WORK

An Illustrated Journal of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

VOL. IV.—No. 162.] SATURDAY, APRIL 23, 1892. [PRICE ONE PENNY.

WORK WORLD.

LORD ROTHSCHILD has just fitted up, at Tring Park, an electric saw mill, comprising a circular saw, band saw, mortising, tenoning, and moulding machine, supplied by Messrs. Ransome & Co. This is, we believe, the first saw mill which is entirely driven by electricity.

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Lead is one of the worst metals to get mixed with gold; even $\frac{1}{2000}$ part of lead melted with 22 ct. gold, and cast into a bar, will cause it to be so brittle that it can be broken with a slight tap from the hammer. Therefore, remove all traces of pewter solder from old work before remelting, for pewter solder is composed of lead and tin.

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A handy and ingenious little article has been invented on the principle of the well-known pencil sharpener, for tapering broom, rake, and hoe handles. To dealers in these articles who have to fit any number of these handles, this ought to recommend itself. All that is needed in the way of fixing is to screw it to a bench or wall, and it is ready for work. Six handles can be fitted in the time of one on the old method.

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A short time ago, Messrs. Broadwood, the celebrated pianoforte makers, purchased three logs of mahogany cut from one tree for the enormous sum of £3,000. These logs were about 15 ft. long and 38 in. wide. They were cut into veneers ⅛ in. thick. The wood was peculiarly beautiful, capable of receiving the highest polish, and, when polished, reflected the light in a most vivid manner like the surface of crystal, and, from the many forms of the fibres, offered a different figure in whatever direction it was viewed.

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An interesting exhibition, containing many first-class specimens of work from abroad, Australia, South Africa, Burmah, and New Zealand, is going on in Dublin, consisting of specimens of the work of the chief prize-winners in the Vere Foster drawing and writing competitions. There were 620 competitors in ordinary writing, 35 in ornamental lettering, 279 in drawing, and 58 in painting. It is interesting to note specially that the chief prize for writing was secured by an Irish girl of Clono National School, co. Sligo.

A wonderful clock is likely to find its way to the Chicago World's Fair. It is only 21 in. high, but it is 9 ft. wide and 3 ft. deep, and will indicate time to the last stroke in 9999. The image of an angel strikes the minutes on a bell, while another strikes the quarter hours. A skeleton, representing Death, strikes the hours. After each hour is sounded, figures representing the twelve apostles appear and bow before an image of Christ. A procession of praying monks passes into the entrance of a church at 6 o'clock. Shortly before midnight a watchman gives the signals for each hour, and at 3 o'clock he goes off duty, and a crowing rooster appears to announce the dawn of day. During Christmas times singing choruses and the four seasons are represented by symbolic figures. The entire apparatus of the clock can be shown in twenty minutes by means of an ingenious invention. This seems to beat the Strasburg clock out of time.

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According to all accounts there is going to be another strike in the London building trade this summer, this time on the part of the bricklayers. It is sincerely to be hoped that they will not carry matters to such an extent as the carpenters did last year; they, it will be remembered, struck for an eight hours day and an increase of wages; the proposed increase of wages would have nearly brought their money up to the same amount as it was with a nine and a-half hour day. This, to an ordinary observer, would not seem a very extraordinary demand, but the employers thought otherwise, and what was the result? After spending thousands of pounds and causing great hardships to their families, to say nothing of themselves, the matter was submitted to arbitration, and the decision of the arbitrator was received by the men exactly as they had pledged themselves it should be, although, as some remark, they are now working "decimals of time."

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Most sanitary authorities will welcome an appliance which does away with the old-fashioned putty or indiarubber joint between the arm of a w.c. pan and the flush pipe; such an appliance is now on the market. It consists of a brass flushing arm connected to the bottom of the flush pipe with a properly soldered joint, and is so constructed that it delivers the main force of the water directly on to the soil and paper sufficiently to pass round and cleanse the whole of the pan, not only driving the whole of the contents from view, but thoroughly out of the trap into the drain. It appears strange that plumbers and others, who would as soon think of committing a crime as connecting the top part of the flush pipe with the waste preventor union by anything else than a proper "plumber's joint," should so long have been satisfied with a piece of rag and string at the other end. The only drawback is that the use of this brass arm is confined to those w.c. pans specially constructed for it.

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Now that the fret and silk as a means of decorating the fronts of upright pianos is being looked upon as old-fashioned, they having given way to the more modern style of panel fronts, gold incised or marqueterie, or both in combination, our German cousins are turning their attention to the backs, which have hitherto been finished in a very offhand manner, being looked upon as in every case destined to stand against a wall. Now fashion dictates that they may stand in the middle of a room, or at any rate standing free all round, or forming a cosy corner. Consequently—chiefly amongst the Germans at present, though London makers may soon follow in the wake—it is becoming more and more regarded as the correct thing to spend as much taste and expense in decorating the backs as the fronts. In this direction a recent strike amongst the "varnishers," as the polishers are called in America, led the Yankees to endeavour to dispense with their services. In some cases this was done, and at the same time the difficulty of hiding the individuality of the piano as a piece of furniture was overcome by making the cases of commoner wood, and passing them on to the upholsterers to cover in velvet, silk, etc., in the prevailing fashions, thus bringing them more in harmony with their surroundings. English makers ought to "hurry up," and with fret backs, on good silks, make the cottage piano backs things of beauty and, if possible, joys for ever. We will offer some designs.

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All the investigations of maritime surveyors prove that the ocean bottom is much like the land above the ocean. In the

United States survey, for the electric cable between California and the Hawaiian Islands, the mountains beneath the sea are so serious an obstacle that a detour must be made. Starting from Salinas Bay, near Monterey, California, is a deep gully 200 fathoms deep, and on each side the rocks rise to within five fathoms of the surface of the ocean, and gradually deepen to 2,500 fathoms, with much irregularity of surface, till 3,200 fathoms are reached, or about three and a-half miles, when the depth is about three-quarters of a mile less. Two degrees further along it changes to 400 fathoms deep, then drops to 700 fathoms, then to 2,700 fathoms, followed by a rise to 2,000 fathoms; then there is another fall of 700 fathoms, and a fairly gradual sinking and rising follows till 3,000 fathoms are plumbed; now a mountain peak rises up about the third of a mile, to less than a quarter of a mile from the ocean surface. This is a summary of two surveys, twenty miles apart, by the United States surveying vessels, one recently, the other fifteen years ago. A third survey will have to be made to find ground on which the electric cable can be laid.

BENT IRON WORK, AND HOW TO DO IT.

BY J. H.

MOUNTS FOR VASES.

MOUNTED BOWL—LEGS—CROSS STRIPS—BOTTOM SCROLLS — VARNISHING — MOUNTED VASE—LEGS—SCROLL WORK ON LEGS — MODE OF UNITING LEGS—CROSS STRIPS—BOTTOM RING—RINGS, USE OF COPPER—UPPER RING—UNION OF RINGS—A SECOND EXAMPLE OF MOUNTED VASE—HANGING FLOWER VASE—BOTTOM RING—SUSPENSION BRACKET—THE SCROLL WORK—IMITATION CHAINS.

Vases.—We are now ready to commence some not very difficult designs in bent iron, and I have selected a glass bowl and some vases for our first essays. The general designs and the same methods of union which are illustrated in these figures will also serve for vases of other forms and diverse sizes.

Mounted Bowl.—Fig. 12 illustrates a glass bowl, A, suitable for holding flowers or ferns. This is supported with the four legs, B. These legs are shown enlarged in Fig. 13, together with the scrolls, by means of which they are tied to each other and against the vase.

Legs.—In the first place, prepare four scrolls like B from the ordinary thin iron strips of $\frac{3}{8}$ in. in width. The quick turns of the scroll at the bottom must be bent with the round-nosed pliers, but the flat curves above can be better bent against one of the flat wooden pins shown in the previous article. The extreme end is turned over at *b* to fall down within the bowl, clipping its edge; and so the bent iron is secured to the bowl at that part.

Cross Strips.—The bowl is supported, and the strips, B, tied at the bottom of the bowl with the two strips, C, C. These are carried straight underneath the bowl if the bottom is flat, or suitably curved if the bottom is convex. They cross each other at the centre (Fig. 13 *f*), and may be fastened to each other there with a spot of solder, though this is not essential. Then, where C and C abut against B, they are secured with clamps, *a*, of bent iron, pinched fast with the flat-nosed pliers.

Bottom Scrolls.—The mounting may be considered complete at this stage if time is a consideration; but the stand will be steadier if the circle of double scrolls, D, is added. The legs, B, will be thereby prevented from spreading outwards, and the curves will form a neat filling-in beneath the bowl, relieving it of the naked appearance which it would otherwise have. There are four scrolls in the figure, and they are clamped to each other at *c* and fastened to the legs at *d*, either with solder or with fine soft iron or copper wire, as seen at d^1 (Fig. 13). This completes the mounting.

Varnishing.—It is usual to varnish all bent iron work. There are several preparations employed, as Judson's black, or a mixture of drop black in gold size. Of these varnishes I shall have more to say later on.

Mounted Vase.—Fig. 14 shows a vase mounted on four legs. One of these legs, with its attachments, is shown enlarged in Fig. 15. The whole of the work is made of $\frac{3}{8}$ in. strips.

Legs.—The main strips which form the legs, A, are bent to the scroll form at bottom and top with pliers; the flat curve in the body is bent round a suitable templet block of wood. The first leg being made accurately, the other three are tested by it, until all four are uniform in shape and size. Or they can be tried upon a full-sized drawing; for it is always desirable before commencing anything in bent iron to mark the outlines to full size upon a black-board with chalk, or upon a chalked board with pencil or crayon.

Scroll Work on Legs.—The scrolls, B, are then bent, and fastened to the legs, A, with clamps at *a*, *a*, and to each other at *b*. There are three scrolls, B, to each leg. There are also two small scrolls, C, at top and bottom, which are clamped to A, and to one of B respectively at b^1. Note that whenever double curves occur in bent iron, as at the parting, b^1, two strips are required to form them, because a single strip cannot be divided by bifurcation. This is shown clearly in Fig. 15.

Mode of uniting Legs.—The four legs, with their scrolls, being prepared, they will be fastened around the vase by means of two cross strips, D, D, and three rings, E, F, G.

Cross Strips.—The cross strips, D, are bent to fit the bottom of the vase, which they support. They are formed into scrolls at the ends and united to the legs, A, at *c*, with clips.

Bottom Ring.—The bottom ring, E, is bent round into a circle, either to a line struck with compasses, or around the edge of a wooden disc, and its ends are overlapped for a length of about $\frac{3}{8}$ in., and soldered. It is fastened to the four legs, either with solder or with soft iron wire (as in Fig. 13, d^1).

Rings, Use of Copper.—The rings, F and G, are made differently. F forms a frustrum of a cone—very narrow, it is true, but, nevertheless, sufficiently conical to give some trouble in the setting out. Its form could be developed and cut out of thin iron, but this would give trouble also, which might be saved in making it in copper, which can be hammered to almost any form with ease. The strip of copper, bent round as a parallel ring, can be hammered to the correct form around a disc of hard wood (Fig. 16), having the same bevel as that portion of the vase which the ring has to embrace. The band of copper will look well by comparison with the iron; in fact, all the bands might be made of the same metal. Later on, I shall show several examples of the introduction of copper ornaments among the bent iron; and even when copper is used only because of its superior ductility, and a uniform black seems desirable, copper can always be varnished to match the black iron.

Upper Ring.—The upper ring, G, is a parallel zone, and may be easily made in iron. Though the bottom ring, E, is in contact with the *inside* faces of the legs, A, it is better that F and G should encircle A. Another point is how to fasten these rings to A. It is possible to fasten them with wire, in the same way as that shown at Fig. 13, d^1, and this, I think, is the usual method; but it is tedious, and does not make a neat job, because it is impossible to make the rings embrace the legs tightly by this method. The method I show is this.

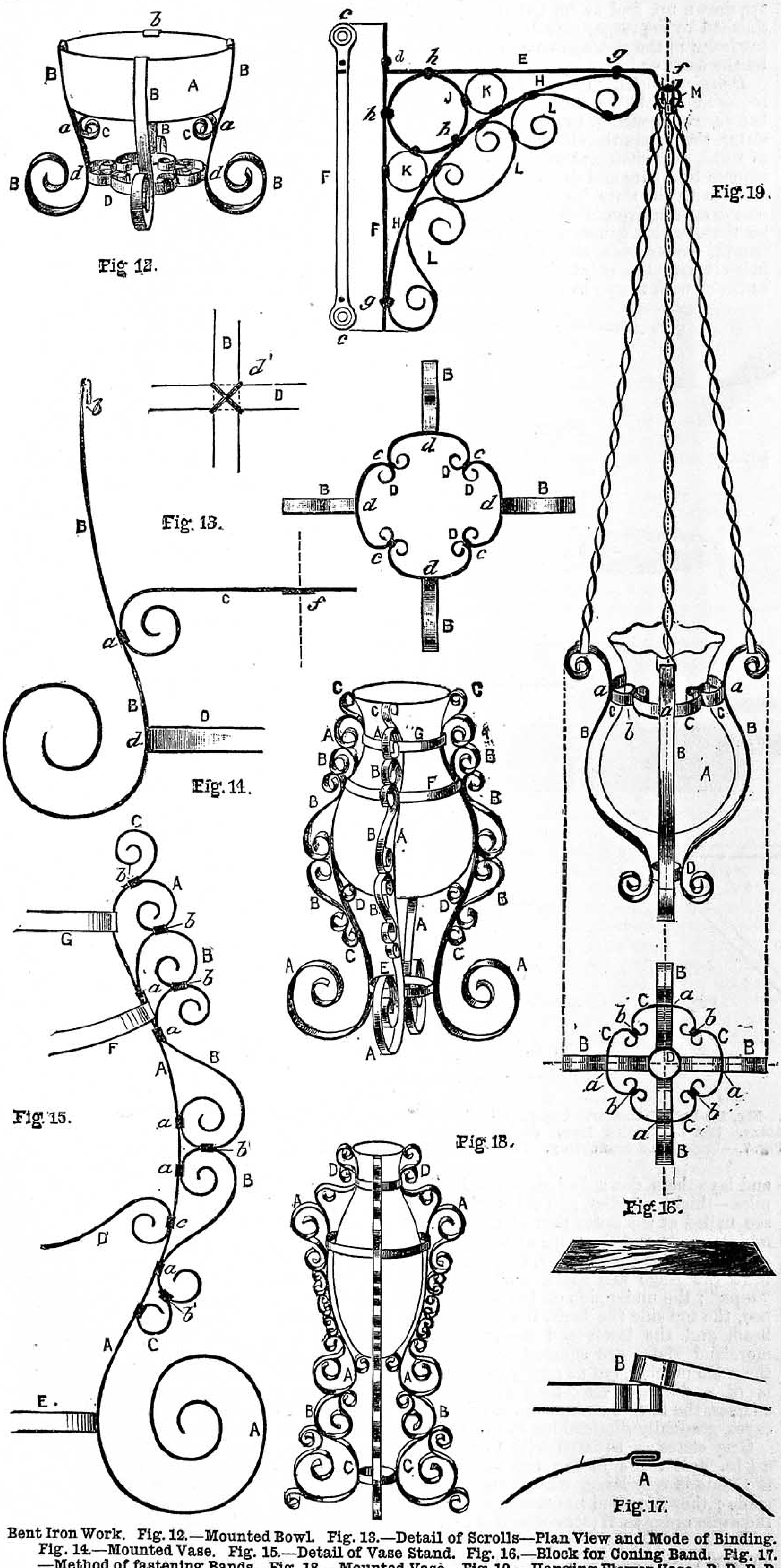
Union of Rings.—Take the diameter accurately, and then turn over the ends to make a tinman's seam-joint (Fig. 17, A); then embrace the legs, bring the ends over one another, B, and slip the two parts together, and the ring will be bound tightly around the legs.

A Second Example of Mounted Vase.—Fig. 18 shows another vase of a more slender form, and mounted in a different design. As the method of making this is essentially similar to the previous one shown, scarcely any comment is necessary. In this instance the main strip of iron in the legs terminates at A A, and the legs are completed with additional curves, B, C, and D. In every case in this figure where curves come into contact they are secured with a clip. The figure is, however, too small for them to be shown distinctly.

Hanging Flower Vase.—Fig. 19 illustrates a hanging flower vase or bowl. A is the vase, B, C, D its framework, and E its supporting bracket. The vase is carried thus: There are four enclosing ribs, B, curved all alike to the outline shown in the figure, using wire pliers and suitably sweeped templet-pins (as previously illustrated). The ribs are united, and the vase suspended by the four double scrolls, C; the scrolls are united to B at *a* with fine iron wire (as illustrated at Fig. 13, d^1); or the opposed faces may, of course, be soldered. This is generally preferable, on the score of neatness, wire fastenings savouring to a workman's taste of cobbling. But be sure of the security of the soldered joints before trusting fragile vases to them—that is all. These flat joints, however, are among the very simplest jobs that can occur.

Bottom Ring.—At the bottom, the ring, D, is fastened to B, either with wire or by soldering. When this ring has been fastened, then the vase may be inserted, and the curves, C, fastened to one another with clips at *b*. The ribs, B, and curves, C, can easily be opened out sufficiently to permit of the insertion of the vase, and with care the clips may be pinched at *b* without injuring the vase; or wire may be used instead of clips.

Suspension Bracket.—The vase is suspended from the bracket, E. I shall have a good deal to say further on about different kinds of brackets. This one is characterised by the most severe simplicity of outline, being, in fact, of quite an elementary type. Its framing is made of iron, having a cross section of about $\frac{3}{8}$ in. or $\frac{5}{16}$ in. by $\frac{1}{8}$ in. There are three main portions—the back, F, top, G, and diagonal, H. F is flattened at the ends, *c*, and drilled to receive screws for fastening the bracket to the wall G is turned up and riveted to F at *d*, and is bent at the other end, *f*, to form a suspension



Bent Iron Work. Fig. 12.—Mounted Bowl. Fig. 13.—Detail of Scrolls—Plan View and Mode of Binding. Fig. 14.—Mounted Vase. Fig. 15.—Detail of Vase Stand. Fig. 16.—Block for Coning Band. Fig. 17. —Method of fastening Bands. Fig. 18.—Mounted Vase. Fig. 19.—Hanging Flower Vase; B, B, B, B, Plan with Vase removed.

hook; H is curved, and riveted to F and G at *g, g*.

