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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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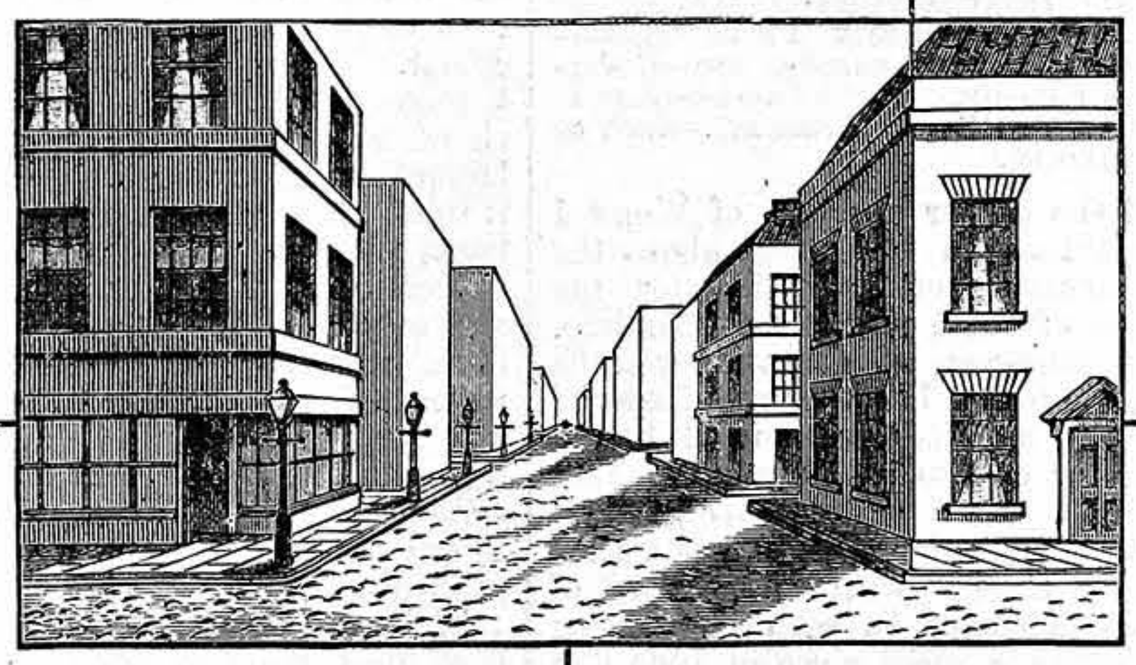


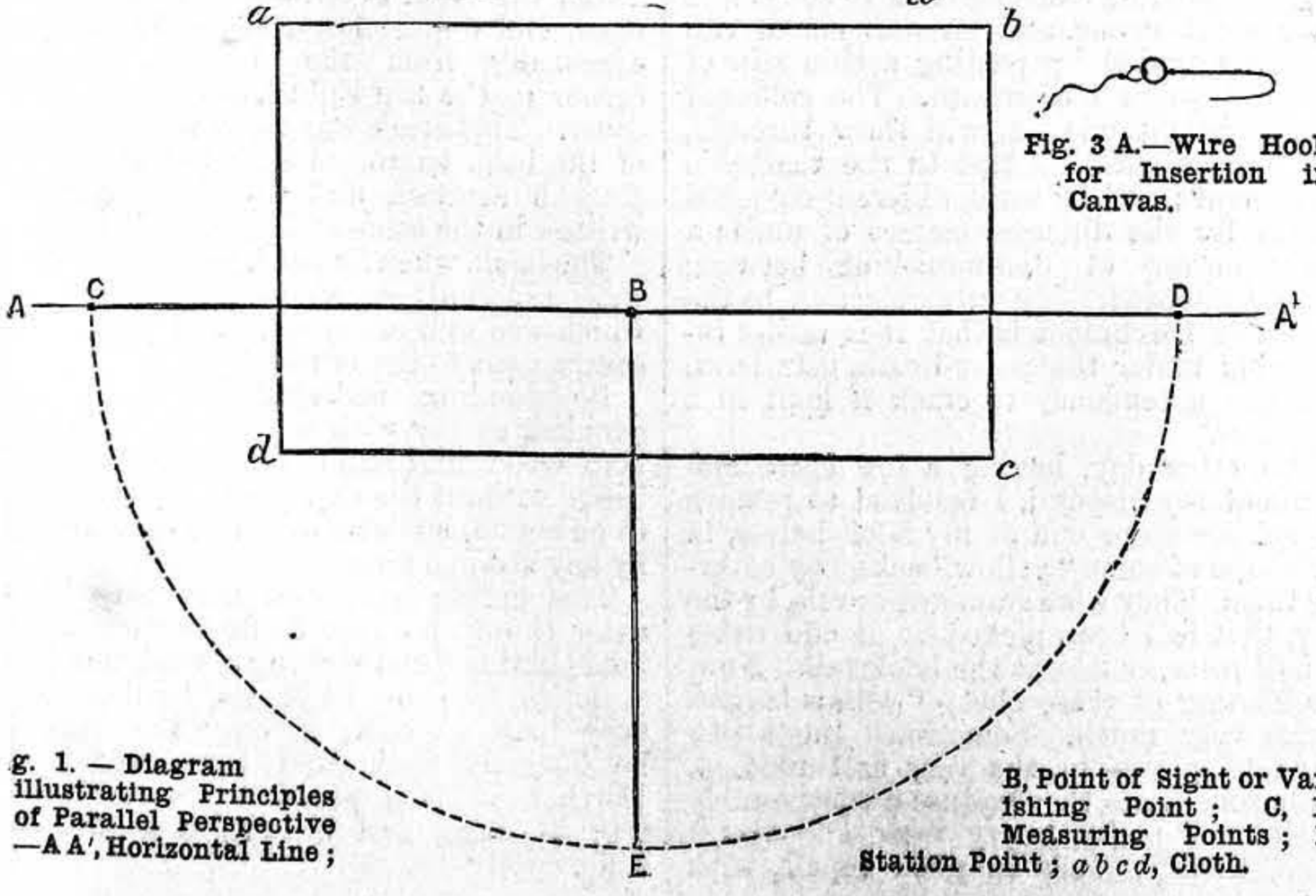
Fig. 3.—Partly Finished Street in Parallel Perspective, showing Working of Principles enunciated in Figs. 1 and 2.

STAGE PERSPECTIVE.

BY WILLIAM CORBOULD.

PARALLEL PERSPECTIVE.

T must be understood by the would-be cenic artist that it is indispensable that he hould thoroughly understand the art of erspective. Although a rather dry study, a ttle patience and trouble will soon simplify he matter; by working out the rules here aid down a few times the student will find he subject prove easy enough. No drawing ould be correct unless the principles now o be laid down, and which may be termed he Grammar of Art, be thoroughly mastered. Do not let these words frighten any beginner, ecause he will find the rules few and simple.



g. 1. — Diagram illustrating Principles of Parallel Perspective —A A′, Horizontal Line; B, Point of Sight or Vanishing Point; C, D, Measuring Points; E, Station Point; *a b c d*, Cloth.

Fig. 3 A.—Wire Hook for Insertion in Canvas.

The most important point I wish to impress upon the learner is the names of the different lines, points, etc.; without their use no correct perspective could be obtained. No matter how well a scene may be painted, defective perspective would spoil the whole.

I now direct attention to the following points and lines, which are shown in Fig. 1:—A A′, the horizontal line; B, the point of sight, or vanishing point; C, D, measuring points; E, sight or station point. There are only two rules of perspective in straight lines—parallel oblique or angular—which I will now try to explain as easily as possible by the aid of diagrams.

Fig. 1.—This plate represents the horizontal line, point of sight and vanishing points, and points of measurement—that is to say, the only lines required to work out a scene

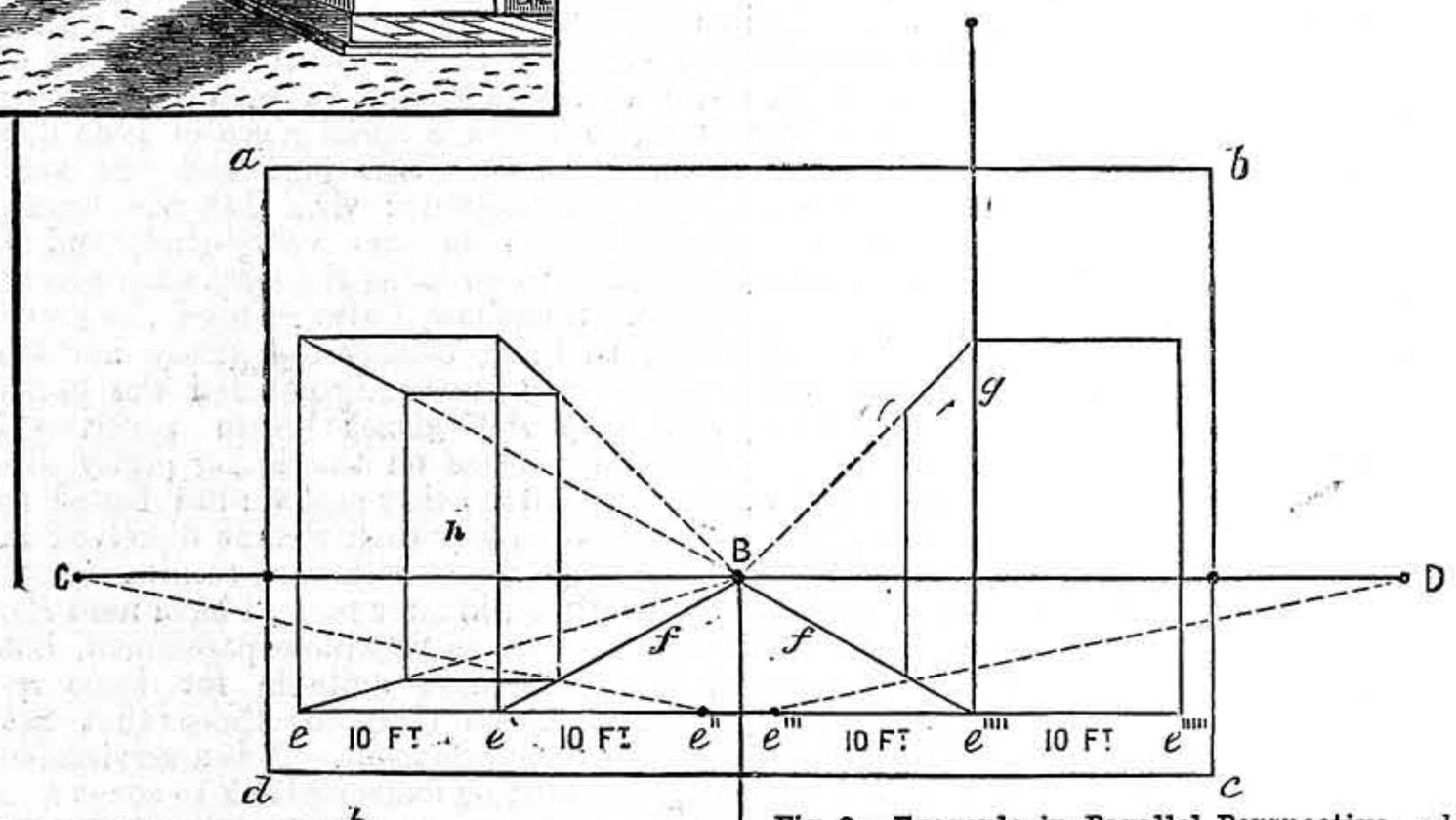


Fig. 2.—Example in Parallel Perspective—*a b c d*, Cloth; C D, Horizontal Line, C and D being also Measuring Points; B, Point of Sight; E, Station Point; *e e⁗⁗*, Base Line; *e′, e″, e‴, e⁗⁗*, Points of Division; *f, f*, Lines to Vanishing Point, B; *g*, Corner Line of Block; *h*, Block.

in parallel perspective. The rectangle, *a b c d*, shows the size of the cloth or scene.

A A′ is the horizontal line. Supposing we were standing on the sea-shore: that line which divides the water from the sky is the horizontal line. If the student were to walk up from the shore to the top of some very high cliffs, this line would be found to rise with him, and still be opposite his eyes. We must bear this in mind, because in painting a seascape or a landscape, the horizontal line must rise according to the height of the foreground represented. If we were to go up in a balloon we should find the horizontal line still opposite our eyes, the balloon hanging, as it were, in a huge bowl. Supposing the scene was a mountain pass, three or four thousand feet above sea level, but we were looking out to

sea, the horizontal line would be two-thirds up the scene, or thereabouts. On the other hand, if the reader were painting a scene from the sea-shore, the line would hardly be more than a fourth.

It is always best in stage perspective to keep the horizontal line as low as possible, taking into consideration that some of the audience are sitting below as well as above the horizontal line.

The point of sight on this line would be the spot where all the lines receding from the eye would fall. In Fig. 1 this point is at B on the horizontal line, A A'. This constitutes the rule, "parallel or linear perspective." The points C and D would be the measuring points. All lines above and below the horizontal line must fall into the point of sight, B (Fig. 1).

We will suppose that Fig. 2 represents a road running straight up the plate, with blocks on each side which might represent buildings, such as a street: *a b c d* is the cloth or scene, C D the horizontal line, E showing how far the eye is supposed to be from the picture.

We may determine this by dividing the horizontal line in halves. One-half would be the distance to point E, or by striking a half-circle from E to the horizontal line it would intersect this line at C and D, which would be the points of measurement (Fig. 1).

The base line, *e e''''*, may be marked off into parts of, say, 10 ft. from the dots *e* to *e'*, *e'* to *e''*, etc.—that is, the blocks would be 10 ft. square. The front of the block would be parallel with the horizontal line. A line drawn from the next point, marking another 10 ft. to the points of measurement, C, D, would give the perspective size of the square where it crossed the ground-line of the building, *f f*. This is where the second perpendicular line would rise. *g* shows the block in perspective if it were framed and glazed.

Fig. 3 represents a partly finished street scene, to show the working out of the first and second figures, completing the first lesson in "parallel or linear perspective."

It will be seen here that the fronts of the houses facing the spectator—that is, the lines of the doors, windows, base, and tops of the houses, as well as the pavement—are parallel with the horizontal line. All lines of both sides of the street will be seen to fall into the point of sight, B (Fig. 2). The lamps come under the same rule, as will be seen if we take a line from the front lamp to the last. I hope this will be explicit enough for the beginner, who with a little practice will soon master this first rule in perspective.

We now come to the use of the horizontal and perpendicular lines (page 640, Vol. II., No. 92).

If one were going to draw a picture or scene on paper, the T-square and ruler would do for the purpose; but it is very different when drawing on a large scale, such as 15 ft., 30 ft., or more. It is obvious that lines would have to be used.

As I have explained before, one should have a plumb-bob attached to it for the perpendicular lines; the first one is represented at *g* (Fig. 2). If we hang this straight down, leaving the bob to steady itself when so hanging, dot here and there exactly behind the line; then take the straight-edge, and by connecting the dots make a straight line. All other perpendicular lines can be measured from this one, always having the line to correct from.

The other line should have a piece of stout wire bent as shown in Fig. 3A, the point to be sharp, so that the student may be able to insert it easily into the canvas. This would be the horizontal line.

When the height of the horizontal line is decided on, place a dot at each side of the cloth denoting the height; hook the horizontal line in at one dot; take a piece of charcoal and rub the line with it; cover the other dot with the line, and pull it tightly. With the other hand draw the line away from the cloth and let it go smartly back again: this will give the first or horizontal line—of course, to be covered with vandyke brown and dusted off.

NEW COVERINGS FOR OLD BOOKS.

BY H. J. L. J. MASSÉ.

GLAZED LINEN AS COVERING—VEGETABLE PARCHMENT—ITS DISADVANTAGES—TREATMENT OF BOOK IN BOARDS—LOOSE PAGES—EDGES—CONCEALING ADVERTISEMENTS, ETC.—COVERING WITH PARCHMENT—END PAPERS—FINISHING COVER WITH RULED LINES, ETC.—COST OF HOME BINDING.

IN one of the earlier numbers of WORK I was much interested in reading about the home manufacture of portfolios for the preservation of loose papers and the like. For special purposes, no doubt fancy stuffs are very appropriate, but they require to be very carefully handled and affixed to the strawboard or cardboard foundation that is underneath. As a boy at school, I used to furbish up my school books when they became very shabby with a covering of brown holland pasted on with very strong paste, in which a small piece of glue had been dissolved. This plan had one very great disadvantage: viz., that the brown holland soon became very dirty, and I soon took to covering the sides with glazed lining. Somehow, I always used the green kind, as being neither too gaudy nor too dull, having previously covered the backs with very stiff glazed brown paper. Of course, the glaze on the lining partly disappeared after being pasted; but I used to varnish the cover with shellac dissolved in methylated spirits with good results.

Sometimes, in later years, I have used the material sold as vegetable parchment, but it is really more suitable for loose removable covers than for those that are meant to be permanent. It is a serviceable stuff for putting a strong back to songs and loose sheet music, and its dull colour can be easily varied by pasting a thin slip of coloured paper underneath. The coloured slip, if bright enough, will show through, and give a pleasing tint to the vegetable parchment; and by using different-coloured papers for the different classes of music a ready means of distinguishing between them is afforded. My only objection to the vegetable parchment is that it is rather intractable under the paste-brush, gets hard, and has a tendency to crack if kept in a dry place.

The other day, having a few spare moments at my disposal, I resolved to remove an eyesore from one of my bookshelves, in the shape of some "yellow backs," by covering them. They were standard novels, by the way, that had been picked up at odd times at half price, or less, at the bookstalls. Now, the binding of these cheap "yellow backs" varies very much. Sometimes the books come to pieces in the very first reading, while sometimes they endure a considerable amount of really heavy wear and tear—mine, luckily, were in good repair, with the exception of a corner or so and a couple of loose pages. The loose pages I secured with a stitch or two, and the corners were strengthened with a little gum. I will deal with one book as a type of the whole batch. One of the edges had been stamped "Reduced to 1s. 2d.," in the so-called indelible violet ink—I say "so-called," because its indelibility is not always to be trusted. By exposing the "indelible" inscription to the sunlight, it faded a little, and to remove it entirely, a gentle rubbing with No. 00 glass-paper was required, the book meanwhile being held in a hand-press, or clamp, made of two pieces of 1½ in. oak, each 16 in. by 8 in., with a ⅜ in. hand-screw in each corner. Next, after blowing away the paper dust thus caused, I brushed the edges over with red aniline ink, taking care to squeeze the book extra tightly in the press, and to avoid leaving any excess of ink at the corners, and after an hour a second coat of ink gave the required depth of colour. When this ink was quite dry I cut a piece of demy paper, like that used by chemists for wrapping purposes, about 1 in. larger each way than the book, and pasting it thinly, covered the back and sides of the book, with the object of hiding the illustration and the advertisements of pills and other articles from view, and put the book, with two layers of clean blotting-paper inside and outside its two covers, into a copying-press to dry. A little practice will soon enable anyone to cover the corners neatly. I should advise everyone to try his hand first on a few waste strips of cardboard.

When the demy paper was quite dry, the book already looked quite respectable, with its clean white cover and brand-new red edges. Next I cut a piece of parchment a little larger than the white demy used above, and pasting it well backwards and forwards till it could absorb no more paste, and giving an extra brush along the edges to finish up with, I put the parchment over the white demy and put the book back in the press, with dry, clean blotting-paper as before. When this was *quite* dry—it must be quite dry, or the book would warp unpleasantly—I put in some suitable fancy end papers which I had got from the city house of Messrs. Marlborough, Pewtress & Co.

This finished the inside of the book. To finish the outside, I ruled a red ink line all round the front cover, about ⅛ in. from the edge, and double lines, about 1¼ in. apart, diagonally from the bottom left-hand corner to the top right-hand corner of the cover. This space was filled with the name of the book engrossed with red ink in Old English capitals, and the name was also written in the same style along the back.

The book, when finished, looked extremely well, especially considering the outlay—which was well under 4d.—and put its late companions to the blush.

Bookbinding technicalities have been avoided, as my wish was not to deter anybody who would like to furbish up any stray books without the expense of sending them to be bound, but who would be disheartened by any strange terms.

