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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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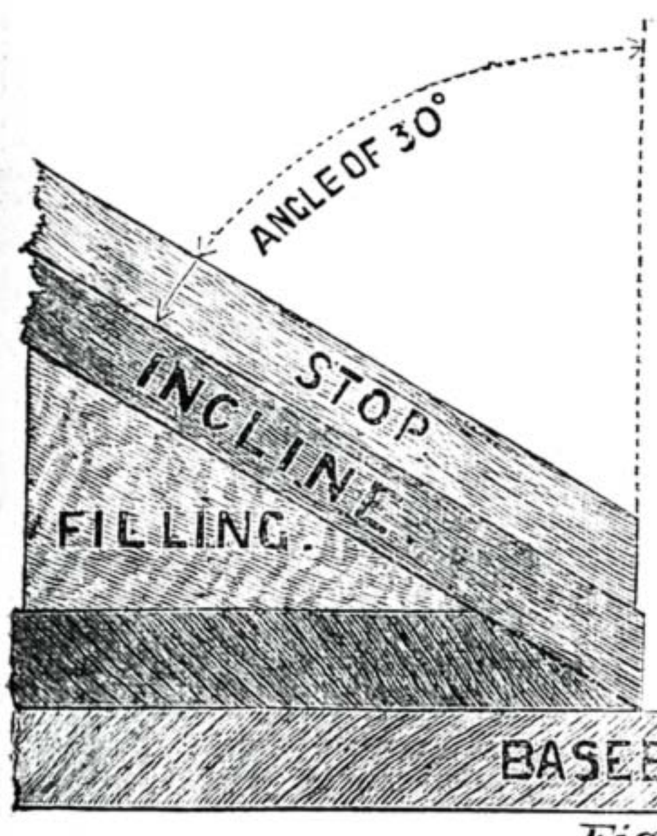

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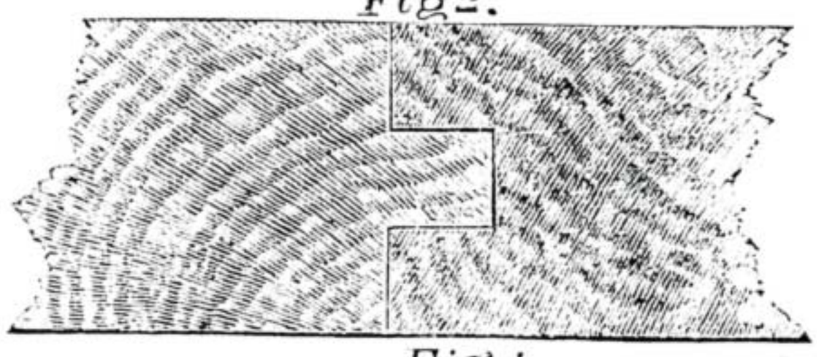

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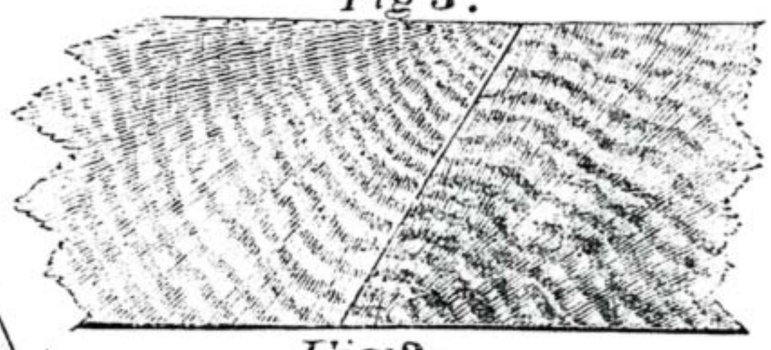

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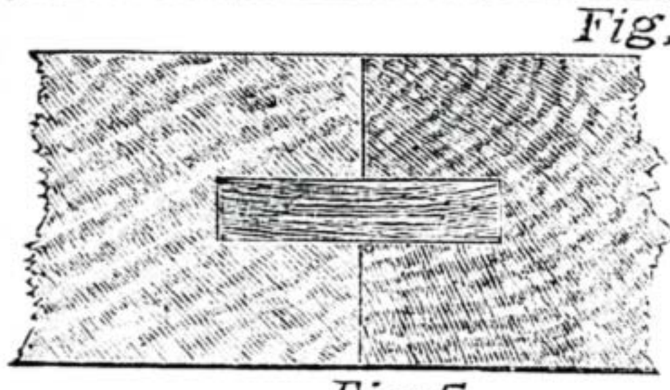

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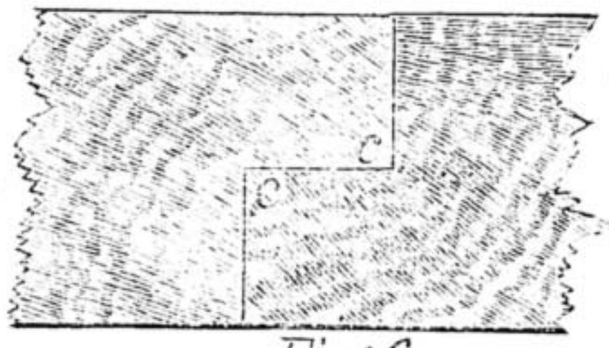

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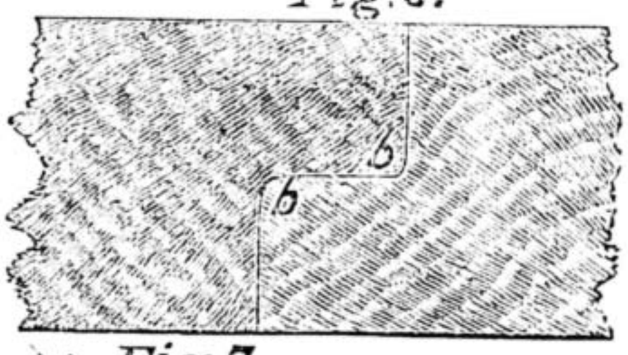

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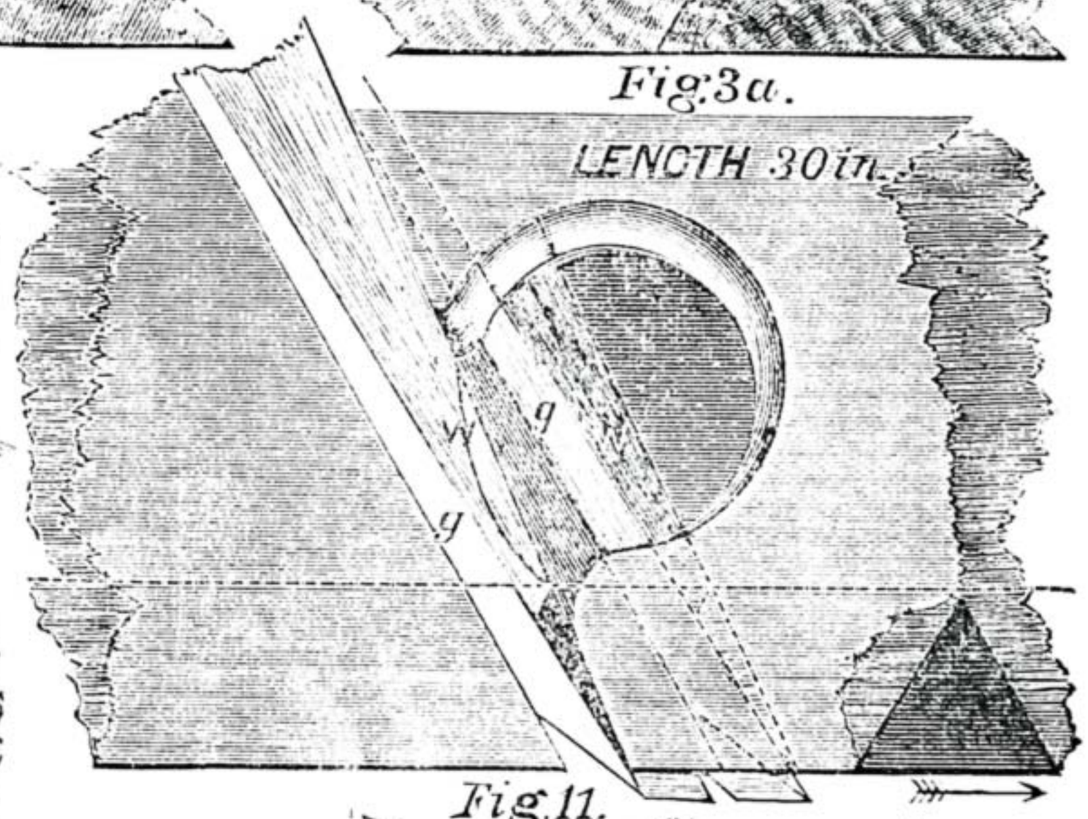

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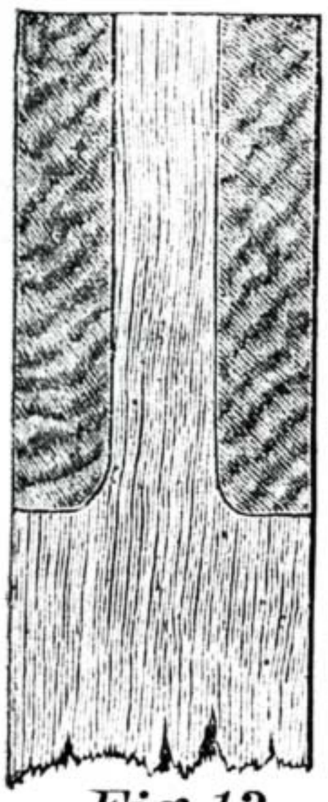

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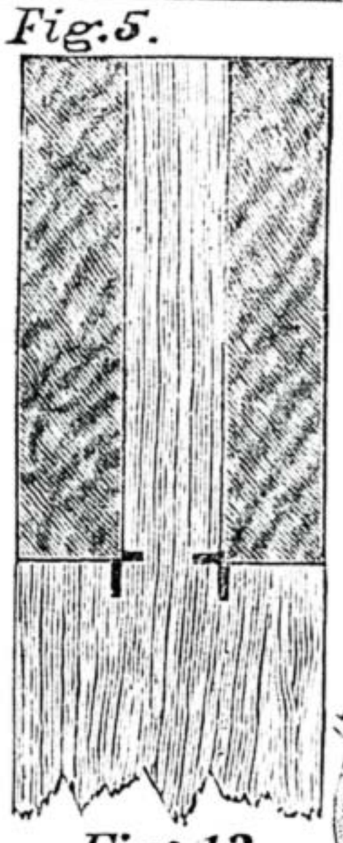

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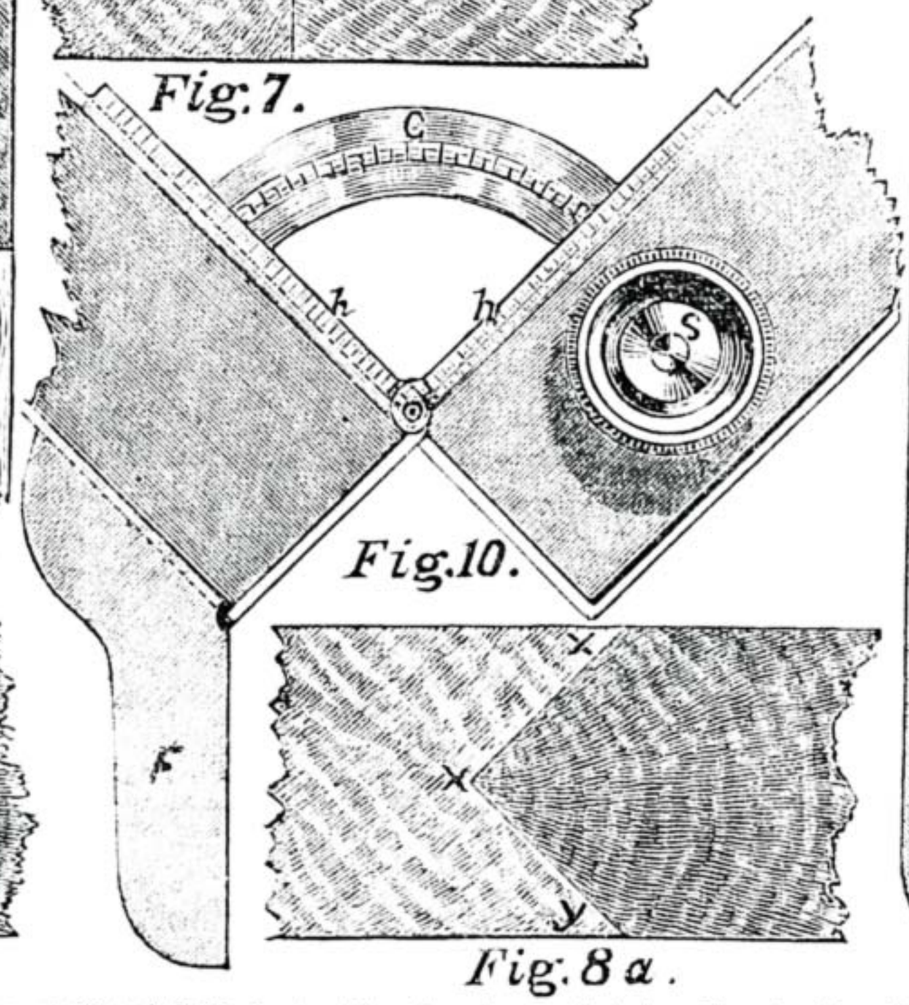

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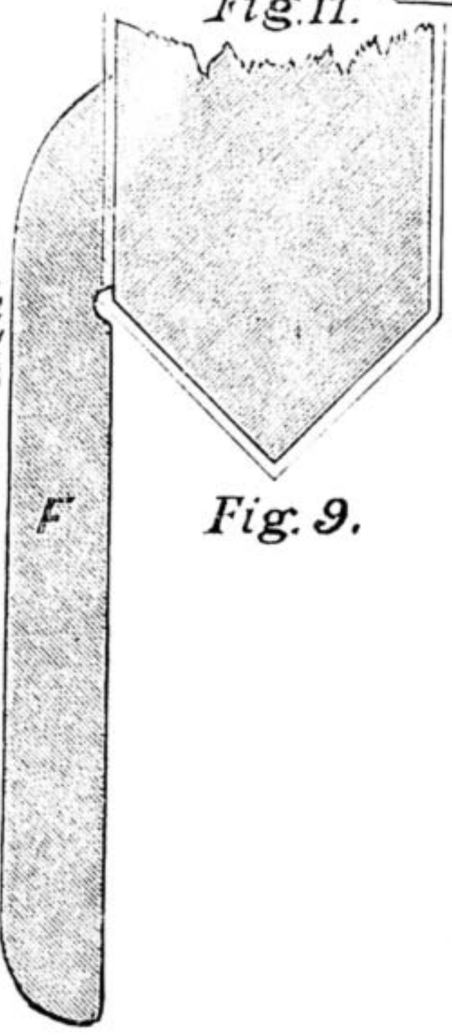

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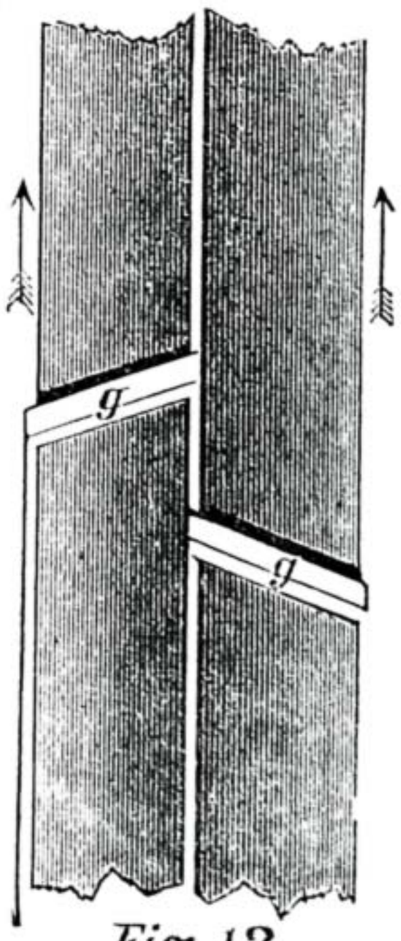

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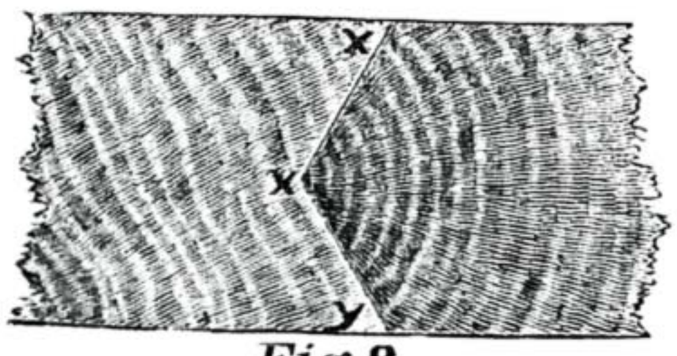


Fig 8.

Fig. 8 a.

Fig. 1.—Shooting Board for Slape Jointing at 30° (¼ full size). Fig. 2.—Jump-Joint. Fig 3.—Bevel Joint, 45°. Fig. 3 A.—Ditto, 60°. Fig. 4 —Groove and Tongue. Fig. 5.—Groove and Loose Tongue Joint. Fig. 6.—Rebated Joint. Fig. 7.—Ditto, rounded, *b b*. Fig. 8.—Double-Bevel or V-Joint at 60°. Fig. 8 A.—Double-Bevel Joint at 45°. Fig. 9.—Section of Plane for Double-Bevel Jointing with Fence, F. Fig. 10.—End View of Twin Plane for V to fit Groove, with Fence, F, and Hinges, *b b*, Quadrant, G, and Thumb-Screw, S, for adjusting to Exact Angle of Bevel Groove. Fig. 11.—Side View of Twin Plane for V to fit Bevel Groove. Fig. 12.—Plan looking up of Twin Plane, *g, g*, Irons. Fig. 13.—Good Mortise and Tenon Joint. Fig. 13 A.—Bad Mortise and Tenon Joint: Saw cuts too deep. Figs. 2 to 13 A full size.

CONSTRUCTIVE STRENGTH IN WOODWORK.

BY JOHN WHITFIELD HARLAND.

JOINTING—JUMP - JOINTING—SHOOTING BOARD—GROOVED AND TONGUED JOINTS—REBATED JOINTS—DOUBLE-BEVELLED OR V-JOINTS—TWIN PLANE—MORTISES AND TENONS.

I HAVE frequently met with practical workmen who know perfectly well how to go about almost any job—that is, know where to mortise and tenon, where to dovetail, and where to halve, where to "jump joint," and where to "groove and tongue," where to "house" and to "flush-shoulder"—but who have never troubled to think whether the ordinary modes of performing these operations cannot be very greatly improved upon. They are content to go on making their framings as they have been taught to do, without seeking to find out the strongest possible way of putting them together, or to think out for themselves how to avoid weak points in these several methods. In dovetailing, for instance, how often do we see the angle so acute as to weaken the joint so made; and in scarfing, fifty weak forms are found to one strong form.