The Scroll Work.—The ring, J, made of the same section of iron as the framing, acts as a stiffener, preventing H from yielding inwards under pressure. It is riveted at *h, h, h*. All the rest of the work—the small rings, K, and the scrolls, L, L—may be made of the thin iron strips, and clips (as shown) will be employed for holding them fast together.

Imitation Chains.—For the suspension of the lamp I show imitation chains, made of bent iron, twisted (as previously shown in the drawing of elementary forms, Fig. 8, page 6). Each length of iron, after having been twisted, is turned over at each end, and is brought underneath the top curve of B at one end, and at the other is slipped into a ring, M. The four rings, M, are slung in the eye, *f*, and sustain the vase.

SLATERS' WORK.

BY A MASTER SLATER.

SLATERS' work is the art of covering roofs with various kinds of slates. They are found in North Wales, Westmoreland, Cumberland, Devonshire, Cornwall, and other parts, also in Scotland and the north and south of Ireland.

Slates are obtained from the Silurian rocks, which are nearly the oldest formation. The best are from the argillaceous strata laying on the mica schists and gneiss, and covered by the old red sandstone or mountain limestone. They are composed of silica, alumina, oxide of iron, potash, magnesia, carbon, and water. The best slates have a metallic ring when struck, and should be practically non-absorbent; they are sometimes tested by being set half their depth in water, and if in the course of six or eight hours the damp has not arisen, they are good; if damp to the top, they are porous and absorbent.

The grey or stone slates are obtained from the laminated beds of stone found in the coal measures in various parts of the country, and are principally composed of quartz and mica.

Welsh Slates.—These are most extensively used, and are quarried in Carnarvon and Merionethshire, in North Wales. The following are some of the principal quarries: Bangor, Carnarvon, Portmadoc, Port Dinorwic, Llanberis, Glenfaron, Oakley Old Vein, etc. They are of various colours—blue, purple, pale green, and grey; the green colour is supposed to be caused by an excess of magnesia, the red by oxide of iron, and the dark-coloured by carbon. At Lord Penrhyn's quarry at Bethesda between four and five thousand men are employed.

Slates are known by various names, according to their sizes—Doubles, 12 in. by 8 in.; Plantations, 13 in. by 10 in.; Ladies, 16 in. by 8 in.; Viscountesses, 18 in. by 10 in.; Countesses, 20 in. by 10 in.; Marchionesses, 22 in. by 12 in.; Duchesses, 24 in. by 12 in.; Princesses, 24 in. by 14 in.; the sizes vary occasionally in the smaller slates. Slates up to these sizes are sold by the thousand of 1,200; above these sizes are called ton slates, and are sold by the ton.

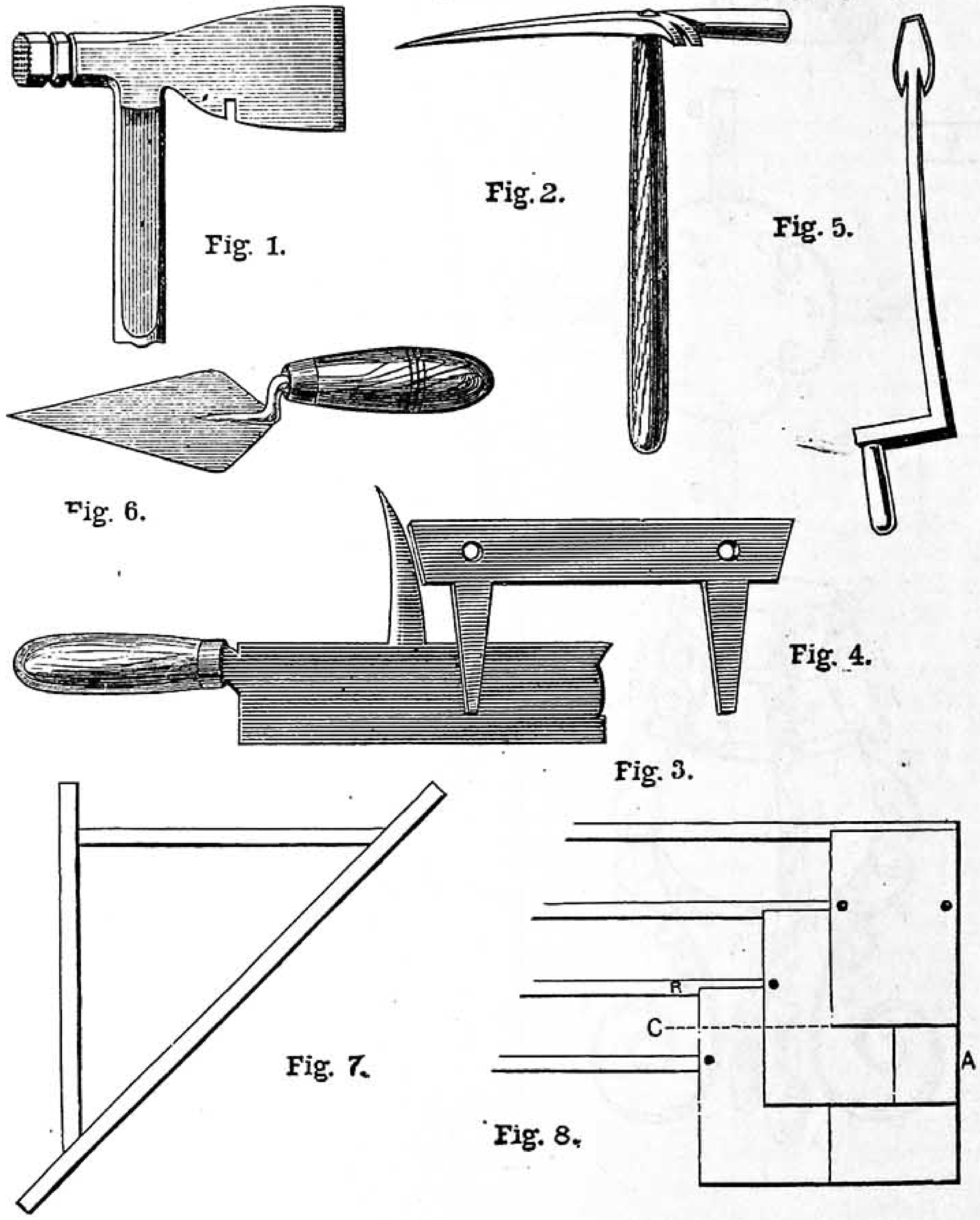
The slates are quarried from the rock by blasting in large blocks, which are sometimes eight feet in length; these blocks are then split by long thin chisels and mallets into slabs the full size; these are cut across into smaller sizes, and again divided by thinner chisels into the proper thickness for roofing slates. If the blocks are exposed to the weather too long they lose the property of being split. After the slates have been split to the desired thinness, they are trimmed and dressed at the edges into the different-sized slates.

Devon and Cornwall Slates.—These slates are of a similar quality as the Welsh slates, and are quarried at Ashburton, and other places in Devonshire, and at Camelford, and other places in Cornwall.

Westmoreland Slates.—These slates are quarried near Kendal, at Coniston, Buttermere, Ambleside, and other places in Westmoreland, Cumberland, and Lancashire; they are a pale green colour, and are thicker and not so fine as the Welsh slates. In covering roofs with them, different-sized slates are used on one roof, the largest sizes being laid on the eaves, gradually diminishing to the ridge.

Grey or Stone Slates.—These slates are quarried extensively in Yorkshire, Durham, Lancashire, and other parts; they are quarried in large blocks, which are afterwards split (to form the slates) into slabs from 1 in. to ⅝ in. thick; they are cut into various sizes, the thickest slabs being made into the largest slates; the head or top end is slightly rounded, and they are hung on the laths by oak pins put through a hole in the head. In some old buildings the leg bones of sheep have been cut in two and used as pins; stronger roof timbers and slate laths are required for these slates than for Welsh slates. These slates are laid on in different sizes, in the same manner as Westmoreland slates.

Tools and Appliances used by Slaters.—The tools used by the slater are the lath hammer (Fig. 1) for nailing on the laths; one side is formed into an axe, to cut off the ends of the laths. The slate hammer (Fig. 2) is used to nail on the slates; the point is sometimes used to hole the slates, the projecting claw is used for drawing nails. The slate knife, or saixe (Fig. 3), is used for squaring and trimming the edges of the slates; the point on the back is used for making the nail-holes in the slates. The cutting iron, or stake (Fig. 4), is used to lay the slates on while trimming the edges or cutting them. The ripper (Fig. 5) is used for drawing the nails out of old slating in repairing or stripping old work. The pointing trowel (Fig. 6) is used for pointing the slates and ridges. Wooden gauges for marking the slates are made by driving two nails through a short piece of lath, leaving the points projecting. A chalk line is also used for nailing the laths and slates by; for cutting ridge tiles, chisels are used. The cripple (Fig. 7) is a triangular frame of wood for scaffolding on boarded or high-pitched roofs; they are fixed about 10 ft. apart by ropes from the ridge, and scaffold boards laid upon them, on which the slater stands; as soon as he slates as far as he can reach, they are drawn up, and so on till the slating is finished to the ridge. Machines for punching holes in the slates are also used, worked by the hand or foot.



Slaters' Work. Fig. 1.—Lath Hammer. Fig. 2.—Slate Hammer. Fig. 3.—Slate Knife, or Saixe. Fig. 4.—Cutting Iron. Fig. 5.—Ripper. Fig. 6.—Pointing Trowel. Fig. 7.—Cripple for Scaffolding. Fig. 8.—Band and Lap of Slating.

Dressing Slates.—The whole of the slates required should be brought to the works before commencing to dress them. The slater then fixes the cutting iron in a block of wood, and, sitting at one end of it, commences to square and dress the edges of the slates with the slate knife, laying the slates on the cutting iron while using the knife; he then, with a gauge made to the correct length, marks each side of the slate, and holes it with the point on the back of the knife, or with the point of the slate hammer, and lays them down bed upwards in three piles—thicks, middles, and thins; the thicks are nailed at the lower part of the roof, the middles next, and the thins at the top. The eave slates are short slates, and the course next the ridge are short, and are called "tops"; the under side of the slate is the bed, the top side the back, the top end the head, and the lower end the tail. Westmoreland slates are squared and holed in the same manner, but as nearly every course is of a different size, they are piled in courses, the largest courses being laid at the eaves, gradually diminishing to the ridge.

Grey slates are squared with a chisel, and a ½ in. hole made in the top end, except the slate is very large, when two holes are made; they are piled in courses, and laid in the same order as Westmoreland slates.

Laying on Slates.—In commencing to lay on slates, the gauge for the laths must be ascertained; the gauge is half the length of the slates after deducting the lap, which is from 2½ in. to 4 in.; the lap is the distance the tail of the third slate covers the head of the first, and is shown at B C, Fig. 8; then mark each end rafter, and drive a nail a short distance in at each mark; a line is then stretched between the nails, and the laths nailed to it; the laths are about 1½ in. wide and ¾ in. thick. The slates are nailed with copper or zinc nails with clout or flat heads. Iron nails should not be used, as they soon rust and loose their hold. If the roof does not project over the walls, the rafters are set back 3 in. to throw up the eave slates; if they project, a lath 1½ in. thick, called a tilting fillet, is nailed at the eaves. The slater stands with his right leg at the lower part of the roof, kneeling on his left knee to nail the slates on, unless the roof is boarded or very steep in pitch, when a scaffold must be made; the eave slates are nailed to a line, and generally project about 3 in., to throw the wet well into the spouts; the next course is laid upon them, and so on to the ridge, keeping the lower edges perfectly straight and parallel, and the vertical joints in each alternate course exactly over each other; this is accomplished by inserting a half slate in every alternate course, as shown at A, Fig. 8. The slating is commenced from the right hand, working towards the left hand. The tails of the slates should fit close down on the backs of the slates underneath them, to prevent the wind getting under and blowing them off. When a slate is twisted, or does not bed solid, it is laid out, to be used for cutting or on another place.

In slating up to hips or valley gutters, the slates must be cut to the slope of the hip or valley, the cutting iron being fixed on one of the rafters.

When the roof is boarded, chalk lines are struck on the boarding as a guide for nailing the slates, and they are bedded in fine lime and hair mortar; sometimes felt is laid on the boarding, and laths nailed upon the felt, the slates being bedded; and sometimes the spaces between the ordinary lathing are filled with plasterers' laths, and the slates bedded on them. A scaffold is required when slating in this manner. When a roof projects at the gables, the slates are sometimes projected ½ in. over the outside rafter, and sometimes finished flush with it, and a moulding is fixed level with the top of the slates, and a piece of strong hoop iron projecting over the slates is screwed on the top edge of the moulding to form a cap, and prevent the wind blowing the slates off. When the projections are boarded, the slates should be bedded in mortar.

In laying Westmoreland slates, as nearly every course is of a different length, the gauge of the laths must be altered to suit. The largest slates are laid on at the eaves, gradually diminishing to the ridge; the laths should be wider and thicker, and the nails stronger and heavier.

In laying grey slates, as they also vary in size, they are laid in the same manner as Westmoreland slates, except that an oak pin is put in the head of the slates to hang them to the laths. When grey slates are to be cut, they must be nicked with the chisel and broken off with the hammer. On large sheds, workshops, etc., with iron roofs, the laths are sometimes of iron, the slates being fixed by lead nails clinched on the underside of the laths, and as they are not pointed, the slates have extra lap: generally 4 in.

Sometimes the slates have the two lower corners cut off or the tails rounded; this is called ornamental slating, and sometimes bands of different coloured slates are used on one roof to break the monotony.

GRAPHS, AND HOW TO MAKE THEM.

BY W. GLEDHILL.

During the last few years this once popular system of copying has been considerably on the wane. The copying machine known by the names of centograph, and various others of a like nature, will be found beneficial in saving a great amount of trouble when a large number of copies of plans, letters, circulars, etc., is required without calling in the assistance of the printer. Its only drawback is its expense, but as the whole machine may be easily made for a trifling cost, this disadvantage is not so great as would at first be imagined.

The process of working is a most simple one, and cannot fail if the instructions which I shall give are carefully carried out.

The apparatus required is very limited, and easily obtainable. You should first procure an old tin biscuit-box of moderate depth with sound corners. Then get a short rod to stir the composition, and also get the ingredients themselves. And finally you should procure a shallow tray to hold the composition. Your tray should be a metal one, and the lid of your biscuit-box will serve you for this purpose.

Next as to the ingredients, which will be as follows:—Glycerine (common), 18 ozs.; water, 12 ozs.; powdered loaf sugar, 3 ozs.; sulphate of barium, 6 ozs.; Nelson's gelatine, 3 ozs. Most of these are procurable at any chemist's shop, and each should cost about one penny per ounce. Nelson's gelatine you will be able to get at any respectable grocer's shop in one ounce packets for fourpence-halfpenny each. The total cost, therefore, will be trifling.

Having got everything ready, put the ingredients into your biscuit-box, taking care, however, that the proportions are carefully measured; and when this is done, place your box on a shelf for twenty-four hours to allow its contents to macerate. When you examine the box again, you will see that the gelatine has assumed enormous proportions, and has absorbed most of the water. However, to make the mixture perfect, you must resort to heat, and the best thing you can do is to place your box over a stove and leave it there for two or three hours until the gelatine has dissolved. Care should be taken, however, that the heat is not too intense, or your composition will in all probability be spoiled.

At intervals of about half an hour the contents of your biscuit-box should be well stirred, in order to thoroughly amalgamate them. And when they are reduced to a thick, creamy-looking liquid, pour the mixture into your tray, which should be placed ready to receive it.

In all probability a number of air-bubbles will be formed on the surface of your liquid. These should be destroyed immediately, or your copies will not be clearly printed. To do this, you should procure a stout carpet-needle, and after heating it to a red heat, prick each bubble with the point. This will burst them, and afterwards the composition will begin to set. For half an hour it should be left alone on a level surface, and at the end of that time it will be ready for use.

Your apparatus is now ready for use, and all that remains for you to do is to write your circular, or letter, or whatever you may require, with the special ink, as neatly as you can, taking care to make your up and down strokes as nearly as possible of the same thickness. The writing should always be left to dry; and when it is perfectly dry, it should be laid with the writing downwards upon the graph.

Now lightly rub your fingers over the paper in order to be sure that every part of it lies in contact with the composition. After leaving your sheet of paper on your graph for about a minute, remove it with the greatest care, lifting it by one corner, and you will have a reversed copy of your writing upon your graph.

Then lay a blank sheet of paper upon the writing, rub as before, and remove carefully after five or six seconds. An exact copy will have been transferred to your paper, and by repeating this process, any number of copies up to sixty or seventy can be obtained. When you have printed sufficient copies, you should sponge your graph with cold water, and afterwards rub it lightly with a piece of clean rag until your writing has almost disappeared. Then allow your graph to dry, and put it away until it is required for further use. It should always be washed immediately after you have taken your copies, or the ink will sink into the composition, and in process of time your graph will assume a violet hue.

After you have used your graph a few times, its surface will most likely become rough and uneven, and totally unfit for further use. When this happens, you should cut the composition with a knife and melt it down again, pour into your tray, and destroy the bubbles as before.

The ink which you will require can be obtained of almost any stationer, and will cost about eightpence per bottle. Preference should always be given to violet ink, as it will be found to be the most powerful, and to give more impressions than red or black inks.

HOW TO LEARN DRAWING OFFICE WORK.

BY ARTHUR BOWES, A.M.I.C.E.

Drawing-Papers, their Qualities—Tracing-Paper and Cloth—Rendering Drawing Paper temporarily Transparent—Sizes of Papers—Drawing-Boards: Danger of Contraction and Warping—How to Treat Indentations—Boards Fitted with Appliances for Stretching Paper.

Drawing-Papers.—The papers which are most in use in the drawing office may be divided into two classes—"cartridge," which is a machine-made common quality of paper, used for work where a fine finish is not required in the draughtsmanship; and a better quality, hand-made, generally of "Whatman's" make, for superior work. One side of the "cartridge" is generally, though not always, finished to a smoother surface than the other, and the smooth surface is the one usually adopted for drawing on. This paper is not suitable for colouring on, as it is soft in texture, and absorbs the colour like blotting-paper. "Whatman's" paper is of a much finer and stronger texture and hard surface. Both sides are much alike in appearance, but the correct surface for drawing on may be ascertained by holding the paper up to the light. Each sheet contains a water-mark, which reads in the right direction when looked at through the working surface. For drawings which have to be submitted to much handling, or which it is desired to preserve in good condition for many years, it is usual to use drawing-paper mounted on holland or linen. The standard sizes of paper are to be bought ready mounted, or if a specially large plan has to be prepared, either "cartridge" or superior paper can be bought by the roll in various widths up to 60 in.