This article is written from no wish to deter those who seek to do better work in bookbinding from making a trial, but from a desire to show what can be done with very little expense, if only the attempt be honestly made and persevered with. Further, it is a pleasant and profitable way of using and utilising a little spare time.

HOW TO MAKE A QUARTER HORSE-POWER STEAM ENGINE.

BY F. A. M.

The Bed-plate—The Cross-head and Guides—The Fly-wheel.

The Four Surfaces of the Bed-plate, and how to bring them True—Screwing the Cylinder to the Bed—The Cross-head Pin, and how to Bore the Hole for it—Chucking the Cross-head—Securing the Piston-rod to Cross-head—Fitting the Cross-head and Guide-bars—How the Connecting-rod acts on the Guide—Making the Cross-head Pin and Boring the Oil Channels—Chucking the Fly-wheel, Boring it, and Slotting the Key-way.

Examine the bed-plate casting and the views of it (Figs. 4, 5, 8, pp. 260, 328), when it will be seen that there are four surfaces to get up true. First, the end surface (1) against which the cylinder is bolted; second, the large facing in the middle on which the slipper-guide works (2); third and fourth, the two smaller facings on which the crank-shaft bearings are bolted (3, 4). The three last mentioned are all in one plane, and, though not necessary, it will be most convenient to have them planed. In fitting or getting up these parts, we must attend to two things: first, it is essential that the first surface against which the cylinder beds should be absolutely at right angles to the other three, or the slipper-guide cannot work without bending the piston-rod, and the rod must point fairly down the middle of the bed; secondly, the recess into which the cylinder cover fits must place the cylinder at the correct height above the three last surfaces; this height is given in Fig. 8: $1\frac{3}{4}$ in. Probably the correct way to do this would be to mount the bed upon the saddle of a lathe, so that the line of the lathe centres shall coincide with the centre line of the cylinder, then a boring-bar would be used both to face the end surface and to bore out the hole in it. We will not, however, propose to make more cutters for our bar, since there is another way which will do very well. If the three level surfaces are not planed, these had better be filed up fairly true, first of all. Get a spirit-level, and, laying it on the three surfaces, pack up with slips of wood, tin, etc., under the bed-plate as it lies on the bench, until the three surfaces come as level as possible; now you can file them up, keeping them in one level plane by trying them alternately with level and surface-plate. The bed-plate had better be screwed down on your bench by wood screws passing through the three lugs. The three flat surfaces being filed or planed, we turn to the end surface, the hole in which requires to fit the cylinder cover. The diameter of the hole is to be $2\frac{1}{4}$ in., and the height of its centre above the plane surfaces, $1\frac{3}{4}$ in.; therefore, the height of its bottom edge above these surfaces will be $\frac{5}{8}$ in. Lay a scribing-block on the second surface, and set its point $\frac{5}{8}$ in. high.; now take a half-round file, and file away at the bottom of the hole till the application of the scribing-block shows it to be $\frac{5}{8}$ in. above the level surfaces. Now turn a short conical mandrel of hard wood (Fig. 38); make it small enough to go into the hole at the smallest end, and at the larger end make it the size the hole ought to be: it may be two or three inches long; rub it all over with chalk, and rub it gently in the hole; take out and file where the chalk appears; continue thus till the cone will go nearly up to the large end, touching also the bottom of the hole, when you file more carefully, and begin to try in the cylinder cover. By this means you can get the cover to fit, without looseness, at the proper height. Fig. 39 is turned in hard wood, and will enable us to file up the first surface at the end of the bed-plate. The neck of Fig. 39 is made $2\frac{1}{4}$ in. diameter, and should fit the hole without shake; the shoulder, A, is turned exactly square and flat; the long shaft is reduced for lightness' sake: it may be 1 in. in diameter, and about 1 ft. 3 in. long, and should be quite parallel. Chalk the surface, A, and put the pin through the hole in the bed-plate; rub A against the end by turning the wood in the hole, and note the direction of the long pin *vertically* and *horizontally*; take out the wood, and file the end surface accordingly. When the eye is satisfied with the direction taken by the pin, measure carefully from underneath the pin to surface 2 at both ends, to see whether the pin is quite level, and from the inner edges of surfaces 3 and 4 to the sides of the end of the pin, to see whether it points fairly down the middle of the bed, passing exactly between them. The surface-plate may be applied to finish the end surface; it need not be scraped, however, but left from a smooth file. We next apply the cylinder cover and cylinder, setting the screw-holes in correspondence while the valve-face is vertical; remove the cylinder without disturbing the cover, scribe through the holes in the cover on to the back of the bed, drill and tap these holes, and now we can screw the cylinder to the bed.

The slipper-guide, or cross-head, and the guide-plates seem to follow naturally, and we will take them next. First finish surface 2 on the bed-plate, on which the guide is to slide, scraping it up true with the help of the surface-plate, as before described. Take next the guide-plates between which the slipper moves; file these top and bottom, bringing them to the same thickness all over; scrape up their lower surfaces and draw-file their upper; square their outer edges and draw-file them; for the chamfered edges make a gauge by filing a notch in a bit of sheet metal with a smooth "three-square" file; use this notch to try the angle of the chamfer, filing to the gauge, and watching the width of the pieces so as to keep them parallel. This chamfered edge must be brought to a true surface by means of the surface-plate and the scraper. Drill three holes for screws in each piece in the positions shown in Fig. 5, and make and fit the four screws seen in the same view, which are used to push them forward into touch with the slipper, but do not bore in the bed the holes by means of which they are held down on to the bed till the slipper is made. Now take the slipper itself, and file up first the sole on which it slides, taking off just enough to make it $1\frac{3}{4}$ in. high to the centre of the bosses. The upper part of this slipper guide is called the cross-head, and the pin which goes through it, and is grasped by the small end of the connecting-rod, the cross-head pin; it is a very important part of the engine, and requires careful workmanship. Look at the view in Fig. 8, and consider what would be the effect on the working of the engine if that pin did not go through *quite* horizontally; look at the plan view in Fig. 5, and suppose for a moment that the hole for the cross-head pin was not *absolutely* at right angles with that for the end of the piston-rod. These points are worth some careful consideration; it is attention to just such points as these that makes the difference between good work and bad, and they are the very things an amateur is most tempted to overlook. The centre lines of the holes in the cross-head, for the piston-rod and for the cross-head pin, must be: first, at right angles; second, in the same plane; third, in a plane parallel to that of the sole of the slipper; fourth, the two planes are to be $1\frac{3}{4}$ in. apart. In the angle-plate we have the very thing to enable us to fulfil these conditions. Taking the fourth condition first: make a little template, like Fig. 40, of sheet iron; bore the hole $\frac{3}{8}$ in. to fit the piston-rod, and let the distance from the centre of this hole to the base be $1\frac{3}{4}$ in. Thread this template on to the piston-rod, and try whether it will touch the guide surface with equal pressure whether the rod be pushed in or drawn out: this will test your work, and show whether the cylinder is really true with surface 2. Now put the angle-plate on the face-plate chuck, drive a bit of wood into the hole in the mandrel, and turn it down to $\frac{3}{8}$ in.; put the template (Fig. 40) on this, and bring up the angle-plate till it touches the base of the template, and fix it there (see Fig. 41). Thus we shall have fixed the upper surface of the angle-plate at exactly the same distance from the lathe centres as the piston-rod of our engine is above surface on which the slipper works. Now remove the template and the bit of wood, and fix the cross-head upon the angle-plate, the dogs holding the sole or slipper down upon the plate, and the bosses for the cross-head pin being centred to run true. Fig. 42 will perhaps make this sufficiently plain. Now face up the boss and bore it through, when the hole will be, of necessity, true with the sole; do not, however, trust to a drill to make this hole straight; a half-round, or D-bit, would do it, but nothing else should be trusted; if, therefore, the workman does not possess a $\frac{3}{8}$ in. D-bit, let him bore with a $\frac{5}{16}$ in. drill, and true out the hole with a fixed tool in the slide-rest, leaving it rather less than $\frac{3}{8}$ in., since it must be cleaned out with a fluted reamer to fit the pin. Having bored this hole, turn a little rod about 4 in. long, or more, that will fit into the hole, being quite parallel its whole length; turn the cross-head one-quarter round upon the sole, and fix it so that the boss of the piston-rod runs true; thread the rod through the hole just bored, and measure very carefully from the ends of this rod to the face-plate chuck, altering the setting of the cross-head until these measurements show by being equal that the hole is parallel with the face of the chuck, and therefore exactly at right angles with the centre of revolution. Now face up the boss for the piston-rod, turning the outside as far as possible; then bore with a $\frac{5}{16}$ in. bit into the first hole, as seen in Fig. 5, and cone out this hole to $\frac{3}{8}$ in. with the fixed tool in the slide-rest, using a very sharp and rather pointed tool, and setting the cutting point at exactly the height of centres. By this method of procedure we ensure the accomplishment of the four conditions before stipulated, and the plan forms a good example, which is very likely to be of use on other occasions. Having prepared the hole for the end of the piston-rod, put the piston and its rod into the lathe once more, and turn the end of the rod to fit the hole, observing the dimensions written along the rod in Fig. 5; drive the cross-head on to the rod, drill a $\frac{1}{8}$ in. hole right through for a pin to hold it on, and put a slightly taper reamer in to enlarge the upper end of the hole.

In an ordinary way there would be a flat key to secure the piston-rod into the cross-head, but this would be a much more

difficult job to accomplish; and, since the piston-rod is of ample strength, it will not pull in two even though half its cross section is cut away by the round pin. Moreover, the pin may be of good steel, hardened and spring-tempered; it will not then shear in two. Also it is quite easy to put a little "draft" on the pin, so as to make it tend to draw the rod into the cross-head; all that is required, after reaming out the hole and fitting the pin, is to put a small rat-tail file into the hole in the piston-rod, and file away a very little at B (Fig. 43), and into the cross-head, and file away a little at A, A—a very little will do it, and the plan often comes in handy.

Having put the cross-head on the rod, driven in the pin securely, and marked the rod so that it may be put in always the same way, rub some marking on the guide surface, and try the working of the cross-head by pulling it up and down whilst the piston and cylinder are in position. Notice whether the sole of the slipper bears all over on the guide surface, or whether the front or back edge is lifted; if so, take the cross-head off the rod and correct the sole with the scraper: it should not require much if our directions have been observed. We have now to file up the slanting edges of the slipper parallel with the piston-rod and with each other, and to the same angle as the guide-bars. Test your work as you proceed by laying the cross-head and two guide-bars in position upon a true surface, as in Fig. 44, and observing whether the guide-bars and piston-rod are all three parallel. (The piston should be taken off the rod, else it will be in the way.) When this is the case, finish filing up the cross-head, elongate the holes in the guide-bars, as shown in Fig. 44, place it and them in position on the guide surface, mark through the holes in the guide-bars on to bed, to give the positions of the six holding-down screws, drill and tap these holes, and put in the screws to hold down the guides and the four others used for advancing them sideways into contact. Now slide the cross-head and piston-rod up and down, the piston being removed and the rod passing through the stuffing-box. Watch whether the chamfered edges of the slipper are in perfect contact with the guide-bars, and correct them till they are. It will take some little time and trouble to do this properly, but it is worth the trouble. The red marking would be rubbed on the guide surface and inside the guide-bars; the cross-head would be rubbed up and down and then pulled out, the piston-rod coming out of the stuffing-box. Thus the chamfer of the slipper can be quickly tried, examined, and corrected, and then put in again. Don't say those fateful words, "It 'll do," till the marking shows the chamfered edges and sole of the slipper really touch all over. Then put on the piston, and test once more.

Here it should be understood that the particular form of guide which has been described is suitable for an engine which will run chiefly, if not entirely, in one direction. Every reader who has studied the Introduction should know by looking at Fig. 4 in which direction the engine will run. The eccentric precedes the crank by a little more than a right angle, and therefore the engine wheel, as seen in Fig. 4, will turn round in the same direction as do the hands of a clock.

In the little diagram at Fig. 45, A B represents a piston-rod, B C a connecting-rod, C F a crank, and C D E a crank circle. Now, if the piston be driving forward the crank from C towards D, were there no guide at B for the cross-head, the tendency would be to bend the piston-rod downwards. It is this tendency which is resisted by the broad sole of the slipper-guide in the engine we are making. But let the motion of the crank be continued past D to E, and let the connecting-rod take up the position of the dotted line, B E; now the piston-rod is pulling the crank, yet the side pressure at B is still downwards, and not upwards, as one might have supposed. If, however, the direction in which the engine runs were to be reversed, then the pressure on the guide would be continually in an upward direction, and our guides would require to be modified. As it is, the pressure comes on the broad sole of the slipper, and is received by the solid metal of the bed, the guide-bars merely acting as safeguards.

We may now undertake the cross-head pin, as seen in Fig. 8. This is to be made of mild steel. Take a piece of Bessemer $\frac{5}{8}$ in. diameter, and about $2\frac{1}{4}$ in. long, and bore right through the centre a hole $\frac{3}{32}$ in. in diameter; this is for the oil or grease to pass. Countersink both ends of this hole to fit the lathe centres. The hole must afterwards be plugged up at both ends; or it might be bored not quite through, as shown at Fig. 8; at any rate, the piece must be a little too long at first, so as to allow for removing the countersunk part and squaring up the ends. Take a $\frac{3}{8}$ in. taper fluted reamer, and clean out with it the hole for the pin in the cross-head so that it can be driven in up to $\frac{5}{16}$ in. of the head. While in that position, bore the hole for the little $\frac{1}{8}$ in. set-screw, seen in Fig. 5, opposite the piston-rod, letting the point of the drill cut a little way into the cross-head pin. Take out the pin from the cross-head, tap this hole and fit the set-screw, then drive in the pin again, and fix it so with the set-screw, which must enter the little hole made for its point. Now bore the oil channels, as seen in Fig. 8; first bore with $\frac{3}{32}$ in. drill from the centre of the top of the cross-head right down through the cross-head pin and out at the sole; this will supply oil to the sole of the slipper. Then bore across the bottom of the hole from one side chamfer to the other, as seen in Fig. 8; bore also the two short holes from the top of the cross-head pin to the central hole, which will enable the lubricant to reach the two bearings at the forked end of the connecting-rod. The single lubricator screwed into the top of the vertical hole supplies lubrication to all these five surfaces.

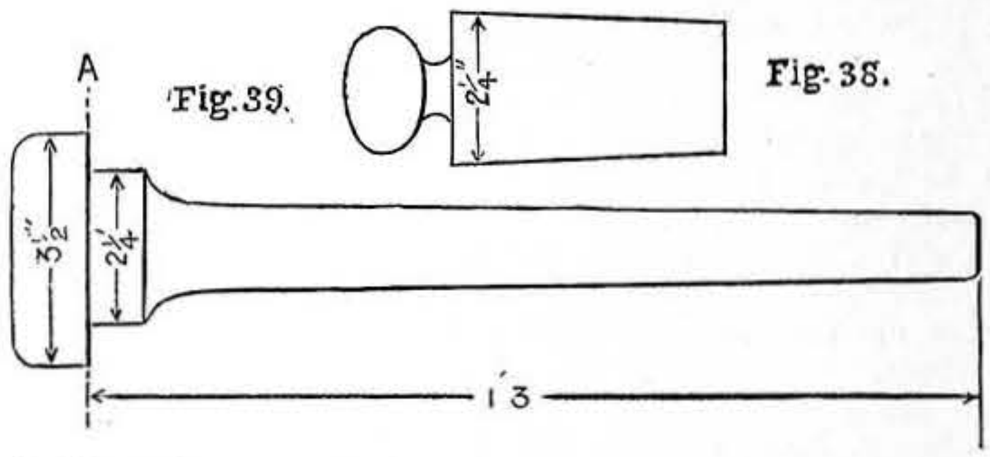


Fig. 39.

Fig. 38.

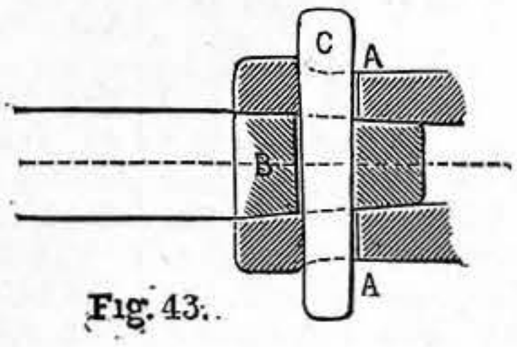


Fig. 43.

Fig 40.

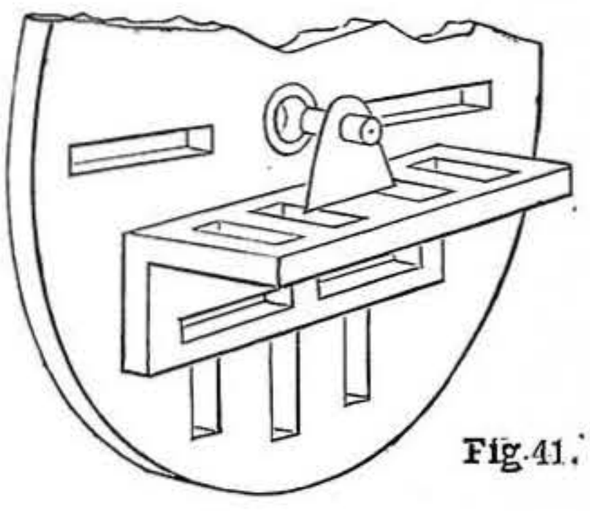


Fig. 41.

Fig. 42.

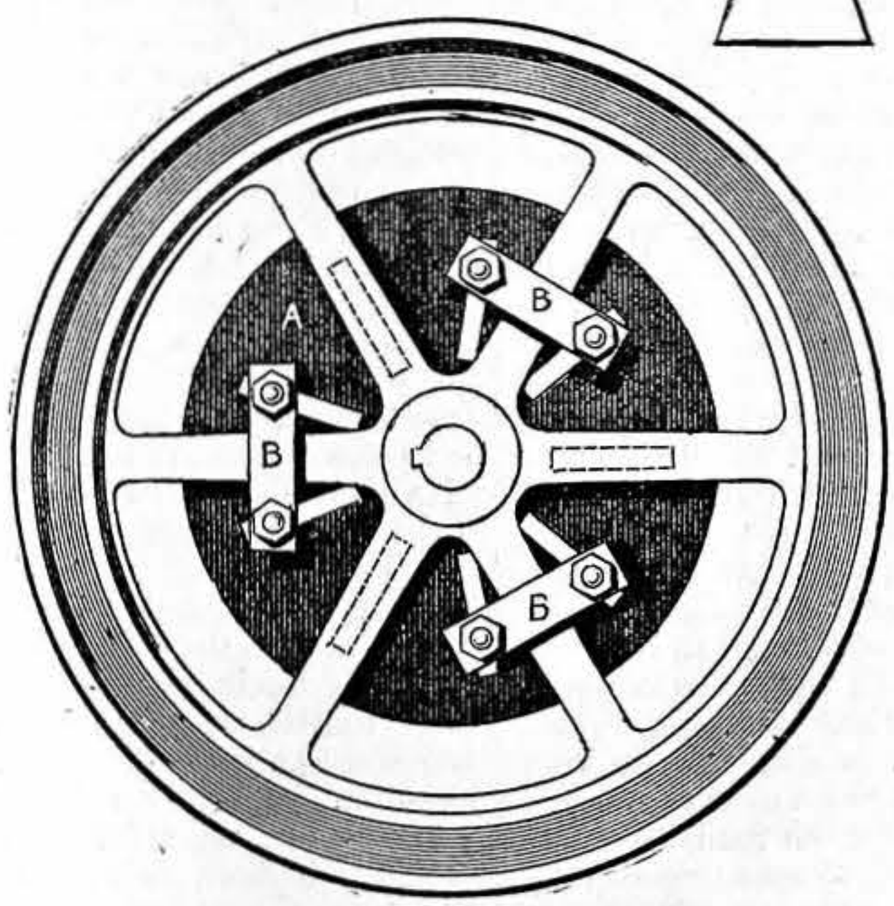


Fig. 46.

