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AN ARMCHAIR: HOW TO MAKE THE FRAME AND UPHOLSTER IT.

BY DAVID ADAMSON.

THE FRAME: ITS CONSTRUCTION AND DIMENSIONS.

THE "great chairs of ease" to which Shakespeare alludes in his *Timon of Athens* are as popular at the present time in civilised—or shall I say luxurious?—communities as ever they were. Not that it must be supposed they bore the slightest resemblance to what we now regard as easy chairs, for it must not be forgotten that upholstery as we understand it is quite of recent invention, and was not dreamt of in the days of Queen Elizabeth. Even then there was a rude attempt at upholstery, but the probability is that Shakespeare had in his mind more what we should call an armchair than a lounge or easy chair. No doubt, if we could see those which he calls chairs of ease, we should consider them anything but easy. In all likelihood they were with wooden seats and high straight backs, such as are typical of the period. The chair about to be described may not inaptly be regarded as a modern rendering of these uncomfortable and stately seats. Although it may be upholstered with springs if we will, it is not to be regarded as an easy chair in the ordinary sense of the word. It is neither low enough in the seat, nor has it the high back to entitle it to that name. Nevertheless, it is a comfortable chair, and those who dislike the low puffy "easy," with its yielding springs and large low seat, may cavil at the objections urged against this designation. To them I only say it is not what in this country and age would be recognised as an easy chair. It is an armchair, certainly, wherein "portliness and pomp may sit enthroned" and enjoy all necessary comfort without being suspected of indulging in superfluous luxury. For an ordinary drawing-room such a chair would be out of place, with its straight lines and general appearance of rigidity and massiveness; but in the dining-room, at the head of the table, these very qualities recommend it. In the smoke-room this seems naturally to follow the dining-room use: such a chair is not to be despised by those who like to blow a cloud; while in the library or study what can be more appropriate? There is nothing frivolous about it, nothing paltry. It seems the sort of seat one would choose to sit in to peruse a classic author or a ponderous theological discourse, and when tired of the weighty thoughts aroused, its back invites to contemplation with the eyes shut. Who, however, would think of reading a "shilling startler" in it. No; the man who owns and habitually sits in such a chair could never be suspected of any weakness for light literature or anything of that kind. Nor could Clericus choose a more suitable chair when wishing to write a sermon of more than usually soporific tendency. Oh, don't fear, good readers, that I am sitting in such a chair while I write, although I am a bit prosy and long winded. But (it is hoped the explanation will be deemed sufficient) I am sitting in a transmogrified church chair, and associations will cling to old furniture, you know, etc. etc. Writers on art tell us we are all influenced by our surroundings, so, gentle reader, for any prolixity blame the chair, not the writer, who is particularly susceptible to the "aura" emanating from old furniture.

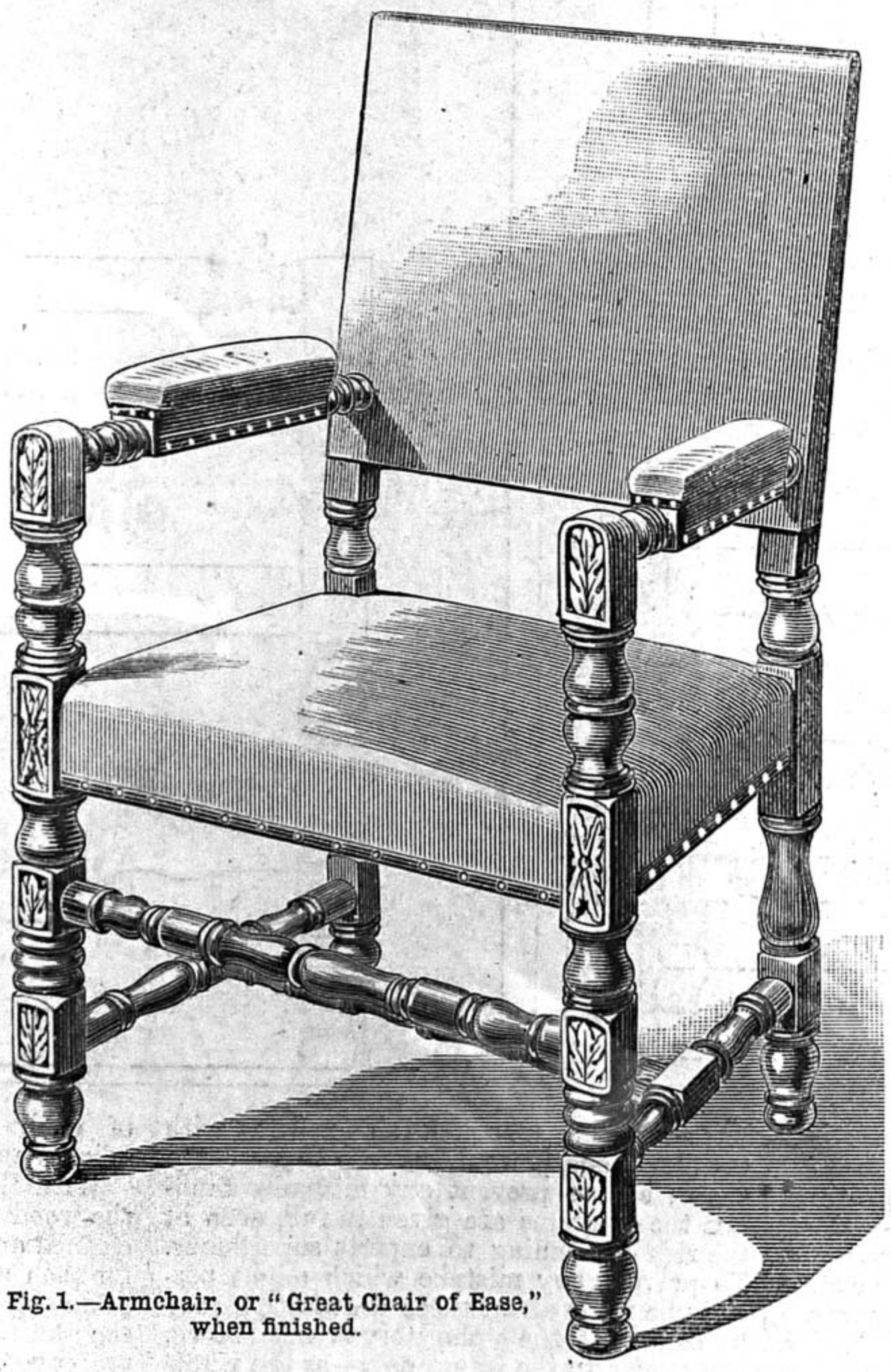


Fig. 1.—Armchair, or "Great Chair of Ease," when finished.

I almost feel inclined to say that our subject, the great chair of ease, naturally divides itself into three parts, though, as a matter of fact, it does not, unless we look on the woodwork, the upholstery, and the polishing as three separate branches, each of which, moreover, is capable of sub-division to an almost unlimited extent.

After all, I do not know that we can do better than adhere to these heads for consideration, for in the ordinary course of work the frame-maker, the upholsterer, and the polisher all have a hand in making the completed chair. For our present purpose it will, however, be more convenient to presume that the work of these three craftsmen is to be put in operation by one individual, who may also combine in his own person the draughtsman, the turner, the carver, and the—no not the needlewoman, for he had better get the sewing done by some adept in working the pricking steel.

Before going any farther, let me give a few hints to this individual in his multiple capacity when making any chair.

First of all, the sizes must be well considered. I do not refer so much now to the substance of the wood—though this is important to a certain extent—as to height of back and seat, size of the latter, and similar points. The dimensions given are generally suitable, but there is no reason whatever why they should not be modified to suit the user. The novice must, however, be reminded that an inch or two make all the difference, especially in the height of the seat from the ground. This is given as about 18 in., or the height of an ordinary dining-room chair.

When sizes have been determined, the next thing is to make careful full-sized drawings of all parts, and moulds or templates of the rails, in order that the right degree at which to bevel them off at the

ends may be ascertained and marked off on the wood with accuracy.

These may seem trivial matters to mention, but it must not be forgotten that the intention is to show novices in chair-making skilful wood-workers, perhaps, but not accustomed to chair work—how to proceed. This, I trust, will be done in the following remarks; and in making them, I shall assume that I am not addressing complete tyros either in joinery, upholstery, or polishing. It will, for instance, be presumed that the worker knows how to plane and clean up wood, how to turn it, carve it, and so on, as well as to make ordinary joints.

This will reduce the amount of labour very considerably. The drawings, of course, will not look so nice, but appearance need not be of the first consideration in a working drawing, and I fancy few employers would appreciate time spent merely on ornamental details on such. Decorative treatment is not necessary; and if a working drawing is comprehensive enough to enable the worker to construct from it, that is all that can reasonably be required from it. The plan of the seat has been referred to, and it is most important that this should be carefully prepared.

In practice it would, no doubt, generally be sufficient to set out the side rails, as, with the elevations, it would be easy to make the chair; but to prevent any misunderstanding, the diagrams are given in full, even at the risk of seeming to experts superfluous. To prevent any mistake which might possibly be made about these drawings, it may be said that the upholstery is not shown. They refer to the frame only—as the whole of the wooden or structural part on which the upholstery is afterwards laid is technically called. Well, reverting to the plan of the seat—which, by-the-bye, is Fig. 4—it will be seen that the ends of the side rails are bevelled off, and without dilating on them at present, let it be said that the ends of the arms and the rails connecting the back and front legs are at exactly the same angle.

The drawings are made as nearly as possible to scale, but to prevent any mistake the principal dimensions are given in inches. From these it will be seen that the chair is a fairly large one, so that when necessary similar chairs may be made considerably smaller. I am not, however, so much describing how any chair may be made as this particular one whose dimensions are given, so that, for the present at any rate, alterations must be at the discretion of the reader, unless—happy thought—he cares to have an opinion in "Shop" before cutting up the stuff, or setting out a chair to other measurements. This may be an assistance to some, though proportions of chairs are a good deal a matter of opinion and fashion.

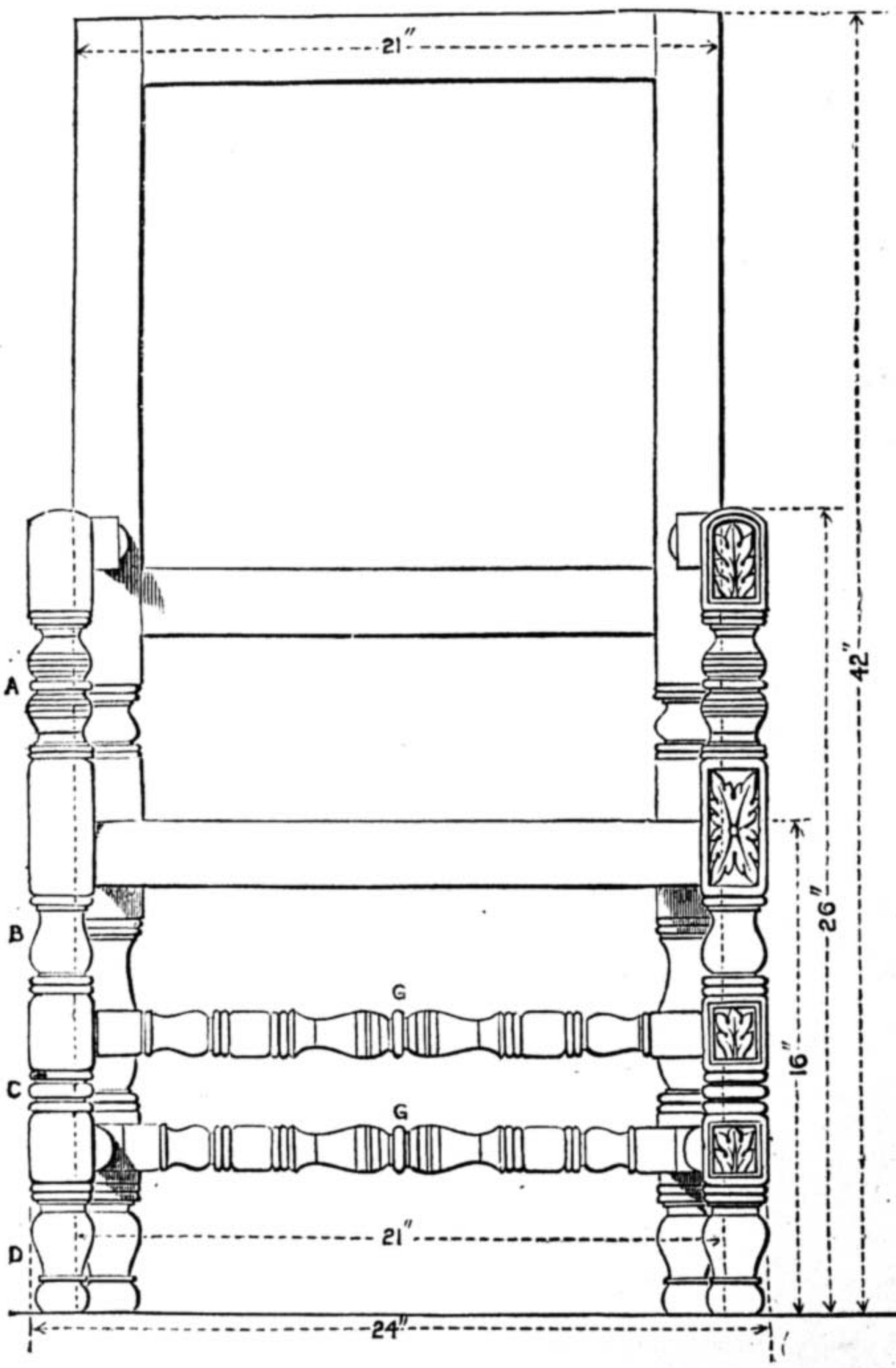


Fig. 2.—Front Elevation.

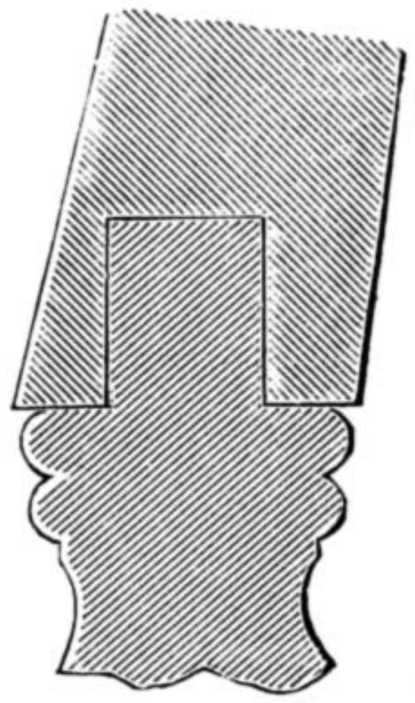


Fig. 5.—Joint in Back Legs.

