WORK

An Illustrated Journal of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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WORK WORLD.

ORMOLU workers, silversmiths, jewellers, and all others who may have to mount up beautiful Algerian onyx, will do well not to be deceived by its appearance into thinking it is as hard and as tough as onyx is generally. It is not. It can be filed and drilled quite easily, but will not stand any more rough usage than will alabaster—of which it is a variety.

* *

We may, perhaps, dare to confess our admiration for the beauty of colour and effect to be found in the humble ribbon jaspers and agates. These pebbles, as they are mostly termed, will often well repay examination, and they would receive greater attention if their smaller but more attractive relations, the diamond, ruby, and sapphire, did not monopolise all the fashionable taste.

* *

Architects—and there are many—who have no practical knowledge, frequently specify scantlings of timber which are so far different from the usual imported sorts of sawn timbers as to necessitate a large amount of extra cutting, waste, and worry. Surely it is not too much to ask that professional men should master such practical details as these; and that the Royal Institution of British Architects should include this subject in their examinations is not an unreasonable suggestion.

* *

Wire glass is the name of a new article on the Dresden market. It is indifferent to the most abrupt changes of temperature, and will even withstand open fire. The glass is especially adapted for skylights, since the powerful resisting qualities of the material enables the usual wire protectors to be dispensed with. It cannot be cut by the diamond save with great force, nor can it be broken without causing considerable noise. For these reasons wire glass is claimed to be, in a measure, burglar-proof.

* *

The Irish Industries Association is doing really good work. It is making all arrangements for an exhibition of laces, linens, embroidery, woollen, and other industries, at the World's Fair, Chicago. Loans have been granted by the Association with the object of promoting the lace and crochet industries as follows:—To the Lace School, Carmelite Convent, New Ross, £50; to the Torchon lace centre, Laccafid, £40; to the Bath and Shirley Lace School, £50. Other sums have been devoted as prizes to individual workers and to teachers for the furtherance of technical education in design.

* *

Masonry executed in very cold weather is not well thought of, but it appears that in Norway building operations are successfully carried on at temperatures as low as 2° Fahr., and that work compares favourably with summer work. The Christiania builders maintain that it is superior. The secret of successful work under these conditions is the use of unslaked lime. The mortar is mixed in small quantities at a time, being made up immediately before use; and it must be put in place before it loses the heat due to the slaking of the lime. The lower the temperature, the larger the quantity of lime required.

* *

The work of constructing the Lancashire, Derbyshire, and East Coast Railway has been commenced without any undue delay. The contract for the central section of the railway has already been let. Huts for the accommodation of the navvies have been erected at Bolsover, and some of the plant used in constructing the Manchester Ship Canal has been obtained. At Monsal Dale, a secluded valley in Derbyshire, the line will be carried on a viaduct 272 ft. in height—the loftiest in the Kingdom. The noted viaduct near Louisville, United States, is 6 ft. lower than this. It was erected in ninety-six days, and has safely borne the wear and tear of traffic since 1877.

* *

The present method of producing sheet steel for the manufacture of tin-plates is one involving melting in the converter, casting into ingots, reheating, and compression or slabbing by means of hydraulic compressors and passing through the rolling mill. Sir H. Bessemer proposes to dispense with these intermediate processes, and to pass the fluid metal between water-chilled rollers, securing homogeneity and toughness equal or superior to that produced by the present roundabout method. The process was introduced some years ago, but in a less perfected form, and the tin-plate makers did not care to take it up, but it is probable that in the face of increasing American and other competition they will now be more inclined to give it attention.

* *

The Birmingham Canal Navigation Company will apply to the Board of Trade for power to alter their rates and tolls, by which freightage will in many cases be more than doubled. Here the great railway and canal companies are practically one, as for the greater part of their distances both run side by side. Traders who were looking forward to water carriage as a relief from excessive railway rates had apparently overlooked this fact. Not so the railway company. Such arbitrary action not only increases the cost of coal to the householder and traders, but seriously cripples trade. It ought surely to lead to concerted action on the part of all interested classes, and hasten the day when English railways shall be more directly under State control—*i.e.*, for the good of the country, and not for the benefit of a few private investors and capitalists.

* *

The usual form of drawing-board for stretching the paper consists of a panel let into a frame, but if a larger size than one easily made with a panel be required, it can be prepared in the following manner. The ordinary drawing-board, with the slabs secured to battens at the back, has made in it a groove of square section—say of $\frac{1}{4}$ to $\frac{1}{2}$ in. side, according to size—running round its face, just inside the edge. Into this groove four slips of wood, like the square rules so common in French schools and offices, fit easily. The paper is wetted in the usual manner, and, when fully expanded, is attached to the board by means of the slips being forced into the grooves, carrying with them the edges of the paper. When it is required to release the drawing, all that is necessary is to push out the slips from the back by a pencil thrust into holes, several of which are bored from the bottom of the grooves right through to the back. To accommodate different thicknesses of paper, the slips may be made to fit very easily in the grooves, and be retained in place by slight plate springs.

Oldham is to have the electric light instead of gas. As a rule the northern towns are backward in electric progress compared with some of the southern towns, several of which have long had the new light.

HOW TO MAKE A PORTABLE HOT-AIR OR VAPOUR BATH.

BY R. A.

Introductory Remarks. — This article is written mainly in response to a correspondent who wished for instructions to make the above-mentioned article; therefore, though I shall give all necessary particulars, yet it will be in a more terse form than is usually adopted: a slavish following of ideas is not required. I will give a general description, with details where necessary, and the intelligent reader will be at liberty to alter dimensions and modify or add to arrangements as may suit his individual requirements. With these remarks, I will commence to describe

The Case.—This can be of any wood the maker chooses; good deal will do as well as anything, and is easy to work. It is in shape a rectangular box, higher at the back than the front. Fig. 1 is a general view of it, with dimensions as follows: Size at bottom, 3 ft. 6 in. by 2 ft. 6 in.; height at back, 3 ft. 10 in.; height in front, 2 ft. 9 in. In the front are two doors, A, A; on the top are another pair of doors or lids, B, B, hinged to the sides of the box. These lids have a semicircular piece cut out of each side, and nicely smoothed and rounded off; this is where the head of the sitter comes through. I might mention in passing that a friend of mine suggested a sloping reading-desk to be fixed at the lower part of one of the doors, so that the bather could place his WORK upon it, and peruse it whilst enjoying the pleasures of the bath. I refrain, however, from adding any such refinement to my plan, fearing that it might, if adopted, cause the user of it to stay longer in the bath than would be good for him. After this warning, anyone can add the desk who wishes to do so.

It is not my intention to give detailed instructions of the making of the case, and will leave it to the judgment and taste of the reader whether the sides and doors shall be plain or panelled, and other little details of making. I would advise that no fastenings of any kind be used to the doors, in case the occupant wishes to step from the bath very quickly. A stop can be placed to keep the front doors from going inwards, or they can be hung low enough for the door to close against the bottom, which will answer the same purpose. The two top doors should project or overlap the front doors an inch or two, and a strip of wood nailed on so that when they are shut they will keep the front doors closed. The occupant of the bath, by simply pushing the top covers and pressing forward the front doors, has at once free passage from it in an instant. The hinges for the top covers should be those known as stop hinges, so that the cover will only open to the extent of a right angle to the position they are in when closed; or, instead of this, cords or leather straps may be used to attain the same object—viz., to prevent them falling right back when thrown up by the occupant. I think this description will suffice for the case, so we will now proceed to the

Internal Arrangements.—First, the stool or seat. This should be 20 in. or 22 in. high; an ordinary chair is hardly high enough to admit of the apparatus we shall require to fit up beneath it. I should make it square, with four plain legs without bars of any kind across, and the seat about 12 in. square. It could have a back or not, at the option of the maker, and a few holes might be bored in the seat. The next thing to consider is the heating and vaporising arrangements. For the lamp, I should advise a Hinks' duplex burner, fitted to a tin tank about 9 in. square by 2 in. deep. Get one of the kind that has an extinguishing lever, which will be useful. We now come to the most important part of all—viz., the vaporising arrangement. I have thought of, and rejected, several plans, but at last I have decided to recommend a method and apparatus that will act as a reservoir for the water, and at the same time conduct away the heat from the lamp. Reference to Fig. 2 will assist in the explanation which I will now give. A is an elbow and flange of 2 in. pipe, to be fixed to the back of the case; B is the reservoir. It consists of an inverted funnel with a deep band round the outside; this you will have to get made—any tinsmith will understand what you mean. The shaded part shows the water, which, of

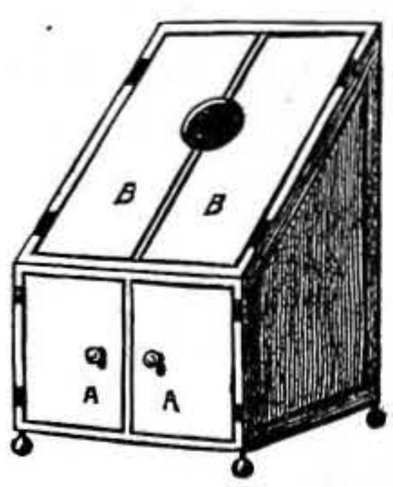


Fig. 1

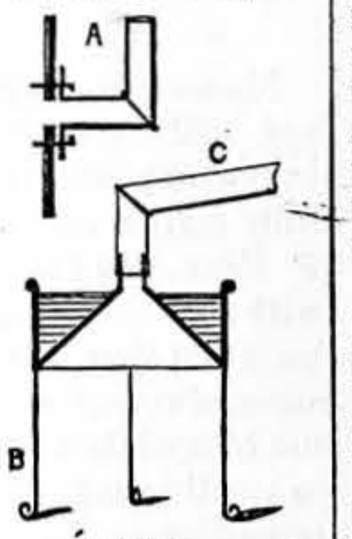


Fig. 2

Portable Vapour Bath. Fig. 1.—General View of Case. Fig. 2.—Water Holder—A, Heat Pipe; B, Reservoir; C, Elbow.

course, would be all round. It must be made—or, rather, it had better be made—of copper. Three legs should be riveted on, of sufficient height to allow the lamp to be placed beneath it. C is an elbow to slip on the funnel top and into the pipe in the back of the case. To work the arrangements, you have simply to place the lighted lamp upon the floor, place the funnel and pipe in position, fill the funnel nearly full of water (hot, of course), place the stool over the apparatus, and by the time you are ready for the bath it will be ready for you. I need not take up further space by detailing means whereby the heat may be increased or lessened: they will suggest themselves to the ingenious operator. I will just mention that a cord can be attached to the extinguishing lever, so as to enable the sitter to put it out at once should he wish to do so. This cord would have to be run through an eye *below* the lever, as the levers are made to pull down. A talc spreader on the top of the chimney would be an advantage, as it would diffuse the heat to the sides of the funnel better. It would also be better if the chimney of the lamp were made of copper, with a talc front, as it could be a little shorter, which would be an advantage, and the expense of breakage would be saved. These copper chimneys can be obtained to order from any ironmonger. This concludes my instructions and suggestions. I trust they will be of service, not only to the original querist, but to all WORK readers.

BOOT AND SHOE MAKING.

BY WILLIAM GREENFIELD.

BUYING THE LASTS, AND FITTING THEM UP TO THE MEASURE OF THE FOOT.

Buying the Lasts.—It has been said, "The first thing in a boot is the last," and in writing the following articles upon the above subject it will be seen I have thought it best to deal with the last first.

In making a pair of boots or shoes, the lasts are the one thing that cannot be done without. German made lasts can be got now at nearly all leather and grindery shops.* Prices range from 9d. to 2s. per pair, according to whether they are wanted for the purpose of ladies', gent's, or children's boots. Many of these lasts are not of good shape, but if you buy a pair of four or five fitting,† there is nearly always enough stuff of which to make a good pair of lasts.

The dotted lines in Fig. 1 indicate the faulty parts of these lasts; but these faults, with a little skill and trouble, and a good rasp, can soon be set right. In doing this the plan of the bottom of the lasts should be shaped as in Fig. 2. This will save the trouble and expense of going to the last maker and having a pair made, and you will really get a good shape, for they can be got to the shape of your foot as well by yourself as anyone, and then you not only take the credit of making the boot, but also of fitting it. This will give you courage to try a pair for anyone else.

Fig. 1, minus the dotted lines, shows the proper shape of a last—being not too round at the bottom (A), nor projecting too much at B or C, for a round bottom will not only make the toe turn up, but will, while the boot is being worn, cause undue strain on certain parts of the front (or vamp). If there is too much stuff at B it will tend to throw the heel of the boot too far back, and also make it higher at the breast (D) than at the back, as shown by the two lines B and D, whereas, if taken off, the heel can be built in proportion all round, as shown by D and E. The disadvantage of a last being too prominent at the place C is that it makes the toe of the top an exceedingly difficult thing to last in.

In Fig. 2 it will be seen that there are three shapes of toes, but this should make no difference in the construction of the inside of the last; for, no matter what the shape of the last is to be, room must be given for the great toe, or a bunion will be the result.

The plan of the bottom of the last (Fig. 2) is (it will be seen by comparison) designed to suit the requirements of the foot, as it is drawn on the sheet of paper (Fig. 3).

To take the measure of the foot, place a sheet of paper on the floor, or any smooth surface. Then let the person stand full weight upon it, and draw an outline of the foot on the paper, being careful to hold the pencil quite perpendicularly at the toe and heel (C and D, Fig. 3). Then draw a second and third line as A and B, to give the curvature of the waist. It is customary then to take the length of the foot with a size-stick‡, but as this, and the measuring

* "Grindery" is the term used for such things as hemp, flax, wax, bristles (hog's hairs), rivets, pegs, heelball, etc.

† "Fitting" is the girth measurement of the joint and instep.

‡ A size-stick is a tool in the form of a rule. It has an upright at right angles, which is a fixture at one end, and another to slide up and down, which (as the stick is pressed against the sole of the foot and the fixed upright at the back of the heel) can be set *ad libitum* to the top of the toe, to indicate the length on the stick.

of the last, is the only use for the tool, I do not think it necessary to do more than give a description of it, as in the footnote.

Fig. 4 represents a penny tape measure (shoemaker's); it has inches on one side, and sizes (three to an inch) on the other. A 5's last measures just 10 in. Before buying the lasts, take the length of the draft from C to D (Fig. 3) with this tape, and, supposing it to measure size 5, you will need a last size 7. Had the length been taken with a size-stick off the ground, it would only have drawn size 4, but you would have needed a 7's just the same. This proves that the joints in the toes elongate in walking, and shows the urgent necessity of having the boot or shoe longer than the foot. When the size of the foot has been taken, as shown by Fig. 5, it should be put upon the drawing. The next measure to be taken is the joint. This should be done with the inch side of the tape. It must encircle the whole of the joint, and be only drawn just tight. For this measurement we must pass under the foot at E E (Fig. 3), and over the great toe joint and knuckle of the little toe, as A B (Fig. 5), this measuring 8 in., which we then place on the draft, and so on with each measure until all is taken. Now take the second joint, passing the larger parts of the ball of the foot as C D (Fig. 5), and next the instep, letting the tape pass under the hollow of the inside waist E (Fig. 5), across the bone F (Fig. 3), and instep bone F (Fig. 5). Then the heel measure is taken, passing round the extremity of heel (G), under the ankle (H), and across the throat of the foot (I). The leg measure is taken about $1\frac{1}{2}$ in. above the ankle bone (H), round the leg from J to J.

In fitting up the last to the measure taken, if it be for a gentleman's ordinary foot, one not too bony or very fat, and the boots are wanted to fit well and not too easy, then let the last be exactly the same measure as that of the foot. If it be for a lady's, it will need to be about half a size* smaller than the measure at the joints and instep, unless the boots are wanted very easy. If wanted easy for gentleman's boots, make them about half a size over the measure. For all children's work about a quarter over the measure must be taken.

If you can get an old shoe that is of no more use for wear it will be found to be one of the safest guides to a fit. You can fit the last up to it—that is, if the shape of the toe you want to make is not wider than the old shoe; if it is, you must cut the toe of the shoe right round, to admit of its spreading out to the shape of the last you are about to put in. By fitting a new last into an old shoe, you can soon see if it is of the size and the shape to suit your tread. If it wants a piece on anywhere, for a corn or bunion, this can soon be added by means of pegging on a piece of leather. Should you want such a piece the exact spot is very readily found while the last is in the shoe, for, if it is deficient at any particular part, the leather of the old shoe will be baggy. Then an awl hole, pierced through it into the last, will show exactly the place where you want the room and where you will need to make the last larger.

Should the last be a little too small in the fitting (girth), or you should want to make another pair of boots a little larger to allow for a thicker pair of stockings, or even a pair for anyone with a little larger foot than your own, you will find it very handy to have a set of ordinary fittings. These are best made from the softest part of crop belly, which is just the flank ends of the leather, and of not much use for anything else, therefore cheap. It must be well wetted, and stretched with a pair of pincers. Then cut out roughly to the shape of Figs. 3, 6, 7, 8, and 9.* The shaded drawings show how they should be skived† thin to the edge; then while wet tack them on the last in their proper position as indicated by the figures 1, 2, 3, and 4 in Fig. 10. Each piece, however, must be put on separate and allowed to dry in order to block it to the last before it is taken off; then the edges can be cut evenly all round, taking care not to take the block (or shape) out. Each piece must be served the same way. For the benefit of booking* them, they can be marked 1, 2, 3, and 4, as shown above. Bunion pieces should be pegged on with fine $\frac{1}{2}$ in. pegs. The piece of leather must be put on wet, and pegged so that it can be skived down all round smooth to the last, leaving an even projection to the shape desired. To put in pegs, a hole must always be made with a peg-awl (Fig. 11) quite as deep as the peg is long, the peg being always driven home with one blow from the hammer. To get the last out of the shoe a tool called a last-hook (Fig. 12) is used. The screw (F, Fig. 1) having been taken out, the hook is inserted in the hole, G, to draw the block, and in H to draw the last, taking the toe of the shoe in one hand and the heel in the other. Then put the handle of the hook on the ground, and by standing on A and B (Fig. 12), you will get plenty of power to pull the last out.