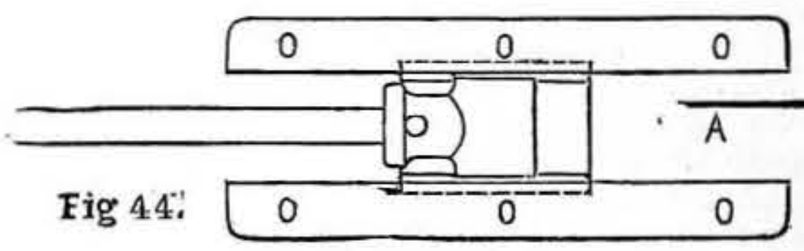


Fig 44.

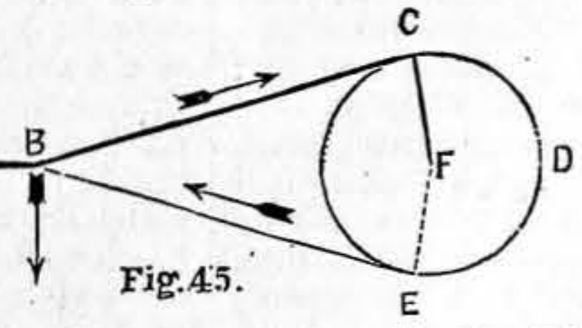


Fig. 45.

Fig. 38.—Wooden Plug for trying Hole in Bed-plate. Fig. 39.—Wooden Template for testing Bed-plate. Fig. 40.—Template. Fig. 41.—Mode of using Template to set Angle-plate to exact height. Fig. 42.—Mode of chucking Cross-head. Fig. 43.—Mode of securing Piston-rod into Cross-head. Fig. 44.—How Chamfers on Cross-head are tested for Parallelism. Fig. 45.—Diagram to explain Action of Connecting-rod on Guide. Fig. 46.—Mode of chucking the Fly-wheel.

Fig. 46 shows how the fly-wheel may be mounted on a 10 in. face-plate chuck for boring $\frac{7}{8}$ in. hole for crank-shaft. It is 16 in. in diameter, and if the gap in a 5 in. lathe were 3 in. deep, the wheel could be mounted as shown, the hole bored and slotted for the key, and the boss turned.

Possibly the rim might also be turned, but it would be with difficulty. It is not necessary to have it turned, though it does certainly improve the appearance of the engine, provided it be kept clean and bright. This rim, like the planing of the bed, might well be left to an engineer or to whoever supplies the castings. In Fig. 46, A is the face-plate; three of the arms are grasped by clamps of iron, B, B, B, and under each arm beneath these clamps are three pieces of hard wood which hold the boss of the wheel off the face-plate. When the wheel had been adjusted to run true and the clamp screws firmly fixed, the boss would be turned and the hole bored, first with a small drill, and then with larger ones, till nearly the right size, when it would be finished with a fixed tool in the slide-rest, using a sharp tool and a very light cut, and trying in the hole a bit of $\frac{7}{8}$ in. turned bar, to make quite sure it is turned parallel.

The key-way would be most easily made by slotting in the lathe—*i.e.*, fixing a slotting tool on the slide-rest, holding the work still, and moving the tool into the hole by working the saddle along by the rack. As, however, an amateur may not think it worth while to make a slotting tool for this key-way, and that in the boss of the eccentric only, he may do the job by simply marking the position of the key-way by two lines drawn inside the hole by the point of the tool which was used in the slide-rest for finishing the hole. To do this, the work would be held still whilst the lines were drawn by moving the saddle along the bed by means of the rack. This method would ensure that the key-way should be marked out parallel with the hole of the wheel, and then the cutting could be done with the chisel and file. The key-way is not "sunk" in the shaft, as is usual, but bears simply upon a flat filed on the shaft, and therefore it should be rather larger than usual, since it is absolutely essential that it should fit well, and hold the wheel to the shaft without the slightest possibility of turning on it, for this would produce a knock at every stroke; and any slight looseness there might be at first would continually increase. Then make key-way $\frac{3}{8}$ in. wide and $\frac{3}{16}$ in. deep.

NOTES ON HAND SAWS.

BY M. POWIS BALE, M.INST.M.E., A.M.INST.C.E.

Author of "Woodworking Machinery," "Saw Mills: their Arrangement and Management," "A Handbook for Steam Users," etc.

SELECTION OF A HAND SAW—SAW SHARPENING—VICE FOR BENCH—VICE VIBRATION—FORMS OF TEETH OF SAWS—ACTION OF RIP SAW—BEVELS OF TEETH—SETTING SAWS—SPRING-SETTING—HAMMER-SETTING.

ON no point connected with wood conversion do opinions differ so much as in what is the best shape and cutting angle of saw teeth, and the proper method of sharpening them. This is, perhaps, more particularly the case with power-driven circular and mill-web saws, and is proved by the fact that there are at least one hundred varieties of teeth in use; but it applies, to a certain extent, to hand saws. The few notes given here, I trust, may be of some service, and I shall not be accused of egotism as I simply give an opinion and nothing more.

Selection of a Hand Saw.—In selecting a saw, for whatever purpose, do not be tempted by a low first cost, as this is no criterion as to its ultimate cheapness. What is required is a blade made of the very best quality of steel, combining, as far as may be, flexibility and toughness with a sufficient degree of hardness to allow of the steel carrying a good cutting edge. A saw bearing the name of a maker of repute should, and usually does, give satisfaction; but as a great number of very inferior ones are sold, some of the points to be desired in a good one, with a few hints on testing, may not be out of place. In selecting a saw, see first that the handle is comfortable to the grasp and made out of thoroughly seasoned wood. Beech handles, with countersunk rivets, are preferred by many. The blade of the saw should be of as thin a gauge and as narrow as the nature of the work it has to do will permit. A thin and narrow saw wastes less wood and will work with less friction than a thick and wide one, consequently it requires less power to drive it; at the same time, it will usually be found that the steel used in thin blades is of finer quality than in thick. Care must be taken, however, that too thin a blade is not selected, and that the saw is stiff in work, as, should it "buckle," it may give a great deal of trouble. Bend the blade of the saw thoroughly, and see that it has a good flexible spring, and will fly back to its original position without marking or buckling the blade. Examine the blade carefully in a bright light, and see that it has been properly hammered and ground. See that it is carefully set and sharpened, and not too soft in temper, or it will rapidly dull and require frequent re-sharpening. If the saw has been "hammer"-set—in contradistinction to "spring"-set—without fracture to the teeth, it is a very fair test as to the quality of the steel. The blade should ring clearly when struck with the finger, and when sprung over by hand it should not jar in the handle. Finally, if possible, try the saw on a piece of difficult cutting wood, and see how it behaves: if it cuts fast and clean with a moderate expenditure of power, it is what you require. Increment teeth have of late come more into use—that is, the point of the saw is arranged with finer teeth than the heel—and are liked by many operators, as the fine teeth commence the cut smoothly, and the coarse teeth prevent the saw clogging.

Saw Sharpening.—Having selected our saw, now comes the question of sharpening it. This is usually done with a three-sided saw-file. These are generally cut in three degrees of fineness. A second-cut or smooth-cut file is best for sharpening a hand saw. Select a file of the very best quality, about 10 in. long, and see that the teeth are cut perfectly even, and the colour of the file is uniform. If it is of a whitey-grey colour throughout, it shows that the temper is uniform; but if it is mottled, you may conclude that the temper is uneven.

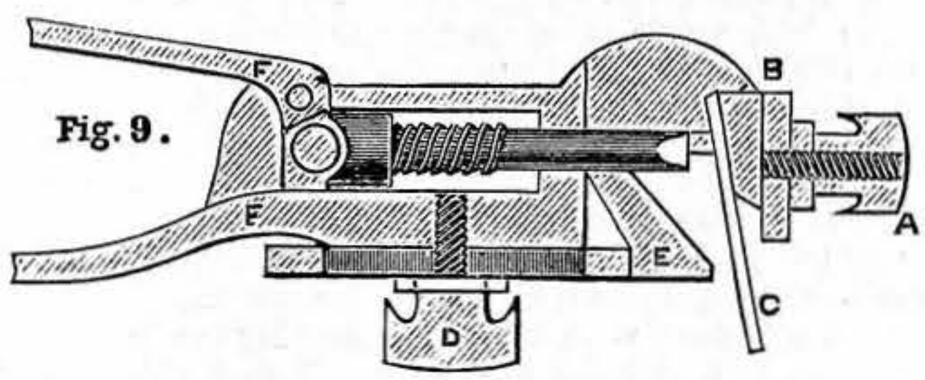


Fig. 9.

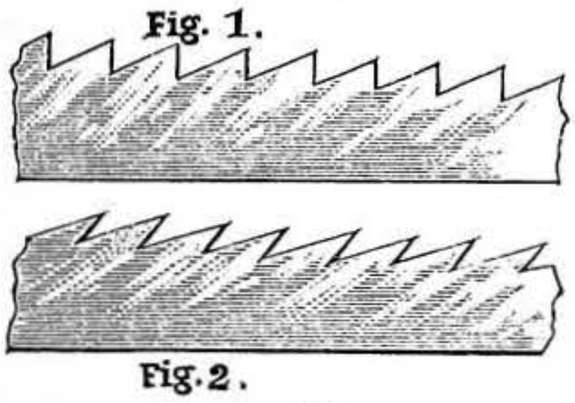


Fig. 1.

Fig. 2.

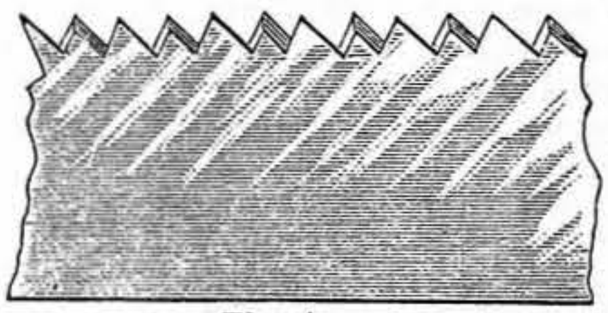


Fig. 4.


Fig. 3.

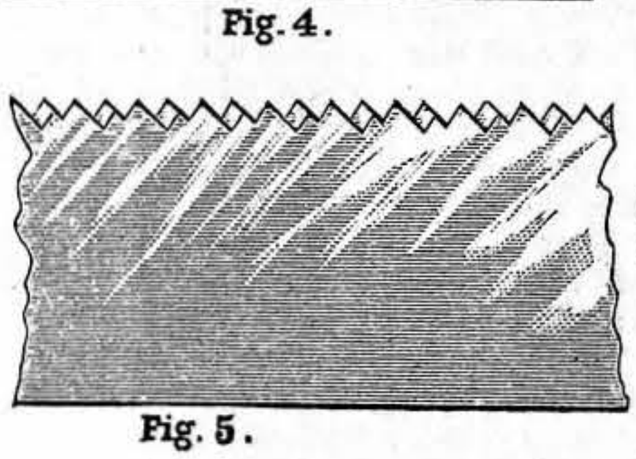


Fig. 5.

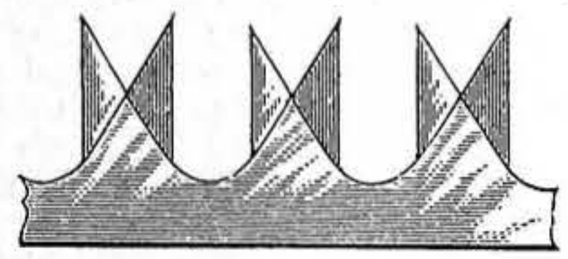


Fig. 6.

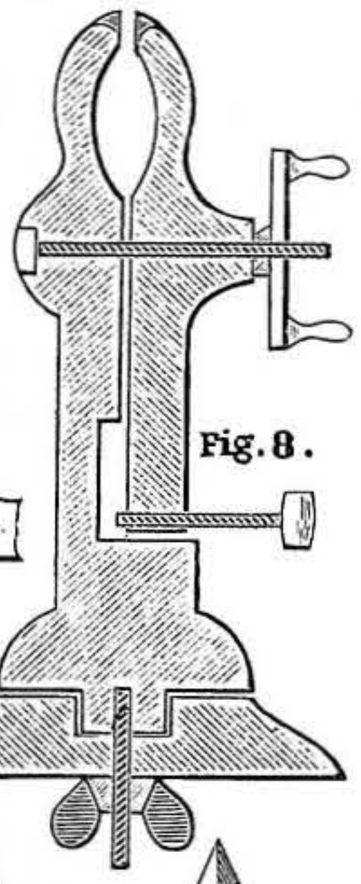


Fig. 8.

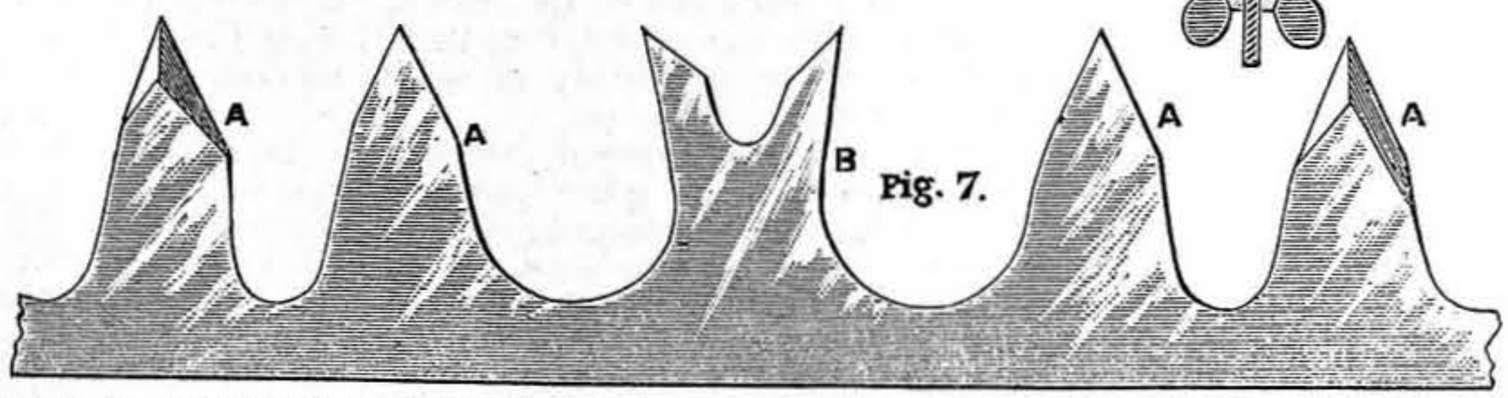


Fig. 7.

Figs. 1, 2.—Saw Teeth that may be filed square across. Fig. 3.—Saw Teeth with Rounded Gullet. Fig. 4.—Cross-cut Teeth for Soft Wood. Fig. 5.—Ditto for Hard Wood. Fig. 6.—M-shaped Teeth. Fig. 7.—Saw for cross-cutting Logs. Fig. 8.—Bench Vice to hold Saw during Setting. Fig. 9.—Patent Saw set for bending Saw Teeth.

To sharpen the saw, clamp it in a saw vice. The clamps should be of hard wood of about 3 in. deep by 1 in. in thickness. The upper edges of the wood should be chamfered off considerably, so as to allow of the file being held at an angle. The saw blade should project slightly above the top of the clamp, but not sufficiently far to allow of any vibration on it, or it will very soon strip the teeth of the file, and rapidly wear it out. The clamps and saw can be held between the jaws of the bench screw. Several excellent saw vices, well adapted for amateurs, are now made which spring the saw slightly, and so prevent vibration of the blade when filing. Vice vibration may be reduced considerably by fitting thick strips of indiarubber between the jaws.

Fig. 8 gives a sectional view of a very simple form of vice for fixing to work-table or bench. It is very handy, and will be found well adapted for amateur and general use. Its action will be readily understood from the illustration.

We will first consider briefly the sharpening of a hand rip saw. The forms of teeth most generally in use are shown in Figs. 1, 2, and 3. Fig. 1 is, perhaps, the most common, and, in my opinion, undoubtedly the worst form of the three; No. 2 a better form; and No. 3 by far the best, although the most troublesome to sharpen. In ripping with the grain of the wood, the saw teeth should act like a series of small chisels, producing minute chips or shavings instead of fine dust; if this latter is produced by a rip saw, it is grinding, not cutting. Correctly speaking, saw teeth should be adapted and modified in shape and set to suit the nature of the wood they have to cut; but as a hand rip saw has usually to do various kinds of duty, all that we can do is to select a tooth that can be used with tolerable success on a considerable variety of woods. The tooth shown in Figs. 1 and 2 is often filed square across, and this will answer fairly well for straight-grained wood; but as cross-grain is constantly met with, I prefer to file the teeth with a slight bevel. After the saw is set, some sharpeners give a bevel to the points of the teeth by holding the file at right angles to the saw. Owing to the rounded gullet, the teeth of Fig. 3 are much less liable to crack at the root than Figs. 1 and 2, which have an angular gullet. M-shaped teeth, similar to Fig. 6, are now largely used, chiefly in America. They have cutting edges both back and front, and will cut in both directions. They are usually bevelled and set alternately, and, if kept in good order, will cut rapidly.

The action of a saw when used for ripping or cutting with the fibres of the wood is entirely different from one used for cross-cutting or severing the fibres of the wood transversely. The shape of the teeth and the method of sharpening should, therefore, be entirely different. In the case of a ripping saw, the action of the saw is chiefly a splitting one,* the saw teeth acting like a series of small wedges or chisels driven into and separating the longitudinal fibres of the wood; whilst with cross-cutting saws, the fibre of the wood has to be severed across the grain, and is comparatively unyielding, and the teeth of the saw meet with much more resistance; it is therefore found necessary to make the teeth considerably more upright and more acute or lancet-shaped in their form than for cutting with the grain. Fig. 4 represents cross-cut teeth, adapted for soft wood, and Fig. 5 teeth for hard wood; the teeth for medium wood being at an angle about midway between the two. The faces of the teeth should be sharpened to a keen edge, so that in work they may have a direct cutting action similar to a series of knives. For soft wood the teeth should have a full set, and care should be taken that the teeth are made of sufficient depth to allow of an easy clearance for the sawdust. About eight or nine teeth to the inch can be recommended for general purposes. For hard wood there should be about ten teeth to the inch, and the back of the teeth filed square. Do not file all the teeth from one side, but file the front of all teeth set from you, and the back of those set towards you. Some sawyers recommend going over a saw several times to get the best results. The last teeth of cross-cut saws should be rounded at the points to prevent tearing when entering a cut.

One of the great difficulties found in hand sharpening is to get the bevels of the teeth exactly alike. A number of mechanical arrangements to guide the saw and effect this object have been tried with more or less success. In the best with which I am acquainted there is a circular casting, divided and indexed from its centre each way, giving bevels for each side of the saw, or square across. The file is fitted into a guide, and is held by a set-screw. The index shows the pitch at which the file is set, and a rod passes through holes in a graduating ring and guides the file. The frame upon which the ring is held slides in grooves cut on each side of the vice in which the saw is fixed; a table connected with the guide is arranged and indexed so as to give the required bevel and pitch for the kind of saw to be filed, and it is only necessary to set the ring for the bevel, and the indicator for the pitch, and the apparatus is ready for use. As the filing is proceeded with from tooth to tooth, the frame follows, giving the same bevel, pitch, and size to each tooth on one side of the saw the same as on the other, thus leaving the saw, when finished filing, with the teeth all uniform in size, pitch, and bevel, so that each tooth will do its share of cutting equally with the others, thus turning out more and better quality of work with a less expenditure of power.

After a saw has been sharpened, it should be carefully jointed, or, in other words, it should be laid flat on its side and the teeth rubbed down with a whetstone or smooth file to remove any feather edge that may be left by the file in sharpening. This gives a larger and better cutting edge to the saw. If the points of the teeth only are allowed to do the work, the action is a scratching and not a cutting one.

For cross-cutting logs with a double-hand saw, I can recommend a saw with teeth similar to Fig. 7, instead of ordinary cross-cut teeth, as it is much quicker and cleaner in cutting. These saws are of American origin, where they are now largely used. The cutting is done by the teeth marked A, and the tooth marked B acts as a clearer; this latter is filed about $\frac{1}{32}$ in. shorter than the scorer teeth. The teeth are often formed on both edges of the blade, and when one set are worn down, they are knocked off, and the other edge of the blade used. The saw is made slightly curved, and the handles reversible. Fourteen gauge steel is used. From experience I can say this form of saw is rapid and easy to work, and does not bind in the cut; at the same time comparatively little set is required. It will cut well both hard and soft wood.

