amplification or ornamentation. Fig. 1 shows the general

Fig. 3. Fig. 1. Fig. 2.

Fig. 1.—Dutch Chair of Sixteenth Century. Fig. 2.—Plan. Fig. 3. —Side Elevation.

construction of such chairs, but as it is drawn from memory, is probably inexact as to the turnings of the legs, which look like anachronisms. Still, there is nothing to prevent the would-be maker from selecting his own particular form of leg—probably the plainer and severer, the more "in keeping" the result would be. Oak, of course, would be the wood to use if one had the choice, but beech or elm would look equally well when stained up and polished. In the originals the seats are simply triangular boards, without the least attempt to "shape," as in modern wooden seats. But a very handsome article of furniture might be made by padding the seat and upholstering in leather. In the originals the workmanship also is as crude as the accompanying drawings, which I hope will be sufficient of a guide to anyone attempting to make it. Instead of adhering slavishly to conventional models, amateurs should study the Swedish, Norwegian, or Danish designs in common use for tables, chairs, stools, etc., all of which will be found well worthy of attention. It is surprising that our technical journals provide us with so few such, as they are, for the most part, easy of construction, while admitting of any amount of ornamentation.

AN EASILY-MADE CHEST OF DRAWERS.

BY DAVID DENNING.

Utility—Origination of Name—Size—Material — Ends — Top Bearers — Bottom — Drawer Bearers — Runners — Guide — Drawer Sides—Fronts—Backs—Bottoms—Mouldings.

As a receptacle for stowing away not only clothes but sundry articles of all kinds, it may be questioned whether any piece of furniture is so generally popular and convenient as what is known as a "chest" of drawers. Even in the wardrobe—which, when of large size, to a certain extent supersedes this useful piece of furniture—a considerable portion is generally devoted to what may be called an enclosed chest of drawers.

As an explanation of a combination of drawers being termed a chest, it may be interesting to note that, as is no doubt well known to the majority of readers, what is generally understood as a chest—*i.e.*, a box —has only a lid to close the top. Chests, of which many old specimens are still extant, at one time formed the storing accommodation for clothes, etc. These old specimens generally stand on legs. Well, by degrees it became customary to put a drawer, or drawers, under the box bottom—the convenience of a drawer, especially when shallow, being, no doubt, readily recognised. The next development was to have two tiers or rows of drawers, with what was, to all intents, the old-fashioned chest with lid above them. By degrees the chest contained nothing but drawers—the lid was done away with. The old title of a chest of drawers has stuck to the modern article, however, and probably at the present time there is no one in Great Britain or the sister island who is unfamiliar with it.

Instead of being a chest, the outer part—that in which the drawers are enclosed—is rather a cupboard without doors, and with rails on which the drawers fit; and if the young or inexperienced maker will bear this in mind, I think some of his difficulties in devising elaborations of a simple chest of drawers will be lessened. It is, however, not my intention now to explain the construction of anything but a simple chest of drawers, and that, too, in the simplest manner, so that anyone almost may undertake it, even though he has little or no skill in drawer work.

However simple in theory and easy to the expert, every novice who has tried it knows that a considerable amount of care and accurate workmanship are wanted. The dovetailing bothers him especially.

Now, I intend to show those who, for any reason, do not want to make drawers in the usual way how they may make a good, useful chest, without more than a very small amount of skill and with few tools, by a very easy method.

The size I must leave to the convenience of the maker, but it may be said that a "four foot" is usually regarded as the standard, and the arrangement shown in Fig. 1 is the ordinary one.

It may be assumed that pine, or American white-wood, which is now obtainable occasionally at about the same price, will be the material, and the only thing which it may be necessary to mention is that, if pine be chosen, it should be free from knots. The other seldom has any.

It stands to reason that the first thing the maker has to do is to decide on the size of the chest, and general arrangement of the drawers. He will then be able to joint up, if necessary, to get the requisite width of plank for the top and ends. The thickness of stuff for these parts, it may be assumed, will be 1 in. Less might be managed with, but then it would be almost impossible to dispense with lining up, and this would entail not only more labour, but would require greater skill.

In actual construction the first proceeding will be to connect the two end pieces. This may be done by nailing the top and bottom direct to them; but if such rough-and-ready joinery will do for any reader, I may as well say that he surely can hardly require directions. It will be better to take a little more trouble and do the thing properly by connecting the ends with bearers, at any rate at the top. The top, or cover, will then be fastened to them. The bottom ends may be treated in the same way, but very little more skill will be required to fit in a solid bottom.

For the top bearers two pieces at least should be used: one at the back, and the other in front. A good deal depends on the width of these pieces, as well as on the width of the chest, whether one more, in the centre, will not be advisable. They should not be less than 3 in. wide, while if they are a good deal more it will not do any harm; for their purpose is to rigidly connect the ends, as well as form a vehicle to which the top is fixed. In thickness they should not be less than 1 in. stuff.

The ordinary way of fixing these would be to lap dovetail them in, but it will be sufficient to sink them into the ends. To manage this, mark their thickness on the inner side of the ends, measuring from the top edge. Then cut away, say, half, or a little more, of the thickness of the ends down to this gauged line for a sufficient space to allow the ends of the bearers to lie within them, with the upper surfaces of the bearers and the top edges of the ends exactly flush.

The front edge of the front bearer must also be flush with the front edges of the ends. That this may be managed without the unsightliness which would be caused by the bearer showing through into the ends, cut a short distance back on the ends of the bearer, making them narrower where they fit into the spaces cut for them, as represented in Fig. 2. The back bearer may as well be set entirely about ½ in. within the ends—*i.e.*, these will project that distance beyond its hinder edge, thus affording supports for the top ends of the backing to be fixed on afterwards.

The bottom may be made in the same way, but it will be almost better to make it solid. A little more material will be required in this case, but then there will not be the labour of fixing runners for the bottom drawers. To fasten the solid bottom in, it is only necessary to cut two or three tenons on it, as in Fig. 3, and corresponding sockets as at top for them.

Naturally, this form of construction does not bind the ends so securely as dovetails would, but then the requisite degree of strength can be got easily by the use of glue and nails. The former, of course, does not hold well on end grains, but still, if properly used, it has some power. The nails—nothing is better for the purpose than the ordinary French or wire nails—should be of a good length—say, 2 in. or 2½ in.—and be driven in slanting in opposite directions.

Before the parts referred to can be fixed finally, it will, however, be necessary to arrange and fasten the pieces on which the drawers run. These pieces are the bearers between the drawers, and by which they are supported in front, and the runners extending from back to front for the edges of the drawer sides to slide against. The bottom drawer, of course, requires neither bearer nor runners below it, as the solid bottom serves for both.

The other bearers should be the same thickness as already mentioned, and it will be noted that they are required in front only. They must be cut back like the top front bearer, and sunk into mortises, or holes, prepared for them in the ends. A nail into each, driven in slantingly from the back edge, should hold them secure enough; for, being tenoned in, they will support any weight the drawers will hold. If, however, the mortises are too large, and the tenons obviously fit too loosely, these may be fastened tightly in by what is called "foxing" them. To do this, slightly split the ends of the bearers, and insert a small wedge or two part way. As the tenon is forced home the wedge will be driven further into the split, and consequently force the inner edges of the tenon wider apart, and cause a tight fit.

The runners now demand attention. They should be of exactly the same substance as the bearers, so that both on the upper and under surfaces they may be flush. It will also be necessary to see that they are fitted square across; for if all, or any of them, incline upwards or downwards, the drawers themselves—however well-made they may be—will be sure to fit badly. The width of the runners may be anything, but in this case it will not be necessary for them to be more than an inch, while narrower—anything not less than the thickness of the drawer side—might suffice. There is, however, no object in having them as narrow as they might be. Now, to glue them on to the ends may seem to the novice an easy way of fastening them, and, so far as the actual fixing is concerned, it might be satisfactory enough; but the result probably would be to cause the ends to split by interfering with the natural play of the wood. To go into the reasons for this would require too much space, and it must suffice to say that the ends must on no account be bound, as they would be were the runners to be glued along their entire length. It will be better to dispense with glue entirely for them; but if any is considered necessary, let it be just a touch at their front ends. One or two nails driven straight through, though, about the same place, will be sufficient, unless the drawers have to contain an unusual weight, and, in any case, screws will probably suffice. The hinder end of the runners should be fastened by one nail, driven in part way only, on the slant from behind, as shown in Fig. 4. By this means the end is allowed to contract without splitting.

The upright fitting between the two top drawers is so simple that it is unnecessary to explain it in detail. There must be another runner behind it, and this runner, having to support two drawer sides, must be wider than the others.

To prevent these drawers "wobbling" sideways, a guide must be fixed on the runner of exactly the thickness of the upright. It may be either glued or nailed on.

The main portion of the carcase being ready, the top may be fastened on at any time. It will be fastened on by a few screws, driven in through the top bearers, and should hardly be less than of 1 in. stuff. The carcase will either be fastened on to a plinth—which is nothing more than a frame of, say, 4 in. in depth of 1 in. stuff—or, as is often done, on turned stumps.

The construction of the drawers may seem the most formidable portion of the work, but little difficulty will occur if the following method be adopted. Dovetailing will be dispensed with, and nails be used instead.

The drawer sides—of thin, say $\frac{1}{2}$ in., stuff—should be got out first, and each be accurately fitted to the place it is ultimately to occupy. To prevent mistakes, they should all be marked to show what part they are intended for, as it will be very accurate workmanship if they are all of exactly the same size, and consequently interchangeable.

The drawer fronts of 1 in. stuff, instead of, as is usual with dovetailed joints, occupying the whole of each opening, must be shorter by the thickness of the two sides, for these are to be nailed on to the ends of the front. To nail the front on to the sides would be very bad joinery; for instead of pulling the drawer out when wanted, the front would very likely come away. An easy way of fitting the fronts will be to place the sides in position in the job, thus giving the exact size to which the fronts should be cut. It may be well to note that at this stage no attempt should be made to give the drawers an easy fit. On the contrary, all the parts should fit very tightly, as the completed drawer can be subsequently sufficiently eased with glass-paper, or even, if necessary, by having a shaving or two removed by the plane. If made easy fitting at first, they will probably be too loose afterwards.

The drawer backs will be of the same length as the fronts, but it is usual for them to be narrower, not only to allow of the bottoms being under them, but to be a little lower at the top than the sides are. Like the front, the sides will be nailed on to them.

Before fixing these parts together, the drawer bottom fittings should be attended to. The bottoms might be nailed on, but a far better way will be to devote a little more time, and proceed in a more workmanlike manner. Those who have a plough plane may prefer to make the usual slips for fitting the bottom into; but for the benefit of others another arrangement, which answers exactly the same purpose, is given as follows: Glue a square strip of wood — say $\frac{1}{4}$ in. square—on the inner face of each