Tracing-Paper and Cloth.—Tracing-papers are made in a great variety of thicknesses, tints, and textures. They have usually one side smoother than the other, and are sold in continuous rolls, 21 yds. or 22 yds. in length, varying in width from 30 in. to 44 in. Tracing-linen or tracing-cloth is obtainable in about the same sizes. It is made with one side glazed and the other rough, or occasionally with both sides glazed. The question as to which side is to be used for drawing upon is one which must be left entirely to the discretion of the draughtsman, some preferring one side, some the other. The rougher side is easier to work on, inasmuch as it takes both ink and colour easily, but a much neater and more effective tracing is produced by using the glossy side, and doing the colouring only on the rough surface. The rougher surface of the paper, it is also worthy of note, is more easily soiled than is the smooth surface.

The statement has lately been made that in some continental offices ordinary drawing-paper is made temporarily transparent by being saturated with benzine, and is then used for tracing purposes. The benzine is applied with a dabber of cotton-wool over the small portion of the paper which it is intended to use at once, as the evaporation of the benzine soon leaves the paper in its natural opacity.

Sizes of Drawing-Papers.—The standard sizes of drawing-papers are as follows:—

SIZES OF DRAWING-PAPER.

	Ft.	In.		Ft.	In.
Emperor	5	6	×	3	11
Antiquarian	4	4	×	2	7
" extra ...	4	8	×	3	4
Double elephant... ...	3	4	×	2	2
Atlas...	2	9	×	2	2
Columbia	2	10	×	1	11
Elephant	2	3¾	×	1	10¾
Double-crown	3	6	×	1	8
Imperial	2	6	×	1	9
Super-royal	2	3	×	1	7
Royal	2	0	×	1	7
Medium	1	10	×	1	5
Demy	1	8	×	1	3

Drawing-Boards.—Much ingenuity has been expended in devising improvements, or supposed improvements, in drawing-boards, and the various forms of this appliance are innumerable. For practical use, one of the best is almost the simplest in construction. The drawing-board shown in Fig. 6 is cheaply and easily made, and will be found to answer its purpose better than many of a more elaborate description. It consists of two or more well-seasoned boards screwed to stout battens, which raise the board two inches or more from the desk, and allow the T-square to be used with freedom. As all wood-work in process of time shrinks to a greater extent across the grain than it does in the direction of the grain, it is advisable for the screws securing the battens to the board to work in slots, as shown on an enlarged scale in Fig. 7. By this means the board, in contracting, draws the screws along with it without unduly straining the screws or battens. Naturally, if properly seasoned timber has been used, the liability to shrinkage will be very slight, and care should be used in the first place to secure suitable wood for the purpose. An old mahogany table or shop counter will provide excellent material.

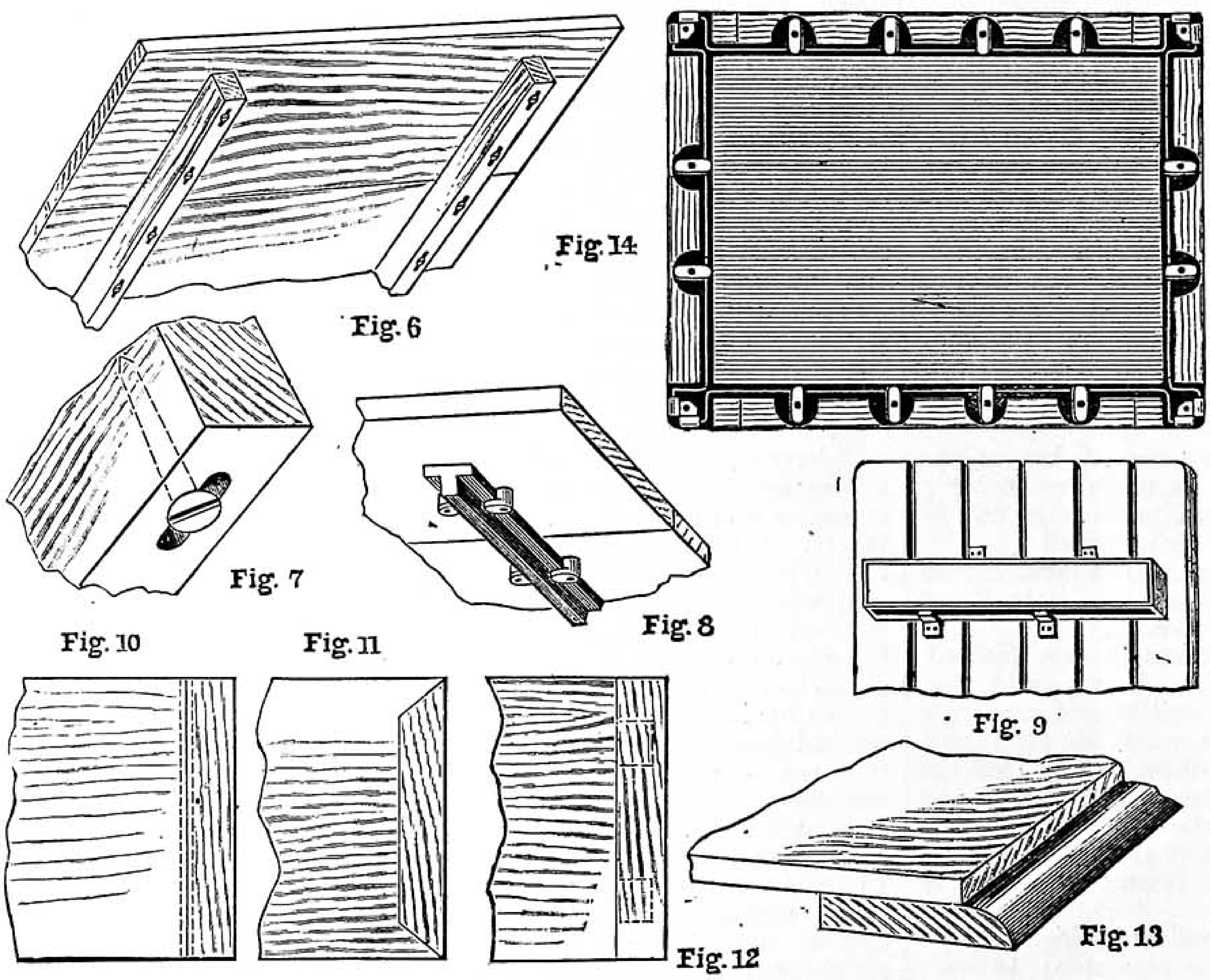
With the object of allowing for the above difference in the contraction of the parts, several modifications of the above idea have been applied. Instead of fastening the battens by screws to the back of the board, wooden turn-buttons may be used, as in Fig. 8, working on rebates in the cross-battens; or the battens may be grooved, and secured to the board by bent brass clips, as shown in Fig. 9.

In the above cases the end of the drawing-board is formed by the planed ends of the boards forming the top, and as this does not form a perfectly smooth surface for the head of the T-square to work against, it is customary in some boards to clamp on end pieces, either simply tongued and grooved straight across the width of the board, as in Fig. 10, or mitred at the corners, as shown in Fig. 11. Sometimes the end pieces are mortised, as in Fig. 12. From what has been said above, the objectionable feature in all these forms will be seen to consist in the fact that the various parts cannot shrink without straining and warping the drawing-board. The simple form of construction shown in Fig. 13 has the merit of protecting the edge of the drawing-board from injury. To provide a smooth bearing surface for the head of the T-square, some makers insert a slip of ebony across the end of the drawing-board.

It may be worth while here to point out that should a drawing-board suffer from rough usage and become indented, the grain of the wood can be raised by placing on the dents several thicknesses of brown paper previously soaked in hot water. On the top of these is placed a piece of dry paper, and then a hot flat-iron is laid on the whole until the vapour has caused the wood to swell. When the board is dry, a shaving or two can be taken off with a smoothing-plane, and the board will be as good as new.

Several arrangements have been devised for stretching drawing-paper on the board without the use of glue or drawing-pins. One of these, Wigzell's patent, is shown in Fig. 14. In using this board, the bent wires round the edges are to be turned back from the grooves into which they fit. The paper, after being damped all over, is placed on the board with its edges overlapping the grooves, and the wires are then turned down and secured by the turn-buttons. The paper is securely held in the grooves, and the superfluous edges can be trimmed off. The turn-buttons and wires are sunk below the surface of the board, so as not to interfere with the free use of the T-square.

In my next paper I shall hope to deal with such requisites of the drawing office as the instruments used; viz., T-squares, set-squares, parallel rulers, etc., and give some preliminary teaching on straight-edges, etc.



Drawing Office Work. Fig. 6.—Battened Drawing-Board. Fig. 7.—Detail of Slot for Screws in Fig. 6. Fig. 8.—Battens with Turn-buttons. Fig. 9.—Batten with Slot and Brass Clips. Fig. 10.—Straight Clamp. Fig. 11.—Mitred Clamp. Fig. 12.—Mortised Clamp. Fig. 13.—Batten projecting at end of Board. Fig. 14.—Secured Drawing-Paper Arrangement without Glue.

CARVED OAK JACOBEAN TABLE CONVERTIBLE INTO A HALL SEAT.

BY M. M.

It is not an infrequent experience among seventeenth-century carved oak furniture collectors to meet occasionally with tables which, when not required to do duty in that capacity, were so constructed as to be adapted to the purposes of chairs; and in the present paper will be found instructions and the necessary drawings for making such a convertible piece of furniture. The design given being quaint, and by no means commonplace, will doubtless be acceptable to some who are on the look-out for artistic novelties; it has, besides, certain good points of a practical character which may make it worth attention. As an occasional table, it has a strength and solidity not to be attained by the ordinary pillar stands, and if used as a writing-table or a work-table, the chair-seat beneath it forms a decided convenience; moreover, whereas the ordinary stand-table is, when not in use and turned up, merely an unsightly encumbrance, this article, when not wanted as a table, is both serviceable and ornamental as a seat for the hall. In the perspective sketch (Fig. 1) it is shown in this latter state.

Although the present design is an original one, the idea on which it is based is as old as the reign of James I., and in style and decoration the taste of that period has been pretty closely adhered to. The carving is not elaborate, or such as will offer any difficulties to amateur workmen. That pattern which, in its chair state, decorates the back of the "combination," is so slight, that it will in no way weaken the board for the uses of its other side as a table-top. The carving on the frame is little beyond mere gouge-work.

As a table, our convertible piece of furniture stands 2 ft. 4 in. high, and has a top 2 ft. 6 in. square, its frame measuring 2 ft. by 1 ft. 6 in. As a chair, the seat is 1 ft. 6 in. high, the arms 1 ft. 11½ in. high, and the back about 4 ft. 9 in. In Fig. 1 we have a general perspective view, the table top being turned up to form the back of the chair. This is, of course, drawn to no precise scale, but the reader will easily grasp its dimensions.

For shaping the legs, it will be seen that the lathe has to be called into requisition. These (*a, a, a, a*, in the section, Fig. 5) are made from stuff 2 in. square; their length is 24½ in., exclusive of the tenon for entering the mortise in the arm, which will demand an additional inch and a half. There is a little ornament on the legs—two rosettes on the outer sides of each—which are carved in sunken medallions; these are of a very ordinary Jacobean type, but at Fig. 7 is one somewhat reduced in size. It will be observed that these rosettes figure on all the legs alike, since all are alike supposed to show when the "combination" is in use as a table. Each leg has mortises ½ in. wide, ¾ in. deep, and 3 in. long to receive the tenons of the cross-pieces, as is shown in the section, Fig. 5.

These cross-pieces are of 1 in. stuff, 4½ in. wide; those for the back and front are 20 in.; those for the ends 14 in. long, exclusive of the tenons, which are ¾ in. long at each end. The line of gouge-work ornament running along them seems too simple to require any explanation. The lower edge of each in the part hollowed out has a hollow moulding worked with the gouge instead of a chamfer. The cross-pieces are marked *b, b, b, b*, in the section (Fig. 5) where these tenons are shown.

On these cross-pieces rests the seat (*c*,

Fig. 5), which is of ½ in. wood. The proper "Jacobean" way of fixing this down to the cross-pieces would be with wooden pegs, but the more modern inventions of screws or brads may perhaps be preferred. I have drawn the seat as coming just flush with the frame (24 in. by 18 in.), and slightly rounded off on its upper edge, but some might choose to gain a little relief by making it project half an inch on every side and finishing off with a moulding. We should then need a seat 25 in. by 19 in., and in this latter case it will be desirable to cut away the projection in the centre of the back where the are given at full size in Fig. 7. On its underside each arm has a mortise 1¼ in. long by ¾ in. broad, and 1½ in. deep to receive the tenons of the legs.

The shape and ornamentation of the table-top on its under side are shown in Fig. 4. This figure being intended to show decoration rather than construction, is not drawn to scale. The top is of ¾ in. board, and is 2 ft. 6 in. square. The moulding round its edge is alike above and below, as is shown in the section (Fig. 6). In this section is also indicated something of the depth to which the carved decoration should be cut.

In the very heading of this paper I spoke of oak as the material for this piece of furniture, and indeed we could have nothing better or more suitable. We are accustomed to look upon oak as the one wood appropriated to the style. Unquestionably it was the wood most in use in the Jacobean era; it is, however, a mistake to suppose that it was used exclusively. True it is that fancy woods with the art of inlaying were little employed in English furniture till much later in the century—till post-Restoration times, in fact—yet Spanish chestnut was extensively used in this country throughout

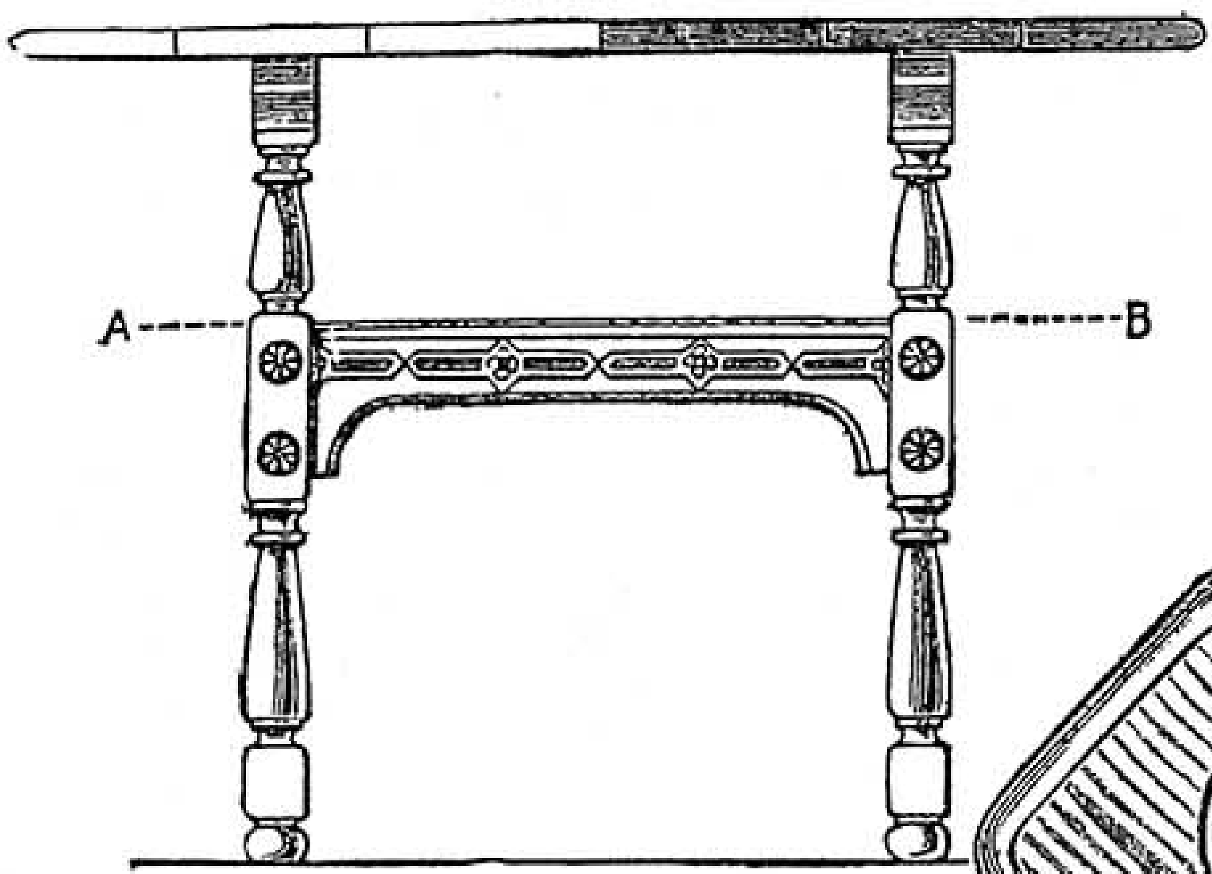
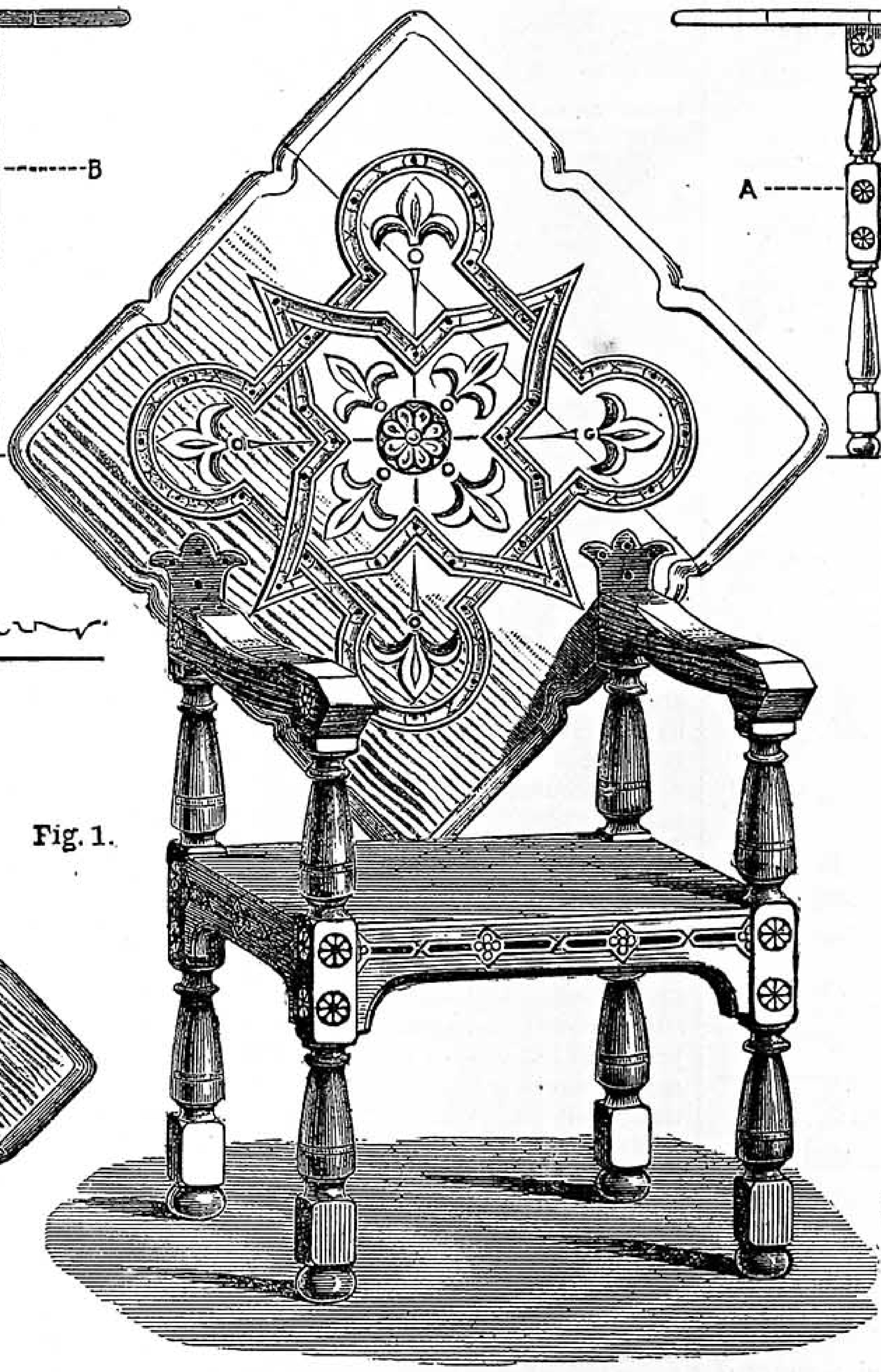