Setting Saws.—After the saw is filed, and all the teeth made as uniform as possible in shape, length, and gullet, comes the important operation of setting the teeth so as to afford a ready clearance for the sawdust. This is apparently a simple operation; but to secure absolute uniformity in setting by the use of the common saw-set is not by any means easy, consequently greater power is required to work the saw. The longest teeth having the greatest set, are rapidly worn down, and the work turned out is scored and rough. At the same time, the saw will run from the line to the side of the saw on which there is most set. If a saw is properly and uniformly set, the teeth should form an angular groove one with the other when held up to the light and looked at from point to heel. The amount of set necessary to allow an easy motion to the saw without pinching it or allowing it to rattle will vary according to the nature of the wood—clinging and stringy fibred woods requiring more set than hard woods; but no more set should be given to a saw than is absolutely required, as the more the set the greater the power required to work, and the greater the loss of wood.

Two kinds of setting are used for hand saws—viz., spring-setting and hammer-setting. In the former the teeth are bent from the line by a saw set; in the latter they are set over by a blow from a hammer.

In using spring-set, it is necessary to slightly over-set the saw, to compensate for the tendency of the teeth, especially when worn and dull, to spring back to their original position. Several capital contrivances are now made for spring-setting, so arranged that all the teeth can be readily set to one line, and when the instrument is fixed it is impossible to overset a tooth; and should the saw be found to bind at any particular point, the teeth can, with this contrivance, be set into line, and any excessive friction reduced. I illustrate herewith such a set (patent) by Fig. 9, which is adapted for setting either hand, circular, mill, or band saws. Its operation will be readily understood from the sketch and the following directions for use: Hold the saw with the teeth upwards; adjust the die, B, by means of the screw, A, in the end of the set, so as to have the angle on the die, B, come near the base of the tooth on a fine saw; on a coarse saw, have the angle of the die strike the tooth about two-thirds down from the point. Set the guard, E, on the underside of the set forward to about $\frac{3}{16}$ in. from the die, B; then let the set hang loose on the saw. When thus held, the space between the tooth and the die shows the amount of set you will be giving the saw. To increase the set, move the guard, E, still closer to the die; to decrease the set, move the guard back.

Saws set by the blow of a hammer or punch are apt to be more irregular than spring-set saws; the operation should, therefore, be very carefully done, and the teeth constantly tried with a gauge or straight-edge, so that all the teeth should be exactly in line. Hammer or swage-set teeth will stand well up to their work in cross-grained and knotty wood, whilst spring-set teeth are more inclined to dodge the knots. I have seen saws working with part of the teeth spring-set and part hammer-set, but the difficulty of keeping them exactly uniform neutralises any advantages the plan may possess.

Before attempting to set and sharpen his own saws for actual work, the amateur should practise on an old saw which he cannot possibly spoil.

* See "Saw Mills: Their Arrangement and Management" (M. Powis Bale).

MY FIDDLE-CASE: HOW I MADE IT.

BY O. B.

PROFESSIONAL AND AMATEUR WORK CONTRASTED—PATTERN OF CASE—MATERIAL—JOINING UP BOX—FORMATION OF LID—LOCK, HANDLE, ETC. FITTINGS—LINING.

IF I were asked to define man, I would say he is a creature sensible of increasing needs. No sooner has he satisfied a want than he feels possessed of a capacity all the larger for having accomplished his object. This is the basis of all human progress, and of this feeling all men are more or less conscious.

These reflections have been occasioned this wise. Having made a music-stand, I soon began to feel that I was sadly in want of a fiddle-box. It is true I had a box, but the more I looked at it the more I became dissatisfied; and for this reason. Nearly thirty years ago I became possessed of a very fine old instrument. I gave a cabinet-maker an order to measure the fiddle for a suit of mahogany and baize, which in due time came to hand with the "little bill;" but one may imagine my annoyance at finding that to reduce the size of the box he had actually shortened the bow to the extent of two inches.

And here I am reminded of a circumstance which came under my notice a little while ago. Being in a town at a distance from my residence, I was accosted by a stranger who had seen my name announced. He wanted to know if my name had not appeared in WORK, to which I pleaded guilty; whereupon a conversation ensued as to the merits of the paper. His opinion was that many of the articles were very amateurish—for example, one on a music-stand. I maintained that one advantage of WORK was that amateurs wrote for amateurs as well as professionals for professionals, and that having faced difficulties, they were better able to explain them than the professional workman, who, from his frequent repetitions and mechanical operations, had long since failed to notice the difficulties. And further: it must have been observed many times over that when a professional gives instruction in his art, either from stronger professional jealousy or otherwise, some essential—some pinch of salt—is left out, so that the explanation is much like that of a professional conjurer: "You don't see exactly, you know." But, granted that an amateur does his work amateurish, what then? Do not professionals make blunders that an amateur would be ashamed of? What amateur would make a box to fit a fiddle and then cut a grand old bow to fit the box? Well, it was for this reason I discovered I needed a new one; for the young people had to carry the bow in paper when they went out with their fiddle; and besides, the box itself was of such a shape that some vulgar little boy cried out, "Heigh! see that lass: she has got a coffin!" and truly, it only needed the upper corners to be taken off to be the exact pattern of a box for "mortal remains;" but then, it was made by a professional, so there is *some* comfort in that.

The pattern and the material cost me some thought. There was the ordinary round-ended case, but to make a presentable one of this pattern, even if I availed myself of a Dutch cheese-box to provide the circular ends, did not seem very easy. Then there was the coffin pattern, but I could not contemplate that with any pleasure. There was only one that I could think of, known, I believe, as the French pattern. This seemed to be the best. Having a good stock of walnut-wood by me for fretwork, I considered this to be most suitable. Shooting one edge true, I measured and marked off two pieces for the sides (as Fig. 1), the long edge 2 ft. 8 in., short edge, 1 ft. 11 in., and 10 in. wide. These were carefully cleaned up. To make the ends the same angle, they were planed together, and then the ends reversed and planed up again. By this means the ends were got true. Two pieces, $10\frac{3}{4}$ in. by $4\frac{3}{4}$ in., for the ends; one piece, 24 in. by 5 in., for the top; and another, 29 in. by 5 in., for the bottom. The end pieces were made the same width, and one end of each squared off.

How should the box be joined up was a consideration. The wood was thin, so I decided on the following plan:—I cut a $\frac{1}{2}$ in. plank into $\frac{1}{2}$ in. strips, and glued and screwed a strip on the inside edges of the end pieces, which would be joined to the sides, being careful to use such screws as would not come through. When the glue was hard, I carefully squared up the edges. I now had a good $\frac{5}{8}$ in. surface to join the side to, which was done by glue, and three screws driven in from the outside. Before the glue set the work was tried, to see that it was true. The top and bottom of the end

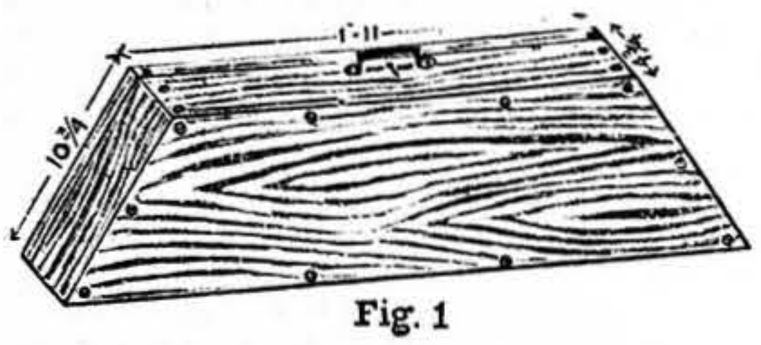


Fig. 1

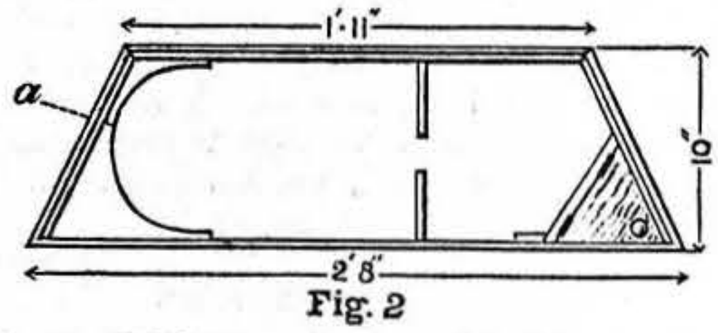


Fig. 2

Fig. 1.—Fiddle-case in Isometrical Perspective.
Fig. 2.—Plan of Case within.

pieces were now planed off level with the sides, and the inside edges of each were lined with strips, to increase the thickness all around. Then the edges were planed and squared up, and care taken that there was no winding on the edges. The top and bottom were now put on with glue and screws, precaution being taken that the screws were put at equal distance by measurement, else they would present an unsightly appearance when the case was completed.

The work was now put on one side to dry and harden, when the screws were withdrawn, and the whole surface was worked up as smooth as possible: first with a fine-set sharp plane, and then with glass-paper. The screw-holes were countersunk, and the screws replaced. The case was now cut in two, leaving a caddy-lid 1 in. deep. The edges were planed true, to make a close joint. On the inside of the deeper half along the top and ends a strip of wood was glued, projecting $\frac{1}{2}$ in., so as to form a rebate for the lid to close over (*a*, Fig. 2). This had to be taken down with a rebate plane, else the lid would be too tight. Blocks had to be glued on the inside of the bottom, to give a foundation to the screws holding the hinges, which, in my case, were ornamental ones fixed to the outside, and not as ordinary butts. A lock and handle were fitted in their place. The inside now received attention. Across one corner, as shown in Fig. 2, a piece of wood was secured by blocks, and a lid hinged, as a receptacle for strings, etc.

At the opposite end a piece of wood was cut with a fret-saw, to fit the end of the instrument. This was glued in its position, and secured with blocks. A piece of stout cardboard was then bent and fastened to the hollow wood with pins; this reached to the bottom. Measuring where the neck of the fiddle would come, a strip of wood was glued across the lower half, with a slot to take the neck. By this means the instrument is kept in its place. A packing-piece was secured from this division, slanting towards the tail, so that the instrument should bed firmly. On this, cotton wadding was laid. The sides and bottom were now lined with velvet. In the lid, on the longer side, two pieces of pine, 3 in. long, were glued, to hold the bow, which is kept in place by small brass buttons. The lid was also lined with velvet.

When the inside was lined, the outside was polished, after which the hinges and handle were replaced, and the case, thus completed, presents an elegant appearance. On the principle that the kitten can go through an opening large enough for the cat, I made my box deep enough to take the highest model fiddle I have, so that a flat model can be taken equally well.

AN EARLY RISER'S FRIEND.

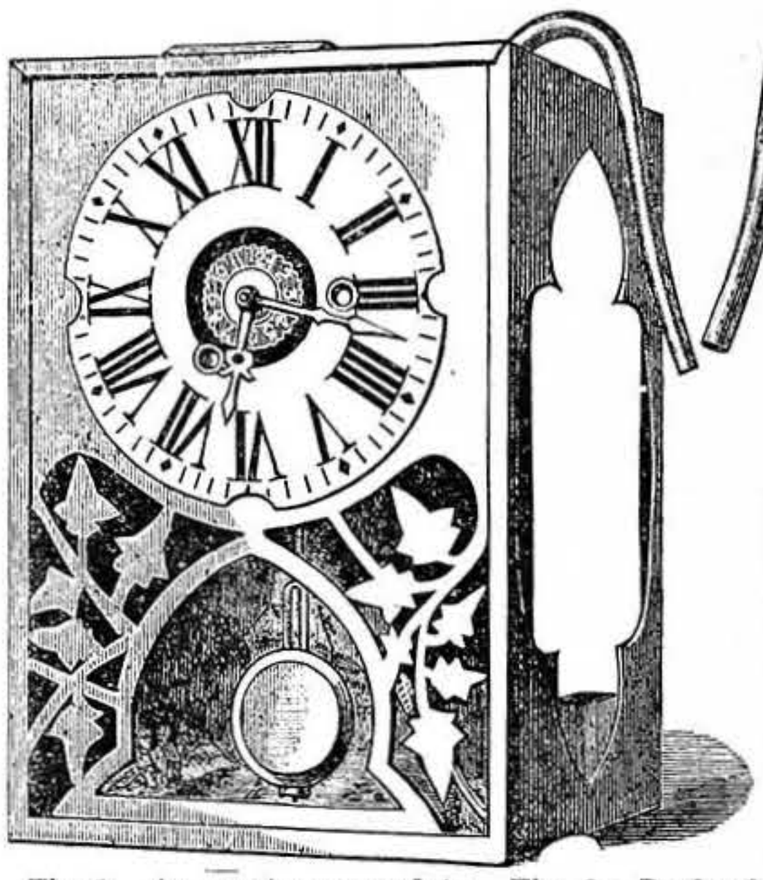
BY C. MAYNARD WALKER.

ADVANTAGES OF ALARUM—DIMENSIONS—CLOCK PARTS—CASE—PARTS OF APPARATUS—MAKING UP—THINGS THE ALARUM WILL DO—ALTERING CLOCK—MATCH-HOLDER AND AXLE—SPIRIT LAMP—HOLDER FOR STRIKING SURFACE—REFIXING CLOCK MOVEMENT.

How to make an alarum for early risers, which will strike a match, light a lamp, boil water, make tea or coffee, and awaken the sleeper at any required hour. The advantages to be derived from the habit of early rising, whether viewed from the points of obtaining or retaining health, or for the lesser objects of acquiring wealth by devoting more hours to labour, or of riding some particular hobby, are pretty generally admitted; and while it may be true that most persons living in the country practise from choice the laudable habit with a regularity that is perhaps hereditary, and also that thousands are compelled to rise early in order to follow their employment, whether they like it or not, it is equally true that a very respectable minority, who, while recognising the advantages of early rising, fail to acquire the habit, either from a want of strength of purpose, from natural sleepiness, or from some other reason equally powerful to keep them in bed, and who therefore usually "oversleep" themselves—unlike the late Duke of Wellington (the Iron Duke), who is reported to have uttered and acted upon the statement that "when a man turned over, it was time to turn out." The enormous trade in alarum clocks, carried on in this and other countries, is evidence that the class of persons referred to is a very large one; and as, doubtless, many of them are readers of this Magazine, and therefore anxious to carry out some of the excellent suggestions therein, will welcome the instructions here given, which, if carefully carried out, will put them in possession of a faithful servant, which will minister to their comfort by calling them at any desired hour,

and, further, getting the breakfast ready at the same time.

In these instructions it is to be understood that the parts are of such form and of such material as are best suited to be made up by persons capable of doing ordinary soldering with sheet metal, and without the use of expensive tools; therefore, such parts of the apparatus which could be much better made from castings and turned may be with advantage so altered. However that may be, the present plan will answer every purpose.



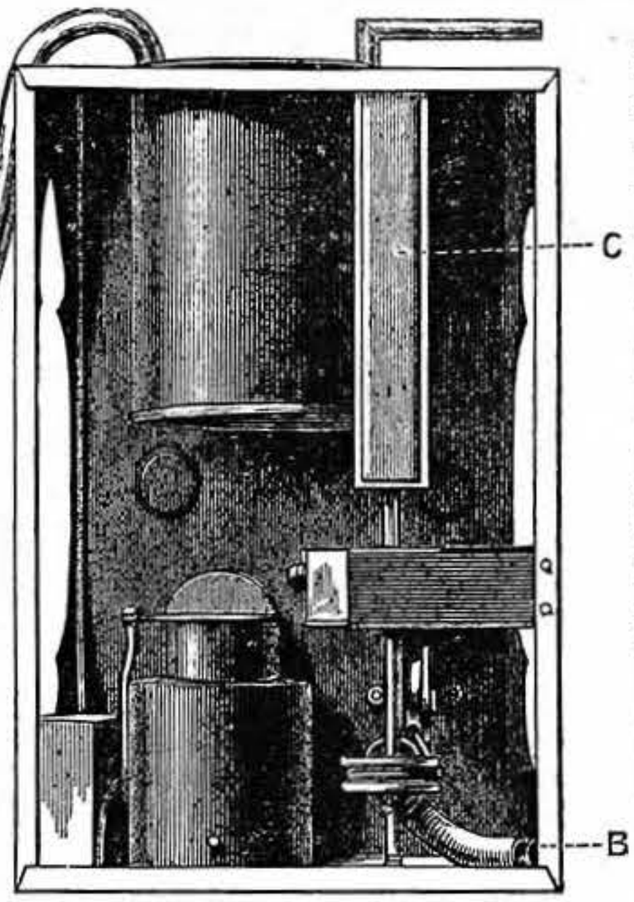


Fig. 1.—Apparatus complete. Fig. 2.—Back of ditto; B, Check Spring; C, Angle-piece.

Fig. 1 represents the complete apparatus, the dimensions being: height, 8 in.; width, 5½ in.; depth, 5½ in. externally, and is taken from a photograph of one in use, and made by the writer. The outer part or case is made of tinplate. The internal fittings are of wire and tin of the simplest kind, so that anyone capable of "jobbing" tin work may undertake the work with every probability of success. The clock part is an ordinary alarum clock, known in the trade as a "Cottage Alarm," and can be bought through any clock dealer, or direct from Messrs. Meyer, Aldersgate Street, E.C., for about 3s. 6d. This will be found a serviceable article. When purchased, it will be in a wooden case, which will of course be dispensed with and put to some other use.

We shall first require to make up the case (Fig. 3), which will need but little explanation beyond pointing out that the edges of the front are turned over on three sides only, the bottom being left to admit of the front sliding into its position; also that the device or cut out at the sides is simply to combine a little ornamentation while strengthening the side. The cutting should be made before the case is made up; also the hole, B, 3 in. in diameter, should be cut. The case is quite open at the back, and from the front a kind of inner case extends 2⅛ in. inside of tin, which will presently form the case proper of the clockwork. In the back of this inner case, at a point 1⅛ in. from the bottom and 1 in. from left-hand side, is cut an oblong hole, 1⅛ in. deep by ⅜ in. wide. This case should be very neatly made and its sides true to each other, or the finished work will present an awkward appearance. We have now to fit up the mechanism, and it will be best perhaps that, at this point, a description of the general idea should be given. We have an alarm clock, which, in its present form, simply sounds a bell at a given hour. We want to make the clock carry out our purpose, so that, in addition to being awakened, we shall be provided with tea or coffee, ready to hand when the alarm is given. In order to do this, we remove the spring of the alarm, and in its place attach a piece of catgut. Connect this to a piece of mechanism at the back of the case, which will carry and strike a match in such a position that the match will ignite a spirit lamp under a small boiler, the water of which will run out as soon as it boils into a tea or coffee pot, and at the same moment sound a shrill call with a whistle on the boiler. The writer has endeavoured to arrange the parts so that they occupy a comparatively small space, and that the case shall present a fairly ornamental appearance, the front (Fig. 1) being a design cut out of zinc with the fret-saw, and the dial of clock let in behind, the whole sliding up the groove referred to in case (Fig. 3).

The details of the various actions of the interior will now be described. Having made the outer case, we require to make the necessary alteration in the clock. Remove it from the case, and take out the wire holdfast on the alarm side, so as to be able to raise the plate. You can then, with a little care, take out the spring-wheel and spring, cutting the latter clear of the bar to which it is fastened to the clock. Having removed the spring from the wheel, punch out the rivet which held it in its place, and in lieu thereof pass one end of a length of catgut (14 in.) through the hole. Leave about ½ in. of the catgut out, tie a small knot, and restore the wheel to its position in the clock, and fasten up the plate as before. In front of the spring-wheel, at the winding-up pin, will be noticed a peculiar shaped piece of brass, which acts as a stop to the winder, and prevents the work being overwound. We shall require to readjust this later on.