I will endeavour, by criticising and pointing out weaknesses in each, to upset this "rule of thumb" way of going about work, and show that if a more scientific way is substituted, equal strength with less material can be attained.

Firstly, let us consider some forms of jointing.

Jump-Jointing.—By far the commonest joint is that which is known as "*jump-jointing*," *i.e.*, shooting two edges perfectly true and rubbing out the glue; and it is the custom to shoot the edges as nearly square as possible. Let us analyse this method, and take inch boards as our instance, say 3 feet long. If jointed square, and the glue is well rubbed out, we have an area of 36 sq. in. only. As these joints depend upon atmospheric pressure, chiefly, for their adhesion, and not upon the cohesion of glue to any great extent, it follows that, other things being equal, the greater the area the greater will be the cohesive strength. To attain this, if the edges instead of being square were shot perfectly straight at an angle of 45°, the superficial area of the joint would be increased proportionately — viz. (Euclid, Book I, 45th Prop.), "The square described on the hypotenuse of a right-angled triangle is equal to the sum of the squares of the other two sides." It therefore follows that, in this case, the surface (in section) at an angle of 45°, subtended by the two sides, of an inch each, at right angles to one another, would give a diagonal very nearly 1½ in., so that the area of joint-surface would be nearly half as much again. Now a square joint offers no lateral resistance to the subsequent warping or winding of the wood should it not have been previously thoroughly seasoned, but a joint at an angle does offer a resistance in *one* direction—that is, the underlapped board could not rise, though it might shrink off. From this reasoning it is clear that a joint shot at an angle is stronger than one shot square. Too great an angle will entail much trouble in rubbing out the glue, as, of course, it is more likely to slip. Indeed, in rubbing out, two strips of stuff should be fixed in the bench-screw with the bottom piece, the angle falling towards them, to prevent slipping off—one at each end, about 4 or 5 inches off. If the shooting board be made at a proper angle to the plane instead of flat (*see* Fig. 1), no more difficulty in shooting would be found. Of course, in long joints the shooting board can play no part, and the square joint becomes imperative. It has been objected to me by practical workmen that there is a waste of stuff in bevelled joints, but I can prove there is not any waste sufficient to counterbalance the gain in strength, for ¾ in. stuff gives on the bevel as much cohesion as 1 in. stuff on the square. My own theory is that an angle of 30° is the best and strongest jump-joint that can be made. I have heard this jump-joint called a "slape" joint in the north of England.

Grooved and Tongued Joints.—In this form of jointing the joint is strengthened (?) by either a groove being ploughed in one board and a tongue cut in another, or by a groove ploughed in both and a loose or, as it is often termed, a "false" tongue glued into both grooves. This joint, if the proportion of the grooves be carefully calculated with respect to the thickness of the stuff, evidently offers a far greater cohesive area than the former, either in the case of "matched" tongues or loose ones; and, of the two, I prefer loose ones if the direction of the grain of the tongue be athwart the grain of the boards to be jointed. By thus crossing the grain, we have in reality a long *mortise and tenon*, which is the strongest means of uniting two separate pieces of wood. I admit that the extra surface entails almost a disproportionate co-efficient of labour in rubbing out, but the gain is indisputable in point of strength. If this joint be well made—the grooves not being too shallow, nor too wide for the thickness of the stuff; and the tongues are cut with accuracy, so as to fit well down to the bottom of both grooves—no stronger means of uniting two boards sideways can be devised. But it is very hard work; and the glue, unless very hot, cannot, unless two men assist, be rubbed properly out, owing to the extra friction offered by the surfaces in contact. My proportions for inch stuff are $\frac{3}{16}$ths groove, $\frac{5}{8}$ths deep in each board; tongue, 1¼ in. (bare) long in the grain; $\frac{3}{16}$ths (bare) in thickness, and put in in widths of 8 to 12 in.—preferably of wood harder than the boards to be jointed. Thus, for mahogany—oak or, still better, beech tongues; for rosewood—ebony or boxwood tongues; for pine—honduras, etc. But the inverse is also true; for extra hard woods, the tongues should be softer. For lignum-vitæ, boxwood, lancewood, etc., birch or honduras form the best tongues; and for this reason, that in soft wood the tongues, if hard, bruise it into a close fit. In hard woods resilience of the tongue is necessary, as one or other must give a little, owing to the glue swelling the wood whilst wet, which afterwards contracts again. This is really the only disadvantage of this form of joint; its shrinkage in drying requiring the tongue to be so tight a fit that one can hardly rub the glue thoroughly out by manual strength; whilst if the tongue is a thin, easy fit, one has to rely on glue more or less thick for its cohesiveness, which is bad.

Rebated Joints.—These consist of rebating the two edges of the boards equally, and making the joint by reversing them (*see* Fig. 6), so that the rebate of one fits the reveal of the other. This is a very strong joint, especially in thick stuff, say 1¼ in. and upwards, as the area of cohesion is added to by the surface of the depth of the rebate. But to make this joint well demands a special plane—a combination of the "trying" or "jointer" plane with the "rebate" or "rabbet" plane; or to be more explicit and correct, a steel-faced "rebate" plane of twice or thrice the usual length, which should be provided with a "fence," like a "plough," so as to make the reveal as straight as the faces of the joint. In rubbing such a joint you have the reveal to rub against, pressure downwards making the other part of the joint. My theory, say for 1 in. stuff, would be to make the rebate ½ in. by ½ in., which gives a cohesive area of 1½ in. multiplied by the length, whilst the reveal opposes resistance to either board warping or buckling. A rub with No. 1 glass-paper on the "arris" of each at *c c*, just to round it slightly, should be resorted to, to ensure that these internal angles should not add friction in the rubbing out of the glue by not being cut down exactly to a sharp true right angle, as it is almost certain, however sharp the blade may be, that something may hang in the corner of both rebates. In theory, if the interior angle or corner were hollowed, and the reveal rounded, the joint would be stronger still (*see* Fig. 7, *b b*). After gluing this form of joint, handscrews should be employed all along to force the reveals together; afterwards, cramps should be applied to force the faces into contact. When dry, the boards would split anywhere except the joint, if they give at all. And here let me remark, in passing, that workmen, as a rule, believe as an article of faith that a normally dry atmosphere and a medium temperature are the only essentials for seasoned work to stand. My own observations and experiments go to prove that there is a third factor—*light* (or more probably actinism), if not a fourth (electricity), which affects to a very great extent the warping tendencies of even long-seasoned timber. And I have carefully observed the tendency, especially of signboards, to become, in bright light, round on the face, and hollow where the back is kept almost entirely in the dark; and am convinced that this is *not* due to the heat of the sun's rays, as it has occurred in north aspects where the direct sunlight never falls to as great an extent, even bending 1 in. battens by its force. Where signboards are 6 in. or so away from the wall I have not noticed much warping. I, therefore, put it down to the action of actinism, by which is meant that portion of the ray of light which has been proved to affect chemically minerals, plants, and animals. I have also sawn up and planed up portions of live oak that for two or three centuries had been rafters in a church roof, with the intention of making up picture-frames of the well-known "Oxford" pattern, and in a day or two have found them as much warped and twisted *towards the light* as new, green wood would have been. Further, by turning them round the opposite side to the light, I have got them very nearly straight again.

Double-Bevelled or V-Joints.—There is another mode of joining edges of board together, which I have myself tried with success, and which I consider very strong and durable, though I never yet met with it in any one else's work; and that is the V-joint (*see* Fig. 8). Whilst I admit that it has one great disadvantage—that the two edges cannot be planed up with the same tool, but require two distinct and different planes—I think it a very strong, efficient, and workmanlike job; very easily rubbed, capable of resisting all warping tendencies in either board, requiring no lateral clamping, whilst the cohesive surface area is about 1½ to 1 of the square jump-joint. At a glance, it will be seen that in rubbing

no side slip is possible; and if the two angles, *x x* and *x y*, are equal and true, the joint can be made as perfect as any other. I should prefer, if having much jointing to do, to make a plane of section as in Fig. 9, with a fence, F, to keep the V-groove straight, and of three times the length of a moulding plane for one edge; and a plane with two blades, one placed an inch behind the other at the proper angles to each other to make the other edge; also with a fence to keep it straight. Again, an angle of 30° would be my choice. In Fig. 10 I give section, and in Fig. 11 side view, of such a plane; and in Fig. 12, view showing how the two blades finish the feather edge where the two angular or bevelled surfaces join. There would be no difficulty in sharpening the blades of either of the planes, nor of setting the double blades to the same angles of the single one to ensure perfect fit; and the joint would answer for end grain to side grain if the V were cut on the end grain wood, and the hollow V or groove in the side grain stuff, thus forming a clamp, instead of the groove and tongue joint now generally used. Messrs. Moseley and Sons, 323, High Holborn, have made from my designs these planes, and also an adjustable shooting-board on the same principle as Fig. 1, but which can be set to any angle.

Mortises and Tenons.—Passing now from joints to the consideration of mortises and tenons, let me point out that they are of two kinds—tenons passing through and afterwards wedged from the outside, and those where the tenons only go part through into mortises, also only partially cut through. The former, being the strongest, are used wherever practicable; but in the case of muntings, the latter only can be resorted to. The former, also, are more easily made true, as being mortised half through from one side, and half through returned from the other, the mortise is more easily kept square both ways; whilst the wedges driven in afterwards keep the shoulders well up and prevent the tenons drawing out. Of course, the tenoning machine cuts mortises equally true, whether part through or right through. In wedging up muntings, "fox" (a corruption of the Norman-French and modern French *faux*, false) wedges are used, their heads resting at the bottom of the mortises, forcing them up as the tenon is driven home; but very frequently this is omitted, and cannot be found out after the framing is put together. There are two very general faults in mortise and tenon joints—viz.: (1) In sawing the tenons sufficient care is not taken that the saw-cut stops short of the shoulder, and (2) that in sawing the shoulder the cut stops short of the tenon. In the first case it looks bad, but, beyond unsightliness, does not matter much. The second is a much more serious matter, and attacks the strength of a tenon in its weakest point; exactly where any strain would be most likely to break it—viz., at the neck. A little extra care and trouble would add great strength to tenons, made as in Fig. 13—where the saw is stopped short of the shoulder and short of the tenon by one eighth of an inch each way, and the wood cut away after with a gouge to the curve of a quadrant of a circle; the mortise edges being rounded with a paring chisel to receive it. A tenon ¼ in. thick would thus be as strong as an ordinary ⅜ in. one, simply and solely because the strength is in the right place—just where any strain would fly to—because it is just where the mortise can give the tenon no support at all, and where the shoulder, moreover, forms the fulcrum of leverage. In mortising spokes into the naves of wheels the extra time and trouble of making the tenons would be well repaid, even when the spokes are not only tenoned but housed as well; indeed, it is regretable that it is not practised in all tenoning.

MODERN FORGING.

BY J. H.

Forges, Anvils, Hammers.

Having made reference to the mediæval art of forging, I shall now commence the treatment of the modern practice of smiths' work.

In this article I will, however, dispose of some primary matters which must needs be dealt with briefly.

There are three conditions under which the smith works, each of which ought properly to receive separate treatment. These are: first, when he works alone without the assistance of a striker, or of steam power, or of dies; second, when he has the assistance of a striker or hammer-man, but is still destitute of steam power; third, when he has the help of a hammer-man, and has also the use of a steam hammer, and dies of various kinds. Amateurs and many country and jobbing smiths come under the first category. Men in small workshops come under the second. The third class embraces all the men in our large engineering and general iron works. I fear that I cannot devote special attention to either without neglecting the others. But yet it is obvious that the particular circumstances under which work has to be performed must often modify the methods adopted. For example, a man who has command of a steam hammer will almost invariably adopt a method of swaging or drawing down, when such is practicable, in preference to upsetting and welding. Again, a man who has command of dies and steam hammer, will not have to spend so much time in finishing and smoothing the surfaces, the angles, and corners of his work upon the anvil, as the man who can put his roughed work between a pair of dies, and finish it with a few blows of the steam hammer. Then the man who has no help from a striker will be greatly handicapped in all classes of work except the very lightest. All heavy work where the sledge is required must needs be abandoned. Iron of nearly the finished sizes and sections wanted will have to be used. No extensive drawing down can be done, no large welds made; little, in fact, beyond such delicate manipulation as can be done with the hand hammer. The top swages, the flatters and fullers, the chisels and gouges—except the anvil cutters—are of scarcely any use when there is only one pair of hands available for holding the work and the hammer or other tools. There is little chance to impart finish to the surfaces other than can be done with the hammer itself. The class of work, therefore, that comes within the range of the unassisted smith is entirely different from that of his brethren who are more favoured in the matter of assistance and tools. But there is all the wealth of ornamental work, like that done by mediæval smiths, possible; all tool work—almost anything, in fact, where the sections of iron and steel do not exceed, say, 1 in. to 1¼ in. in diameter.

Obviously, the choice of forges, tools, and so forth, as well as methods of work, will be different under these several conditions.

Notwithstanding that the forge is so common an appliance, there are few articles that exist in more diverse types. A brief notice of some of the principal of these will be useful as a guide to the choice of one. We take first the portable bellows forges, which are made in both rectangular and circular forms. These are made in a great many sizes, and are adapted both for amateur use and for the workshops. Sizes and prices can be obtained from makers' catalogues. One with a hearth measuring about 25 in. by 18 in. is sufficiently large for a single-handed workman. Such a forge is large enough to heat a bar of iron about 1 in. or 1¼ in. square. For heavier work, requiring the aid of a hammer-man, the hearth may measure 33 in. by 26 in., and range thence up to 39 in. by 30 in. for the largest work. The proper forge for average and occasional heavy work is the common rude form built of bricks or stone.

For those who cannot afford to buy a portable forge, nor to build one in masonry, I refer to a sketch of a forge already given in Vol. I., p. 733—in reply to a correspondent—that is easily and cheaply made. It is built of angle iron, flat bars, and thin sheets.

For blast, a bellows, or a fan, or a blower will be used. The old-fashioned bellows hold their own in country shops; but in modern establishments a fan blast or a blower is used in preference; and either of the latter is superior in all respects to the bellows. There is now so very little difference in the cost of blowers and fans, that I should give preference to a forge fitted with a Roots blower—one of those made by Thwaites, of Bradford, or by Samuelson, of Banbury. Fig. 1 shows a forge with hand blower attached, and Fig. 2 an enlarged view of the blower and gear, the revolvers being shown in section. These revolvers embody the latest improvements introduced by Mr. Roots. The smallest made cost between £7 and £8, the hearth measuring 20 in. by 14 in., and the blower being equal in power to 24 in. bellows. If cheapness is sought, then get one of the fan forges (Figs. 3, 3A), sold by the Britannia Co., of Colchester, at half the price.

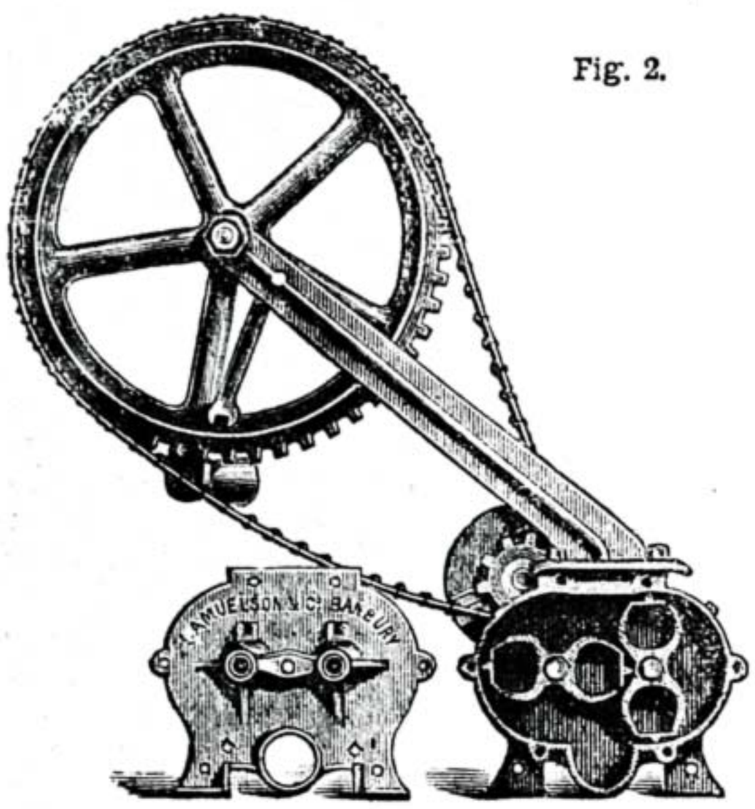
The blowers are undoubtedly the best. The blast pressure is under perfect control, and is of the nature of a positive current, that is, one definite in amount. A soft and continuous blast is superior to one that is spasmodic, variable, and intermittent; and the blast from a blower or fan is for these reasons better than one from bellows. The cost is not exceptionally high; and considering the neatness of the arrangement, and the good results attainable, this type of portable forge is the one which should be recommended to an amateur or to a private workman.

There are several kinds of blowers used in portable forges, and on behalf of each some superiority is claimed over others. I will not pretend to settle contending claims; but, if I may express an opinion without getting into hot water, I should say that though each possesses perhaps some practical features which are not possessed by its rivals, yet there is not very much to choose between the *average* working value of each. Beyond this I will not venture.

In workshops a row of forges will be supplied with blast from a single fan or blower, each forge being furnished with a throttle valve in its tuyere pipe.