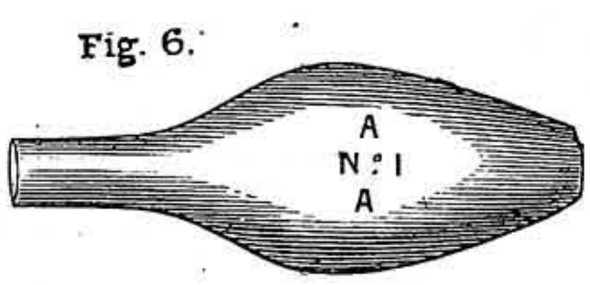


Fig. 6.

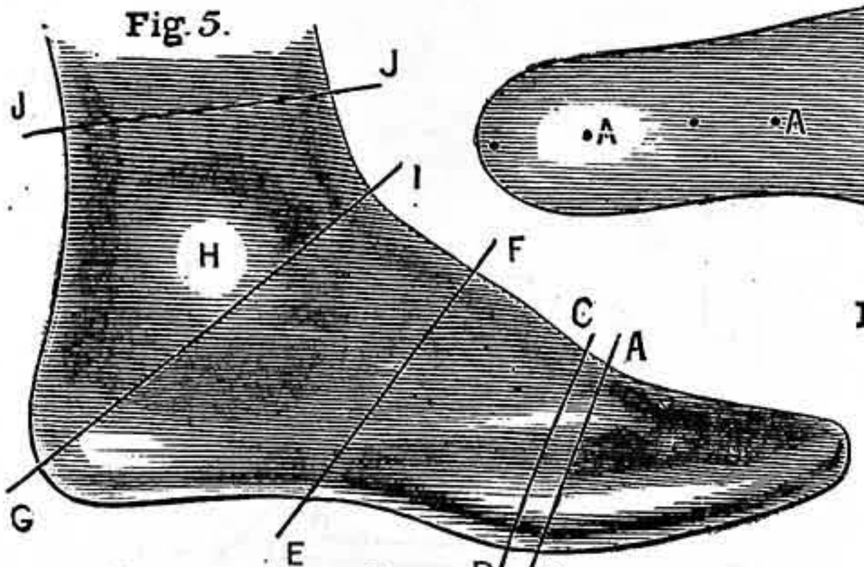


Fig. 5.

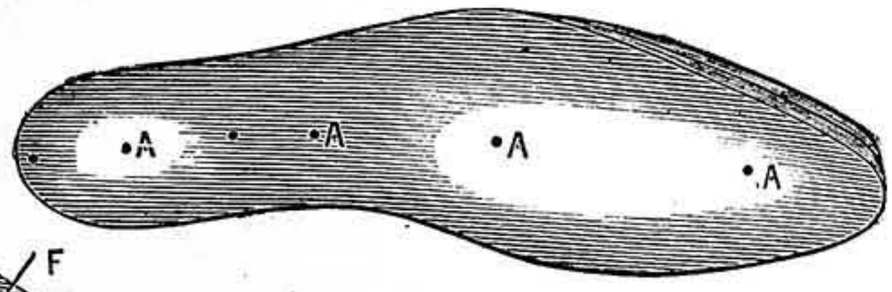


Fig. 2.


Fig. 9.


Fig. 11

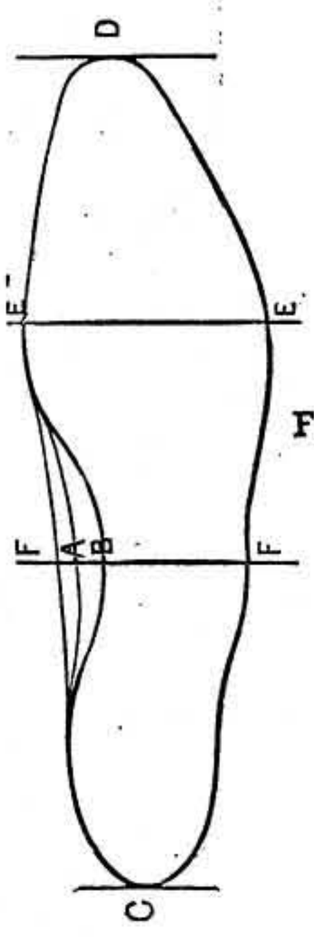


Fig. 3.

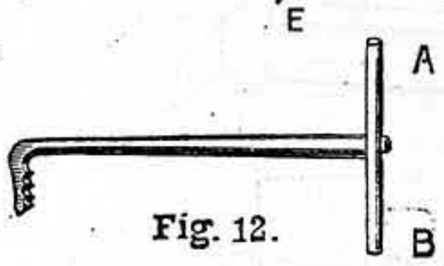


Fig. 12.

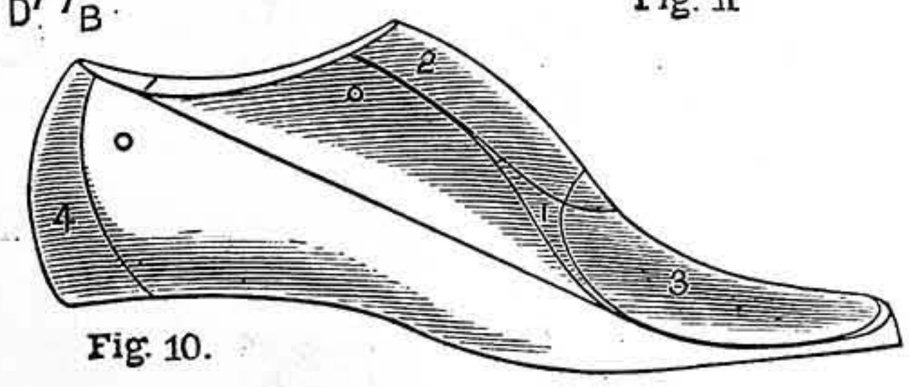


Fig. 10.

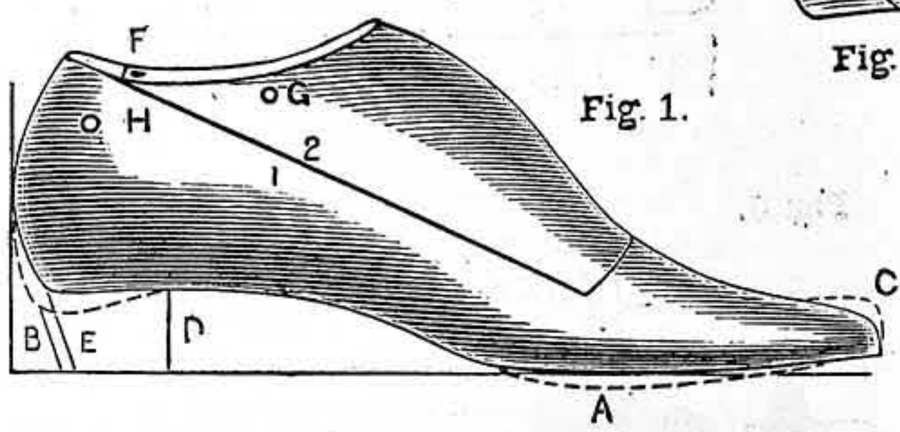


Fig. 1.

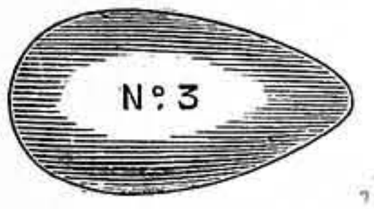


Fig. 8.

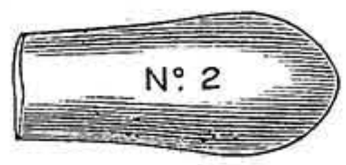


Fig. 7.

Fig. 4.

Boot and Shoe Making. Fig. 1.—The Last (1) and Block (2). Fig. 2.—Bottom View of Last with Three Shapes of Toes. Fig. 3.—The Shape of the Foot on a Sheet of Paper. Fig. 4.—Shoemakers' Tape Measure, with inches on one side and sizes on the other. Fig. 5.—The Stockinged Foot, showing how to take the Measure. Figs. 6, 7, 8, and 9.—Tools as Noted. Fig. 10.—Last with Fittings and Heel-pin, showing their Position. Fig. 11.—Peg-awl in Handle. Fig. 12.—Last-hook with Handle.

* A sixth of an inch.

* Fig. 6 is called a long leather (abbreviated L. L.); Fig. 7, an instep leather (abbreviated In.); Fig. 8, joint leather (abbreviated J.); Fig. 9, heel-pin (abbreviated H.-p.); when a piece is put on the toe it is called a toe-pin (abbreviated T.-p.); a piece on either side, a side-pin (abbreviated S.-p.).

† To skive, is to take the knife from A A (Fig. 6) just in a slanting position to the outer edge, and skive away the shaded parts gradually till there is *nil* at the extreme edge.

* Supposing a last is used with no fittings on, and you have numbered it 1, book it as 7's, No. 1 bare; or if you used it with heel-pin, toe-pin, and one L.L., book it 7's, No. 1, H.-p., T.-p., and No. 1, L.L., and so on for any fittings.

A GEARED WHEEL-CUTTER AND DRILLER.

BY F. A. M.

An ordinary drill will only produce a hole, but if the drill be fixed, while revolving, upon the top slide of a slide-rest, then the

workman has the power, not only to advance it into cut, as when drilling holes in a division-plate, but he can also cause it to *travel sideways* while cutting, and thus produce a groove or slot. This process was partly illustrated on p. 92 of Vol. I., but there the driller was only intended for working upon wood, and to run at a quick speed (see Figs. 1, 2, 3). Where, however, we desire to drill slots in metal, the driller must be of a stronger form, and it must be geared, so that the speed of the driving-belt shall be translated into power at a slower speed. This gearing is for a similar purpose to the "back-gear" of lathes, and it may be managed in the usual way by cogged wheels, or, as in the example before us, by a worm and wheel. As an example of slot-drilling, notice the hole in a spirit-level through which the glass is seen; it may be 1½ in. long, and has rounded ends. The power to produce slots or grooves of any section, flat-bottomed or round, is most useful to the workman, and the drills are very easily made.

The grooves in shafts for keys to secure wheels, and the spaces between the teeth of cogged wheels, may also be formed by slot-drilling; but this work can be done much more advantageously by milling cutters, little hardened steel discs or wheels about 2 in. in diameter, having their edges serrated, so as to act as saws or revolving files (see p. 252 of Vol. II.). Now, for this purpose there is generally provided a frame, carrying a spindle, geared to produce the speed and give power to the cutter, and so arranged that it can be held in the slide-rest. Here, however, the idea suggests itself, Why have two sets of gearing and two spindles; cannot the two instruments be combined? The answer to that question is the design now laid before our readers.

Thirdly, both the geared driller and the geared wheel-cutter need to be adjusted for height, and for this we require a vertical slide. Some idea of one may be obtained by looking at p. 730 of Vol. II., where will be seen a wheel-cutter designed by Mr. Milnes having a vertical slide for height adjustment. This is a very good appliance for wheel-cutting—it drives very smoothly and with great power; the present design is an attempt to improve upon it by making it do drilling and other things as well. Looking again at the Fig. on p. 730, it may be noticed that the angle-bracket is intended to bolt down upon the tool-plate of the slide-rest, so that the cutter can, by the vertical slide, be adjusted to the height of the lathe centres. If now the spindle and its bearings were made detachable from the face of the vertical slide, then this face would be available for bolting work to, which work might then be held firmly in front of the mandrel, and, a cutter being fixed therein, the work could be milled. This makes a third use to which the apparatus could be put. Turning now to Fig. 1, we see the vertical slide alone; fixed, not on the tool-plate, but on the cross slide, in the place of the slide-rest; this brings it lower down and more opposite the centre of the mandrel; it is fixed by the bolts which usually secure the slide-rest. Figs. 2 and 3 show this part in detail, and in Fig. 3 there is a line (C D) showing the position of the line of centres when the bracket is fixed, as in Fig. 1, whilst the line E F shows the height of centres when it is secured to the tool-plate by putting the central hole of the flange over the holding-down bolt of the tool-holder. Thus mounted, the appliance holds work to be milled by cutters running in the mandrel.

Fig. 4 shows how the geared driller can be attached to the face of the vertical slide. This part is shown in detail in Figs. 5 to 10. The driller may be driven by the worm and wheel, or the pulley may be exchanged for the worm-wheel, when it appears as in Fig. 4, and is driven by the band direct. The small bracket (Figs. 9 and 10) fits upon the end of the driller; it carries a hard steel spindle running in hard collars; at one end of this spindle is a two-speed groove pulley, and at the other a worm; this little bracket can be swung round to suit the band, and fixed, or it may be taken off altogether. Passing on to the main drilling spindle (seen in section at Fig. 6), it is bored throughout with a ⅜ in. hole; it may be bolted upon the top of the tool-plate by the centre one of the three holes, and when in that position its centre line should correspond with the lathe centres; it is bored at the large end to fit the smallest Morse-taper size, and the hole in the mandrel being the same, any drills, chucks, milling-cutters, slot-drills, etc., can be used in either, and should interchange. Thus the driller is equivalent to a perfect little lathe-head, and can be used, driven by a band from the overhead, for making small screws from stock passed in through the thoroughfare hole. A little set-screw is shown for securing the chucks, but probably many will prefer to dispense with it, and trust simply to driving them in. A cutter or slot-drill might, for instance, be turned up in the mandrel, and, when finished, transferred to the hole in the driller, where it should fit equally well and run perfectly true.

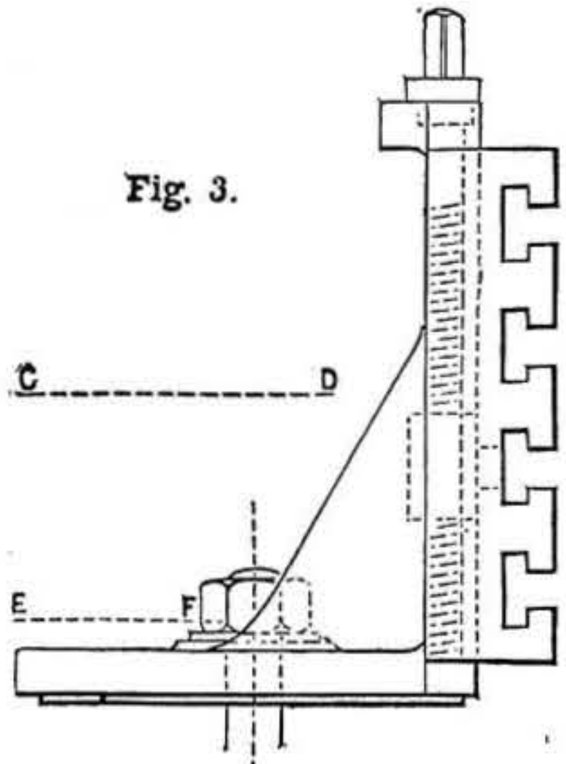
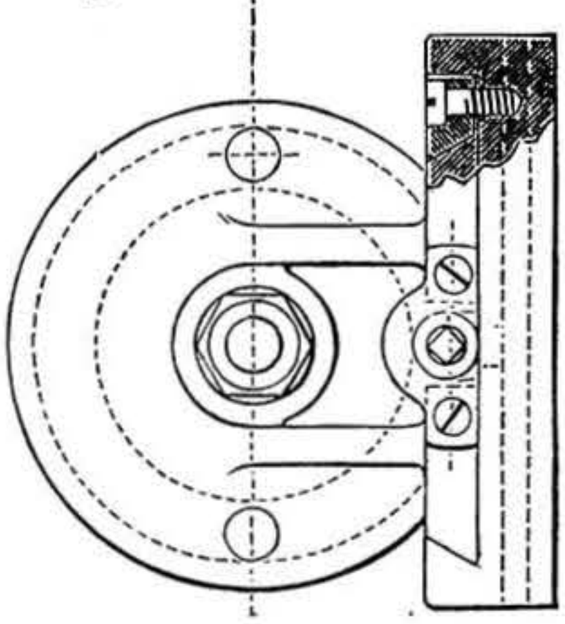


Fig. 3.

Fig. 2.