Further down at the bottom of the works will be noticed an escapement in connection with the alarm, having a small weight on a piece of wire, which acts as a bell-hammer. Cut this off with wire-cutting pliers. Also notice attached to this two steel pellets, which, when the alarm runs down, alternately escape, and give the necessary intermittent action of striking the bell. We do not

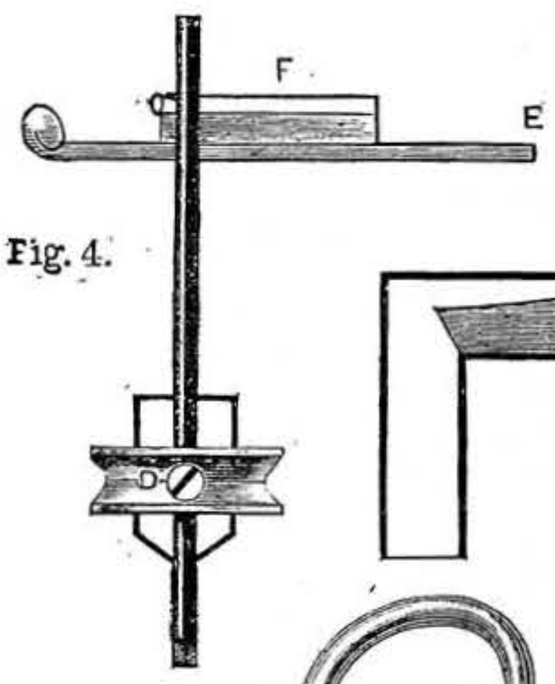


Fig. 4.

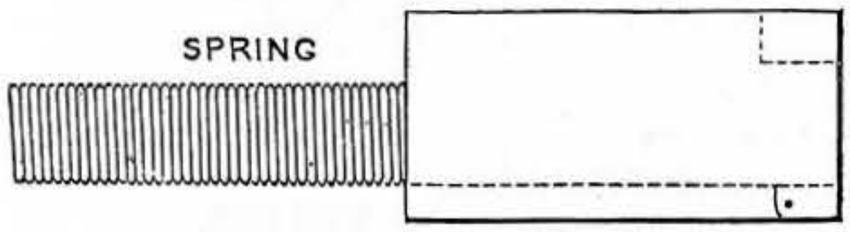


Fig. 7.

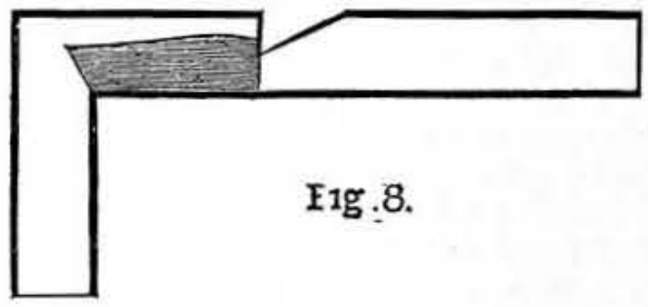


Fig. 8.

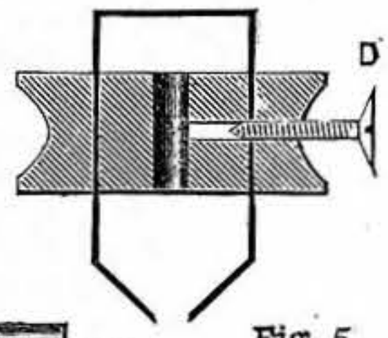


Fig. 5.

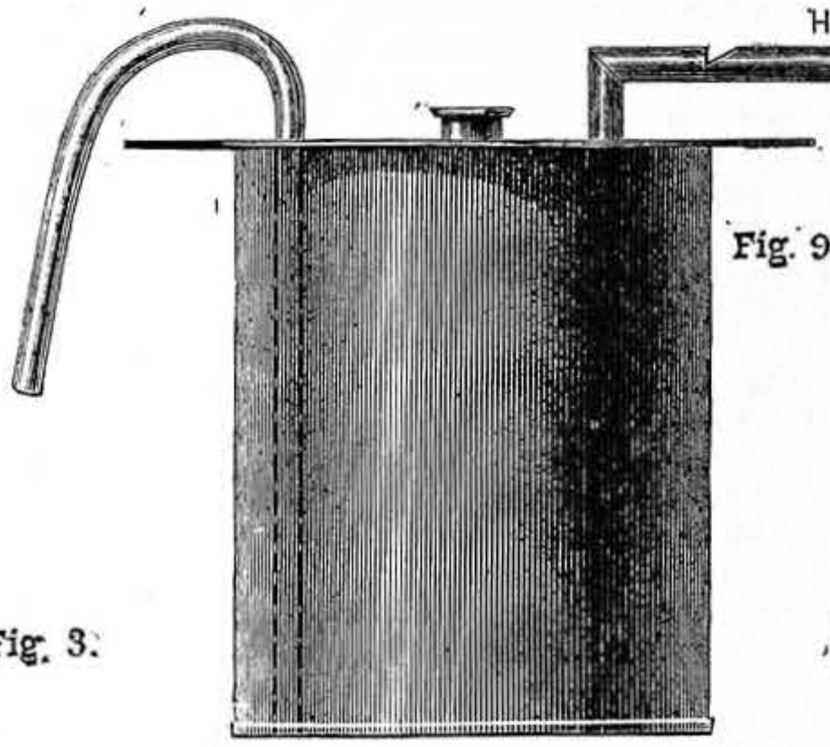


Fig. 9.

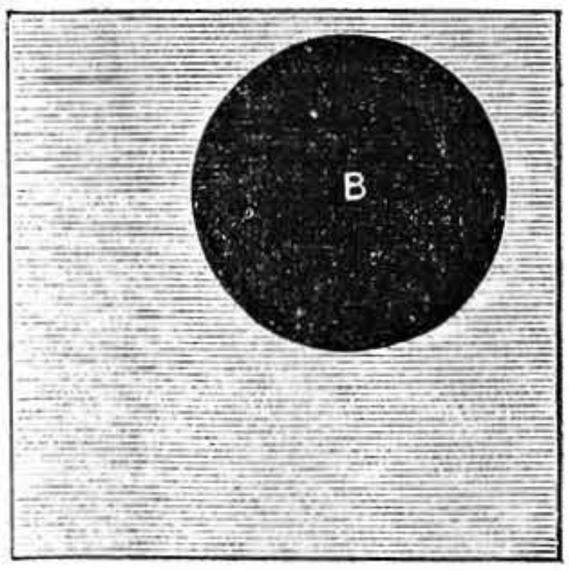


Fig. 3.

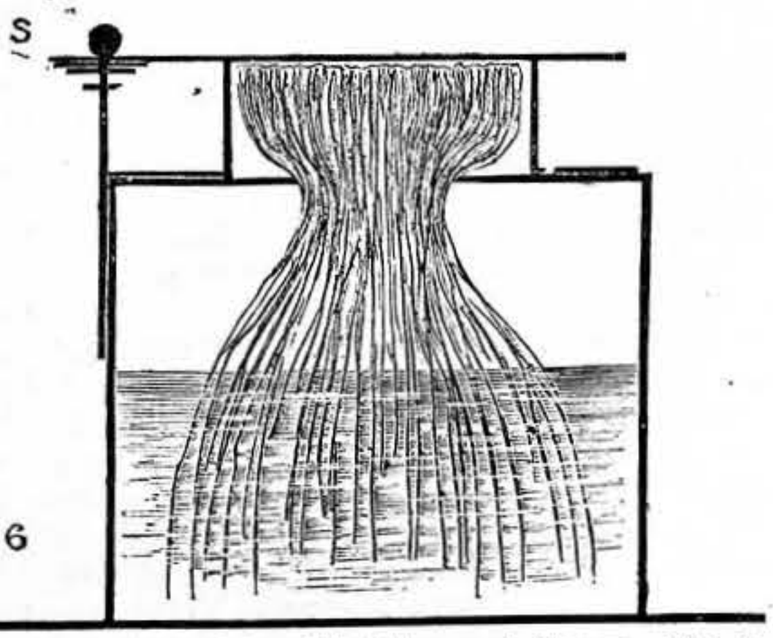


Fig. 6

Fig. 3.—Plan of Top of Case. Fig. 4.—Match-holder and Support (half full size). Fig. 5.—Pulley-wheel (full size), with Wire and Screw. Fig. 6.—Section of Lamp with Sliding Cover pivoted at S. Fig. 7.—Carrier for Friction Surface (full size): the Dotted Lines show where Edge of Metal is turned up. Fig. 8.—Section of Steam Whistle (full size). Fig. 9.—Boiler Pipe and Whistle.

require an intermittent action, but a continuous run down. So take firm hold of the *lower* pellet, and break it off. Being hard steel, it will readily snap. Hold the other part firmly, so as not to break both off. Now set the clock aside for a time. Then make a bearing to connect the catgut at right angles, for which purpose we require a pulley-wheel (such as are used by venetian blind makers, and sold in London about sixpence per dozen). This is fitted in the slot in the back of case by passing a piece of wire through the wheel, and soldering to the case. As this has to bear a considerable strain, the ends of the wire should be bent over, and let into the case before soldering. This will ensure the necessary strength.

We now require to make the match-holder and axle (Fig. 4), which consists of an upright piece of wire, $\frac{1}{8}$ in. thick by $4\frac{1}{8}$ in. long, to which, at a point 1 in. from bottom, is fitted another pulley-wheel, of the same kind just described. This is readily fastened by first drilling a hole on each side of the centre, passing a piece of bent wire through, as shown in Fig. 5, and soldering to the upright. Bore another small hole, and insert a screw, D. This will later on be connected to the catgut. At the upper end of Fig. 4 will be seen the match-holder, which is simply a piece of tin or zinc, 1 in. long by 1 in. wide, bent over a piece of $\frac{1}{8}$ in. wire, and pinched in under the wire, leaving a kind of tube when the wire is withdrawn. This is soldered to the upright, 1 in. from the top, and at right angles to the screw, D. A piece of tinned or brass wire is bent, as E, with an eye $\frac{5}{8}$ in. from the holder, F, leaving $1\frac{3}{4}$ in. extending in the opposite direction. This is soldered to the holder and to the upright, neat and strong. The next operation is to provide bearings for this work. The lower one will consist of the bottom of the case. For the upper one we must make an angle-piece (C, Fig. 2)—a piece of stout brass or zinc, $\frac{3}{4}$ in. wide, $7\frac{1}{4}$ in. long, bent to a right angle, 4 in. by 3 in., and soldered, the longer end to top of case, the shorter end to back of case, at a point $1\frac{1}{4}$ in. from the right-hand outside of case. Before soldering up, however, a hole to admit the upright should be punched in the shorter piece, at a point $1\frac{1}{4}$ in. from the bend. Having soldered this up, make a corresponding hole in the bottom of case, exactly under the other, so that the match-holder action-work will be vertical—that is, as shown in Fig. 4. If the measurements have been correctly made, you should have about $\frac{1}{8}$ in. to spare of the upright wire at each hole; and you can now secure this into its place, so that while it is free to move round, it cannot move up or down, by soldering at each end a bead of solder slightly larger than the holes.

We now require a small spirit lamp (Fig. 6), which is easily made of sheet zinc. The lamp is circular, with a square base, $1\frac{3}{4}$ in. high to shoulder, the part which forms the burner extending $\frac{1}{2}$ in. higher, having a diameter of $1\frac{1}{4}$ in. A "hank" of ordinary white darning cotton cut into three and placed inside the lamp forms a capital wick. The latter should not project above the lamp when in use, or it will hinder the action of the slide-cover. This cover is connected with an upright wire soldered to side of lamp (Fig. 6), and at a point level with top of lamp. A ledge is soldered to the wire. A hole is made in the extended side of cover, and is passed over the wire. A bead of solder on top serves to secure it, while leaving it free to move. Across the cover is soldered a semi-circular piece of tin, against which the wire at the opposite end of match strikes and knocks it away.

We have now to make the holder for the striking surface (Fig. 7), which is given full size, and is simply a piece of tin with edge and corner turned over at dotted lines. This is attached to a piece of crinoline steel spring, and soldered at its other end to the right-hand upright of case. It is best before soldering to pierce the steel, and insert a portion of an ordinary pin—the head part, and as much as is wanted of the stem. The steel must be softened at the ends to enable this to be done, which is readily effected by holding the ends in a lamp-flame till slightly red, and letting it cool of itself. It can then be punched with the point of a centre-punch or bradawl. The spring, when in position, should be curved inwards, so that the eye of match-holder just clears it. Thus, when the projecting match is in the holder, it will strike with some force. I prefer to use safety matches—the large size, Bryant and May's—and in the striker I place a piece of their friction surfaces, which are sold at most Italian warehouses at twopence per packet. Each sheet cuts into three, and each of the three is used four times—that is, I turn a different corner to the path of the match each time. Thus, a twopenny packet will last about nine months, daily use. I keep the box of matches in the case at the left-hand of lamp, and solder a strip of tin upright, which serves as a holder for the match-box, and keeps the lamp in position. The latter is best made with a square bottom, and to fit easily into the space left of the floor of the case. The lamp, of course, should be under the hole in top of case which was provided for the boiler (Fig. 9), which is 4 in. deep by 3 in. wide. The top extends $\frac{3}{8}$ in. beyond, all round. A piece of compo. pipe, $\frac{1}{4}$ in. bore, is soldered into top, near edge, and reaches to nearly the bottom; or, what is better, cut the pipe on the "skew," so that the water can run easily. A brass screw-cap is used for the filling hole, and a brass whistle (H) is made in an elbow form. Take a piece of brass tube, $\frac{1}{4}$ in. bore, $2\frac{3}{4}$ in. long. Saw off $\frac{3}{4}$ in., so as to make a mitre, and on the longer piece, $\frac{3}{4}$ in. from mitre, file an angular cut (Fig. 8). Stop up the longer end with solder, and insert in the shorter end a piece of cane or hard wood, the exact size of the tube, having previously filed the top flat, about $\frac{1}{16}$ in., slightly more at the mitred end. Just try it, and if you like the tone, secure the wood in its place by drilling a very small hole, and pass a pin in and solder to tube. Now solder the shorter end to top of the boiler, having previously made a hole at the spot. Next take a piece of suitable ordinary "bell-check" steel spring. Fasten the loop end to a piece of wire, and having passed the wire through the base of clock case, at the right-hand corner extreme point, solder underneath, and bend the other end of spring wire over the screw, D, in Fig. 5, so that when at rest it pulls over the striker a little beyond its proper position of being over centre of lamp.

There remains now only to fix clock movement into position, and connect the catgut (through the opening of clock case back) with the striking work at the point D. This is easily done by giving the gut a turn over D, and tying it to the wire over wheel. The gut should be so fixed that it brings back the striker to its position to centre of lamp. It will be necessary, of course, to pass the gut round the wheel, and the point D should be in the position of right angles to the striker. Now, if you wind up the alarm, you will see the action of the brass stop, before referred to. Take it off and adjust it when you have wound the gut up far enough to bring the striker to the right-hand side of case, so as to be easily manipulated in fixing match, and taking out the same. Stop its further turning by putting the stop so that it can turn no further. Replace the pin. Try the work a few times, seeing that the alarm escapement frees itself readily, and the work runs down with a sudden run. This being found all right, paint the whole (except clock) with black japan, and, when dry, slide into position the clock face. Fix on the hands and pendulum, and all is ready for use. I find about half a pint of spirit is used in a fortnight. As spirit easily evaporates, the cover must be put back as soon as lamp is blown out. Do not put the match in holder until wound up. I use a small china tea-pot, set under the pipe of boiler, for tea, and a jug for coffee. The apparatus makes these or cocoa admirably, from the fact that the water is actually boiling over when it comes into contact with either.

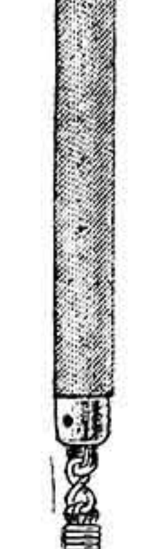
AN ASBESTOS LEAD JOINT RUNNER.

BY J. C. KING.

A PLUMBER is supposed to carry his kit of tools and melting pot, with some solder, with him, and do a job at joint soldering in a place which is sometimes almost out of sight and often difficult to reach.

Sometimes contriving an appliance to hold up the lead or solder to a joint to be wiped or scraped in the best manner, the awkward position admits of little chance of a clean job. The inventions of plumbers' tools have been slow, and differ but little year after year; yet the want of such handy appliances is felt alike by masters and workmen, especially at the away-from-shop jobs.

The invention now illustrated is by William Vanderman, 21, Church Street, Willimantic, Connecticut, U.S., and is intended to serve for running a joint for soil, water, or gas pipes, or bell pipes of any kind where a joint is poured with molten lead. It consists of a specially woven asbestos rope, with a safety chain down the centre, with tapering ferrules on the ends of the rope, fastened to the chain with a hook on one end and a coil spring and extension of chain on the other end, to draw round the pipe to get the rope in position below the joint that has to be run.



Asbestos Lead Joint Runner.

To operate it, make the lap on the top of the pipe with the tapered end under; draw tight, pass chain under pipe to opposite side, let the pull draw on the spring to take up any slack of the rope, and attach the hook to chain to keep all tight.

Be sure there is no space or opening except the space intended into which the lead is to be poured. If there is, press the joint runner up close against hub or lap. The

molten lead or solder will not injure the asbestos or bring any of it off to spoil a nice joint.

The usual plan of a putty or clay gasket, in some jobs stuck up like a swallow's nest, while the solder is baled with a spoon from a ladle and poured at a joint, is quite uncertain in results, as the clay or putty may be too hard or too soft, or get into the joint and spoil it.

No doubt this invention will lead to asbestos belting with chain inside for some forms of joint gaskets.

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 anyone 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.*

61.—Messrs. Marris and Cooke's "Victor" Child's Carriage.

In Vol. II., page 142, of Work, I had the pleasure of calling the attention of readers to

Fig. 1.—Messrs. Marris and Cooke's "Victor" Child's Carriage.

the original form of the "Victor" Child's Carriage, invented, patented, and manufactured by Messrs. Marris and Cooke, of Grimsby, who are also the proprietors of the Victor Bicycle advertised in these pages. The "Victor" Carriage in its earliest form was an excellent vehicle for children, and especially for children who were strong and active enough to take their turn in the shafts and draw one another; but its new development certainly has the merit of being more attractive in appearance, and is, in every way, more suitable and convenient as a child's carriage when mistress or maid is the motive power. This will be apparent to all who will take the trouble to compare the illustration given above with that in page 142 of Vol. II., over which it presents many decided advantages. Among these are the position and form of the shafts or handles, which are so contrived and affixed as to render it unnecessary for the tallest person to stoop when pushing it; and the carriage itself, which is level, or nearly so, when in transit, remains so when the shafts are relinquished by the driver, as when these are let down it rests on the irons which carry the front step; and, further, the irons attached to the back of the car prevent its being tilted up beyond a certain extent, and at the same time are not so long as to touch the ground when the carriage is being pushed along in a level position. The front seat is reversible, so that the child who occupies it may sit facing or with its back to the occupant of the back seat, the feet of both children being in the well of the car when the children are face to face. By means of two pieces of wood laid between the seats a bed is formed, on which an invalid child can recline with ease. It is well painted and nicely finished; it moves easily and without jolting on its springs; and its bicycle wheels are furnished with rubber tires, which render them absolutely noiseless, and

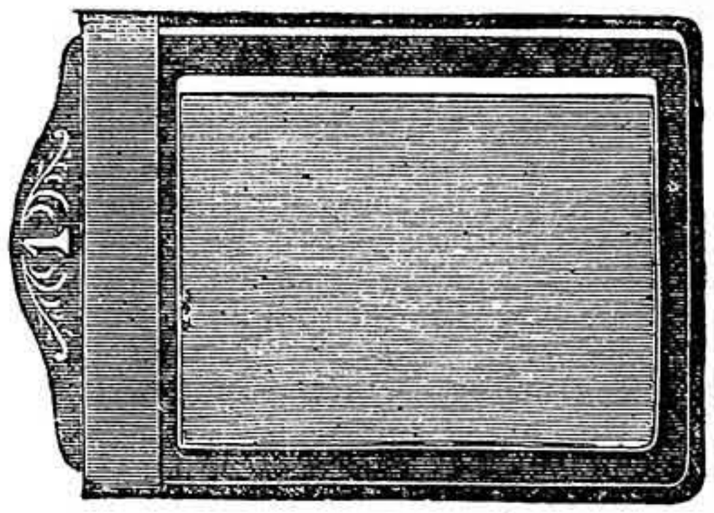


Fig. 2.—Tylar's Single Metal Dark Slide: Shut.

protected by broad mud-guards, which serve the double purpose of protecting the children from any mud that may be thrown up by the wheels, and also of preventing them from attempting to touch the wheels, which children are sometimes apt to do. The price, carriage paid to any part of the United Kingdom, is £2 5s. It compares favourably with, if it does not excel, any child's carriage of its kind, or any perambulator now in the market.