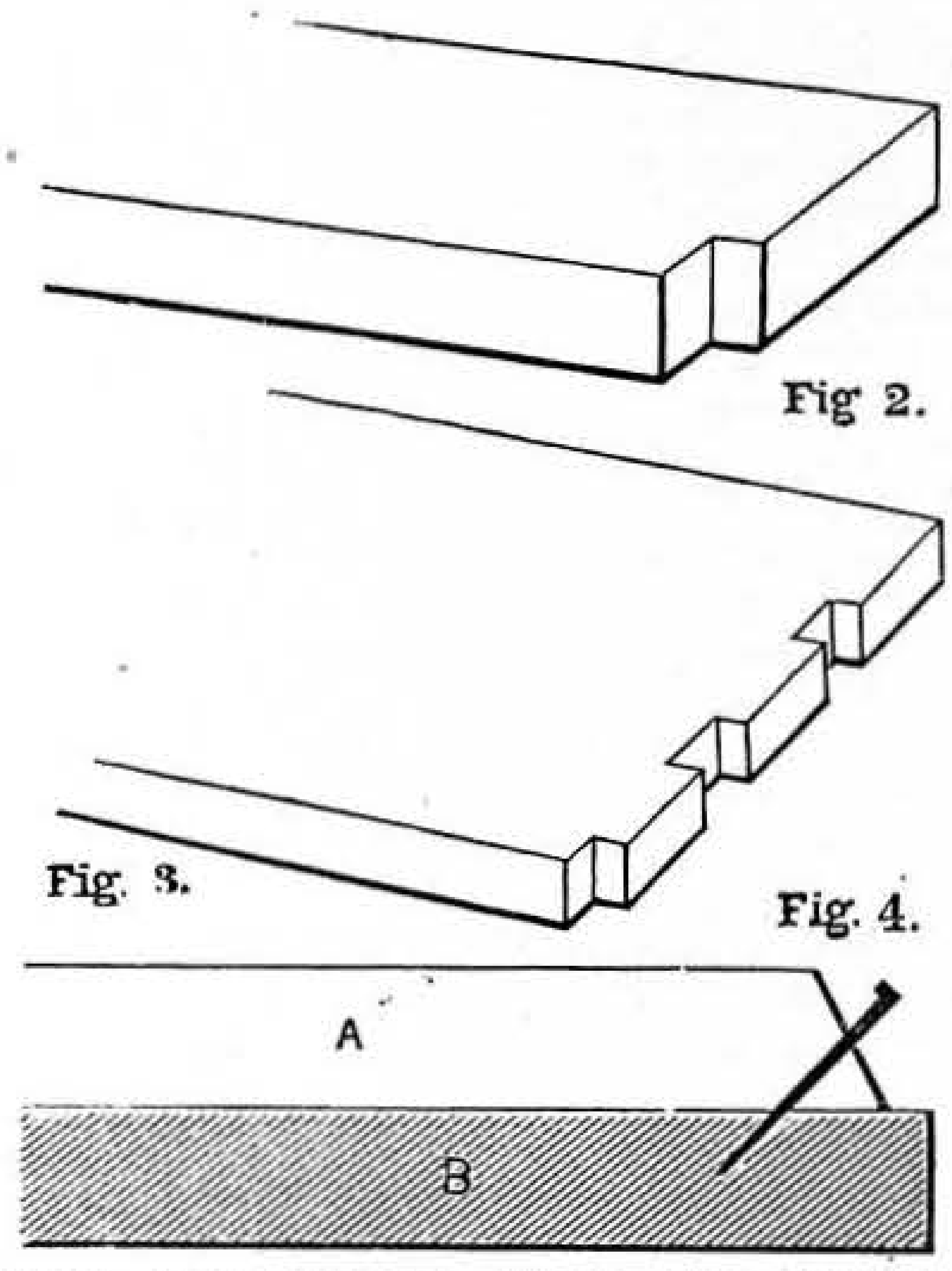


Fig. 2.—End of Bearer. Fig. 3.—End of Batten. Fig. 4.—Fastening of Runners (A) to End Section (B).

side, close to the lower edge, and extending from the inside of the front to the back. Above each strip, leaving a sufficient space for the thickness of the bottom, glue another. Between the two there will thus be a kind of groove, within which the bottom will be held. It may be glued to the drawer front, though it will be preferable to have a similar groove there, too, but on no account use glue in the groove or anywhere else. The drawer back fits above the bottom, which should be left projecting $\frac{1}{2}$ in. or so. If necessary a brad, or, far better, a screw, may be driven into the back through the bottom, though, if this is glued in front, there will be great risk of its splitting as it contracts.

It will be noticed that the end grain of the sides shows in front. If this is objected to, as it probably will be, it is only necessary to fasten on a simple moulding, mitred at the corners, and carried round the drawer front. This gives a handsome appearance to the whole, and the unusual construction of the drawers can only be detected by an examination of the sides when they are pulled out.

Such matters as locks, handles, and method of finishing the work, either by staining, painting, or any other means, may be safely left to the consideration of the maker. If he follows the suggestions given, he may rest assured that he will have a chest of drawers which, for appearance and solidity, will compare very favourably with those of ordinary construction, and not be any less useful.

STAGE CARPENTRY.

BY WILLIAM CORBOULD.

ROLLERS: HOW TO MAKE, FIX, AND WORK THEM—THE FIXING OF THEIR ROPES, AND HOW THEY SHOULD WORK, ETC. ETC.

MY intention in this paper is to explain, by diagrams, the way in which to make three or four different kinds of rollers or tumblers. A certain amount of skill is required in one or two of the rules, which I shall explain as simply as possible. The first will be a solid roller, which would do for a small cloth, such as 15 ft. by 12 ft. In choosing a piece of timber for this purpose, let it be dry, "straight," and clean, free from knots as possible, and about $3\frac{1}{2}$ in. or 4 in. square. First plane off the four corners (see Fig. 1), which brings it to an "octagon," after which you go on planing off the eight corners until you get a nice round surface. Rub it over with a piece of coarse glass-paper, and you have a simple roller ready. You may now tack your cloth or scene on to it as it is, taking care that you tack it perfectly straight. It would be best to draw a line on the roller by the aid of your charcoal line, and tack to it: this will ensure the cloth rolling up straight. The way it should roll will be explained further on. Another good plan is to saw your roller straight through, placing the cloth between the two sections (see Fig. 2), tacking it on the face of one section. Afterwards place the two sections together, and put two, three, or more screws in them, taking care that the heads of the screws are level with the roller, or they will soon spoil the scene; countersink the wood a bit, so that the screw-heads are a little below the surface. Afterwards fill them with a little hard stopping of glue and whiting, with a

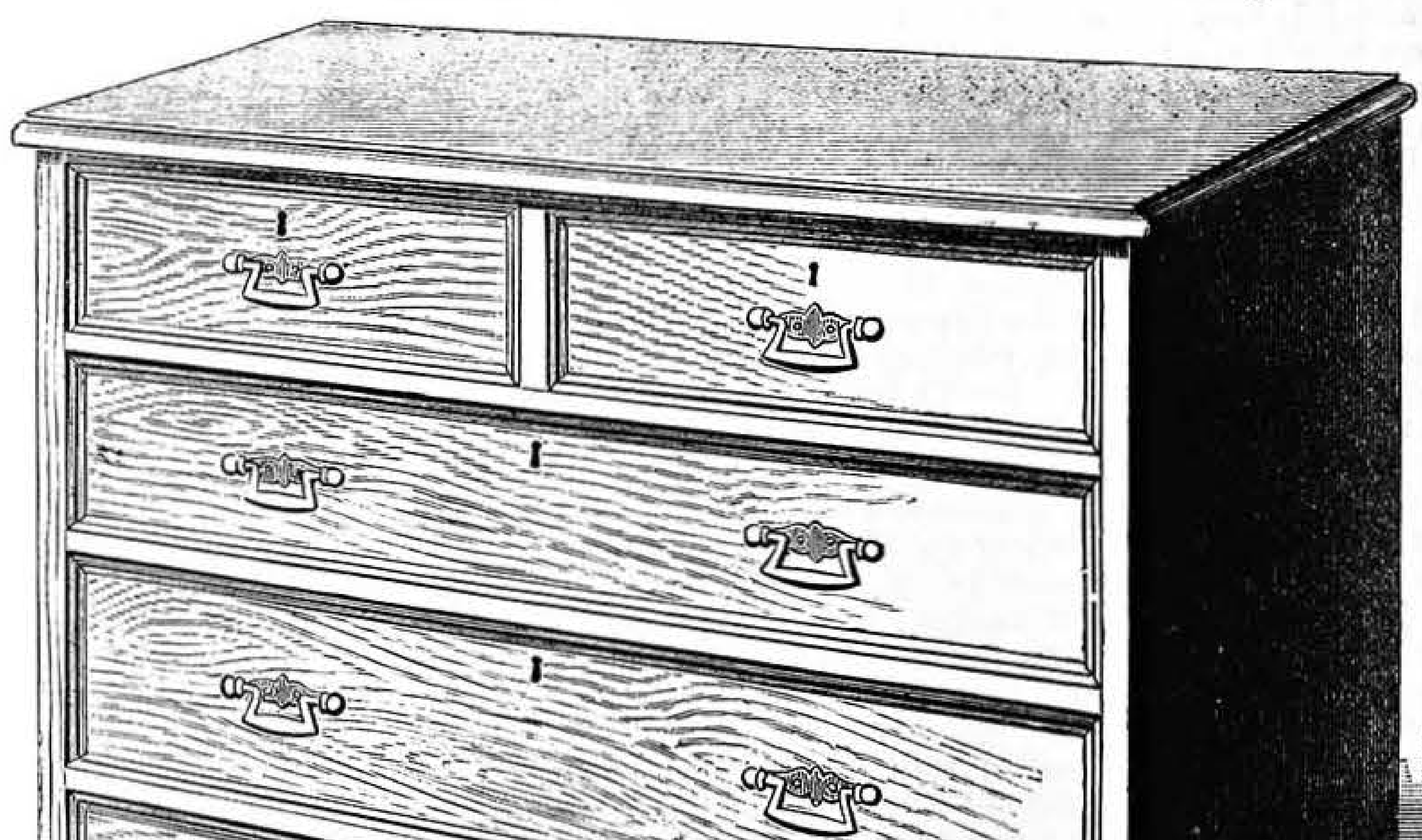


Fig. 1.—Easily-made Chest of Drawers: Perspective View.

little boiled oil. When dry, paper off smoothly. This is a solid roller.

We now come to rollers that are what I will call "built." It is obvious that solid rollers, larger than the first one I have made, would be too heavy. When a roller reaches the dimensions of more than 3 in. or 4 in. in diameter, and, say, 15 ft. or 18 ft. long, it should be made hollow. There are several ways of making these. I will describe the two simplest. Suppose we are making a roller 6 in. in diameter, or thereabouts. First have a piece of timber about 5 in. square and 4 ft. or 5 ft. long; plane off the four corners, bringing it to an "octagon," the same as Fig. 1. You now saw this into pieces about 6 in. long. These are the cores which you build your roller on. You have now sixteen slating battens; bevel off two edges with the plane, making them somewhat wedge-shaped (see Fig. 3). When you have finished all of them, cut four in half, which gives you eight 6 ft. and eight 12 ft. lengths. Take first a 12 ft. length; divide this equally with five of your cores (see Fig. 4), taking care to have the one at the end (A, Fig. 4) divided in half, so that the next length will rest on the other half to butt or slope against the 12 ft. length (see B). This would be a 6 ft. length. Put a brush of glue between your cores and the battens; nail them down with $1\frac{1}{2}$ in. nails. If you now go on alternately altering the lengths by placing a 12 ft. length alongside the 6 ft., and a 6 ft. by the side of your 12 ft., each time you will see that you break the joint (see Fig. 5). When you have got all your lengths together, you will find that the roller will be an 18 ft. one. You might extend it to 20 ft. or 22 ft., but it would not be advisable to go beyond that. Get it now on your bench or two tables, solid. As you have to plane off your eight corners to get it as round as possible, always remember, when nailing, to have your nails in the centre of your battens, or you will not be able to plane it round, let alone spoiling the plane. When you have worked it round and "smoothly" as you can get it, make some strips of canvas, about 2 in. wide and 6 ft. long. Commence at one end of your roller by first well gluing it all round for about 18 in.; take a strip of canvas, hold it slanting ways, and roll it round, just allowing the canvas to touch the edge of each turn. When you have got as far as you have glued, go on the same as before; and when you have finished, well rub down with a wet rag, the same way as explained in the making of "Profile" (see No. 140, Vol. III.).

Now for roller No. 3. This may be made to any size or length. Columns are made in the same way for large buildings on the stage, either interior or exterior, which must be light in structure, one man often having to carry one on and off the stage, where the scene has to be shifted quickly. The first thing is to prepare the cores, the diameter varying according to the size of your tumbler or roller. They are made of elm or beech.