Fig. 2.



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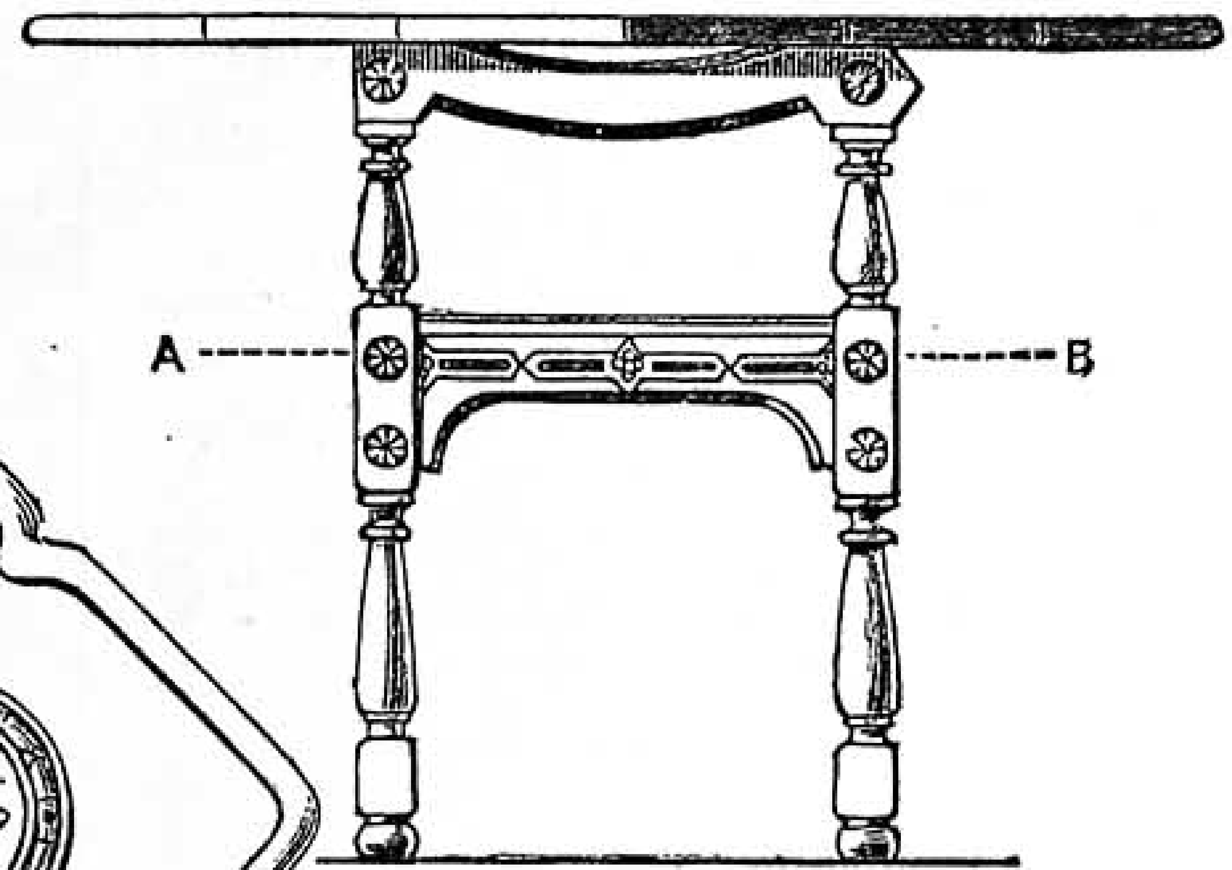

Fig. 3.

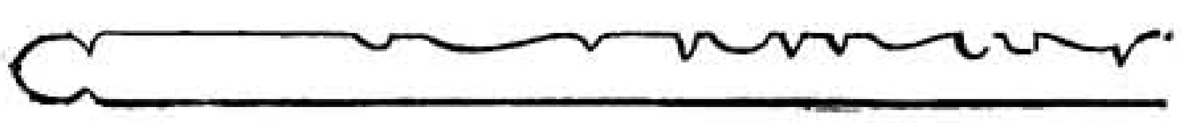

Fig 6.

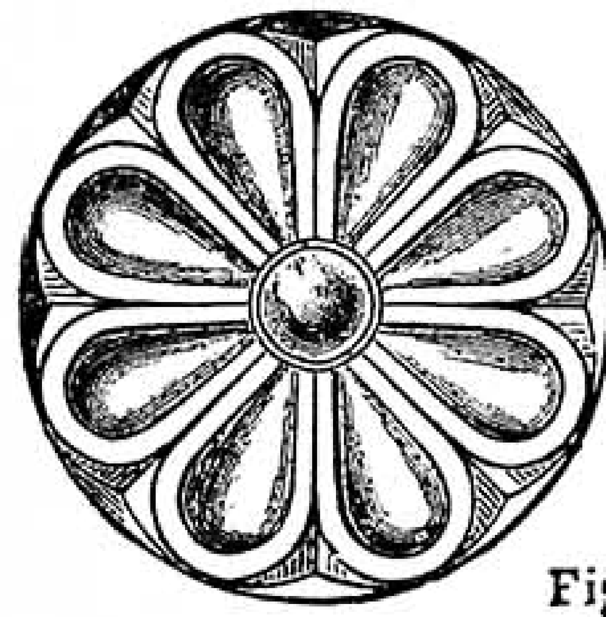

Fig. 7.

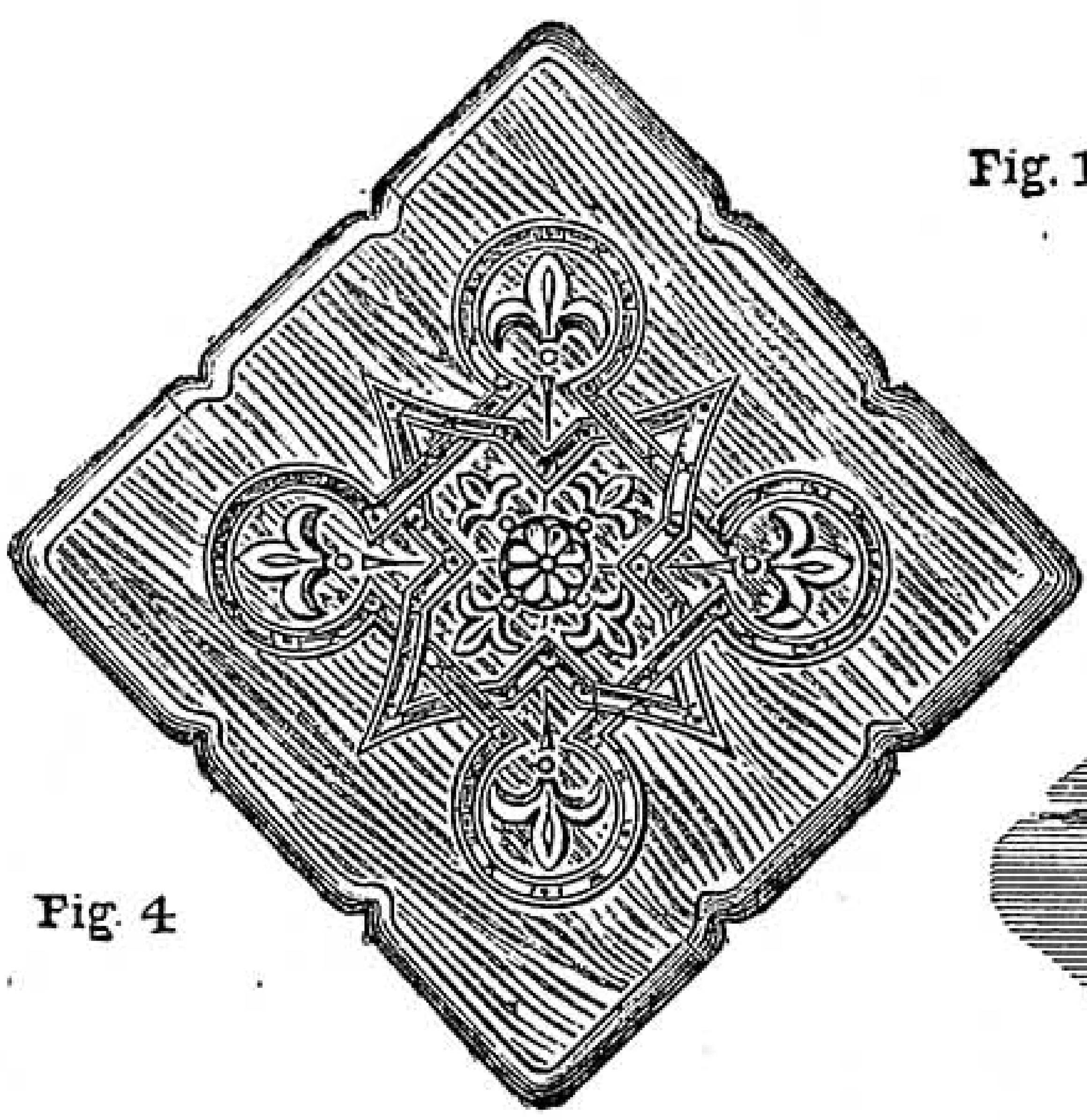

Fig. 4

Fig. 5.

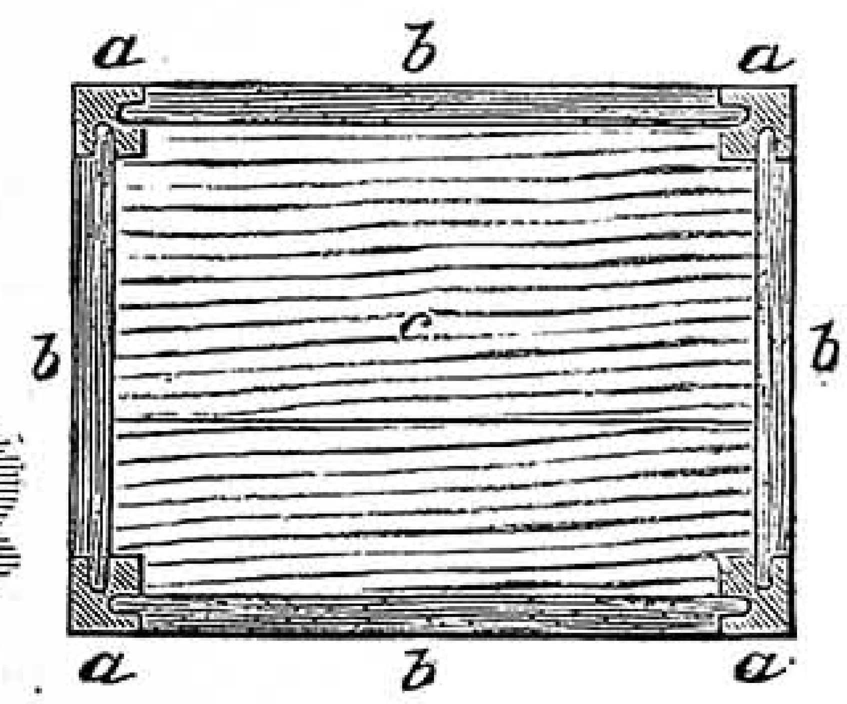

Fig. 1.—Jacobean Convertible Table. Fig. 2.—Front Elevation. Fig. 3.—End Elevation. Fig. 4.—Under-side of Top. Fig. 5.—Horizontal Section on Line *a b* from below. Fig. 6.—Section of Top. Fig. 7.—Rosette on Legs and Arms.

turned-up table-top touches against it, or, when in use as a chair, the upper part of that member will tilt forward objectionably.

The arms, on which the table-top rests when turned down, are cut from stuff of the same thickness as the legs, namely, 2 in., but in depth they are 2¾ in. They are, as shown in Fig. 3, hollowed on their upper face; this adds to the comfort of the chair, and the table-top is rendered more firm by resting on four points only. Below a corresponding curve is given, and the edges of both the upper and lower curves are chamfered off. These arms are 19¼ in. long, for it will be seen that their front ends project 1¼ in. beyond the general line of the frame. The rosettes carved on the outer sides of the arms are similar to those on the legs, and The carving here shown is mere surface decoration, an adaptation of the band-work so often met with in seventeenth-century panels. The interlacing bands are marked out by a line on each side incised with the V-chisel, whilst down their centres a shallow hollow is run with the gouge, which hollow is afterwards enriched by using the grounding-punch at intervals, or by dots or markings made with other gouges, as the fancy of the carver may direct. The top is shown to be fixed to the arm by ornamental hinges, and these should be let in so as to come flush with the surface of the wood.

None of the drawings are given to scale, but should any difficulty arise on this score, the matter can be soon set right through the welcome columns of "Shop."

the Tudor period and in the early Stuart both for ecclesiastical and domestic work. This wood has scarcely less endurance than oak. I have worked up and carved some, certainly not less than 200 years old, which was as sound as ever. It is well suited for carving, and, as a matter of fact, we find a reasonable amount of old carving executed in it, some of which is highly elaborate. Other woods were also used at that date—in my own possession is an arm-chair of the time of Elizabeth in English yew. This timber, however, was but rarely employed, and then only slightly carved. I mention these matters to show that carrying out a design like the present in some other wood than oak need not necessarily be inconsistent.

is published at La Belle Sauvage, Ludgate Hill, London, at 9 o'clock every Wednesday morning, and should be obtainable everywhere throughout the United Kingdom on Friday at the latest.

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FOREIGN COMPETITION.—It appears that the pencils used in the Post Office and other Government departments come from abroad, and once or twice questions have been asked in the House of Commons why the Government should not give the work to our own manufacturers, and so tend to the increased employment of our own people. We have never yet seen a satisfactory answer given to these questions, which suggest the advertisements of many firms who appeal to the public to purchase their commodities and so encourage British industries. There is a most satisfactory and conclusive answer to such questions, however, and we make a present of it to any member of the Government who may hereafter be challenged about these pencils. The answer is, that the consumption by this country of foreign pencils, or foreign anything else, does not rob our workers of one single hour's labour. To understand this, think for a moment how we get these foreign pencils or foreign anything else. Do the foreigners give them to us for nothing? Clearly they do not—no one would say that they do—yet everyone in speaking of this subject seems to imply that they do. Well, if they don't give us them for nothing, they must take something from us in exchange for them. What do they take? They take our gold, you say. Well, suppose they did take our gold, how do we get that? Do we get that for nothing? Clearly not; we must give something to get it. What do we give? What can we give but the produce of British industry? Thus, when we consume foreign articles, even when we have given gold for these articles, we are really consuming the produce of British industry. But it is not true that we give the foreigners gold for these foreign articles; on the contrary, so successful are our international commercial transactions, that the foreigner, besides sending us his produce to liquidate his obligations to this country, has also to send us *his* gold. This is shown by the return of the imports and exports of the precious metals in bullion and specie—the excess of the imports over exports during the period 1886-90 being the difference between £121,465,469 (gold and silver imported), and £110,989,696 (gold and silver exported), or £10,475,773. Alas! the wealth of this country.