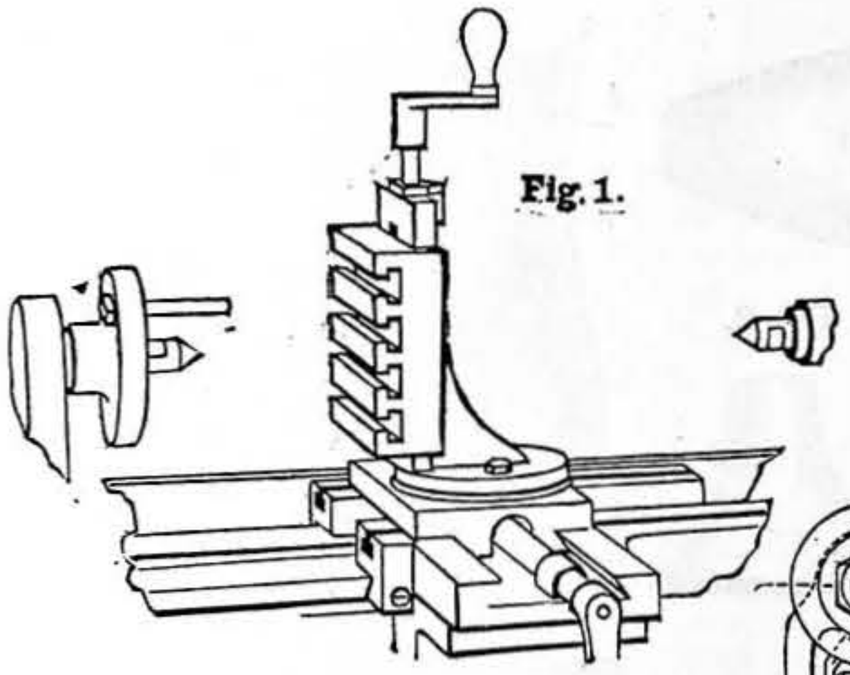


Fig. 1.

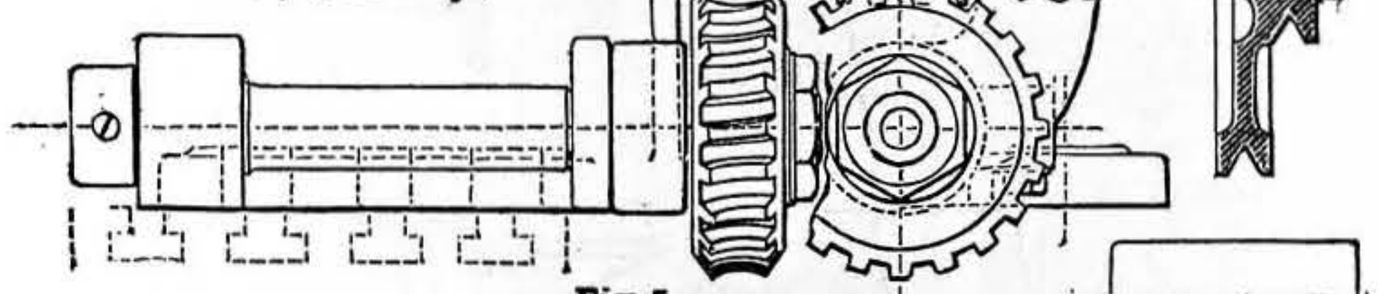


Fig. 5.

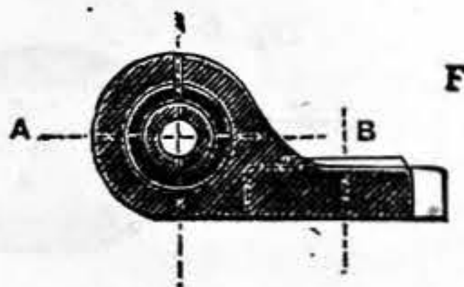


Fig. 7.

Fig. 8.

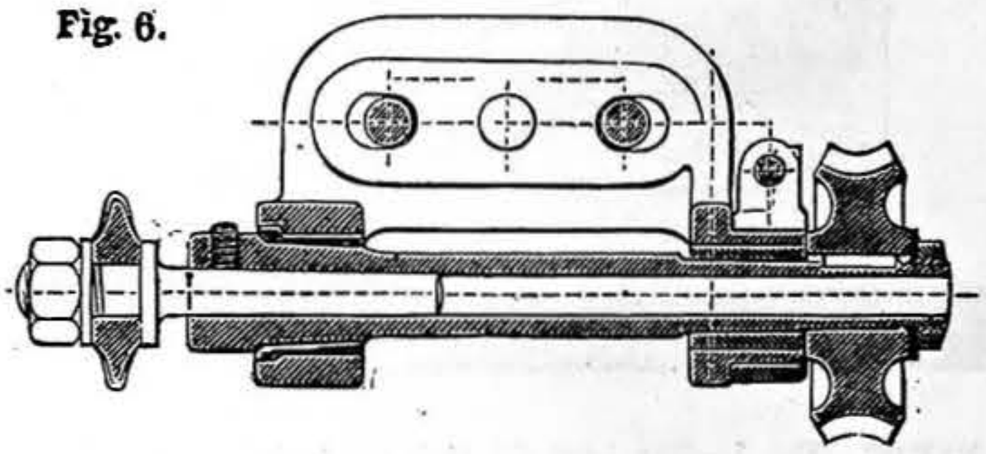


Fig. 6.

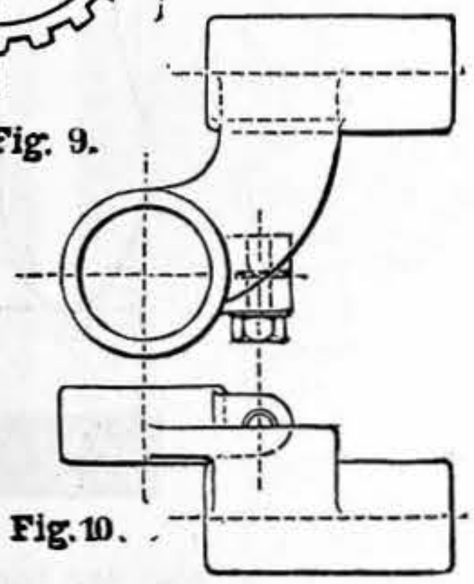


Fig. 9.

Fig. 10.

Geared Wheel-Cutter and Driller. Fig. 1.—Vertical Slide for Milling. Fig. 2.—Plan View. Fig. 3.—Side View of Angle-Bracket. Fig. 5.—Side View of Wheel-Cutter and Driller. Fig. 6.—Sectional Plan. Fig. 7.—Section through A B. Fig. 8.—End View of Section of Worm Shaft. Fig. 9.—End View of Removable Worm Shaft Bracket. Fig. 10.—Plan of Worm Shaft Bracket.

Fig. 11 shows the apparatus arranged as for wheel-cutting, except that it should be bolted on to the tool-plate, so as to raise it higher up; also the swivelling bracket is secured by a set-screw instead of by the proper method shown at Figs. 9 and 10.

Now as to the speeds at which the cutters can be driven. We may have a fly-wheel of 28 in. diameter; on the pulley of the driller there are two speeds of 4 in. and 2 in. Supposing an average rate of treading of 80 revolutions per minute, and that the band coming down from the overhead runs at the same speed as that leading up to it; then, since the worm-wheel has twenty teeth, and the worm one thread, we have the speed ratios of—

$\frac{28}{4 \times 20} = \frac{7}{20}$ or about $\frac{1}{3}$, and $\frac{28}{2 \times 20} = \frac{7}{10}$

This gives for the cutter at 80 treads per minute $80 \times \frac{1}{3} = 27$ revolutions, and $80 \times \frac{7}{10} = 56$ revolutions.

If we take 80 revolutions as the proper speed for a 1 in. cutter working on cast-iron, then the 2 in. cutters for wheel-cutting might run at 40 revolutions, which gives 20 ft. per minute, about, for the rate of cutting; so that by treading a little slower, the faster speed would be right for cast-iron and the slower speed would do for cutting steel or when a larger cutter must be used.

Mr. Milnes has adopted the design, and by means of this comparatively simple apparatus, which can be made at a low cost, a vast variety of work can be done.

HOW TO TEST GOLD.

BY H. S. GOLDSMITH.

SEVERAL correspondents wanting to know how to test gold, it has been thought best to make the subject one for a short article. I suppose it is testing by the "touch" that they want to know about, and not by "assay." If it is by assay, then the best course will be to join a class in metallurgy under the Science and Art Department, where it would be taught under proper supervision; for to carry out properly this most delicate process it is necessary to have seen it done and to practice the methods, as there are two, a "wet" and a "dry" assay.

With the "touch," which is more of a rough-and-ready test, I can perhaps deal successfully here.

The chief requisite will evidently be something which will discriminate between qualities, and nitric acid does that for us; and it *is by comparison of the way nitric acid acts on certain known qualities of gold, with the way it acts on the article to be tested, that the "carat," or quality, is ascertained.*

The necessary appliances are:—

(1) A touch-stone (usually a piece of Lydian stone, which is, I believe, a black variety of jasper): this has its surface smooth and partly polished, but is not bright; or a piece of Wedgwood ware (black for choice) does very well; and, at a pinch, one might even use a piece of ground glass.

(2) A series of "needles," or pieces of gold, of such qualities as we think are necessary. These are to be our standards of comparison; and for general use small pieces of wire of 9, 12, 15, and 18 ct. should be sufficient.

(3) Nitric acid in some convenient bottle. There are bottles specially made, with a long-pointed stopper, so that a small drop of the acid can be got out without dropping any or without coming in contact with the fingers; for it would destroy the skin where it touched.

The ordinary commercial nitric, as sold

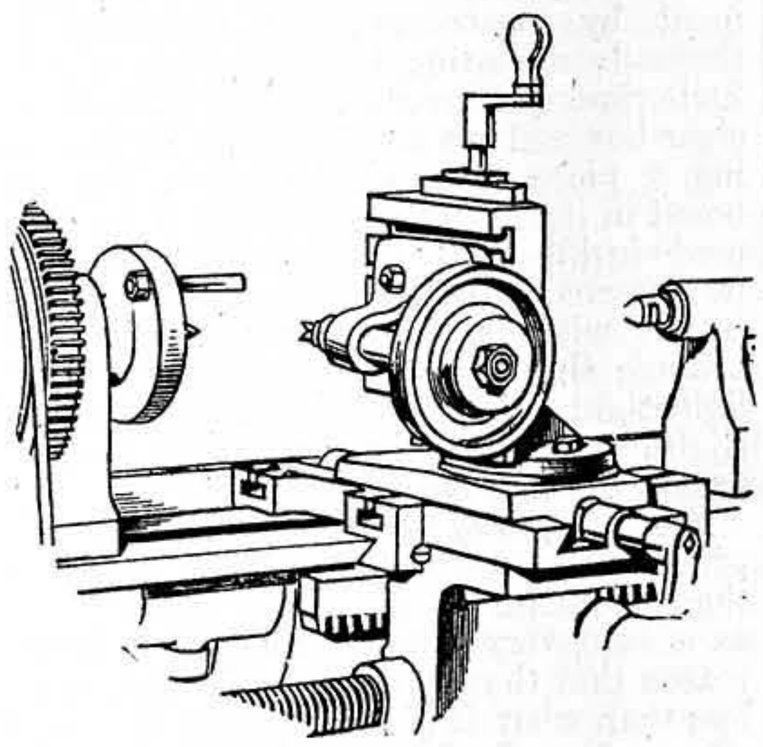


Fig. 4.—Gear-Cutter arranged for Slot-Drilling.

by oil-shops, will do. Aquafortis is another name for the same stuff.

Now, to test any article we first have to get a rubbing on to the touch-stone from some one or two places that shall fairly represent the whole. For example, let us say we get a clean streak of gold, $\frac{1}{2}$ in. long and $\frac{1}{8}$ in. wide. Now, by the side of this we take rubbings from our known qualities, then put a narrow streak of nitric acid across the whole lot.

What are we to look for now? Why, simply to see which of our standards is acted on in the same way as the rubbing from the article. The effects may vary from no change at all with good qualities to complete destruction of the rubbing in low qualities. On removing the acid by means of tissue-paper or a rag, the effect can be better judged.

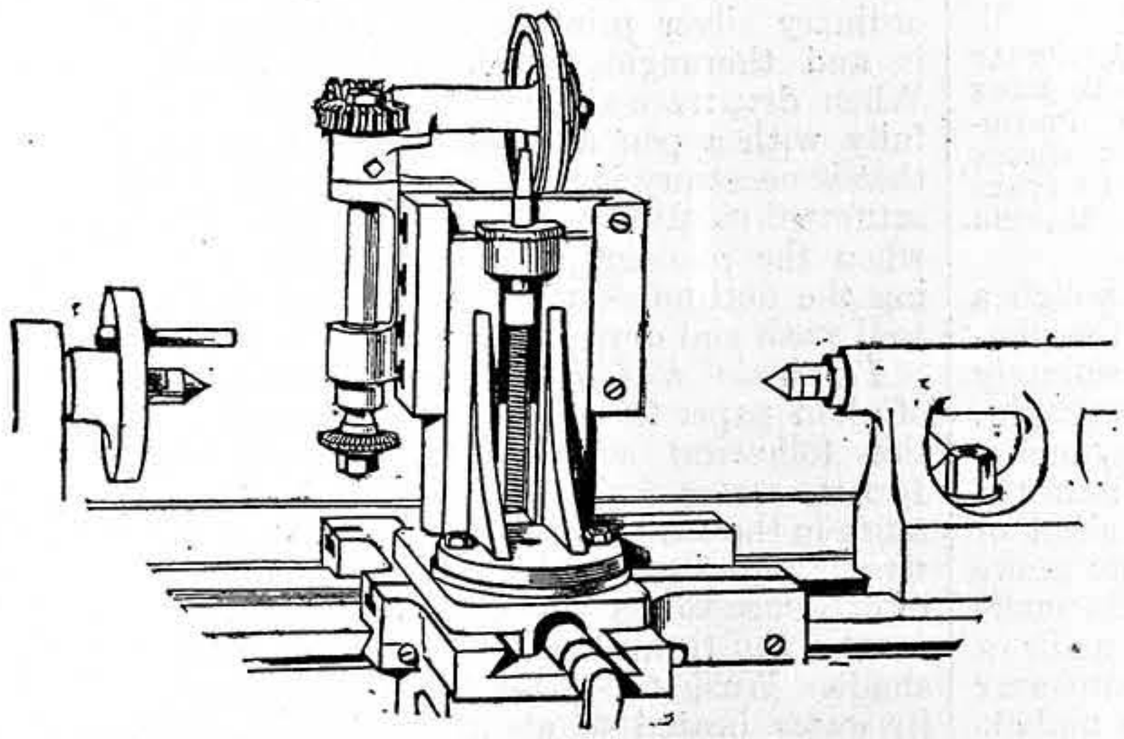


Fig. 11.—Appliance arranged for Wheel-Cutting.

Let me repeat that it is by comparison we arrive at a result; but, of course, it is easily possible to arrive at a false conclusion if an unfair sample (or rubbing) is taken. A piece of work may be very thickly plated, or even gilt, and the rubbing taken may not go through the gold into the metal; and, on the other side, the soldering seam may alone be tested, where the gold will naturally be poorer. Therefore judgment is wanted to select a place or places to apply your test; and even then it is better to file away a portion of the surface as well, and apply the stone or acid direct to it.

After some practice, when one knows the effect that acid has on the different qualities, it is customary to do without the touch-stone in most cases; but it is well to use it, at any rate, until one is quite used to the process roughly indicated here.

Coloured gold articles do not always need the application of acid; for if, by scraping the surface, there is a granular brown layer, then one can judge very nearly indeed the quality of the article by the extent of the change that has taken place below and on the surface while the article was undergoing the process of colouring. If the article is coloured, it must be more than 12 cts., fine anyhow, and is generally 15 ct.

I said that nitric acid was used—and I use it myself, as it is always to hand in the workshop—but a writer on the subject (Gee, in his "Goldsmiths' Handbook") advises for the purpose a solution made up as follows:—Nitric acid, 2 oz.; water, 4 dr.; muriatic acid, 1 scr. These to be well mixed together and kept ready for use in a stoppered glass bottle. It does not act on any quality of gold above 9 ct.; so to me it appears rather useless, being useful in qualities below 9 ct., a quality which is not much used in any decent class of jewellers' work.

Following up the way nitric acid is used on gold alloys to find the quality, so should comparison be made with its effects on silver and brass, copper, etc.; for although brass will boil green, so also will some very common qualities of silver and gold. It is a matter of experience, chiefly, this capability of judging qualities.

And besides, to people that are used to handling gold-work, the very appearance of the article is often sufficient to denote its quality.

Then its specific gravity is also another way of finding out the quality. But I must stop. Some day I hope to write an article dealing fully with this matter, and illustrating it with drawings from actual pieces of gold tested by the "touch" and by other methods. But enough is said here to clear up the present doubts of our correspondents. If more information is wanted it can be given in "Shop," on receipt of a letter of inquiry.

HOW TO PURIFY THE CISTERN.

BY E. DICKER.

I DO not think it can have failed to strike anyone, in walking about the residential parts of large cities, how very much the water cisterns are exposed to all the dirt and filth that run down the walls and copings of front and back areas when it rains, and in the dry weather to all the dust and dirt which blow about—to say nothing of cats. As I write in London I see two cats seated on the cistern next door; and whenever I go out in the morning (which is early, by the way), I see broken lids, large gaping joints in the tops, and cats asleep on these, and I often think to myself what an amount of nastiness must get into the cistern from time to time.

What would the generality of people say if their meat-safes were exposed as the cisterns are? Then they would exclaim, "That is where we keep our food"; and one would never think of putting the safe in such a position. But the cistern is where

you store the water that you drink, inasmuch as the safe is where you store what you eat; and, according to the best authorities, pure water is of quite as much importance as wholesome food, and I think I may say—if there is any difference—more so. Therefore, the first step towards making the water cisterns healthy is to have a top which will render it impossible for the above-mentioned impurities to get into them. They should be made water-tight, either by lids properly made of wood, or the defective ones should be covered with zinc or lead.