62.—Tylar's New Patent Single Metal Dark Slide.

This new invention of Mr. William Tylar, 57, High Street, Aston, Birmingham, and one of his most recent additions to his already large stock of photographic novelties, is specially designed for use in detective cameras, although there is nothing about it to prevent its use, generally speaking, in cameras so constructed as to admit of the use of dark slides. Its construction will be recognised from the accompanying illustrations, of which Fig. 2 represents it with the slide in or closed, and Fig. 3 with the slide withdrawn or open. To the back of the flat frame, which is shown in front, is attached a sheet of metal, moulded in the form of a shallow tray, and the slide or shutter works closely but not too tightly and stiffly in the groove, formed by the back of the frame and the upper surface of the margin of the back, rendering the dark slide absolutely light-proof. Below the groove, two projecting pieces of metal are attached to the sides of the

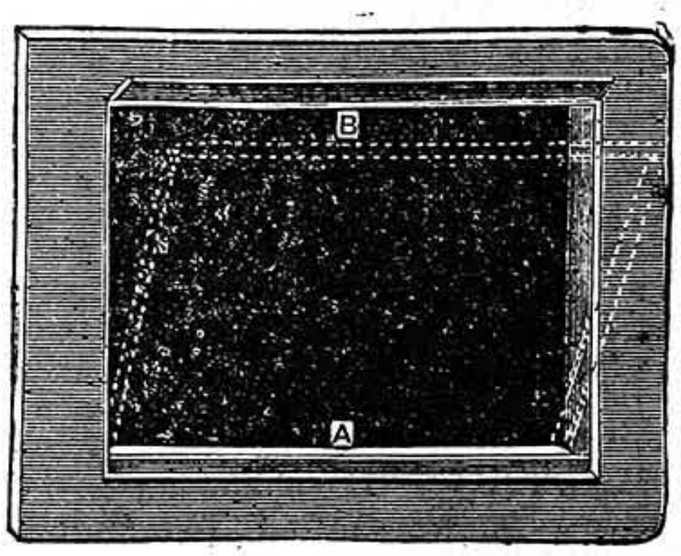


Fig. 3.—Tylar's Single Metal Dark Slide: Open.

rim of the so-called tray. That at A is fixed, and one side of the plate, which is dropped in from the front, as shown by the dotted lines in Fig. 3, is pushed under it. The slip at B lifts up, as shown in the illustration, and is closed down on the plate, thus holding it in position. Every slide and every shutter are interchangeable. They are supplied as ¼ plate slides, at 15s. per dozen: or at 20s. in a sling canvas case with focussing screen register. Mr. Tylar sends with this cheap and excellent machine-made slide a little finder for detective cameras, in the form of a small triangular box. The shorter sides are at right angles to one another, and are furnished, one with a lens and the other with a small ground glass plate, 1 in. by ⅞ in., on which the image of the object to be photographed is shown. It is fitted with perforated lugs for purposes of attachment, and is supplied at 2s. The Editor.

SUGGESTIONS FOR WORKERS AND HINTS TO INVENTORS.

Ammonia Gas Engines.—For very many years inventors have been endeavouring to devise a form of boiler in which ammonia can be profitably used in place of water. As, to give a pressure of 100 lbs. to the square inch, the latter must be heated to a temperature of 300°, while ammonia will give the same pressure when raised to 60° only, the enormous saving of fuel secured by using the latter is obvious. Unfortunately, however, ammonia is not so cheap as water by a long way, and its use can only be commercially successful if the gas evolved can be recondensed into a liquid so as to be again subjected to expansion by the application of heat. According to a New York journal, an American inventor has succeeded in fitting a condensing apparatus to his boiler, which goes a long way towards solving the problem. No one, however, has successfully tackled it on this side of the Atlantic as yet, and ingenious minds may find the hint useful. It is quite possible that the ammonia engine may, under certain circumstances, form the intermediate link between the steam engine and the electric motor.

Mechanical Shoe Blacking.—Considering the millions of boots and shoes which require blacking daily, it seems strange that no one has thought of producing a handy little apparatus which would save time and trouble when performing this operation. Electricity has already been pressed into service to drive mechanical blackers in certain shops at Paris and some of the larger American cities, but they are fitted up rather to attract customers than to effect any economy. Moreover, the average British housekeeper has not, as yet, laid on electricity into his house for motor purposes. The field is still open for the production of a cheap, handy, and effective substitute for the brushes. It need hardly be said that the shine produced by rapidly revolving polishers is, as evidenced by the electrical polishers to which we refer, much superior to that appearing on the boot blacked in the ordinary way.

Welding Copper.—Amateurs often ask for some easily applied process for welding copper—*i.e.*, dispensing with the use of spelter, and the consequent yellow marks along the seam when the operation is completed. To such the following description of an effective process may be useful, but it must be premised that great care in its performance is necessary, and that a first attempt is liable to be unsuccessful. The edges to be welded should be brought to a dull red heat, and most carefully cleaned from scale or ash. Then take 124 parts boracic acid and 358 parts phosphate of soda: mix them thoroughly, and apply to the seam. Increase the heat until the metal becomes cherry-red, and then, using a *wooden* (not an iron) hammer, weld the edges together. Non-success sometimes arises from either the edges being imperfectly cleaned or from want of judgment as to the colour of the metal before commencing to weld. The result, however, when successful, is very neat.

Gas Meter.—The recent case, in which a gentleman, dissatisfied with the record of his company's gas meter, fitted an extra one at his own expense, which indicated greater consumption than the official meter, shows the need of a *really* accurate meter. Inventive ingenuity should be directed towards devising an apparatus for providing uniform pressure of gas before it enters the indexing chambers. Gas companies usually have their meters tested under the same, or nearly the same, conditions, whereas, as every gas-burning resident knows, the pressure from the mains often differs widely on different days of the week.

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. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letter from a Correspondent.

Testing the Accuracy of Framework.—J. C. K. (*London, N.W.*) writes:—"In Work, p. 326, I read a simple way of testing the accuracy of framework by two diagonal measurements, having seen a similar statement, almost, in Work, May 2, 1891, thus: 'And a final check on its accuracy taken by measuring it across diagonally from corner to corner, when, if both diagonals are equal, the board will be square.' Though I do not think anyone will be misled into testing for squareness by this erroneous plan, I venture to send a sketch of a trapezoid, which has, at Fig. 1, a base line and two lines nearly at right angles to it, forming ends or sides, each line exactly $4\frac{7}{12}$ in. long and 5 in. on the top or opposite parallel line or side of an assumed

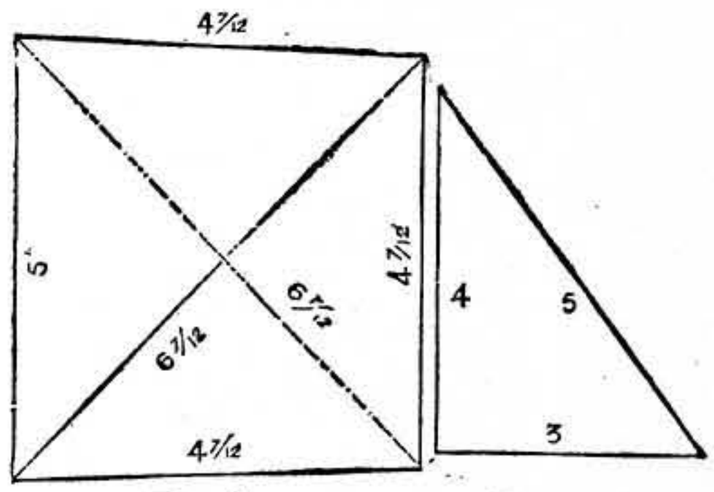


Fig. 1 Fig 2

Framework-testing Diagrams.

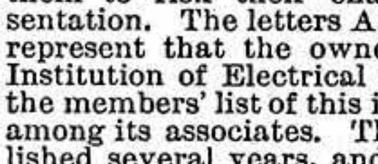
square. We will measure the two diagonal lines shown by the lines of dots. They are each exactly the same, $6\frac{7}{12}$ in., yet the sides are not square with the base line or top line, nor are the sides parallel with each other. There are several ways of ensuring accuracy of squareness to a frame, etc., by compasses or rule measure. One of the simplest and, perhaps, oldest known—practised by the slave workmen of Egypt and Greece thirty centuries ago—is to subtend a line from a base to a perpendicular, the base being as 4, the perpendicular 3, and the hypothenuse 5. This 3, 4, 5 is an immutable law of geometric proportion, and proves two sides are right-angled or square."

II.—Questions Answered by Editor and Staff.

Model Dynamo.—A Novice.—Mr. Bottone, Wallington, Surrey, makes a small model Siemens dynamo capable of lighting a 5 c.-p. lamp, and sells this machine for 15s.; castings in the rough for the same machine at 5s. the set. He will also supply you with a 10 c.-p. machine for 30s., or a 20 c.-p. machine for 50s. If you care to get the castings and make the machine yourself, you will find full instructions in "Model Electric Lights," published in Work, No. 92, Vol. II., on December 20th, 1890. If you choose a 20 c.-p. machine, run it on two 10 c.-p. lamps, instead of one of 20 c.-p. You can get suitable lamps from the vendor of the machine. The machine will work best on a firm foundation, but, as it will have to be run at 3,000 revolutions per minute, it must not be in a shaky position. The lamp may be close up to the machine if so desired, but must not be subjected to severe jolting. If you will read carefully the series of articles on "Model Electric Lights," which appeared in Vol. II., I think you will obtain all necessary information on dynamos, lamps, etc. etc.—G. E. B.

Carbon Plates.—M. C. (*Lewisham, S.E.*).—Carbon plates may be made of powdered gas carbon (not powdered charcoal) mixed with treacle to a paste, compressed in iron moulds of the required shape, and baked in the moulds. Powdered charcoal mixed with resin or shellac will not do for the purpose even when baked in a mould, as the mixture would be too friable, and the plate be a bad conductor of electricity. As carbon plates are sold at a low price, it will not repay an amateur to make them himself. Gas carbon may be cut into plates by means of an old saw or a strip of sheet iron improvised as a saw, together with wet silver sand. An unlimited supply of elbow grease will also be required. As you can get carbon plates at a cheap rate from Messrs. Peppercorn, Broadway, Deptford; or from Bonney & Co., 19, Avenue Road, Lewisham, it will not pay you to cut them from gas carbon.—G. E. B.

Bromide Enlargements.—Water.—Procure your lengths of pitch pine wood 3 in. wide by 1 in. thick. Cut out a groove about $\frac{1}{4}$ in. deep, and 1 in. from one edge along the side of each piece—which, of course, must be of the proper length for the tray in question. The corners, instead of being mitred together, are best rebated. The preliminaries having been made ready, the grooves and corners should be well smeared with a mixture of ground red and white lead, made just thin enough, and no more, to work with gold size. Three sides of the frame being securely screwed together, a piece of stout glass is pushed into the groove, close up, leaving $\frac{1}{4}$ in. projecting to fit into the end piece, which is now carefully pressed on, and well screwed at the corners. Now we have a dish with wooden sides and glass bottom, but not *sufficiently* watertight. Let this dry well in a warm current of air for a week, when we can set to work to render it absolutely waterproof with equal parts of pitch and paraffin wax *carefully* melted together, and well stirred during the operation. Having warmed the dish by the fire, and got it thoroughly dry, with a ladle pour some of the melted composition into all the corners, inside and out. If it happens to set too soon, get a hot spatula and rub it in. You will now have a thoroughly watertight dish, which had better be filled with water, and let stand one night, to dissolve anything prejudicial that may have been in the cement. Once more dry, and give the woodwork a coat inside and out with shellac dissolved in methylated spirits. When this is dry—which will be the case in a few hours—the dish is ready for use. Of course, small dishes may be made of lighter wood on the same principle. Pitch and paraffin wax is one of the best cements for this sort of dish. The accompanying diagram will show how the woodwork is put together.—D.



School of Electrical Engineering.—N. R. (*Carlisle*).—I think you are perfectly justified in making strict inquiries respecting the character of the school and its principal before parting with any money. Although I am not personally known to any of the gentlemen named in your letter, I should not doubt their good faith in recommending the school, as it cannot be of any personal interest to them to risk their characters by a false representation. The letters A.I.E.E. attached to a name represent that the owner is an Associate of the Institution of Electrical Engineers. On searching the members' list of this institution, I find the name among its associates. The school has been established several years, and is, I believe, doing good work.—G. E. B.

Incandescent Gas Burners.—C. B. V. (*Aldershot*).—If the pressure of the gas supply is weak, I think the light will not be improved by using incandescent gas burners, as my experience with these leads me to observe that they are useless when the pressure of gas is low. If the pressure of gas is fairly high, these burners give out a glowing, white, hot light, and they also give out considerable heat—more than an ordinary burner. They are useful where a room is to be lighted and heated with gas. I do not know the particular make mentioned in your letter, so cannot give the address of the maker. As you get such a bad light from gas, I recommend you to get some good oil lamps, as these give the next best light to good gas, and cost less than electric lights. If you have the power at hand to drive a small dynamo, then, as you have a good workshop and tools, why not make one, and lay down a small installation of electric light? You will find full instructions in "Model Electric Lights," published in Vol. II. of Work.—G. E. B.

Motive Power for Dynamo.—J. M. (*Hebburn-on-Tyne*).—Your idea, when worked out, should result in perpetual motion, if this were possible. If you could make a small dynamo to work a motor with part of its current, and then gear the motor to the dynamo, and thus work the same dynamo with its own current-driven motor, you would completely solve the question of perpetual motion. This equals the idea of a young friend of mine, who thought he could arrange a system of syphons to carry the tail water of a mill back into the mill-pond, and thus prevent waste of water. Suppose it takes, say, 100 units of power to drive a small dynamo 3,000 revolutions per minute. Part of this power will be used up in overcoming friction in the machine and belting, and part in heating the wires of the motor, still more in friction of the motor; so that we shall only get, at the best, about 70 units from the motor. As some of this will be lost in the friction of gearing with the dynamo, we shall only get about 50 units of power from the motor, or only half enough to drive the dynamo, even when the motor is supplied with *all* the current from the dynamo.—G. E. B.

Water Engine.—Water.—It is not possible to advise you without an inspection of the engine. Cannot you get a friend in your locality to look at it? Any working fitter could do so.—J.

Bench Maker.—J. O. H. (*Wandsworth*).—There is a cabinet bench maker in Old Street, St. Luke's, E.C., nearly opposite Pitfield Street, Hollis by name; but carpenters usually make their own benches.—B. A. B.

Galvanometer.—Galvanometer.—Take a needle, a little thicker than that fixed in the base-board, and fix at the eye end a piece of wood to form a handle, and using this in the same manner as a bradawl, work it carefully through between the coils of wire in the centre of bobbin, and when through, work it round to enlarge the hole, and slip it over the needle in the base-board. By using a little care, you can get the needle through without injuring the covering of the wire. Or you may fix a pin in the centre of bobbin before the wire is put on, and draw it out after the wire is wound on. You must be careful to fix the needle in the base perfectly square from the board, and at the proper height for the magnetic needle to be in the centre of the opening; also not to damage the point of the needle, and to make the conical hole in the brass very accurate, so that the needle will swing easily, as this will be more likely to impair the working of the instrument than if you should slightly abrade the covering of the wire.—M.

Frosting Ornaments.—A Would-be Decorator.—I have never heard of powdered mica, so cannot tell you where to buy it. As regards your difficulty, it is evident the acid has not sufficiently acted upon the mica; either it was not strong enough, or you did not boil it sufficiently long. Get the strongest acid and the thinnest sheets of mica, and try again, when you ought to succeed.—W. E. D., Jr.

Chemical Apparatus.—J. S. (*Little Horton*).—Put water into your flask, and suspend in it, by means of a string, a muslin bag containing your herbs. As the water distils over, it carries with it a little of the essential oil of the herb. Should any oil collect on the surface of the water, it can be drawn off. The oil which is dissolved in the water can be separated from it by saturating the liquid with common salt, when the oil rises to the surface.—F. B. C.

Oil Painting on Silk.—P. MacN. (*Shettlesworth*).—A preparation for this is sold by artists' colourmen, but the purpose will be served by dissolving a little isinglass in water, and sizing the silk with it. Take care to size it slightly *beyond* the future outline of the painting, or the oil will run.—S. W.

Porcelain Studies.—S. T. (*Amsterdam*).—As these are required *wholesale*, you are advised to apply direct to Messrs. Raphael Tuck & Sons, London.—S. W.

Watch-Case Engraving.—J. H. (*Ballina*).—Send your watch case to Messrs. Grimshaw & Co., 35, Goswell Road, Clerkenwell, or Haswell & Sons, 49 and 50, Spencer Street, Clerkenwell, either of whom will re-engrave or engine-turn it and re-polish as new, the price being about 2s. or 3s., depending on being a double case or an open face.—A. B. C.

White Pitch.—W. W. (*Bristol*).—This is also called Burgundy pitch, and is obtained from pine resin or white resin. It is of a pale yellow colour, and is sold by most chemists; the price is, I believe, about 2d. per oz. If you cannot procure any, if you write me through our Editor, I can get you some. There are also Venice turpentine and Canada balsam, both of which are light-coloured gums, and which harden by exposure.—M.

Answers in Work.—J. W. H. (*Nottingham*).—While writing, why did you not repeat your queries?

Medical Battery.—Reader.—It is not enough to simply describe the battery as a "constant current battery." There are many types of constant current batteries. I must know the name of your battery before I can tell you how to re-charge it. If you cannot give me the name of the maker or of the type of battery, I must trouble you for a complete description of it; then I can give directions for re-charging the cells, and say nearly the probable cost. The address of Messrs. J. & A. Churchill is 11, New Burlington Street, London, W.—G. E. B.

Low Voltage Incandescent Lamps.—Lamps.—The lowest voltage lamps are those of one candle-power, having a voltage of from 3 to 8 volts. Then there are lamps of two and a half candle-power, having voltages ranging from 5 to 25 volts. If you will apply to Mr. Bottone, Wallington, Surrey, and tell him exactly what you wish to do, he will advise you as to the best lamps for the purpose of floral decoration, and supply you with all things necessary for the installation.—G. E. B.

Electric Belt.—J. A. R. (*Wandsworth*).—The current obtainable from such a belt, as proposed by you, would be very feeble. The pockets containing the zinc discs should be all on the inside, and the pockets containing the copper discs all on the outside, of the belt, opposite to each other, with only a thin partition of flannel between. The outside discs of copper should be connected to the inside discs of zinc in each alternate pair, and thus make a battery of the whole. I do not see how a belt of alternate pieces of copper and of German silver wire, connected "on the thermopile principle," can do any good. The heat from your body would not be sufficient to make such an arrangement a good thermopile. But, whatever arrangement you may determine upon, the effect upon your body will be in accordance with your faith in its efficacy. The curative action of all these electric belts is much increased by faith.—G. E. B.

Copal Varnish for Floorcloth.—H. F. (*Gateshead-on-Tyne*).—If the copal or oak varnish is evenly applied by a brush, and allowed a reasonable time to harden before being used, it would undoubtedly do much to preserve your floorcloth from wearing out so soon. At any rate, it will freshen up the appearance, though it will be well to bear in mind that the wear is on both sides, the underside being usually protected by a coat of paint. As you say your varnish dries in the open air, but not indoors, would it not be better to remove the whole outdoors some fine day and do it there, first taking the precaution of well washing it with some soda water (a handful of washing soda to a gallon of water), and wiping quite dry? If the varnish has thickened by keeping, it will be necessary to thin it down a little with turpentine—not naphtha, as you suggest—and the addition of a little japanners' gold size will assist its drying properties.—LIFEBOAT.