In small forges the tuyere is simply a tube and nothing more. But in all large forges operated by powerful blast, a water tuyere is used. That is, the tuyere is

surrounded with water, which protects the nose from the destructive heat of the fire. There are several forms of such water tuyeres. The commonest are shown in Figs. 4 and 5. In the first, a cast-iron tank (A) contains a supply of water, which also fills up the annular space (B) around the nozzle (C). In the second (Fig. 5) —made both in wrought and cast iron—a supply of water enters the annular space by the pipe (A) and leaves it by the pipe (B),



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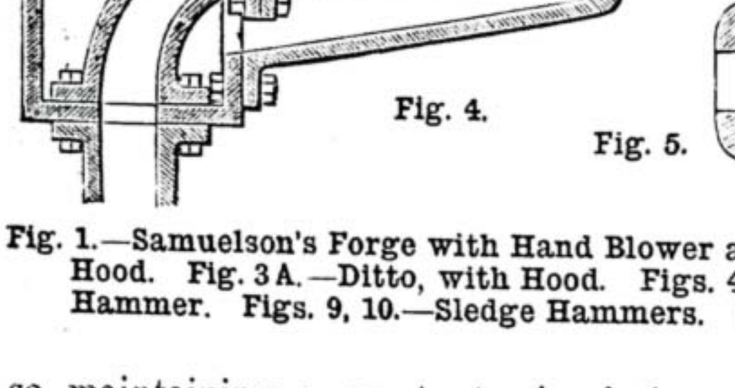

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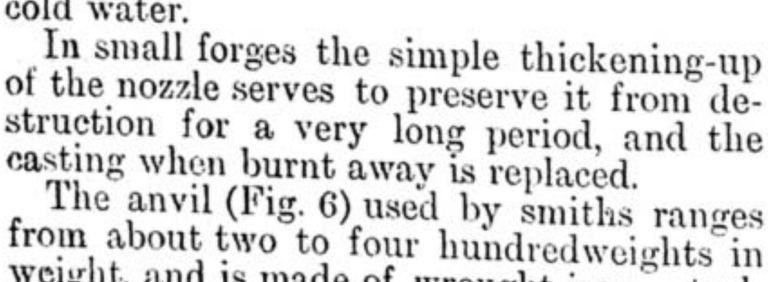
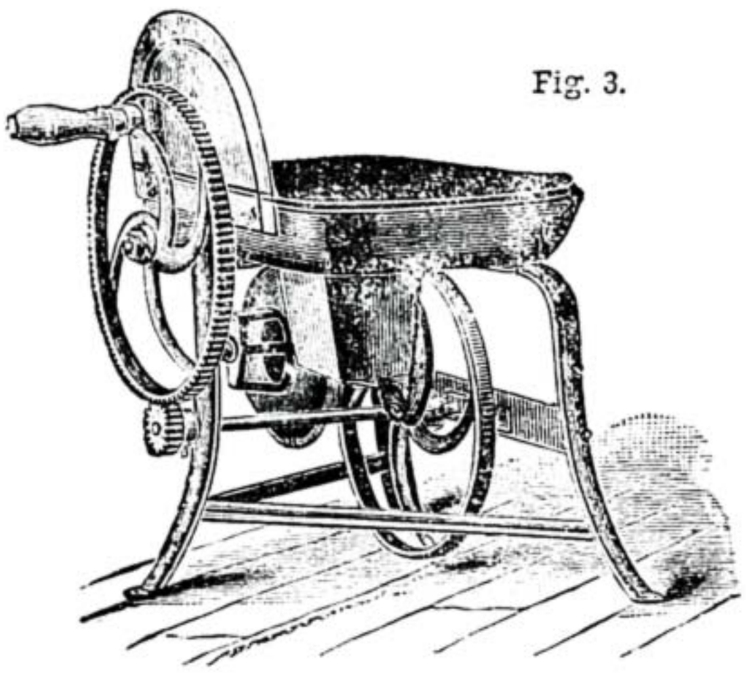


Fig. 4.

Fig. 8.

The anvil is supported upon a stand so that its face is about 22 in. high from the ground. The stand is often made of a block of wood, upon which the anvil is prevented from slipping sideways with spikes driven into the wood close alongside the anvil-feet. For neatness, a casting is often substituted (Fig. 7). An iron stand is better than one of wood, because it is much firmer; and, as the expense is only incurred once, it is better to have the stand in iron.



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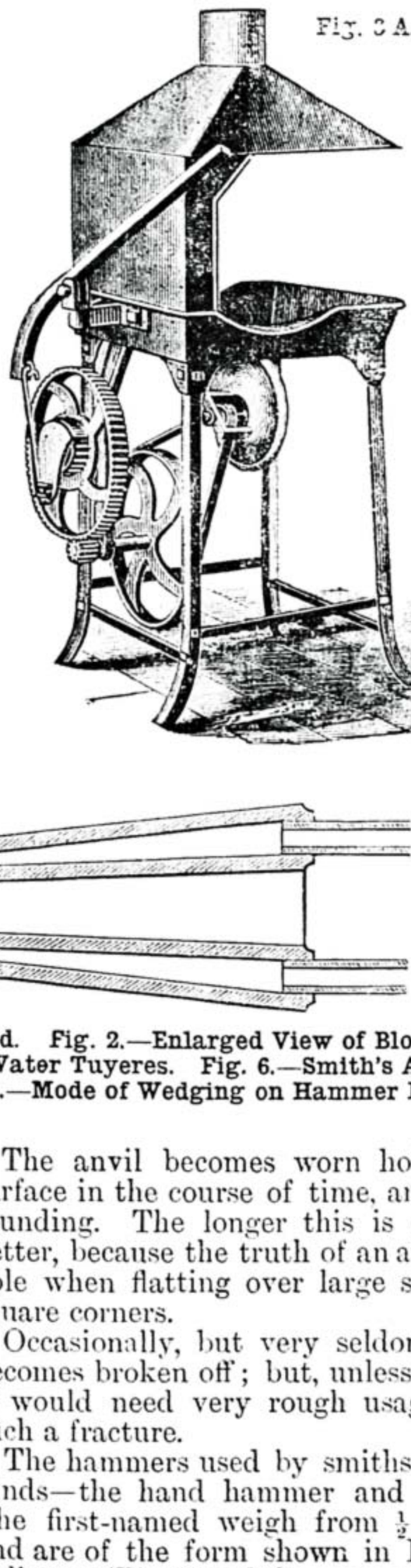


Fig. 3 A.

Fig. 5.

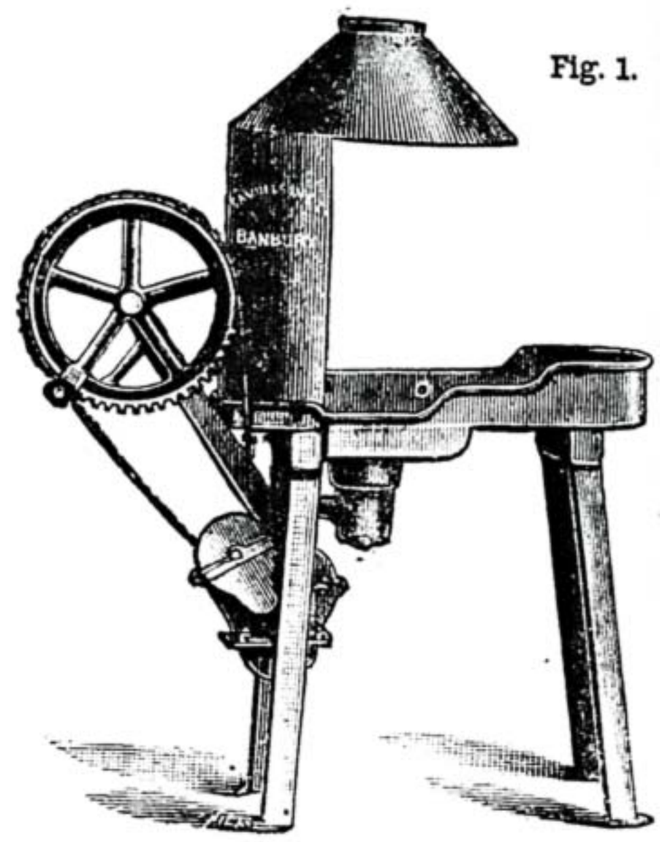


Fig. 1.

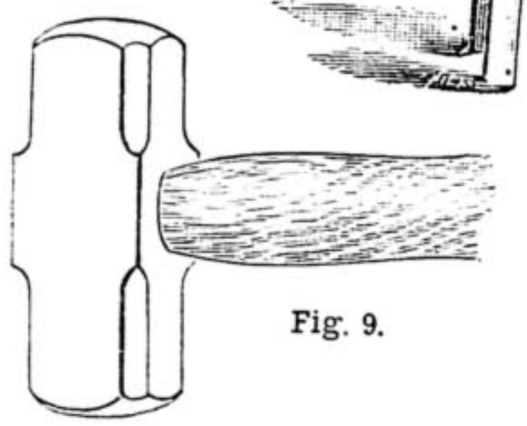


Fig. 9.

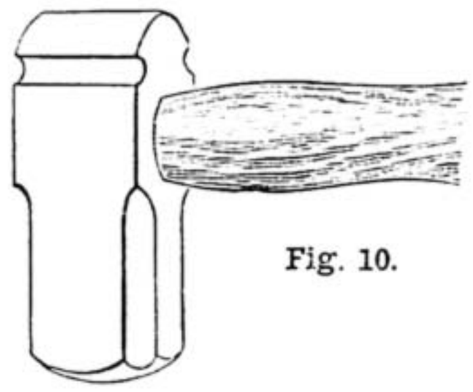


Fig. 10.

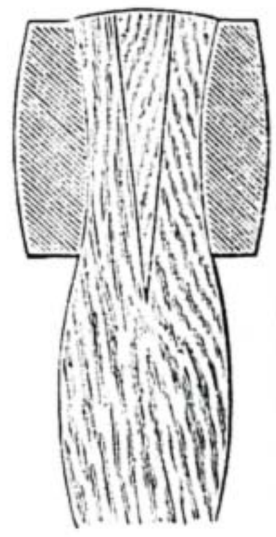


Fig. 11.

Fig. 7.

Fig. 1.—Samuelson's Forge with Hand Blower attached. Fig. 2.—Enlarged View of Blower and Gear. Fig. 3.—Britannia Company's Fan Forge without Hood. Fig. 3 A.—Ditto, with Hood. Figs. 4, 5.—Water Tuyeres. Fig. 6.—Smith's Anvil. Fig. 7.—Iron Casting for Anvil Stand. Fig. 8.—Ball Pane Hammer. Figs. 9, 10.—Sledge Hammers. Fig. 11.—Mode of Wedging on Hammer Head to Shaft or Handle.

so maintaining a constant circulation of cold water.

In small forges the simple thickening-up of the nozzle serves to preserve it from destruction for a very long period, and the casting when burnt away is replaced.

The anvil (Fig. 6) used by smiths ranges from about two to four hundredweights in weight, and is made of wrought iron—steel-faced. The conical end (A) or "beak" is used for turning bars upon, and the hole (B) is for the reception of the anvil chisel, and various bottom tools. Bruising of the edges of the anvil should always be guarded against as much as possible.

The anvil becomes worn hollow on the surface in the course of time, and the edges rounding. The longer this is delayed the better, because the truth of an anvil is valuable when flatting over large surfaces and square corners.

Occasionally, but very seldom, the beak becomes broken off; but, unless it is faulty, it would need very rough usage to cause such a fracture.

The hammers used by smiths are of two kinds—the hand hammer and the sledge. The first-named weigh from ½ lb. to 1 lb., and are of the form shown in Fig. 8. The ball pane (Fig. 8) and the cross pane are used for fullering and drawing down. The flat pane is used for striking heavy blows, and for finishing surfaces. The sledges are of one of the two forms in Figs. 9 and 10, and weigh from 4 to perhaps 14 lbs.; one of from 6 to 8 lbs. weight being about the average. To swing a sledge constantly without making the hand sore, the handle is kept very smooth. Any roughness is at once removed with glass-paper. The head must needs be well secured to prevent possible flying off. Fig. 11 shows how it is wedged on. Hammer handles are properly kept in stock in a dry place for several weeks previous to use; because, if not well seasoned, they shrink with the heat of the smithy, and are apt to work loose on their heads.

The miscellaneous small tools used by the smith, though numerous, are resolvable into a few broad types. They consist very largely of tools for moulding or shaping metal into diverse forms. Like the tools used in many other trades, these accumulate in large quantities, being made as occasion requires.

A workman is familiar with the forms and uses of these tools, an amateur is not. As I write in the interest of both, I will adopt a method of compromise. Instead of occupying two or three chapters with the description of these tools—uninteresting to the first, interesting and useful to the second—I will describe them in connection with the processes and operations for which they are used, so spreading this section over the entire series of articles. In pursuing my subject I shall introduce at the same time the distinctive tools and appliances used in the operations described, and in that way I hope to omit nothing of any material interest or importance.

good road map of the country or county, provided with a spring holder, hanging in the hall or other suitable place?

I do not, of course, lay any claim to novelty for my subject, but finding it most useful and also very easily made, I offer the result of my experience for the benefit of any readers of Work who may need an article of this kind.

I would suggest oak or mahogany for the main parts of the holder. The former will be most suitable for amateur workmen, as, in my opinion, it requires less skill in the art of polishing to turn out a creditable piece of work in oak than in any other wood. Should the workmen, however, stuff, and of some such shape as indicated, being about 14 in. deep, and of sufficient width to suit the maps, etc., for which the holder is intended, *i.e.*, about 5 in. wider than the map.

The wood should be carefully cleaned up, finished with scraper and sand-paper, and the front edges chamfered, etc., according to fancy.

Fig. 5 shows shape of the two brackets, which serve to carry the roller, support the top cover, and to which the ends of the front covering are also attached.

These are also of ¾ in. stuff, and should be carefully cut and finished so that both may be exactly the same. They are let into

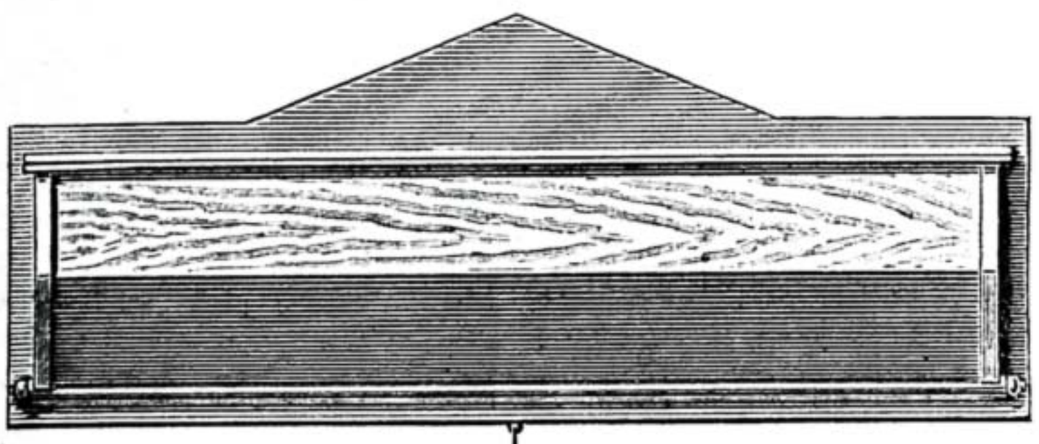


Fig. 1.

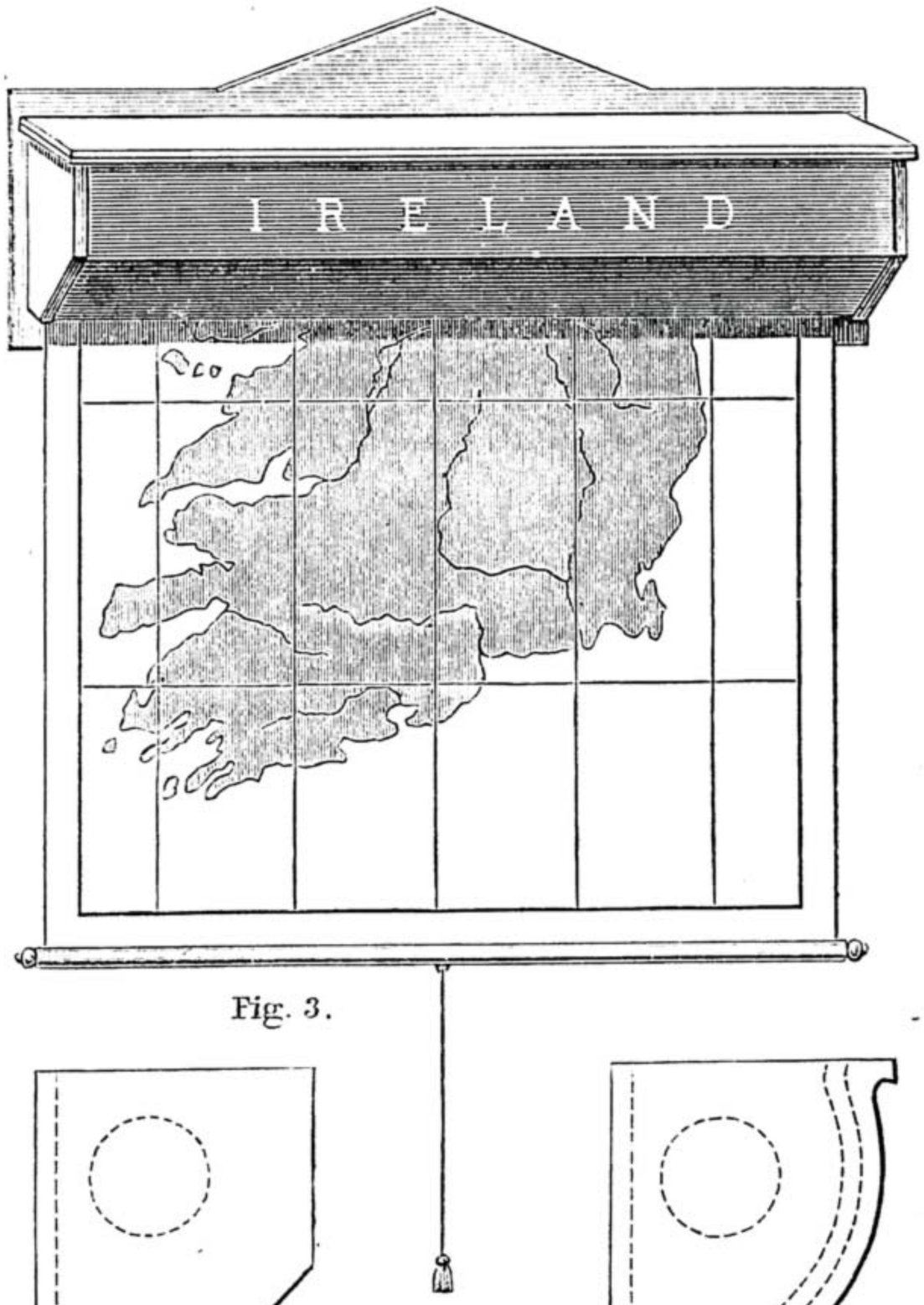


Fig. 3.

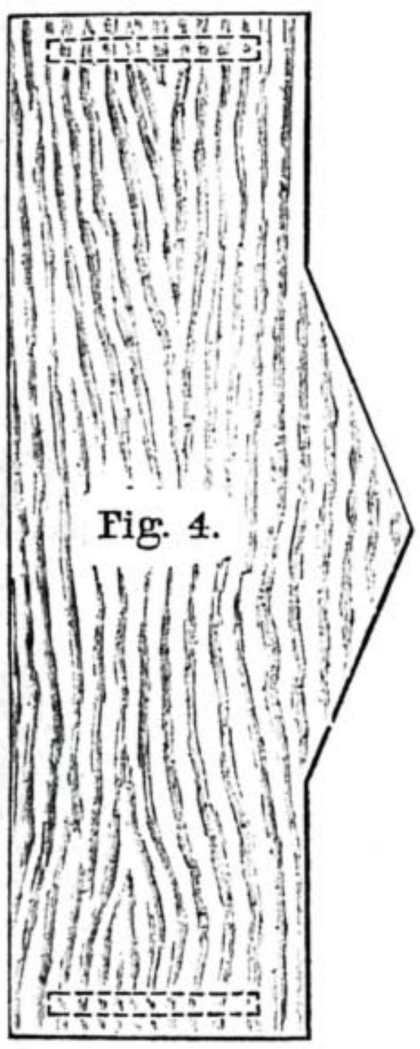


Fig. 4.

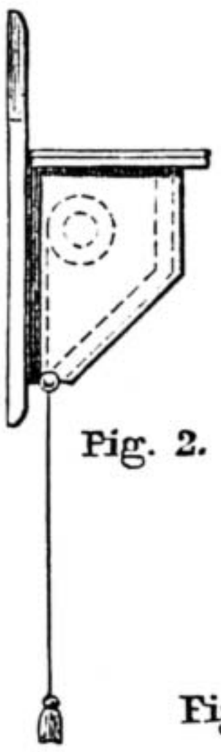


Fig. 2.