They should also be periodically cleaned out. To do this, hang up the ball-valve by a piece of string to prevent the water running in, and then empty the cistern, after which thoroughly scour it out with a scrubbing-brush, and clear up any deposits left in the bottom.

In some cisterns there is what is called a trumpet waste, which is a short piece of lead pipe with a "ground in" union at the bottom. This pipe forms the overflow, and by taking it out of the "ground in" joint you can easily empty the cistern. Sometimes it is necessary to bale out the last three or four inches of water, as the "draw-offs" are generally kept some distance above the bottom, to keep clear of any deposits.

When the cistern is emptied and *thoroughly dried*, it would be a great advantage to give it two coats of one of the best of the enamel paints. By paying attention to these simple matters, one can rest assured, as far as they themselves are concerned, that the water they drink is clean and pure, also that the cistern itself is healthy. The enamel can be bought for a few pence at any oil stores, but be sure that before using it the cistern is perfectly dry. In view of the diseases and epidemics which set in with the hot weather, this cistern matter is an all-important one, which it would be a blessing to arouse everybody's sympathy with.

PHOTOGRAPHIC EXPERIMENTS.

CURIOUS, AMUSING, AND INSTRUCTIVE.

BY WALTER E. WOODBURY.

PHOTOGRAPHS WITHOUT A LENS — A CHEAP CAMERA—PHOTOGRAPHING CLOUDS—TO MAKE A PEN-AND-INK SKETCH FROM A PHOTOGRAPH—TO MAKE RED PICTURES; GREEN PICTURES; VIOLET PICTURES; BLUE PICTURES —RECOVERING FOGGED PLATES — MAKING DIRECT POSITIVES IN THE CAMERA.

Photographs without a Lens.—Although a lens is the most important part of the photographer's apparatus, it is not absolutely necessary for the production of photographs. Very good pictures can be made by means of a pinhole. Remove the lens from the camera, and insert in its place a sheet of thin, hard cardboard. In the centre make a tiny hole with a fine-pointed needle made red-hot. Another method is to make a large hole in the cardboard, and paste over it a piece of tinfoil and make the pinhole in this. The essential point is that the hole be perfectly round without any burring at the edges. The most perfect arrangement can be obtained by getting a watchmaker to drill a fine hole through a piece of sheet metal. The diameter of the hole should not be greater than the one-fiftieth of an inch. Whatever is used, cardboard or metal, it should be blackened all over to prevent the reflection of light in the camera. The focussing glass should be brought within about 6 in. of the hole. Owing to the small amount of light admitted, focussing is very difficult. It can be done by pointing the camera towards the sun and focussing its image. For the same reason the exposure is very long, ranging from ten minutes to half an hour; it is, in fact, difficult to over-expose.

A Cheap Camera.—In the foregoing we have shown how a photographic negative may be made in a camera without the use of a lens. Those, however, who do not possess a camera can easily try the experiment by constructing an apparatus for themselves, costing but a few pence and a little time and trouble. Take an ordinary cigar box and cut a hole in one end, inserting a piece of metal having a fine hole bored in it. At the other end a groove is made inside so that the sensitive plate can be inserted. Blacken the whole of the inside with a dead-black varnish, and arrange the lid so that it will be perfectly light-tight. When the box is closed not the slightest trace of light must be admitted except through the pinhole aperture.

Photographing Clouds. — Nothing improves the appearance of a landscape more than beautiful cloud effects, but these are, as a rule, very difficult to obtain, for the reason that the exposure required is so much less than what it is necessary to give to the surrounding landscape. Further, the blue sky is almost as active as the clouds themselves, so that the contrast is lost to a very great degree. The most effective plan is to arrange in front of the lens at a suitable angle a sheet of black glass, one surface of which is a true plane, and to photograph its reflection of the clouds. The effect of this black mirror is to extinguish the polarised portion of the blue light of the sky and to reduce the brilliancy of the general illumination. All the finest and most beautiful structure of the clouds, which otherwise is so dazzling as to be obscured from sight, is now plainly visible, and for the making of cloud negatives for printing in landscapes this method excels all others.

To Make a Pen-and-Ink Sketch from a Photograph. — The following is a plan so simple that anyone without any knowledge of drawing can produce from a photograph a perfect pen-and-ink sketch suitable for reproduction as an illustration. Make an ordinary silver print from a negative, fix it, and thoroughly wash without toning. When dry, trace all the outlines out carefully with a pen and ink. This done, all that is necessary is to immerse the print in a saturated solution of bichloride of mercury, when the photograph will disappear, leaving the outline sketch intact. Thoroughly well wash and dry.

To Make Red Pictures.—Float a piece of plain paper for about twenty seconds on the following solution—uranium nitrate 1 part, water 5 parts—and dry it before a fire in the dark. Expose it behind a negative in an ordinary printing frame. Length of exposure varies from eight to ten minutes in the sun to an hour or two hours in the shade. Wash the print for a few seconds in water heated to about 120° Fahr., and immerse it in the following: potassium ferrocyanide 1 part, water 50 parts. In this solution the picture will in a few minutes become of a beautitul red colour. It should then be well washed until the water is colourless, and then dried.

To Make a Green Print.—Take a red print made in the manner described above, and place it in nitrate of cobalt 2 parts, water 100 parts. Remove it, and without washing dry it before a fire, when it will become of a green colour. To fix, place it for a few seconds in the following solution: sulphate of iron 2 parts, sulphuric acid 1 part, water 50 parts. Well wash, and again dry before the fire.

To Make a Violet Print.—Prepare plain paper with uranium nitrate as recommended for making red prints, and after printing underneath a negative, wash in hot water and develop with chloride of gold 8 grains, water 2 oz. When a fine violet colour is obtained, wash the part in several changes of water, and dry.

To Make Blue Prints.—Float plain paper on a solution of potassium ferrocyanide 20 parts, water 100 parts. Dry in a dark room. Print under a negative while the shadows are of a light bluish colour. Place the print in a saturated solution of bichloride of mercury, then wash it in water, and place it in a saturated solution of oxalic acid heated to a temperature of 100° Fahr. It is then washed in several changes of water and dried.

Recovering Fogged Plates.—It often happens through accident or otherwise that sensitive dry plates get exposed to the light and are considered spoilt and of no further use. This is not the case, however; all that is necessary is to immerse the plate for about five minutes in a solution composed of chromic acid 30 grs., potassium bromide 60 grs., water 10 oz. The operation must take place in the dark. They are then thoroughly washed and dried, after which they can be again used in the camera as before, only that they are somewhat less sensitive, and consequently require a little more exposure.

Making Direct Positives in the Camera.—Prepare a saturated solution in water of the crystals of thiosinamine, and add from two to eight minims of it to an ordinary pyro or eikonogen developer. Expose rather less than usual. The effect of this addition to the developing agent is an entire reversal of the image, a positive instead of a negative being obtained. Ammonia will assist the reversal. Colonel Waterhouse, the discoverer of this process, recommends in some cases the plates being subjected to a bath of 5 per cent. nitric acid and 3 per cent. potassium bichromate before exposure, followed by a thorough washing.

PLASTERERS' WORK.

BY A WORKING PLASTERER.

INTRODUCTORY—TOOLS—MORTARS AND CEMENTS—HAIR — LATHS — THREE-COAT PLASTERING — RENDER, FLOAT, AND SET—SCREEDS—LATH, LAY, FLOAT, AND SET—FINE STUCCO—ROUGH STUCCO—TWO-COAT AND ONE-COAT WORK—PUGGING—ROUGH-CASTING—CONCRETE FLOORS.

Introductory.—Plasterers' work is the art of covering walls and ceilings with mortar or cement; it also includes the running of beads and mouldings, and the casting and fixing of trusses, ceiling flowers, and enrichments. We are indebted to the labour of the plasterer for much of the comfort of our houses.

Tools.—The tools used by the plasterer are: the plastering trowel (Fig. 1), with which the mortar is spread on the walls or ceilings; the mortar is laid on a hawk or hand-board, which is a board about 12 in. square, with a handle on the underside, and is held in the left hand. The gauging trowel, which is an ordinary trowel with a blade about 7 in. long, and is used for mixing gauged stuff. The screeding or floating rule is about 6 ft. long, narrowed down at the ends, which is used for straightening the work. The hand float is made of wood, about 10 in. long and 4 in. broad, with a

wooden handle on the back, and is used for floating and levelling the work. The darby, or two-handed float, is about 2 ft. 6 in. long, with two handles on the back, and is used for levelling large surfaces.

The lath hammer (Fig. 2) is used for nailing the laths to ceilings and stoothings. Mitring tools (Fig. 3) are used for mitring mouldings, and are of various sizes; they are made of steel. The mitring rule (Fig. 4) is also used for mitring mouldings. Flat and round brushes are also used by plasterers, and moulds of various kinds. The mortar is laid on a large mortar board, supported on legs about 2 ft. 6 in. high. For preparing the mortar, riddles and sieves of various degrees of fineness are used. A scoop with a long handle is used for ladling the liquid lime into the riddle; and a drag, which is a rake with two or three iron prongs, is used for mixing the hair with the mortar. A wooden beater 4 in. square, with a cross handle at the top, is also used for beating the mortar.

Mortars and Cements.—The mortar used by the plasterer is made from the best stone lime; chalk lime is not suitable, although it is sometimes used for putty. The lime should be freshly burnt, and should be laid under cover if possible. A pit of a suitable size, about 18 in. deep, and lined with boards or bricks, is prepared, also a tub about 3 ft. in diameter and 2 ft. deep. A quantity of the lime is thrown into the tub and covered with water; it will begin to boil in a short time, and is stirred with the drag till it has all fallen, when it is ladled into a riddle or sieve fixed above the pit; it should be of a thick, creamy consistency, but not too thick. When the riddle is full of "craps," as they are called, it is emptied, and again refilled, till the pit is full; if hair is to be added, it is mixed in the pit with the drag, and the whole is allowed to stand till stiff. If water rises to the top of the mortar in the pit, it should be run off. Sometimes the lime is slaked, and used in powder instead of being boiled, but it works better when boiled. If the lime is wanted for putty, no hair is added. Parian, Keene's, and Martin's cements are used for running skirtings, mouldings, etc. They are mixed with fine sand, and set very quickly; they finish with a beautiful smooth surface. Plaster-of-Paris, made from calcined and ground gypsum, is used for running mouldings and casting trusses, etc. It sets very quickly, and is generally mixed with about two-thirds fine white putty.

Robinson's cement is used for casting and mouldings; it sets very hard. It is also used for plastering where work requires finishing very quickly. The makers state that it can be papered or painted in a few days after finishing; the cost is rather more than ordinary plastering. The first coat is laid on with No. 2 quality, No. 1 being employed for finishing (it is mixed with about three parts of fine, sharp sand); No. 3 quality is used for floors, concreting, etc.

Portland cement is used for wall plastering, for skirtings, for concrete floors, and tile-fixing, and for coring or floating under the more expensive cements; it is generally mixed with three parts of fine, sharp sand.

Scagliola is a species of plaster invented in Italy; it is composed of various earthy colours mixed with plaster-of-Paris, and when laid on can be polished to a very fine surface.

Hair.—The hair used by plasterers is generally bullock's hair; it should be long, and free from hard lumps; its use is to strengthen the mortar. In mixing, it is beaten on a wood floor, then soaked in water, and mixed in the liquid lime by means of the drag.

Laths.—The laths are made of fir, and are from 2 ft. to 5 ft. long, 1 in. wide, and from $\frac{3}{16}$ in. thick; from 110 to 120 are in each bundle. They are split or riven with a special knife, and are nailed on with cast-iron or steel nails; they should be about $\frac{3}{16}$ in. apart, so that the mortar can be squeezed through between them, forming a key on the inside; the bond should be broken every 2 ft. 6 in. when nailing them; if nailed too close, the work will crack or fall off. Sawn laths are also made, but they are not so strong as split laths. Laths are known as single, lath and half, and double, relating to the thickness. Woven wire is sometimes used instead of laths.

Three-Coat Plastering.—In executing three-coat plastering, the walls are first coated, then scored over with three or four pointed laths nailed together, to form a key for the second coat; this is allowed to get white dry, when the second coat is laid on with the float, and when this is about half dry, the third coat is laid on and smoothed with the trowel and brush. The first coat on walls is called rendering, the second floating, and third setting. In order to make the floating straight, "screeds" are laid on the walls at intervals of about 6 ft. These are bands or widths of plastering about 6 in. wide, which are straightened with the floating rule. Screeds are fixed in the angles; these should be made plumb, and the intervening screeds are lined to them; after the screeds have been laid on, the spaces between them are filled up and straightened with the rule and made level with the darby and hand float. The joints in the walls should be raked out, and the walls brushed and wetted before commencing to plaster.

Three-coat work on ceilings and partitions is executed in a similar manner; it is called lath, lay, float, and set. The laths are first nailed on, then coated over and scored to form a key to the floating; this must be white dry before being floated. It is then floated and set in the same manner as described for walls. The first coat on ceilings is sometimes called "pricking up." The mortar for laying and floating ceilings is mixed in the proportion of about one of lime to three of sand; that for walls contains a greater proportion of sand. The setting or third coat on walls and ceilings is made with putty and fine sifted sand; the putty is washed lime which does not contain hair. The sand for plastering should be clean and sharp; good work cannot be made with soft or loamy sand. Sea sand should not be used, as it strikes out damp. Sometimes the third coat is mixed with a proportion of fine, light-coloured hair, and trowelled smooth; this is called fine or trowelled stucco. Rough stucco is that which is finished with the float. A piece of felt is often nailed over the float for finishing this work.

Sometimes plaster-of-Paris is mixed with the putty for the finishing coat, which makes it finish with a hard, smooth surface. This is called gauged work, and when plastering is required to be finished very expeditiously the whole is executed with gauged stuff.

Two-coat plastering is rendered, and levelled at once with the float, then set when dry; it is not scored or screeded.

One-coat plastering is rendered, then smoothed with trowel and brush. The two latter methods of plastering are only used on inferior work.

In using the hand float, a nail is sometimes driven through it with the point projecting; this scores the floating, forming a key for the setting or putty coat.

Pugging.—This is coarse mortar mixed with hair, and spread to a thickness of $1\frac{1}{2}$ in. to 2 in. on boards nailed between the upper floor joists in houses to deaden sound.

Rough-cast.—This is used in some districts for covering the outer walls of houses. The wall is rendered with hair-and-lime mortar, and, while soft, the rough-cast, which is formed of gravel about the size of peas mixed with liquid lime, is thrown against it by a flat board with a handle at one end. The sand is sifted out, and the rough-cast must be made as level as possible, and must completely cover the rendering.

Concrete Floors.—These are formed of Portland cement, and crushed bricks, slag, or limestone to pass through a $\frac{1}{2}$ in. mesh. The foundation must be levelled and well beaten; wood pegs are then driven in, the tops of which are level with the finished surface of the floor. Then lay a covering of broken stones to pass through a 2 in. mesh over the whole surface, and from $1\frac{1}{2}$ in. to 3 in. below the tops of the pegs according to the required thickness of the floor. The broken stones should be not less than 3 in. thick, and for heavy work should be more. The stones are beaten down level, then mix the concrete on a wooden platform, in the proportion of one of cement to five of crushed bricks (the ingredients should be measured in a box, open at the top and bottom); the whole is then turned over and thoroughly mixed with the shovel and drag; then form it into a pie and mix with water. It must not be saturated, but every portion must be wetted, turning it over and mixing with the drag. Then commence to lay the floor, starting from the side opposite the door; the concrete is levelled to the top of the pegs by a rule, and beaten solid by a beater similar to a hand float, but made larger. When the whole is laid and beaten level, it must be left from eight to twelve hours to harden; it is then smoothed over with the plastering trowel.

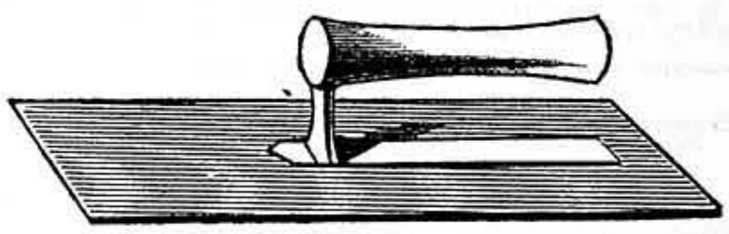


Fig. 1.

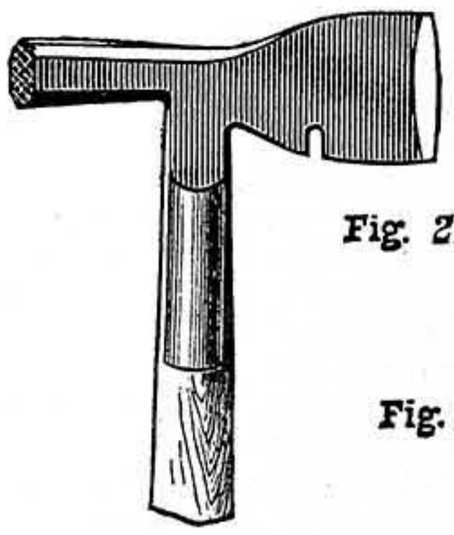


Fig. 2.

Fig. 3

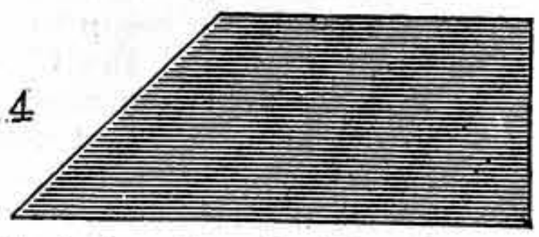


Fig. 4

Plasterers' Work. Fig. 1.—Plastering Trowel. Fig. 2.—Lath Hammer. Fig. 3.—Mitring Tools. Fig. 4.—Mitring Rule.