Pin-hole Photography.—JOHNNY GILPIN.—The number of WORK in which the article appeared is No. 17. The plates used, and the development of the same, are precisely the same as for other photographic work. The only difference between pin-hole photography and that with ordinary lenses is that the pin-hole image is *never* absolutely sharp, but that the focus is always the right one, no matter at what distance the objects may be from the camera. The exposure is always very prolonged, so much so, that pin-hole photography is useless for ordinary work or dark subjects. The exposure is regulated by the square of the distance between the pin-hole and plate, and also the size of the picture by the distance between them. The size of the plate is quite immaterial, as, at a proper distance, *any* sized plate can be covered; but with very large sizes the loss of light is so considerable as to render photography impracticable.—D.

Oak Stain.—READER OF "WORK."—You would have done well had you told us for what particular purpose you required the stain. Do you wish to stain common white wood in imitation of oak? or do you wish to make light oak darker? Had you given us these particulars, your question could have been answered more fully and to the point; as it is, we can only answer in a general way. To stain common white wood in imitation of oak by the aid of spirit stains and varnishes is a rather ticklish job for an amateur; to stain the colour of oak is a comparatively easy matter. It can be done by giving one or more coats of asphaltum dissolved in turpentine or coal tar naphtha (½ lb. crushed asphaltum to a pint of turps); or you may thin down brunswick black with turps. The former is the most cleanly to use. Both must be used alone, not mixed with varnish; and both can be varnished over with spirit varnish, after first allowing a reasonable time to elapse for them to dry. If it is light oak that needs to be made darker, the asphaltum stain is a useful one, though the correct and most cleanly way is by means of fumigation, particulars of which you will find in "Shop," under the heading of "Stain" (p. 219, June 20th, 1891). If, on the other hand, it is cheap furniture you wish to do, you might do worse than read a reply given in "Shop" on "Graining Cheap Furniture," that appeared in the issue of June 6th, 1891 (p. 187). You will find there some useful hints. You say you have tried umber and spirits, but it does not suit. This would have been all right had you given the work a coat of patent size or varnish first, that had been stained by the addition of a little yellow ochre or lemon chrome—so forming a yellow ground to work on. The umber stain should be mixed with three parts spirits, one part polishor varnish (not all spirits). If, when this is applied, and while still wet, a grainer's steel comb is drawn over it, a passable imitation of oak will be the result. Finish by giving a coat of clear varnish. I append a couple of recipes for brown oak stains: (1) Mix together 2 oz. of pearlash and 2 oz. American potash in a quart of warm water, and apply to the parts to be stained. (2) 2 oz. vandyke brown, ½ pint liquid ammonia, ½ oz. bichromate of potash. A tinge of red in the polish or varnish will improve these. If stained varnishes are used, care should be taken to carefully strain through fine muslin before using; and you will be more likely to gain an even surface if the work has been previously sized over.—LIFEBOAT.

Looking-Glass.—F. L. (*West Cowes*).—Any glass merchant or furniture dealer will supply you with the above at about 3s. per foot super. But if you want such a quantity as would repay you for the cost of carriage, I should advise you to write to one or two large firms in London or Manchester for special quotations.—E. D.

Lathe Making.—LATHE-STRUCK.—It is well to be enthusiastic about the charming and useful art of turning, if your enthusiasm leads to patient and persevering work rather than trying to jump to the top of the tree at a single bound! Pray don't attempt to *make* a lathe till you know how to *use* one. Can't you get some workman friend to let you use his in the evening, when he has done work? You say you have no lathe, nor access to any; yet you write from a town where there must be a great many, and if you can't pay for the use of a lathe, you can, perhaps, earn the loan of one by working for its owner. Offer to go errands, etc., for some turner, for instance. If he will let you try your hand, make yourself useful to him, help him in any way you can *in his work*, and let him see you want to learn; and when you have worked at the lathe some two or three years, and can turn wood and metal, use files, chisels, tags, and dies; make and use drills; forge slide-rest tools; and, in short, when you have mastered the *a*, *b*, *c*, then you may think of making a lathe. Don't let your enthusiasm tempt you to try to do impossibilities, but rein it in, and make it keep you to the practicable.—F. A. M.

Paint.—H. E. R. (*York*).—If you had stated in what way the wall was damp, and from what cause, I might have been able to have given you a remedy far preferable to paint. Write to the Damp-proof Paint Co., Cannon Street, London, for particulars of their paint, and if you are not successful with it, let me know more about the damp, and no doubt we can get over the difficulty.—E. D.

Waterproof Glue.—F. B. (*Aldershot*).—If your two letters to the Glue Company had no fuller address than the one you sent us—which is quoted above—it is no wonder that you have received no answer to your communications. When you write a letter, you should add your full name and address.

Printers' Roller Composition.—POTASH.—A "compo." which is an improvement on the old glue and treacle, is said to be made of glycerine and gum; but instead of making, POTASH will be far wiser to buy his compo. ready mixed, as he can do from any printers' broker at from 1s. to 1s. 6d. per lb. The Durable Patent Roller Composition is sold only by the company so named (57, Shoe Lane, London, E.C.) and their agents.—S. W.

Fixing Carbon.—NO NAME.—Le Page's glue, or any bicycle cement, will fasten a piece of carbon to ferrotype or wood. These cements are very useful for all such purposes.—W. D.

Safe Locks.—J. A. (*Walsall*).—I cannot do better, in answer to your query, than quote Mr. Chatwood, the eminent safe maker. "In an ordinary lever lock, the bolt has fixed upon it, at right angles, a projection called the main stump, and each of the levers has a passage or gating, which, in a well-made lock, should be no wider than is absolutely necessary for the stumps to pass through. In unlocking the lock, all these levers have to be raised, each exactly to its right position, before the bolt can be withdrawn. If anyone of them should be raised too high, or not raised sufficiently, the stump is blocked, and therefore the bolt cannot be withdrawn. At the first glance it would appear impossible to pick such a lock, if the number of levers be considerable. The key has a number of steps, each of which—except the bottom one—lifts one of the levers. The bottom step then engages with the bolt, and draws it back. To pick such a lock, pressure is applied to the bolt, so as to cause the main stump to press against the face of the levers; then, by raising each lever in turn, the position of the gating is easily ascertained by the difference between the friction on the lever when pressed by the main stump and when in position and no longer pressed by the main stump. In a lock with many levers, special appliances are necessary for these purposes. The apparatus used in picking lever locks consists of a tubular key having one step upon it, and a solid key fitting inside it, and also having one step upon it, having an ordinary key bow with a lever arm carrying a small weight. These can be operated quite independently of one another. The step in the solid key engages with the talon of the bolt, and the weight on the lever arm attached to it causes the stump to be forced with suitable pressure against the faces of the levers. By means of the step on the tubular key, the levers are raised in turn to feel for their gatings, and as each is found, extra pressure necessary to retain them in position is provided by moving the weight along the lever arm. When all the levers have been thus arranged, the bolt is withdrawn." Lever locks with patented improvements, such as are now manufactured by Messrs. Hobbs, Hart & Co., and Messrs. Chubb, are practically unpickable.—T. W.

Distemper Lines.—J. B. (*Manchester*).—Lines of colour may be run with lining-fitch and straightedge upon paper, distemper, or such-like absorbent surface either as "size colour" or "turps colour." For the former, mix *best* venetian red powder with water to a stiff paste, then thin for use with strong jelly size. This must be kept warm in using, as you may surmise. For turps colour, use japan gold size to make the dry pigment into "batter" consistency, then thin for use with turps. Both of these should work well and stand sizing. The simplest plan for blocking marble is a red or black pencil drawn round a wooden frame of block size.—F. P.

Smooth Surface for Decoration.—G. S. R. (*Tewkesbury*).—When a wall is badly plastered, no subsequent rubbing or smoothing will remedy the mischief. The best that can be done is either to prepare it in distemper, or to line it. After removing the old paper, and washing down the walls thoroughly to remove the old paste, etc., make some distemper (see Index, Vol. II.), but with *double* the quantity of *size*. Give the wall a good coat of this, used just warm, which will fill a lot of cracks, etc. Stop holes, etc., with plaster, and when all is dry, rub down with "coarse 2" glass-paper. It can now be treated with alabastine direct, or—a much better job—give it first a thin coat of oily paint. *Lining* the wall—viz., covering it with a stout white lining-paper—requires a paper-hanger's skill; and the wall must be also well prepared. The first is the easiest and dirtiest, and the latter the quickest and dearest, plan.—F. P.

Japanese Leather Papers.—F. R. E. (*Darlington*).—For Japanese leather goods, etc., *wholesale* and in large quantities, write Messrs. Rottman, Strome & Co., St. Mary Axe, London, who are makers, having factories at Yokohama, Japan. Maw & Co., Farringdon Road, City, E.C., are also large importers of all oriental goods. For odd yards and remnants, write Liberty & Co., Regent Street, W.—F. P.

Gilding on Varnish.—F. R. E. (*Darlington*).—For this class of gilding oil gold size is used. The surface of varnish scarcely ever being free from sufficient "tackiness" to hold gold leaf, it is first necessary to coat the work all over with albumen of one egg blown into half a pint of lukewarm water. Twist it into a froth with the brush, and brush on the froth. Use the gold size very barely. When gilded (see recent article), wash off the egg size with hot water and soft sponge, which removes also all superfluous gold leaf.—F. P.

Battery for Electric Light.—F. G. (*Paddington, W.*).—Get four glass pickle jars or marmalade jars 7 in. by 4 in. The mouths of these should be from 2½ in. to 3 in. in diameter. Get for each bottle two carbon plates 7 in. by 2 in. by ¼ in., and one zinc plate 7 in. by 2 in. by ⅛ in. Also get a binding screw clamp to fit each zinc plate, and a similar clamp with jaws 1 in. deep and 1¼ in. apart, to clamp the carbon and zinc plates together in each jar. Amalgamate the zinc plates with mercury. Put the zinc clamps on the tops of the zinc plates, ⅜ in. at one side of the centre. Cut two strips from a cigar-box cover 3 in. by ⅝ in. for each zinc plate, place them along the top of each zinc plate on each side, place a carbon plate on each side of these, and clamp the whole together. The strips of wood will keep the carbon plates from touching the zinc plate, and the deep-jawed clamps will connect the two carbons. If you do not care to go to the expense of brass clamps, place a strip of sheet copper between the top of the zinc and the wood, and two strips between the carbon plates and the wood on each side to form connections. Separate the zincs and carbons at the bottom by two similar pieces of wood, and bind the whole together with indiarubber bands. This is a cheap makeshift. Battery plates thus put together can be easily taken apart to be cleaned. Charge each cell with a solution of chromic acid and sulphuric acid in water, 3 oz. of each to each pint of water, and allow the solution to cool before using. You should get 8-volt lamps to use with a battery of four such cells. Place the battery in a box in a cupboard or in the cellar, and lead No. 18 copper wires from the battery to the lamp-holders on the piano. Each lamp must be covered with a conical shade to screen the eyes from the glare of the light, and throw this down on the music-book. A switch should be provided to throw the lamps in or out of action at pleasure.—G. E. B.

Faulty Induction Coil.—NEMO.—Although four medium size Leclanché cells placed in series do not furnish a battery strong enough to work an induction coil 9 in. by 5 in., the current from such a battery will magnetise the core, and cause the hammer to vibrate, if the coil has been properly made, and the connections are all right. If you can get a current from this battery "through the machine" without "any magnetic effect whatever on the core," then there must be a serious leakage across the primary, such as connection between the first turn of the first layer and the last turn of the last layer, or the both ends in contact with the core, foot of break spring, or similar good conductor. If I could see it, I could tell you in a few minutes where the fault lies. Without seeing it, I can only suggest the above as being the most likely fault. If the coil is properly made, it should take the current from six bichromate or chromic acid cells.—G. E. B.

Electro-Magnetic Apparatus.—F. H. (*Drayton Park*).—To work the apparatus described by you, it will be necessary to have a horseshoe magnet with cores 3 in. by ½ in. fitted with bobbins 1½ in. in diameter, wound to the full with No. 22 silk-covered copper wire. The weight to be lifted must be attached to an armature of soft iron, ½ in. by ¼ in., and long enough to span the poles of the magnet. The current should be furnished by three medium size Leclanché cells in series. Connect the cells to the clock and to the electro-magnet with No. 18 wire; then you need not fear any serious decrease in power whether the machine is placed twenty or forty yards from the clock. A stud must be placed on the clock face, and a spring contact fitted to the hour hand to sweep over the stud each hour and keep in contact with it for five seconds. Used thus, if properly fitted up, the battery would probably retain its power and keep in working order for several months, perhaps a year.—G. E. B.

Measuring Instrument.—POLYGON.—The instrument about which you inquire is a sector, by the aid of which all questions in proportion may be solved; lines may be divided either equally or unequally into any number of parts that may be desired; the angular functions, viz., chords, sines, tangents, etc., may be set off or measured to any radius whatever; plans and drawings may be reduced or enlarged in any required proportions, and, in short, every operation in geometrical drawing may be performed by the aid of this instrument and the compasses only. I suppose yours is the ordinary six-inch sector, which, when opened, forms a rule of twelve inches; and this circumstance is taken advantage of by filling up the space not occupied by the sectoral lines with such lines as it is the most important to lay down upon a greater length than the six-inch plain scale will admit. Among these the most usual are (1) the lines of logarithmic numbers, sines, and tangents;

(2) a scale of twelve inches, in which each inch is divided into ten equal parts; and (3) a foot divided into ten equal primary divisions, each of which is sub-divided into ten equal parts, so that the whole is divided into one hundred equal parts. This last is called the decimal scale, and is placed on the edge of the instrument. The "sectoral lines" proceed in pairs from the centre, one line of each pair on either leg, and are, upon one face of the instrument, a pair of scales of equal parts, called the "line of lines," and marked L; a pair of lines of chords, marked C; a pair of lines of secants, marked S; and a pair of lines of polygons, marked POL. Upon the other face the sectoral lines are: a pair of lines of sines, marked S; a pair of lines of tangents up to 45°, marked T; and a second line of tangents to a lesser radius, extending from 45° to 75°. Each pair of sectoral lines, except the lines of polygons, should be so adjusted as to make equal angles at the centre, so that the distance from the centre to the corresponding divisions of any pairs of lines, and the transverse distance between these divisions, may always form similar triangles. On many instruments, however, the pairs of lines of secants and of tangents from 45° to 75° make angles at the centre equal to one another, but unequal to the angle made by all other pairs of lines. The divisions of each sectoral line are contained within three parallel lines, *the innermost* being the line on which the points of the compass are to be placed, because this is the only line of the three which goes to the centre, and is, therefore, the sectoral line. The line of polygons is chiefly used for the ready division of the circumference of a circle into any number of equal parts from 4 to 12—that is, as a ready means to inscribe regular polygons of any given number of sides from 4 to 12 within a given circle. To do which, set off the radius of the given circle (which is always equal to the side of an inscribed hexagon) as the transverse distance of 6 and 6 upon the line of polygons. Then the transverse distance of 4 and 4 will be the side of a square; the transverse distance between 5 and 5 the side of a pentagon; between 7 and 7, the side of a heptagon; and so on. If it be required to form a polygon upon a given straight line, set off the extent of the given line as a transverse distance between the points upon the line of polygons answering to the number of sides of which the polygon is to consist; as for a pentagon between 5 and 5; or for an octagon between 8 and 8; then the transverse distance between 6 and 6 will be the radius of a circle whose circumference would be divided by the given line into the number of sides required. All regular polygons, whose number of sides will exactly divide 360 (the number of degrees into which all circles are supposed to be divided) without a remainder, may likewise be set off upon the circumference of the circle by the *line of chords*. Thus, take the radius of the circle between the compasses, and open the sector till that extent becomes the transverse distance between 60 and 60 upon the line of chords; then, having divided 360 by the required number of sides, the transverse distance between the numbers of the quotient will be the side of the polygon required. Thus, for an octagon, take the distance between 45 $\left(\frac{360}{8}\right)$ and 45; and for a polygon of 36 sides take the distance between 10 and 10.—F. B. C.

Varnish for Walking Sticks. — C. BROS. (*Leeds*).—These, when done in large quantities, are generally finished by drying in a hot room or drying stove. Suitable varnishes are sold by most varnish makers, amongst whom, in your neighbourhood, you might write to or call upon Mr. H. O. Milnes, Leeds Road Varnish Works, Bradford, stating your requirements; he will, I think, be able to suit you. Also with a black varnish suitable for dipping your iron wire in. If, however, you have no drying stove, or large quantity of sticks to do, what are known as spirit varnishes are most suitable. Foremost among these is that known as brown hard spirit varnish, made as follows:—Gum sandarach, 4 ozs.; seed lac, 2 ozs.; gum elemi, 1 oz.; methylated spirits, 1½ pints; when dissolved, add Venice turpentine, 2 ozs. Another:—Rectified naphtha, 1½ pints; gum sandarach, 2 ozs.; best amber resin, 2 ozs.; gum benzoin, 4 ozs. Both must be carefully strained before using, then applied with a camel's-hair brush. If required harder, this can be done by adding one-third part of French polish, made by dissolving 6 or 8 oz. of best orange shellac in 1 pint of rectified naphtha.—LIFEBOAT.

Cleaning Old Gilt Frames.—A. E. S. (*Wootton Bassett*).—The only way, save re-gilding, of improving the appearance of old gilt frames is to wash off the dirt and fly marks contained in the coat of size which covers all gold framework. This may be done by using a small sponge barely moistened with hot spirits of wine or oil of turpentine; *do not wipe* afterwards, but leave to dry. This process requires great care.—F. B.

Alloy.—ALLOY.—This querist asks to be informed of a metal nearest in strength to iron, which will not rust, and which can be melted on an ordinary fire. I think the metal or alloy which complies nearest with these conditions is brass. This may be melted on a close range fire under favourable conditions, and though greatly below iron in strength, yet it comes nearest to it to comply with the other two conditions — viz., non-rusting and fusibility.—R. A.

Pewterers' Flux.—A. E. (*Langton*).—The flux generally used by pewterers for soldering pewter counters, pots, etc., is Gallipoli oil. It is an inferior kind of olive oil, of a greenish tint. I have not tried it, but should think ordinary flask olive oil would do as well. As regards the composition of Baker's fluid, I believe it is simply distilled and diluted chloride of zinc.—R. A.