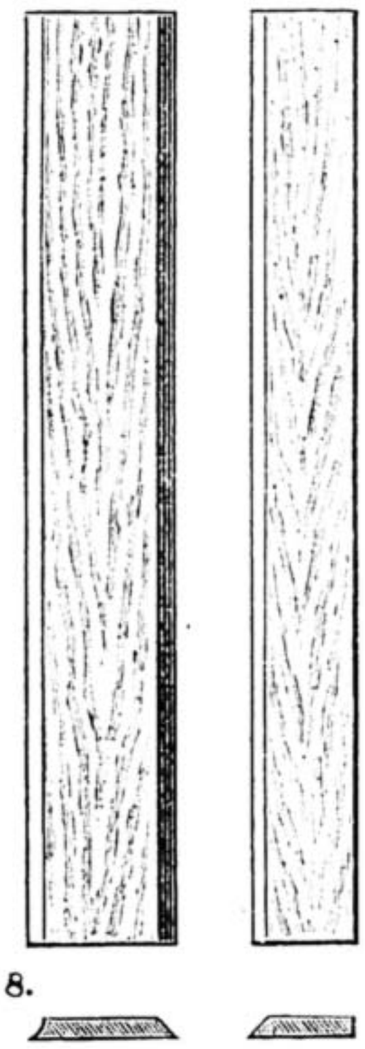


Fig. 8.

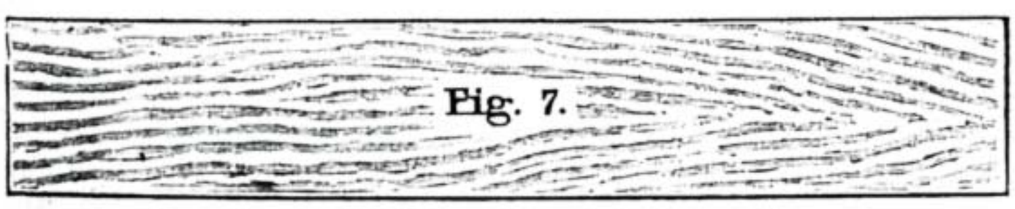


Fig. 7.

Fig. 5.

Fig. 6.

Fig. 1.—Front Elevation, showing Map rolled up. Fig. 2.—Side Elevation. Fig. 3.—Sketch showing Map exposed. Fig. 4.—Backboard. Fig. 5.—Shape of Bracket. Fig. 6.—Alternative Brackets. Fig. 7.—Top Cover. Fig. 8.—Front Cover in two portions, showing Section of each Piece. (Scale, 1 in. to 1 ft., except Figs. 5 and 6, 2 in. to 1 ft.)

A MAP HOLDER: HOW TO MAKE IT.

BY OPIFEX.

Those who have frequent occasion to consult maps, charts, etc.—if not already supplied with something of the same kind—may find the subject of this paper useful, as by this means the map is kept clean and fresh, besides occupying far less space than when hung upon a wall in the usual way, and also saving the wear and tear consequent on rolling up by hand or stowing in portfolios.

In the country it is often very desirable to have a map of one's locality to which reference may easily be made; for example, in the case of that ever-increasing class of cyclists, what is more convenient than a

prefer it, pitch pine will suit admirably, or even pine or red deal stained and varnished need not be despised.

The dimensions of the holder will, of course, depend upon the size of the map for which it is intended. The accompanying illustrations are, therefore, merely suggestive as to shape; and, with the exceptions of Figs. 5 and 6, being drawn to a scale of 1 in. to a foot, represent a holder to suit a map about 30 in. wide and of average length.

Fig. 1 represents the holder with map rolled up; Fig. 2 shows side elevation, while Fig. 3 shows the map exposed.

Fig. 4 is the backboard, which, as it serves for a foundation for the whole, should be got out first. This should be of ¾ in. grooves in the backboard (see dotted lines, Figs. 4 and 5), to which they are secured with a little glue, and two screws to each bracket driven from the back; but first, the position of the mountings for the spring roller should be decided upon, and the roller cut to the required length. I have used Hartshorn's patent blind rollers, and find them work admirably, and their price is exceedingly low, being only a shilling each, including roller with patent spring arrangement and the requisite fittings.

The front cover may next be got ready, and may be composed of two pieces, Fig. 8 arranged as at Fig. 2, or better, of one curved piece, as in the alternative shown at Fig. 6. In either case, the front cover should be let into suitably shaped grooves about

¼ in. deep in the brackets, to which it is secured by gluing. Care should be taken to ensure that the lower edge of the front cover may correspond in shape with the semicircular portion of the brackets — which should be about an inch diameter.

This arrangement is meant to allow of the round roller, which is to be attached to the lower side of the map (see Figs. 1 and 2), to fit close when the map is rolled up and so close the aperture so that no dust may enter.

The top cover (Fig. 7) may be of ⅜ in. stuff, and should be made to hinge to the back-board, being fastened in front with a small lock, or at the ends with small brass hooks and eyes, or it may be screwed on but not glued. This is necessary in order that access may be had to the roller, etc., at any time, either to remove the map, or in case of repair, etc.

The map should be mounted on stout calico, and should be attached to the spring roller like an ordinary window-blind, but *very* short tacks should be used to avoid interfering with the internal arrangement of the spring, etc.

The lower edge of the map is attached to a round roller of pine, or some other light wood, which should be long enough to project slightly outside the brackets at each side (see illustrations).

To the centre of this roller a cord is attached of sufficient length to suit the height at which the holder is hung.

To fix the map in position for working, roll it rather tightly round the spring roller until the lower roller is pressed into the semicircular part of the brackets; it may then be pulled down by the cord, and will remain in any desired position by simply slackening the cord, and will run up upon receiving a slight jerk.

Two small brass "eyes," by which to hang the holder upon the wall, complete the construction of this useful article, which should be polished, varnished, or painted, according to the description of wood employed, and the fancy of the maker.

SET OF PLATE SHELVES FOR KITCHEN.

BY DAVID DENNING.

For illustration showing set of plate shelves the reader must be referred to that accompanying the remarks on a kitchen dresser in p. 117, Vol. II., of Work. Much that was then said is equally applicable to our present subject; indeed, the dresser and the shelves are so intimately connected, that had the exigencies of space permitted they might fairly have been regarded as parts of a whole. At the same time, separated as they are in these pages, so may they be treated in actual existence, for it by no means follows that the two must be used together. The dresser alone must be regarded as a complete piece of furniture, and so may the set of plate shelves. These may be hung on any part of the wall that may be most convenient; but without some sufficient reason for not doing so the most natural position seems to be just above the dresser, to which they may in some respects be regarded as furnishing an appropriate back. In our illustration just referred to it will be noted that the shelves are quite independent of the dresser, to which they are not attached in any way; but intelligent readers, *i.e.*, all readers of these pages, will easily understand that there is no reason why the dresser and the shelves should not be more intimately associated. The shelves and their supports may, in other words, be as much part of the dresser as the back of a sideboard is to its lower portion.

Before, however, treating of the shelves as forming part of the dresser, they must first be considered as separate when the various modifications which may be necessary will be dealt with. At the outset it should be stated that everything that was said about size in connection with the dresser refers with equal force to the back. It is, therefore, not so much with dimensions that we have now to do as with formation, but in case the reader may want a few hints, some remarks on the former may not be considered out of place, and will perhaps give confidence to the novice in setting out his work.

The total height will naturally be one of the chief points which will engage the maker's attention, and we may therefore take it first. That the height cannot be greater than that of the wall it is to occupy goes without saying, and in a low room the available space may not be great. It is accordingly in a lofty room, where for all practical purposes the space may be regarded as unlimited, that any embarrassment may be felt. It is, however, one which soon vanishes when common sense is appealed to, for, remembering that the shelves are more for use than ornament, the absurdity of making the top one too high to be reached with comfort is at once apparent. What "too high" may be must be for each man to determine for himself, or perhaps, as the kitchen is generally ruled by the female portion of the household, it will be better to take others into council before deciding. Some may not think the top shelf excessively high if it can be reached with the aid of a chair or step-ladder, while others might wish to reach it without climbing. Perhaps if we take 6 ft. to 6 ft. 6 in. as a fairly convenient height in the latter case we shall not be far wrong, and unless in a very lofty room the shelves will not appear too dwarfed. It may be well here to note that we are talking of the height of the top *shelf*, and not of the extreme height to the top of the cornice, which may be any reasonable distance above.

In connection with the space between the highest shelf and the top, we may take into consideration the number of shelves and the spaces between them, for the maker must determine them on the same principles. He must ascertain what the shelves are to hold, not only the quantity but the sizes of the articles for which they are destined. These, we may assume, are pieces of crockery, but not entirely plates, as the name of the contrivance may seem to indicate it is intended solely for. There will be some dishes, probably. Well, set two or more of the shelves at a convenient distance apart to receive these larger articles, and regulate the others in the same way. Perhaps some readers might prefer to have definite measurements given, while others may think that the foregoing remarks might have been dispensed with altogether, because they see that the rules, or, rather, the hints, for regulating measurements are so simple that every maker would have thought of them for himself. Those who hold the latter opinion I am sure will forgive the infliction on their patience when they remember that the hints are given just as reminders for those who might have overlooked some of the considerations which should guide them in knowing what to do. For those who want detailed measurements, let me suggest that a very small amount of calculation will enable them to overcome any difficulty in setting out their work.

Every one who wishes to make a set of plate shelves will, I take it, now be able to start fair and square. The wood will be the same as that for the dresser, and of the same substance as the principal parts of it. The width of each shelf will be the same, and here again the maker may please himself what it may be. As the plates and such like things will be placed to lean against the wall, the shelves need not be more than sufficiently wide to let the crockery slope backwards; but usually a little more than this bare necessary width is allowed, as the extra width of the shelves then allows various small articles to be kept on them if desired. It may accordingly be considered that a 5 in. or 6 in. shelf will do, while those who prefer may have it wider.

Whatever the width of the shelves, the ends supporting them should be at least equal, while, if a strip to form a ledge is to be placed along the front of the former, they should be a trifle wider to allow for the ends of strip coming within them. In any case, it will not be objectionable for the end pieces to be a little wider than the shelves, so that the fronts of these lie back a little within them.

The shelves may be fixed to the ends with nails, the heads of which should be well punched and the holes afterwards stopped; but very possibly there are some makers who would not be content with this simple method, though it is thoroughly reliable. The mortise and tenon joint may be used instead, or the attachment may be the same as that for the drawer bearer of the dresser. If this latter construction be chosen, the effect will be neater if the groove be stopped a short distance from the front and the dovetail cut away for the same distance. The shelves, of course, will then have to be inserted from the back. Such elaboration is, however, quite unnecessary so far as strength is concerned. The stretcher or rail which is shown below the bottom shelf might then be regarded as superfluous, for if dovetailed to the ends its principal object is to bind them together. A board either nailed or dovetailed to the tops of the ends keeps them together there. This board, by the way, is not visible in the illustration, being concealed by the moulding which is afterwards planted on. A narrow piece of wood across the top will answer for the stay, but if it be made the full width of the ends it forms in reality another shelf available in case of need.

The moulding referred to is merely intended as a finish, and may be omitted altogether without affecting the utility of the set of shelves. Its depth or members are of quite secondary importance, and a suitable piece will be obtainable from most builders. At the front corners it should be mitred. Some may fancy that the moulding alone will have a paltry look and think that the appearance would be improved by a frieze. For the benefit of those who do not know what is meant by this it may be explained as a border of plain wood extending some three or four inches below the moulding. Full details of a construction which may be adopted for this part will be found in Vol. I., p. 23, of Work in the article on "Artistic Furniture."

The upright piece at the back of the shelves is put to prevent them "sagging" under the weight of their contents, and in a very small set might be omitted altogether. If simply nailed on behind it would clearly be awkward and keep the shelves themselves away from the wall. The proper way will be to cut spaces in each shelf within which

it can fit, when a few screws or nails will hold all fast.

In order that plates and dishes may not slip down, each shelf should have either a groove cut in it, or a piece of beading fastened on from end to end at a sufficient distance from the back, to allow of crockery being securely put up. In some respects the groove is more convenient than the beading, which is apt to be in the way if plates, etc., are laid down flat. With a strip planted along the front of each shelf neither the bead nor the groove is so necessary as it otherwise is. A few cup-hooks on the edges of the shelves will, no doubt, be considered a necessity, and when they are added the set of plate shelves may be regarded as made and finished, unless, indeed, staining is considered as an improvement.

Now for the few modifications which may be adopted, and are in some degree necessary if the shelves, instead of being fastened only to the wall, are to be attached to the dresser. The most evident alteration will be in the lower parts of the ends, in which the shaping would be out of place. They should be left square to rest on the dresser top. Then the background of the dresser and the bottom rail of the shelves will be one and the same thing. It will, of course, be placed between the ends so that it lies on the dresser top, to which it will be fastened by means of screws driven in from below the dresser top, which, it will be remembered, was described as overhanging a little at the back. If, however, the back of the plate shelves is of wood, it will be as well to carry it down behind the top. This method of enclosing the back will give the set of shelves a far more important appearance than they will have if left open, but, of course, the amount of material will be greater. It may perhaps be necessary to say that the boards should be placed perpendicularly and not horizontally, and that if they are glued together to make one solid piece of the necessary width the back will probably split. It should, therefore, be mounted or panelled. It may be suggested that match-boarding will form a very suitable material, especially if there is a beaded edge to "break the joint." With the concluding remarks that if the back is fastened on behind the dresser top a space equal to the thickness of the back wood should be prepared for it to fit into, and that the easiest way to manage this will be to rip off a piece from the entire length of the dresser top and then glue short ends on again, it may be assumed that all necessary directions for the construction of dresser and plate shelves have been given.

BORING HOLES IN GLASS.

BY P. B. H.

In order to drill a hole in glass, the principal factor necessary is to have an exceedingly hard and well-tempered drill, at the same time keeping the glass and drill well moistened with turpentine. Menders of porcelain use the same means for boring the holes in which to insert their rivets and cramps.

To drill holes of small diameter, an ordinary steel drill is used, the secret of success being in the temper given to the tool.

In order to obtain the necessary degree of hardness, the drill must be heated to a dull red, and then plunged into mercury. The metal thus becomes very hard. It is, however, necessary to anneal the shaft of the drill, as, in this state, it would be too brittle. The question is, "How to do it without destroying the temper in the point." The method is this:—Before heating the drill, bore a hole with it in a piece of lead, leaving the point hidden therein. You can now raise the temperature of the shaft of the drill by means of a blowpipe till it attains a blue colour nearly to the point. The drill and lead together are now immersed in cold water. The drill will now be found of the required temperature, the point exceedingly hard, while the shaft, being annealed to a certain extent, is less hard, but tougher. This tool, when mounted in holder and the point moistened with turpentine, will attack glass rapidly. Do not press too severely when working the drill, and, if possible, drill from both sides successively. To enlarge a hole thus obtained, the operator must use a rat-tailed file soaked in turpentine.

To drill a hole of a larger diameter, take a simple tube of copper or bronze, the outside diameter of which equals the diameter of the hole required in the glass. The edge of this cylinder must be kept revolving in

Fig. 2.

Fig. 1.

Fig. 1.—Boring Holes in Glass.
Fig. 2.—Copper Tube, etc.

the same place while being supplied with turpentine and fine emery.

Some precautions are necessary, however, to ensure the glass from breakage.

To mount the tool, drive a wood block, A (Fig. 2), past the centre of the copper tube, B (Figs. 1 and 2), to be used as a fulcrum to turn it. On this lay a piece of indiarubber, C, and above that fit in another piece of wood, D, with a hole in centre. This hole is for receiving a three- or four-cornered reamer, or other suitable tool, fixed in the drill, in order to rotate the tube.

The indiarubber between the blocks of wood gives the necessary amount of elasticity, without which the glass might be easily broken. During the process of boring, only press very lightly on the tool.

It will be also found necessary to guide the last-mentioned tool by some special means, as, without guide, it could not be kept revolving in the same groove by the most expert manipulator. A block of wood, as shown in sketch, is taken, raised on two pieces of wood at each end, the thickness of which depends on the work to be drilled. In this block a hole equal to the outside diameter of the copper tube is drilled (this, in sketch, is shown broken), and this constitutes an excellent guide. This block is fixed at each end either by cramps or screws. The glass, laid on several thicknesses of paper to correct any inequalities in the table, is placed in position under drill. This paper, with the indiarubber above, gives the necessary amount of elasticity to prevent breakages.

Nails placed round the circumference of the sheet of glass will keep it in its place. It can also be pressed down by means of wood wedges inserted carefully between the block of wood serving as guide and the glass.

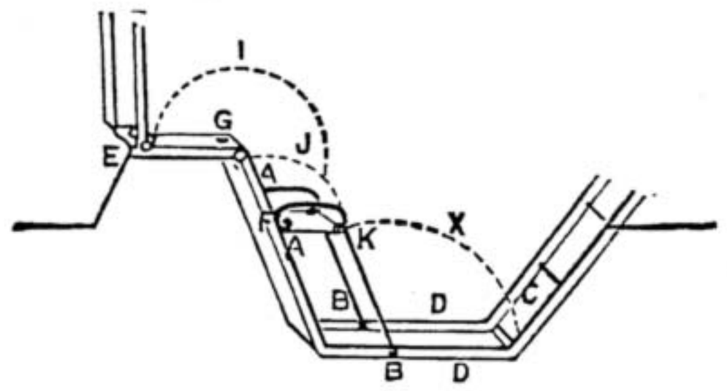
By conforming scrupulously to these rules, success is certain to follow, even when glass of the thickness shown in sketch has to be drilled. The piece of glass here shown is for an electric machine.

CRICKET SEATS FOR CARRIAGES.

BY J. C. KING.

This is the name of a small additional seat in a vehicle, and is more familiarly known in some old farm-houses as the stool in the chimney corners for children to sit on, the name doubtlessly suggested by the companionship of the crickets that mostly abound in such places.

In English carriages they are applied to broughams and victorias, chiefly in victorias, the panel at the back of the coachman's boot opening down as a desk lid to the



Cricket Seat for Carriage.

horizontal position, forming a seat for two extra riders. It is held up by two strong hinges and chains, straps, or quadrant-stays. For broughams a hinged prop-leg serves to uphold this seat.

Cricket seats on a different method of adjustment are in use in France, and for the purpose simpler and stronger. The victorias that ply for hire in the street have their extra seat folded up against the heel-panel of the seat, C, as shown by diagram of part of a victoria. Two iron legs are fixed by joint-screws to the bottom edge-plates at B B, and to the edges or ends of the cricket seat, K, so that at one motion the seat, C, is turned over into its position for use at A K. It is very cheap to make, and the cushion part is kept clean by being shut against the panel, C, and cannot be used as a foot-rest for riders on the back seat. The dotted line, X, shows the movement. For victorias for private use a larger and more commodious seat is used. The space under the coachman's seat, E G, is recessed, and a seat frame with side guards is hinged at G. The coachman's seat is hinged at E to allow of it opening as a box-lid when the cricket seat is to be folded down, which is done with the aid of two sets of joints; one set at G serve to turn the supports down (the dotted line, I, shows this movement), and the cushioned seat, A K, and side guards turn down from joints in the supports, as shown by the dotted line, J. It is a capital contrivance for a serviceable seat—the invention of M. Chaillon, Paris, and was awarded a prize at the Exposition, 1889.