CONCILIATION BOARDS.—Apropos of the Labour disputes in Birmingham, district rules have been prepared for a proposed conciliation board. In the present arbitrary attitude taken up by both masters and men, we see a standing menace to the industries and the domestic peace of the country. If the colliers take a week's holiday, the coal owners, in an equally arbitrary fashion, propose to reduce wages. That some thousands of engineers should strike work on account of a trivial dispute with their fellow-workmen, the plumbers, has aroused feelings—not too justifiable—against their arbitrary conduct, on the part of the masters, throughout the country; and, in the present serious decline of the engineering trades, it would be no marvel if the masters were to attempt reprisals. If the men have their Unions, it must be remembered that the masters have their Association, both for offence and defence. If we read the signs of the times aright, the struggle between associated labour and associated capital tends to become more bitter, more severe. Boards of conciliation are one remedy for these eternal industrial disputes. Their operations as yet have been very limited, but they are well worth an extended trial. A large proportion of labour disputes arise from want of knowledge on both sides. Workmen cannot know the points of business workings, and employers seldom take their workpeople into their confidence. Bare unsupported statements are not believed, but the statements officially made by a board of conciliation, whose members were representatives of *employers and employed*, would be received with implicit confidence, and prevent disputes which harass industry, and inflict untold misery on the lower grades of unskilled labour, and on dependent families.

PATENTS.—The number of inventors and aspirants to that title increases in fair proportion to the population: even the perpetual motion illusionists are not extinct, and their offerings are accepted at the English Patent Office. By the way, we can scarcely wonder at the unenlightened enthusiast paying for a patent for an impossibility, so long as the educated officers of the Patent Office will grant it. If anyone thinks he, or she, has invented something, a model should be made, no matter how rough, so long as it is a working model; this course will settle the practicability of the alleged invention, and, in a majority of cases, will save money, time, and protracted waiting for ultimate disappointment. An inventor who makes a model before depositing his provisional specification will satisfy himself as to the essential features of his apparatus, and therefore not run the risk of subsequently invalidating his patent through discrepancies of principle between the provisional and complete specifications. A more general knowledge of the first principles of physics and mechanism will close the era of impossible inventions, but in the meantime the making of a model is the antidote, though it would be much better if the granting of patents were restricted to possibilities. The large profits of the Patent Office would then afford the employment of competent technical examiners and clerks.

ABOUT BORDER ORNAMENT.

BY CHARLES KELSEY.

Fret or Key Borders.

Introduction — Antiquity and Extent of Usage — Archaic Greek Work — Utility and Applicability of these Patterns — Essential Principles — Description of the Diagrams — Hints on "Setting Out" — Ancient Labyrinths — Garden Mazes — Labyrinthes de Pavé — Conclusion.

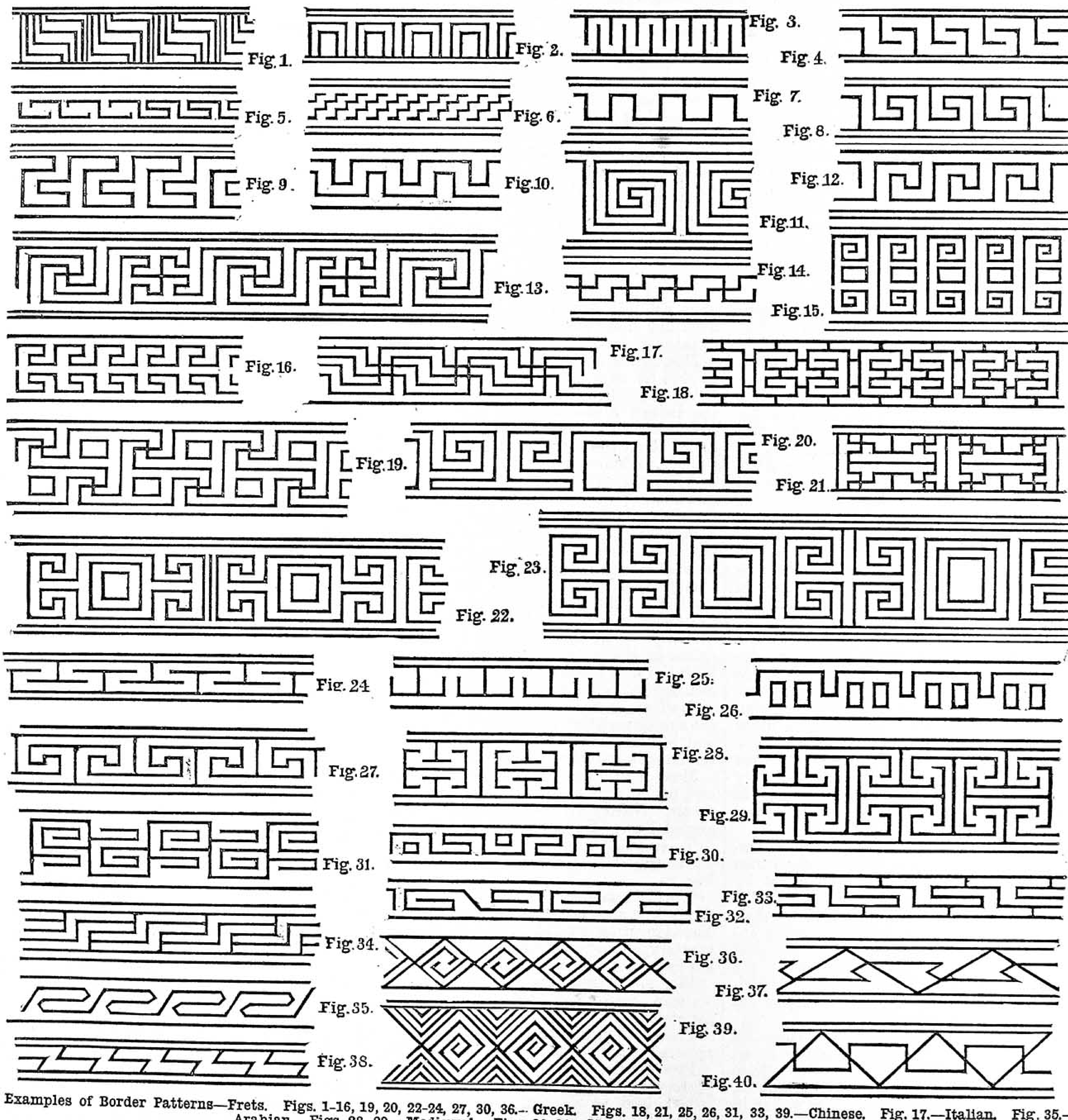
Introduction: Antiquity and Extent of Usage.—In a prominent position in the Octagonal Hall which forms the centre of the National Gallery in London appears the following axiom :—

"Those works which have stood the test of ages have a claim to our respect and veneration to which no modern work can pretend."

This motto refers primarily to the examples of painting by old masters which are exhibited within these walls, but it is quite as applicable to the series of patterns which are illustrated with this article. Indeed, on the score of antiquity, even the oldest of the paintings—dating, though they do, from the thirteenth century—appear modern when compared with many of these patterns, which can boast of twenty-five centuries of continued use, and yet still form "stock patterns" with the designers of modern articles.

Most of the Greek examples here given appear to have been developed by the potters working early in the fifth century before Christ; they were subsequently used by the Greek architects and the workers in other materials.

Many of the Chinese examples can no doubt lay claim to as great an antiquity, for their ornamental forms are highly traditional; and it is a well-established fact that they were expert workers in many of the arts at a period prior to the date of civilisation in the West. These fret or key patterns—the latter term referring to their resemblance to the wards of a key—have been used, modified, and developed by artists and decorators of every age, clime, and faith, and show no signs of ever falling into disuse. Indeed, it is surprising how frequently they are used upon modern work. Ample evidence of the extent of this usage



Examples of Border Patterns—Frets. Figs. 1-16, 19, 20, 22-24, 27, 30, 36.—Greek. Figs. 18, 21, 25, 26, 31, 33, 39.—Chinese. Fig. 17.—Italian. Fig. 35.—Arabian. Figs. 28, 29.—Mediæval. Figs. 32, 34.—Mexican. Figs. 37, 38, 40.—Persian.

may be gained by observing the articles in any modern day furnished room: it will be almost remarkable if our old friend is not met with in some one of its forms.

In the examples illustrated, I have selected many unfamiliar specimens—many which have not been previously published—and at the same time those which appear most likely to bear within themselves suggestions for further variations.

Archaic Greek Work.—It is a singular fact—one which may be observed in all Greek art-work of this character—that the earliest examples are much more suggestive than the later ones. In archaic times the fancy seemed more free to rove than at the later periods, when the skill of the Greek worker seemed to be directed more towards the perfecting of established forms than to the development of new ones. For this reason, the Greek ornamental forms are at once very few and almost perfect.

Utility and Applicability of these Patterns.—This collection of patterns will be found useful to many of the busy readers of WORK; to instance the methods of decoration, and the articles to which they may be applied, would be to specify almost every known craft and article. As a general rule, it may be said that the Greek examples will be most appropriate to the decoration of simple-shaped, solidly constructed, and stately articles, whilst the Chinese and Persian examples will be most suitable, from their quaint character, to less formal articles, fancy goods generally, and the like.

Frets are most suitable for the decoration of flat surfaces, fasciæ and fillets, or used as borders. On sharply-curved surfaces they will be more difficult of execution, and will be likely to appear distorted; but this objection does not extend to surfaces of a gentle curvature, on which the slightly curved form given to the component lines will be rather pleasing than detrimental.

Their "setting out" needs only a little exercise of patient observation; and as all the lines may be ruled, ability in drawing is not essential to success.

They will be found, perhaps, most useful to that large class of persons who possess skill in the construction of articles, but who experience a difficulty in the last stages of ornament and decoration. How frequently we meet with well-constructed articles, spoiled by the addition of ornament of a most puerile description! Little wonder may be expressed at this, if we consider for a moment that the ornamentist requires certainly not less study and application than is necessary to acquire perfection in other crafts. To such workers I would say, it is much better to borrow or adapt an old good thing than to use ornament which has only novelty to recommend it: such cannot do better than adapt some of the patterns given herewith.

Essential Principles.—To those more ambitious ones who desire to design their own ornament, many lessons may be learnt by studying a group of patterns like these. The "survival of the fittest" evidenced by their long-continued use indicates that there are here present principles which are essential to good ornament, and the object of the study should be to discover and absorb these principles, to serve as guides in designing ornament of our own.

The late Owen Jones strongly advises this method of study, and lays it down as an axiom that until the existence of these general principles is more fully recognised, little improvement will take place either in the individual or the national taste.

He also says: "The principles discoverable in the works of the past belong to us." We shall be indeed foolish if we do not seek diligently for them, and employ them to the best advantage in our own work.

Let me endeavour to point out some of these principles. First, notice the contrasting of the vertical with the horizontal, and in some instances the inclined, lines. This principle of contrast is an ever-present one in all good ornament, in some of its forms: contrast of vertical with horizontal and inclined lines, as in these examples; contrast of straight and curved lines or forms; contrasts of broad masses and fine details; contrast of light and dark; contrasts of bright and subdued colour, and so on. Next, observe the symmetrical proportion in the length of the various component lines: this, too, is a valuable principle. Now notice the square stability of the patterns: the use of the straight lines produces this. Ornament composed wholly of beautiful curves always has a flaccid and flabby appearance, and needs a few straight lines to supply the desirable principle of strength and stability. The parallelism of the lines with the bounding edge is also a valuable feature; it echoes and emphasises the primary duty of a band or border, which is to bind and confine the more loosely arranged centre patterns.

If these four principles are thoroughly grasped, these works of old designers will not have been reproduced in vain, and our own work in which these principles are acted upon will be found to please even those who, most likely, are unable to explain the reason of this satisfaction.

Description of the Diagrams.—To return to the illustration, the Greek specimens have been culled from the Greek pottery in the British Museum, many of the articles from which they are taken having been produced about the year 500 B.C. The examples show a gradual development from simple to complicated varieties. Fig. 1 is a very early specimen—possibly the parent of the more complicated examples; it is executed simply as a series of impressions made by some sharp-pointed instrument upon the clay shape before firing. Figs. 2, 3, and 6 are also early examples, which served as the basis for further developments. Nearly all of the examples are executed with some dark-brown pigment, upon the natural red or buff colour of the pottery. Fig. 11 shows a fret with the working lines displayed. The more complicated specimens seem to have been arrived at by adding extra lines or limbs to the simple varieties, by interlacing two frets, and in some cases by the addition of intervening square features.

Most of the Greek specimens are continuous, but some few are fragmentary in character. Nearly all consist solely of right-angled lines. Fig. 36 is an exception, and it is singular how close this corresponds with the Chinese example shown in Fig. 39.

The Chinese examples are from articles in the British and South Kensington Museums. The elongation, as in Fig. 33, and the fragmentary character, as in Figs. 18 and 21, are typical of Chinese frets.

Fig. 17 is from the decorations in the Vatican, carried out by Raphael and his assistants.

Figs. 28 and 29 are from mediæval illuminated manuscripts of the tenth century.

Figs. 32 and 34 are from ancient Mexican pottery in the British Museum. The inclined line in Fig. 32 is suggestive of further modifications.

Fig. 35 is an Arabian example. Its raking lines and diagonal-formed ends led to the production of many elaborate interlacements by the followers of Mahomet.

The Persian varieties are from illuminated manuscripts in the British Museum. Figs. 37 and 40 show the fret combined with the chevron or zig-zag, suggestive of further variations.

Hints on "Setting Out."—In "setting out" frets, a sort of unwritten law prevails that the dark and light spaces shall be equal, but this is not essential or altogether desirable. If the one portion is made less, as in the rendering of the present examples, where the black is thinner than the intervening white spaces, the fret comes out clearer, and with, perhaps, a better effect. Any of the frets may be elongated; this, in some instances, is an improvement. The direction in which the pattern should run is almost immaterial. By repeating the patterns on some geometric basis, they may be developed into diapers to cover larger superficial areas than bands or borders.

Ancient Labyrinths.—Portions of such patterns were anciently used as symbols of the ancient labyrinths, which were constructed on similar plans. The oldest of these was an Egyptian construction, the ruins of which still exist near the Lake Mœris. The best known in classic history is the legendary labyrinth in Crete, famous as the prison of the Minotaur, and for the fable of Theseus. The Athenians sent yearly fourteen victims, who were doomed to lose their path in its intricate windings, and to be destroyed by the monster. Theseus is credited with the destruction of the monster, and with obtaining egress from the labyrinth by a clue furnished for that purpose by Ariadne, the daughter of Minos.

Garden Mazes.—In later times garden mazes were constructed on similar plans. Most Londoners are acquainted with the one now existing at Hampton Court.

Labyrinthes de Pavé.—In some French Cathedrals—notably the one at Chartres—similar patterns were executed in marble mosaic, in the nave pavement. They were a symbolical allusion to the Holy City—perhaps a reminiscence of the places of worship of the Early Christians in the Catacombs, and certain prayers and devotions accompanied the perambulations of their intricate windings. In that at Chartres, a person following the various turnings of the figure would walk nearly eight hundred feet before arriving at the centre, although the circumference does not exceed forty.

Conclusion.—The many other instances of the past use of these patterns cannot here be referred to; but sufficient has been said to intimate what a wealth of association lies behind the familiar Greek key pattern.

[In furtherance of this all-important subject of Decoration in Design, our next number will include the first of a series of valuable papers on Ornament and Decoration of all Nations, which our readers will, doubtless, make known to their friends.—Ed.]

HOW TO SPLICE LADDERS.

BY CHOPSTICK.

I DARESAY every man in the building trades has, at some time or other, found it necessary to tie two ladders together in order to get to a higher elevation than he could manage to do with one only. In some places this is rarely necessary, as a good supply of long ladders is kept; but the long ones cost a great deal of money, and it is also a difficult matter to rear them; and I think it is a much better plan to splice two short ones, if it can be done safely and quickly, than to trouble with a long one. A good many men do not like going up on the ladders when spliced, on account of their liability to slip as the cord stretches; and when a man is forty feet from the ground, it gives him a "turn" if the ladder only slips an inch—a fact I can speak of from experience, as I have had to catch for my life sometimes. But with the ladder spliced as I am about to describe this never happens; and I have no hesitation in saying that I would prefer going up on two ladders spliced together, to going up on one long ladder, for the reason that the two would be much stiffer and would not sway about so much as the one. I think I have now said enough by way of introduction, so in a very few lines I will give instructions to enable anyone to try my way for themselves.

We will, by way of illustration, suppose that we have work to do thirty feet from the ground, and have a 25 ft. and a 15 ft. ladder to do it with. In the first place, we must have two ropes—ordinary scaffold ropes will do—then place the longer ladder in position against the wall, and the shorter one in front of it (as shown in Fig. 1); then double one rope in half, and pass the loop under the bottom stave of the hindmost ladder, and pass the two loose ends through it, thus fixing it to the round in the centre, and leaving two ends of equal length. Pass these ends upwards between the two ladders until you get to the proper height (in this case it will be the eighth stave), then bring them through to the front.

We have now got as far as shown in Fig. 1, and must now mount the shorter ladder, while our mate lifts up the hindmost one until the bottom stave is on a level with the stave which the rope is passed over; then give the two ropes, or rather the two ends of the rope, a twist, and bind one round the two ladder sides as many times as the length will allow, finishing it off by passing the end between the rope and the ladders; then bind the other side the same. You have now only to put the other rope on in the same way at the top of the shortest ladder, and the appearance will be as shown us in Fig. 2; and on trying it you will find that it will not slip in the slightest manner, while the time occupied in making the splicing will be found to be far less than that occupied in rearing a 30 ft. ladder. I have shown in Fig. 3 details how to bind and fasten off the rope, and I think no one will fail to understand this short but, I hope, useful paper. To those workmen who are in the habit of tying and requiring to use rope knots, I cannot do better than recommend a careful study of the series on "Knotting and Working Cordage," which appeared in Vol. III. of WORK.