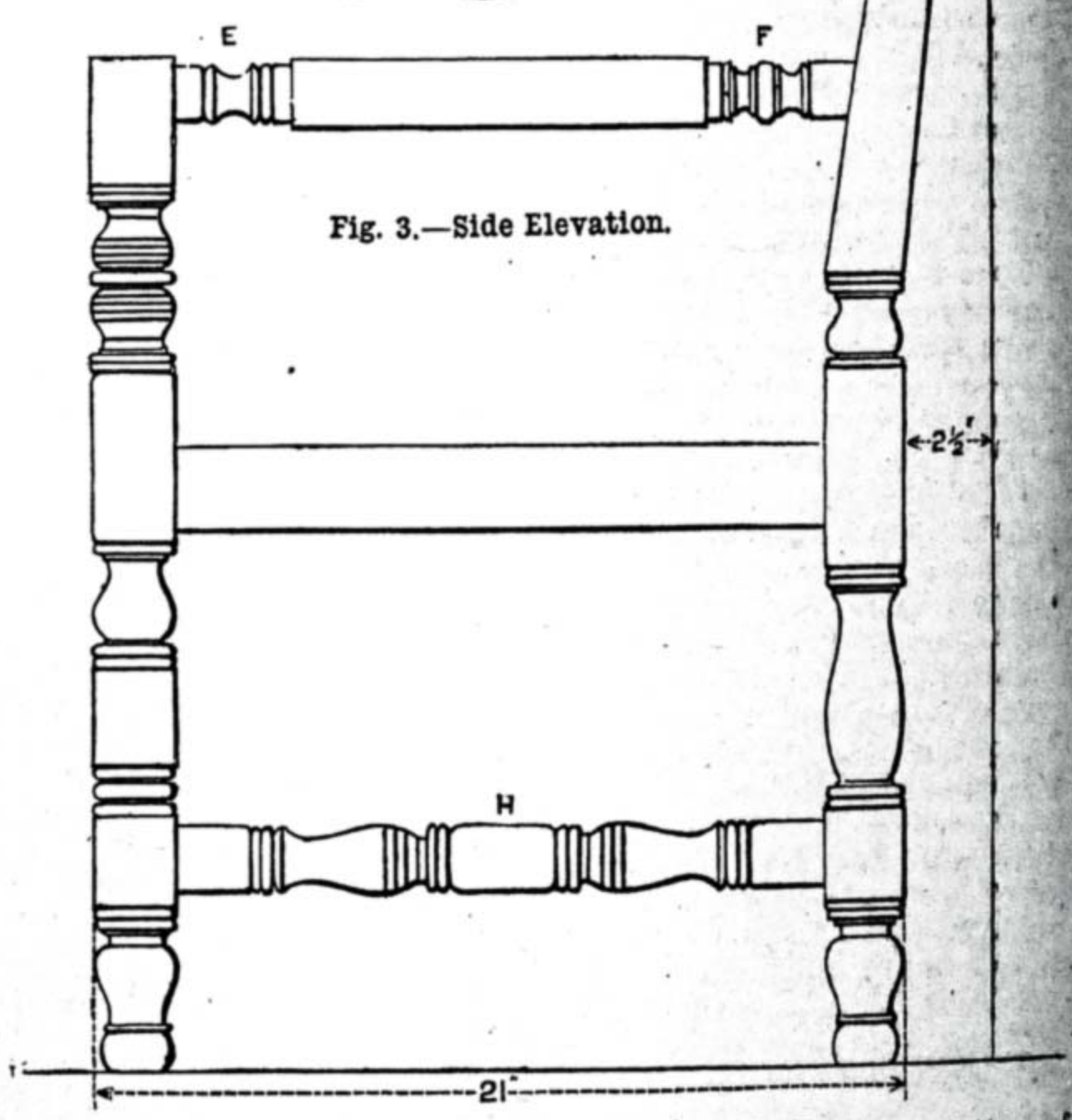


Fig. 3.—Side Elevation.

It may as well be said that this chair is a very suitable one for the novice to construct, as it presents few of the difficulties which those unaccustomed to frame-making might be apt to meet with. Its construction is of the simplest; there are no curves to perplex him, and with a very small amount of care he cannot help making a successful job of it. With the illustration (Fig. 1) showing the completed chair to guide them, many chair-makers would dispense with any drawing, except a plan of the seat, but it will be better to make as well one each of the front and side elevation, as Figs. 2 and 3, but, of course, in full size. To simplify them as much as possible, the turning need not be shown *in extenso*, as it will be quite sufficient to draw each part of the pattern once and refer to it by letter or number wherever it is repeated.

With the exception of the seat rails, all the wood is 2 in. square "down," *i.e.*, when cleaned and finished off. The natural wood for such a chair as this is oak, but walnut or any other may be used, if preferred. For the seat rails and those in the back, as they are covered over, beech may be used with economy. It does not, however, much matter what the wood for these parts is, but a soft one such as pine is not to be recommended, it not being strong enough to hold the tacks safely.

The back legs, by which is understood the upright parts above the seat as well as below it, are the only pieces which may present a difficulty, owing to the slight rake. This is necessary not only for comfort, but for appearance. Owing to the

length of these pieces, it is extremely unlikely that the amateur, at any rate, will have a lathe long enough to turn them in, so a construction which will allow of this being managed must be contrived, and with ordinary care it will be found quite as serviceable as, and not to be recognised by its appearance from, the method which would be perhaps adopted and advocated were the chairs to be made in quantities, or in a workshop provided with every requisite for chair-making. The plan I would recommend is simply to make each back leg in two parts: one to include the whole of the turned portion, and the other the square above it. The former should finish off with a good stout pin, say not less than 1 in. thick, and a couple of inches long. This, of course, will fit into a corresponding hole in the other piece, which by being cut on the bevel can be made to assume any reasonable amount of slope. Fig. 5 shows this mode of fitting on an enlarged and also somewhat exaggerated scale so far as the slope is concerned, in order that it may be clearly seen that the turned portion is perpendicular, and that the spring only begins at the square part above it. This joint may be regarded as a source of weakness, and I can almost imagine some of my readers shaking their heads with horror at the bare suggestion of it, perhaps contemplating indignant letters to the editor—aye, or possibly even sending them. Well, do so: it will be good for the revenue of the P.O.; but even at the risk of this not being benefited, let me say that a chair made in this way—a chair, in fact, from which this description is written—has been in constant use for the last ten years, and that its general occupant is a man of some eighteen stone weight. It is, therefore, quite strong enough for light and sylph-like creatures up to that, but others who are really ponderous should be careful. The back might give way under the severe strain of, say, twenty-five stone, but on the whole I think it may be considered reasonably strong, which is all that is required.

The square part of the back legs is further tapered from 2 in. at the bottom to about 1¼ in. at the top, the taper being clearly indicated in Fig. 3.

Now, those who do not care, notwithstanding what has been said, to form each back leg of two pieces joined end-ways, may adopt another method, and make them without the necessity of having the pin joint, which, in theory at any rate, is objectionable. Two pieces will, however, still be required. Fig. 6 shows this alternative form of construction, where the continuation of the lower part of the leg is shown by the dotted lines. The front of this, after the turning has been done, is tapered off, and behind it another piece of equal width is firmly fixed with glue and screw nails. As this second piece is, to a certain extent, fitted with its end grain against the other, in order to render the glue as effective as possible, the grain should be stopped by sizing it with thin glue before making the joint, the size, of course, being allowed to dry. Three or four screws should then be quite sufficient to make the back legs as substantial as if they were formed from one piece of wood.

If any reader wishes to make a quantity of these chairs, or at any rate, chairs of a similar construction, as a matter of business, and desires to avoid the necessity for any jointing, the best way will be to set the back legs out on 2 in. stuff, and get as many as are required cut at a saw-mill. To turn the legs in the lathe, screw temporarily a piece on the sloping front. As all the legs will be the same size, one piece, of course, will do for the lot.

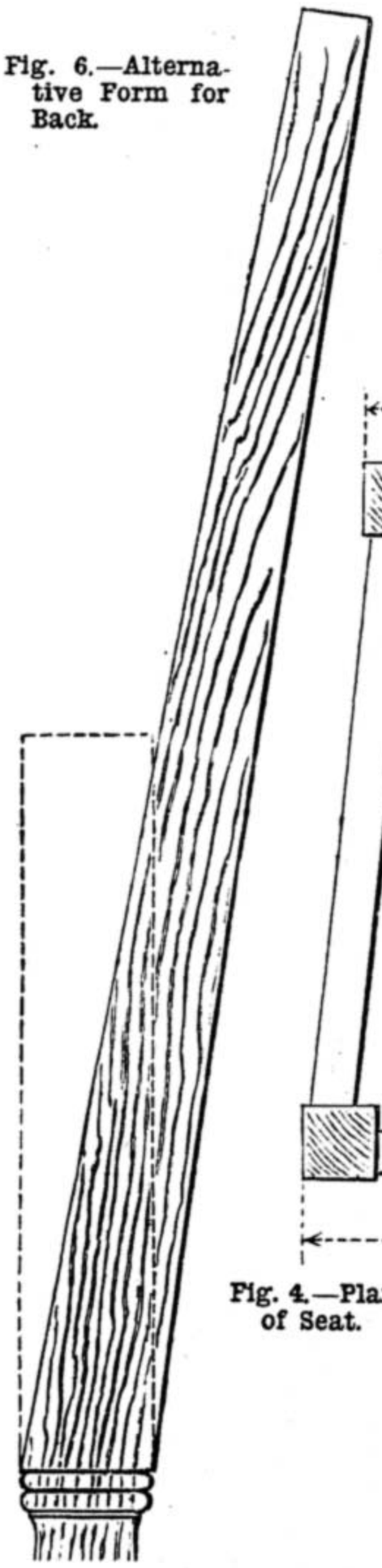


Fig. 6.—Alternative Form for Back.

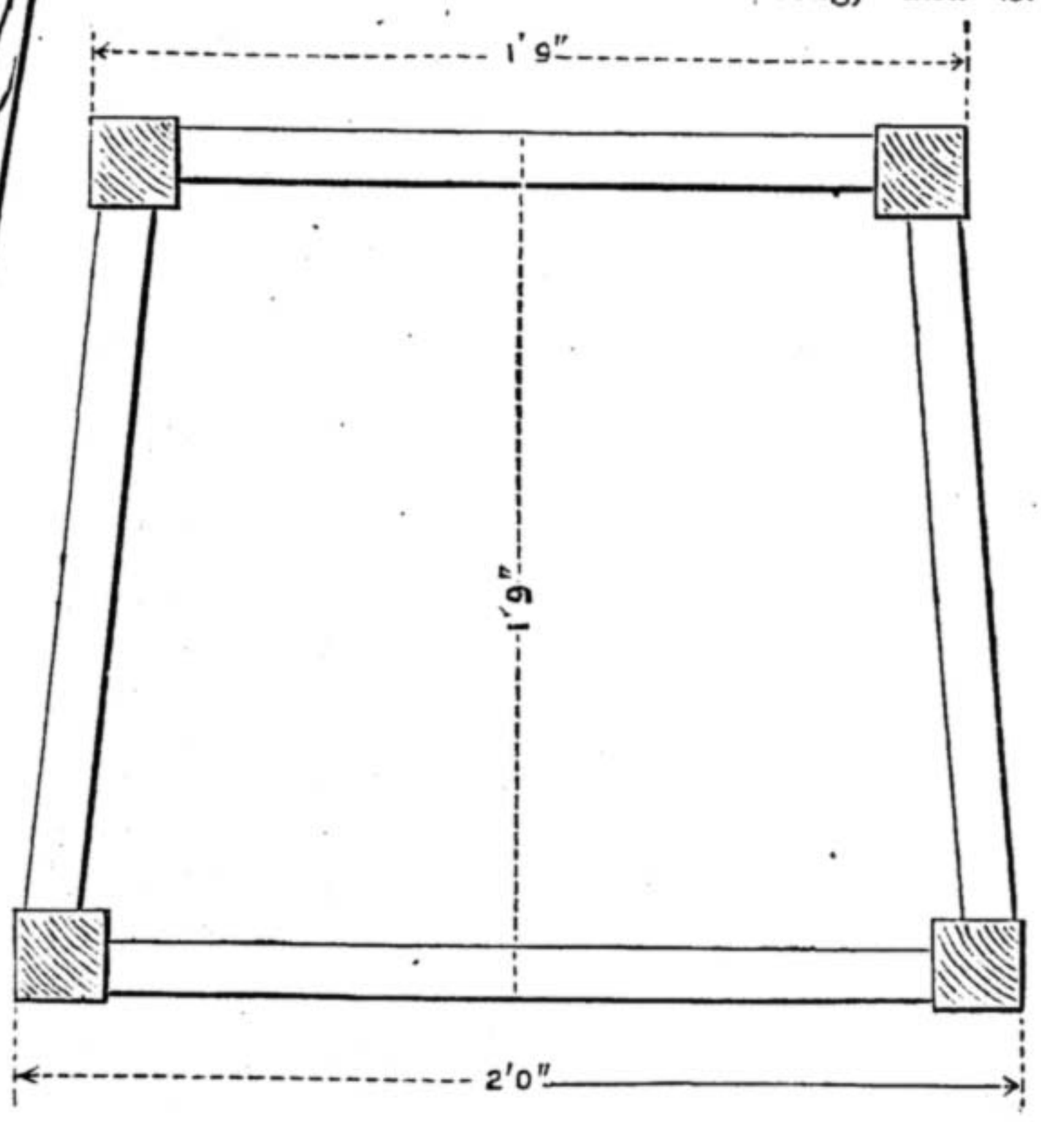


Fig. 4.—Plan of Seat.

SIGNALLING IN COMPASS STEERING.

BY J. C. KING.

MR. FRANK M. PURINTON, of Providence Island, New Jersey, has perfected a system and code of fog-whistles which may be aptly termed "Compass signals," as any point of the compass may be indicated and understood in an instant by anyone who has had one or two readings of the code. Exchange of signals from ship to ship will at once convey the exact compass-point they are steering to—thus a possible collision may be prevented. The same from a lifeboat station, lighthouse, or any place near enough to be heard.

The system may be described in so few words that it claims notice for its simplicity, and for its obvious service to imperilled humanity exposed to the dangers of the deep in storms, at night, or in fogs.

For steering north, by a ship, one long whistle is sounded; for south, a short whistle; for the west, two short whistles; for the east, two long whistles. Here are four points of the compass so simple to learn, that no one can mistake them. The long signals are of three seconds duration, and the short signals of one second duration. A compass chart, if marked with a long dash to N., and a short dash to S., two short dashes to W., and two long dashes to E., gives to the vision the simple text of this code comprehensible by any one.

Now for other bearing points of the compass. The code is built up on these four short and long sounds. To signal N.E., the signals of N. and E. are both sounded, producing three long sounds or whistles marked on the index compass chart by three long dashes; S.W., three short whistles, by three short dashes; N.W., a long whistle and two short ones, or a long dash and two short ones; S.E., a short whistle and two long ones, *i.e.*, a short dash and two long ones on compass chart.

Thus eight points of the compass are marked, the long and short signals meaning always opposite directions. The composite signals of long and short make their identity obvious, N. and E. combinations being all long, and S. and E. combinations all made up of short and long signals. The S.W. are made up of short signals. The N.W. are made up of long and short combination signals.

In working the code, the general course of the vessel is first announced, and, after a pause, the special direction told by the whistle. Of course, so simple a system admits of visual as well as oral application, by night or day; by lights or flags visible at intervals corresponding to the length of the whistle sounds and interpauses.

BURNISHING AND BURNISHERS.

BY G. EDWINSON BONNEY.