Melting Brass.—NO NAME.—Figs. 1 to 4 illustrate the standard type of brass-melting furnace. Fig. 1 is a vertical section, through one of the furnaces and the chimney. Fig. 2 is, on the right-hand side, a section through the right-hand furnace (× × in Fig. 3, and Z Z in Fig. 1); and, on the left-hand side, a view in front of the left-hand furnace, seen from the ash-pit (Y Y in Fig. 3). Fig. 3 is a general plan; Fig. 4 a view of the cover. In these figures, A, A, are the melting holes or furnaces, measuring from 12 in. to 18 in. square, according to the amount of metal that requires to be melted. A 14 in. or 15 in. hole will take a pot with a melting capacity of 50 lbs. or 60 lbs. The depth of the furnaces will range from 2 ft. to 2 ft. 6 in. It is essential to give ample depth, in order that the crucible shall be entirely enclosed in the fuel. The reason why furnaces are built in twos or threes, is to get sufficient melting capacity for heavy casts; or even where that is not the case, to be able to use one furnace while the other may be undergoing repairs. Still, if you are an amateur, and intend only to melt brass for your own use, a single furnace will suffice. Underneath the furnace is the ash-pit (B) and the opening (B′) through which the ashes are raked into the front area (C). In Figs. 1 and 2, the line D D represents the level of the stone or brick floor, into which the furnaces are built. The ash-

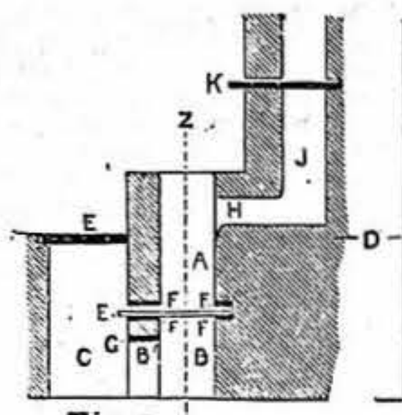


Fig. 1

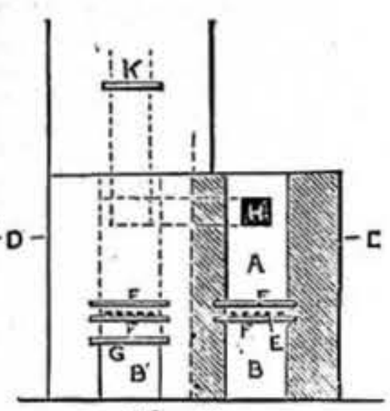


Fig. 2

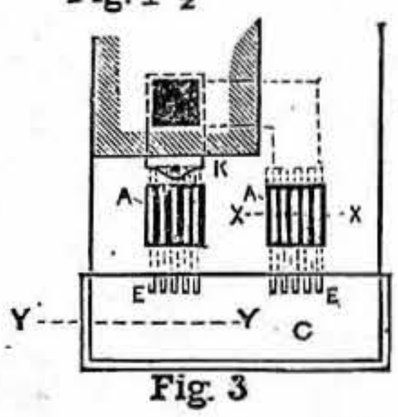


Fig. 3

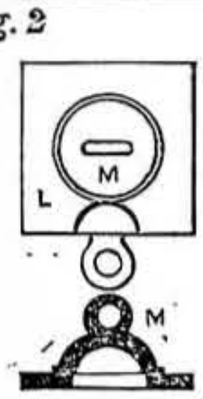


Fig. 4

Brass-melting Furnace.

pit (C), therefore, lies entirely beneath the floor level, and is covered over with a cast-iron grating (E). The object of this arrangement is to allow the attendant standing on the grating to be well over the furnaces, and so be able to exercise all his strength in lifting the pots of molten metal out of the furnaces. To clear the ashes out from underneath, it is necessary to remove the plate (E) and get down into the pit (C). E, E, in the figures are the fire-bars, upon which the fire is built; they are simply bars of wrought iron about 1 in. square, laid loosely across the bottom of the furnace. It is necessary to make them easily removable, so that the attendant, getting down into the ash-pit, C, may draw them out endwise, and let the cinders drop into the ash-pit, B. Replacing the bars, the fire can be rebuilt. In order that the constant removal and replacing of the bars shall not break away the brickwork, plates of iron (F, F) are built into the brickwork immediately above and below the bars. A similar plate (G) is built in to carry the brickwork over the opening B′. Both furnaces lead, by the openings H, into a common chimney (J); and the height of this chimney should not be less than from 12 ft. to 15 ft. A short chimney will not create sufficient draught to melt the metal quickly and properly, and artificial blast is not used for brass furnaces. The draught is regulated by means of the damper (K), placed in the chimney, and all the air necessary for combustion passes down through the perforated cast-iron plate (E). Fig. 4 shows a cover used for the mouths of the furnaces (A). L is a square cast-iron plate, having an eye cast in for sliding it on and off the furnace mouths. This plate is left in position during melting, but a light cast-iron top (M) is removed from time to time, for the purpose of watching the progress of the melting, and to throw in fresh fuel, if necessary. The furnace is built of fire-bricks, built with fire-clay joints, the clay being mixed with water to about the consistence of thick cream. Either gas coke or furnace coke can be used for melting brass, but the latter is more satisfactory, because of its heat-giving power. After the fire has been built, it is allowed to burn up, and then the crucible, with its charge of metal, is set about midway in the furnace, and covered over with fresh coke; the cover (L) and tile (M) are then put on, and the melting proceeds for an hour or more. You can purchase crucibles of the Morgan Crucible Company, Battersea; they will cost a trifle over one penny per pound of capacity. Now, in reference to the last part of your query, I am afraid I must refer you for the present to treatises written on the subject. The subject of moulding, to include that of the brass foundry, will be treated of in WORK by-and-by, and if so it will possess more practical value than any book I can recommend you. There is a book by Graham, price 2s., published by Crosby Lockwood & Co.; and there is another by Larkin, price 10s. 6d., which, I believe, is published by Spon. There is also Spretson's work, which contains a chapter on the brass foundry, one on fine-art work, and one on bell founding.—J.

Re-tinning Rusty Spots.—R. H. (*Notting Hill*).—In answer to your first query, I must say that I have seen a good many churns repaired, and also repaired many myself; but I never knew anyone "take on" the job of re-tinning the rusty patches—that is, unless there was a hole there, and a piece of tin had to be put on it. In this case, of course, the usual method of scraping or filing must be adopted to keep it clean, and then use spirits of salts and a soldering iron and solder to "tin" it preparatory to soldering on the piece. This is the usual, and, in fact, the only, way to get over it. If, as you say, you cannot get on with spirits of salts or resin (resin is no use for rusty tin), there must be something wrong, either with your materials or your method of procedure. (2) How to keep tools from turning rusty in a few hours after cleaning. You are quite right in supposing that this is caused mainly by the fumes of the spirits—this is one of the ills that tools are heir to in a tinman's shop. I will, however, offer a few suggestions that will help you to minimise the evil. In the first place, I would ask, Why do you want your tools bright? There are only a few tools that it is absolutely necessary to keep polished, such as the anvil, a few heads, and a few hammers. The anvil you should make a tin cover for, and grease the face of the anvil; for the hammer and head you can have wash-leather bags or caps to tie on over the faces, and keep them in a drawer when not in use, and clean them once a week whether they need it or not. The ordinary tools that lie about in constant use it is almost impossible to keep clean without constant looking after; but I find that, after they have got to a certain degree of tarnish, if they are rubbed occasionally with an oily rag, and then well rubbed dry, that they will scarcely be affected. Of course, faces of hammers and of tools will need to be rubbed up now and again. In conclusion, never keep any unkilled spirits of salts in the workshop, and cover your spirit jar when not in use, and I think you will go a great way to get over your little difficulty.—R. A.

Patent Lock.—A. M. (*Willenhall*).—If the patent for the lock still exists, you certainly must not make any imitation of it. Your best plan will be to consult a respectable patent agent, or approach the maker of the lock, and see if he will buy your improvement.—T. W.

Relief Scraps on Screen.—J. W. (*Morley*).—I know of nothing better than a stiff glue paste, such as that used for hanging Japanese "leather," and other heavy embossed papers. First dissolve the glue by boiling, and to prevent its burning to the bottom of the saucepan, wrap it in rag and tie it to the lid; then stir in the flour and boil. The paste should have time to soak into thick paper or card before fixing.—S. W.

Prescription.—SHEF.—We do not undertake to answer in WORK any questions appertaining to medical matters.

Lime.—E. F. B. (*No Address*).—You may mix the lime with coarse sand, fine gravel, coke breeze, crushed spar, or granite. The material should be screened through a mesh of the required size, and also screened a second time through a smaller mesh to remove the fine dust. You may put two parts to one of stone lime, and if chalk lime, rather less, unless the lime is very strong. You must not exceed this, or it will not set hard. You might try on a small quantity first. If you had said for what purpose, or how you mean to use it, I might have been able to give you more definite information. If you want it to set quickly, you could mix a little Portland cement or plaster of Paris with the lime. If this is not exactly what you require, if you write again, giving more particulars, I shall be glad to give you any further information.—M.

Polish for Bookcase.—H. A. W. (*Blyth*).—All dirt, grease, and furniture paste must be first removed by careful washing with soda and water and powdered pumice-stone or Bath brick (common washing soda the size of a walnut to a pint of warm water). It can then be French polished, if you like, but I cannot advise you to make your maiden efforts at polishing on anything with carvings and mouldings, etc., such as your clock case would be likely to have. Far better practice on some flat surfaces first, reading carefully the articles on French polishing appearing in the present volume of WORK. For the present, a decidedly fresher and more satisfactory appearance will be given by the application of one or two coats of brown hard spirit varnish, such as can be bought at any respectable oil and colour merchant's, to be applied carefully with a camel's-hair brush.—LIFEBOAT.

Phonograph Cylinders.—J. P. A. (*Walthamstow*).—I do not think it would be worth your while to try to make the above from your waste product. The demand at present does not seem to be very large. I could not undertake the trouble of inspecting one.—W. D.

III.—Questions Submitted to Correspondents.

Ink for Poster.—C. B. (*Highbury*) writes:—"I shall be very much obliged to M. D. C. (*Liverpool*) if he will tell me how to mix a good red ink or paint for poster-writing. The stink of the benzine and oil paint recommended by SMILING SMUDGER is horrible. It also runs a little. Gum water is not of much use."

Crimson Dye.—G. B. (*London, W.*) writes:—"I should be much obliged for the ingredients for a good crimson dye, which would be economical and fast—for cloth."

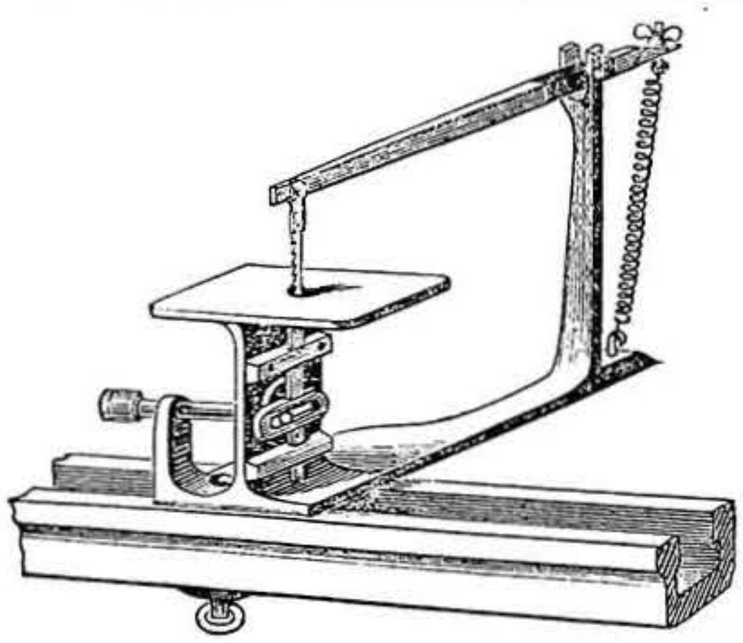
Nets.—C. C. (*Dartmouth*) asks:—"Could some correspondent kindly give in 'Shop' instructions, with drawings, as to how to make a trawl net for a 10 ft. beam? I should also be glad for notes concerning other nets."

Upholstery.—QUEEN'S ISLAND writes:—"Will any reader tell me how to cut the cloth to cover a couch so that it will be free of wrinkles, as those I have as yet covered do not look very well?"

Cotton Band Machine.—E. W. (*Halifax*) writes:—"Will any reader kindly inform me of the best and cheapest method of making a *small cotton band machine* to make lengths, say, from 1½ yd. to 2 yds. long?"

IV.—Questions Answered by Correspondents.

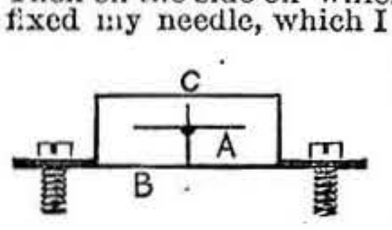
Mandrel for Lathes.—J. A. M. (*Stamford Hill, N.*) writes, in reply to J. T. (*Walworth*) (see page 159, Vol. II.):—"For jobbing engineering work I can recommend A. W. Salter, 15, Brunswick Street,



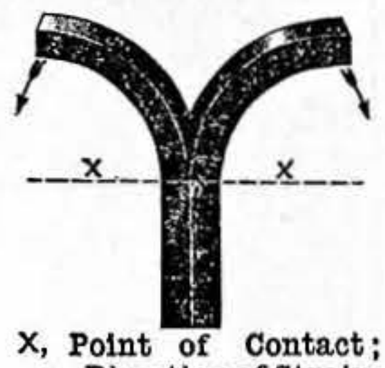
Hackney Road. He has done a good deal for me, and has forge, steam power, and almost every needful appliance at hand. Above is a drawing of a fret-saw attachment for my lathe which he has just made, and which will, I think, prove a serviceable tool."

Chuck.—M. (*Bishop Auckland*) writes, in reply to IGNORAMUS (see p. 366, No. 127):—"If you refer to p. 28, Vol. II., of WORK, you will find sketches and description of oval chuck, which you can make in metal or in hard wood, facing the V slides with brass to prevent wear. If the information is not sufficient, I will be glad to give you any further particulars through this column, if you write again. I can get you the castings, if you send me your address."

Galvanometer.—F. S. (*Normanton*) writes, in reply to GALVANIC (see page 206, No. 117):—"I will tell how I made a cheap and simple galvanometer. If, like me, GALVANIC is hard up, it will be just the thing he wants, as it cost me but a trifle, and any amateur could make it. First, I made a box like a linesman's detector: that is, two halves hinged together, 5 in. by 3¾ in. by 2½ in. Before putting on the front, I cut a hole 3 in. in diameter, and into this fitted a glass, which I got off an old bicycle lamp, and thus had glass and rim complete. I made the dial by taking a thin piece of wood, just large enough to fit inside the front half, and pasted on a sheet of white paper. Then on the side on which the paper was pasted I fixed my needle, which I made out of an old coil spring, and made it 1½ in long for the support. I took a piece of brass shaped as in diagram, A being needle and axle, B piece of thin brass clamped between dial and angle brass, and C being angle brass. The needle simply rested on pivots, the bottom being slightly heavier to keep in the centre of the dial. I must not forget to say that the needle was magnetised. At the back of the dial I fixed a bobbin of wire (six layers No. 24 s.c.) lengthways across the dial, and connected the ends to terminals at the top of the box. On sending a current round the coils of wire, the needle was deflected to either side, according to which way the current was sent. To give the dial a finished appearance, I drew two half circles round the top of the needle which represented the graduations. If GALVANIC liked, he could fix a horseshoe electro-magnet to the back of the box, with the poles pressing against the back of the dial, but this would not be so good as a coil, as he would have to find which way to send the current to repel the needle; but perhaps some other reader could describe a better galvanometer, as this would be of no use for a professional electrician."



Joining Vulcanite, Steel Etching, Rubber Stamps, etc.—H. B. (*Sheffield*) writes:—"I have gone through the Indexes of Vols. I. and II. of WORK, but cannot find the description of a method to fasten together two pieces of polished vulcanite. I shall be greatly obliged if any of your correspondents can inform me what composition to use without heat or need for repolishing to securely fasten together two flat surfaces, say, ½ in. square, at bottom of strips ¼ in. long by ½ in. wide, to resist a strain of 1 lb., as shown on enclosed sketch, and also to withstand the action of water. Some years ago a patented process was shown in Sheffield to etch upon steel direct from a rubber stamp in conjunction with certain acid salts, and was called 'E. Menstacta's New Direct Etching Process'; it is now, I believe, impossible to procure in this country the particular mixture of salts used. Could you inform me, through the medium of WORK, what ingredients to use which, in a plastic state, would contain sufficient power to light etch into steel direct from a rubber stamp a word moulded from 'nonpareil condensed type,' which, as you will probably be aware, does not carry a great body of ink in printing?"



X, Point of Contact; ← Direction of Strain.

Lace Frame.—C. E. M. (*Birkenhead*) writes, in reply to MART (see page 14, No. 105): "Here is a description of a simple macramé lace frame, which I have found quite as convenient as any of more elaborate construction. Smooth a piece of pine, 28 in. by 8 in. by ⅝ in. thick; at each end of this screw on a piece 8 in. by 1½ in. high, and ⅝ in. thick. The screws must be put in from the back, three to each piece. On the outside of each of these insert a row of about twelve round-headed screws, ½ in. apart. Those on the right-hand end should be put in at an angle of 45°, points down. (Fig. 1.) The reason for this

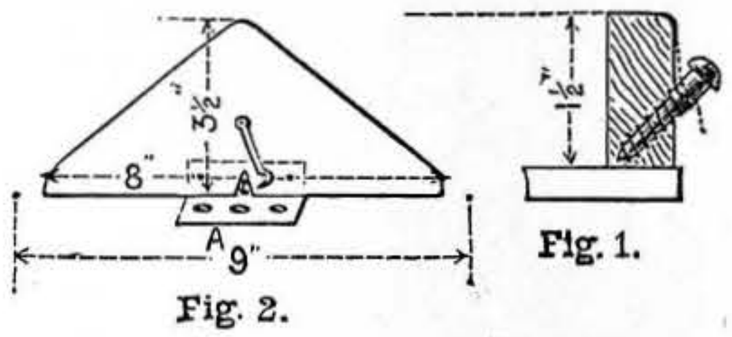


Fig. 2.

Fig. 1.

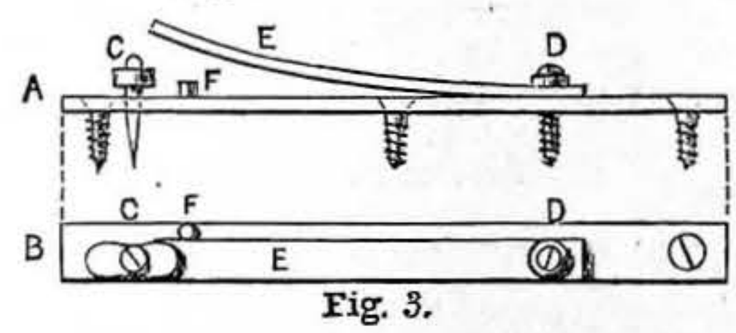


Fig. 3.

Lace Frame. Fig. 1.—Section of Right-hand End; Dotted Line, Foundation Cord. Fig. 2.—Flap—A, Hinge and Notch in Wood to allow for Eye. Fig. 3.—Brass Attachment—A, Side View (open); B, Top View (closed); C, C, Button; D, D, Pivot Screw and Washer; E, E, Spring; F, F, Small Brass Stud, to prevent Displacement of Spring.

is that, when a foundation cord is stretched across the board, it only requires one turn round the screw to secure it tight. The secret of making good macramé lace lies in having the foundation cords strained as tight as possible. A couple of flaps are hinged on to the back of the board, about 4 in. from each end. When the board is in use it rests on these, which are held in position by hook and eye. (Fig. 2.) At the left-hand side of my board I have screwed a brass attachment, for gripping the lace when a long piece is being worked. It consists of a brass plate 8 in. by ⅝ in. by ⅛ in., to which is attached a piece of spring-brass, one end turning on a pivot, while the other is placed under a brass button when in use, and kept in place by a small stud. (Fig. 3.)"

V.—Brief Acknowledgments.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—D. S. (*Glasgow*); W. M. (*Dundee*); A. G. (*Dublin*); LISFARREN; F. R. (*Salford*); T. W. (*Bolton*); J. B. (*Stoke Newington*); E. J. (*Yeovil*); DENIS; JACK PLANE; J. O. H. (*Nottingham Road*); R. J. H. (*Penzance*); E. B. (*Dorsetshire*); W. P. (*Scarborough*); F. W. & SON (*Billingshurst*); YOUNG CHIPS; H. N. (*Ballycanew*); M. & C. (*Grimsby*); CHOPSTICK; W. D. (*Belfast*); E. H. (*Warrington*); S. B. (*Nottingham*); J. H. S. (*Romsey*); D. A. (*Glasgow*); SHEF; W. D. (*Wigston-Magna*); J. P. (*Manchester*); A. L. (*Belfast*); R. J. L. O. (*Bangor*); H. T. M. (*Kentish Town*); J. E. B. (*Epworth*); QUÆSITOR; RAWTENSTALL; VENTRO; R. C. J. (*Cheadle*); POKER; WYNBERG; A. T. (*Canonbury*); CONSTANT READER; J. J. J. (*Morriston*); W. R. (*Cressington*) HÆRKO; C. H. D. (*Guernsey*); F. D. (*Devonport*); E. C. (*Norfolk*); E. G. (*Salford*); C. F. T. (*Taunton*); W. N. (*Lowfield*); EBONY; W. B. (*York*); PLUMBER; G. F. B. (*Notting Hill*); E. McN. (*Gateshead*); W. H. (*Blyth*); J. H. B. (*Norton*); GANITE; T. H. B. (*Sowood*); W. E. B. (*Bowden*); C. C. (*Clapham*); W. J. H. T. (*Birmingham*); AURORA; G. P. (*Chester*); J. G. B. (*Clapham*).

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