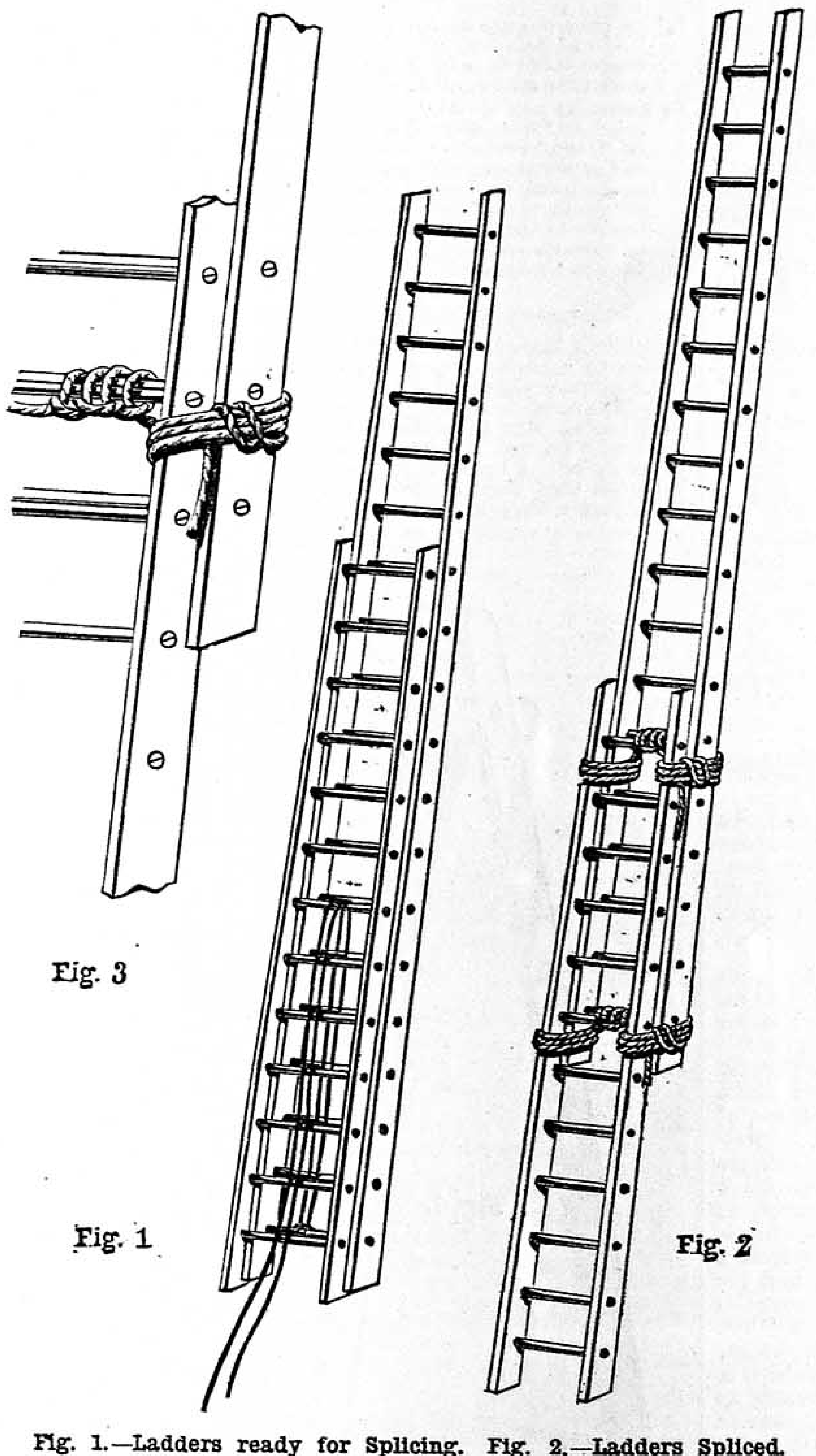


Fig. 1.—Ladders ready for Splicing. Fig. 2.—Ladders Spliced. Fig. 3.—Details of Splicing.

NOTES FOR WORKERS.

DR. WOLF, of Heidelberg, has discovered two minor planets by means of photographic plates taken on the 22nd and 23rd of December, 1891.

THE art of stellar photography has made rapid strides of late years, and has now become a powerful instrument in astronomical research.

THE effect of the earthquake on the beautiful cone of Fujiyama, in Japan, is that the south-western slope of the summit is wholly destroyed, there being a subsidence 4,000 ft. long, 2,000 ft. wide, and 1,000 ft. deep.

AN electric fog bell has been erected at the port of Ravenna, in the Adriatic. A current is conveyed to it from a battery in the lighthouse, about 1,000 yards distant.

A GALLON of distilled water contains 277,274 cubic inches, and weighs 10 lbs.

ONE horse-power equals 33,000 foot-pounds per minute. This is a purely arbitrary quantity, and was adopted by Watts on the supposition that an ordinary horse could raise 33,000 lbs. through a height of 1 ft. in one minute.

THE American navy have adopted for use for heavy guns a smokeless powder, the joint invention of Professor Munroe and Commander Jewell.

A PARISIAN electrician has succeeded in forcing violets by the aid of electricity, and sent a bunch of these flowers, only four hours old, to the ex-Empress Eugénie.

SCIENCE TO DATE.

Halogen Salts of Cæsium.—A remarkable series of eight compounds of the metal cæsium with the halogens have been discovered by Messrs. Wells and Penfield in America. The formulæ of these compounds are CsI_3, $CsBrI_2$, $CsBr_2I$, $CsClBrI$, $CsCl_2I$, $CsBr_3$, $CsClBr_2$, $CsCl_2Br$. They are all prepared by adding the requisite quantity of iodine, bromine, or chlorine to a haloid salt of cæsium, and cooling or evaporating to the crystallising point. The salts are perfectly stable. They are very interesting theoretically. We cannot suppose that cæsium is trivalent, for that would be opposed to the Periodic law of Mendelejeff, and hence they must be regarded as double salts.

Dust in the Air.—Mr. Aitken, who some time ago invented an apparatus for counting the number of dust particles in a given volume of air, in a paper before the Royal Society of Edinburgh has come to the following conclusions after two years' observations: The air in inhabited districts is always impure, and the dust is carried by the wind to enormous distances. Dust is found in the air even on the summits of mountains. When there is much dust, fogs are thicker, and great humidity gives great density to the atmosphere when it is accompanied by a great quantity of dust. Further, there is more dust the higher the temperature, and a great quantity of dust reduces the transparency of the air.

March of Electricity.—The beautiful experiments of Mr. Tesla, which were recently shown to crowded audiences at the Royal Institution, indicate what a wonderful advance has been made in electrical science. It seems that the light of the future will be a soft phosphorescent glow, the colour of which may be arranged to suit any taste. Our rooms will be electrical fields in a state of rapidly alternating electrical stress, in which, though nothing is sensible to the occupant, vacuum tubes and phosphorescent globes will shed their light wherever they may be placed, no connecting wires or any attention being necessary.

Chlorobromides of Carbon.—There are three chlorobromides of carbon indicated by theory—viz., CCl_3Br, CCl_2Br_2, and $CClBr_3$. The first was prepared some time ago by heating bromine and chloroform together in a sealed tube to 170° C. M. Besson has now succeeded in preparing the remaining two by simply carrying the operation further. The sealed tube is opened at intervals to allow of the escape of the enormous volumes of gases produced, and then, being re-sealed, is heated to a higher temperature. The reaction is complete at 275° C., and then the three substances may be separated from the product by fractional distillation. CCl_3Br is a liquid, while the other two are solid substances.

Velocity of Electricity in Submarine Cables.—Recent experiments have shown that the velocity of electricity in submarine cables is 8,000 miles in 1·05 seconds.

Collection of Chemical Elements.—Prince Lucien Bonaparte has bequeathed to the South Kensington Museum a valuable collection of the chemical elements. All the elements, with the exception of one or two—the existence of which is doubtful—are represented, even to the one most recently discovered—viz., germanium. They are on view in the Science Collections, and our London readers, at least, should examine the collection. It would well repay a visit.

New Star in the Milky Way.—A new star has been discovered in the Milky Way about 2° south of χ Aurigæ. It has a yellow tint, and is of the sixth magnitude.

Action of Water Vapour on Magnets.—A Swiss paper is responsible for the following: Magnets, when heated in steam, lose from 27 to 67 per cent. of their magnetic power, but after re-magnetising them and submitting them to the same action, the loss of magnetic power is insignificant, and diminishes continually as the operation is repeated.

TRADE: PRESENT AND FUTURE.

*** *Correspondence from Trade and Industrial Centres, and News from Factories, must reach the Editor not later than Tuesday morning.*

PAINTING AND DECORATIVE TRADES.—Trade in the provinces generally is much better than in the metropolis. In the leading South Wales centres, Cardiff, Swansea, and Newport, it is very good. From the north also the report is satisfactory.

BUILDING TRADE.—Owing to the fine weather, building is going on rapidly on the outskirts of Liverpool; large numbers of houses are being built, and a great deal of jerry work is being done. These houses have "all the latest improvements," many including electric bells throughout. As far as the latter are concerned, owing to bad connection, they prove mere ornaments, and will not ring. Work is progressing on the new University College, and in a short time plans will be issued of a new General Post Office for Liverpool, so that the building trade promises well. There is very little change in the prices of materials; the only figures I can now give are: Spirit of turps, 26s. 9d. to 27s. per cwt.; refined petroleum, American, 5¼d. to 6½d., Russian, 4⅜d. to 4½d. per gal.; Manilla hemp, £26 15s. to £27 per ton.

HARDWARE TRADE.—Messrs. Charles Cammell & Co., the armour plate manufacturers, have declared their *usual* annual dividend of 12½ per cent. The net profits for the year were £175,712 19s. 5d.; the balance from last year being £38,496 16s. 5d., making a total of £187,959 15s. 10d., from which an interim dividend of 5 per cent. was paid last October. Happy shareholders! At the close of the meeting, the shareholders were invited to witness the rolling of a monster armour plate. One of the turreted warships the Government are having built is the *Ramillies*, which will have two barbettes, one fore and one aft, and each barbette will be composed of twenty-two plates. These are being manufactured at the Cyclops Works, and the plate rolled on this occasion for the fore barbette is 17 ft. long, 6 ft. 8 in. wide, and 17 in. thick. The weight in the rolled state was 51 tons; when planed and fitted, it will be reduced to 33 tons. In Birmingham and district, the coal crisis has had disastrous results, some of the ironworkers not having yet got over its effects. One large order for £3,000 worth of iron has been sent to Belgium from Wolverhampton, the ironmaster claiming that, by so doing, he can gain £1 per ton more profit than if he starts his own works going.

CYCLE TRADE.—In Australia, there are nine months in which this pastime may be indulged in, the remaining three months being too hot for cycling. As to the trade, a number of the British houses are represented there. Marriott & Cooper, as also Singer & Co., of Coventry, have long had a dépôt there, while one of the Jennings Brothers, of Glasgow and Manchester, opened a dépôt in Melbourne some five years ago, and holds agencies for new Howes, Swifts, Bayliss & Thomas, Sharral & Lyle, etc. Other houses are also represented, as the Humber and Raglan. The trade, however, is not likely to develop quickly, as the Australian roads, except in or near the towns, are bad for cycling. An authority says if the roads there were as good as our own, Australia would soon "lick creation" as a cycling country. In Wolverhampton, the state of the trade may be gleaned when it is mentioned that the Humber Co. have nearly as many orders on their books at the present time as they executed during the whole of last year. The works are going till ten o'clock at night, and this to fill almost entirely foreign orders, two of which may be mentioned—one for an American house, 750 machines, and one for a German house, 550 machines. With regard to the home trade, they declare they never had so many inquiries so early in the season.

IRON TRADE.—At the Middlesbro' market it was expected there would have been a substantial rise in the price of iron, but Middlesbro' warrants, which still continue to regulate the price of iron, were lower. The immediate decreases, both in make and stocks, are more likely to be much heavier even if the strike of Durham miners were to terminate at once, but it may continue another month. As I write it seems probable that not more than seven furnaces will shortly be in operation. The merchants are not willing to sell any No. 3 Cleveland GMB at less than 37s. 6d., though small lots were procurable at 37s. 3d; makers were asking 38s. and 40s. Middlesbro' warrants were quoted 37s. cash, grey forge at 37s. 3d. The shipments are very small, and owing to the strike, a large proportion of the spring business with the Continent is being diverted to other districts. Iron founders and engineers have been able to stock coal, and are mostly working pretty regularly, but shipbuilders are beginning to be affected for want of iron and steel. Some consumers are sending to the Midlands for supplies. A fair supply of coal is being brought from other districts, chiefly for household purposes.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

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

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

I.—LETTERS FROM CORRESPONDENTS.

Artist's Easel.—W. S. (*Woodbridge*) writes:—"I beg to submit to the readers of WORK sketches of artist's sketching easel I designed and made for myself several years ago, and which I have found very useful. Fig. 1 is a sketch of the easel as standing ready for use, and Fig. 2 shows it folded ready to carry off. I think it will be plainly seen from sketches that the two front legs are screwed to block just wide enough apart to allow the back leg,

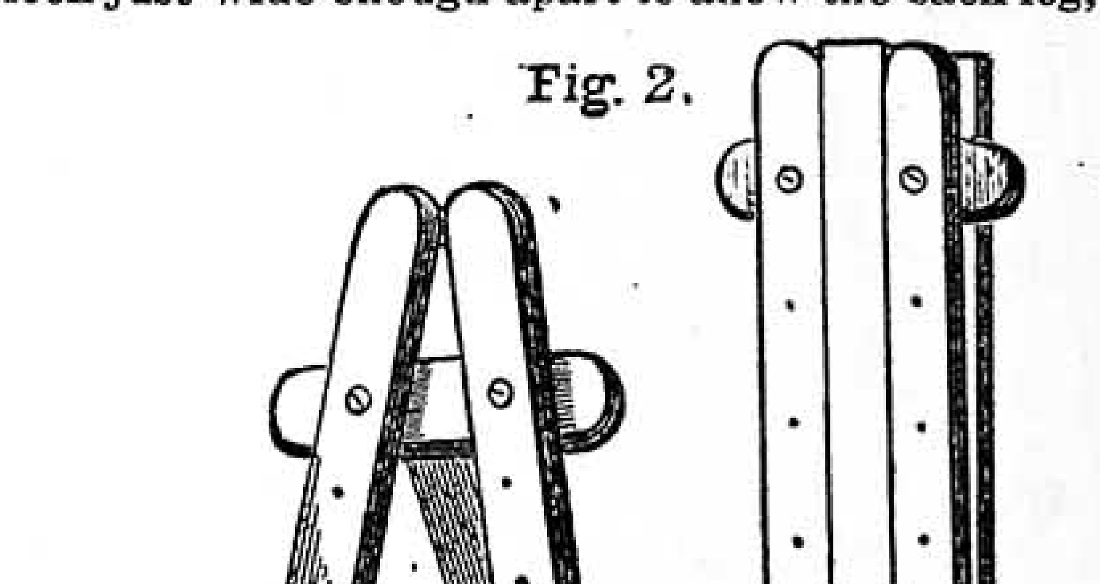


Fig. 1.—Open Easel. Fig. 2.—Closed Easel.

when folded, to come between them, and far enough down to allow the two front legs to open out to a convenient width. The back leg is hinged to block with ordinary butt hinge, and three more are used to form joints in legs. If small hasps are put on legs as shown, they will make it quite strong and rigid when in use. All other details are the same as in the one described by A. CONWAY (No. 143, page 614)."

Two Armourers' Hammers.—C. J. F. (*Eastbourne*) writes:—"I was pleased to see the above article in WORK (see page 807, No. 155, Vol. III.). It is interesting to readers, whatever their occupation may be, illustrating, as it does, tools of former ages, which are also works of art. The sketch of No. 1 does not show, nor does the writer state, the shape of the pane. Supposing it to be straight, like a carpenter's hammer, both it and the face would be suitable for curving the strips of steel at the waist and joints of a suit of armour, just as a cooper stretches and curves hoop-iron for casks, etc. If the pane is curved instead of straight, it could then be used for sinking edges in the crease and for wiring, as at the neck and arm-holes of a breastplate; the broad square face being also used for smoothing and planishing. No. 2, strictly speaking, can hardly be called an armourer's hammer, though used for the decoration of armour. I might suggest that it was used for damascening, the short, slight handle being only suited for dealing light blows—the curved pointed beak for shaping and curling the wire into the channels prepared for it, and the diamond-shaped face for finishing off, and for use in corners, etc. The head, being of bronze, would be unsuited for any other work. Both it and the handle, being inlaid with wire, seem to point to the purpose for which it was intended, and could be shown as specimens of the owner's skill, just as the smith with chisel and punch ornamented his hammers, or the carpenter with gouge and knife carved and decorated his tools. I should like to know where they may be seen, and also to become acquainted with CAROLUS REX. I am a sheet-metal worker by trade, and the subject of armour is one I am particularly interested in."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Chilled Steel.—MAGNET.—You can make use of it for the purposes you name. Send it to Crompton and Co., Chelmsford.—J.

Boiler.—G. H. B. (*No Address*).—I should not like to say, but certainly very little. It is too thin, and it should have been brazed, not soldered. Do not venture on more than eight or ten lbs. per inch.—J.

Blacklead to Iron.—J. T. (*Biggleswade*).—The ordinary blacklead (plumbago) of commerce is prepared with sufficient binding qualities to stand, when mixed with water, a fair amount of rubbing without being detached from the surface so coated. The only addition the writer can suggest to increase that adhesive quality would be of the nature of beer, vinegar, or a weak solution of shellac. Blacklead can also be used as a wash by diluting with gum-water. If you go beyond this degree of binder, it is a question whether the pigment or mineral would not lose other properties of vital value. For instance, if the particles are encased in any skin, however thin and imperceptible, it stands to reason the friction could not produce a proper polish. Besides this, nothing that heat will affect would answer the purpose, for reasons which are self-evident. *Berlin black* is a lustreless black fluid, with which hammered art metal-work (iron) is usually coated. Upon this blacklead will doubtless "take" much better than upon the smooth iron. Turpentine could be used to spread the blacklead with instead of water, and you might try the binding effect of a little Berlin black into it.—F. P.

Removing Varnish Coats.—W. G. (*Bruton*).—There are several "patent" pastes and solutions on the market for effecting the removal of oxidised paint and oils. Their nature must be strongly alkaline, and their action is to *saponify* the hardened films—that is, to break and dissolve the paint by chemical action. Common hot lime and soda, say, in equal parts, dissolved in water to a thick paste or batter, will answer the purpose equally as well as the "6d. per pound" patent mixtures. Get an old paint brush to put the "pickle" on with. Let it stand for a time, but not long enough to dry, and then scrape off with a plumber's shave-hook, or other suitably shaped tool. If all the paint does not come off first time, repeat the process. When all old stuff is removed, and before the surface has time to dry, well wash off all remaining traces of paint, and pickle with cold water and hard brush. Don't unnecessarily soak the wood with water. When thoroughly clean and dry, coat with vinegar all parts so treated. This kills any remaining trace of the alkalies. Two coats are safer than one. If you omit this, the new work may be destroyed by minute traces of the pickle. When thoroughly dry, glass-paper down, and treat with paint or varnish just as if it were new wood.—F. P.