Burnishing.—An electro-deposited coat of silver of moderate thickness always presents a dead white surface as it leaves the plating solution, unless this has been made to deposit bright silver by using a brightening solution. This surface is entirely devoid of lustre, and appears, when viewed through a powerful magnifying-glass, to be made up of a fine network of silver grains cemented together. In this condition they absorb the light, and cause the deposit to assume a dull surface, designated "matt" silver. It closely resembles frosted silver, and has a pleasing appearance when freshly deposited, rinsed in clean hot water, and quickly dried in a room free from dust. When this "matt" surface is scratch-brushed, it loses, to a certain extent, its peculiar dead whiteness, but no amount of scratch-brushing and polishing will give it the beautiful mirror-like surface so much admired and desired in silver plate. To get a highly polished, reflecting surface on electro-plated goods, they are subjected to a process known as burnishing, after they have been well washed, scratch-brushed, and dried. In factories where a trade is done in electro-plating, the process of burnishing is regarded as a distinct branch, and the work

is done by females, who finish the goods after they leave the hands of the electro-plater.

As amateur electro-platers, and workmen in a small way of business, cannot employ a finisher, but have to finish the goods themselves, a few words on burnishing will be acceptable to them. It is most important that the work to be burnished should be properly prepared for plating, as on the perfection of its preparation will depend to a great extent the perfection of the finished surface when burnished. In the first place, all scratches, lines, indentations, and corroded pits must be removed by filing, rubbing down with water of Ayr stone, polishing, and burnishing, before the article is pickled and quicked with mercury preparatory to being placed in the plating vat. The slight roughness imparted to the surface by the action of the acid pickle is not in any way detrimental, but should a stain be left on the brass or German silver surface, or should the operator leave his finger-marks thereon, these will be distinctly traceable in the surface of the finished article if the spot does not strip under the burnisher. The utmost cleanness must be observed in the preparation of the articles to be burnished, and care must be taken to put the quicking coat of mercury on evenly, or the silver will be apt to strip from slightly soiled spots, as also from those where thick blotches of mercury have been left on the surface. Articles made of pewter, Britannia metal, and similar soft alloys, are usually difficult to burnish, because they are softer than the overlying coat of silver, but they are made worse by lack of care in their preparation. Such goods as these should be transferred at once from a clean potash dip to the plating solution (after being properly cleaned and prepared) without any intervening rinsing, because such alloys are readily tarnished when exposed to the air whilst wet. Potash dissolves the tarnish on such metals.

Silver will strip under the burnisher when it is deposited too fast or too slow, since its hardness is greatly affected by its rate of deposition. The plater should, therefore, find out by trial the best rate at which to deposit a coat for burnishing on the several metals, or alloys likely to be employed. Silver will also strip when a plating bath has been made up by dissolving chloride of silver in a solution of cyanide of potassium, or when chloride of silver has been used in building or faking up a plating solution. A similar result will follow on the use of too much brightening solution in the plating bath. Plating solutions thus ruined should be set aside for the most common work, and allowed to work out, then treated for recovery of silver.

When the requisite amount of silver has been deposited on the article to be burnished, detach it from the battery or machine, and swill to and fro in the plating solution for a few moments to dissolve off any sub-cyanide of silver adhering to the deposit, which, if left on, might discolour the pure white coat on exposure to daylight. Next rinse in clean hot water to remove all traces of the plating solution, and dry off quickly in hot boxwood sawdust. This sawdust is obtainable from boxwood block makers and engravers on wood, and it should be perfectly clean, else it will soil the silver. For the same reason the dust of other woods is unsuitable, because in all, or nearly all, except box, there is found some trace of acetic or of tannic acid, or of some resinous substance. The dust is best made and kept hot over a water bath or in a steam heated chamber, to prevent charring of its particles.

After the articles have been dried, they are next scratch-brushed, or else scoured with very fine sand in soap-suds applied with a soft cotton brush, then rinsed in hot water, and transferred to the burnishing bench, where they should be laid on a clean soft pad of rag, on which they will be held whilst being burnished. If now the operator attempted to burnish them whilst surface and burnisher are dry, the tool would heat and drag off the silver in the form of fine dust. A lubricant is, therefore, essential, and this is effectually furnished by weak

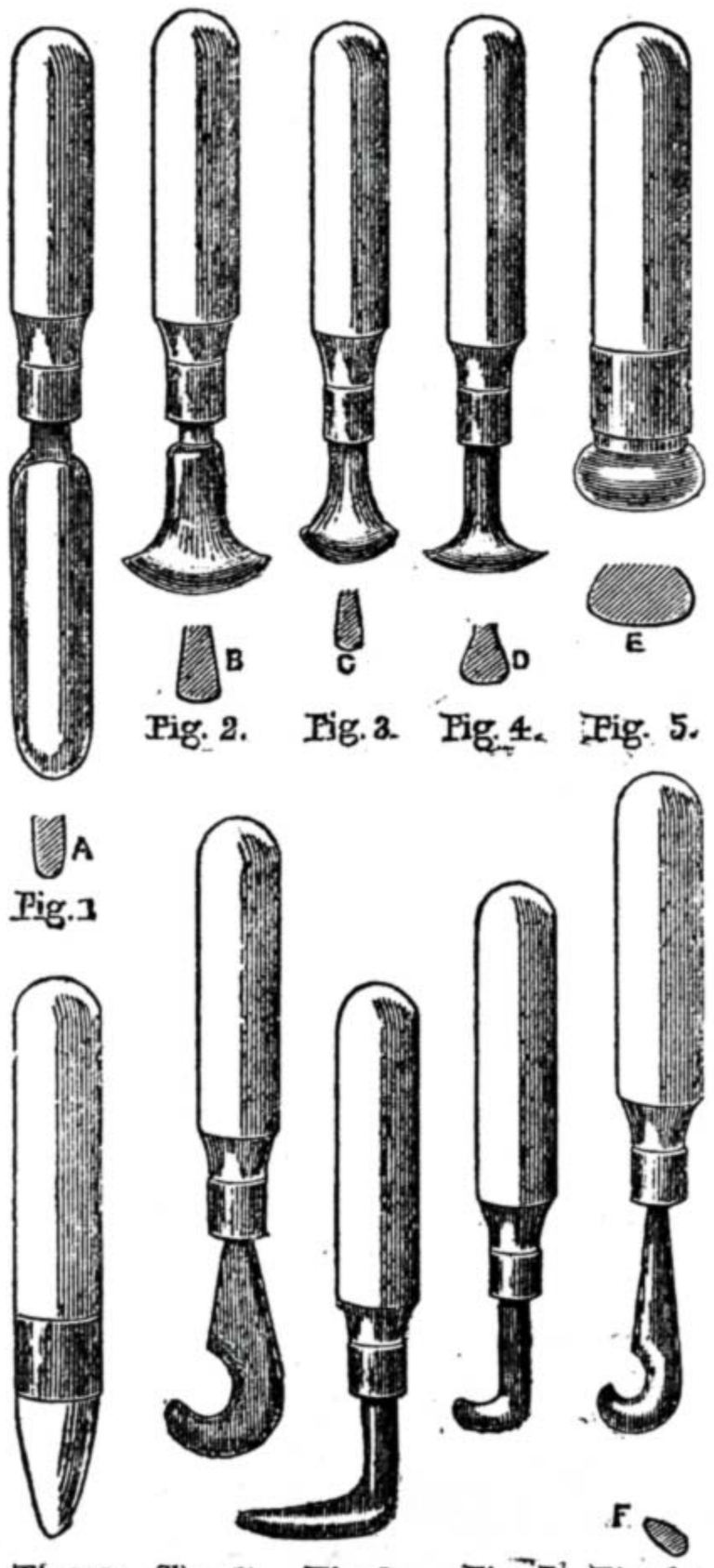


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7. Fig. 8. Fig. 9. Fig. 10.

Figs. 1-10.—Some Forms of Burnishers used in finishing Electro-Plated Surfaces. Reference Letters show Sections of the Blades.

linseed tea, or a decoction of marsh mallows will do equally well, as both these are of a slippery nature, and are harmless when applied to silver. Soap-suds are used by some persons, and these form a fair substitute when freshly made, but they should never be set aside for use a second time, as they are apt to undergo changes whilst standing exposed to the air, which result in the formation of acids injurious to the silver coating.

The burnisher must first be polished to a dead black lustre, by rubbing its edge or face briskly along a groove worn in a polishing buff charged with jeweller's rouge. A thin burnisher is first selected to ground the work, and this is afterwards gone over with one having a broader surface, finally finishing off with a broad bloodstone burnisher. The tool is held in the right hand, the lower part of the handle resting on the outside of the little finger, and the upper part resting against the inside of the three other fingers, with the ball of the thumb on the top of the handle. In this position great pressure can be brought to bear upon the tool, if required.

The strokes of the burnisher should always be given in one direction, since cross strokes will spoil the appearance of the burnished surface. Each stroke must be applied with some pressure, and the burnisher must be kept supplied freely with the lubricant, to prevent heating. Each succeeding stroke should slightly overlap that of its predecessor, so as to leave no unburnished metal between the strokes, and a clear, mirror-like surface behind. As the surface or the edge of the burnisher gets dull by use, polish it up on a polishing pad, made for the purpose out of buff hide (such as soldiers' belts are made from), mounted on a piece of wood like a large razor strop, and charged with rouge or with the finest putty powder. Very pleasing effects on ornamental goods are sometimes obtained by burnishing certain parts, such as bands and raised parts, whilst others are left matt. Gold-plated articles are treated in a similar manner to those of silver, but it is not usual to burnish nickel, since this metal is somewhat hard and intractable under the burnisher. When articles have been burnished, the finishing polish is put on by hand with soft rags charged with a suitable plate powder, or on a dolly of soft linen revolving in a lathe. Some of the forms of burnishers used in this process are described and shown in the following paragraph.

Burnishers. — Silver-plated and gold-plated articles have a finished lustre imparted to their surfaces by tools named burnishers. In their least expensive form, these are made of steel blades varying in form, and fixed in wooden handles by a tang running into the wood. Straight burnishers, shaped as shown at Fig. 1, and in section at Fig. 1 A, are used for burnishing stems of spoons and forks, and plane surfaces generally. Curved burnishers, such as those shown at Figs. 2 to 6, and in section at B, C, D, E, and F, are used for burnishing the insides of the bowls of spoons and for hollow curves. Burnishers made of chips of agate, and of bloodstone or hæmatite, set in brass ferrules and mounted on wood, are more costly than those made of steel, and they also impart to the goods a more finished surface. Some of the forms in everyday use are shown at Figs. 5 and 10.

Burning the Work.—When the current of electricity supplied to a plating bath is too strong, the solution deposits its metal in the form of a dirty grey loose powder, or a coat having the appearance of pewter. This is named in the trade "burning the work." When gold is deposited under similar conditions, the deposit may vary in appearance between a loose brown powder to a foxy red, and from this to a dark bronze, resembling in colour that of a dirty penny. Brown deposits of gold may be improved by a judicious use of colouring mixtures, but those of a foxy red and bronze tint are usually intractable, and the workman will find that they can only be restored by freshly cleaning and re-gilding the article. As "burning" is caused by too great a density of current delivered at a high E.M.F., it may be avoided by using a resistance board in circuit with the vat, and throwing in sufficient resistance to stop back the excess volume of current.

SHEET METAL WORK.

BY R. ALEXANDER.

DESCRIPTION OF TOOLS:—HAND TOOLS, HAMMERS, GRAVERS, RIVET SETS, PUNCHES, ETC.—PRICES OF TOOLS—REPAIRING.

RESUMING the subject of tools, Figs. 1 to 10 show the various kinds of hammers in use. Fig. 11 is the tinman's anvil, very different, you observe, from the blacksmith's tool of the same name: it is steel-faced, highly polished, and perfectly flat; it is usually fixed in a block, but sometimes a large hole is cut for it in the bench; on this tool is done the planishing of plain surfaces in tin, brass, or copper. Fig. 12 is the anvil stake—a similar tool, but smaller. Fig. 13 is a round bottom stake, useful for riveting patches on bottoms of stewpans and many other purposes. Two or three sizes are required. Fig. 14 is a pepper- or flour-box and teapot-top head. Fig. 15, the stock shears for cutting out new work in quantities. Fig. 16, Scotch shears, used mostly for sheet-iron work. Fig. 17 is the bent snips used for cutting out kettle tops, etc. Fig. 18, straight snips. Fig. 19 is a rivet set. Three or four of these are required for the various sized rivets. There are about sixteen sizes made, but there is no need to have one for every size rivet. I have but five myself, and manage very well. Figs. 20 and 21 are solid and hollow punches. The solid punches run from $\frac{1}{16}$ in. to $\frac{7}{16}$ in., in about ten sizes, and the hollow from $\frac{3}{8}$ in. to $2\frac{1}{2}$ in. Fig. 22 is a groove punch, or groover, as most people call it: it is for laying the seams of articles together. Fig. 23 is the tinman's square for marking out, squaring-up sheet, etc.: it is figured on both sides. It is made in three sizes: 18 in. × 12 in., 24 in. × 12 in., and 24 in. × 18 in. The 24 in. × 12 in., known to the craft as the "two-foot square," is the one mostly used. Fig. 24 shows the tinman's mallet: this is, or should be, made in boxwood in several sizes, from 2 in. to 3 in. in diameter. $2\frac{1}{4}$ in. and $2\frac{3}{4}$ in. are very useful sizes, the small one for light work, and the heavier one for strong stuff and stovepipe work. There will also be required cold chisels, cutting pliers, round-nosed ditto, and other sundries, which will be mentioned as required. Although I have mentioned a great many machines and tools, the number is not yet exhausted, and some will probably be described in the more advanced stages of these papers.

Prices.—I have already given the prices of the machines; and the stakes, hand tools, hammers, etc., are sold by weight as follows:

		s.	d.
Anvils,	per lb.	1	4
Anvil stakes,	,,	1	3
Bick-irons, wrought iron		1	1
,,	over 20 lbs. weight	1	0
,,	cast iron	0	4½
Crease-irons,	per lb.	1	5
Extinguisher stakes,	,,	1	3
Funnel stakes,	,,	1	0
,,	cast iron, ,,	0	4½
Tea-kettle heads,	,,	1	6
Pepper- or flour-box ditto,	,,	1	5
Half-moon stakes,	,,	0	11
Hatchet stakes,	,,	0	11
Block hammers,	,,	1	5
Hollowing hammers,	,,	1	2
Planishing hammers	,,	1	6
Rnd. and square-faced do.	,,	2	6
Paning hammers, each		1	8
Creasing ,,	,,	1	9


Fig. 1.


Fig. 2.


Fig. 3.


Fig. 4.


Fig. 5.


Fig. 6.

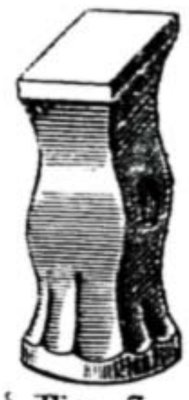


Fig. 7.


Fig. 8.


Fig. 9.


Fig. 10.

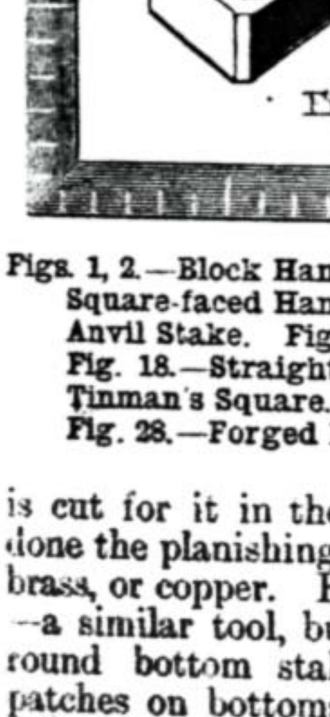


Fig. 11.