WORK

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CRAFT TRAINING.—The Company of Armourers and Braziers have just been holding their third exhibition of works in brass. We welcome exhibitions of this class. The example of the Armourers might be followed with advantage by many of the other City companies. It is not one of the wealthiest of the City companies, yet it is especially active in the interests of technical education. If the City companies wish to justify their continued existence, they must do good work that will be appreciated by the people. It is impossible to over-estimate the ultimate effect of technical education among the people. The craft companies of the City of London could soon make the old-fashioned rule-of-thumb workman as extinct as the dodo. Then would evolve a new race of artist workmen whose works might rival those of their mediæval brethren, "the evangelists of art," "laureates of their gentle craft," who left their noble deeds in stone and metal. The Armourers will award their certificate of merit to prize-winners, and grant the Freedom of their company to any especially gifted craftsman, apprentice, or student. There is one point, however, to which we should like to invite the attention of the Company of Armourers. People living in the large provincial towns which have long since outgrown numerically those of London in the matter of craftsmanship are unable to derive advantage from these exhibitions. Could not some of the wealthy London companies join with poorly-endowed technical schools in the provincial towns to promote exhibitions of this character, changing the location from year to year? London is now a commercial not a manufacturing centre; but Manchester, Glasgow, Leeds, and a score of other cities, are the centres of teeming industries. If the provincial workmen cannot come to London, cannot London go to the provinces? Despite what is done through the City and Guilds of London Institute channels, the City companies as yet only reach a very meagre few of the technical student element of the country.

ALUMINIUM.—The cost of aluminium, and alloys of aluminium, has been reduced so immensely by the invention of electrical processes, that it will shortly come into very extensive use outside of engineering. Aluminium bronze, in various grades, is already extensively used in engineering. The latest field which appears to be opening up for its employment is that of domestic utensils. It possesses the advantages of extreme lightness, and of being practically unaffected by acid liquids, not excepting vinegar, so that possibly our kitchen utensils may be made of aluminium in the near future. There would be an æsthetic pleasure in the use of a metal, or an alloy, having the lustre and colour of silver, without its expense. The report some weeks since that the German army had found the spirit flasks, made of aluminium, vehicles of poison for the troops, requires better authority than the testimony of the ordinary paragraphist.

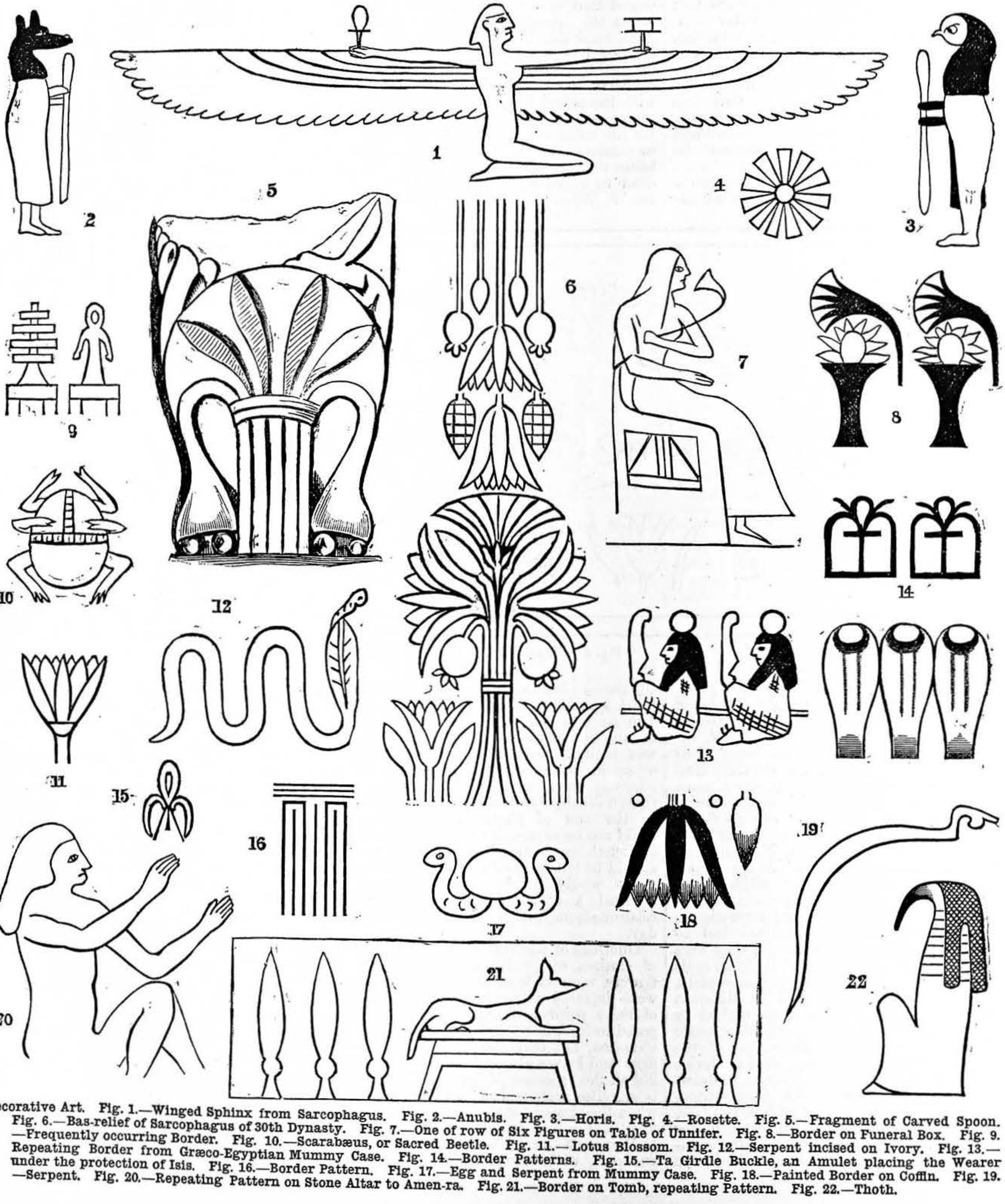
AMERICAN V. ENGLISH LOCOMOTIVES.—An engrossing topic for some months has been English and American locomotives, and endeavours have been made to show that the American locomotives are superior to the English, carrying greater loads on the same consumption of fuel. Our contemporary, the *Engineer*, takes the matter up, and proceeds to analyse the statements published in an American journal, and finds that the American locomotives burn more coal than those of this country, which the writer "is at a loss to explain." Does he know that the orifice of the blast pipe generally used there is much smaller than that used in this country—from a third to half smaller—and in consequence the "pull" on the fire when the engine is under way is tremendous, and causes the fire to be pulled out of the box at a rate nearly sufficient to account for the greater consumption of fuel? It would almost seem that in America it is a sure sign of a good engine if you can hear her at a great distance—the further the better. Some time since an American engineer visited one of our great terminal stations to see the express go out. He eyed the start with great interest, but exclaimed, "Where's the blast? I don't *hear* it!" Notwithstanding an explanation to the effect that it was more satisfactory to take the power out of the steam in pulling the train instead of letting it make a row up the funnel, he would not be convinced. The Midland Nottingham express was a further poser. Though greatly struck with the design and workmanship of these splendid specimens of mechanical skill, the visitor could hardly believe that the engine, with a goodly number of carriages, runs from Nottingham to London and back, or *vice versâ*, with from 42 to 45 cwt. of coal for the double journey—250 miles—and does the journey, without a stop either way, in about two hours and ten or fifteen minutes, on a consumption of 21 to 22 lb. per mile. Here, as the engine started, he could not hear the blast, and seeing what could be done without the tremendous crash of the American blast, he concluded they must be wrong in their practice, and on his return intended to wake them up a bit on this point. As a rule the American locomotive carries steam a greater distance in the cylinder before cutting off than the English; consequently a greater bulk of steam has to escape; and this also causes more steam to be used, and therefore more fuel is used to keep her going. There is no doubt that American locomotive practice is far from perfect, and there is great room for improvement.

DESIGN AND DECORATION OF ALL AGES.

BY M. H. C. L.

Egyptian.

There is, perhaps, no country in the world so interesting, so absolutely fascinating to the student of old times, as Egypt, emerging as it does from the misty blackness of thousands of years before the Christian Era, and leaving evidences of a learning and civilisation which some modern writers maintain held all the knowledge to which we in our own day have but just arrived. When we study their art, we are astonished to find the skill and perception which guided their construction of design, and their command over the material in which they worked. The Egyptians were admirable carvers in stone and wood, though the lack of suitable timber restricted their use of the latter. They wove the most delicate textures, and embroidered them with consummate art. Their repoussé work, enamelled work, and inlaying were all exquisite. They made tapestry in simple geometrical designs, they worked in leather, their pottery was beautifully decorated, their paintings retain, under the time-stained surface, the brilliancy of the day they were produced. In very early ages the Egyptians became masters of the art of colour, each workman having his own



Decorative Art. Fig. 1.—Winged Sphinx from Sarcophagus. Fig. 2.—Anubis. Fig. 3.—Horis. Fig. 4.—Rosette. Fig. 5.—Fragment of Carved Spoon. Fig. 6.—Bas-relief of Sarcophagus of 30th Dynasty. Fig. 7.—One of row of Six Figures on Table of Unnifer. Fig. 8.—Border on Funeral Box. Fig. 9.—Frequently occurring Border. Fig. 10.—Scarabæus, or Sacred Beetle. Fig. 11.—Lotus Blossom. Fig. 12.—Serpent incised on Ivory. Fig. 13.—Repeating Border from Græco-Egyptian Mummy Case. Fig. 14.—Border Patterns. Fig. 15.—Ta Girdle Buckle, an Amulet placing the Wearer under the protection of Isis. Fig. 16.—Border Pattern. Fig. 17.—Egg and Serpent from Mummy Case. Fig. 18.—Painted Border on Coffin. Fig. 19.—Serpent. Fig. 20.—Repeating Pattern on Stone Altar to Amen-ra. Fig. 21.—Border on Tomb, repeating Pattern. Fig. 22.—Thoth.

little bags of paints, and mixing them for himself. The colours were laid on in flat washes, and in the best period of decoration were so used as to form a "scheme of colour," giving to each tableau a general prevailing tone of red, blue, or gold. The Egyptians loved colour; all their carvings and bas-reliefs were painted.

There was in Egyptian decoration, as in that of other countries, a classical age up to which art was continually improving; a subsequent decline, a short renaissance, and a final decadence characterised by a corruption of the native style with that of other countries, notably of Greece, ending in extinction.

It is of the purely Egyptian designs, as they were handed down from generation to generation, each retaining its individuality through century after century, that this paper treats. The designs of Egypt may be classed under two heads: the sacred and the secular. Only a small proportion of the decorations which have come down to us are distinctly secular, but there still exist some humorous paintings in the form of caricatures of animals. There are alsorecords of wars and victories, and more peaceable scenes forming the subjects of wall paintings — herds of oxen with their drivers, flights of wild birds and flocks of geese, fishes swimming, men engaged in different kinds of handiwork, and amusing themselves in the chase. The Egyptians evidently loved animals, some of which, as we know, were considered sacred. The lotus is the only flower we find, except in the rarest instances, upon their decoration, if we except the stalkless blossom varying in semblance between a marigold and a potentilla, which is technically called a rosette. The lotus was no doubt peculiarly prized by the Egyptians as being the produce of the sacred Nile lotuses. These lotuses were grown in the tanks, which were the favourite adjuncts to an Egyptian garden. A representation of one of these tanks from a wall decoration is given in Fig. 23. The Egyptians had no knowledge of perspective, though they were admirable draughtsmen, and their animals in profile were drawn not only accurately, but with much spirit and in different varieties of pose. When they wished to represent figures of men in line, they made the head of each appear above that of the one in front, or by some similar device showed all the figures separately. In drawing the human figure it was their custom to give the head in profile, with a full face, eye, and bust, the trunk in three-quarter view, and the legs in profile. In the specimen given, the pond is seen in bird's-eye view, the four edges being the banks, while the animals and lotuses are seen sideways.

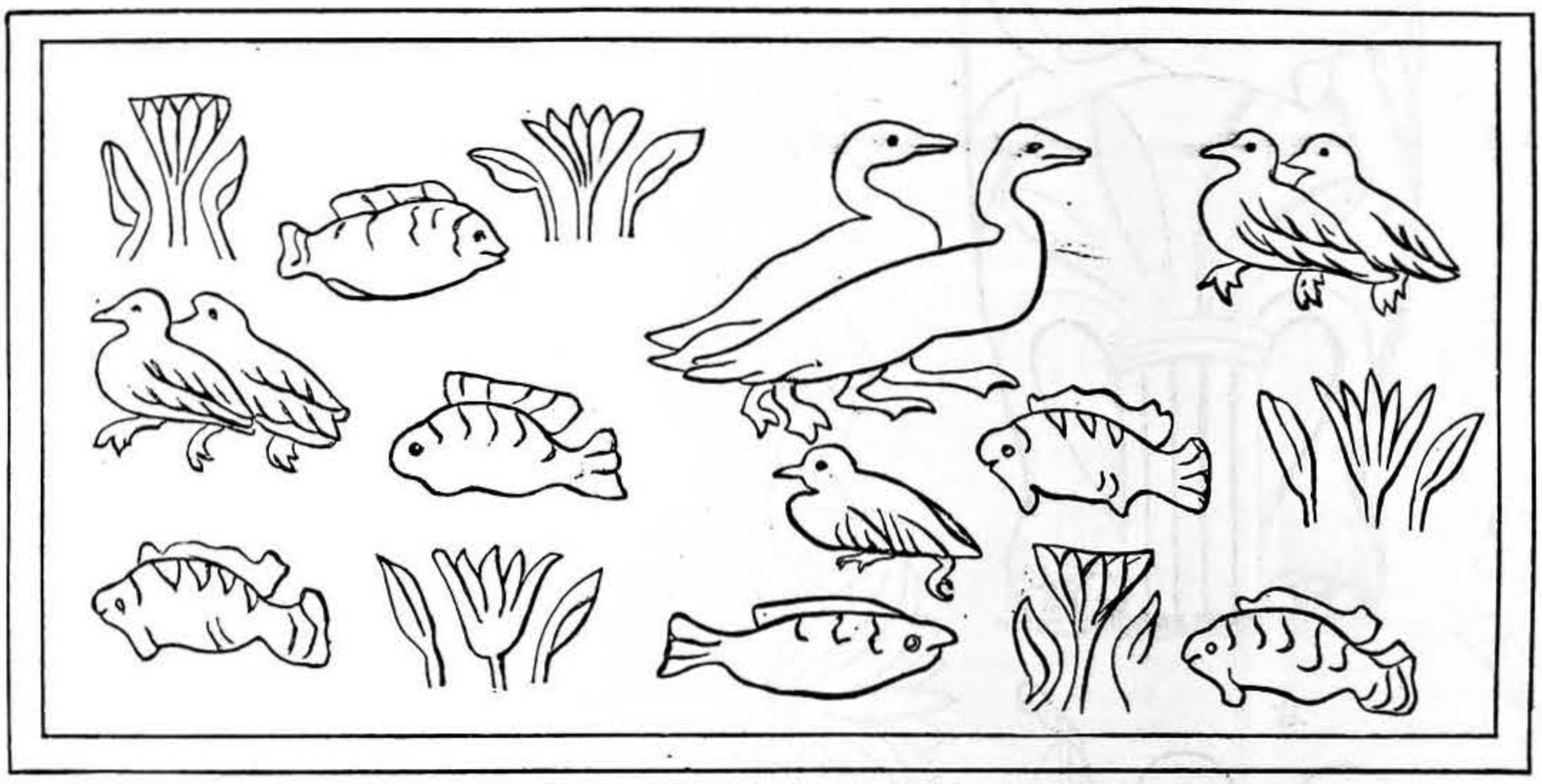


Fig. 23.—Wall-Painting of a Fish Pond.

Among the wall decorations are pictures of offerings being made to the gods. The mystic ceremonial religion of old Egypt entered intimately into the life of the people, and, in fact, their secular art merges in the sacred. The most numerous and important remains of Egyptian decoration are from the tombs. While the houses and palaces were open to destruction from invaders and pillagers, the tombs were so carefully concealed that many of them have remained intact till discovered by modern explorers. Man, according to the Egyptian faith, was composed of four parts: the body; the *ka*, or double of the body; the soul; and the divine spark. This *ka* precisely corresponded with the astral body with which the theosophy now in vogue has made us familiar. Its life continued as long as the body was in existence, but died with its destruction, hence the care taken by the relatives of the dead to guard against the violation of a tomb. When the mummy was deposited, the passage leading to its resting-place was filled, and the entrance carefully concealed. The *ka* had his chapel in earliest times in another portion of the tomb, which was built in the rocks, but later it was often at some distance from it. Here offerings were made on stated days, and should ideally have continued to be offered to the end of time. But filial piety could not be expected to survive the third or fourth generation, and for fear the *ka* should be left to starve, a plan was hit upon which would satisfy the appetite of so ethereal a creature, while relieving his relations from further cares after the burial day.