PAINTING DECORATIVE PANELS.

BY FRED MILLER.

WITH regard to hanging cabinets, having recesses closed in with doors, it may be suggested that the panels should be either carved or painted. In the present number of WORK I give designs (Figs. 1 and 2) for painted panels. As will be at once apparent, these designs are modifications of Japanese designs. My reason for giving Japanesque designs is twofold. Many readers of WORK can procure books of Japanese designs, or study Japanese painting and decoration for themselves, and, as occasion requires, adapt such to suit the special work they may have in hand, for the opportunities for studying Japanese work are now considerable, either by referring to examples in our museums or private collections, purchasing books of Japanese designs such as are sold at Liberty's, in Regent Street, or Batsford's, in Holborn; or referring to books such as Cutler's "Grammar of Japanese Art," "L'Art Japonaise," etc. etc. And, in addition to the facilities for studying the subject, Japanese work is full of suggestions to the designer, and is a good school for the decorator to study in. No nation is more skilful than the Japanese in utilising plant form to decorate a surface, whether it be a lacquer box or tray, a sword hilt or screen. To begin with, they are excellent draughtsmen, with strong individuality, and keen perception for the characteristics of the plant, or bird, or whatever it is they draw, putting down with a facility and precision all that is most noteworthy. The casual observer is too apt to think of Japanese art as always grotesque. It is strongly tinctured with the personality of the nation, but it is, at the same time, work of quite unique excellence. A Japanese can not only draw a flower, bird, or insect with a freedom and ease that shows him to be a master of his materials, but what is of equal importance, he knows how to simplify and omit all that is purely adventitious and casual, in order to fix down the real character of the object under his view. A good many people draw, as they think, very literally, but are so taken up by purely individual peculiarities that the real character of the plant, those traits which differentiate it from all other plants, are confused or passed over. Take the way a Jap throws a sprig of wild cherry or plum across a panel. He gets all those striking angles in the stem that are so decorative a feature, and he just breaks his blossom over these, apparently always in the right place, and the whole thing is put in with a crispness, ease, and nervousness that show the artist *felt* what he was doing. No hesitancy, bungling, clumsiness, but directness, simplicity, and delicacy of draughtsmanship that give the Japanese work a charm that is not possessed by the handiwork of any other people. Their painted work, too, is very suggestive, and the reverse of laborious. Notice, for instance, in putting in leaves, how it seems to be done by pressure exerted on the brush as it touches the paper. This is the cleverest kind of brush work, for it needs great certainty to suggest a form accurately by the varying pressure exerted upon the brush; and the effect, too, is far before stippled or highly-wrought painting, as the colour, flowing on freely, forms a kind of light and shade of its own, and a certain accidental quality is obtained that is always more effective than where the effect is produced by deliberateness and mathematical precision.

A word may be fittingly said as to this quality artists term "accidental." We must recognise the fact that nature cannot be imitated. If you attempt to put in every vein in the leaf and every serration of the edge, every spine on the stem and stamen in the flower of a rose, we produce a hard, lifeless, mechanical-looking thing. We only challenge comparison with Nature by attempting to imitate her, a comparison

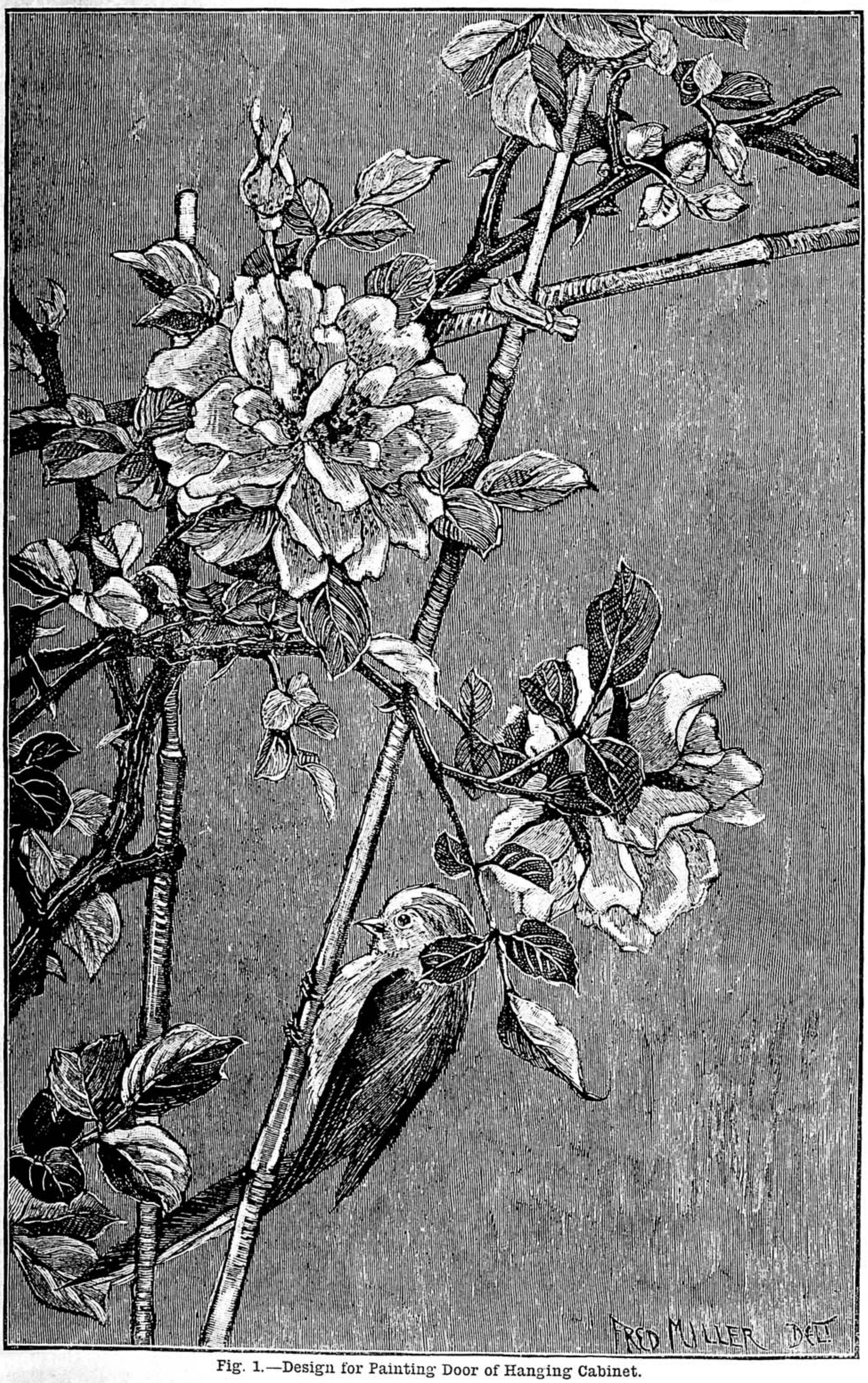


Fig. 1.—Design for Painting Door of Hanging Cabinet.

greatly to our disadvantage. But if we can give the effect of the growth of the leaves by a few clever brush marks, we at once think of the skill of the artist rather than his limitations. The Japanese sometimes adopt a purposely conventional method, especially where the design has to be reproduced by a means that is in itself laborious, such as raised lacquer or inlay. Then you simply take an agreeable series of lines whose curves and angles are pleasantly opposed to each other, and you merely insist on a few well-marked features of the plant, such as the growth and shape of leaves and flowers. Elaborate foreshortening, which always depends on the management of the light and shade, cannot be attempted, nor can the appearance of infinity be given, seeing that every object is done with deliberateness and preciseness. Much has to be left out; nature has to be simplified; but what you do put down see that it does not tell a falsehood, either through carelessness or ignorance.

The system of outlining all the forms in decorative panels is to be commended in conventional and ornamental work where a few simple forms alone are reproduced; but I think that the outlining was carried to excess a few years since, and the result was, in many cases, hard and mechanical—the very reverse of decorative. The outline was supposed to give the work character, and so it does, if it is put in with feeling which comes of skill and knowledge; but a clumsy, unsympathetic outline can add no charm to one's work.

Very pleasant decoration can be produced by painting direct from nature a branch of apple, spray of wild rose or blackberry, or other decorative plant whose growth is free and whose leaves, etc., are not too complicated. Select as far as possible specimens that are themselves simple, and such as are not too full of leaves and flowers, and in painting the panels, bear in mind to keep your work simple in design and treatment, rather than lose yourself by trying to put in all you see. It may seem strange to some readers to be told not to try and see too much, but it is, nevertheless, the best advice I can give you. Lowell says that the great writer knows what to leave in the inkpot, and, in the same way, the artist trains himself to see what is essential to the exclusion of much that he knows is there before him. Get into the habit of half-closing your eyes when you draw or paint from nature, so as to shut out insignificant details in order that you may see *mass*—*i.e.*, the general form and arrangement.

Coming to the design given with this article, it will be noticed how gracefully the spray of rose falls over the pieces of bamboo supporting it, and how it seems to occupy the space without filling it. A large part of the panels have nothing on them, and yet the general effect is one of completeness. The introduction of birds is always a good feature in decoration, for it not only gives a feeling of life by suggesting movement, but introduces a spot of colour quite distinct from anything else in the scheme. The birds figured are the wren and blue tit. Insects, too, can with advantage be introduced, and the spider's web I have shown in the right hand panel gives great character to that panel. Don't attempt to introduce any accessories without reference to nature. Get a few butterflies, beetles, or bees, or else make studies of them in a museum, in colour, so that you have something to guide you when painting them on your panels. It requires considerable skill and wide knowledge to draw largely upon the memory for such accessories, and even the man whose memory is clear and precise misses a certain quality that intercourse with nature would have given his work. You can draw upon your inner consciousness when you arrange your material, so as to make it occupy the space agreeably, but don't lose touch of nature, for you get a suggestion by painting from nature that is invaluable.

Fig. 2.—Design for Painting Door of Hanging Cabinet.

If the cabinet is to be stained black, you might paint on the black panels. The wood should be stained and *slightly* polished, just to prevent the sucking of the wood. When the decoration is quite hard (use as little medium as you can with the colours; no oil), the panels can be finished, being polished. Decoration under the polish has a brilliant look, and, of course, the polish preserves the work. Keep the colour as thin as possible on the wood, for if the paint is put on thickly, it makes the polishing of the panels difficult, and the paint is apt to crack after a while. Painting under the polish will stand well, witness the old painted satin-wood furniture of the last century.

Gold grounds are often used in decoration, and very effective they are. The panels must be gilt (imitation gold does not do), and the colour can often be used transparently with advantage. Such colours as burnt sienna, Antwerp blue, raw sienna, gamboge, Indian yellow, French ultramarine, and rose madder, can all be used pure and in combination, transparently on the gold. Mix with a little copal and poppy oil, and put on more or less thinly, and the gold grinning through the colours gives them a most beautiful effect. Of course, for the greys and whites solid colour must be used, but the combination of transparent colours with solid is to be commended.

Avoid crudity in your colour, especially on black grounds, and introduce three or four tones of colour only, such as a grey for the back of the leaves, a rich green for the dark leaves, a yellow green for those where the light shines through them, and a very bright grey for those leaves catching the light. This is not a purely arbitrary arrangement, but is founded upon a careful observation of nature, for if we look at a spray of rose in the light, we shall see that the colours of the leaves are much as I have suggested. Painting on gold grounds is not generally polished.

OUR GUIDE TO GOOD THINGS.

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

20.—"Painting, Graining, and Decorating, to Prevent Blisters."

This is the title of a new work, which appeals chiefly to professional house painters and grainers, written by Mr. Edward Mathieson, of Ardrossan, near Glasgow. The author, who is a practical man, and who furthermore is connected with a firm of colour makers at Ardrossan, claims to have overcome the blistering effect to which ordinary oil paints are liable when exposed to intense heat. The volume under notice deals in a lucid and practical manner with every phase of the annoyance, from the cause and explanation of blisters to the completion of work, the condition of which the tradesman can be responsible for a twelvemonth. The author's conclusions are not the result of chemical analysis and theory only, but are further founded upon the successful results which his process has given when tested by time and both solar and artificial heat. The subject of "blisters," although of much importance to the general community, is one that particularly concerns provincial painters and country residents. Many instances of master painters obtaining customers upon the assurance of non-blistering work has come to our personal knowledge, but we have never seen the promise fulfilled by the ordinary methods of oil-painting. Mr. Mathieson obtains success by working on special lines, and with special, but not inconveniently so, materials. A valuable reputation could soon be built up by a master grainer upon the non-blistering qualities and durability of his work, and viewed in this light, the price of the volume (10s.) would soon be repaid to him a hundredfold. Besides the treatise on blistering, the work contains special chapters on oak graining, and is, further, a valuable acquisition, on account of recipes for making enamel oil paint, enamel oil, and damp-proof liquid, the two former, at the present time of perishable spirit enamels, being simply invaluable to provincial or colonial masters. The publishers are Dale and Reynolds, 24, Wellington Street, Strand, and John Menzies & Co., Edinburgh and Glasgow.

21.—The Britannia Company's Ornamental Slide Rest.

This is a very successful attempt to produce for £15 a slide rest (Fig. 1) which shall be solid and substantial, neat in appearance, and perfectly accurate, and it is certainly the best rest yet produced at the price. The sole plate is 12 in. long by $2\frac{1}{2}$ in. wide, planed below and at the sides, and fitted into a gun-metal cradle, securing its position at right angles to the back of the lathe. It is clamped by an eccentric instead of the ordinary bolt and bow nut. At the top of the stem of the main frame is a graduated circle of good size and very legible reading against a steel index point, and below it is an elevating ring of gun-metal, milled for the better grasp of the fingers. This is $3\frac{1}{2}$ in. in diameter, the divided circle being almost equal in size. The stem, or tenon, of the main frame is $1\frac{1}{2}$ in. diameter, by which it will be seen that this rest is no mere toy, but a substantial affair fit to stand any amount of work. The frame of the main slide is 11 in. between the ends, 12 in. out and out, by $2\frac{3}{8}$ in. wide, and the eleven inches are graduated and figured in inches and tenths. The main screw is of ten threads to the inch, and its head is also graduated. The stem or tenon has two vertical grooves into which the rounded point of one of two screws in the pedestal fits accurately. These serve for the adjustment of the frame in two positions, either parallel with the lathe bed or at right angles to it, a second screw securing it when thus adjusted. This supplies the place of the usual set studs, or stops. The tool slide is 5 in. by 2 in. at the base, where it slides as usual between adjustable steel guides, but the $\frac{9}{16}$ receptacle does not reach the entire 5 in., but occupies $2\frac{3}{4}$ in. of the length; and instead of two separate tool clamps, there is a long one with two screws, this fitting being otherwise arranged according to the usual plan. This gives the clamp a bearing of $2\frac{1}{2}$ in., and it is very firm. The advancing screw of the tool slide is in front instead of at the side, and is very ingeniously fitted. It is tapped (with twenty threads to the inch) into a collar on the under part of the slide, and near its end is a groove into which a little slide or flat bolt fits, preventing, when slid forward, the end-long movement of the screw. When thus held it works the tool slide, but on drawing back the bolt, the tool slide is at once set free, to be actuated by a lever. This arrangement answers admirably, and well supplies the place of the usual bridle, which has to be detached to free the slide, to the danger of losing its screw. The slide is, moreover, instantaneous in its action, and there are no loose parts that can be mislaid. The advancing screw has a reading collar very cleverly arranged, but as the divisions are somewhat difficult to see, there is a division plate also upon the upper part of the bed of the tool slide. The fitting of all parts is excellent, and the Britannia Company deserve much credit for the production of so good a rest at a low figure.

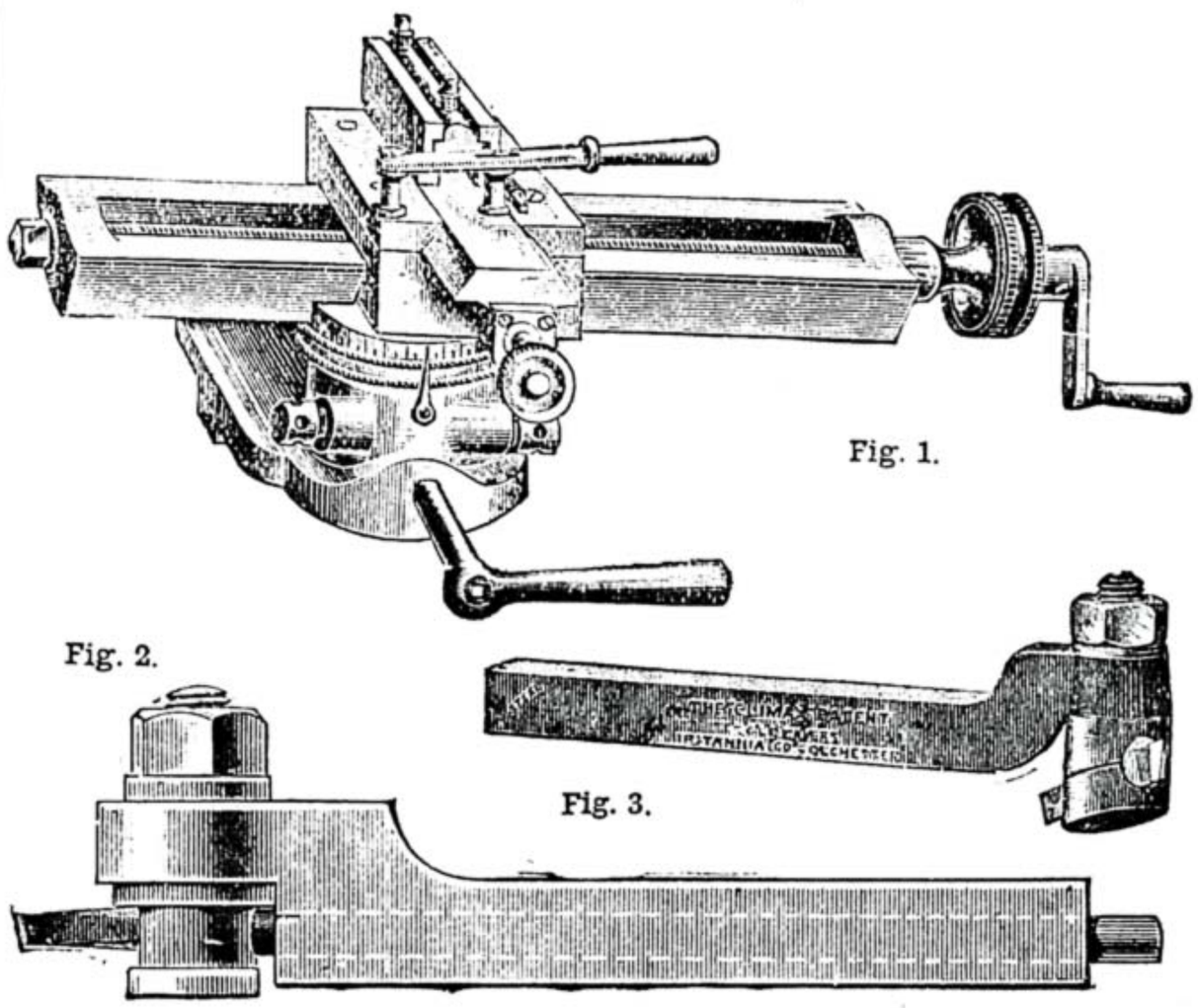


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 1.—The Britannia Company's Ornamental Slide Rest. Fig. 2.—Bent's Patent Tool Holder. Fig. 3.—The "Climax" Tool Holder.