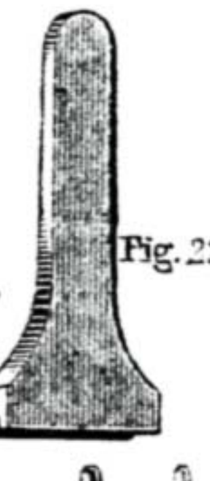


Fig. 12.


Fig. 13.


Fig. 14.


Fig. 18.

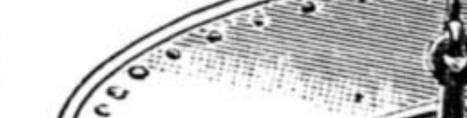


Fig. 17.


Fig. 15.

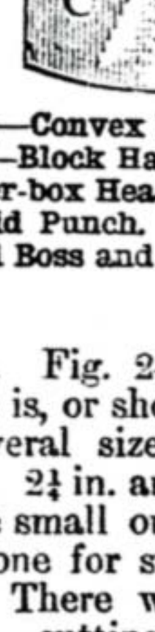


Fig. 19.

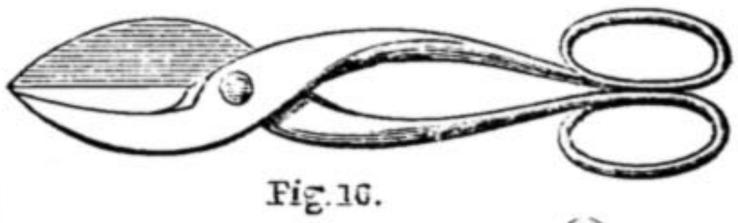


Fig. 16.

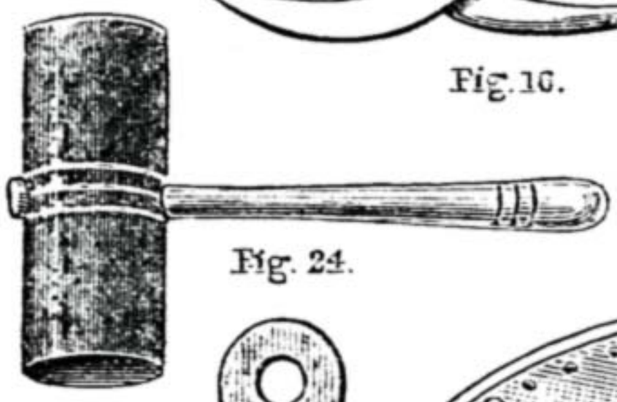


Fig. 24.

Fig. 26.

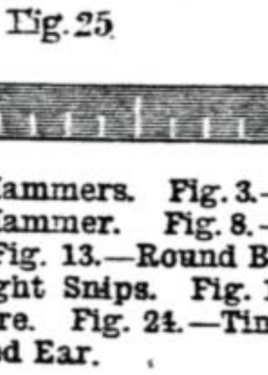


Fig. 22.

Fig. 25.

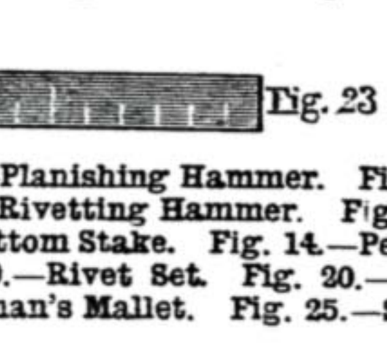


Fig. 21.

Fig. 20.

Fig. 23.

Fig. 27.

Figs. 1, 2.—Block Hammers. Fig. 3.—Planishing Hammer. Fig. 4.—Convex Hammer. Fig. 5.—Concave Hammer. Fig. 6.—Creasing Hammer. Fig. 7.—Square-faced Hammer. Fig. 8.—Rivetting Hammer. Fig. 9.—Block Hammer. Fig. 10.—Hollowing Hammer. Fig. 11.—Tinman's Anvil. Fig. 12.—Anvil Stake. Fig. 13.—Round Bottom Stake. Fig. 14.—Pepper-box Head. Fig. 15.—Stock Shears. Fig. 16.—Scotch Shears. Fig. 17.—Bent Snips. Fig. 18.—Straight Snips. Fig. 19.—Rivet Set. Fig. 20.—Solid Punch. Fig. 21.—Hollow Punch. Fig. 22.—Groove Punch or Groover. Fig. 23.—Tinman's Square. Fig. 24.—Tinman's Mallet. Fig. 25.—Stud Boss and Punches. Fig. 26.—Mode of re-lining Coal Scuttle. Fig. 27.—Stamped Ear. Fig. 28.—Forged Ear.

		s.	d.
Hollow punches, per set of 13, from		35	0
⅛ in. to 2 in.			
Solid punches, each		0	10
Bottom stakes, per lb.		1	4
Rivet sets, each	from 1s. 9d. to	4	0
Stock shears,	per lb.	1	3
Tinman's horse,	,,	0	9
Pipe stakes, wrought iron,	,,	0	11
,, cast iron,	,,	0	4½
Side stakes, wrought iron,	,,	0	10
,, cast iron,	,,	0	4½
Stud bars and punches, per set		12	6
Scotch shears	14 in., 8s.; 17 in.,	10	6
Straight snips	10 in., 3s.; 12 in.,	4	0
Bent snips	9 in., 3s. 9d.; 10 in.,	4	0
Groove punches	from 1s. 9d. to	3	6

The reader will observe a great difference between the price of wrought-iron and cast-iron tools. Cast iron will do very well for some of the tools, if expense is an object;

but the hatchet stake, side stake, crease-iron, and bick-irons should, at any rate, be of wrought iron.

These tools must be disposed of in the handiest way possible in the workshop: the heavy stakes on the floor, somewhere out of the way, and yet where they can be conveniently got at; and the lighter ones hung on the wall between two stout nails. Punches, rivet sets, groovers, and small tools in trays on a window-ledge in front of you, where they can be easily reached and put back. Have, as far as possible, a place for everything. Keep all bright tools and hammers well greased when not in use, and keep spirits of salts and sal-ammoniac as far away from them as you can.

We will now return to our muttons, as the French say—viz., to the consideration of the saucepan that is presumed to be waiting for a new bottom to be put on it. The bottom will be cut off in a similar manner to the coffee-pot, and an edge thrown off. Before throwing off the edge, a portion of the seam or seams must be cut off with a chisel, or it will be too thick to pass the wheels in the jenny. It must next be scraped for soldering. This may be done either inside or out: much depends on the state of the saucepan. For instance, it is frequently the case that a saucepan is furred and dirty on the inside, and quite bright and clean on the outside. In this case, it is best to solder outside, as the scraping required is almost *nil*, whereas the inside would want a file applied, and take much longer to get it sufficiently clean to solder. It may, however, be considered a general rule that all kitchen utensils, such as saucepans, boilers, fish-kettles, and the like, should, where practicable, be soldered inside. Having prepared the saucepan, strike out the bottom with the compasses, leaving a proper allowance for a turn-up. Turn up the bottom as previously described, slip it on, and pane down. Then put up the hatchet stake, and holding the saucepan with the body of it close to the stem of the tool, and the edge of the saucepan over the edge of the tool, go round it with the flat side of the mallet. This turns the edge a little, and prepares for the next process, which is "knocking-up." This is done as follows:—

Put up the pipe, or side stake, on the bench: let it point to the front of the bench, then turn your back to the bench so that the tool will be on your right hand as you then stand; place the article on the tool, hold it with the left hand with the fingers spread over the bottom and thumb on the body; commence to knock up the bottom with the mallet, and be careful not to hit your thumb; as you strike the blows, turn the saucepan with the hand that is holding it on the tool. This will seem rather awkward at first, but you soon get accustomed to it. Put the blows close together, and only move the article a little at a time. Turn it from you, and give the mallet a kind of drawing motion. After having been once round it with the mallet, take a hammer and go round again, giving quicker, lighter, and closer blows. Be careful to keep the bottom close to the tool, or the turn-up will be bruised and unequal. Solder round, and the job is completed. If soldered inside, use the bottoming iron, illustrated in Vol. I., page 257; but if outside, use the ordinary pointed iron. This last-mentioned method of putting on bottoms is, of course, the strongest and best of the three ways I have described; but in many cases articles are not worth the trouble, and then either of the other ways are adopted.

Many workmen put all their toilet-can bottoms on by the slipping-on method, while others will not hear of it. I always knock them up, but all this is a matter of custom, personal choice, and convenience.

I think this is all there is to be said on the subject of re-bottoming, except that water-pots, toilet cans, and boiler fillers have what are termed studs soldered on the bottoms to protect them. It is usual to put four on oval cans and three on round ones: they are punched out with a large hollow punch on a lead piece, which is a block of lead about 1½ in. thick, and from 8 in. to 12 in. square; they are then hollowed up with a small hollowing hammer, called a stud hammer, in a hollow made in the lead piece, or with a stud boss and punch (Fig. 25).

Re-lining Coal Scuttle (Fig. 26).—This is a different style of job to the previous ones, and will bring into use different tools. It is a frequent job in most shops. They generally wear out in the bottom between the foot and the back, and then require a piece of iron or zinc riveted in. This is the way to set about it: Measure the scuttle from back to the front edge, then bend a narrow strip of zinc round the inside of the body; let it come within ¼ in. of each side, just where the ears are riveted on. These two measurements are the right size to cut out the piece of stuff for the lining of the bottom: 22-gauge will be about the right thickness to use; and after cutting, bend it to the shape of the scuttle, either in the rollers or over the pipe stake. Having done this, place it in the scuttle, and with a slate pencil mark round to the shape; remove it, and cut about ¼ in. within the line: this can be done without flattening the lining; replace it, and see that it touches the back all round; if not, trim with the snips till it does. Place the scuttle and bottom on the pipe stake, have ready to hand some rivets (No. 6 or 8 will do, tinned or black), rivet set, and hammer. Hold the scuttle and bottom together, draw them a little way off the tool, and place a rivet on it; draw the scuttle on again till the rivet is ¼ in. from the edge of the lining; take the hammer, and give a tap where you think the rivet is; you will, if you hit on the rivet, see a mark appear on the outside of the scuttle; place the part of the rivet set with the hole in it just over this mark, and strike the set with the hammer: this will draw the rivet through; give a blow or two before removing the set to draw the rivet quite close to the stuff, hammer the rivet to a head, and with the "button" or countersunk side of the rivet set put the finishing touch on the rivet. Then work round the scuttle in the same way, putting one on each side alternately: not all on one side first, or the lining will "draw," and not lay close on the other side.

The rivets should be 2 in. or 2½ in. apart on the front, and 4 in. along the sides; when finished, paint with Brunswick black.

New Back and Foot to Scuttle.—It frequently is the case that the back is worn as well as the bottom. There are then two ways open of repairing it: one is to knock off the old back, take the back handle off, cut out a new back in the same way as for the bottom of a saucepan, re-rivet the back handle on, and put on the back and pane down. But the method most generally adopted is to put a piece in the back. In this case the bottom should be lined with zinc or galvanised iron, and then the back can be soldered to the lining as far as it goes. The back cannot very well be marked out on the stuff from the scuttle because of the back handle, but this is the way I get at it: cut a piece of brown paper large enough to match the back, cut out a hole for the handle to go through, place the paper on the back, and rub round the edge with the hand, holding the paper so that it will not shift: this will mark the paper sufficiently to enable you to cut it. You will see, of course, that it will be just as much too large to go in as the width of the edge of the scuttle; cut the pattern that much smaller all round, then dip it in a pail of water for a minute, and dab it on to the piece of zinc you are going to cut the back from; it will not be so likely to move then as if you simply held it with your fingers and marked it round with a scoring-awl; in this way you will not need to mark it: simply cut round quite close on the paper. It is then slipped into the scuttle and soldered round, and two rivets put in at the top part, using a bottom stake to rivet on.

New Foot.—A new foot is required when the old one has come off, and the flange is too much broke about to allow of its being riveted on again.

The old foot is generally available to flatten out and use as a pattern, which should be kept for future use; and I may here say that whenever you take the trouble to make a pattern for anything, always keep it: it is almost sure to come in again some day. These scuttle feet are generally made in two pieces: this is for economy in stuff and to use up odd pieces; but if so wished, they can be made in one piece, by marking it from the old one without taking the two pieces apart. Only one seam will then be required: this can be riveted together. Let one side lay over the other about ½ in., and put three rivets in; then throw off the edge for the wire: this may require a little explanation. We will suppose that it is a large foot being made, and for that we must use No. 11 wire. Take the compasses, and set them the size of two wires, and make a line round the foot with the compasses: this is the width of the edge to be thrown off. Put up the side stake, and holding the foot against the square edge of it, lay off a flange as far as the mark made by the compasses, using a thick pane hammer, and letting the heaviest portion of the blows go to the outside edge: this stretches the material and helps it to flow. The tyro will perhaps be surprised to find his round foot going into an oval; but do not try to alter it, as the next process will bring it back to its shape again to a great extent, and when wired it can easily be put into shape. When you have thrown the edge back as far as possible on the side stake, take the half-moon stake and finish turning the edge on that, then cut off a piece of wire long enough to make a ring the size required for the foot; place one end of it an inch or two to the right of the seam, and holding it in position with the thumb of the left hand, commence to knock the edge down over it with a mallet, using the round part of the side stake to work upon; this operation is called "wiring," though all wiring is not done in the same way. As you knock the edge down over the wire give the mallet a kind of drawing motion: this brings the stuff over the wire better; but when the fold or edge is too large, strike the blows straight down, or with a slight drawback motion: by this means any slight error of judgment can be, to some extent, corrected. Having wired it, take out the puckers by letting the wired edge rest on the square part of the stake, and going round it with a mallet, shape up, and then throw off the flange for rivetting it to the body; this will be done in the same way as described for wiring, except that it will not

want to be thrown back so far; try on the scuttle till it fits nicely. To rivet it on, the holes for the rivets must be punched, as it would be very awkward to hold the foot on and draw the rivets through the same as in the case of the lining; the holes must be made in the foot first, three each side, and then the foot placed on the scuttle, and the holes marked with a piece of slate pencil or a brass scriber (a piece of brass wire pointed with an eye the other end); be careful to put the foot the right way about when you mark it: that is, so that the mouth of the scuttle cants upwards. I have seen them put on the other way, and not noticed till the scuttle was placed on the floor, when it presented a comical appearance, you may be sure. After punching the holes in the body, put in one rivet each side first, then the remainder, and paint with Brunswick black, as before.

Fitting New Ears and Handles to Articles—This is another frequently recurring job, especially in a dairy district. There are several kinds of ears used for pails and cans. Figs. 27 and 28 show two of the most used. Fig. 27 is a stamped ear, and Fig. 28 a forged ear. The forged ear is much the strongest, and does not break so frequently as the stamped one; but the stamped, being a deal cheaper, are much used for the commoner class of pails, and always for camp kettles, yeast cans, etc. These ears frequently break across at the place indicated by the dotted line A in Fig. 27, when a new ear must be put in. The broken part of the old ear must be got off first; to do this, place the article on the pipe or side stake, and with a sharp chisel cut off that part of the rivet that is burred over the hole in the ear: hold the chisel upright for this, and the little pieces will fly off; then take a nut with a hole in it slighty larger than the head of the rivet, and place the nut on the stake and the article on the nut, so that the rivet head comes over the hole, then with a hammer and small punch knock out the old rivets. On offering the new ear against the pail, or whatever it may be, it sometimes—indeed, often—happens that the holes do not exactly correspond in position. In this case rivet through one hole, and then draw the other through where it comes. End handles of boilers, slop pail ears, etc., are done in the same way. It is often the case that after punching the old rivets out the holes are too large to make a good job by putting the new in the same holes; when this is so, a piece of tin must be soldered or riveted on, of sufficient size to well cover the holes, and the ear or handle riveted to that; it also makes a better job to solder over all rivet heads.