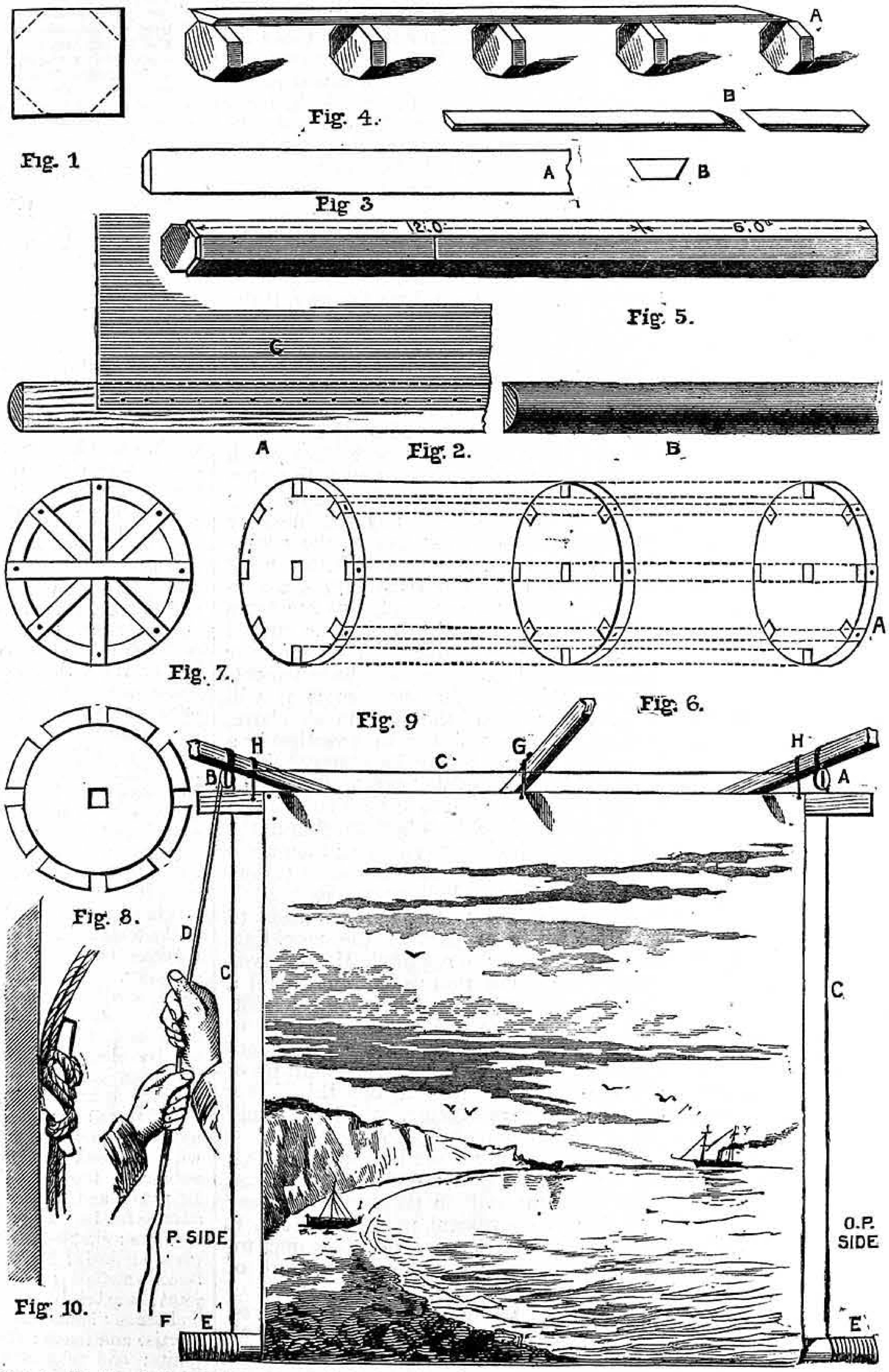


Fig. 1.—Mode of shaping Octagonal Block. Fig. 2.—Rounded Roller cut in two, with Cloth (C) tacked on Part A before replacing Part B. Fig. 3.—Lath with Edges bevelled to fit on Side of Octagonal Block. Fig. 4.—Lath with End bevelled at A for Overlap by next Lath, as at B, nailed along Series of Octagonal Blocks. Fig. 5.—Laths tacked to Blocks so as to break Joints. Fig. 6.—Skeleton View of Large Circular Roller. Fig. 7.—End, etc., formed by nailing Laths to Ring. Fig. 8.—Disc notched to receive Laths. Fig. 9.—Method of Roping a Roller. Fig. 10.—Cleat for securing Rope.

The way to get Roller out. — You must not have the piece of wood less than 1 in. thick. We will suppose the roller to be 9 in. in diameter. Square out a piece of $9\frac{1}{2}$ in. with your compasses, strike a circle 9 in. in diameter, and saw this all round: this is the solid disc or core. Should the laths or battens you are using to make the skeleton of (see Fig. 6) be 1 in. square, strike another circle on the core, 1 in. from the edge (see Fig. 7). Now divide the core into as many parts as you intend the skeleton should be made—that is, as many battens as you intend should form the circle to carry the outer skin or covering of profile. Now at the corner of each square, bore a hole either with gimlet or centre-piece, large enough to receive your profile saw (see Fig. 7). Cut out all the squares. These square-cut holes, as you no doubt see by this time, are to receive the inch square battens (see dotted lines, Fig. 6). You will want a core about every two or three feet, according to the size of the roller you are making. When you have ascertained that, and made them all, you commence putting your roller together. You must divide your battens, as explained in Fig. 5, in the making of roller No. 2; and where they join, dovetail them together (bevel on B, Fig. 4).

Fig. 8 represents the core when cut and finished. The square hole in the centre is for the purpose of a batten passing through the whole of the cores. In fitting the battens into the cores, use your glue brush, putting a fine inch and a half nail through the battens to the core (A, Fig. 6). We will now suppose the skeleton complete, and ready for the outer covering of profile. The profile boards are laid on, and bent round to the skeleton. To do this, you must lay the board flat on your bench, and make a chalk line, about 2 in. apart—that is, divide the board its whole length, commencing 2 in. from either side. A 9 in. board might have four lines. Take your tenon saw and cut about half through the board, covering the whole of the lines. You will see now that you can bend the boards round easy enough. Have a good straight-edge to your boards, so that they may butt well together. Mark your first board where the cores are, so that you may know well where to nail to in the finishing. Should the profile boards be stout, you must have more cuts in them, or the roller would not be round. You may cover the joins of the profile with a strip of canvas, well rubbed down.

How to Rope a Roller.—To the amateur this is a difficult thing to do. We will suppose you were about fixing a cloth 18 ft. wide and 20 ft. high to the rafters. Forty-eight yards of rope would be required, one double and one single block. Fig. 9, A, is the single block; B the double block; C, C, C are the ropes attached to the roller running through the blocks to the hands at D, which part we call the fall, because as you haul the scene or cloth up, the ropes pass through the hands and it falls to the ground. When the cloth is right up, the ropes are fastened off on a belaying-pin or cleat (see Fig. 10), fixed to any convenient spot opposite the cloth, and clear of the head. It is usual to have them arranged in a row, where two or more cloths are hung together. The rope is attached to the roller either by a staple driven in the end of the roller at E E, the rope being passed through, and a firm knot tied in the end to prevent its slipping through, or the ends are nailed with clout nails, about 1 in. When the rope is fixed, it must be passed round the front of the roller, so that the part C is always at the back. We have the rope forty-eight yards long. First fasten at E, O.P. side: pass the other end through the single block, A, taking it through the back sheaf of the double block, B; then pass the end through the front sheaf of block B, and fasten it on the roller, E, P. side. Put about fourteen turns round the roller at each end, pull up, and when it goes all right, having two turns on the roller when it is up, roll up and down two or three times. To make sure, you may cut the rope at F, which will keep the coiling out of the ropes, allowing it to work right. G is the centre deadline, helping to keep the cloth straight, and free from bagginess. H, H are the two side deadlines. By the term "deadlines" is meant all lines that are fixed and do not work.

To the reader who may not know, I will explain what a profile saw is. You purchase the handle, which has two screws in it to hold the saw, and insert a saw blade at pleasure. The saws are very narrow, after the style of a keyhole saw, or compass saw, and cost about 3d. each. Of course, the handle will last for years; it costs about 2s.

SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

WORK INVOLVING CURVED LINES.

HITHERTO we have considered work with straight lines only, except the stuck or added decoration of mouldings.

We will now try to combine curved lines with the straight ones. The simplest form of curved surfaces presents itself in those cases where the larger surfaces are flat, but the edges are cut in various curved lines. Many examples can be seen in legs of forms and stools, wrought barge-boards, finials, ornaments for staircases, pierced and shaped balusters, canopy boards, the shaped legs of console tables, etc.

However these are cut when large numbers are required, the amateur will cut those he wants with either the bow saw or a compass saw. Now, the use of the bow saw depends on one very simple condition, which, however, is not easy to obey. The saw should be held so that its blade is at right angles to the board being cut. It is difficult to explain how this can be done, but consideration will prove that it is, and must be, the condition of accurate sawing. It may be needful to use the saw somewhat higher than is usual in wood fixed in the bench-screw, but some little practice will soon show the way, if the practice is combined with an effort to do the best, and a knowledge of the conditions to be observed. Sometimes it is difficult to see the line, because the saw is in the line of vision. In that case, shift the position of the wood. The cleaning-off of these curved edges will be done with a spokeshave, which should be kept sharp, and used with a constant reference to the most favourable way of the grain. Whenever any roughness or tearing results from the use of the spokeshave, reverse the action, and better work may be expected. For large curves, a compass-plane may be procured, but amateurs will not generally need it. Other curved work likely to be required by an amateur include shaped mouldings for the ornamenting of cabinets. In such cases it will be best to cut out the outline as above, making the joints either in a vertical or a horizontal plane, as may be required, and, by the aid of a template, cut to the profile of the moulding; carve it with chisels and gouges, using the chisels first to obtain the members which chisels can form; then those that need a gouge—hollow curves; then chisels to melt the hollows, where needed, into rounds; finally using scrapers made to suit the whole or part of the moulding, according to the size required. Many curved forms are made of thin wood bent round a strong-shaped mould. These offer a difficulty that is more one of method than of workmanship. Curved work is sometimes—indeed, I may say frequently—built up of pieces of segmental form, but this chiefly occurs in pattern-making, which is rather out of the amateur's province.

Thus in making a semi-circular heading, say to a wooden garden arch, or the arched entrance to a trellised porch, the amateur will find it convenient possibly to form it out of three thicknesses of wood, put together as segments of circles instead of sawing it out of the solid.

Mouldings can often be bent round curved edges, sometimes without, but often with the aid of sawing. This sawing is needful only when the curve is of small radius, or the moulding is thick. Instances can often be seen in staircases, on the edge of the skirting next the wall, and particularly in the case of winding stairs. When these saw-kerfs are necessary, glue should also be used, as well as fine nails or brads.

I do not think I have said that the spokeshave must be sharpened entirely on the inner edge, which is inconvenient but obligatory—inconvenient because of the two tangs which hold the blade in the handle; obligatory because the flat outer side of the blade forms the guiding surface of the tool, and therefore should not have its accuracy diminished by the use of the oilstone.

OUR GUIDE TO GOOD THINGS.

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

115.—MANUAL INSTRUCTION IN WOOD.

THE work before me purports to be "A First Year's Course of Manual Instruction in Wood," arranged for the use of teachers and pupils of elementary schools, by Joseph H. Judd, Member of the Institution of Mechanical Engineers (M.Inst.M.E.), and Head Master of the Brighton Technical and Manual Instruction School. It is illustrated with numerous engravings of tools and technical procedure in wood-working, and contains a useful appendix in the form of "Lecture Notes on Soft Woods in Common Use."

A glance through this pamphlet, which, I think, would have been better and more comfortable to handle had it been produced in ordinary book form and not in the shape of a small, oblong drawing-book, is certainly all that its author claims for it, and may be regarded as carrying out the principle embodied in it, and its general aim and scope—namely, that of a first year's course in wood-working—in a most satisfactory and efficient manner, and is none too much for any conscientious and intelligent student to accomplish in the first twelve months of his training, provided that he has the will and time to obtain sufficient practice in each lesson before he proceeds to that which immediately succeeds it. The exercises, so called, are twenty-four in number, and the first deals with the use of the two-foot rule for drawing and marking off material. The exercises, it should be said, are mostly in three parts—namely, (1) Introduction; (2) Description of Tools; and (3) Instructions. Exercises 2 to 6 inclusive are devoted to "sawing to a line" (along the grain), and the use of various tools that are chiefly used by the beginner, thus making him acquainted with the nature and uses of the tools he has to deal with, and what is to be done by their aid. The remainder of the exercises, from No. 7 to No. 24, is devoted to a consideration of the various modes of jointing, and includes many that may never have been heard of by some of our amateur wood-workers, and which have certainly not yet been touched on in the pages of WORK. For the benefit of my readers I will append a list of these exercises, so that if any of them are unknown to them, they may supply themselves with the book itself, which is published by the author at the Technical School, York Place, Brighton, and is sent by him post free to any address for 1s. To return to the joints described, they are: simple halving joint; dovetail halving (first method); half-lap joint; dovetail halving (second method); notching; cogging joint; bridle joint; stop bridle; oblique bridle; simple mortise and tenon; haunched mortise and tenon; oblique mortise and tenon; tuck tenon; bevel and mitre joints; and rebated and stop-chamfered frame with combination bridle and mitre joints. The method adopted in describing each mode of jointing is particularly good, and runs in this manner: Firstly, the application of the joint is shown, and the purposes for which it is adapted, and the uses to which it is put in practical work; then instructions for making the joint itself are given in due order, enumerating the various steps to be taken in due order from the beginning of the work to its finish. Thirdly, an equally useful step is taken in recapitulating these operations very briefly in due order of procedure, so as to give, as it were, a bird's-eye view of the whole in tabulated form; and lastly, a list is given of the various tools required and used in the construction of the joint under consideration. Mr. Judd's book is undoubtedly a good one. THE EDITOR.