22.—Bent's Patent Tool Holder.

This excellent tool holder, which was invented by Mr. B. H. Bent, B.A., Demonstrator of Applied Mechanics in the University of Cambridge, and is manufactured and supplied by the Britannia Company, Colchester, is one of the best that can be bought for boring and cutting internal threads. The cutters or tools may be made of rounded rod, which can always be easily obtained. They are held firmly in the tool holder, and in boring it is very easy to adjust depth of cut. Various sizes of steel can be held in the same holder. It is an economical tool, no skilled smith being required to forge the cutters, and it can be used for ordinary turning, sliding, and surfacing. The tool holder is made in six sizes, ranging from $\frac{3}{8}$ in. to 1 in., and supplied, post free, at prices varying from 9s. 6d. to 17s. 6d.

23.—The "Climax" Tool Holder.

The "Climax" Tool Holder, a useful all-round cutting tool for lathes, shaping and planing machines, etc., will cut straighter irregular work, and into corners and face either right or left without altering its position in the slide rest. It is invaluable for screw cutting, as the cutter can be canted to suit the angle of any thread, whether V-shaped or square. It is made entirely of steel, the bolt, etc., being case-hardened. The cutting tools are of uniform section, and are made from the finest cast steel that can be got. For the two largest sizes cutters of Mushet's special self-hardening steel can be supplied. The sizes of shank vary from $\frac{9}{16}$ in. square to $\frac{7}{8}$ in. square, and sections of cutters from $\frac{5}{16}$ in. by $\frac{1}{4}$ in. to $\frac{7}{8}$ in. by $\frac{3}{8}$ in.; prices ranging from 13s. 6d. to 20s. Prices of best cast steel cutters per dozen range from 4s. 6d. to 8s. 6d.; Mushet's cutters being 8s. and 11s. per dozen.

The tool holders described in this and the preceding notice will be found to be reasonable in price and serviceable in every respect by those who buy them, whether amateur or professional.

THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

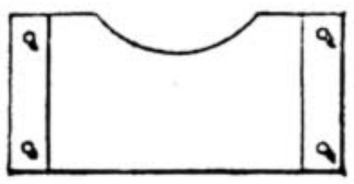
NOTICE TO CORRESPONDENTS.

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

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

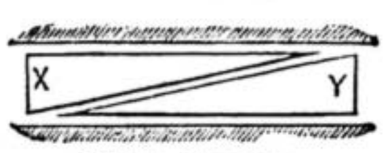
Invalid's Bed Tray and Æolian Harp.—J. B. (*Stonham*) writes:—"The invalid's bed tray described on page 13, Vol. II., of WORK, will be found much more convenient if made with a half circle cut out of hind part thus—



Invalid's Bed Tray.

as the invalid can get closer to the articles on tray. I have made two, one of which is in constant use and very handy. I have also made an Æolian harp, double action, and would advise any one making same to put sound-posts in body similar to those in violin, as mine would not sound much until I did so; now it goes well."

Mitre Cramp.—H. J. L. J. M. (*Ealing*) writes in sequence to KILBURN, Vol. II., page 43:—"My account of my mitre cramp is rendered less intelligible by two printer's errors—'lined' in line six should be 'planed,' and 'unhinge' should be 'impinge' (line 20). If KILBURN will try wedges inserted lengthwise in the space between D and E in this way, and gently tapped with a light hammer at the ends marked X and Y, he will find they will give plenty of pressure. If he had read my short article carefully, he would have seen that I said my plan answered very well for gluing up frames. If he wants to nail them he can do so when the glued joint is dry. For small gilt frames nails are not required, and look unsightly."



Mitre Cramp.

Weight of Wood.—A. R. (*Scorrier*) writes:—"The following figures will give the average weight in pounds per cubic foot of twelve kinds of wood, which may be useful to buyers, carriers, and even to some who have had long experience in a timber yard:—

Cedar ...	.. 35 lbs.	Ebony ..	.. 83 lbs.
Yellow pine	.. 34 ,,	Logwood	.. 57 ,,
White pine	.. 34 ,,	Red hickory	.. 52 ,,
Red pine ..	.. 37 ,,	Ash ..	.. 53 ,,
Spruce ..	.. 31 ,,	White oak	.. 54 ,,
Chestnut ..	.. 38 ,,	Well seas'd pine	30 ,,
Lignum vitæ	.. 83 ,,		

Weight of Iron.—A. R. (*Scorrier*) writes:—"In looking over the 'Shop' columns I find that a reader has been asking a question in reference to weight of iron. Perhaps the following table may be of benefit to more than one reader of WORK, which gives the weight of square and round iron in pounds per foot length, from 1 in. to 3 in. square, and from 1 in. to 4 in. diameter:—

1 in. square ..	3·33 lbs.	1 in. diam. ..	2·60 lbs.
1¼ ,, ..	4·21 ,,	1¼ ,, ..	3·31 ,,
1¼ ,, ..	5·20 ,,	1¼ ,, ..	4·9 ,,
1⅜ ,, ..	6·30 ,,	1⅜ ,, ..	4·95 ,,
1½ ,, ..	7·50 ,,	1½ ,, ..	5·89 ,,
1⅝ ,, ..	8·80 ,,	1⅝ ,, ..	6·91 ,,
1¾ ,, ..	10·20 ,,	1¾ ,, ..	8·1 ,,
1⅞ ,, ..	11·71 ,,	1⅞ ,, ..	9·20 ,,
2 ,, ..	13·33 ,,	2 ,, ..	10·47 ,,
2⅛ ,, ..	15·05 ,,	2⅛ ,, ..	11·82 ,,
2¼ ,, ..	16·87 ,,	2¼ ,, ..	13·25 ,,
2⅜ ,, ..	20·80 ,,	2⅜ ,, ..	14·76 ,,
2½ ,, ..	25·20 ,,	2½ ,, ..	16·36 ,,
3 ,, ..	30·00 ,,	2¾ ,, ..	19·79 ,,
		3 ,, ..	23·56 ,,
		3¼ ,, ..	25·56 ,,
		3½ ,, ..	27·65 ,,
		3¾ ,, ..	29·82 ,,
		3¼ ,, ..	32·7 ,,
		3½ ,, ..	36·81 ,,
		4 ,, ..	41·88 ,,

One cubic foot weighs 486·75 lbs.; 4·59 cubic feet, one ton.

Gongs.—W. A. Y. (*Camorrage*) writes:—"May I remark that the thin plates referred to by W. E. W. (see page 78, Vol. II.) are probably Martineau & Smith's 'Campanels.' M. and S., whose address is Holloway Head, Birmingham, would send him particulars if in the trade, otherwise W. E. W.'s ironmonger could get him particulars. The plates are round, about ⅛ of an inch thick, and are bell metal, copper coloured, and have a rich deep hue."

Time Alarum Fitment.—F. S. (*Islington, N.*) writes:—"My clock is only a common alarum clock, from which I took away all the alarum works, excepting the small figured piece in the centre of dial. Of this piece I made use in the following manner, shown in the sketch. Fig. A is the piece looking at the back of it. The chain line shows how it was, and the plain line shows how I have altered it, and what I have filed away, leaving only a small piece (B) projecting. This I have bent out a shade, as shown in Fig. 2; then I bent a thin piece of sheet

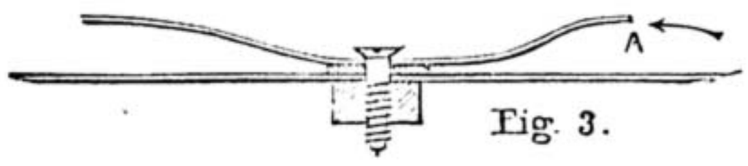


Fig. 3.

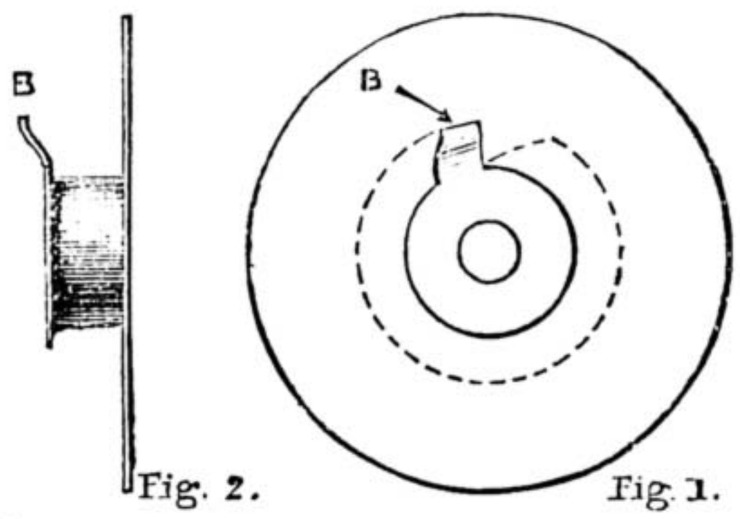


Fig. 2.

Fig. 1.

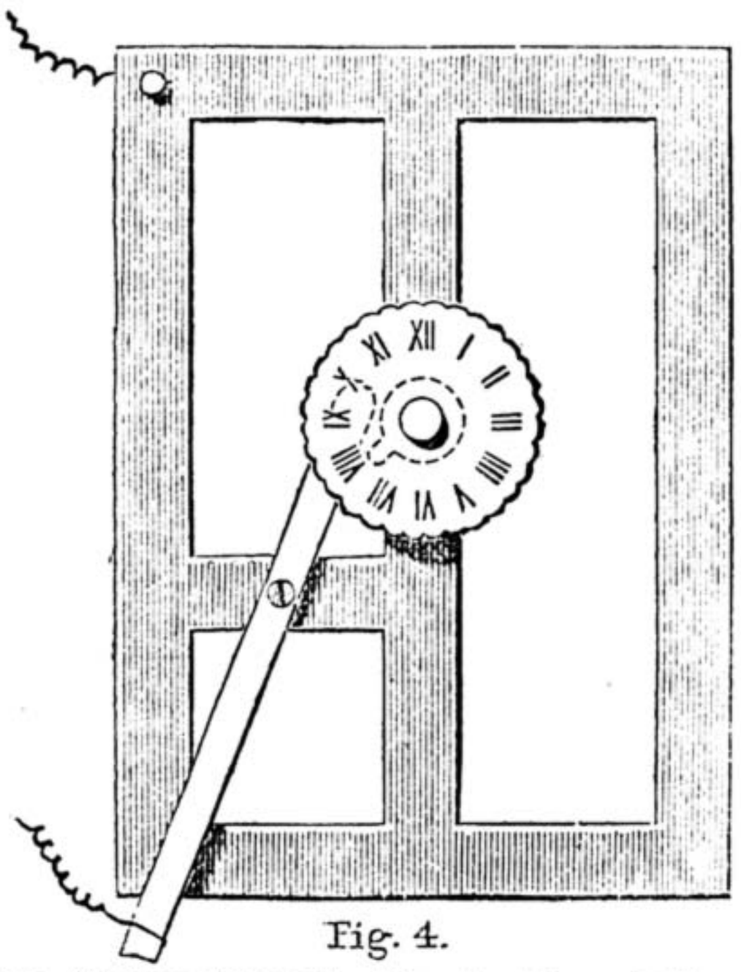


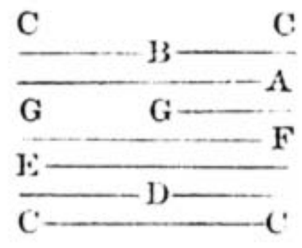
Fig. 4.

Time Alarum Fitment. Fig. 1.—Figured Piece. Fig. 2.—B, Projecting Piece. Fig. 3.—A, End which will contact with projecting Piece. Fig. 4.—Position of Fitment.

brass about ¼ in. wide and 2½ in. long in the shape of Fig. 3. This is very thin, and forms a weak spring. I made a hole in this, and fastened it to frame of clock works, with a screw through the hole that the winding up spindle came from, merely putting a small screw through and a small piece of wood at the back to act as a nut; also a leather washer between the spring and frame to insulate it from frame. Fig. 4 shows the position it is placed in. The dotted lines show how the small figured centre piece will contact. One wire leads from the other and from this spring, and the other wire from the frame the clock works. Of course you want a switch with this, but I daresay you can see the idea, and fellow-readers may be glad to know that it works well. When I set my clock I turn the hands to the time I wish it to go off, then gently turn the figured piece round until the bell starts ringing; then I put the clock right time. It is simple enough if you saw it, and it only took me a matter of two hours to fit it up. If any one cares to see it, I should be glad to show it them at 38, Spencer Street."

Learning Marbling, etc.—R. A. D. (*London, S.E.*) writes:—"In WORK, No. 50 (Vol. I., page 797), I notice a reply to W. H. (*Newington Butts*) signed F. P., respecting where to learn marbling and graining at small cost. The advice is given to go under a clever marbler and take lessons, which, I venture to say, is bad advice. Marbling and graining, I take it, are imitations of the respective woods and marbles, but how many of our present day marblers and grainers take this view of the subject? If he went under a marbler, he would but learn his teacher's view of what nature was, and a view which nature never possessed, a view which is often but the outcome of an ingenious and inventive mind, and the fruitful cause of the abominable rubbish which we see about passing as woods and marbles, and which have done more to ruin the trade than any other thing that I know of. There is one thing I noticed with pleasure in the reply, and that is, 'In any case, you will have to devote a large amount of time and patience to it.' If the student is willing to set out with this idea firmly established in his mind, and to start at the beginning, and not think he can learn it in a month or so, but remember it is only by close study and hard work that he can ever hope to be a workman worth his salt, then I should strongly advise him to join the House Decorating Class at the City and Guilds of London Institute in Kennington Park Road. There marbling and graining is taught from nature, as it ought to be taught, and not from another man's view of what it is or what it ought to be. They have there a very fine collection of marbles and woods for the use of students and individual instruction. The fee is but 2s. 6d. per month of three nights a week and two hours each night; and in addition to this, the school finds colours and paper, making it but a mere nominal fee. It is the only class of its kind in the United Kingdom, and only wants to be further known to be extensively used. I have, of course, no interest in wanting any to join beyond the fact that I have benefited by it, and wish others to do the same. You do well to recommend the Dutch work you speak of: it is the finest work on the subject ever brought out. It is written by the brothers A. R. and P. Van der Burg, who are most undoubtedly thoroughly practical men. The work is issued by Crosby Lockwood & Co., and is translated into the English language. The plates and instructions are generally excellent, and a painter could not make a better investment than to purchase a copy of it. I did so some time ago, and have never regretted it, but consider I have been repaid over and over again for my initial expense. It may be tiring perhaps to hear the one string, 'Copy from nature,' harped upon, but I believe it to be the only thing that will make good workmen in whatever trade almost they may be, especially in trades where there are any pretensions to artistic effects. If we follow it we can never go far wrong—not so far, at any rate, as if we went unguided but by our own tastes."

Cutting Music for Organette.—B. A. B. (*Hampstead*) writes in reply to AMATEUR MUSICIAN (see page 814, Vol. I.):—"I can give but scanty information in the overcrowded columns of 'Shop,' but will try to give AMATEUR MUSICIAN a little help. First, there are three sets of chords in every key: one on the keynote itself, one on its fifth ascending, and one on its fifth descending—or its fourth; these are important in the order they are placed, the keynote chord being of the greatest value. With chords on these three notes, any note of the scale can be harmonised, as AMATEUR MUSICIAN may see, thus:—



These can be inverted, transposed, some notes strengthened in the octave below, or omitted, according to the taste, skill, and knowledge of AMATEUR MUSICIAN. The two most binding rules are that no consecutive fifths or octaves are permissible, and the last chord must be a keynote chord. This applies to the major mode. For the minor I expect other notes absent on AMATEUR MUSICIAN'S instrument would be required."

Re-waxing Meerschaum.—ONE WHO IS NOT A SMOKER writes:—"A. H. (*Sydenham*) (page 750, Vol. I.) inquires how to wax meerschaum pipes. The process is as follows:—They are first soaked in wax, then in tallow, and finally polished with shave grass or crape. The latter is used to remove scratches. But I doubt if you can get shave grass in England, as I have never heard of it, and they are polished in Germany. If you succeed, I should like to know through 'Shop.'"

Boat-building.—J. R. (*Newcastle-on-Tyne*) writes:—"In reply to BOAT HOOK (*Manchester*) (see page 38 of WORK, Vol. II.), it is evident that the reason of his boat being so crank and unsteady in the water is because of its being too sharp and lean in the bilges. A boat with sharp bilges will be

very unsteady, while a fuller mould of bilge will make a very steady and safe boat. If he will fasten a bilge rail or keel on each bilge of his boat, in a line with the keel at about a foot distance from it, it will greatly add to her stability, bilge rail to be about six feet long, two or two and a half inches deep, one inch thick, tapered to a sharp point."

Exhibitions of Craft Work, etc.—T. J. M. (*Manchester*) writes:—"I have derived much profit and instruction from exhibiting and examining the exhibits of others in various craft shows during the last year or two; and I should be glad if readers of WORK would make known to their fellow subscribers in good time any such exhibitions coming on."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Dovetailing.—DOVETAIL (*London, N.E.*).—I am afraid anything that can be said in "Shop" about dovetailing, or rather making a box, will not help you very much, for I imagine you are not familiar with joinery. It is a pity you did not say what the box is for and give some idea of its size, as then it would have been easier to answer in a way that would be more useful to you. Not knowing what kind of a box you want to make I can only give the following general directions:—After having planed up the stuff plane one edge straight. Work from this for lengths and make to width required. Then set your gauge to thickness of wood and gauge on ends of pieces. Do so on both sides. Next set out for the dovetail pins. Saw down to the gauged lines and chop out the waste wood with chisel, cutting from both sides of the wood with a slight inclination inwards. Then mark off on the other pieces the sockets for the dovetails; saw and chop out the waste. To ensure close fitting, saw outside lines for the dovetails and inside lines for the sockets. This compensates for the saw kerf.—D. D.

Index to WORK.—J. G. (*Stockport*) and numerous other readers are informed that an Index to WORK has been prepared, and has been on sale for some time. See notice on page 828, Vol. I. It can be had from the publishers or through any bookseller, price 1d.—ED.

Battery for Electric Lamp.—VOLTA (*Rochester*).—Your 12-volt 5 c.p. incandescent electric lamp is made to be lighted with a current having an E.M.F. of not less than 12 volts. This can be obtained from six single fluid chromic acid cells arranged in series. The cells should contain two carbon plates and one zinc plate in each cell, and this should hold at least one pint of liquid if the light is to be maintained for three hours at a time. In my articles, "Model Electric Lights," which will appear shortly, I have given full instructions for making and charging such batteries. You will also learn much from my replies to other correspondents.—G. E. B.