A SIMPLE METHOD OF ETCHING ON STEEL OR IRON.

BY R. G. NAISH.

We often see in many of the leading journals, under the heading of "Answers to Correspondents," an answer to an inquirer respecting how to etch on steel. This answer being characterised by a conglomeration of chemical formula, or a redundancy of process, must, I aver, dishearten the anxious inquirer, and result in the incapability of rendering practicable the instructions given. To overcome this difficulty is my intention, and, as far as I am able, to put in the simplest manner instructions by which almost any one may etch on steel or iron, and have good results, even in a first attempt. My method must be looked at purely from a mechanic's point of view, and not for the production of elaborate or artistic work. I can answer for my method, having used it for years with success.

The mechanic's name, for instance, on certain tools he may possess is almost indispensable. It is the only security. He may leave them in a place where only such would secure their return. Carpenters, and other similar trades who use tools with handles composed of wood, generally resort to punching their name in this soft material; but, of course, this may be easily obliterated; whereas if the name is etched in the steel blade of the tool, erasure is not so easily effected, and I doubt whether such would ever be attempted; so much trouble would be involved, and probably in the end all efforts prove futile in attaining the desired aim.

First of all you may be inclined to advance the usual interrogation, "What will it cost?" knowing that something will have to be purchased to carry out the process. Well, I don't think you will be discouraged by learning that about sixpence will supply ample materials for dozens of operations. So the process is comparatively inexpensive, considering the results obtained.

The first thing to get is one pennyworth of nitric acid from the chemist. It is very cheap. Dilute this about one half with clean water; be very careful in using it, for it will burn almost anything it is dropped on. It is well to look after the fingers in this respect.

The next thing is the "ground" to resist the corrosive action of the acid. Various grounds are often tried in the shape of soap, wax, grease, etc., but these are far from being up to the mark, and often play a trick with the article to be etched; there is no security in their use, being inadequate to the corrosive properties of the acid. Something better is needed; therefore, purchase three pennyworth of Japan black. It may be obtained at any paint stores. Have the best. It is not quantity you will want. As a ground for ordinary purposes, I don't think this black can be beaten. There is no need of altering the temper of your tool by heating it, as is the case with some grounds which require manipulating in this manner (and this is of great import to a mechanic), neither is it expensive, as a very small quantity will go a long way, and it is easily procurable.

Also get one pennyworth of spirit of turpentine to clean off the ground after the etching is completed. If turps is not handy, paraffin will answer the purpose just as well. Get a bit of sponge, and a piece of wood about the size of a camel's-hair brush—a brush handle would do—and cover the top with black. This may be employed in dropping the acid on the article to be etched, or spreading some on any particular place under the agency of capillary attraction. With all this, and a careful following out of instructions, you will rarely have to complain of failures.

Having the materials we will now proceed to business. Take a wood chisel, for instance, a tool which most workmen possess, and say you wish to etch your name on the steel blade; see that it is clean, and if not, rub a bit of fine emery cloth over it. This will soon give it a bright appearance. Now for laying on your ground. Tip the bottle containing the black, and, placing your finger to the place usually occupied by the cork, obtain a small quantity. Some may be inclined to use a brush, but I always use the finger. Now spread your black backward and forward. Endeavour to keep it as even as possible, and be on the look-out for bright streaks, which sometimes occur when a bit of grit has mingled with your black. Don't have it too thin for a start; if you did not put on enough the first time, put on some more; but you must do this quickly, for it is very rapid in drying. For first trial it is better to have it too thick than too thin; and a few trials will soon acquaint you of the right consistency.

Having done this, you place your chisel by, and let it remain for about twenty-four hours; so if you purpose doing two or three articles, you might "ground" them all at the same time. The time is not particular to an hour or two, but I take twenty-four as an average. The ground having then become firm and yet not brittle, will admit of your name (or anything else) being drawn upon its surface with the aid of a point—and so expose the steel—with ease and sharpness.

You might do your name in ordinary script, or if you are any good at letters, Old English characters should be essayed, as a certain amount of elasticity may be exercised in their construction without altering their general appearance. Block letters also look well, though a little care is necessary to give them a nice, upright, square appearance. However, I will leave you to your own ideas as to what letters you use; some fellows have not the time for elegancy, the roughest answering their purpose just as well.

To work nice and smooth with your point don't have it too sharp; there is no necessity for scratching the metal, but simply to remove the ground, exposing the steel that the acid may act freely upon it. To brush away the detached ground, a camel's-hair brush or something stiffer may be used. There is no need to fear using it, as the ground will stand a moderate amount of rough usage. After your letters are done, it is always best to have a good look to see if any bits of ground require dislodging. Some may have been neglected, and these appear as a bright spot after biting, through the action of the acid being retarded.

"Biting in" the letters is the next process. The name, having been inscribed, must be subjected to the action of the dilute nitric acid, to eat away the exposed steel to a certain depth. A little care is necessary to carry this out properly, and on it depends the success of your enterprise.

Have your chisel on a level place, and drop a few drops of acid on the letters, spread well over, taking care not to allow your acid to go beyond the ground. Your object should be to cover the letters with as much acid as is reasonable, spreading to any particular place with the japanned stick.

At once the bright surface of the steel turns black, and bubbles will rise to the surface of the acid, and burst incessantly over the letters marked. This will continue for a few minutes, after which the acid will become thick and turbid. When the bubbling has subsided, absorb it off with your sponge, swilling same in clean water at once. About two of these bitings will be sufficient for ordinary work; but should you want the letters in very deep, you have only to repeat the "biting in." But it is well to remember that the more the letters are exposed to the acid, the coarser they are liable to get, as one may well understand. The acid, having eaten to a certain depth, will undermine the edges of the letters, and eat away the metal under the ground; and, though scarcely perceptible in most

instances, at times, if the biting is overdone, the letters will appear very much coarser than desired.

After you have finished biting, remove the ground with the spirit of turpentine or paraffin, and your letters will appear of a nice, dark colour, clear and sharp; but, if you have been etching on iron, the letters will be bright.

One or two words in conclusion. Don't begin working on the black if it is "tacky." Better let it stay and dry a little longer. It should work nice and sharp; not as though you were scratching at wet paint. Always get your letters as clear of ground as possible. Don't have your acid too strong. Better have it a little weak, and take a little longer to do, than spoil the job. Be careful and cover the blade *well* with black. When the acid is in a state of ebullition, the bursting of the bubbles produces a kind of spray, which would discolour any unprotected part it may happen to fall on. Or you may happen to tip over your article, and in doing so the acid would run down the sides, and play havoc if the metal was not protected. Of course, all this will be unnecessary after a few trials. One soon overcomes all the trivial difficulties which beset a beginner, and obstacles at first, are overcome another time by the suggestions of a little experience.

The utility of the process described above must be sufficiently obvious to all, as the process affords the means of affixing the initials or name of the possessor of any article of iron or steel to the article itself in a manner that is practically indelible and indestructible. And that it is the best manner of claiming and determining the ownership of any article that is thus marked may be considered as being beyond dispute, chiefly on account of the impossibility of effacing the inscription without seriously injuring the tool itself in every way. Its neatness, also, will commend it to all who desire to mark their tools as being incomparably superior to the plan of branding with initials by means of a heated iron stamp the handle of any tool, which causes great disfigurement by the depth of the letters thus burnt in.

ELECTRIC CONNECTION FOR ALARUM CLOCK.

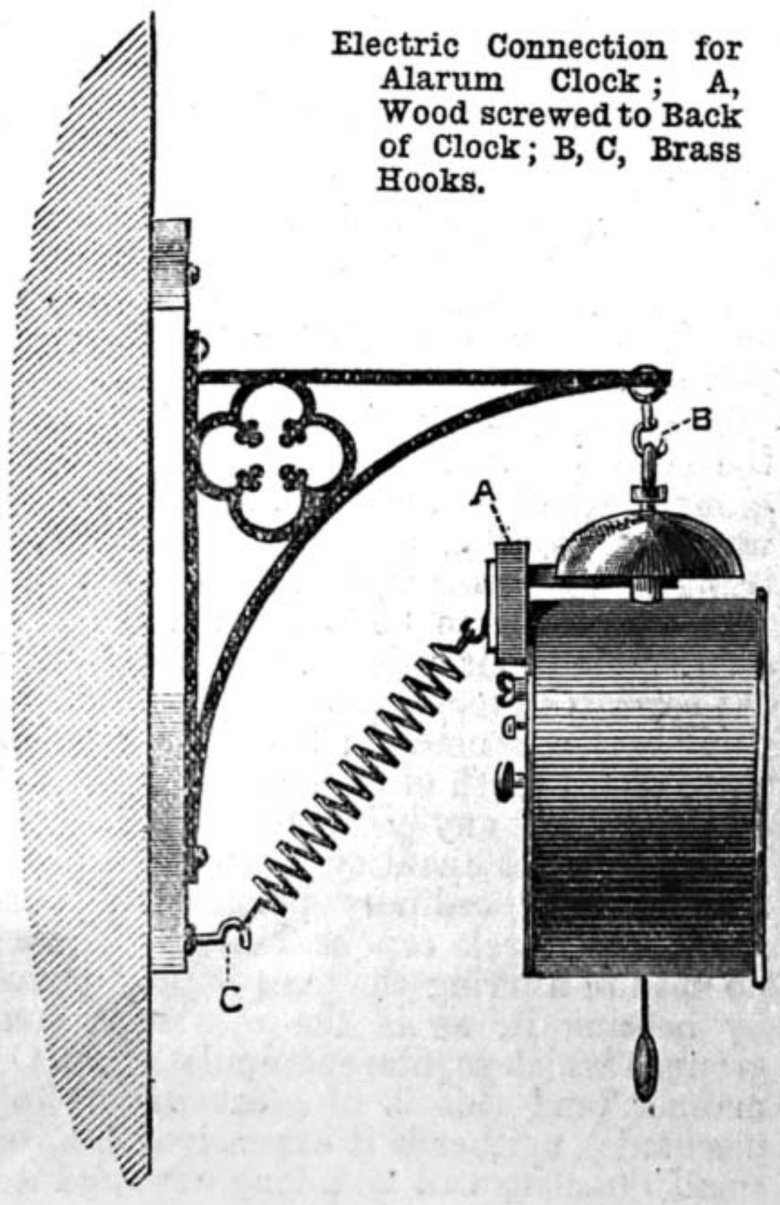
BY L. PENDRED.

PERHAPS the following description of an electric alarum connection for an American clock may be serviceable to some. I have fitted my "Peep o' Day" alarum thus, and it works very satisfactorily.

I removed the back of my clock, and near the top of it punched two holes in such a position that I could screw on (from the inside, of course) a piece of wood about 2 in. by ¾ in. by ½ in., marked A in the illustration. One end of this piece, it will be seen by the sketch, stands up over the top of the clock, and to its further side is screwed a piece of flat thin brass spring of sufficient length, and in such a position that its extreme end, which should have a small platinum point soldered to it, touches the hammer of the alarum. To the other end of this spring, which is bent round the wood, is soldered a small hook, from which hangs a brass spiral spring. I should mention that the wooden piece is fixed diagonally in a certain position, which must be ascertained by trial. It is necessary to have it placed thus to avoid touching one of the set screws at the back of the clock.

A piece of silk cord is attached to the hammer of the clock by one end, and a small wooden weight hangs from the other.

The brass bracket shown in the sketch is screwed to a velvet-covered wooden shield, which is nailed firmly to the wall of my room. A small brass hook (B) is soldered to the end of the bracket, and a similar hook (C) is screwed into the shield. This hook is connected to one wire of the battery, and the bracket to the other, a bell and switch being in the circuit. When the clock is hung from the top hook, and the spiral spring hooked to the bottom hook, if the flat spring touches the hammer, contact will be made. Now you will notice, if you try, that when the clock is wound up the hammer is held by a spring in the mechanism in a certain position. The flat brass spring is set so that it *just* does *not* touch the hammer head when the clock is wound. When, however, the clock has "gone off," the wooden weight pulls the released hammer head against the spring, and contact is made, and the bell rings till



Electric Connection for Alarum Clock; A, Wood screwed to Back of Clock; B, C, Brass Hooks.

I get up and stop it. The wooden weight is not too heavy to prevent the clock alaruming properly. I should mention that I removed the silencing switch attached to the clock, and raised the gong about ⅛ in. higher than it was originally. This, it will be found, leaves a little more space for the spring.

A MANTELPIECE WITH ITALIAN RENAISSANCE CARVINGS.

BY ALEXANDER MARTIN.

CARVINGS OF MOULDINGS, ETC.—ALTERNATIVE TREATMENT OF MANTELPIECE.

THE remaining illustrations show the carvings for the different portions of mouldings, etc., already mentioned. The central portion of frieze is given half full size in Fig. 17. It would take up too much space to give it in full length; but the left-hand vase and fruit may be used at both ends. The other vase may be used for the two centre vases, but reversing the spiral, or twisted fluting in vase, and rearranging the apples, plums, etc., on top. The upright leafage in Fig. 17 in centre of frieze, and the arrangement in Fig. 18, may be used at the two other intervals between the vases. The dotted curved line at the left-hand end of Fig. 17 represents the position of the adjoining piece of frieze which butts against this, and which consequently must be left clear of carving for that purpose, of course retaining the same curve as the rest of the ground has. This ground should be taken down to a bare eighth of an inch at each side, as shown by dotted line in Fig. 41 (page 370), which is a section of the wood as left by the cabinet-maker. This allows ½ in. of wood for carving, which is enough for the purpose. The little piece of frieze at each side of carved pilaster is shown in Fig. 19, and the piece round break of jamb in Fig. 20. The outside gable (Fig. 5, page 369) is carved similar to Fig. 19, but the scrolls, etc., are extended to fill up the larger space.

The moulding E, which is carved above pilasters, is shown in Fig. 21 drawn full size. There being four semicircles of carving above each pilaster, the two end ones may be as the left-hand pattern in Fig. 21, while the right-hand pattern is shown with two arrangements—that on one side being for one of the inner semicircles, and that on the other for the other inner one. The base of pilasters is carved as in Fig. 22; this is very simple work on account of its position. If much cutting were put on this base, lying as it does it would constantly be catching dust. What dust does lie on this moulding will easily be swept off the pattern of carving employed.

The remaining illustration (Fig. 23) is a detail—full size—of the dentils in clamp on shelf. (See Fig. 16, page 370.) They are cut in the plain band, which is carried uninterruptedly all the way along. Ordinary dentils consist of little square blocks separated by a narrow space; but here, in Fig. 23, we have a much richer dentilling. Three patterns are given; these should be cut in groups of three—three of the first design, then three of the second, then three of the third, after which a triplet of the second and then the first design, and so on.

The polishing of this article should receive very careful attention. The carvings should have no polish on them at all, so that the cutting may always have the crispness and sharpness with which it leaves the tool. The other parts may be polished and dulled with pumice-stone, to take the glaze off. If the mantel be made of mahogany, the wood should be stained a dark colour—commonly called "Chippendale" colour, on account of that maker's furniture being universally of the rich dark shade that mahogany assumes through age.