Offerings of portions of oxen and gazelles, of clothes, of furniture, of birds and of flowers, were made at the funeral, and these were depicted on the walls. On the sight of these painted objects the *ka* was supposed to feed, but for his diversion, or instruction, not only the actual portions of flesh and loaves of bread were represented, but all the processes of their production and preparation were added. In later centuries, when the idea of future reward and punishment had gained prominence in the religion of Egypt, a record of the career of the deceased, with scenes from his life, were painted on the walls. Later again, the progress of the soul as it followed the sun through the infernal regions of the night and out into the glory of day formed the subject of the pictures. All these representations, by their formal repetition from age to age, tended to crystallise into mere conventional decoration; but every form thus employed had its significance, and, till the complete decadence of Egyptian art and religion, conveyed to the spectator some mystic import, corresponding to the Christian symbols of the cross and the Sacred Monogram. Indeed, the painting of such symbols on a sarcophagus, or in the chamber of the dead, was believed to act as a charm. The lotus flower (Fig. 11) is constantly met with in every species of decoration. It signified eternal youth, and was an offering much affected by the gods. It had one conventional form both for bud and blossom, but was adapted in a variety of ways.

Fig. 18 is part of a painted bordering on a coffin. Fig. 6 is carving on the stone Parsep sarcophagus of the 30th dynasty. Fig. 8 is from a painted sepulchral box, one of those chests in which the *ka* kept such possessions as were made his on the day of his funeral. Another favourite symbol in decoration was that given in Fig. 15; it was used in solid form as a girdle buckle, and represented the blood of Isis, which washed away the sins of the wearer. The scarabæus, or sacred beetle (Fig. 10), symbolised duration of life on earth and in the after world. It preserved from death, while a frog was the emblem of renewed life. A winged scarabæus is painted on the coffin of Soter, Archon of Thebes. Serpents were numerous, generally bent up in decorative though improbable attitudes, and rearing an angry head (Figs. 12 and 19). Very frequently in the mummy cases we find a procession of men or animals carrying a serpent. In what is considered one of the oldest forms of symbolic art, the serpent is represented with an egg (Fig. 17), the egg symbolising life and the serpent eternity. In its passage through the nether world the soul had many serpents with which to combat: there was one to guard each hour. Down there were also the fearful assessors of the dead, corresponding with the human beings above, who sat in judgment on the corpse, and determined whether he were worthy of burial in its gorgeous tomb. The gods are constantly represented — quaint creatures with the heads of animals on human forms (Figs. 2, 3, and 22). On nearly every mummy case a winged figure is painted, the wings being drawn in a highly conventional and decorative

manner, doubtless representing the wings attained by the departed soul when it had safely passed through the terrors of judgment. As a rule, there is a human head and upper part of the body between the wings, sometimes a completed body as in Fig. 1, though occasionally a scarabæus or a bird's head, and dogs were very common in funeral decoration: Cerberus was the guardian of the Hall of Judgment (Fig. 21).

The human figure was very largely employed, generally with the hands stretched out, one higher than the other, in a graceful attitude, symbolic of devotion (Fig. 20), standing, seated (Fig. 7), or in what appears to have been a favourite pastime among the Egyptians, squatting on the ground (Fig. 13). The painting on the walls of the tombs and sarcophagi were to a great extent reproductions, more or less exact, from the illustrations in the "Book of the Dead."

This wonderful work, the oldest book in existence, gave an account of the soul's progress through the unseen world. It was considered in the highest degree sacred, and passages from it were written on the sarcophagi and on slips put in the hands of the dead to act as a charm. The tombs and sarcophagi so elaborately decorated were of course those of kings and great men; the poor were buried in pits and in clefts of the rocks, simply bandaged or wrapped in palm branches, with an amulet or two to protect them in the realms of the departed. In life, however, the common people were not shut out from the world of art. As with us in the middle ages, every craftsman was an artist, and gave a touch of beauty in the form of some simple and appropriate decoration to whatever he made. There is nothing lovelier of the kind than the wooden perfume spoons and kohl boxes carved in the form of lotus plants, figures in various attitudes and the like, of which one specimen is sketched in Fig. 5.

Here variety of invention came in, whereas in the paintings and bas-reliefs—which were nearly always consecutive tableaux of fixed and definite meaning, or symbols of traditionary form and usage—there was little scope for originality. Certain sketches of design made by Egyptian artists yet remain drawn on a surface marked out in squares, like the architects' paper of our own day, to facilitate their enlargement by the copyists. Early efforts at drawing have also been found, with the master's corrections in red ink. Till a late and degenerate period of Egyptian art, when the Greek influence began to be felt, all drawing was done with a brush formed of a reed, and not with a hard, fine-pointed instrument.

There is not much in Egyptian design that can be taken as it stands and applied to modern European decoration; so large a proportion of their ornament was exclusively concerned with their own religious rites. The lotus adaptations and animal forms which have been rendered decorative without any departure from fidelity to nature might indeed be copied direct. But the great gain in studying the decoration of the Egyptians lies in the insight thus acquired into their especial artistic genius—*i.e.*, the combining severity of outline and a frank conventionalism with artistic grace and truth to nature. This they attained by seizing and emphasising the main features of their subject, while suppressing all unnecessary details which would interfere with the effect of the decoration as a whole.

Those who have not the opportunity of travelling to the East, may make explorations almost as valuable for practical purposes within the walls of the British Museum. Egyptian remains are also preserved in the Soane and the South Kensington Museums.

For the letterpress of this paper the writer is much indebted to Maspero's work on "Egyptian Archæology," translated by Miss Edwards.

ABOUT THE ARLBERG AND OTHER ALPINE TUNNELS.

BY HENRY FRITH.

The success of the St. Gothard line aroused the emulation of Austria, and her eagle eyes were turned to a separate line to Paris from Vienna, *viâ* Constance, Landeck, and Innsbrück. The Brenner Railway runs at right angles to the Arlberg line.

The necessary tunnel for the new line was begun in 1880. It was estimated to occupy five years in construction. The other portions of the railway between Bregenz and Innsbrück are also very interesting—the engineering is excellent; the views are magnificent. Seated in the hindmost carriage, with its immense sheets of glass all round, the prospects and gradients and cuttings can be studied by the passenger at leisure.

But our business is chiefly with the Arlberg Tunnel, which pierces the water-shed of the Arlberg, lying between the Rhine and the Danube.

The great tunnel was begun in 1880, and the engineers having the Cenis and Gothard experiences before their eyes, were enabled to work very cheaply and expeditiously. They progressed so rapidly that the line was actually open in 1884! On the 15th of May, 1880, the order to begin arrived; on the 13th of November the boring began; on the 13th of November, 1883, the borings met, the working having been, as usual, from both sides simultaneously.

The contractor had performed his work in four hundred and twenty days less than the stipulated time; and this was the most satisfactory part of the business, for the Government had agreed to give him £80 a day for each day he lessened the contract time. Thus he earned the welcome sum of £33,600—his private share of the undertaking—as a premium.

The motive power for the works and some machines was water, which exists in quantities on the Arlberg. The streams were dammed, and the water conveyed, under tremendous pressure, in pipes to work the necessary machinery. The borings in the tunnel were also done by compressed air, and two kinds of machines were used. There was quite a rivalry between the men employed on these when one was worked by air and the other by water.

The drills were the Ferroux and the Brandt. The former was worked by air, the latter by water. The former is a percussion drill, something like the instrument employed in the Mont Cenis Tunnel on the Sommeillier system. The Brandt machine drills holes by revolving-boring, and has been pronounced the superior tool, inasmuch as a certain number of Brandt machines will do as much work as twice the number of Ferroux drills under equal conditions.

Twelve miners and seven navvies were employed on the Ferroux drills each shift. Seven miners and seven navigators only were employed on each of the Brandt machines, with one mechanic to repair them; the Ferroux were taken away and repaired. The explosive used was dynamite. The manner in which the work was done is as follows: The "heading," or upper cutting of the tunnel, was "levelled" with the intended railway below. From the heading the men drove vertical shafts downwards at certain distances. When they reached a proper level, each party cut sideways, and thus formed the lower gallery (to meet each other), into which the rock and *débris* was thrown down by the shafts and carried off.

The tunnel was carefully lined with bricks, the progress made being about 18 ft. a day. As the actual tunnel was completed the rails were laid, the *débris* carried out, and materials carried in. Regular trains of trucks were constantly in movement, and "marshalling" them was quite a business. The men laboured in semi-darkness daily; and the contract provided for a supply of air to the extent of 5,300 cubic feet per minute for the workmen.

This, the main tunnel on the line, is just 6·375 miles in length. It extends between two stations—St. Anton and Langen; it cost £1,209,400; and three years were occupied in its construction—the actual boring of it. In less than a year after the railway was actually opened—viz., in September, 1884. There are nine other tunnels on this line from Innsbrück to Bregenz, which will well repay a visit.

Several other schemes for driving great tunnels through the mountains have been projected. Of these, the Simplon Tunnel seems to be the most likely to be begun. It will be about ten miles long. The railway is already at Visp, in the Valais, and at Domo d'Ossola, in Italy. The gradient is estimated at 1 in 90 on the Swiss side, but much heavier on the southern slope. The borings will be exceptionally heavy. The expenditure is estimated at £2,118,000. The big tunnel will cost, perhaps, £1,877,000, and a considerable sum, in addition, for ventilation plant must be added.

Other tunnels, which have not advanced much towards estimates, are those suggested to penetrate the St. Bernard and Mont Blanc. The writer has seen no late suggestions concerning these projects. They were proposed to reach Aösta by different routes, and the plans vary greatly. The St. Bernard is to have steep gradients and a short summit tunnel; the Mont Blanc route is to have easy approaches and a long tunnel. The cost of these undertakings cannot be less than £40,000 a mile.

SCIENCE TO DATE.

New Fossil Mammal. — Mr. C. Dawson has discovered the tooth of a mammal in the Weald, near Hastings. It seems to be related to the well-known Plagiaulax from the Purbeck beds. It is the first trace of a mammal of the Cretaceous period yet found in Europe.

Volcanic Action in the Lipari Islands.—A Royal Commission appointed by the Italian Government to study the phenomena exhibited by the eruptions of the Island of Vulcano in the Lipari Islands during the period from August, 1888, to March, 1890, has just published a voluminous report. A typical eruption of this volcano consists of a huge column of volcanic dust carried up by volumes of steam to a height of several thousands of feet, and this is accompanied, in the more violent explosions, by the ejection of huge bombs of incandescent lava and brilliant electrical discharges. No lava flow, however, occurred during the whole period. It is interesting to note that the neighbouring volcano of Stromboli, though only about thirty-six miles distant, is not influenced by the condition of Vulcano, and that the material ejected from the two volcanoes is different, being blacker and containing less silica and more bases in the case of Stromboli. Hence there must be some subterranean barrier between the sources of lava supply of the volcanoes.

New Determination of the Velocity of Sound.—Regnault many years ago determined the velocity of sound in air by firing a pistol containing one gramme of powder—so as always to produce sound-waves of equal strength—at one end of a long tube, and receiving the sound-wave on a flexible membrane placed at a measured distance inside the tube. When the sound-wave reached this membrane it threw it into vibration, and by means of a small metal disc fixed at its centre the membrane struck against a metallic contact, thus closing an electric circuit, which traced on a chronograph the exact time when the sound-wave reached it. MM. Violle and Vauthier, taking advantage of a subterranean conduit destined to carry water from Rochefort to Grenoble, have recently made a re-determination of the velocity of sound in air by a similar method, but laying special stress on points omitted or left doubtful by Regnault. They found the velocity of sound in dry air at 0° C. to be 1,086 ft. per second. This is a little less than the value usually employed in calculations—viz., 1,093 ft. per second.

TRADE: PRESENT AND FUTURE.

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

TIMBER TRADE.—The deliveries from the London docks show a further decrease, amounting in a week to a fall of over 2,000 standards. The uncertainty of the labour market has much to do with this. It is to be hoped that the mid-season and fall will this year improve, and that we shall be able to show an increase over last year. The hardwood trade seems to be fairly busy, judging from recent spirited buying at the sales. Tabasco mahogany was sold at 3¼d., Jamaica mahogany, 40s. per ton, Mexican mahogany from 3½d. to 10d. per ft., and Mexican cedar at 2⅜d. A recent sale held at Epping brought forward some hundred fine oak trees at prices varying from 2s. to 4s. per ft. cube over bark.

SHEET METAL TRADE.—In South Wales and Monmouthshire the price of tin plates remains unchanged, but makers are holding out for higher prices. Best charcoal plates are quoted 13s. 9d. to 14s. per box. Dulness reigns in the London tin plate trade, and makers refuse the low prices offered. Manufacturing departments are a little better in various parts of the country, especially in galvanised wares and dairy goods.

COTTON TRADE.—The great lock-out in the cotton trade continues, and there is but little prospect of a settlement being arrived at. Indeed, many do not hesitate to assert that the negotiations are being purposely conducted in as tardy a manner as possible, in order to prolong the stoppage. It is generally thought that the lock-out will last some three weeks longer, while in some cases it is more than probable that work will not be resumed until after the Whitsuntide holidays. Nearly all the mills in Oldham are closed, and there is no anxiety either on the part of the employers or the operatives to resume work. The employers consider that by keeping their mills closed they will not only clear out their stock, but also strike a blow at the operatives; while the latter contend that the curtailment of the supply of yarn will improve the condition of the trade. In Bolton and district the masters have agreed to run their mills four days a week only. In Rochdale and district the lock-out has assumed a more serious aspect during the last few days, several of the largest mills which had started working, and which everyone thought would cause the collapse of the lock-out, have stopped again, and for an indefinite time. In addition to the spinners who are "playing them," some of the weaving sheds are working short time, as the material is likely to run short.

SHIPBUILDING TRADE.—Clyde shipbuilding continues depressed. Several new contracts have been fixed, but the output far exceeds in tonnage the new work booked. In all, eight sailing vessels and nineteen steamers were launched during April, the gross tonnage being fully 37,600 tons, an increase of quite 4,000 tons over the output for April, 1891. The total output for the four months ending 30th ult. was over 128,000 tons (gross). The prevailing depression is ascribed to the dearness of fuel and the low freights prevailing. Shipowners, in many instances, refuse to accept carrying contracts at current freightage rates, preferring rather to pay harbour dues for their idle vessels. One result is that several Clyde-built vessels (owned by Glasgow firms) are now "laid up" for want of work. During April Messrs. J. & G. Thompson, Clydebank, secured an order for engines for a second-class cruiser which is being built in one of the Government dockyards, while orders for three sets of engines, aggregating 630 horse-power, were booked by Messrs. Ross & Duncan, of Govan, and one by Messrs. Blackwood & Gordon, Port Glasgow, for triple expansion engines for a foreign steamer. Marine engineers all over the country are feeling the effects of the dulness in the shipbuilding trade, and unless some unexpected development takes place immediately, these industries will be likely to remain slack throughout the summer; indeed, some authorities incline to the belief that a revival will not take place during the present year. West of Scotland steel makers also complain of continued dulness (a substantial reduction of wages is about to be enforced in this trade), while another important Scotch industry—viz., the mineral oil trade—shows unmistakable signs of stagnation.

PLUMBING TRADE.—There is a probability of another strike occurring in Aberdeen, the masters and men having come into conflict on some matters of detail arising out of a strike which occurred a few months ago. A new code of bye-laws, dealing with the relations between the two parties, had been drawn up by the workmen's society, and recently submitted for consideration and approval by the masters. The main point at issue is with regard to the number of apprentices employed in the trade, the men holding that the proportion of apprentices should be one to each journeyman, while the masters, on the other hand, contend that there should be no restriction. A second source of contention is the period of notice to be given on either side in the event of a dispute pending, while the workmen, in addition, ask that when employed at a distance of two miles and over from their place of residence, there should be a weekly allowance of 1s. or 2s. given extra. The masters have had the matter under consideration for some time, and a turn-out seems inevitable.

SILVER AND CUTLERY TRADES.—The Sheffield silver and electro trades have not improved since our last report. In the cutlery trade there is very little alteration, and makers of bone, ivory, and pearl handles complain of the depressed state of business. Great efforts are still being made by makers of files, scissors, knives, razors, and tailors' scissors, to supply the Spanish markets with these productions, in anticipation of the announcement of the new tariffs, which will affect most seriously the future manufacture of these articles.

IRON TRADE.—At Barrow there is no change in the hematite pig iron market. Everything is quiet. No business is being done by makers. Most works are stopped, and only eight furnaces are in blast. Warrants are at 49s. 4d. net cash, and makers are asking 50s. for parcels of mixed numbers of Bessemer iron. Stocks are being reduced considerably. Several mills in the steel department at Barrow are to be restarted this week, including the plate, tin, bar, and Siemens furnaces. Shipbuilders are busy, but want material. Coke is still very scarce. Iron ore is weak. The iron trade in the Rochdale district is getting worse every week. Our Sheffield correspondent writes:—It cannot be expected that pig iron will decline much further in value. It has dropped lately from 49s. 9d. to 48s. 8d. per ton. Forge iron realises 41s. per ton locally. The only branch of trade in which there is much activity appears to be that devoted to the supply of railway material. This industry maintains the good position it occupied at the commencement of the year. Makers of springs, tires, and wheels are well off for orders.