SHOP:

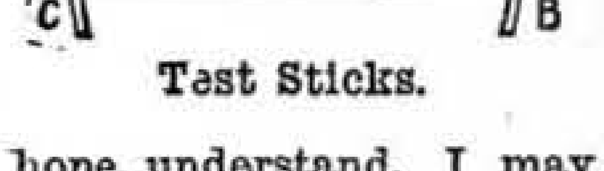
A CORNER FOR THOSE WHO WANT TO TALK IT.

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

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given.*

I.—LETTERS FROM CORRESPONDENTS.

Short Lessons in Wood-working.—J. C. K. (*London, N.W.*) writes:—"In column 2, line 15, p. 567, No. 140, Mr. Baxter says, 'See that these are parallel.' The pieces or their position when placed in relation to each other? 'These pieces are to be placed across the work, one at each end,' etc., as below probably. If placed by hazard a little oblique to right angles to piece A, the 'winding sticks,' C, B, may show truth, yet A may be 'winding.' How about the middle of A at O? this must be tested as well as the ends."—[The words "see that they are parallel" refers to the winding strips. If my polite critic reads the sentences before the words quoted, he will, I hope, understand. I may be allowed to humbly point out that the effort to plane two pieces so as to agree is advised, and precedes the mention of the winding sticks in my paper. J. C. K. may be informed that it is just possible that two surfaces agree, and yet neither be perfectly flat. The winding sticks are introduced as another step in the beginner's effort to attain the mastery of the plane. "The pieces are to be placed across the work at each end." J. C. K. may, if he chooses, use a try-square to test the exactitude of the position of the winding strips; then when he views them they will not appear foreshortened, and the test will be *slightly* more decisive, but the accidental deviation from a correct position will not matter to the young beginner. I take the word *across* to mean roughly at something near right angles, or to include such a meaning. J. C. K. ought to have read the whole of the short lesson, and he would have found—"When some facility has been obtained, the blade of a 12 in. square or a straight-edge should be employed to test the accuracy or the want of it." I think this is sufficient for a beginner, if not for a critic.—B. A. B.]



Test Sticks.

Spots for Emigrants.—DISGUSTED writes:—"For some time past I have been turning over in my mind whether I should not resort to emigration with the view to obtaining more regular work and better wages than are open to me in the old country. My chief difficulty is where to go to, and it has occurred to me that much service might be rendered to many similarly placed to myself were you to open your 'Shop' columns occasionally to a few suggestions from your readers who either are already or who have been abroad, and can speak with authority on the requirements for, and prospects of, the districts they know about. The labour market of England is overstocked, and I can do better out of it, if I can get my WORK."—[If you are disgusted with the old country, you ought to emigrate, but be sure and continue your allegiance to WORK wherever you are. We shall be very pleased to have the views of our home and many foreign readers about the best spots for emigrants.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Harmonium Reeds.—GAMMA.—From what you tell us, there is nothing to be done but to put new reeds to the instrument. The old ones are evidently worn out, and do not offer that resistance to the air necessary to produce the sharp tone you require.—G.

Ornamental Carved Stools.—J. W. B. (*Huddersfield*).—Try an advertisement in WORK.

Graining and Marbling.—E. S. C. (*Gravesend*).—Your letter has been dealt with by our specialist. In case you have missed it, the name of W. Kirby, 46, Clipstone Street, Great Portland Street, London, is known to us as a good grainer and marbler. You had better question him yourself as to whether he teaches the art.

Drinking Flask.—J. J. (*Trealaw*).—We cannot give the maker of this a free advertisement in WORK by quoting his address. Any stamped letter shall be forwarded.

Camphor Black.—WORKITE.—Camphor black is not mentioned in the leading colourmen's lists in London. It was doubtless derived from a French or American list as a term to signify superior black pigment. To kill the yellow tinge in clay, blue, not black, is used to be most effective.—J. C. K.

Softening Dressed Rabbit Skins.—ALLEN.—You can render them soft by rubbing. If, as you say, they are now so hard as to be liable to crack, you can make them more mellow by first rolling in a damp cloth. Draw them backwards and forwards over a blunt metal edge, such as a door scraper or through the handle of a drawer. The softening may be helped by working some mellowing substance into the skin, such as soft soap, grease, or oil. Kid skins are softened for glove making, by saturating with yolk of egg, and then drawing them to and fro over a blunt knife. The skins brought from South Africa owe their exquisite softness entirely to patient rubbing between the hands of native women. You propose buying the back numbers of WORK. In them you will find information on this subject in various places, notably in Vol. II., pp. 294 and 830 (Nos. 70 and 104).—M. M.

Pantograph.—G. H. (*London, W.*).—A description of this appeared in WORK, No. 42.

An Artist's Studio Easel.—D. S. R. (*Cambuslang*).—This subject was treated in No. 143 of WORK.

Window Frame.—LEARNER.—Window-frame making has been treated in WORK, Nos. 135 and 139. Buy the numbers of your bookseller.

Battery for Medical Coil.—C. B. (*Old Street*).—The exciting paste in your dry battery was probably a paste of sulphate of mercury. If you clean the zinc and carbon rods and the cell, and recharge it with this paste on blotting-paper, the battery may be restored and put in working order. The Electric Stores Co., Cannon Street, E.C., have now some good things in the way of dry batteries, some of which are very small and powerful, and would, I think, just suit your small coil. I am glad to hear of your success with electric bells made from directions given in WORK, and also your achievement with a coil made from bits of information picked up in "Shop." You will be interested in knowing that something better in the way of coils is in the Editor's hands. The superiority of the pictures in WORK over those of some other journals is due to the fact that Messrs. Cassell & Co. have an art department, employing skilled artists and engravers, who work up authors' rough drawings into a presentable form before they are published in WORK. The journal you name merely transfers a copy of a rough sketch to a zinc plate, and prints a *facsimile* of a contributor's rough drawing, hence the scrawls of which you complain.—G. E. B.

Electric Belts.—C. V. (*Bristol*).—I think the flexible wire cords should be soldered to the insides of the zinc discs. If put on the outsides, they would, as you remark, be liable to chafe the skin, and this must be avoided by all means. It would be an advantage to have two or three rows of discs in the width of a belt, but the discs should be small to avoid overweight of the belt. The number of discs is immaterial—about a dozen in a row, divided into four sections of three in each section, would be enough. Connect them by flexible wire cord, not by wires only. A great interest is being taken in this subject just now, and several persons have written to tell of the benefit they have derived from wearing these belts.—G. E. B.

Medical Battery.—J. R. (*Glasgow*).—I suspect you mean a medical coil, although you have asked for a medical battery. Any galvanic battery will serve as a medical battery if you have cells enough in series to generate the necessary pressure or E.M.F. to send the current through a body. This may be done with a small medical coil and one cell of a battery, so I suspect you want a coil. I have not space at my command here to describe one, but there is a series of articles on the subject in the Editor's hands, and a full description of such a coil appears therein.—G. E. B.

Electric Belt.—N. S. (*Cambridge*).—So many different electric belts have been and are advertised that I am unable to say how the belt is made to which you refer, as you only give the price of the belt as a clue for my guidance. I have seen several methods of making these belts, and all agree in the material employed for the couples. These are discs, plates, or strips of zinc opposed to discs, plates, or strips of copper. Discs of metal from the size of a penny to that of a crown are generally employed in preference to plates or strips. In some belts the two discs are riveted together through the belt, with the zinc discs inside. In another form they are linked together by links passing through the belt. In another, the row of copper discs on the outside is made to overlap the edges of the zinc discs inside, and the two are connected by clasps on opposite edges. In some the rows run up and down across the width of the belt; in others the discs form parallel rows running the length of the belt; in others the rows are grouped as shown in your sketch. When grouped as shown in your sketch, the generated current will not pass around the body. The zinc discs must be inside next a flannel protection, and separated from the copper discs by thin flannel. The zinc of one couple must be connected to the copper of the next, and this is done by means of flexible wire cord soldered to the discs. There has been much about these belts in the third volume of WORK. Kindly get the index about to be published and search for yourself.—G. E. B.

Coupling Transformers.—NED.—As you have a spare transformer of the "same size and make" as that now in use, your course is quite clear. Couple the two transformers in parallel, and take current from both for your incandescent lamps. There need be no fear of burning anything up, as transformers of the "same size and make" are destined to run in parallel, and, therefore, do not differ in the direction of the winding. If you cannot determine how a transformer is wound by examining the wires and connections, you may do so by noting the direction of the induced current. If this differs from that of its companion, then it is probably wound in an opposite direction, always presuming that you connect both to the source of current by the right terminals. If you find the current from the second transformer going in the wrong direction, alter the connections and send the direct current from the dynamo in the opposite direction. But if you are going to supply current to a new set of lamps in another circuit, the direction of the induced current need not be taken into consideration, since incandescent lamps will burn equally well when the current is sent through them in either direction. There will be no difficulty whatever in connecting the voltmeter to them by means of branch circuits controlled by switches. Merely put in a looped circuit as for an extra lamp, and have a switch in the circuit in the ordinary way. The pressure will be the same in all branches of the same circuit.—G. E. B.

Enamelling Electro-Plate.—E. A. (*Sheffield*).—I think you must mean lacquering electro-plated articles, not enamelling, since the process of enamelling proper would injure the electro-plated surface. Electro-plated surfaces are protected from injury by giving them a coat of transparent lacquer. This may be tinted with aniline dye to any colour, and the coat will then resemble enamel. I have found the transparent lacquer named Kristaline, sold by Messrs. J. E. Hartley & Sons, a very good lacquer for the purpose. It may be applied with a soft varnish brush on the previously warmed electro-plated goods, or these may be dipped in the lacquer, then hung up in a dust-proof closet, heated to 90° Fahr., to drain and dry. Electro-plate thus protected is almost untarnishable, and may be exposed to the fumes of gas or damp sea air without "going off colour."—G. E. B.

Recharging Electric Bell Battery.—OLD BOAT.—From your description of the battery I infer it to be a Leclanché battery. The inner cells are of porous earthenware, filled with a mixture of manganese and carbon pebbles packed closely around a central plate of carbon. The glass cells are to be charged with a saturated solution of sal-ammoniac—that is, as much sal-ammoniac as will dissolve in enough rain-water to nearly fill the cells. This will take nearly ½ lb. of sal-ammoniac, and will cost about 6d. First fill up the jars with warm water, and add about a tablespoonful of spirits of salts to each. Allow the porous cells and zincs to soak in this for half an hour, then brush them with a hard brush, and rinse in clean warm water. Clean the screws with emery-cloth, and clean the ends of the wires from the zincs, so as to have clean wires clipped by clean screws. Connect the zinc in one cell to the screw of the carbon in the next cell, and connect the zinc of this cell to the bell wire. The other bell wire will go to the carbon in the other cell. Charge the cells to within 1 in. of their tops with the mixture of sal-ammoniac and water mentioned above. The stuff may be got from a druggist, or a drysalter, or an oil-and-colour shop.—G. E. B.