As an alternative treatment of this design, it may be mentioned how the profuse carving might have some simpler decoration substituted for it. First of all, the frieze might be treated as shown in Fig. 24—this being a section half full size of the wood, ready for fixing in its place. The beads carried right along and round the mitres of framing of jamb would be rather pretty. Then the carved pilasters might be framed together, as in Fig. 25, forming one long panel, which would be relieved by the various mouldings on either side of it. A section of such moulding is shown full size in Fig. 26. The carving in base and bed-mouldings would also be omitted, and the ordinary dentilling substituted for the carved dentils in the clamp to the mantelshelf. With these alterations, a simple yet chaste and effective mantelpiece would be the result.

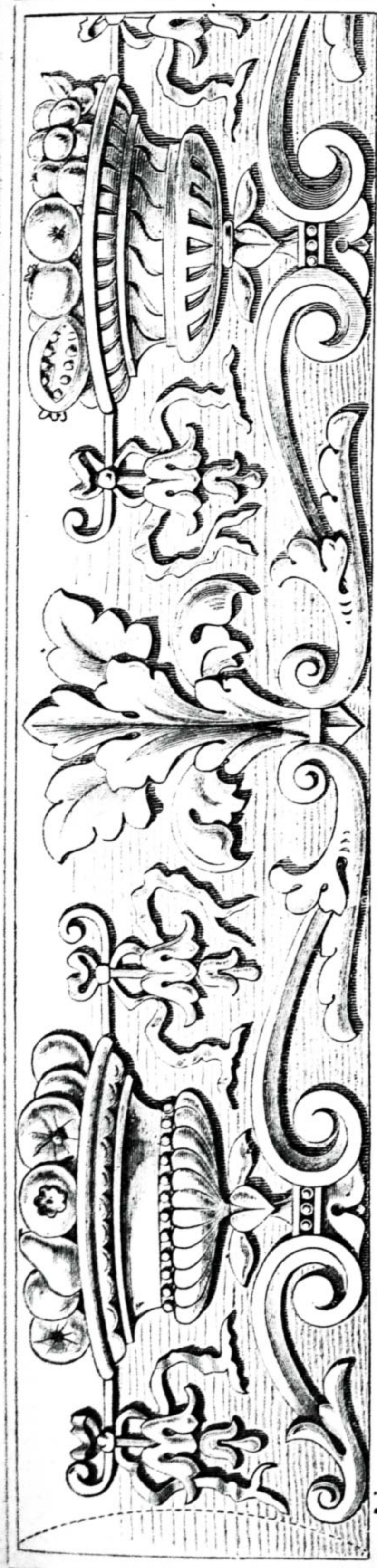


Fig. 17.—Central Portion of Frieze (half full size).

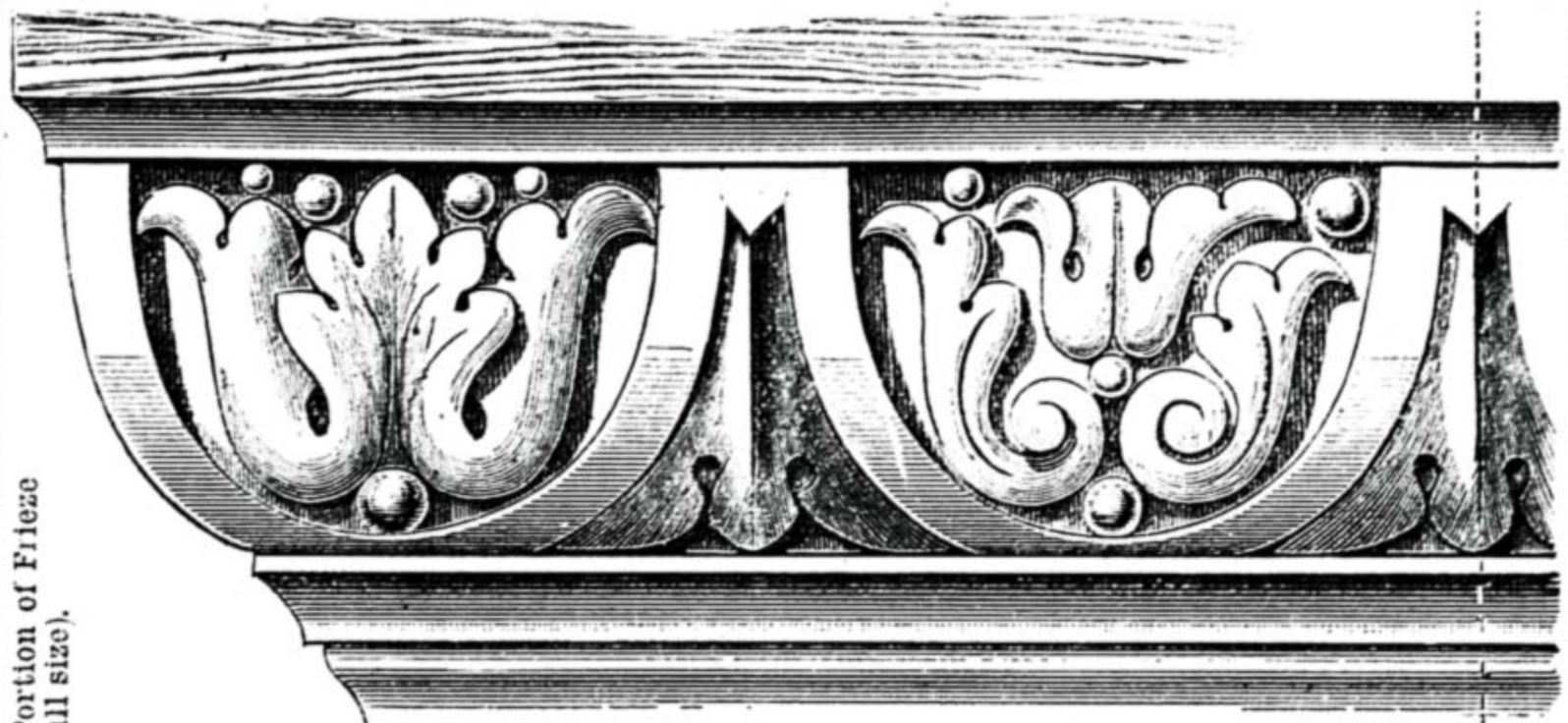


Fig. 21.—Carved Work on Moulding (E, Fig. 5) above Pilasters.

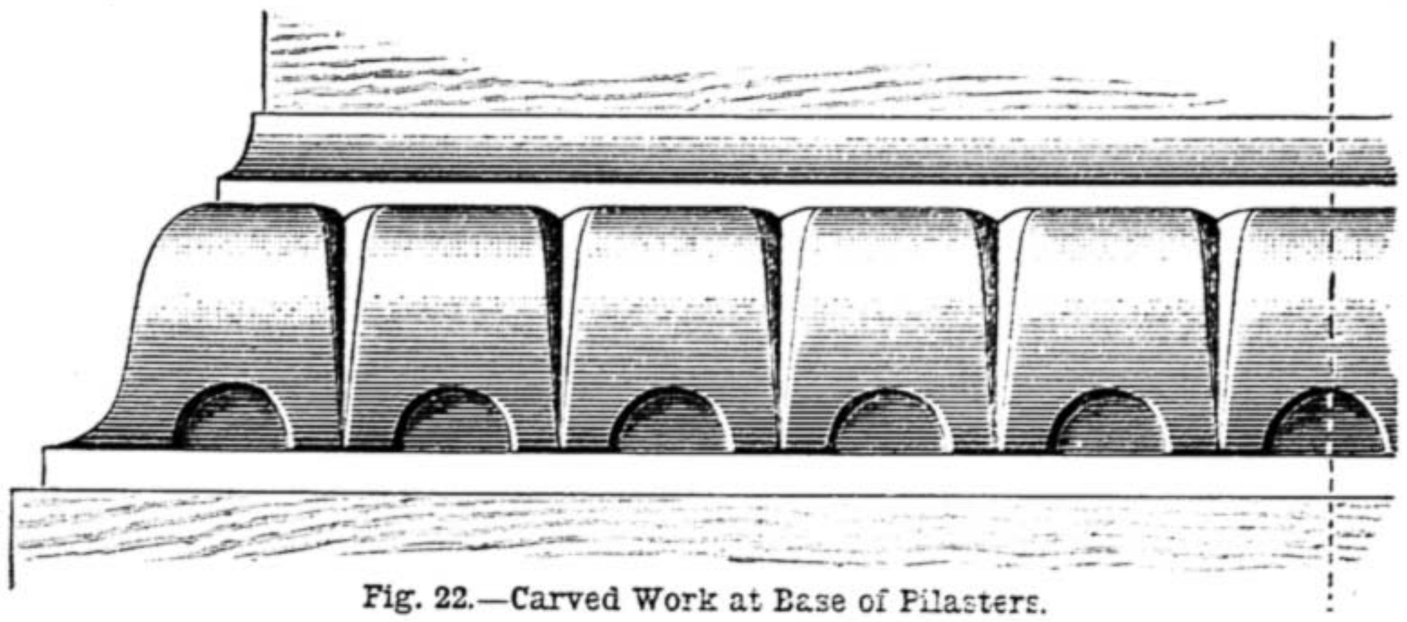


Fig. 22.—Carved Work at Base of Pilasters.

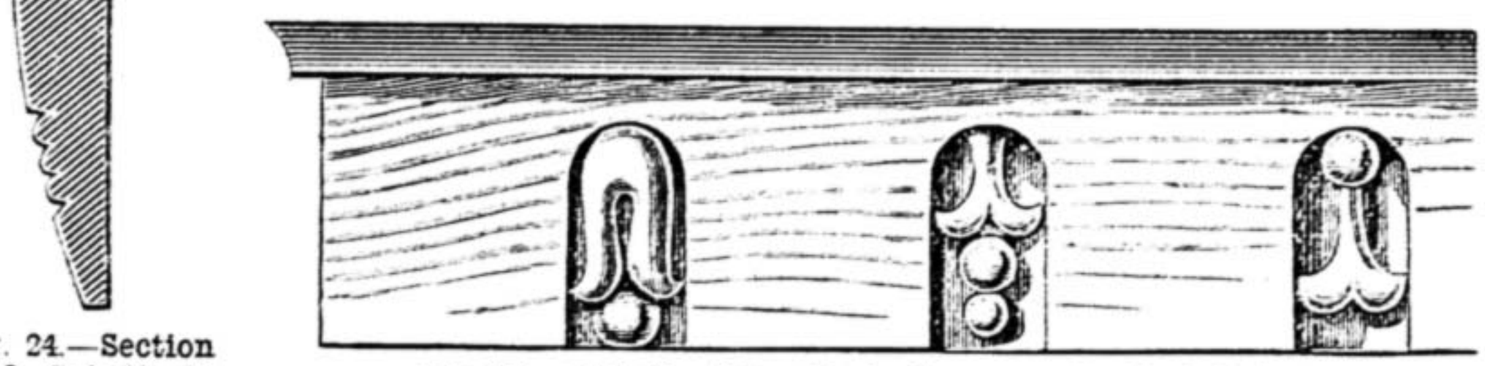


Fig. 23.—Details of Dentils in Clamp on Shelf (full size).

Fig. 24.—Section of Substitute for Frieze.

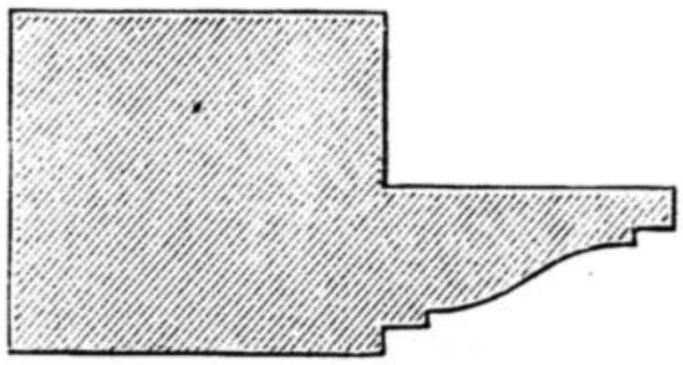


Fig. 26.—Moulding round Panel (full size).

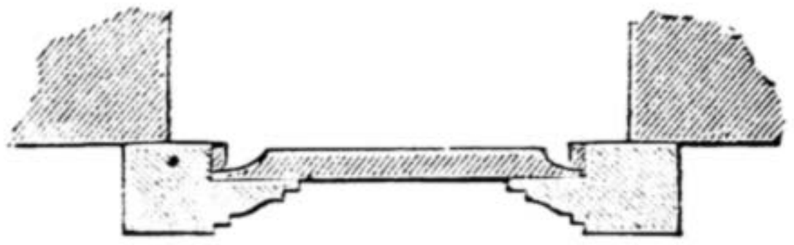


Fig. 25.—Section of Panelled Pilaster.

Fig. 18.—Foliage for Intervals between Vase on either Side of Prieze.

Fig. 19.—Carved Work on each Side of Pilaster at Top.

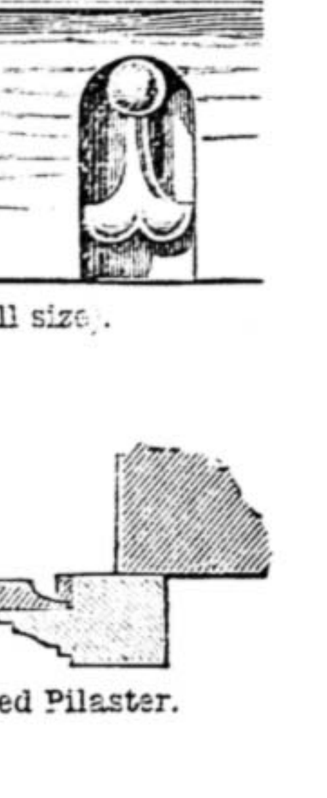


Fig. 20.—Piece round Break of Jamb.

"WORK" EXHIBITION, 1890-91.

CLASSIFICATION of Exhibits for which it is intended to offer Prizes, Medals, and other awards, to readers of WORK (the illustrated magazine of theory and practice for all workmen, professional and amateur), to be held at the Polytechnic Institute, Regent Street, from December 29th, 1890, to January 10th, 1891, inclusive.

Group I.—WORK in Wood.

Furniture, Cabinet Work, Carving, Fretwork, Pattern-making, Turning, Carriage and Cart Building, Wheel-making, Pulley-block-making, Carpentry, Marquetry, Parquetry.

Group II.—WORK in Metals.

Casting, Forging, Stamping, Die-sinking, Medal-striking, Finishing, Turning, Screw-cutting, Repoussé Work, Arms (Guns, Rifles, Pistols, Swords, Bayonets, Lances, Armour), Armour Plating, Iron Ship-building, Amalgams, Mixed Metals.

Group III.—Tools for WORK.

Hand Tools, Machine Tools, Tools for Sharpening Tools, Photo-micro and Electric Apparatus (except Lighting and Telegraphy), as Cameras, Magic Lanterns, Slides, Microscopes, Surgical Instruments, Mathematical and Drawing Instruments, etc.

Group IV.—WORK in Design only. *Exhibits to take the Form of Drawings or Models.*

Designs for Decorative Purposes (including Stained Glass). For Architecture (including Ventilation). For Mechanical Purposes, such as Boilers, Engines, Machines. For Engineering, Forts, Ships, Roads, Bridges, Canals, Sewers, Railways, Trams, Balloons, Parachutes, Ambulances, Tents, etc.