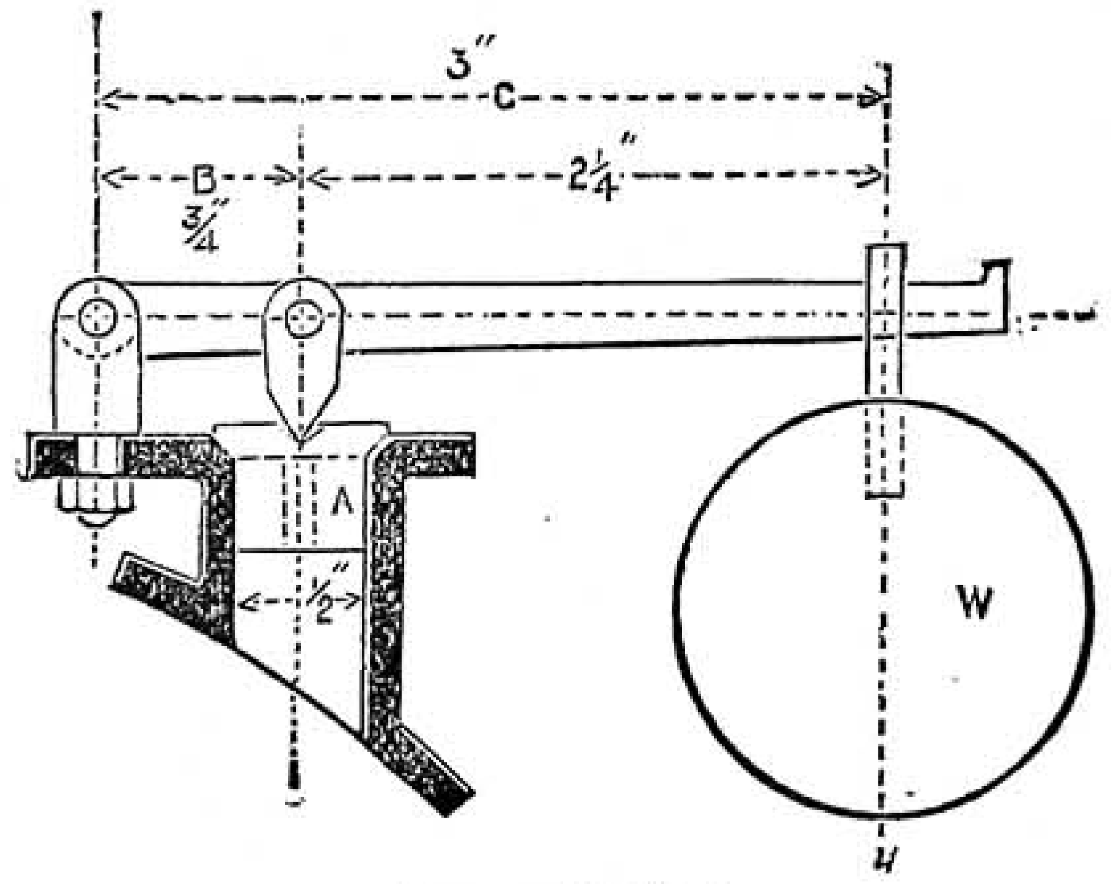
Iron Scroll-work.—G. M. (*Swaffham*).—The subject has not yet been treated *in extenso* in WORK. A series is, however, now appearing (Nos. 157, 159, 162) in the present volume, and in this a very fair representative selection of examples of bent iron-work will be illustrated and explained.—J.

WORK in Australia.—S. L. (*Sydney, N.S.W.*).—Thanks for your encouraging letter. Amateurs like yourself shall be well provided for, and we shall be glad to hear from you occasionally as to matters at the Antipodes. Our publishing and publicity departments will attend to the points alluded to in your letter.—ED.

Water Motor.—R. B. T. (*Frome*).—I cannot gather from your letter what type of motor you refer to, but suppose it to be a turbine. If you want a reply to be of any use, you must send a clear sketch of the "wheel" and the rest, and repeat your questions along with the sketch.—J.

Soldering.—J. W. (*Leeds*).—You will find full instructions for making solder, and also how to apply it with the iron, and also how to use resin and spirits of salts, if you will procure Nos. 17, 23, and 32, Vol. I. of WORK, as well as much more on the same subject. If you have any difficulty in procuring the back numbers from your newsagent, write for them to the publishers.—R. A.

Copper Boiler.—E. C. (*Birkenhead*).—The pressure your boiler will stand safely depends on the workmanship. The metal is stout enough to stand 100 lbs. pressure to the inch without risk. But then, you may have injured the metal by brazing; and, further, I very much doubt if you will make steam-tight joints with bolts, as you propose to do. Riveting and caulking are the proper and only sure methods. If this were done, I think I could advise you to work at 40 lbs. pressure, and then you might manage to drive a $\frac{1}{4}$ h.-p. engine. But if you blow up, I shall get the blame, and so I shall say do not work beyond 20 lbs., unless, indeed, you have the boiler tested first by hydraulic pressure to double its intended steam pressure. The safety-valve for 20 lbs. pressure may be made to the proportions



Copper Boiler.

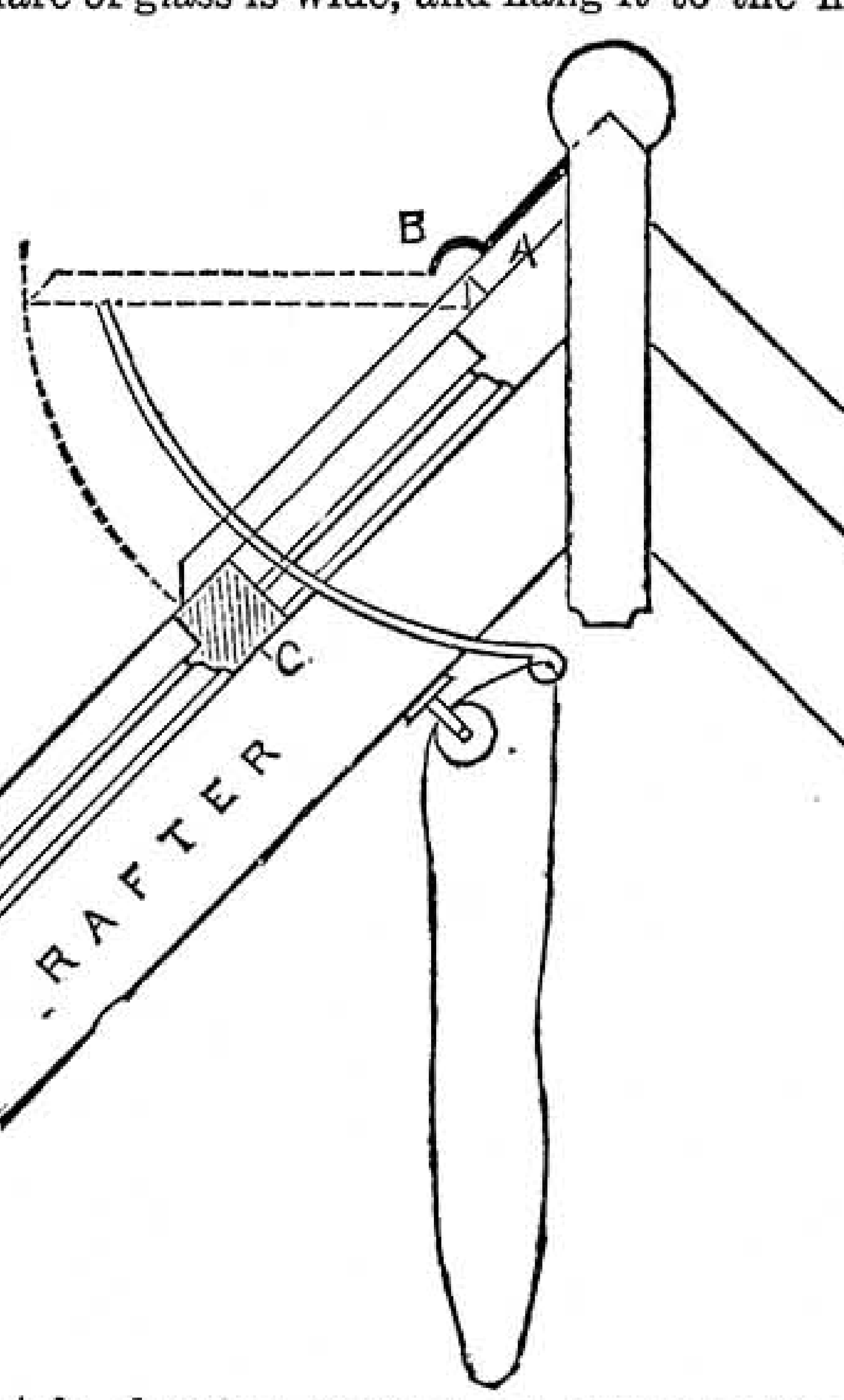
shown in the figure. Let the valve, A, be $\frac{1}{2}$ in. in diameter, the length of fulcrum, B, $\frac{3}{4}$ in., the length of lever, C, 3 in., then by formula

$$W = \frac{\text{area of A} \times \text{B} \times \text{pressure,}}{\text{C}}$$

you will have—
$$\frac{\text{·1963 in.} \times \text{·75 in.} \times 20}{\text{3 in.}} = \text{·98 lbs.}$$

That is the weight W will be, ·98 of a lb., and that will be the weight of a cast-iron ball—roughly, $1\frac{7}{8}$ in. diameter. You ask about cross-tubes in up-take. Do not put them in. They would be too short to be of much service. And exposed as they would be to the direct heat of the gas flame, they would become burned, and leak. You cannot carry out the details of a large boiler in a workable manner in a model. —J.

Sash.—W. R. J. (*Camberwell*).—If you had only sent a section through the part of light you consider the best for ventilating your plants, I could have told you exactly what to do, but I have assumed there is nothing out of the ordinary about it. The simplest and cheapest method I know of is to cut out about 9 in. of glass on either or both sides of ridge, and put in a new top rail, as shown; then take a piece of wood about 3 in. longer than the square of glass is wide, and hang it to the fillet, A;



Sketch showing Method of forming Ventilator in existing Span Light.

this flap or ventilator should be strengthened and kept from warping with two pieces of galvanised iron screwed on either on top or underneath, about $\frac{1}{4}$ in. thick by $1\frac{1}{4}$ in. wide. The joint at B should be covered with a piece of 4 lb. lead, as shown by thick black line. The ventilator can be as long as you like, embracing two, three, four, or even six squares; but if you do not want to alter the construction of your light, do not cut the bars, but insert the new top rail (C) between them. The ventilator is opened by means of a pulley, and quadrant and cord, or by means of one of the many patent fanlight openers (Ball's, for instance). You will find an exhaustive treatise on House Painting in Nos. 27, 29, 35, 36, 42, 43, 44, 46, 50, and 52 of Vol. I. —E. D.

Fret Photo Frame.—W. W. (*Wokingham*).—We do not believe photo frame in fretwork, submitted by A. D. (*Monkwearmouth*) in No. 152 of WORK, is to be bought. The pattern was given for you and other fretworkers to make use of.

Fountain. — WOODBINE. — Your proposed arrangement will certainly not work. By no mechanical contrivance can water be caused to raise itself above its own level. According to your sketch, you expect the water to pump itself up to a higher level, and overcome the friction of a water-wheel and pump in so doing. To raise water or anything else, energy, or work, must be expended, and no such work is provided for in your scheme, which is, in short, an attempt at perpetual motion, and one that has often been proposed before. Do not waste any more time or thought over it, but if you have leisure time, read up some sound work on mechanics, then you will not again fall into a similar error.—F. C.

Workshop Erection.—J. W. B. (*Brixton*).—From my reading of an abstract of the Factory Act—if you do not employ boys, have no machinery in the shop, and only have one man in it—I think you will not come under the provisions of the Act; but as there may have been some alterations lately, it might be advisable for you to get a copy, which you can do from Messrs. Eyre & Spottiswoode; or any local bookseller would procure one for you. But there is another point on which you may be liable to a penalty. If you have built the workshop in the yard, and have not submitted a plan to the local authority or vestry, or if it has been made inside the house you may be required to give notice. If you have not done this, you had better see the engineer or surveyor, and offer to submit a plan or give notice (if it is required). When you are at the office you may be able to ascertain if you come under the Factory Act at the same time, as they will most probably have a copy. I know that this is required in the country, and suppose there will be a similar regulation in London.—M.

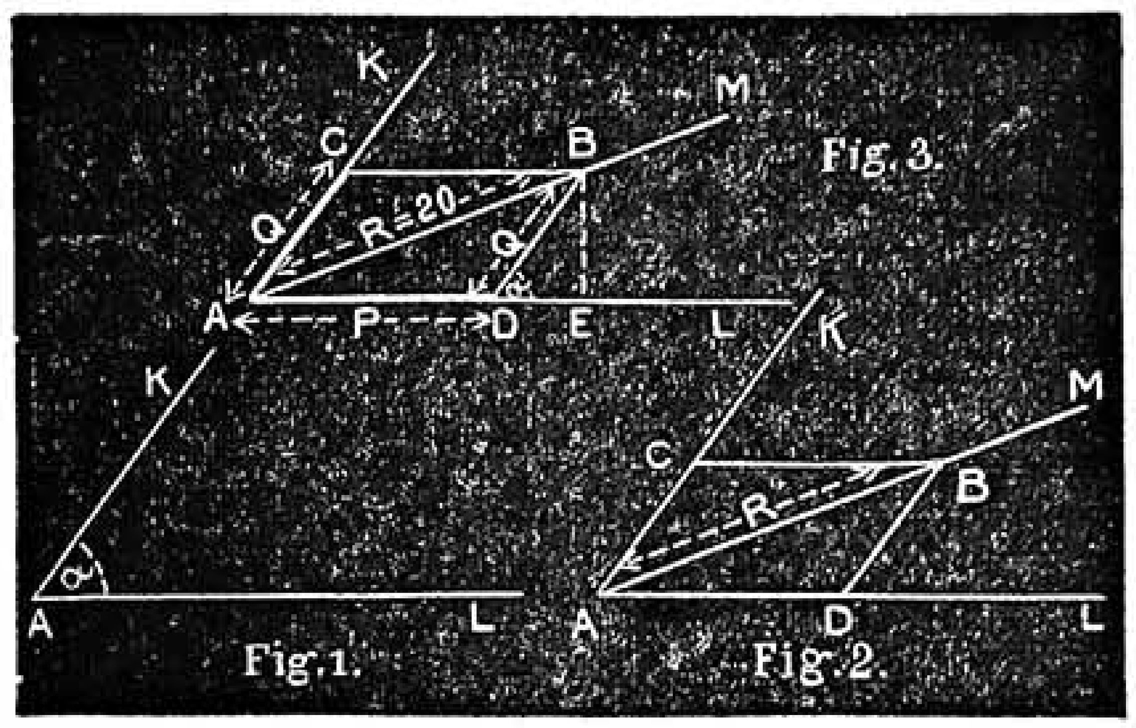
Laggings.—OLDHAM ENGINEER.—(1) You had better rub off the old paint or varnish with glass-paper, firing it first, if necessary. (2) To find the pressure on a safety-valve in pounds per square inch, add half the weight of the lever to the weight of the ball; multiply this sum by the length measured horizontally, from the centre of the ball to the fulcrum; divide the product by the horizontal distance from the centre of the valve to the fulcrum; add the weight of the valve, and divide the result by the area of the valve in square inches. An example may make this clearer to you. Let the valve be 3 in. diameter = 7 sq. in. area at its seating; distance from weight to lever-fulcrum = 26 in.; distance from centre of valve to lever-fulcrum = 4 in.; weight of ball = 50 lbs.; weight of valve = 4 lbs.; weight of lever 5 lbs.; then

$$50 + \frac{5}{2} = 52\tfrac{1}{2}\text{ lbs.};\ 52\tfrac{1}{2} \times 26 = 1365;\ \frac{1365}{4} = 341\tfrac{1}{4};$$

$$341\tfrac{1}{4} + 4 = 345\tfrac{1}{4};\ \frac{345\frac{1}{4}}{7} = 49\tfrac{9}{28}\text{ lbs. per sq. in.}$$

This is the pressure at which the valve will blow off; but it will not shut, if it has a conical bed, until the pressure is somewhat less, because while it is open the steam is pressing against a larger area than it does when the valve is closed. For this reason it is desirable to make the seating as narrow as is practicable, so that the pressure may not fall much below that to which the valve is set.—F. C.