ENGINEERING TRADE.—While, generally speaking, there is little change to report in the condition of the engineering trades of the Lancashire district, yet in one or two localities business appears to be decidedly better than for some weeks past. This is notably the case with Bolton, where, a fair amount of new work coming in, stationary engine builders have been enabled to increase their staff of hands. For the most part, however, this branch of the trade is sharing the general depression which now characterises the engineering industry in many parts of the North of England. Machine tool makers have but little work in hand, and although machinists are still fully engaged in completing existing orders, the unsettled state of the cotton trade has had the effect of restricting local inquiries. One or two firms, however, have secured some orders from abroad, which will keep them busily employed for many months. Locomotive builders report only a small amount of new work coming forward, and there is unfortunately every indication of a very decided slackness occurring in this branch. The shipbuilding and marine engineering trades of the district remain in an extremely depressed condition, and it is reported that not a single new order for a marine engine has been secured by any Mersey establishment for some weeks. The principal shipbuilding yards are still fairly busy with the vessels in hand, but there are no inquiries for new work, and some of the small establishments are almost entirely without occupation of any kind. In the Barrow district, both shipbuilders and engineers continue busy, but the new orders do not appear to be of any very great weight. The iron trade shows but little improvement, and as many of the steel works are stopped, owing either to disputes or scarcity of raw material, there is some difficulty in obtaining boiler plates. Boiler makers are, however, now experiencing the lessening activity which is everywhere becoming general.

CYCLE TRADE.—In Sheffield, the spurt in the cycle trade is maintained, and manufacturers of cycle parts and pneumatic tires are well employed. The makers of the New Rapid cycles have just received an order from a Belgian agent for over two hundred of these machines. As, from their high quality, they cannot be produced at a cheap figure, it shows that our Continental friends know where to look for a good thing, and that they are willing to pay for it.

COAL TRADE.—The strike in Durham, which has caused some irritation and loss in local manufacturing circles, is less sorely felt at the present time. Sheffield firms have discovered that they can obtain supplies of well washed hard coke in the immediate vicinity, which is almost, if not quite, equal in point of quality to the coke hitherto obtained from the North. As there is a difference in price of nearly 8s. per ton in favour of the South Yorks material, it is probable that some portion of the Durham trade will be diverted to this part of the country. There is very little change in the situation. Hematites have risen 3s. per ton since the beginning of the Durham dispute, and are now quoted at 60s. delivered in Sheffield. This heightened price is solely due to the cause mentioned, and on the collapse of the strike, it is anticipated that values will drop to the points they occupied a month or two ago. There is very little improvement in the pig iron markets, but those qualified to judge express hope in the future. Consumers are economising, for what reason is not clear.

IVORY TRADE.—Soft descriptions were in demand at the London auction, and prices were £2 to £3 per cwt. higher. West Coast African was firm at last sale's prices, and, owing to the small quantity of newly arrived ivory, old stock was freely bought. Bangles were the only exception to the general firmness, probably in consequence of several large consignments having been sent back to India on account of trifling defects. Egyptian ivory was selling better than at the previous sales, but still cheap as compared with other qualities. For very defective pieces such low prices as £20 and £25 per cwt. were accepted.

BUILDING TRADE.—There is no lessening of activity in Manchester and district—a large contractor, indeed, finds difficulty in getting sufficient *good* men. In the Rochdale district, bricklayers' labourers are out on strike, the old question of the masters allowing a labourer to each bricklayer being again opened, in addition to some other minor details which the men demand. As the masters declare they will not give way any further, it is likely to be a long job.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

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

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Indiarubber.—VIGILANTIA. — Your experience is a common one. Perhaps the best way to proceed is, first, to cut the surfaces you wish to join so as to produce a good fit, and then moisten them with mineral naphtha, so as to make the opposing surfaces somewhat sticky. When this has been done, apply as cement a solution of indiarubber in mineral naphtha, press the surfaces into close contact, and leave under pressure in a warm place until the naphtha has evaporated.—QUI VIVE.

Inking Ribbons.—J. B. (*Jubbulpore*).—These may be kept damp by the application of a little glycerine and water.—QUI VIVE.

Indiarubber.—RUBBER.—A thick solution of shellac in methylated spirit forms an excellent cement for sticking indiarubber to wood, and will resist moisture. It must, however, be used whilst the wood is still dry; and as you state that the wood to which the rubber is to be cemented is hard, I recommend you to coat it first with a thinner solution of shellac, the rubber being afterwards cemented on with the thicker solution.—QUI VIVE.

Indiarubber.—J. H. (*Oldham*). — Indiarubber cannot be melted without spoiling, and solutions are unsatisfactory for moulding purposes. Commercially, old (vulcanised) rubber is mixed with a proportion of new rubber and sulphur, and then re-vulcanised in the form required. Rubber so prepared is, however, of inferior quality, and its preparation is an expensive process.—QUI VIVE.

Soap-making. — K. L. (*Leeds*).—Seventy per cent. caustic soda may be used, but the result will be inferior, as the large proportion of uncombined carbonate of soda contained in the weaker preparation will have the effect of making the soap prepared from it very harsh, and unfit for any but rough use. If you decide to try the experiment, you should use nearly one-half more of your 70 per cent. than would be required of the 98 per cent. See article on Soap-making, WORK, No. 103.—H. C.

Soap-making.—F. will probably find the information he requires in Watts' "Art of Soap-making," published by Crosby Lockwood & Co., price 9s.—H. C.

Turbine.—NEW SUBSCRIBER.—It is quite possible to do as you say, and more. With a fall of 10 ft. you should get something like 6 h.-p. But so many matters have to be considered, that I think your best course would be to write to Gunther's, of Oldham, and ask them for estimates, giving them full particulars of the proposed arrangement of pipes and gearing. This in the end would be your cheaper plan, because, speaking with a full knowledge of the subject, I know the trouble of casting the vanes accurately. These are made in cores. If you can cast them yourself, they must be done very accurately. If you put them out, then it will be cheaper to order the turbine complete than to have one portion cast to order and make the rest yourself. If, however, you intend to try, I will reply to any specific questions you may put, though to go through the details of the work properly would occupy more space than can be spared in "Shop." A practical work on the subject, which you may study with advantage, is "Hydraulic Motors," by G. R. Bodmer, published by Whittaker & Co., Paternoster Square, London, E.C. Its price is 14s., and you will find every form of turbine illustrated in it, and the necessary formulæ for obtaining dimensions for different conditions of head and velocity, and the curves of the vanes.—J.

Tool-Holder.—A. T. S. (*Bedford*).—(1) I presume you mean tool-holders for chisels and plane-irons. If so, I only know of one general type—that in which the tool is set at a suitable angle with a pivoted appliance, provided with a certain roller at the end opposite to that in which the tool is clamped. The appliance being set at its proper angle, the roller runs with the stone, and the facet of the chisel is maintained at practically a uniform angle. You can get it of Melhuish, Fetter Lane, E.C., or some of the other tool merchants who advertise in WORK. (2) No, hardly ever; it is an amateur's crutch. (3) Certainly not; the facets of all cutting tools used by woodworkers should be sensibly hollow. (4) I cannot say; you would have to search through the records of the Patent Office.—J.

Fig. 1.

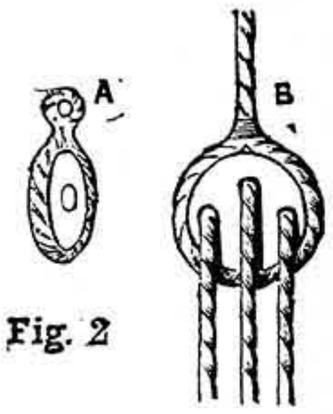


Fig. 2

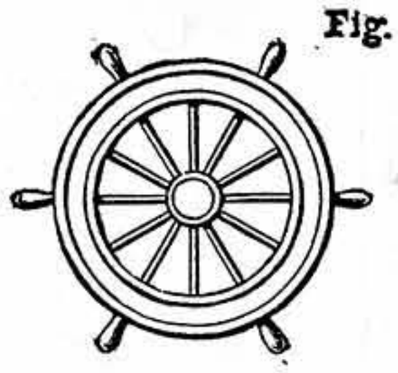
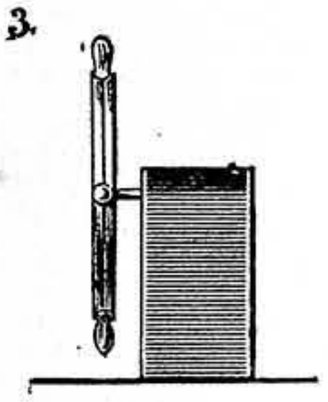


Fig. 3.



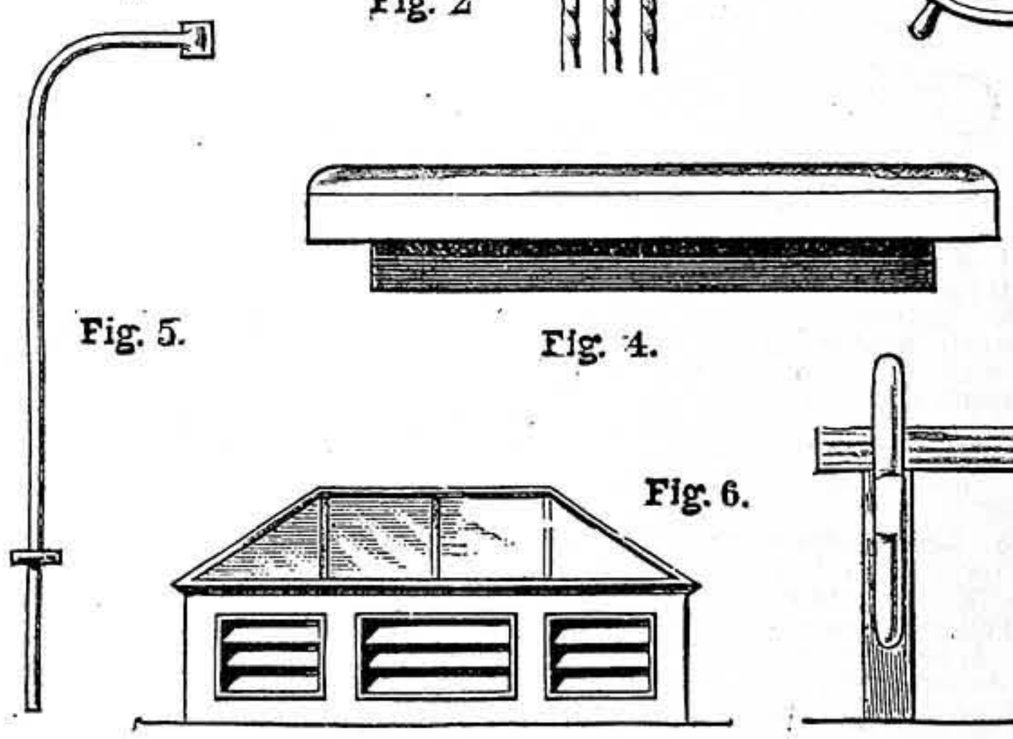


Fig. 5.

Fig. 4.

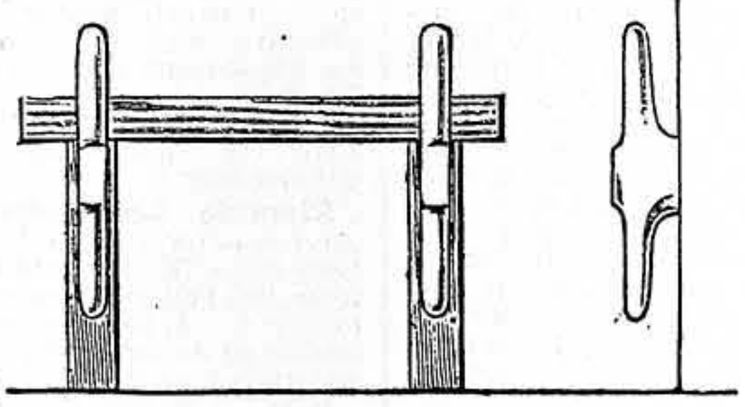


Fig. 7.

Fig. 6.

Model Yacht. Fig. 1.—Single-sheaved Block. Fig. 2.—Dead-eyes. Fig. 3.—Steering-wheel. Fig. 4.—Hatchway Cover. Fig. 5.—Davitt. Fig. 6.—Skylight. Fig. 7.—Cleats.

Fake and Buff Ball.—W. W. (*Brentford*).—You will not be able to buy fake, as it is not sold ready for use, but it is made in the following way: Take two hard heelballs and about two-thirds of a white glazing ball, break them up into small pieces, and put them into a small tin box. You can buy proper fake tins; any one will do, but the deeper the rim of the lid is the better, as it will prevent the spirit evaporating when not in use. You just cover the contents of the tin with naphtha, and then put the whole on the hob or in the oven; but the fire must not be fierce, the lid must not be on the box, and it must be well watched, for this process, of course, rarefies the spirit and intensifies its inflammability. White ball is not buff ball, but people sometimes apply that term to the glazing ball spoken of above. The use of fake is to lessen the labour in finishing, for if heelball is ironed on, it is very hard to rub off. It is used after the edge has been knifed, rasped, scraped, sand-papered, inked, dried, and been nicely ironed with warm irons, which gives it, in itself, a good gloss. The fake is rubbed on with the finger, and when it has set a little, rub it off with a nice soft cloth till it leaves a bright even gloss, which should be a jet black. If you want to finish brown work, it is done in the same way, and the fake is made just the same, only all white ball is used, and not any heelball.—W. G.

Martin Mantelpiece.—G. P. U. (*Ulceby*).—Such a mantelpiece as you require only awaits opportunity of publication, which shall not be long.

Positive and Negative Poles.—P. S. (*Leigh*).—(1) The positive pole of an electric battery is that which gives out electricity. The negative pole is that which receives electricity. In other words, when the two elements of a battery are connected to an outside circuit of conductors, the electric current starts from the positive pole of the battery, passes through the conductors—wires and other connections—to the negative pole, and returns by it to the battery. (2) Inside the battery cells, that element is positive which wastes away—is dissolved—and, in dissolving, gives out an electric current. As zinc is generally used in batteries, we may say that zinc is the positive element. The negative element is that which receives the current set up by the positive element, and transmits it to the outer circuit. It therefore follows that the positive element of a cell is the negative pole of the battery, since it gives out a current inside the cell and receives it outside the battery.—G. E. B.

Dry Battery.—R. S. (*Felixstowe*).—(1) Get a zinc cylinder of ⅛ in. zinc, 7 in. by 3 in. Close the edges, and solder a thin strip of zinc over them. Cut a disc of thick zinc to fit in the cylinder, and solder this in to form a bottom. (2) Get a large lump or plate of carbon to go inside the cylinder of zinc, and fit to it a brass terminal. Stand the carbon on a piece of porcelain or glass in the cylinder, and pack the intervening space with equal parts of gypsum and oxide of zinc moistened with chloride of zinc. Seal over with pitch. (3) Yes. Gypsum is plaster-of-Paris or sulphate of lime. Oxide of zinc is the "zinc white" used in paint. Chloride of zinc is the "killed spirits" of the plumber. (4) I do not know the exact ingredients employed in charging the Gassner dry battery, nor their proportions. It is a patented invention. (5) I do not know of any dry battery capable of lighting a 5 c.-p. 8 volt incandescent electric light for two or three hours every night. It would, probably, take seven Gassner cells in series to light up such a lamp, but the light could only be maintained for a period of ten minutes at a time, after which the battery must rest for several minutes before turning on the current again to the lamp. Dry batteries are only employed in intermittent work, and are not suitable for *constant* electric lighting.—G. E. B.

Model Yacht.—T. H. L. (*Newport*).—I send sketch of fittings. Fig. 1 is a single-sheaved block. Make it of boxwood or plane-tree; cut the mortise for pulley; then shape with chisel and rasp. Make a notch round the outside, and fix a loop of cord. The pulley is brass, with a groove on the edge, fixed with a wire pin. Double-sheaved block is made in a similar manner, but with two pulleys. Fig. 2 shows dead-eyes of boxwood—A is the small size, with a groove round the edge; B is for the main shrouds. Fig. 3, steering-wheel. Turn it as a disc, and cut the spokes out; fix handles on the rim; a steel wire axle is fixed in the centre, with a wooden roller, round which the tiller ropes are coiled, and carried round guide-pulleys to each side of the rudder. Fig. 4, cover for hatchway. It should have cork or indiarubber fixed round the rabbet, to prevent water getting in. Fig. 5, davitt for boats, made of strong wire, with an eye formed at the end: two are required for each boat; the boat is hung with blocks and tackle, and is fixed against the bulwarks. Fig. 6, skylight over cabin or saloon; the top is covered with glass, and louvres in the sides. Fig. 7, cleats for holding ends of halliards, made of wood or brass, and fixed on a rail at the foot of the mast, as shown, or on the inside of the bulwarks. You can fix the compass on a small turned pillar in front of the wheel. There is also capstan, windlass, and pump, but I think you will hardly need these.—M.

Winding Dynamo.—C. R. (*Oldham*).—If you wind the field-magnets of your little dynamo with 4 lbs. of No. 22 double cotton-covered copper wire, and the armature with 5 oz. or 6 oz. of No. 22 silk-covered copper wire, and drive it at a speed of 3,000 revolutions per minute, it will, when connected in shunt, develop a current of 2 ampères at a pressure of 25 volts. With this current you may light a 25 volt 10 c.-p. lamp, or two 12 volt 5 c.-p. lamps in series.—G. E. B.

Electric Belt.—A. E. (*Birmingham*).—If you will get the index to Vol. III. of WORK, and look through the section devoted to "Shop," you will see numerous references to electric belts, and, on looking up these in back numbers, you may learn how to make a genuine electric belt.—G. E. B.