Group V.—WORK in Printing.

Letterpress, Type Founding, Press-work, Machine-work, Lithography, Drawings on Transfer Paper, on Stone, on Wood, on Zinc; Engraving on Steel, Copper, and Wood; Colour Work, Photography on Stone, on Wood, Photographic Printing, Bookbinding, Music Printing, Transferring, Stereotyping, Electrotyping.

Group VI.—WORK in Domestic Appliances.

For Decorative Purposes. For Cooking (Hardware, Glass, Pottery, Faïence), Heating, Washing, Drying, Lighting, Cleaning, Sewing, Bathing, Teaching; Home Recreation, Games, Gymnastics; Hygiene; Toys, Dolls, Wax-work (Figures, Fruit, and Flowers); Telegraphy, Telephones; Watches, etc.; Basket-work.

Group VII.—WORK in Wearing Apparel.

In Tailoring, Hat-making, Boot and Shoe-making, Mantua-making, Millinery, Beading, Dress-making, Baby Linen, Lace-making, Knitting (Machine or Hand), Needlework (Machine or Hand), Button, Cotton, Silk, and Thread-making, Hose, Gloves, Wigs, Theatrical Costumes, Court-Dresses, Uniforms, Liveries, Belts, Buckles, Fans, Feathers, Artificial Limbs, Eyes, Teeth, etc., Abdominal Belts, Trusses, Surgical Bandages and Appliances, Electric Belts and Bandages, Jewellery, Hair-dressing.

Group VIII.—WORK in Painting and Decorating.

House Painting; Decorative Painting in Oil, Distemper, Flatting and Fresco; Gilding, Graining, Marbling, Sign and Facia Writing, China Painting, Carriage Painting, Heraldic Painting, Scene Painting, Stained and Painted Glass and Imitation ditto, Plaques, Panels, Appliances for Painting and Decorating.

Group IX.—WORK in Textile Fabrics and Leather.

Curtains, Carpets, Blinds, Rugs, Upholstery Screens, Brackets, Frames, Harness, Saddlery (Civil and Military), Bags, Trunks, Portmanteaux, Travelling Bags and Trunks, Dress Baskets, etc.

Group X.—WORK in Musical Instruments and Music.

1. Organs, Pianofortes, Harps, Violins, Banjos, Mandolins, Guitars, Cornets, Trombones, Clarinets, Oboes, Drums, Flageolets, Flutes, Piccolos, Fifes, Bagpipes, Triangles, Cymbals, Metronomes, etc. 2. Musical Compositions, Systems of Teaching, Appliances for Learning.

Group XI.—WORK in Watches, Clocks, Alarm Bells, etc.

1. Design of any of the above (including Musical Boxes and Mechanical Contrivances). 2. Actual Models or Finished Working Specimens, Clockwork for Lighthouses, Burglar Alarms, Electric Signals.

Group XII.—WORK in Building Appliances and Material for Building.

Bricks, Tiles for Floors and Mural Decoration, Stone Masonry and Carving, Terra-cotta Chimney-tops, Drain Tiles and Pipes, Sanitary Stoneware and Pottery, Mosaics, Hot and Cold Water Appliances, Baths and W.-C.'s.

Group XIII.—WORK in Chemical Processes and Products.

Stains, Dyes, Colours, Inks, Varnishes, Soaps, Cleansers, Disinfectants, Food Compounds, Drinks, Igniters, Fuels, Explosives, Manures, Detergents, Antiseptics, Anodynes, Electric Lighting, etc.

Group XIV.—WORK in the Utilisation of Waste (Novel and Original Feature).

Utilising Waste Space in crowded Cities and Towns.
" " " in Agricultural Districts.
" " Heat.
" " Water.
" " Sewage.
" " Products hitherto unused.
" " Labour, manual and mental.
" " Time.
" " Capital (including legacies not applied for by claimants).
" " Charity Funds, which have exceeded testators' expectations.
" " Power, of Combination for legal purposes, Purchasing power, Co-operation, Power of oppression by sweating.

Exhibits in this Group to take the form of Essays, Plans, Précis of Experiments, and even Suggestions.

There will be three classes of Exhibitors, viz.:—

1. **Workmen** or Workwomen actually employed and gaining their livelihood in and by the craft under whose name they exhibit.
2. **Apprentices**, *bonâ fide*, serving an apprenticeship to the craft or calling under whose name they exhibit (whether indentured or otherwise).
3. **Amateurs** or connoisseurs who either do not practise any craft as a means of subsistence, or who exhibit in any group other than their own craft.

The Exhibits will be judged in accordance with the above classification of Exhibitors.

The Jurors will judge all Exhibits in Groups I., II., III., X., according to workmanship alone, irrespective of design, which may be new or old.

The Jurors will judge all Exhibits in Groups V., VI., VII., VIII., IX., XI., XII., according to merit in design associated with meritorious *workmanship*.

The Jurors will judge Exhibits in Groups IV., XIII., and XIV., solely as to novelty, originality, and improvement upon known and existing forms, formulæ, and processes, designs, or inventions, irrespective of workmanship in their execution.

The Jurors will be practical and competent experts.

Exhibitors may declare their Exhibits as not in competition.

CONDITIONS AND REGULATIONS.

1. Any *bonâ-fide* subscriber to WORK shall be eligible to exhibit on the Conditions and under the Regulations stated below.

2. All intending Exhibitors must make the prescribed entries upon the printed form to be obtained of the Secretary (see foot of page), and sign the same in the presence of a reliable witness, who shall also sign and give his address and occupation. N.B.—Any false or fraudulent statement will disqualify.

3. Every Exhibitor is to pay the carriage of his Exhibit to and from the Exhibition. The Proprietors of WORK will supply printed labels for attaching to packages. It must, however, be distinctly understood that the Exhibit will be entirely at Exhibitor's risk. No package will be received unless it bears the official label, and is packed.

4. Every Exhibitor must fill in, on the Application Form, the value or price he places upon his Exhibit, and of any separate portion thereof, so that in case of sale and for insurance purposes, no dispute may arise.

5. The Secretary will advise, on printed forms, the receipt of an acceptance of all Application Forms which are correctly filled up, and will return any for correction which are not filled up correctly. All correspondence must be addressed prepaid to the Secretary, "WORK" EXHIBITION, LA BELLE SAUVAGE, LUDGATE HILL, E.C. *All letters requiring an answer must be accompanied by a stamped and addressed envelope.*

6. The Awards of the Jurors shall be final and binding without appeal.

7. The Proprietors of WORK reserve the right to decline any Exhibit which they may deem unsuitable or unworthy, and the Secretary will advise the Exhibitor of such decision.

8. All Exhibits must be forwarded so as to arrive on the 19th or 20th December, and not before. Applications for space must be filled in and forwarded AT LATEST BY THE 30TH DAY OF OCTOBER, after which date they cannot be received, and no labels for carriage will be thereafter issued. It is intended to open the Exhibition on Monday, December 29th, 1890, and to keep it open till Saturday, January 10th, 1891.

9. Every Exhibitor will be entitled to a free Admission Ticket, not transferable, available during the Exhibition. Exhibitors at a distance unable to come to London, may have such ticket transferred to a London friend on nomination by previous arrangement with the Secretary. Applications for Free Tickets for Attendants should reach the Secretary not later than the 10th of November.

10. No articles must be removed till the close of the Exhibition.

11. The Proprietors of WORK reserve the right to remove the Exhibit of any one who does not conform to the regulations, and also the right to alter, add to, or cancel, any of these Rules.

12. Awards, Medals, Prizes, etc., will be forwarded, post free, to all Exhibitors who do not present themselves at the Distribution of Prizes, the date of which will be duly announced in WORK.

PRIZE LIST.

Group Prizes.—GOLD MEDALS.—A Gold Medal will be given for the best Exhibit in the whole Exhibition, together with a First Class Certificate (except Group XIV.). A Gold Medal will be awarded with a First Class certificate to the best Exhibit in Group XIV.

SILVER MEDALS.—A Silver Medal, a Money Prize of One Guinea, and a First Class Certificate, will be awarded to the best Exhibit in each of the Groups as classified above, except Group XIV., where a Gold Medal will be awarded.

Class Prizes.—BRONZE MEDALS.—A Bronze Medal, a Book Prize of Half-a-Guinea, and a Second Class Certificate, will be awarded by the Jurors to the best Exhibit in each Class or Sub-Division of Groups.

Special Prizes.—Special Prizes, of which details will be announced later on, will be given to the best Exhibits from actual Working Drawings published in "WORK."

Certificates of Merit.—A First Class Certificate and Book Prize of One Guinea will be awarded (1) To the Second Best Exhibit in the Exhibition, (2) To the Second Best Exhibit in Group XIV.; and if recommended by the Jurors, a special extra SILVER MEDAL will in either case be given. A Second Class Certificate will be awarded (1) To the Third Best Exhibit in the Exhibition, (2) To the Third Best Exhibit in Group XIV. N.B.—The Proprietors of WORK reserve to themselves the right of

Forms of Application for Space will be sent, post free, upon writing to The Secretary, "Work" Exhibition, Messrs. Cassell & Company, Limited, La Belle Sauvage, London, E.C.

publishing in the pages of that Magazine any Essay or Suggestion for which a Prize shall have been awarded.

SECOND CLASS CERTIFICATES will be awarded to the Second Best Exhibit in each Class or Sub-Division of Groups.

THIRD CLASS CERTIFICATES will be awarded to the Third Best Exhibit in each Class or Sub-Division of Groups, and if specially recommended by Jurors, Second Equal Awards in case of Ties of Merit.

Limitation.—It shall, however, be understood that the highest Prize Medal only shall be given, in lieu of minor honours; but all honours obtained shall be recorded upon the Certificate in each case. *No Prize will be awarded except on the Jurors' recommendation as to merit.*

Exhibitor's Certificate. — Every Exhibitor, whether a Prize Winner or not, will be entitled to a separate Certificate that he has exhibited.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

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

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

I.—LETTERS FROM CORRESPONDENTS.

Cutting Mitres.—F. H. (*Streatham*) writes to POST OFFICE BOX (*Richmond, Va. U.S.A.*) (see page 323, Vol. II.):—"You have not been badly advised, but both with a 'shooting board' and a mitre-cutting machine great care is required to cut gilt moulding without it chipping off. I have used both, and my experience is that a mitre-cutting machine is far better than a shooting board, as the knife cuts from the top downwards, and can be cut more gently; whereas with a plane it requires a sharp thrust. I have one of Booth Brothers' mitre-cutting machines, and find it answers fairly well. In the one that I have there is one fault: the set screws had round heads, so that moulding that did not come up to the centre of the screw would be out of truth. But this has been remedied by having flat-headed screws instead of round ones. It is the opinion of old practised hands that there is nothing to beat the mitre shooting board: but that I take as jealousy against simplifying machinery."

A Useful Vehicle.—H. A. H. (*Manitoba*) writes:—"I send you a diagram of a most useful vehicle used out here. The diagram speaks for itself, and I have given dimensions of parts. The shafts are attached to the front axle as near the wheels as

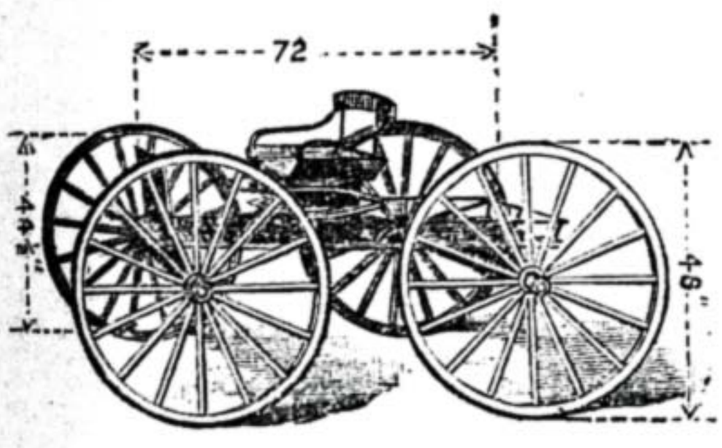


Fig. 1.

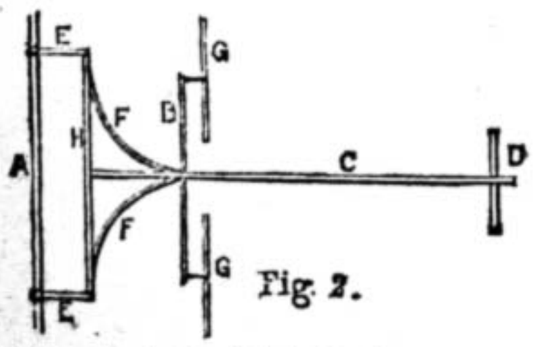


Fig. 2.

A Useful Vehicle.

possible, say about 4 or 6 in. The pole is also attached, as shown, to the axle. For farmers and others carrying small parcels at the back, the backboard is comfortable and convenient. I have used one for over four years over the prairie. In front, below the seat, the lathes are covered with thin boards."

Oval Drawing.—F. C. (*Leytonstone, E.*) writes:—"I think the answer of J. W. H. to A. B. in the 'Shop' supplement to WORK, No. 66, is very misleading. The point I allude to reads as follows:—'Further, all ellipses so drawn, either inside or outside this ellipse, where the proportion of major to minor diameter is the same, irrespective of size, will and must be parallel to the first.' Now this is not correct. No two ellipses can be parallel, because a line parallel to an ellipse is not an ellipse. My sketch, Fig. 1, will clearly demonstrate

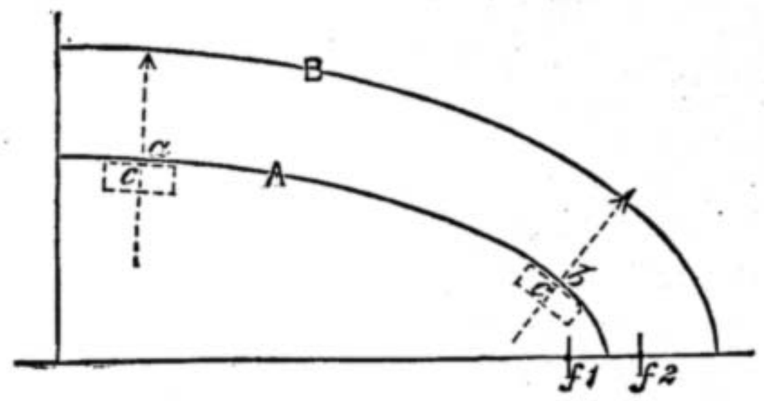


Fig. 1.

this. A and B are the curves of two ellipses, struck by the thread and pin method, *f* 1 and *f* 2 being respectively a focus of each. It will be found on measuring that although the proportion of major to minor axis is the same, the lines are not parallel. Fig. 2 shows the method of drawing a parallel to an ellipse. The inner curve is an ellipse: *f* 1 and *f* 2 being the foci. To obtain the outer curve, take a number of points, *a*, *a*, *a*, join these to *f* 1 and *f* 2; bisect the angle *f* 1 *a*, *f* 2, this gives the line *a b*, which is normal to the ellipse; on this, set off the distance of the required parallel as *b*, *b*, *b*, then trace the curve through the points *b*, *b*, *b*. To find the foci, take the length D E, and from the point G set it off on the line C E. The method sometimes adopted in practice is:—First, to cut out the inner curve, then gauge from this

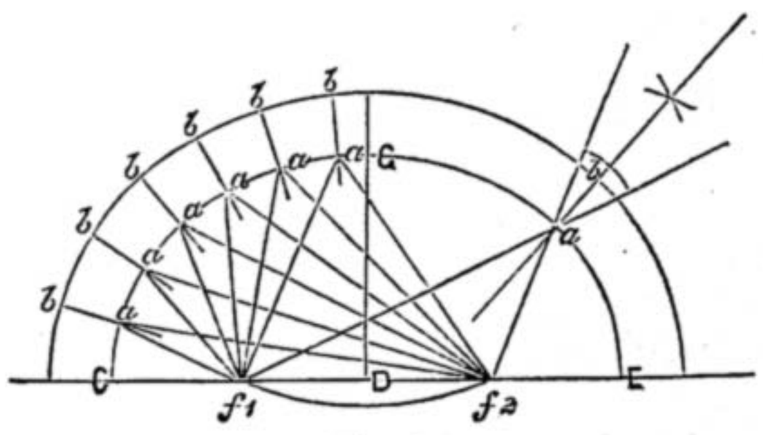


Fig. 2.

the distance of the required parallel with an ordinary marking gauge. The accuracy of this method depends upon the eye of the workman, for if the gauge is not kept normal to the ellipse the lines cannot be parallel. There are one or two other questionable points brought forward by J. W. H., but, as they are not of practical importance, it is not worth while to mention them."