Consumption of Steam.—G. B. (*Armadale Station*).—We are unable to give our correspondent the information he seeks, inasmuch as he does not furnish us with the two most important points needed to enable us to ascertain the facts, and these are—first, how far the steam is allowed to follow the piston in the cylinder before it is shut off from the boiler—*i.e.*, what is technically termed the point of cut-off; and next the number of strokes per minute in the single-acting engine, and the number of revolutions per minute in the other, and whether there are one or two cylinders to this engine. When we have these particulars, we shall be happy to settle the question.—C. E.

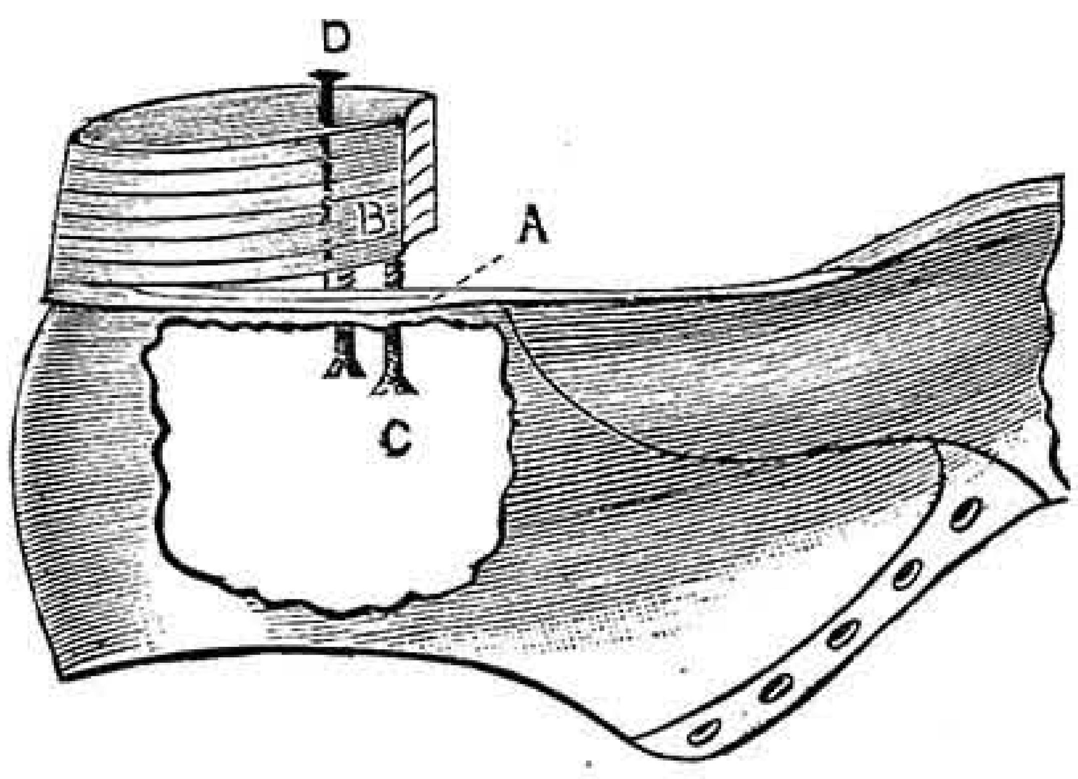
Compressed Air Engines.—SEMPER FIDELIS.—It is only for special purposes, where a very light motor is required, or work done in places difficult of access—as in mines and tunnels—that compressed air can be recommended for conveying power. The original power is supplied by an air compressor, and the air becomes heated when compressed; the heat thus generated, in part or entirely, passes away in waste by radiation. You can no doubt compress air by a windmill working air compressors, but it would be far more economical to store the power by pumping water into an accumulator and drive your lathe or other machine by an ordinary hydraulic engine. An air compressor for high pressure is not easy of construction except by a specialist. On this subject I think you might get information from Messrs. John Fowler & Co., Leeds. For particulars of hydraulic engines you might apply to Messrs. Tangye & Co., Birmingham.—F. C.

Roller for Mangle.—AMATEUR TURNER.—Any wood turner would supply you with this; or write to any maker of mangles—Kent & Co., High Holborn, London, or Harper Twelvetrees, Finsbury Square, London.

Lathe Wheel.—GAMMA.—Your best plan would be to sell the weights, and buy a metal wheel with the proceeds. I sometimes get cast-iron mowing-machine wheels for 1s. or 1s. 6d. If you had a small wooden cart-wheel, you could weight its rim by boring holes at intervals and pouring melted lead in. Whether you could beat the clock-weights into shape depends upon their present form, but probably not. It would be much easier to melt the lead and cast it in a mould.—SELF-HELPER.

Hand Saw.—DOBRA.—Your question in reference to grinding a hand saw at home rather surprises me, as the simplest form of grinding machine would cost a deal more than a good hand saw; therefore it would not pay you to erect such a machine merely to grind one saw. It would be far better for you to purchase a saw of the thickness you require. A saw may be ground thinner by placing it between two grindstones, each stone revolved in an opposite direction, the stones being revolved by toothed wheels. But even such a simple device would cost you more than several new hand saws; and after the saw had been ground it would require glazing to give it a fine surface. This would add to the cost. My advice to you is to abandon the idea of grinding your hand saw thinner.—A. R.

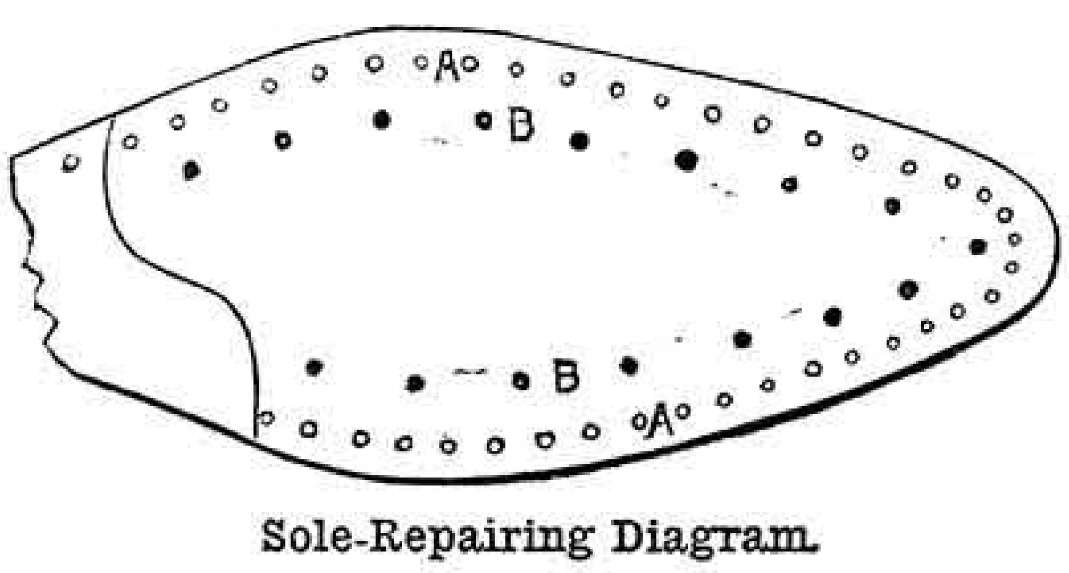
Repairing Heels.—J. B. (*Dalton-in-Furness*).—By what I can glean from your question I see no reason why you should take the heel down and re-build it. It is not quite your fault, for it should not have given way there unless you knocked it about without regarding it as a shoe. But the best thing to do now is to bore two holes, each large enough to admit of a screw passing through, as at A in the



Heel-Repairing Diagram.

figure, and then make two small holes at B, just as a lead for the screws, which can be about ¾ in. or 1 in. long. Now screw the two well into the heel from the inside, as at C; then put it on the iron foot, and drive a long French nail in from the top just behind the screws, as at D, and I think you will then find the heel as solid as it was at first. Perhaps you may, by putting in another screw, be able to dispense with the nail. If so, so much the better, as nothing can then be seen of the job from the outside.—W. G.

Repairing Shoes.—J. B. (*Dalton-in-Furness*).—You say you have soled a pair of shoes, and when you were taking off the old sole the under one came away. This being so, you should not have soled it until you had first repaired the damage you had done, which should have been rectified in the following manner:—If you are repairing on an iron last, or an iron-bottom last, hammer the middle sole (the under one) back into its place, first taking out all the old nails; then, supposing the line A A in the figure to be the place where the rivets will pass through the middle sole when you have put the sole on, put a few short rivets or long tingles, according to the sub-



Sole-Repairing Diagram.

stance of the bottom, in through the line B B. These dots show pretty well where the tingles should be put. They should only just be long enough to clench on the bottom of the last. If you are repairing on wooden lasts, when this is being done you must take them off and slip them on the iron foot to clench them, for they must be clenched before the new sole is put on. When you are putting the new sole on and patting in the rivets, put an extra long one in here and there, say an inch apart, and these just long enough to clench through the whole—that is, the new sole, middle sole, tops, inner sole, etc. The long rivets should be brass, so that when the shoe is soled again these will draw out with the thin old sole, and not disturb the middle sole again in so doing.—W. G.

WORK in the Antipodes.—REV. E. C. I. (*Kyneton, Australia*).—Glad to hear that WORK reaches you so promptly. As to your promising wood-carving pupil, Brocket, you cannot do better than write to Mr. G. A. Rogers, Wood-Carving School, Maddox Street, London, or Mr. Hemms (wood carver), of Exeter, England. We shall be very pleased to see the specimens of the work done at your school.—ED.

Power of Model Engine, etc.—A. H. (*Bridgeton*).—The power of your engine you can reckon yourself if you will read the explanation on p. 24 of the present volume. I cannot put it any plainer. The area of 1¼ in. is 1·2 sq. in., and the area of 1½ in. is 1·76. Say you have 50 lb. pressure in boiler and an average of 40 lb. per square inch on the piston:—Area of 1¼ piston=1·2 sq. in.; area of 1½ piston=1·767 sq. in.; 1·2 × 40 = 48 lb. on 1¼ piston; 1·767 × 40 = 70·68 lb. on 1½ piston. Now for speed, you can take 200 revolutions; piston moves 5 in. at each revolution, and 5 × 200 = 1,000 in. = 83 ft. per minute moved by piston; 83 × 48 lb. = 3,984 foot-lb.; 83 × 70 lb. = 5,810 foot-lb. Thus 1¼ diameter may give one-man power, and 1½ diameter half as much again.

Hot-Air Engine.—F. F. (*Homeland, Polk County, Florida, U.S.A.*).—Your letter has been forwarded.

Barometer.—W. B. R. (*Westbury*).—It is not possible, by the method you suggest, to construct a barometer using either glycerine or any other liquid except mercury. The diameter of the tube does not in any way enter into the question. The same height of column would be required whether the tube were $\frac{1}{100}$ in. or 100 ft. bore. As the specific gravity of pure glycerine is about 1·2, the length of the tube must be at least 30 ft. Of course this is out of the question for an amateur. In order to make a satisfactory mercury barometer, so many precautions have to be taken that I should advise W. B. R. to either refrain from attempting the manufacture of one or else to purchase one direct from the makers, who have every facility for the process.—J. G. L.

Nozzle for Water Motor.—R. R. T. (*Frome*).—If you have a supply pipe running full, there is no reason why you should not use a nozzle ¾ in. diameter. It would be an advantage to make the floats concave towards the jet, so that its pressure may be always normal. The running would certainly be improved by the introduction of a fly-wheel. You do not mention the length of pipe through which the water flows, so it is not easy to determine the power; but if you have a pressure of 150 feet, and only a short delivery pipe, the discharge through a ¾ in. adjutage will be about 90 gallons per minute: so the work done by the water would be 90 × 10 lbs. per gall. × 150 ft. fall = 135,000 foot-lbs. per minute. The form of motor used might give an efficiency of 33 per cent., or 45,000 foot-lbs. per minute. The corresponding horse-power is 45,000 ÷ 33,000 = 1·37 h.-p. nearly.—F. C.

Wire Gongs.—VERY ANXIOUS.—Of the making of these I have had no chance of observation or knowledge. Therefore, rather than lead you astray, I will ask those readers who possess the information to respond as promptly and generously as did those who replied to a query concerning mole-traps, which was as equally a puzzle to me. A set of deep-sounding chimes as fitted to American clocks is what particulars are desired of.—J. S.