Technical Work on Dynamos.—F. A. (*Wandsworth*).—Have you seen Professor Thompson's book on dynamo electric machinery? If you have not, I should advise you to get it, and study up the principles of construction as therein laid down. Then you will be able to more fully understand how a dynamo is constructed. Surely that book will not be too elementary! You will also find some technical information on dynamos, and also electro-motors, in "Electricity in the Service of Man," now being issued in monthly parts by the publishers of this paper. I am not sure, but I think Professor Perry was one of the first to construct a motor to run at a perfectly uniform speed under varying loads.—G. E. B.

Electrical Questions.—R. B. (*Laurencekirk*).—(1) The Fuller cell is now in general use, and may be made up by any person. (2) I do not know of any good book dealing exclusively with galvanic batteries. (3) Apply to Trübner, foreign bookseller, Ludgate Hill, E.C., for price of Cazin's work on electric or galvanic batteries. (4) See reply to G. L. (*Pimlico*). Try Spon, publisher, Charing Cross, London, for list of books on electric lighting.—G. E. B.

Securing Copyright.—J. C. (*Smethwick*).—Your letter is not very explicit, but it is presumed that you wish to secure copyright for a label or some such business matter which does not come within the definition of a trade mark. It is probable that you will find the forms supplied for that purpose from Stationers' Hall perplexing. It will be better to call there or get some friend in London to do so, and have the forms filled in by the official.—C. C. C.

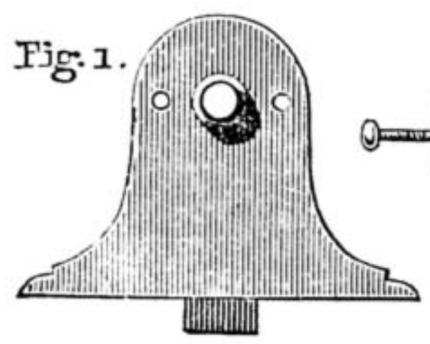
Payment of Royalties under Patent.—PATENT (*London*).—The ordinary practice in the writer's district is for the licensee to pay Royalties monthly. The January Royalty, say, would be calculated and audited by some person agreed upon by both parties: payment being made to the Patentee on the 21st of February, and so on. If the licensee fails to meet his payments the usual stipulation is that the licensee shall revert to the Patentee. But, of course, these things are matters for agreement between the two contracting parties. The auditor's expenses are shared; he is the joint servant of both parties, and being usually an accountant who has a professional reputation to maintain, the system, as a rule, works smoothly.—C. C. C.

Taking out a Patent.—A. H. (*Portsmouth*) has invented an improved instrument, but before taking out a patent he wishes to learn whether he is first in the field with this improvement. He should go to a Specification Library—there is one, free, in most large towns—and search the index for the instrument in question. Let us suppose that this improved instrument is a level. He must look in the index for the word "level," and if he finds any patent on the subject, read the specification, and see if the invention clashes with his own; continuing his search backwards through the volumes of as many years as will satisfy him one way or the other.—C. C. C.

Correspondence in "Shop."—W. H. G.—Every correspondent is entitled to express his views on matters relating to construction and decoration freely in "Shop," which is intended to serve as a means of imparting information on all appropriate subjects, respecting which inquiries are made, and to promote discussion, which often tends to draw out much useful knowledge and suggest ideas.

Staircasing and Handrailing.—W. H. G.—These subjects will be dealt with in due course, but papers on them cannot appear at present. The carpenter who was to have written on his own method, and has handed me two diagrams with a very brief description, has quitted the neighbourhood to undertake a good job in one of the Western counties.

Oval Chuck.—A. S. H. L. (*Walworth*).—The small sketches sent will, I hope, make the oval chuck clear to all, but there are some details which can hardly be explained by sketches. (1) If the ordinary chucks come near the headstock casting, then the plate, Figs. 2 and 3, *must be thin enough to clear chuck*. (2) Upon this depends projection of A and B in Figs. 4 and 5; they must clear the headstock casting when revolving. (3) The screws in Figs. 2 and 3 grip the headstock and are to be kept clear of A and B. (4) Probably C will have to be filed off almost to the dotted lines to allow enough movement to take place. (5) The rectangular portion of the chuck is dovetailed to C as in sketch, Fig. 7, and must fit well. (6) In using chuck the tool must always cut at the same height from lathe bed, or every variation will cut an ellipse having greatest diameters not coincident, which is to be avoided.



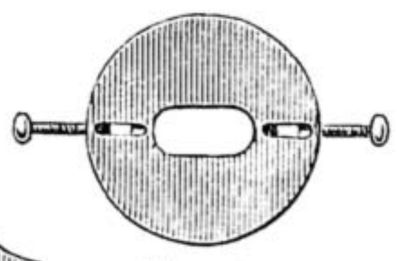


Fig. 2.

Fig. 3.

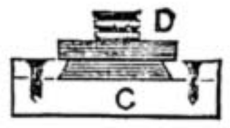


Fig. 7.

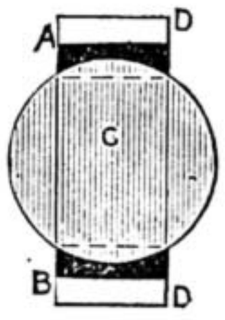


Fig. 4.

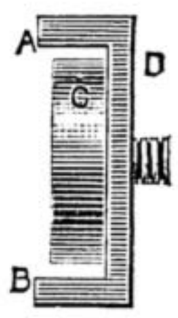


Fig. 5.

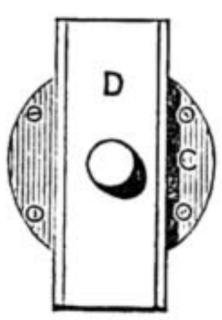


Fig. 6.

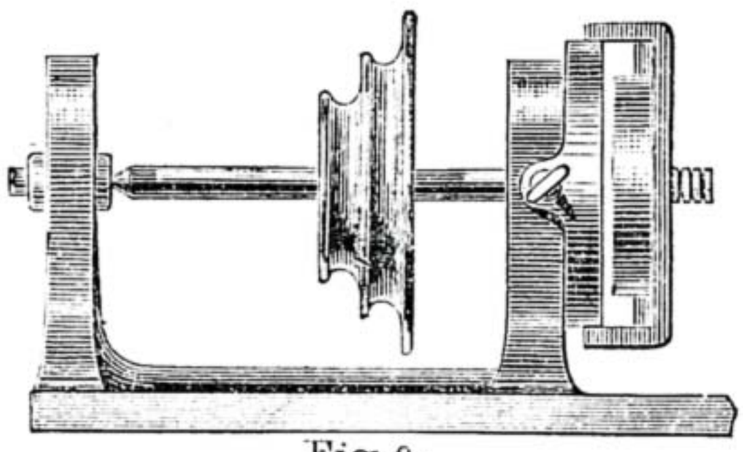


Fig. 8.

Oval Chuck Fittings.

As A. S. H. L. does not give size of lathe, this is not to scale. Fig. 1, face of headstock, showing two screw holes to fix plate. Fig. 2, plate to fix on headstock elevation. Fig. 3, section of plate; the face screws hold plate on headstock and edge screws adjust amount of eccentricity. Fig. 4, the chuck (back); the rectangular portion, D, slides accurately between guides on C, which is fitted to mandrel nose as usual. The stops, A and B, must be exactly the diameter of Fig. 2 apart. Fig. 5, edge view of same (references the same). Fig. 6, front of chuck having an exact copy of mandrel nose *fixed* in centre upon which ordinary chucks can be used. Fig. 8 is a sketch of the whole in position, showing how Fig. 2 fixes on headstock, and Fig. 5 is compelled to follow its eccentricity.—B. A. B.

Veneering, etc.—G. W. D. (*Ventnor*).—I cannot altogether agree with your remarks about the use of toothing plane and smoothing plane in connection with burr veneers. Certainly the former requires a little less care in use than the latter, but I do not know that that is any recommendation. If a man is of the "slap dash" order of humanity, perhaps he will do better to confine himself to the toothed plane; but if he is one who wants to turn out his work in first-rate style, and to become proficient in handling his tools, I think most people who know would prefer the smoothing plane. As you are practically acquainted with every detail of the cabinet line, you will, no doubt, understand the reasons without their being specially given. I wonder how you can have learned so much in a decade, for ten years is a very short time in which to have acquired a knowledge so extensive. I should like to see you, for one of the cleverest cabinet makers I know told me recently that though he has been at the bench for thirty-five years he is always finding that there is something fresh. With regard to the veneer hammer, all I can say is that different workers use different tools, and if you like one without iron by all means use it; but I think those who have used both sorts prefer one with an iron, as it is considered to work sweeter. As it is generally a home-made tool, veneering hammers are found in considerable variety, and I daresay you know that the hammer may be only a piece of board without any handle. Yours must have seen some service, since it was made more than half a century ago, and I do not wonder at your being attached to it, for I have a tool of about the same age which I would not willingly part with on account of its associations. I should like to ask if you have ever known an iron veneering hammer to stain the veneer when it has been properly used? I never have. I must confess I am rather surprised at any one of your experience asking for names of wholesale houses for such everyday articles as handles and for prices of glass. However, as I wish to be helpful to you, I may say that Grew and Bridge, Summer Row, Birmingham, supply the former, and that prices of the latter will be sent by any of the wholesale plate-glass houses if you write. Have you never heard of the "trade" papers? Sorry you object to the articles on hinges, but then everybody who reads WORK has not got your vast experience, and I am sure you will be pleased to learn that the instructions given have been much appreciated by many who are not so well informed. You will see articles some time about making a rule joint and butler's tray, but I hardly think that one showing how to use a veneering hammer is necessary. If you or any one else wants to know I shall be pleased to tell you, for the intention of all concerned is just to make WORK what you call it, viz., "a mine of usefulness in practice and theory, teaching hands to labour with greater skill in art, craft, and science, and at all times for both young and old a treasure for thought." I hope to hear from you again, for though we don't agree quite, interchange of opinion is beneficial for all workers.—D. A.

Handrailing.—W. G. H. (*Bury*).—I have much pleasure in acknowledging your letter. Handrailing will be treated in due course, but not on stereotyped lines, and when I am satisfied with papers sent in on the subject they will appear in print. This will be a sufficient answer to your letter.—ED.

Registration.—HERTFORD has evidently overlooked the information which he requires in WORK. He will find it in Vol. I., No. 37, page 578.—C. C. C.

Licensee under Patent.—LITTLE VULCAN, saddled as he is with his inactive licensee, is much to be commiserated. Unless by his agreement the licensee is bound under penalty to do a certain amount of business, we do not see what remedy the Patentee has, unless at Equity. But he will understand that we are giving no opinion on the law of the matter, and that it would be quite out of the province of WORK for us to do so. If he feels it necessary to act under his grievance he should consult some trustworthy solicitor. For such a book as he requires he had better apply to a law-stationer, or to a bookseller with a legal connection.—C. C. C.

Model Locomotives.—J. W. (*Bolton*).—Eventually we shall, but not yet a while, owing to pressure of other matters.

Monumental Brass Engravings.—MONUMENT (*Walton, Liverpool*) wishes to know the qualifications of a first-class monumental brass engraver. The main qualifications are equal skill with either the chisel or graver. But monumental work is not wanted every day, so that MONUMENT must be able to engrave other kinds of work found in the situation he wishes to fill. If the situation he desires is a brass manufacturer's, the work will be most varied, but pretty constant, and will be found to be rather hard work, which doubtless he is prepared for. With regard to his studies of Gothic ornament, he will find them useful. I recommend him to look through R. W. Billings, Esq.'s, books on the subject of "The Infinity of Geometric Design Exemplified," and "Power of Form as applied to Geometric Tracery." Also "Original Geometrical Designs," by D. R. Hay, Esq., as they include many splendid designs for church work. In conclusion, I would suggest that MONUMENT will hardly find the berth he wants in London; I think he would stand a better chance in Birmingham, that city being the centre of the brass trade, and from which place tons upon tons of ornamental brass work are sent away to be sold as London manufacture. The volumes referred to will, doubtless, be found in the reference department of the Liverpool Free Library.—N. M.

Handrailing—WORK Numbers.—R. A. (*Manningham*).—The handrailing has to wait. No number of WORK is out of print. Send us the name of any newsagent who says so.

Cabins.—PATERFAMILIAS.—Yes; I hope to have from a man who lives in Florida a description of the way in which houses are built there. A villa was discovered at Brading, Isle of Wight, a few years ago, which was fully described and illustrated in the *Illustrated News* and other pictorial papers, and perhaps a search in a file of *Illustrated London News* would bring this to light. I do not know of any detailed description of a *restored* ancient Roman villa.

Chair Cane.—A. B. C.—This is procurable in quantities of not less than ¼ lb. The price is for

"Crossing," 2s. 4d.; fine, 2s. 6d.; finest, 3s.; "setting," 3s. The quantity required for recaning half a dozen chairs would be about 1 lb. "crossing," ¼ lb. "setting." S. J. Eaton & Co., of 131, Great Titchfield Street, W., undertake to supply this article on remittance. But A. B. C. would do better to reseat his chairs with Austrian perforated bottoms costing about 6d. each, and devote his time to some pursuit more calculated to call forth his ingenuity. The Austrian perforated bottoms strengthen the framework, and can be screwed on in a few minutes.—F. D. B.

French Polishing.—J. F. (*Kelvinside*).—As you do not say of what wood your cabinet is made it is impossible to give you more than general directions, but you may possibly pick up a few hints which will be of use to you by reading answers which have already appeared in "Shop." If the wood is of a light colour and you wish to make it resemble some other, of course you must stain it, but if you only want to darken the present tint oiling may do. Wood, as a rule, does not require staining to give it a "respectable appearance," and whether it is improved or not is altogether a matter of taste. To polish, oil, fill in, body up, and finally spirit off, different kinds of wood, however, require different treatments, and as you do not say what kind you have used I am unable to help you further at present.—D. D.

Registration. — DIAMOND (*Falmouth*). — There are many patent agents who are reliable business men, and if we quoted a firm here it would appear that we were advertising them to our readers. If, however, you will send us a stamped and addressed envelope we will enclose to you the address of a patent agent who, we believe, will give you every satisfaction.—ED.

Delta Metal.—JACOBUS.—Delta metal is an alloy of copper combined with iron. Iron is dissolved in melted zinc till the zinc is saturated. This iron-zinc alloy is then used in proper proportions in making brass. To prevent oxidation in remelting and the resulting variation of quality, a small amount of phosphorus is added, in combination with copper. The density of delta metal is 8·4, its melting point 1800°. It can be worked hot or cold. It can be brazed. Cast in sand, it has a tenacity of about twenty-one tons per square inch. Forged at a dark red heat the tenacity is thirty-three or thirty-five tons per square inch. Hammered cold its tenacity is forty tons per square inch. It can, therefore, be made as tough as wrought-iron and as strong as steel. The writer has seen it used for the spindles of cranes for gunpowder factories, and he has also seen castings of wheels made from it. When required in sufficient quantities, these castings can be made in dies, and are then practically as cheap as the best gun-metal castings, while possessing the accuracy of machine-cut work. One great advantage of delta metal is that it resists corrosion better than iron, steel, or gun-metal, and is, therefore, serviceable for use in sea water, mines, and chemical works. It is used for nearly all purposes: propellers, cranks, Kingston valves, pump rods, plungers, valve spindles, bolts, nuts, studs, tubes, liners, condenser plates, cog wheels, ornamental work, and many others. It will be seen, therefore, that, according to the proportion of mixture and method of preparation adopted, delta metal possesses the advantages of cast, wrought-iron, and steel, without their disadvantages.—J.

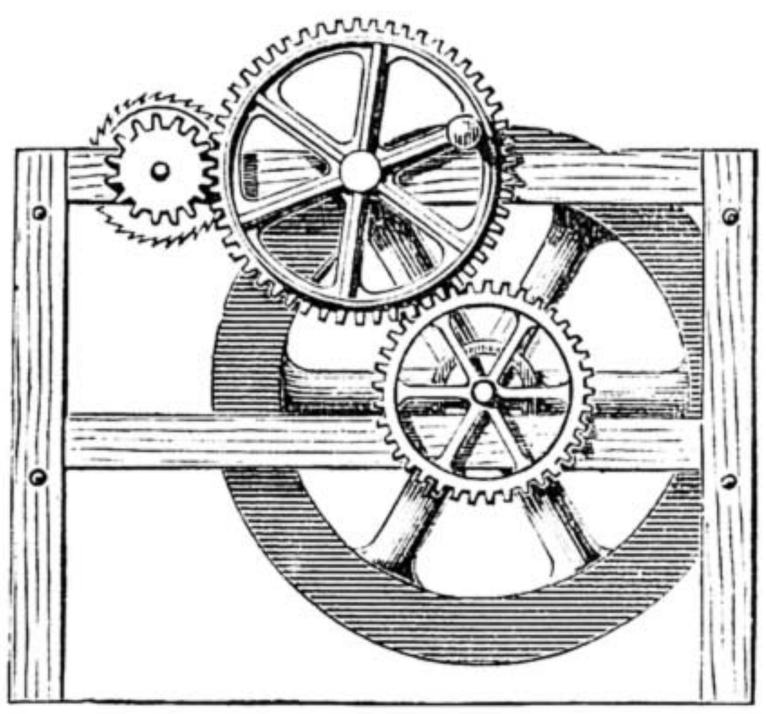
Forge Fan.—J. G. (*Wirksworth*).—It is not at all difficult to make a fan to work by hand, with blast powerful enough for a blacksmith's fire. You can make the vanes either square or tapering, concentric or eccentric. In a small fan I do not think there is anything gained by eccentricity, though it increases the efficiency of large fans. The vanes may measure ten or twelve inches across the tips, the openings in the sides four or five inches diameter. The size of the fly wheel need not be much more than the size of the fan casing, say, from twelve to fifteen inches diameter. Multiplying gear would have to be used to get up the necessary speed. I should not go to all this trouble, because you can buy a forge fitted with fan complete for from £2 to £4, or a forge fitted with a Roots blower for about £7.—J.

Plate Camera.—J. H. T. (*Herts*).—The description of parts, and instructions how to put them together, were as explanatory as it was possible to make them. Your best plan would be to carefully look at a camera already constructed—one by G. Hare, for instance. No doubt you then would gain more information than any amount of writing would convey. All these diagrams and instructions presuppose a certain amount of constructive and carpentering skill, without which it is useless to attempt putting work together. The firm you suggest has been recommended in these columns three or four times during the past year. No special names can be given to bits of brass-work that do not explain themselves, as hinges, screws, etc.; the use to which they are applied is their explanation.—E. D.

Plaster of Paris.—MOULDER (*St. John's Wood*).—We know of no means by which plaster can be made to set a second time, or even a first time if it has been long exposed to the air, unless, possibly, by re-burning, which would cost as much as new plaster. The only use to which old plaster can be put is by using lumps of it to strengthen the outside of moulds, and thus save new. But even this is scarcely worth the doing, when one considers the very small cost of the coarse plaster used for backing up.—M. M.