Galvanometer.—LINESMAN.—An illustrated article on how to make a linesman's galvanometer is now in the Editor's hands, awaiting space for publication. From this you will learn how to make the instrument. By making the case a little larger, or by making a separate case for a dry battery, and attaching it by brass hooks to the case of the galvanometer when required, you can provide yourself with a portable galvanometer and battery combined. I recommend dry cells for several reasons, apart from that of portability. You will need several pairs of elements to get the necessary E.M.F., and the required number can only be got into the space at your command by using some form of dry battery. The cells may be of papier-mâché or cardboard, well soaked in melted paraffin wax. Each cell may be 2 in. in depth, 1 in. in length, and ½ in. in width. The elements may be silver foil and zinc plate, separated by a pad of blotting-paper, having silver chloride on the side next the silver foil, and zinc chloride on the opposite side.—G. E. B.

Books on Electric Lighting.—ELECTROLIER.—The best and cheapest book on the subject is "Practical Electric Lighting," by A. Bromley Holmes, and I can heartily recommend it to all who, like yourself, wish to know something on the subject for the first time. You will learn much from my articles on "Model Electric Lights," published in WORK, Vol. II.—G. E. B.

Glass Embossing.—E. P. (*Birmingham*).—I wish you had said if you wrote as an amateur or professional. It makes a difference sometimes when answering questions. To take your queries in the order you ask them:—(1) Whether you "bought ground glass and etched, or plain glass and afterwards grind it," must depend upon circumstances of which I have no knowledge; all I can say is the first plan would result in a saving of time, which, if you used any quantity of glass, would be very considerable. But why not frost by the gas method, and leave the letters plain? certainly not etch them by liquid as well: that would not be needed, and the frosting would be much finer than ordinary commercial ground glass, which is very coarse by the side of the other. (2) I suppose you mean to cut through the Brunswick black; if so, any sharp-pointed steel tool would do. (3) Fasten it on with Prout's glue if you like. (4) The ordinary kind. (5) Turpentine is used in making Brunswick black to thin it to the proper consistency, so you may use that *if needed*, but be sure and not make it too thin. I always warm Brunswick black (by setting the bottle in front of the fire some time before I want to use it) if it is not very hot weather: whenever I use it for any purpose, I find it works easier, and very seldom needs thinning. (6) The reason you cannot get the black off ground glass is because the surface is so uneven that the tool used will not reach every part; turpentine will take it off, but I think you will succeed far better by using plain glass and the gas process, as I advised in answer to first question. I hope I have made it perfectly plain to you, and shall be glad to help you at any time.—W. E. D., JR.

German Silver.—SOCRATES.—Sheet German silver may be obtained from the Berndorf Nickel and German Silver Works, Moorgate Street, E.C.; Messrs. Stedman & Co., Billiter Street, E.C.; or, failing them, Messrs. Barker & Allen, Surrey Street, Sheffield; the prices being, best quality, 1s. 5d. per lb.; second quality, 1s. 4d. per lb.; third quality, 1s. 2d. per lb.; and fourth quality, 1s. 1d. per lb. Ascertain the thickness you require by means of the sheet-metal gauge, or take a sample with you. You may probably have to pay a little more than the prices mentioned above, unless you require a large quantity, in which case you may ask for the usual wholesale terms and discount.—N. M.

Rubber Solution.—C. P. (*Barley, Royston*).—The address of Mr. John Piggott is 117, Cheapside, London, E.C., and probably you could procure the solution named at that establishment. It is procurable of most respectable dealers in rubber goods. Failing Mr. Piggott, you should apply to The Indiarubber, Gutta-percha and Telegraph Co., 106, Cannon Street, London, E.C., which firm can certainly supply you.—QUI VIVE.

Tricycle.—W. R. (*Mile End*).—If W. R. will state his wishes more fully, I will be glad to help him in the matter by making a sketch or otherwise.—A. S. P.

Taking Out a Patent.—MEXICO.—This article appeared in WORK, No. 35, bearing date of November 16, 1889.

Model Hot-Air Engine.—G. M. (*London, S.E.*).—I see nothing in the drawing you send which should prevent your engine from going, if only the piston and plunger of the displacer fit fairly well without friction, and the lamp flame plays properly upon the bottom of the heater (it looks too far off). The opening from heater to cylinder seems unnecessarily large; and what you took to be a "wire brace" was the line where the cylindrical body of the engine is cut away to leave two standards to hold bearings for the crank-shaft, these standards being formed of the body tube by cutting out a piece from each side. The water then can be filled up to where you have put the bottom of the wire braces. I think you will get your engine to work all right. You should disconnect the working connecting-rod from the crank, and then, when the lamp is lighted, turn the wheel so as to move the displacer up and down. The working piston being free from the crank, you should see it rise and fall about as much as it would if connected with the crank. I should like to hear you have succeeded.—F. A. M.

Cleaning and Restoring Oil Paintings.—W. C. G. (*Bowes Park*).—If your pictures are only dull and dirty, the defect can be remedied by "oiling out"; or, if not already thickly coated with old varnish, they may, after oiling out, receive a very thin coat of varnish. Should they be covered with several coats of old varnish, each of which has in turn picked up dirt and dust, they then require to be cleaned by means of the old varnish being removed; this is in itself an art, and requires the hand of an expert. Spirits of wine and turpentine are used, but as they attack the paint as well as the old varnish if the further action of the spirits is not arrested at the right time by a free use of water, it is, as I say, a process that requires some experience. However, should you care to experiment on some unimportant canvas, you may work in the following way:—Mix in a cup 2 parts turpentine with 1 part rectified spirits of wine. With a piece of cotton-wool dipped in this solution begin rubbing softly, commencing at the top left-hand corner of the canvas; it is well to attack a small portion at a time—say a surface 3 in. square. As you rub gently, keep sponging with cold, soft water, the secret being to know when you have removed the varnish and reached the paint. That being done, allow the picture to dry slowly but thoroughly; then varnish with the *thinnest* coat you can possibly lay on; this should be done always in a dry atmosphere and out of any current of cold or damp air. One of the best varnishes for this purpose is Sanders' improved picture varnish, prepared and sold only by B. Keen, chemist, Park Street, Bristol, 1s. 6d. per bottle, or mastic varnish may be obtained at any artists' material shop. For oiling out dirty pictures that have dried into the canvas, wash well with water only just off the chill, dry with linen cloth, then polish with silk duster when quite dry; take some boiled linseed oil, put about two or three drops on a good handful of cotton-wool, and, beginning at top left-hand corner, just polish as you would a pair of boots, leaving as little of the oil on as possible; do a small square of the surface at a time; you may then, if desirable, varnish as advised above.—F. B.

III.—QUESTIONS SUBMITTED TO READERS.

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

Skins.—A. B. C. (*Arbroath, N.B.*) writes:—"Will any reader please tell me the best way to fan and soften rabbits' skins thoroughly? I can do the alming part very well."

Musical Reed Brass.—W. C. (*Bulwell*) writes:—"Would some reader give me information how brass is hardened to make reed tongues for organs or harmoniums? Also what special tools are used for the purpose?"

Perspective.—SPECTEMUR AGENDO writes:—"Will some correspondent recommend me a book on practical perspective? I am anxious to learn how to draw articles of furniture in perspective from plans and elevations."

Binding WORK.—J. H. B. (*Pendleton*) writes:—"Will some reader of WORK be so good as to tell me the name and address of some working bookbinder in the neighbourhood of Manchester, and what the charges for binding WORK should be?"

Clock Stand.—G. N. (*Henley-on-Thames*) will thank any reader for an easy ornamental clock stand.

Grinding Scissors, Knives, &c.—OLD MAN writes:—"Will any reader kindly give me instructions for constructing a machine such as is used in the streets for the above purposes? A few hints on grinding, etc., would be thankfully received."

Whitewood Polish.—POLISH writes:—"Will some reader of 'Shop' kindly give a wrinkle as to polishing whitewood without in any way discolouring or obscuring grain of the wood—*i.e.*, a perfectly clear polish, and how to apply same?"

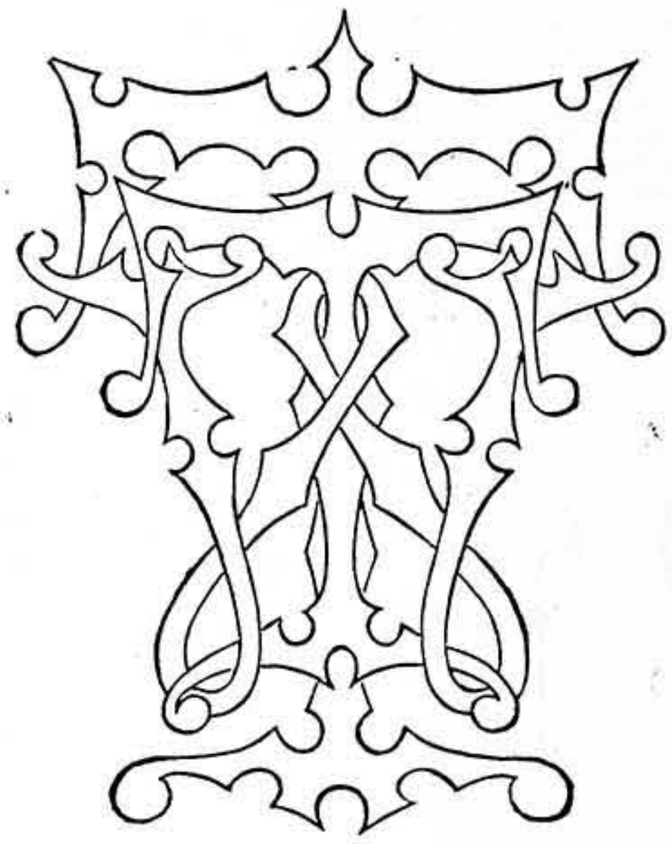
Photo Shutters.—S. M. L. (*Goderich, Canada*) writes:—"I should be very much pleased if some of our amateur or professional readers will give me, through columns of 'Shop,' some sketches of photo shutters suitable for hand cameras, to work behind lens—those that can be operated from outside of camera preferred. Also, will someone explain the principles of shutters that open and close from centre of lens, and made of thin leaves of vulcanite or metal?"

Engraver's Tools.—ENGRAVER WALES writes: "I should like to know where I could obtain tools for engraving names, etc., on brass and metal coffin plates, and where I could get tuition? I am a good writer on coffin plates, but am wishful to learn engraving. Will any reader oblige with full information through this valuable paper?"

Cardboard.—L. G. (*Dorking*) writes:—"Will any reader kindly inform me where I can obtain cardboard suitable for ticket writing?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Monogram.—J. B. (*New Cross*) writes to T. W. T. (*London, N.*) (see No. 156, page 830):—"If your bag is polished leather, any oil colours will do; if it is not, you had better use artists' colours, and no oil, only turpentine, as a medium, to prevent a greasy edge appearing. Then varnish with good spirit varnish neatly up to the line. A very effective way to guard against the chance of an unpleasant edge is to put the design in with Brunswick black, then do the letters in with any oil colours, leaving a thin, bright, black edge all round the whole design; this throws the work up wonderfully."



T. W. T. Monogram.

Electric Locomotive Engine.—M. (*Bishop Auckland*) writes to J. J. (*Blackpool*) (see No. 159, page 46):—"You cannot use the engine in its present form, but you could connect the wheels to an electric motor fixed on the tender. You can obtain a motor, or materials for one, from Mr. G. Bowron, electrician, of Praed Street, London, W."

Lathe.—M. (*Bishop Auckland*) writes to RICHMOND VA (see No. 159, page 46):—"Get the book, 'Metal Turning,' advertised on p. 40 of WORK, which will give you directions."

Polishing Paste.—A. A. P. (*South Shields*) writes:—"QUILLDRIVER (see No. 157, page 14) can get a splendid polishing paste for brasses from G. Pemberton, Salisbury Street, South Shields."

H. E. B. Monogram for Metal Working.—F. J. K. (*Tufnell Park, N.*) writes to WIN (see No. 155, page 814):—"If you are not already suited, perhaps this monogram will answer your purpose; but I must say it is not my business: it's a pleasure."

H. E. B. Monogram.

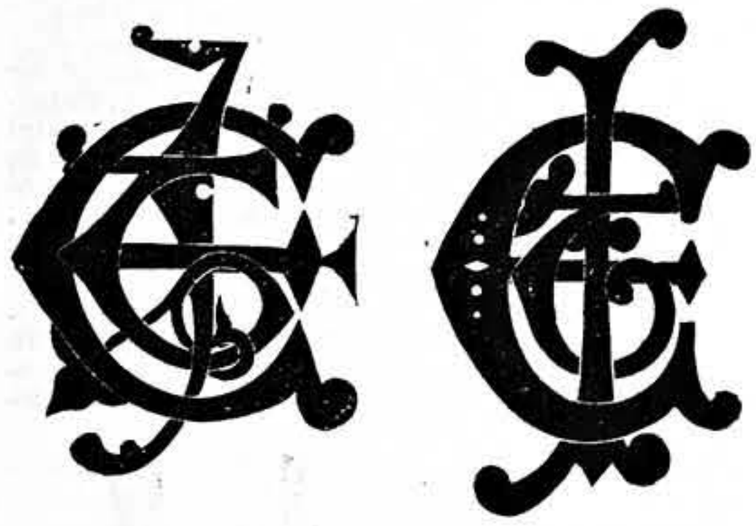
Lantern.—C. A. P. writes, in reply to E. H. L. (*Leicester*) (see No. 157, page 14):—"You will find full description and illustrations of the apparatus you require by reference to page 144, Vol. II. of WORK."

Maguay Lamp.—M. (*Bishop Auckland*) writes to ELECTRIC LIGHT (see No. 150, page 733):—"You can procure this from the Secretary, Sherborne Electrical Installation Company, Dorset."

Blowing Fan.—M. (*Bishop Auckland*) writes to WAREHOUSEMAN (see No. 151, page 750):—"You can procure these from Ernest Scott & Mountain, engineers, Newcastle-on-Tyne; the Union Engineering Co., Pollard Street East, Manchester; or Aland & Co., Commercial Road, Lambeth, London."

Coal-dust.—M. (*Bishop Auckland*) writes to HOUSEHOLDER (see No. 151, page 750):—"This is sometimes mixed with clay into balls and burnt. There is also a process of mixing it with coal-tar, and subjecting it to pressure, forming it into briquettes, but I believe it is a patent."

J. E. T. Monogram.—E. E. GIBBS (*Portsmouth*) writes, in reply to YOUTHFUL READER:—"I enclose two designs for fretwork monogram."



J. E. T. Monogram.

Frame-making Trade.—J. A. (*Smallheath*) writes:—"If SENTINEL (see No. 159, page 46) is a tradesman, I should strongly recommend him to get a good strong mitre-block, shooting-board, and shooting-plane, at a cost from 17s. 6d. to 20s.; or if he would like to make them himself, I will send sketch and full particulars. The mitre-cutters are all very well in their way, but such accurate work cannot be done with them as with tools named above. The main thing with either is practice, and plenty of it."

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—CAWD HUD; J. B. (*Ashton-under-Lyne*); OXY; ANXIOUS; S. B. (*Ardwick*); J. O. (*Leeds*); T. O. J. (*Wellington*); S. M. H. (*Bootle*); HEN FRIND (*Ludwig*); AB UNO DISCE OMNES; W. M. (*Finsbury Park, N.*); G. B. H. (*Leeds*); J. McC. (*North Brixton*); HANSOT; A. B. C. (*Alnwick*); W. M. (*Northaw*); MOTOR; ELDRID; H. B. P. (*Southport*); J. K. (*Bolton*); E. A. M. (*Birmingham*); J. J. (*Newcastle Emlyn*); F. W. (*Liphook*); H. R. (*Colne*); A. E. S. (*Maidstone*); H. W. (*Smethwick*); W. E. (*Battersea Park Road*); W. B. (*Manchester*); A. P. (*Manchester*); C. H. (*No Address*); BELL; J. W. (*Banbridge*); A NOVICE; F. K. (*Staveley*); A LABOURER; T. G. M. (*Dublin*); W. H. E. (*West Hartlepool*); W. W. (*London, W.*); CONSTANT READER; J. W. G. (*Keighley*); OLD HAND; J. L. (*Bexhill*); B. E. T. (*Harrow Weald*); ANXIOUS; T. P. (*Clifton*); H. H. (*Staines*); J. H. S. (*London*); W. H. (*Failsworth*); COACH PAINTER; YOUNG READER; D. McD. (*Bristol*); H. G. S. (*Bishop Stortford*); G. B. (*East Dulwich*); HOWELL; THROUGH; T. D. (*Liverpool*); MARKWELL; E. A. (*Bethnal Green*); J. K. (*Glasgow*); J. J. C. (*Carnarvon*); P. R. B. (*Hitchin*); H. B. T. (*Brixton*); EDDIFRA; F. B. (*London, E.C.*); TIMA; J. J. (*Shadwell*); ÆOLUS; B. R. P. (*Battersea*); IGNORANT; A. T. C. (*Finsbury Park*); ACCRINGTON; SUFFOLK LAD; DROPSAID; J. B. (*Calderbank*); E. C. M. (*Ipswich*); W. F. (*Birmingham*); J. M. (*Liverpool*); C. J. (*Hoole*); T. M. (*Wakefield*); A. M. (*Glasgow*); H. B. T. (*Brixton*); E. E. (*Eastbourne*); E. E. (*Aberlour-on-Spey*); J. H. S. (*Ripley*); E. C. (*Kingsbridge*); A. S. (*London, W.*).