Venetian Iron-work.—T. M. M. (*Bristol*).—As far as I know, W. Whiteley, Westbourne Grove, W., is the only firm which keeps in stock the iron strips used for Venetian iron-work. At the builders' counter in the ironmongery department of this business, you can obtain everything connected with this style of work. The strips are to be got ¼ in., $\frac{3}{16}$ in., and ½ in. in width—any other width to order—and they are 18 in. or 24 in. in length. They are sold by weight, the price being 10d. per lb. The necessary tools can also be got there; those sufficient for beginners can be purchased for some few shillings. They consist of one pair of flat snips, one pair of 4½ in. flat-nose pliers, one pair of 5 in. flat-nose pliers, one pair of 4½ in. round-nose pliers, and one pair of 5 in. round-nose pliers. Iron wire for attaching is 8d. per lb. I feel quite sure that if you write to this firm, they will forward you all the materials necessary for your work. If you should, after all, prefer to buy the goods personally, I think you can order the strips from any ironmonger's, but it will always take some few days before you will get them. The strips are mainly cut from large sheets of iron in "24-wire gauge quality," as the technical term is; each sheet is 6 ft. by 2 ft., and the weight is about 12 lb. As you will see, there can be cut two gross of strips, ½ in. wide, 24 in. long, out of one sheet, the price thus being ½d. for each strip. The black used for iron-work is Berlin black; it is kept by all ironmongers: it is to be applied after the work is finished, usually in one, sometimes in two, coats.—J. N.

Weather-Glass Tube.—BAROMETER, YOUNG AMATEUR, and OTHERS.—The reason for using such a long tube is twofold. (1) If a short length of tube, say 3 ft., be used, there is always a liability of an overflow when the barometer is unusually low (*high*, of course, in the glycerine barometer). (2) I gave 4 ft. as the length of tube, as this is a usual size; and by using this size a little latitude in the size of the bottle is allowed. One correspondent states that he cannot get the glycerine to rise more than 12 in. In reply, I may say that if this happened with an instrument made according to my instructions, the reason will probably be found in one of two things: either the barometer (mercury) was unusually high—and hence the air in the bottle was unusually compressed—or, as I think more probable, some mistake has been made in the construction: possibly in the size of the bottle. In reply to those correspondents who ask where glass tubes may be purchased, I may say, as I have already said, of any scientific instrument dealer, or, in default of these, Reynolds & Branson, Commercial Street, Leeds, or Messrs. Philip Harris & Co., Bull Ring, Birmingham.—H. L.

Incubator.—F. H. (*Finchley*).—It is a matter of choice whether evaporating tray should be fixed to centre frames or not. It is not absolutely necessary, but if desired it can be so fixed by a couple of lugs or ears soldered to bottom of tray. As the lamp flue forms part of the evaporating tray, it must be fixed to it with hard solder, as stated in the article. The radiating disc need not be fixed. It is better if loose and laid between the arms of tripod, which should be shaped as Fig. 1 herewith, and which should grip the disc tightly. The lines in drawings on p. 609 are somewhat blurred and do not show this clearly. There is no sheet of metal over centre frames, as is clearly shown by reference to Fig. 3, p. 609. How is regulator to be fixed? This is a matter I quite overlooked. It should be fixed with a small metal strap, as shown by Fig. 2 herewith, the straight parts being slotted to slip over screws (round-headed) inserted in centre frames for the

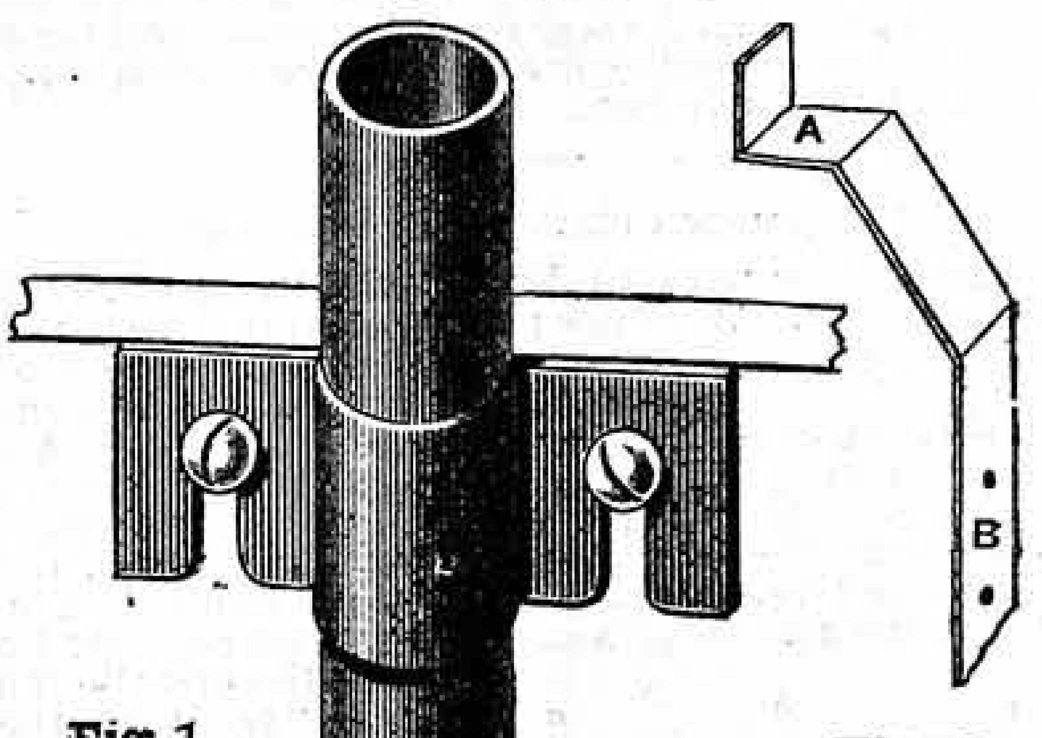


Fig. 1. Fig. 2.

Incubator. Fig. 1.—Clip or Strap for fixing Regulator Tube. Fig. 2.—Arm of Tripod Head to Lamp Flue—A, Flat Portion for Disc to rest on; B, Rivet Holes.

purpose. The hole in perforated zinc will fix the short limb. If the strap does not quite fit the long limb, a chip of wood pushed in behind the glass will make all secure. The float or plunger may be turned out of bone or ivory, or may be a cork nicely fitted, but if the latter is used, take care it does not get wet, or it will swell and bend in the tube. The former is the best, and it should be about ¾ in. long, and fit the tube without any play. P.S.—In reply to your second letter, please allow us breathing time. There is great pressure on "Shop," and each reply has to take its turn. Were it not so, it is a little unreasonable to expect an answer within a week, and in your case a diagram has to be drawn and engraved. Other correspondents please note.—LEGHORN.

Microscopes.—CANTAB has asked three very definite questions:—(1) "A short description how to mount object glass for microscope?" If you are purposing to use a good object-glass, I advise you to buy it mounted in its cell, and do not attempt to mount a good one yourself, as they are costly things. There will be a thread chased on the cell; a corresponding thread must be chased in the nose-piece. Supposing, however, you intend to experiment with a low-price lens, it might be worth your while to mount it. Fig. 1 is perhaps the simplest plan. A little cell is made to take the lens, which screws on to the nose-piece. Fig. 2 is a better plan, but more difficult, perhaps. (2) "The difference between the eye-pieces known as A, B, C?" The

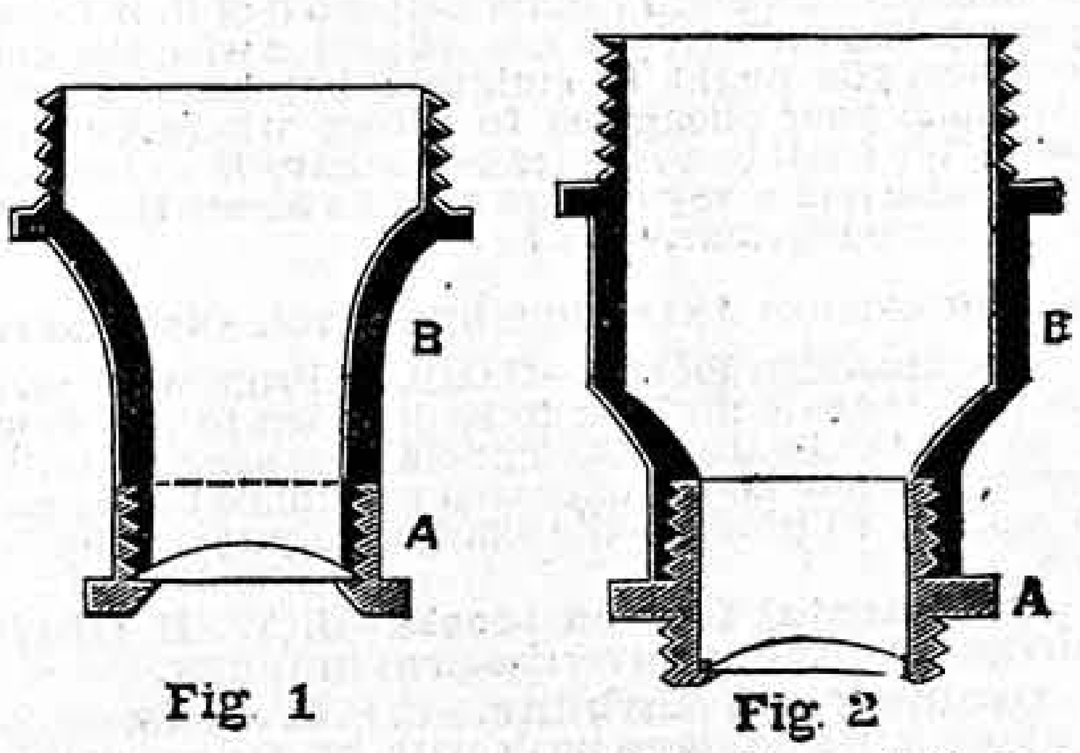


Fig 1 Fig 2

Microscopic Object-Glasses. Fig. 1.—A, Cell containing Lens; B, Nose-Piece screwed into Cell, retaining it in its place. Fig. 2.—A, Cell with the Lens bezelled; B, Projecting End of Cell carries a thread to carry a doublet or treblet.

difference is simply one of magnifying power. There is no absolute measurement, as the power of an eye-piece all depends on the length of the power tube. The difference is only relatively. The optician who supplies you with the lens would, if desired, supply different powers. (3) "When may we expect the promised article on Eye-pieces?" In this matter I can only say the Editor is supreme, and he alone knows. Many others have asked the same question. I have no doubt at the proper time it will be forthcoming. I am pleased to know you are working from my design. I have heard from several correspondents who have done so, and it has gratified me to learn that they have succeeded, and are pleased with the results.—O. B.