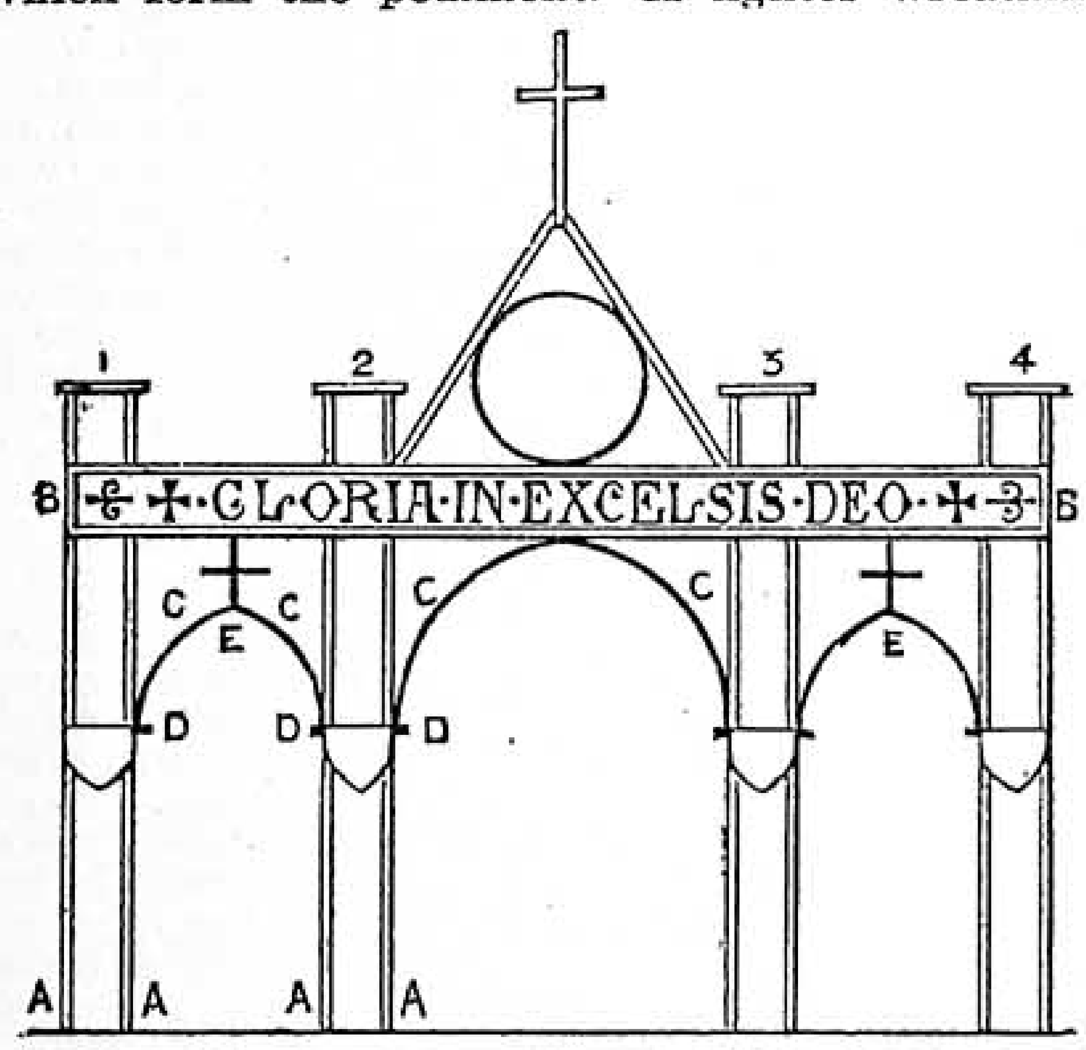
Resolution of Forces.—CORKSCREW.—You will have to use a general formula. Take any two lines, A K and A L, making an acute angle α between them. Through A draw any straight line, A M, and cut off a part, A B, equal to the resultant, R. Through B draw B C parallel to A L, and meeting A K at C, and also B D parallel to A K, meeting A L at D. Then A C is one component, say Q, and A D is the other component, P. From B drop a perpendicular, B E, on to A L. Now note that because A C is parallel to B D the angle B D E is equal to the angle C A D: *i.e.*, to α (by Euclid I. 29); and also that, by the properties of parallelograms, B D is equal to A C: *i.e.*, to Q (by Euclid I. 34). As angle α is an acute angle, then angle B D A is an obtuse angle, and the triangle A B D is an obtuse-angled triangle. By Euclid II. 12, in obtuse-angled triangles, the square on the side opposite the obtuse angle (*i.e.*, the square on A B) is equal to the sum of the squares on the sides containing the angle (*i.e.*, the squares on A D and B D) and the rectangle contained by the side (A D), on which, when produced, the perpendicular (B E) falls, and the part, D E, between that side and the perpendicular. Thus, $(\text{A B})^2 = (\text{A D})^2 + (\text{B D})^2 + 2\ \text{A D},\ \text{D E}$—*i.e.*, $R^2 = P^2 + Q^2 + 2\,P,\ \text{D E}$. Now $\frac{\text{D E}}{\text{B D}}$ is a trigonometrical ratio called the cosine of the angle B D E, or, shortly, cos. B D E, *i.e.*, cos. α. Then if $\frac{\text{D E}}{\text{B D}} = \cos.\ \alpha$, then D E = B D, cos. α; but B D = Q, and, therefore, D E = Q cos. α. Therefore our formula becomes: $R^2 = P^2 + 2\,P,\ Q \cos\ \alpha$. This formula is universally true for all forces. In your case, R = 20, α = 60°, and if we call $P = x$, then Q will $= (22-x)$, because P + Q = 22. Thus: $20^2 = x^2 + (22-x)^2 + 2\,x\,(22-x)\cos.\ 60°$. On referring to a table, you will see that the cosine of an angle of 60° = $\frac{1}{2}$: thus our sum now becomes, $400 = x^2 + 484 - 44x + x^2 + (44x - 2x^2)\,\frac{1}{2}$—*i.e.*, $400 = x^2 + 484 - 22x$, and *i.e.*, $x^2 - 22\,x + 84 = 0$. Now, to solve this quadratic, write the expression thus: $x^2 - 22\,x = -\,84$, and add the square of half the co-efficient (22) of x to each side of the equation, thus: $x^2 - 22\,x + (\frac{22}{2})^2 = -84 + 121 = 37$. Now $(x^2 - 22x + 121)$ is the square of $(x-11)$, and so by taking the square root of each side of the equation, we get $x - 11 = \pm\sqrt{37}$, and, therefore, $x = (11 + \sqrt{37})$, or $(11 - \sqrt{37})$. Now P = x, and, therefore, P, one of your forces, is either (11 + $\sqrt{37}$ lbs.), or (11 − $\sqrt{37}$) lbs. Q = $(22-x)$; and if you take $x = (11 + \sqrt{37})$, then Q = $(22-11-\sqrt{37}) = (11-\sqrt{37})$, or if $x = (11-\sqrt{37})$, then Q = $(22-11+\sqrt{37}) = (11+\sqrt{37})$. Thus your two forces are (11 + $\sqrt{37}$) and (11 − $\sqrt{37}$) lbs., which together



The Resolution of Forces.

equal 22 lbs, and, acting at an angle of 60°, have a resultant equalling 20 lbs. You can see this by noticing that $\sqrt{37}$ is just over 6, and so the forces are just over 17 and just under 5. Draw your figure to scale, and try. This is a very difficult problem to those not used to mathematics, but I do not know a simpler method for the figures you give. Had one of the forces been given instead of their sum, you could have drawn a diagram to scale, and not used mathematics at all.—F. B. C.

Temporary Decorative Screen for Church. —SCREEN.—Annexed is a sketch for the wooden skeleton or framework of such a screen as you appear to require—scale, $\frac{1}{8}$ in. to 1 foot. The uprights, A, are of the scantling used for rafters, say, 4 in. by $2\frac{1}{2}$ in. They are about 12 ft. high, and to them is nailed the board, B, which carries the text. The curves of the arches, C, are of $\frac{3}{8}$ in. board, $2\frac{1}{2}$ in. wide, "sprung" or bent into position, and there fixed. This easy way of forming an arch is described in the articles on "Temporary Decorations" (Vol. II., p. 161, No. 87). The bottoms of the sprung boards rest on strips of wood, D, nailed to the uprights; their tops in the side arches are fixed by the shaft of the cross, E. The circle in the pediment at centre is a wooden (dry cask) hoop. On the top of each pair of uprights is nailed a round piece of board (1, 2, 3, 4), to serve as a pedestal. On this may be set plaster figures 2 ft. or $2\frac{1}{2}$ ft. high. Nos. 2 and 3 should have SS. Mary and John, whilst Nos. 1 and 4 should have angels. Such figures may be bought at the plaster shops. Failing figures, vases of flowers may well fill these pedestals. In dressing this frame, evergreen wreathing is wound pretty closely round the uprights and the pieces which form the pediment. A lighter wreathing



Temporary Screen for Church.

would be used for the curves of arches, hoop, etc. Wreathing would also be used as a border for the text-board, on which the letters would be of white paper on a red ground. The crosses would be covered with ivy-ribbon, with flowers disposed upon it either in bosses or in lines along centres. If flowers are abundant, they can be used at the junctions of woodwork. Sprays of evergreen should be arranged so as lightly to fill up the spandrels of the arches and circle, but a frequent error in this kind of work arises from overdressing with evergreens, and thus hiding the design. The shields, of course, suggest their own ornament. Church banners, if used, should come over the side arches. The evergreen dressing will probably be much the same on both sides, but the front only will have flowers.—S. W.

Self-threading Needles.—W. H. (*Northwich*).—We should not have supposed that difficulty could have been found in getting these at any good draper's shop, but W. H. appears to find such a difficulty. The side-slit needles are produced by various Redditch firms; those threading at top (the calyx-eyed) are only made by Hy. Milward & Sons, Washford Mills, Redditch. Stamps forwarded to them would doubtless bring a sample packet; or try W. Woodfield & Sons, Easemore Works, Redditch, for a sample packet of side-slits.—S. W.

French Polishing Painted and Grained Furniture.—S. S. (*Salford*).—If the painting and graining has been done in oil colours, it is not usual to finish by French polish, nor can it be recommended. It should be finished by what is known as oil varnish, such as oak, copal, or carriage. The use of spirit varnish on such a foundation, though it may look well at first, will ultimately result in a cracked surface. To make the work look perfectly smooth and bright with oil varnish may require two or three coats, allowing each coat to get perfectly dry, and flatting—*i.e.*, smoothing and dulling down by means of powdered pumice or pumice-stone rubbed to a smooth face, and water—before the next coat is applied. But this is not the usual plan adopted by the trade, either for painted or polished cheap furniture—it is too costly, except for really first-class work. If you will refer to No. 116 of WORK, Vol. III., p. 187, you will find a reply, "Graining Cheap Furniture," and in No. 134, p. 476, "Staining and Polishing Cheap Furniture." Read these carefully, and adopt the plan you think most likely to suit you.—LIFEBOAT.

Staining and Polishing Pine Drawers.—T. W. (*Silloth*).—The work being well cleaned off, and free from dust, stain by means of one of the walnut stains frequently recommended in "Shop" (see p. 254, No. 120, and p. 537, No. 139). You will do well to experiment on odd pieces of wood similar to that your drawers are made of—especially as you have two kinds of wood—till you gain the required tones. To make the carcase match the red wood of the drawers, you will require a tinge of red stain in the polish, omitting it when doing the drawers, unless you wish the drawer fronts to show up red as a contrast. When the stain is quite dry, wipe all over with linseed-oil, then "fill in" with a mixture of finely-crushed dry whiting, made to somewhat match the wood by the addition of a little brown umber; make into a paste the consistency of thick cream by mixing with turpentine. Rub well on your work with rag crossways of the grain; wipe off clean. It is then ready to polish at any time. Your inquiry as to the use of "finish"—which is merely a trade term for methylated spirits—suggests that you are not thoroughly conversant with the subject of French polishing. Read carefully through the articles on polishing with which Volume III. of WORK abounds, and take special note of a reply in "Shop," p. 476, No. 134, "Staining and Polishing Cheap Furniture," and adopt the hints therein given by using spirit varnish in conjunction with your polish: it will save you much trouble, and be more likely to lead you to be satisfied with your work.—LIFEBOAT.

Phenomena in Vacuum Tube.—H. McM. (*Bootle*).—This correspondent writes: "In experimenting with a vacuum tube I noticed that if one of the wires only was connected with it, and I brought my hand near the outside of the tube, a faint but quite perceptible glow was discernible in the tube. Would you kindly explain this?" Precisely similar phenomena have been observed by Prof. Crookes, Mr. Tesla, and others. The luminous effects are due to an electrostatic charge of the vacuum tube, such charge being given to it by the condenser of the coil, which is, as you are aware, highly charged with electricity. The charge becomes dissipated on the approach of a hand or other conductor of electricity, and the faint discharge becomes apparent in the vacuum tube. Similar effects have been observed in incandescent lamps placed near a spark coil, as between the poles of the secondary wires, but not in actual contact with them.—G. E. B.

Elements for Batteries.—H. McM. (*Bootle*).—(1) As I have no data to guide me (either my own or other person's experience), I cannot say how a mixture of pulverised coke and sulphur would behave when subjected to heat and cast in a block whilst the sulphur was in a liquid condition. I do not think the blocks would be of the slightest use as carbon elements for bichromate batteries. Carbon plates are cheap enough to preclude the necessity of making them in this or any other way at home. (2) Cast zinc is not nearly so effective as best annealed and rolled sheet zinc for the positive elements of bichromate and other batteries. Cast zinc is porous, contains hard nodules, and is liable to hold impurities, all of which tend to promote local action in the battery, with a consequent loss of power.—G. E. B.

Consumption of Coal by Marine Boilers.—NEW READER.—Your first query is very vague, but I think I can give you the information you require. The sizes of the fire-grates being known, and the quantity of coal burnt per square foot per hour ascertained, the consumption in twenty-four hours is readily calculated. The quantity burnt will, of course, vary with the quality of the coal; but it may be taken that—with good stoking—20 lbs. of coal can be burnt per square foot with ordinary funnel draught. In very favourable circumstances this quantity may rise to 25 lbs. In the mercantile marine about 15 lbs. per square foot is the average useful consumption, and although 20 lbs. may be *consumed* when the fires are forced, they should not be supplied with more than 15 lbs. to obtain complete combustion, without which economy is lost. With a steam blast in the funnel, from 20 to 30 lbs. of coal can be burnt per square foot of grate surface; but this is a wasteful plan. When "forced draught" is used under a pressure of 3 in. of water, 62 lbs. per square foot may be burnt, and 96 lbs. of coal at a draught pressure of 6 in. As an example, suppose we have three fire-grates, each 2 ft. 3 in. clear width, and 5 ft. 6 in. long, then their total area will be—$2{\cdot}25 \times 5{\cdot}5 \times 3 = 37{\cdot}125$ square feet. If the consumption of coal averages 15 lbs. per square foot per hour, that for twenty-four hours will be—$37{\cdot}125 \times 15 \times 24 = 13{,}365$ lbs. = 5 tons, 19 cwt., 1 qr., 9 lbs. Extra allowance must be made for emergencies; and you must, in determining what the consumption per square foot will probably be, consider what is required of the engines, and whether it may be necessary to force the fires in order to properly supply them. In regard to your second question as to entering for examinations, you should apply for particulars to the Marine Department of the Board of Trade.—F. C.

III.—QUESTIONS SUBMITTED TO READERS.

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

Monogram.—J. McD. R. (*Leith*) will thank any reader for a monogram of A. M. M. for fretwork.

Black Crayons.—J. H. M. (*Longsight*) writes:—"I should be glad if some kind reader would give me a recipe for making black chalk crayons, about 3 in. long and ½ in. thick. I want them for drawing rough, rapid cartoons on white paper. Something like the ordinary white chalk sticks commonly used in schools would be just the thing."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Adhering Compo.—A. G. (*Sheffield*) writes to F. W. (*South Darenth*) (see No. 152, page 765):—"Try ordinary bicycle tire cement."

Glass Blowers.—M. (*Bishop Auckland*) writes to DROFSABA (see No. 156, page 830):—"You can procure glass tubes, rods, and chemical and scientific glass-ware from Messrs. Orme & Co., Barbican, E.C.; but any local chemist will procure them for you."

Varnish.—W. S. (*Batley*) writes:—"If your correspondent J. A. (*Patricroft*) (see No. 152, page 765) will write H. O. Milnes, Leeds Road, Bradford, he will get any kind of varnish he may require at a cheap rate. I have done business with the above, and have been very well satisfied."

Staining and Varnishing.—M. (*Bishop Auckland*) writes to J. T. S. (*Sheffield*) (see No. 149, page 718):—"You will find a good deal of information on this subject in Vol. II. of WORK, or in 'House Painting,' by Ellis A. Davidson, published by Crosby Lockwood."

Electricity.—M. (*Bishop Auckland*) writes to P. L. (*Selly Oak*) (see No. 154, page 798):—"You will find Jameson's 'Manual of Magnetism and Electricity,' published by Charles Griffin & Co., Exeter Street, Strand, a very useful book. It is in three small volumes, price 4s."

Enamelling Fretwork.—W. I. (*Laurencekirk*) writes to G. F. R. (*Bournemouth*) (see No. 149, page 718):—"Try limewood or any similar wood that does not show the grain. It is better to stain fretwork with a good water stain—such as Stephens'—and, when thoroughly dry, varnish, if black stain, with white spirit varnish or, better still, French polish, and you have a clean finished article. I have used successfully Ardenbrite metallic enamel, and find it excellent for fretwork, as it does not clog in the cuttings, as ordinary enamels do."

Fret Machine.—H. L. H. (*West Hampstead*) writes, in reply to W. M. (*Brixton Hill*) (see No. 145, page 654):—"For a light machine you cannot do better than the Dexter C. If you want a machine of greater capacity and power, then the 'Empire.' Much has been said and written about 'true vertical stroke,' to the detriment of machines with swinging arms; but, speaking from twenty years' experience, during which I have tried every machine in the market, I believe the distinction is theoretical rather than practical. A true cut may be made with any well-made machine *in which the saw-blade maintains a position vertical to the plane of the work*. This condition is fulfilled by the Empire, Dexter, Windsor, Lester, and scores of others; but, of course, excellence of workmanship must be paid for. One hint more: Most fret-saws, like most lathes, are sent out with stands and fly-wheels much too light. Buy the machine separately, and mount it more substantially. In the matter of easy running, the swinging arm machines can give points to the machines which work in 'guides.'"

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—FIRST START; GOLFING BAD; H. C. (*Old Charlton*); F. H. C. (*Slingsby*); H. N. W. (*Greenock*); E. B. (*Manchester*); ROOFING; W. C. (*Bulwell*); A. EDISON; W. H. (*Fraserburgh*); "WORK" ADMIRER; T. M. (*Torquay*); J. W. P. (*London, W.C.*); HOROLOGICAL; W. H. R. (*Peckham*); J. P. (*Hull*); A. E. P. (*Victoria*); H. F. P. (*Guildford*); S. B. C. (*Birkenhead*); T. W. (*Kendal*); H. A. (*Ipswich*); H. A. H. (*Tunbridge Station*); W. W. (*Keighley*); J. W. H. (*Edinburgh*); E. E. W. (*Dublin*); W. T. (*Cardiff*); VICTOR CYCLE CO.; POLISH; W. B. (*York*); R. W. W., JUNR. (*Camberwell*).

NOTICE TO READERS.

As noted in another column, the next number of WORK (*i.e.*, No. 163) will contain the first of the series of Valuable and Original articles, *fully illustrated*, promised in the prospectus of this Volume, and entitled "Design and Decoration of all Ages." The Editor desires to call special attention to these papers, as they embrace such a wide and exceptional research, both in their matter and illustrations, that they cannot fail to be of the greatest interest and value to all ornamental and decorative craft workers whatever be their particular occupation. Readers and friends of WORK would do well, therefore, to make this series known, either by taking an extra number of this issue, or by forwarding this intimation to friends who are not already subscribers.