Drilling China.—W. H. S. (*Willaston*).—You will find no difficulty in repairing your pitcher, providing it is not broken into too many pieces. The drills and diamond bits can be bought at several places in London, but I can strongly recommend Mr. E. Clarkson, Tower Street, King's Lynn, or you can make a drill for yourself, especially if you have a lathe. If you would like to do so, let me know through "Shop," and I will give you full directions and drawings. Drill your holes as deep as the thickness of the pitcher will allow. Take a piece of brass wire, flatten one side with a file or old knife, turn down one end with a pair of nippers, place this in one of the holes, and carefully mark and then turn down the other end. When you have made all the holes and rivets, proceed to fix the latter in their proper holes, taking care to see that each fits tightly; then fill up with plaster of Paris mixed with water.—M. D. W.

A Hand Circular Saw Bench.—E. C. M. (*London, W.*).—Frame of deal 4½ by 3, the two sides being mortised through, the end rails slightly tenoned and bolts close under rails. The height of bench 3 ft. 6 in. Driving wheel is to gear into fly wheel spindle and also into saw spindle, both of which are brought through frame to carry a cog wheel for that purpose. The fly wheel would then revolve



Hand Circular Saw Bench.

rapidly (unless fly wheels do this they are of little use). The saw revolves still more rapidly, and being geared to driving wheel slip, the bane of saw benches, is prevented. This machine would take some starting, but would work well if the three cog wheels were well fitted. The fault of all manual power machines driven by belts is either slip, or a tight belt causing great friction and strain. Although I do not think it within the scope of WORK, I will try and ascertain prices of fittings. Fuller description would be too long for "Shop."—B. A. B.

Door Fastener.—J. G. (*Brimpsfield*).—You do not give sufficient particulars of the fastening to enable me to judge who would be the best firm to recommend you to. In any case, it would be advisable to get a provisional protection for it before showing the specifications to any maker in the trade.—T. W.

Bamboo Purchasing.—C. C. (*Birmingham*).—S. J. Eaton & Co., 3, New Inn Yard, Tottenham Court Road, W., are prepared to supply all the canes necessary for making bamboo furniture or other work at prices *pro rata* of the quantities ordered. If C. C. will state what quantities he requires and what thicknesses, S. J. E. and Co. will send him some at the lowest market prices. It should be understood that the prices vary very much according as the market may be bare or glutted. Now, and for twelve-months past, prices have ruled high consequent upon the greater demand caused by the increasing favour shown by the public to this elegant and useful branch of manufacture. A few leading items of information as to sizes and prices may be conveyed here as a general guide. Bamboos for furniture are imported and sold in lengths of 6 ft. 6 in. without roots, and in thicknesses varying in diameter from ¾ in. to 1¾ in., and rising in price per stick from 7½d. to 11d. These are fairly equal in diameter from end to end. If they taper the cost is slightly decreased. Long *tapering* sticks 13 ft. by 1½ in., 1¾ in. diameter, may be had for 1s. 9d. each. Also 4 ft. lengths with roots from ⅝ to ¾ diameter at 3½d. and 4½d. each, and ½ in. "grec" for inserting transversely, etc., at from 1½d. to 2½d. each. A reduction of from 5 per cent. to 10 per cent. is made when a dozen of a sort is taken. The fine white matting, best quality, 1s. 1d. per yard. Whangees: these pale straw-coloured canes with the knots at nearly equal distances, now so much in vogue for screens, frames, etc., mounted on a timber framework, are costly. Thick, 2 ft. 6 in. long, and thin, 3 ft. long, are 5d. each; 4 ft. 6 in. long are 8½d. each. They are not equal but tapering. Cane, best white, 1s. 1d. per lb. These are the pith peeled, and uniform in thickness. Rattans, thick, 8d. per lb. These are unpeeled. Black varnished, 8 ft. 6 in. in length. These range progressively through 17 gauges from ¼ in. to ⅝ in. diameter, and in price from 1s. 9d. to 8s. 6d. per dozen. Tonkins: these are the commonest kind, and resemble somewhat our reeds in appearance. They are, however, useful for certain purposes, particularly in the conservatory and garden. Many light and pretty articles may be contrived with them, and they are cheap. In length from 42 to 46 in., and varying in diameter from ⅛ to ⅝ in.; Various in colour and marking, some even in diameter, others tapering from one end to the other; the price is, mixed, for 100, 2s. 6d.; selected, for 100, 3s. Where necessary an extra charge is made for packing, but all these articles, nearly, can be sent tied. S. J. Eaton & Co. will furnish any desired information on receipt of stamped and directed envelope.—F. F. B. B.

Aluminium, etc.—E. G. (*Bolton*).—You can get aluminium at Johnson, Matthey & Co., Hatton Garden, E. C., for 70s. per lb., or 4s. 6d. per oz. The impurities of commercial aluminium are chiefly silicon and iron, for which you can test as follows:—Dissolve a piece of the metal (not larger than a threepenny piece) in dilute hydrochloric (muriatic) acid, and one or two drops of nitric acid, in a porcelain dish; evaporate to dryness and heat gently at a temperature a little above that of boiling water until it no longer smells of acid. Now add a little hydrochloric acid and boiling water and warm; all the aluminium and iron will dissolve, leaving the silicon as silica or sand, which can be filtered off. To filtrate, add a solution of potassium ferrocyanide (yellow prussiate of potash), which will form a blue coloration or precipitate of Prussian blue if iron be present. Or, instead of this, add to the filtrate from the sand a solution of potassium sulphocyanate, which gives a blood-red coloration with iron. These tests only show the presence or absence of silicon and iron, a more elaborate process being necessary for their estimation, which, however, I shall be pleased to describe if you require it. Aluminium bronze is made by melting 90 parts of copper in a crucible made of plumbago, or some other highly-refractory material, and then adding 10 parts of aluminium, the two metals uniting with the evolution of intense heat. With these proportions the maximum degree of hardness, strength, and tenacity is obtained, a larger proportion of aluminium making the alloy weak and brittle.—F. B. C.

Electro-plating Model Dynamo.—W. F (*Edinburgh*). — There are few parts of a model dynamo that can be electro-plated without doing injury to the machine in the way of impairing its usefulness. You might nickel-plate the binding-screws, connectors, brass or gun-metal bearings and fittings, but I should not advise you to plate the ironwork of the machine. This is best ornamented with paint, varnish, or coloured lacquer. A very pretty contrast is effected by coating the exposed parts of the iron with black japan, the wires with sealing-wax varnish, the brass bearings with gold lacquer, and nickel-plating the terminals and brush holders. The steel spindle should be left bright. Instructions in silver- and nickel-plating will be given in WORK in due time. The article on "The Dulcimer and How to Make it" was published in No. 31, Vol. I., page 490. When you write a letter to us again, do not seek to evade the letter rate of postage, but prepay the postage with a penny stamp. Letters may not be sent for a half-penny, even when loosely folded and not sealed.—G. E. B.

Winding Dynamos.—PERPLEXED ONE (*London, S.E.*).—In a series-wound machine the field magnet coils are connected in series with the armature coils, the work being done in the outer circuit. The magnetism in the fields, therefore, varies as the resistance of the circuit, being less when the resistance is high than when it is low. In a shunt-wound machine the field magnet coils have their resistance proportioned to that of the work to be done in the outer circuit, and the coils are connected by a shunt through the brushes as well as to the terminals of the machine. There are, therefore, two paths open to the armature current: one through the F.M. coils, and the other through the work to be done in the outer circuit. When the resistance in the outer circuit is lower than that of the F.M. coils and shunt, more current goes by way of the outer circuit than goes round the coils, and the intensity of the magnetic field is reduced in consequence. On the other hand, when the resistance of the outer circuit is higher than that of the F.M. coils and shunt, more current goes by way of the coils, and this raises the magnetic intensity of the fields. The effect of this is to raise the potential of the current, and enable it to overcome

the extra resistance. In a compound-wound machine the F.M. coils are of thick wire, connected in series with the armature coil. Over these thick coils, or side by side with them, is wound a very long thin wire of high resistance. This is connected in shunt with the armature coils, consequently a certain portion of the armature current is always passing around the fields, maintaining them at a constant magnetic intensity, and giving to the machine a constant potential. Each style of winding has its own peculiar advantages, adapting it to the kind of work to be done by the machine. Carbons are soft-cored to give them additional burning qualities, and increase the brilliance and steadiness of their light.—G. E. B.

Moulding Composition.—J. B. C. (*Worstead*).—This material can be obtained of the London Rubber Printing Co., 33, Cheapside, London; or of Mr. Lindner, 170, Fleet Street, London.—QUI VIVE.

Engravers' Wax.—INVICTA (*Stepney, E.*) wishes to know where he can obtain engravers' wax for filling in the lettering of brass plates, having been unable to find an oilman who sold the article. Perhaps INVICTA did not try in the right direction. The most likely shops would be amongst the engravers' and printers' district—Farringdon Street, Holborn, and Farringdon Road to Clerkenwell. But I give a few names of makers of sealing-wax, some of which will, no doubt, make engravers' wax; and before he goes further into the matter, I beg to direct his attention to the third column of page 596 of WORK, December 7th, 1889:—H. Allen, 17, Ironmonger Row, E.C.; Waterson & Sons, 9, Rose Street, Newgate Street, E.C.; G. Dove, 13, Southgate Grove, Southgate Road, N.; J. Finlayson, 144, Bermondsey Street, S.E.; G. Owen, 214, Cable Street, E.; P. Hinds, 37, Ashford Street, Hoxton, N.—N. M.

Book on the Magic Lantern.—H. S. (*Uxbridge*).—The Magic Lantern, by Hepworth, price 1s., published by Chatto & Windus, 214, Piccadilly, London.—F. J. C.

Preparation of Brass Plates for Engraving.—To. Po. (*London, W.*) wishes to learn the process of truing up brass plates as from the metal dealers, and I have to say that unless he is an expert flat hammerer, he will fill his plates with hammer marks, which will give him unlimited trouble to remove; and, like myself, will, no doubt, consider a shilling or so well spent by having the plates flattened by a man who is up to his work. However, To. Po.'s intention is laudable enough, so I will give him the required information. He will require a "stake," that is, a flat steel head about two inch diameter firmly fixed in a cylinder of wood, which is driven tightly into the ground, a silversmiths' flat hammer, and a straightedge. Place the plate upon the stake, and, commencing at the outside edge, work towards the centre, trying now and then its truthfulness with the straightedge. Considerable judgment must be exercised as to the general condition of the plate before hammering, as it often happens that a few blows in the right places will set true a plate in the course of a few minutes. Or he may procure a pair of heavy planishers, with which he may accomplish his purpose most easily. After the plate is made flat, put it in the vice with clams, take a twelve-inch flat safe edge file (keep this file for brass-work only), not too coarse a cut, and true up the edges (and bevel if desired). Next drill and countersink the holes at the corners. Now take a large piece of pumice-stone with water and scour away until something like a face is obtained, and finish with water of Ayr stone, now called "Tam o' Shanter" hone.—N. M.

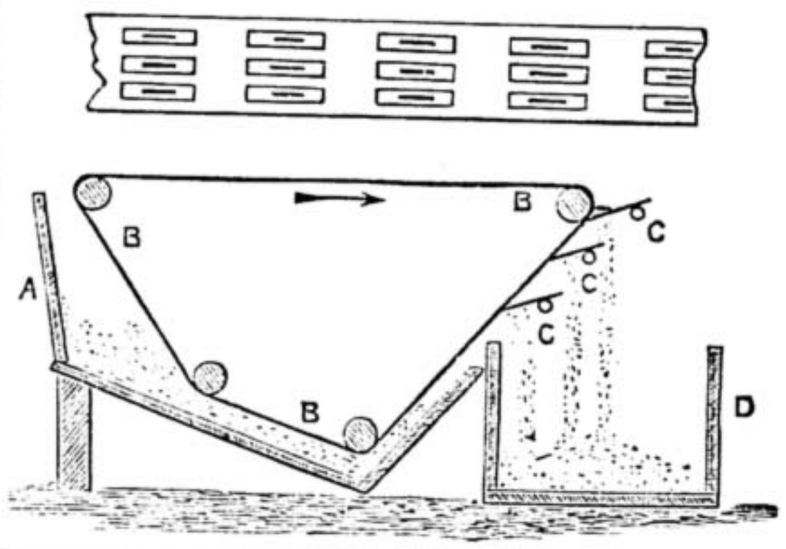
WORK Back Numbers.—S. E. A. (*Hooley Hill*).—All the back numbers of WORK, price one penny each, are still in print and can be had by order of any bookseller, or direct from the publishers by post for three halfpence each.

Air-Pump.—W. F. H. (*Dartford*).—I should think a double acting pump with a piston packed with metal rings would suit your purpose, of course it must be well lubricated. The valves may be ordinary light stalk valves with indiarubber seats to prevent concussion; but to advise you fully I should want to know the quantity of air required per minute, for in designing such a pump speed is a most important factor. The temperature of the air will rise very considerably during compression, perhaps higher than is consistent with the use of indiarubber if the speed is very great, then a different form of valve must be used. If you want the air at 30 lbs. *when cold*, you will be pumping against a higher pressure. If you send full particulars I can give you a design.—F. C.

Umbrella Patent.—J. L. (*Wandsworth*).—Your invention is undoubtedly good and useful, and should be a "blessing to housekeepers." The only question is if the capacity of B is sufficient, but this may be enlarged. In patenting this you should deposit a "complete" Specification (£4), because, until that is accepted and your patent sealed you cannot proceed against imitators, and so if you put your invention upon the market under "Provisional" protection only, other people can make and sell the article without hindrance, until you get your seal, and then you can only recover for *future infringements*. Therefore first perfect your invention and then prepare a carefully drawn Specification for deposit.—F. C.

Choice of a Profession.—J. L. (*Wandsworth*).—Unless you have a leading position an engineering draughtsman's position is not lucrative. There are many men walking about, who have been apprenticed or articled to the profession, who would accept £2 a week willingly, and for £3 3s. a week many of the practising "Civil Engineers" nowadays expect to get men competent to *design machinery and structural ironwork*, in fact not merely draughtsmen but engineers. If you have friends or influence to force you into a good position that is another matter. One reason why there are not so many chances as in former years is that many of the civil engineers practically leave the designing of the work to the contractors, giving only outlines, they themselves doing the financing and company-forming part of the business. You would not be able to do much as a draughtsman until you have had some practical experience on works or in the shops, and this means giving up time, which at your age is a serious thing to contemplate, unless you have private means. Of course if you have the influence alluded to competence does not matter much, as a subordinate would probably be put to do the work for which you would take the credit. This advice is the result of over thirty years observation in close connection with all branches of the profession. Some men certainly have risen from nothing to the highest positions, but they have begun young in the shops when there was much to invent and before technical education became so widely spread as to put the great majority on a level in point of knowledge. If you are making a living out of clerkship I should advise you to cultivate that for a subsistence, and keep engineering for a hobby.—F. C.

Electro Magnet for Cleaning Brass Filings.—BRASS (*Wolverhampton*).—If I had the job to clean the "swarf" from iron filings, I should try what could be done by means of a magnetic separator, and thus avoid the expense of making a dynamo and a magnetic machine such as you describe. My idea is expressed in the accompanying sketch, which shows a magnetic separator in section. The two top rollers must be made to revolve and thus



Magnetic Separator for Iron and Brass Filings: section.

A, Box of swarf or mixed filings. B B B, Endless magnetic belt passing around rollers. C C C, Brushes of bass fibre. D, Box for iron filings swept off by brushes. M, Belt of webbing, with magnets sewn on to surface.

carry the endless belt round. The two lower rollers of wood are fixed in the box of swarf. This box is inclined as shown to facilitate the descent of the filings by gravitation, and counteract the effect of the belt's motion on them. The belt should be of webbing, or a cotton belt will do, and the permanent magnets sewn on to this with tough brass or copper wire. The magnets may be 2½ in. to 3 in. lengths of crinoline steel, magnetised. The brushes may be made of bass fibre, and these brush off the iron filings, which then fall in a box as shown in the diagram.—G. E. B.

Boring Organ Soundboards.—W. J.—(*Bedford*).—The sizes of the holes in the soundboards depend entirely on the scale and power of the pipes to be blown. For an ordinary chamber organ stopt diapason the holes should be about as follows: C C, 1 in.; tenor C, ⅜ in.; top G, ⅛ in. Open diapason: C C, ½ in.; tenor C, ¾ in.; top G, ⅛ in. Smaller scaled stops may be a trifle less, but roughly take as a guide the diameter of the open diapason pipes, and make the holes for pipes of the *same diameter* the same size as for those pipes. For the larger pipes on the soundboard it is usual to bore two holes side by side, and take out the intervening wood, thus forming an oblong hole. A slip of thin mahogany is glued over this opening in the stock board and a round hole bored in it to receive the pipe foot. By this method a hole is made large enough to admit plenty of wind without its being wider than the channel over which it is bored. The latter part of your query is not intelligible. What do you mean by "split" pallets?—M. W.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—H. H. W (*Pimlico*); S. G. N. (*Manchester*); NO FAD; S. S. S.; H. S. (*Chesterfield*); L. A. C. (*Wigan*); INCUBATOR; H. A. O (*London, N.*); E. H. M. (*Portsmouth*); R. T. (*Durham*); A NEW SUBSCRIBER; JACK OF ALL TRADES; J. A. (*West End*); T. J. W. (*Stoke Newington*); ACID; J. B. (*Bradford*); E. T. (*London, S.E.*); H. L.; ORGAN BUILDER; A. B. (*Ashford*); E. J. (*Leith*); G. W. W. (*Surrey*); G. R. G. (*Ennis*); T. P. (*Islington, N.*); R. D.; S. G. H. (*Oldham*); W. S. T. (*Blairgowrie*); A. B. F.; INDEX; J. M. (*Glasgow*); J. S. F. (*Swindon*); W. H. N. (*Birmingham*); W. C. (*Peterhead*); BRASS; J. M. (*Durris*); OLCAR; IRON GIRDER; A CONSTANT READER; BAZAAR; D. M. (*Glasgow*); H. V. A. (*Newton Abbot*); G. D (*Woolwich*); C. H. (*Finsbury*); F. G. H. B. (*Cradley, Staffs.*); ENQUIRER (*Jersey*); W. S. (*Watford*); SPARROWBILL; S. B. (*Nottingham*).

Trade Notes and Memoranda.

THE average daily water supply delivered to London from the Thames during February last was 79,095,922 gallons; from the Lea, 58,487,010 gallons; from springs and wells, 21,941,414 gallons; from ponds at Hampstead and Highgate, 327,352 gallons. The last is used for non-domestic purposes only. The daily total was therefore 159,851,698 gallons for a population aggregating 5,631,229, representing a daily consumption per head of 28·38 gallons for all purposes. The relative proportions of the supplies from the above various sources were as follows:—From the Thames 49·48 per cent.; from the Lea, 36·59 per cent; from springs and wells, 13·73 per cent; from ponds, 0·20 per cent.

AN important point in railway practice to which considerable attention has been given in the United States, is that of electric lamps for engine head-lights. Mr. G. H. Prescott, superintendent of the Vandalia Works, is said to have pronounced the electric head-light that they have been testing on two of their engines for three months a perfect success. It throws the light from half to three-quarters of a mile ahead—far enough to stop a train running sixty miles an hour in time to prevent an accident. Another advantage the light has is that the light is thrown directly in front of the locomotive, and does not illuminate to any extent on either side of the track. Twelve of the Vandalia engines will be equipped with this light.

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