Amateur Mechanical Dentistry.—S. E. (*Camberwell*).—First as to taking the impression and procuring model. To replace natural teeth that have been extracted with artificial teeth, supposing time has been allowed for the gums to heal, the mode of procedure would be thus:—Procure a variety of impression trays, also composition and pure beeswax, to be obtained at the dental depôts. Having found a tray to fit the mouth accurately, whether it be for upper or lower, you take a portion of composition or wax and soften it by placing in hot water. Be careful not to put any more composition in the tray than you want for your impression. When it has become sufficiently soft, take it and knead it well in the palm of the hand, after which, while it is soft, you shape it to fit the tray; and having placed it round the tray, you convey to the mouth of patient. If for the upper, you press well up, for the lower well down, taking great care that your tray is quite square and level in the mouth. Hold it in this position till the composition has become hard; then be very careful in withdrawing it, which must be done by raising the tray slightly by the handle, to allow air to find its way at the back of the palate, when it can be readily withdrawn. This requires great care, otherwise it will drag and give a false impression. In taking this impression it is necessary that it should be correct, for what your impression is so will your work be when finished. This accuracy can only be obtained by constant practice. Supposing our impression to be correct, we then have to get a model from it. We take plaster of Paris, the best to be obtained at the dental depôts, and mix with water a little thicker than the consistency of cream, taking care to mix well to avoid air bubbles. We then pour into the impression sufficient to fill the tray. The remainder that is left in the vessel is mixed quickly with an addition of plaster, and is then placed on a flat surface to about the thickness of your tray; then take your tray and turn it over, so that the plaster may unite. When it has remained so for twenty minutes, you may trim round with a knife all superfluous plaster beyond the tray. When it has become quite hard, you may take it from the board, which it will readily leave by tapping the board, and place it in hot water. Let it remain until your composition has become quite soft, take it out, and the composition will leave the model readily; then you have a correct model, providing your impression is perfect. This procedure is precisely the same for plate work, only that your model must be made deeper. Supposing our model to be correct, and we have to make a partial upper case in vulcanite, we then have to obtain a correct bite. This may be done by taking impressions of both upper and lower jaws, and obtaining models from each. We now want to put, say, five teeth in the upper jaw. We now take some composition, made soft by placing it in hot water, and stretched to the thickness you will require your vulcanite to be, and pressed well into your model, exactly where you require the vulcanite. Then take toughened wax, made so by adding gum mastic, say two ounces and a-half to one pound of beeswax, with a little whiting added, melted together, and poured on a plate or other flat surface, previously made moist, or the wax will stick. When set, take pieces and warm them and fill in places on model where you intend the artificial teeth to be, taking care that the wax adheres firmly to composition already on model, having previously shaken a little French chalk all over the model to prevent the wax sticking. In some cases bonds or clasps are required, but we take it for granted that the present case is to be kept up by suction. Now take composition and wax combined off the model, and slightly warm wax only, either over spirit-lamp or by holding in a little hot water. You place it in the patient's mouth while wax is soft, and request the patient to bite up slowly; repeat this two or three times and carefully watch your patient's mouth and see that the lips meet with the case in the mouth without any effort whatever. Being satisfied that your bite is correct, you may then remove it carefully from the mouth, taking care not to break it, and place it on the model. Then you take your lower model and place it on the upper, when you will find that the indentations made in the wax while in the mouth will correspond with the teeth on model of lower jaw. Supposing the two models fit accurately one with the other, they are retained in that position by placing an elastic band round them both to prevent them shifting. We then mix plaster of Paris rather thick and pour on a flat surface, to about three or four inches square and about one and a-half inches thick. Having previously painted the back ends of both models over with a non-adhesive liquid, obtained at the dental depôts, to prevent adhesion, place your two models in the plaster on the board (front of mouth upwards) and allow the plaster to set, when you will be able to take them up, and with a slight tap they will separate themselves from the back. You then take away your wax and composition and obtain your artificial teeth, having taken the exact shade of your patient's teeth, and grind them to fit the gum: lathe and wheels can be obtained at dental depôts. This, also, is one of the things that requires great care and practice. Suppose we are using pin teeth, you roughen the ends of both pins and turn them outward, thus, ⌉⌈. This must be done to prevent them dragging out when in use in the patient's mouth. You then take modelling wax sufficient to fill the place of the intended vulcanite. Having warmed it, you place it on the model and press well down, when it will remain in that position. Then take your teeth and place them in the vacant spaces, at the same time watching the length of your teeth for the bite, which is seen by placing your two models together on the back. This also is very important. You then put more modelling wax round the backs of your teeth, sufficient to obscure the pins; you then trim and smooth off with modelling tools, for what your case is in the wax so it will be when finished. Your case is now ready for packing. More anon.—DENTA.

Covered Strings for Piano.—T. S. (*Bognor*)—I presume some of your strings are covered with white metal and the remainder with copper. I prefer copper-covered, as they retain their tone longer than the metal, so you may have them copper-covered throughout. I would advise you to send an inch or two of the first and last covered strings as to thickness, as well as the paper pattern, and write on the pattern fifteen single and fifteen double notes. The name of the ironmonger you require is J. and J. Goddard, ironmongers, Tottenham Court Road. You could get the strings made there if you choose. The price of covered strings fluctuates with the price of copper in the market. As a rule they are 2s. 6d. per lb. If you had described your instrument I could have told you the weight you would require. If it is a modern piano, about 4 ft. high, I should say 4½ lbs. would be heavy enough.—T. E.

Wood Imitation.—INQUIRER.—The only school that I am aware of, at which the imitation of woods and marbles is seriously taught, in London or its environment, is the establishment at Finsbury in connection with the London City Guilds. Certainly there are a few private schools—or, rather, classes held by leading marblers, etc., for learners—but the fees are usually very high. I believe—and I speak from some knowledge and experience—that much more can be done by home study and practice in these matters than by class lessons and studies. To make the former thoroughly successful, however, these things are necessary: patient determination and continuous effort on the part of the student, and a good technical guide and samples by which to work. The former you must yourself supply, or "go under"; the latter you can get, in good value for the cost, from Vol. II. of WORK, or with every possible advantage that skill and coloured patterns can give by getting the "Art of Graining" from Manchester (see advertisement in WORK).—DECORATOR.

Keeping Brushes Moist.—S. J. G. (*London, W.C.*).—Paint brushes naturally get hard and useless if left exposed to the air with paint in the bristles, since the very property that causes the paint to dry causes this hardening. If the brushes are small and used very seldom, they should have the paint rinsed out with a little turpentine or petroleum, and then carefully washed *clean* with soap in warm water; well rinse in cold water, and then set aside to dry gradually. Don't use *soda*: it ruins the bristles; and don't use *hot* water—it dissolves the cement that holds the bristles to the handle. If the brushes are used too often for washing, the paint should be well scraped out, and then the brush stood in a vessel with sufficient water to cover the bristles, but not more than that, since the string binding the brush gets rotted. Varnish brushes you must serve exactly as those used for paint, so far as washing goes; but if they are large brushes, and required often, they must be carefully stood—not jammed—in a vessel containing raw linseed oil, instead of water as with paint brushes. Scrape water, paint, and oil well out of the brush each time it is required and done with.—F. P.

Bamboo Canes.—G. R. E. (*Crigglestone*).—Bamboo canes can be purchased in small quantities, of all sizes and dimensions, and at very reasonable rates, from Messrs. Eaton & Co., who advertise in WORK. Respecting a stain for bamboo to give a walnut colour, I think the best and easiest plan would be to purchase some good hard-drying (or "Church") oak varnish. This is a copal varnish, drying in about eight hours, and is then very hard for handling. Ordinary oak varnish does not dry sufficiently hard for articles of furniture, etc. Bamboo will not take a dye like ordinary wood; the former is not nearly so absorbent. I think, if you purchase a little—threepennyworth—of *best* burnt Turkey umber, ready ground in oil, and then mix this with the above varnish (say one pint), you will get a stain and varnish combined which will work easily, give any depth of colour according to the amount of umber used, and will dry hard and glossy.—F. P.

Tarred Wall.—RUFUS.—The proportion of hot Russian tallow to be incorporated with limewash as a coating for walls exposed to much bad weather is more a question of economy than ounces. Although 1 lb. of tallow to the gallon of wash would be sufficient for all ordinary purposes (this would be about 3 lb. to a good bucketful), double that quantity could doubtless be advantageously used in some instances; whilst 50 per cent. less than the proportion given would be sufficient to give a good, useful body to the wash. In every case the two ingredients must be thoroughly mixed and incorporated with each other before being spread.—F. P.

Child's Cot.—M. M. E. (*Openshaw*).—The only way in which I think you can overcome the nuisance occasioned by the ends of the swinging cot wearing the supporting posts away, is, unless you face the damaged posts with iron, to curve each post on the side directly presented to the end of the cot, the curve embracing the whole area aggrieved and extending as close under the bearing as is possible without weakening the post. The depth of each curve must, of course, be sufficient to permit the cot to swing without any part of it or its supporting irons contacting with the posts. If the damage results only in the immediate vicinity of the parts marked D in your sketch, then a short curve only will be necessary. A gradual curve is preferable to an abrupt one, as with the latter the posts may be somewhat weakened.—J. S.

Inlaying with Fret Machine.—J. T. S. (*Sheffield*).—I must say that your present question is far from clear. What do you want to know? To say "inlaying with fret machine" gives no clue. If your wish is to cut inlay with a fret machine instead of with a "donkey" (the machine identified with inlay cutting), of course you can do so, although not so neatly or comfortably. The veneer should be placed between two thicker boards during the process. I cannot say whether any book on inlay shows a "donkey," or deals with machines, but if you would like a sketch of one I would prepare one for you in these pages similar to that I have seen a professional friend use with surprising ease and accuracy. The saw works horizontally, while the further end of the frame travels in a swinging pair of supporters.—J. S.

Lenses: How to Grind them.—J. A. (*Wandsworth*).—It is impossible to exactly say when the papers upon the above subject will make their appearance, but they will doubtless appear as soon as a favourable opportunity occurs. You should bear in mind that it is impossible to treat everything at once, and something must wait. In the meantime, if you have any special question, it shall receive every attention.—C. A. P.

French Grey Paint.—A READER.—The ingredients for making about 40 lb. of best glossy paint for indoors, tinted to a French grey colour, would be, say, ¼ cwt. (28 lb.) *genuine* white lead, 3 lb. best patent dryers, about ½ gallon raw linseed oil, and 1 quart turpentine. Break up the lead and dryers with a broad stick to the consistency of a thick paste, using linseed oil. If all is to be tinted one colour, for French grey add a little ultramarine blue (so-called) and either a little Venetian red or common black. If you want a "warm" grey, add the red; if a cool, metallic tint, add the black. The ultramarine you can only buy in powder; well mix this with a little oil before adding it to the paint; the other colours you will easily get ready ground in oil. Respecting the economical aspect of ready-mixed *v.* best paint, it cannot be expected that the former, sold as low as 3½d. per lb. in some parts, can be equal in value to the best white lead paint, especially as you may have to give 4d. per lb. for the *genuine* white lead. The blue powder will probably cost about 2s. 6d. per lb., and you will require at least ⅛ lb. of that. The liquids lower the average cost. per lb. when the quantity is all made ready for use; but when you consider the time required for making the paint, matching a particular colour, and then straining the paint through muslin or a very fine sieve, the price usually asked for such best paint—viz., 6d. per lb.—is but fair value. Eight lb. of paint for painting the wall of one room is not at all a large quantity. For first coating on new plaster, you can use nearly all linseed oil and a little dryers—very little lead. This will stop the suction of the plaster, and then with two more good coats of paint you *may* make a decent job; but, as a rule, new plaster requires four coats to get a good surface. I am afraid you will find oil paint very costly for the house throughout. For the bed- and sitting-rooms I should strongly advise you to try "Alabastine."—DECORATOR.

Fretwork Machine.—TYRO.—Consult the indexes to Vols. I. and II., which can be had of any bookseller, at the price of 1d. each.

Safety Fuse for Electric Lamps.—H. M. T. (*Cornwall*).—You may include a 25-volt, 8 c.-p. lamp in a 50-volt electric lighting circuit if you place the lamp in a branch connected with the main circuit, and insert enough resistance in the branch to balance (together with the resistance of the 8 c.-p. lamp) the resistance of the 50-volt lamps. In doing this you will not reduce the voltage of the current (that is, current pressure), but you will reduce the volume of the current passing through that branch of the circuit. Ohm's law does not teach you that you can reduce the voltage in a circuit by inserting a resistance to the current in that circuit. It teaches you that the volume of current flowing in an electric circuit is equal to the total voltage, pressure, or E.M.F., divided by the total resistance of all the conductors in that circuit, according to the formula, $C = \frac{E}{R}$. We will apply this law to your case. The 25-volt 8 c.-p. lamp will take ·96 ampère of current to properly light it, or say nearly 1 ampère in a 25-volt circuit. We will suppose its resistance, therefore, to be 25 ohms. Now, if we placed this lamp in a 50-volt circuit, the result would be for a moment, $\frac{E\ 50}{R\ 25} = C\ 2$ ampères, the next moment darkness. Now, if we insert a resistance of 25 ohms in circuit with the lamp, the result will be $\frac{E\ 50}{R\ 25 + 25} = C\ 1$ ampère, the voltage of the current being the same in both, but the volume of the current reduced to one-half by the extra resistance. Include a safety fuse in this resistance to protect your lamp.—G. E. B.

Dry Plates Backed.—M. E. (*Leicester*).—Procure some burnt sienna, ground in water, from the colour-dealer's, and mix it with equal parts of methylated spirit and water to the consistence of thick cream. The proportions are immaterial. Add a little caramel, say 2 oz. to ½ lb. of the sienna, and ½ oz. gum arabic, dissolved in water. The whole being thoroughly mixed, a hog-hair brush, charged with the compound, is passed over the back of the plate, painting to within about half an inch of the edges, and then kept in the dark to dry. A very small quantity of the paint is sufficient. The plates can be backed in this manner and put in the dark slides whilst wet, but if any quantity have to be done it is best to let them thoroughly dry in a warm room. Set on a shelf, face to the wall, great care being taken to prevent light getting to them. Any plate-dealer will supply backed plates to order: they are not usually kept in stock.

III.—Questions Submitted to Readers.

**** The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

Rubbering Steel.—A. H. (*Manningham*) will thank any reader to give him information regarding "the best method of covering a steel ring with indiarubber, *not* by vulcanising."

Black Skin Dye.—M. T. (*Newcastle*) writes:—"Will any reader kindly oblige with information as to what will dye a hare-skin black?"

Paste Diamonds.—J. H. (*Bury*) will thank any reader of WORK to give him information how paste diamonds are made.

Fender Designs.—N. E. R. H. (*Newcastle-on-Tyne*) writes:—"Would any reader kindly tell me where I could get designs for a large fender top, say 9 in. high by 10 in. broad, and 3 ft. 15 in. long—or higher, if pillars are required? Is there anything new in patterns?"

Screw Cutting.—LATHE writes:—"I want to know of the best book on this subject. Replies will oblige."

Sleigh Bells.—A. S. (*London, E.C.*) writes:—"Can anyone tell me, through 'Shop' columns, how to alter the tone of 'sleigh' bells (metal) so as to match with others?"—[In important bell work the general method for tuning bells is by filing.—ED.]

Enamel.—W. B. (*London, N.*) writes:—"I used some enamel on a brass ornament (which I previously cleaned), and applied it in a warm atmosphere, but the smell did not go off for quite three weeks, and fairly poisoned the atmosphere. Will any reader kindly say in 'Shop' what was the cause of this, and how to prevent it? I have a cruet-stand I want to apply it to, but fear the smell."

Indiarubber.—J. W. H. (*Brackley*) writes:—"Having a lot of old indiarubber I should like to utilise it. I should be glad if anyone could give me the current price for old indiarubber, and the best place or firm as a market."

Marqueterie or Buhl Work.—SUBSCRIBER A. W. writes:—"Can any of your readers give me information respecting marquetrie or buhl work?"

Air Pump.—H. S. M. (*Ripon*) will feel obliged to any reader who will give him information as to the Mawson & Swan air pump.

Monuments and Tombstone Stains.—MONUMENTAL SCULPTOR writes:—"I should feel greatly indebted, and I have no doubt many of my fellow-craftsmen would too, to be informed of some solution that will remove discolorations in marbles standing indoors and in the open air, and which solution would not destroy the marble."

Electricity.—P. L. (*Selly Oak*) writes:—"Will any reader tell me the price of a small, but good, book on electricity suitable for a beginner?"

Softening Indiarubber and Metals.—LUDOVICUS writes:—"What is used to make indiarubber soft enough to make rubber stamps? Also, which is the easiest way to soften iron or steel as soft as lead?"

Monogram.—B. R. (*Sandbach*) writes:—"May I ask if any reader of WORK would kindly give me a monogram of the letters H. L. for painting on glass, to be seen through, and to be illuminated?"

Oil Light.—G. C. (*Pendleton*) writes:—"Will any reader of WORK have the kindness to explain the mechanism of the Wells' oil light, or any other similar light produced from oil by the same means? Also if it could be advantageously used on a very small scale? The light alluded to is used largely among contractors and for out-door use."

Pipe Mouthpiece Thread.—S. M. A. D. A. (*Tunbridge Wells*) writes:—"Can any reader of 'Shop' oblige by informing me how to make the thread in amber mouthpieces for pipes? I can drill them, but not get a good thread for the screws."

Engineering Examinations.—YOUNG ENGINEER writes:—"I would thank any reader to enlighten me as to any public competition or examinations in which an engineer student may compete, in order to lighten the cost to a poor student seeking to qualify as a C.E."

Quarter Horse-power Gas Engine.—T. P. B. (*Bradford*) writes: "Will any reader oblige by telling me how to make a ¼ horse-power gas engine, which would, I feel certain, be better adapted to all home workers than a steam one, as it would not require a boiler?"

Lathe Outfit.—YOUNG TURNER writes:—"I want to take up the lathe as a hobby, and should feel much obliged to any experienced turner if he would inform me the best kit to get, and where to purchase same. My age is nineteen."—[YOUNG TURNER should consult the advertising pages of WORK.]

Glass Cement.—A. S. writes:—"I shall be obliged if anyone will kindly tell me of an adhesive for glass which will withstand continued wet."

Banner and Flag Painting.—BANNER (*Wynberg, South Africa*) writes:—"Will any kind reader of WORK let me know where I can get a book on flag and banner painting; also a firm for painter's materials; also books on coach painting, etc?"

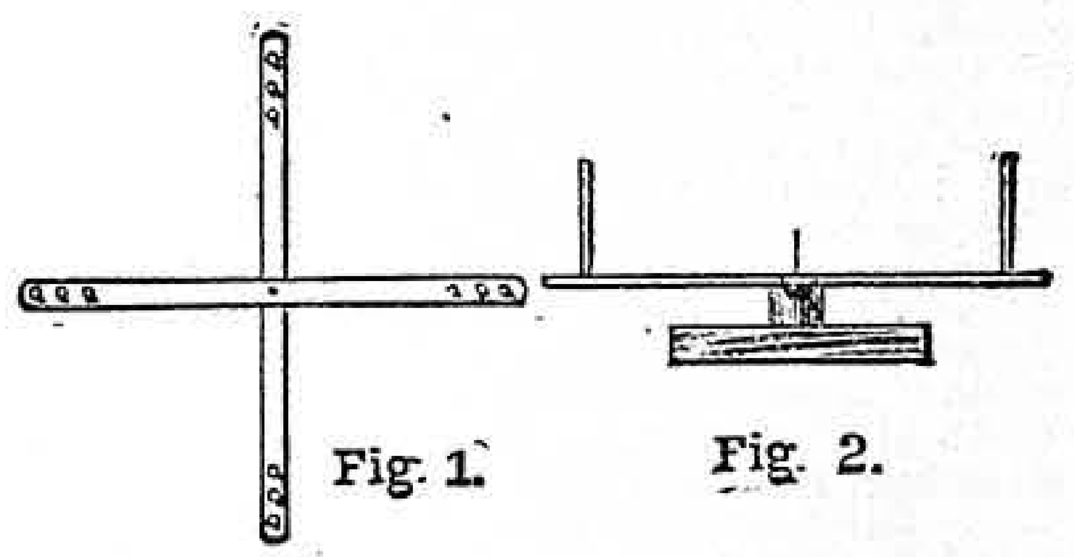
Bookcase.—R. S. (*Chorley, Lancashire*) writes:—"Would any reader of WORK kindly give me a sketch or some instructions of how to make a small portable bookcase, which would fold up and appear like a box, and not have too much work about it?"

Microscopic Objective.—W. S. (*Gosport*) writes:—"I have an objective mount of the usual English pattern, to which I want to put lenses for 2 in. focus. It is made for two lenses nearly together. I desire the shape of lenses, and the focal length of each, and whether one or both should be achromatic."

Lenses.—SCIENTIFIC asks:—"Can any reader of WORK tell me how to make and polish lenses, or where I can get the necessary information? Also, where could I get a good quality of glass for the above purpose?"

IV.—Questions Answered by Correspondents.

Wool-Winder.—M. (*Bishop Auckland*) writes, in reply to MART (see p. 621, No. 143):—"Make a cross of two laths half lapped together, of a suitable size for the hanks of wool. Bore three or more ¼ in. holes in the ends, and fix four pegs in them 4 in. long. Make a stand of 1 in. board, 9 in. square; fix in the centre of this a piece of wood 1 in. high, with a



Wool-Winder. Fig. 1.—Cross for holding Wool. Fig. 2.—Cross fixed on Stand.

wire in the centre. The stand should be weighted with a plate of lead, to prevent it being moved. The cross is fixed on the wire, and the wool on the pegs; as the wool is wound the cross turns round. Fig. 1 shows the cross; Fig. 2 the stand and cross fixed upon it. There is another form which folds up. If you want this, write again, and I will send sketch of it."

Luminous Paint.—F. S. (*Leek*) writes, in reply to R. R. (*Upholland*) (see p. 637, No. 144):—"The following is a good recipe: For orange luminous paint, 46 parts of varnish are mixed with 17·5 parts prepared barium sulphate, 1 part Indian yellow, 1·5 parts prepared madder lake, and 38 parts luminous calcium sulphide. For yellow luminous paint, 48 parts varnish are mixed with 10 parts prepared barium sulphate, 8 parts barium chromate, and 34 parts luminous calcium sulphide. For green luminous paint, 48 parts varnish are mixed with 10 parts prepared barium sulphate, 8 parts chromium oxide green, and 34 parts luminous calcium sulphide."

Steel Springs.—A. DARWIN (*Harrison Street, Hillsborough, Sheffield*) writes to WING (see p. 686, No. 147):—"WING can be supplied with these by writing to the above address, coiled or in full length to coil himself."

Modelling Wax.—EDDIFRA writes, in answer to CARVER (see p. 622, No. 143):—"Use white wax, melted and mixed with lard. In working it, the board or stone is best moistened with water, to prevent it sticking. Dip the tools also in water. To colour it, use dry colours."

V.—Letters Received.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—F. (*Huddersfield*); W. H. B. (*Salford*); A. C. (*Leeds*); D. C. (*Kinross*); EDDIFRA; W. G. W. (*Bruton*); W. A. Y. (*Poole*); N. W. (*Camberwell*); D. S. (*Stanley*); J. L. (*Harleston*): S. & J. (*Lhanbryde*); THORNHILL; A. B. (*Blackburn*); G. F. B. (*Victoria Barracks*); AMATEUR; D. L. (*Selly Oak*); W. E. N. (*Deptford*); E. D. (*London, S.E.*); J. B. (*Liverpool*); F. & C. (*Liverpool*); W. G. (*Ruabon*); J. S. (*Wakefield*); W. V. E. (*Derby*); R. S. (*Blackburn*); P. S. (*London, E.C.*); A. P. (*Longsight*); W. F. (*Winchester*); J. R. E. (*Congo, S. W. Africa*); E. W. (*Chirk*); T. E. A. (*Manchester*); F. M. (*King's Lynn*); H. G. P. (*Brixton*); MORGANWG; YOUNG JOINER; C. O. S. (*Tenby*); C. H. W. (*Dewsbury*); SUBSCRIBER; CALNE: STERO; P. P. (*Withington*); E. H. L. (*Leicester*); F. P. (*Northwich*); W. H. (*Northwich*); C. P. & CO. (*London, S.E.*); H. M. W. (*Bootle*); S. F. C. (*Stoke Newington*); G. W. S. (*Hyde*); W. H. (*Birmingham*); YOUTHFUL READER; J. S. (*Glasgow*); J. H. B. (*Manchester*); SHOPITE; F. S. B. (*Queensbury*); ELECTRICIAN; G. S. (*Stangate*); OVEN; W. E. D. (*Belfast*); S. A. L. (*Portsmouth*); H. J. (*Oxford*); E. P. B. (*Penge*); J. S. (*Bedford Leigh*); CHIPS; W. L. P. (*Glasgow*); R. J. H. (*Dublin*); E. C. M. (*Portadown*); P. B. (*Oldham*); J. C. (*Ardwick*); W. H. W. (*Lambeth*); ANTI-PROCRASTINATION; AMATEUR; J. W. D. (*Chorley*); A. W. T. (*Sheffield*); H. F. (*Taplow*); C. S. (*Seacombe*); BASEBOARD; J. W. T. *Huntingdon*); GRATEFUL; CONSTANT READER; BONA FIDE; CHICK; E. H. M. (*Bideford*); C. H. T. (*Wigan*); W. L. (*Fitchin*); J. E. (*Liverpool*); CANOE; OLDHAM ENGINEER; P. B. (*Harthill*); H. W. (*Halifax*); H. S. (*Dalston Lane*); W. W. N. (*Leeds*); HOROLOGY.

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