J. W. H. writes in reply to F. C. (*Leytonstone, E.*) that he admits that ovals parallel to ellipses are not mathematically true ellipses, but as A. B. asked for a method of drawing ovals, and the heading was "Oval Drawing," there need be nothing "misleading." F. C.'s Fig. 1 is not as he says, however, an example of the same proportion between major and minor axis. His major in smaller ellipse is $5\frac{3}{16}$ in. to 2 in. minor, and in the larger one $6\frac{1}{4}$ in. to $3\frac{1}{8}$ in., or $\frac{41}{16}$ to $\frac{32}{16}$ in one case, and $\frac{105}{16}$ to $\frac{48}{16}$ in the other, so that the one major = $2\frac{1}{8}$ to 1, and the other major = $2\frac{1}{2}$ to 1. Simpler than F. C.'s method of drawing an oval parallel to an ellipse is to keep the pins in my Fig. 3 (page 230 WORK, supplement to No. 66) at G and H as before, and lengthen the thread to any desired distance outside the ellipse, and then proceed to describe the larger orbit, which though not, strictly speaking, an ellipse, is usually called so. As to describing an oval by means of a working gauge, F. C. ought to know that it is impracticable, as the head of the gauge would bear off at the quick part of the curve, not only shortening the arm by the distance at *c b* as compared with *c a* in the lines I have dotted to represent the head of gauge on F. C.'s Fig. 1, but the normal could not be maintained.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Incubation.—J. W. (*Holloway*).—Chicks break out themselves if all goes well. Sometimes a chick may need assistance, which may be given if the egg is "starred" (chipped), and no progress made after the twenty-one days are fully up. The egg should be taken out and aired in the cool air of the room for fifteen minutes each day, and turned over completely when replaced in the machine.—L. W.

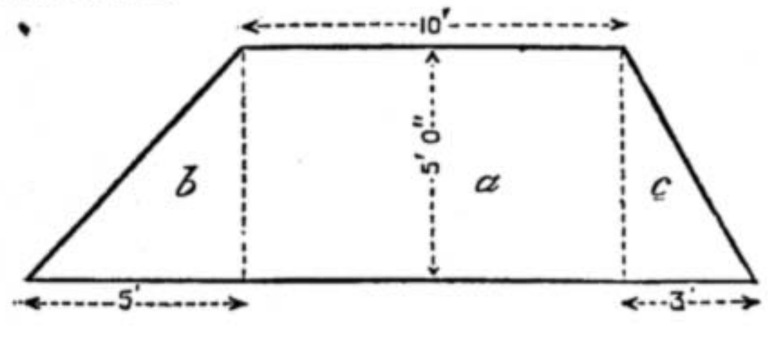
Hot Water Apparatus.—E. D. C. (*Leytonstone*).—I think "Hot Water Fitting and Steam Cooking Apparatus," by F. Dye, would suit your requirements. It is published by Messrs. Spon, 125, Strand. The price is 1s. or 1s. 3d. You might also get much useful information by watching "Shop" columns of WORK.—T. W.

Glass Silvering.—W. K. (*Cardiff*).—Neither the old mercurial nor the newer chemical process is suitable for amateur work. The latter requires a thorough knowledge of the chemistry connected with it. To give you the formula would therefore be only calculated to induce you to lose money instead of helping you to economise. Probably the recipes you refer to have been correct, and failure is rather owing to want of skill than to inaccuracy on the part of the writers. Many chemical processes and experiments require the most delicate manipulation.—D. D.

Canada Balsam Cement.—E. H. W. (*Highbury*).—Why not give your information through "Shop" for the benefit of all readers?—ED.

Overmantel. — PLUMBER. — It appears to me almost impossible to answer your question about colours for overmantel satisfactorily as I do not know the colour which prevails in the room, but I cannot recommend you to paint the outside in two, and the inside another colour, as you would then have three colours to consider. Unless very carefully considered, such a combination would probably result in a gaudy, vulgar-looking piece of furniture which would be more of an eyesore than an ornament in your room. Instead of using three colours you will find it better to stick to one, and use it in three shades. I am, however, averse almost to even this, and prefer to advise you to use only two shades, if you are not satisfied with one. Let the inside of course be the lighter shade, as it will show up the bronze ornaments better. If you were to put pieces of looking-glass at the back of the recesses holding the bronzes it will be an improvement. Before painting, look over an enamel paint card of tints and select the one you like best. If the wood of the overmantel is nice, clean, sound stuff, would it not suit your purpose to stain it to match the rest of the furniture and finish it by polishing?—D. A.

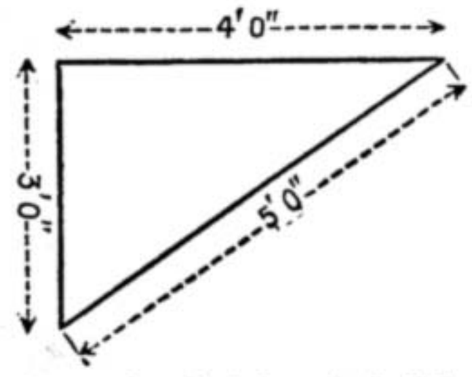
Slating.—F. M. (*Ayrshire*).—The mould generally used for ornamental slating is a wooden one, which is laid on the slates and marked round; the slates are then cut in the usual manner. A simple way of measuring irregular forms of roofs is to divide the area up into as many squares as possible, and treat the remaining triangles as squares, and halve them.



a.—10 in. by 5 in. .. .. = 50 in.
b.—5 in. by 5 in. = 25 in. ÷ 2 = 12½ in.
c.—3 in. by 5 in. = 15 in. ÷ 2 = 7½ in.

The whole 70 sq. ft.

The height (or width) would be measured flat on the slates from eaves to ridge: that is to say, that if a roof was 4 ft. high, and one half of the span was 3 ft. wide, the height (or width) from the ridge to eaves would be 5 ft.



The rest of your queries being couched in Scotch technical terms, I am in doubt as to what is meant, but if you will translate or make them clearer to me by sketches, I shall be only too happy to assist you. You will find Beaton's "Builders' and Surveyors' Technical Guide," published by Crosby Lockwood & Co., London, very handy in measuring.—E. D.

Prices and Patterns. — J. A. P. (*Preston*). — I cannot exercise any control over prices asked by firms for tools and appliances—a fact which goes without saying, as the phrase runs. Your hope that amateurs may be able to obtain good and reliable castings of engines, machines, etc., will, I trust, be realised at no distant date. I have had the question of supply of things of this kind on my mind for some time.—ED.

Mail Cart.—AN AMATEUR.—An article on the above subject giving all details as to construction appeared in No. 30 of WORK.

Bicycle Seats.—T. K. M. (*Whitehaven*).—I have tried riding with the seat well back and all the intermediate positions up to that with the nose of the saddle about ½ in. behind the centre of the crank shaft, and I find that this latter position is the easiest; and as I have had some years' experience in going about the country, I can recommend it. And I am glad your experience is the same, as the positions of cyclists when cycling are getting frightful. The reason that you cannot adjust your machine to suit you is that it is badly designed. You say that you are short legged. Therefore, when ordering a new machine, you should be measured for it. When I say, in article, that the seat and handle bar should be level when both are in the centre of

their vertical adjustment, I don't intend the handles to remain there. If the man is a short armed one, then the handles must be raised; and if he is long armed, then they must be fowered; so that when sitting upright he can just grasp the handles comfortably with the arms extended. The reason I suggest that they be level is that men's arms, when properly proportioned to the body and slightly extended to grasp the handles, would be just level with the seat. The model machine shown in my sketch, Fig. 3, was taken from a Humber machine, Beeston make, which I possess, and this firm are considered the best designers; and I think you cannot do better than go to them for a new one, as their workmanship is also good.—P. B. H.

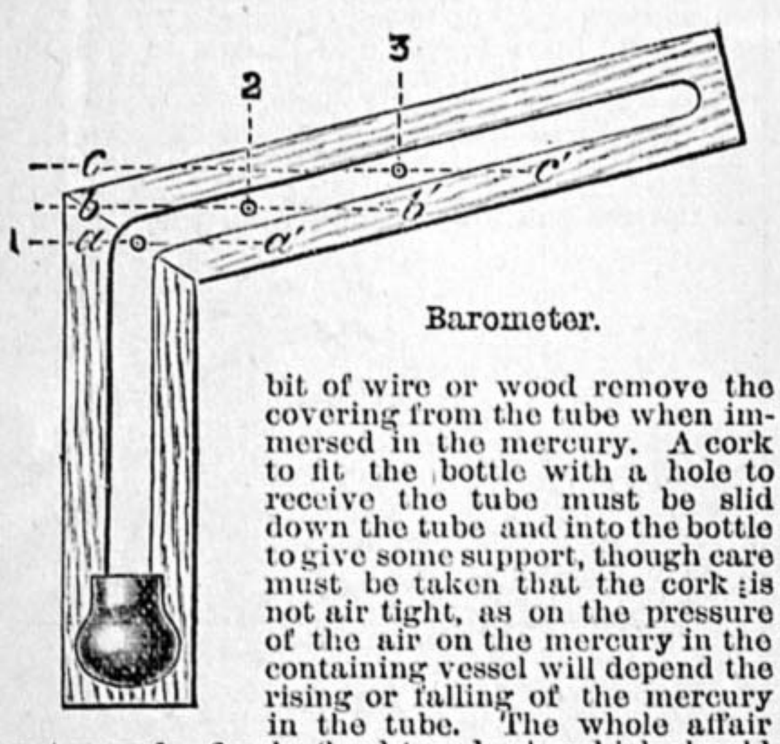
Patenting an Idea.—A. B. (*Northampton*).—If the invention in question will do away with those ugly pauses, which, in the absence of it, are so annoying, we should say that (provided it is simple and not too costly in production) it will have a reasonable chance of success. A. B. cannot, he says, himself make a model, but surely he can make such drawings as will explain the principle and construction of his apparatus. How rough these may be will not greatly matter. These he might place in the hands of Mr. W. Cook, "Inventors' Model Maker," Headless Cross, Redditch, who will "lick the idea into shape" if any one can. If the model is found to answer A. B.'s expectations, he should then procure provisional protection; and to negotiate the sale or working of his plan, he should have the assistance of one of the agents who undertake such matters. He might try Mr. Clarence S. Newton, Royal Court Chambers, Chancery Lane, London, E.C., who is a patentees' agent.—C. C. C.

Jet Black Ink.—W. T. S. (*Padiham*).—Owing to the extreme pressure on the columns of "Shop," the reply you allude to has been crowded out. If I mistake not, the initials then were P. B. L. (*Padiham*). Before this appears W. T. S. will have seen that reply, or if he should overlook it, I may just say that good writing ink with a little white sugar added to it will have the appearance when dry that he desires, and is used by ticket writers.—J. W. H.

Cigarettes.—F. A. W. (*Handsworth*).—I do not know where my correspondent can procure "solid" ends for cigarettes; but I can tell him a very easy way to make them for himself. It is, however, a misnomer to call them "solid." They are simply spiral coils of thick paper with the outer layers gummed or glued together. I never use them, although I smoke half a pound of cigarettes a week on an average, often more; neither do I ever use a machine, rolling them as the senoritas do in Spain, in my fingers; alas, not so pretty and taper as theirs, for mine are deformed with "work." Take a sheet of cartridge paper and rub your thumb nail along one edge, and with your palm roll it into a coil until it is thick enough for your size of cigarette, when with a penknife you can cut it off and commence the next long roll, and so on. These rolls may be gummed, pasted, or glued just at the edge of the last lap of the spiral if desired; but if, after cutting into lengths of about ½ in., they are squeezed and sprung into the cigarette covering, they would better answer their purpose and be more cleanly than if glued or pasted. One sheet of paper would, I compute, make more than 1,000 mouthpieces; and if placed along with the tobacco in most of the ordinary cigarette machines would keep in place.—J. W. H.

Sanitary Inspectors' Duties.—R. A. (*Liverpool*).—A reply to R. A. hardly appears to me to come within the scope of WORK at all, but I will this time advise my correspondent, firstly, to get an introduction to some duly appointed inspector; secondly, to diligently search the free library catalogues for any book that bears on the subject; not to be afraid of learning too much, and to write more carefully, both as to spelling, and more particularly in the arrangement and expression, clearly and concisely, of his ideas, than his letter exhibits. I do not wish to discourage R. A. in the least; I would help him in his efforts to improve his position, and in this connection I am candid enough to say to him, "First improve yourself and your position will soon follow suit."—J. W. H.

Barometer.—CHEMIST asks for directions to make a barometer, and says, "I work in a chemical laboratory; I have glass tubing, etc., at my hand." CHEMIST does not say for what purpose he wants to make a barometer, nor of what type; I therefore shall assume he is a youngster fond of trying experiments. CHEMIST must be aware that putting the question in the open way he has, it becomes a very wide one; too large, I am afraid, to get into "Shop." I shall, therefore, narrow down my remarks as much as possible. First, the patterns which lend themselves best to an amateur. The simplest will be a straight tube, the lower end open and dipping into a vessel of mercury. The next, the syphon, in which the short leg is left open and serves the purpose of the vessel in the previous form. And third, a modification of the first, but instead of the tube being upright, it is bent nearly at right angles, about one third of its length from the trough. This, for a reason hereafter shown, is very sensitive though somewhat unsightly. *Tubing.*—For either kind glass tubing must be procured of, say, ¼ in. internal diameter, and 30 in. long. Care must be taken in selecting the tube, that it be of the same diameter throughout, else a reliable barometer will be impossible. Next see that the bore is chemically clean. Wash it with strong soda to remove any trace of grease, then with acid to remove all trace of soda, and finally with a plentiful supply of clean water. One end must now be melted and sealed, which CHEMIST, I presume, well knows how to do. *Mercury.*—It is absolutely necessary that the mercury should be chemically pure, for if impure, not only is its density altered, but it will cling to the glass and the thing will become useless. It can be purified by squeezing through clean chamois leather, or by passing it through a funnel of writing paper folded as a filter paper with a pin hole in the bottom; this should be repeated until no dross or impurity is left on the paper, though the best way would be to distil it. When perfectly pure see that it is dry. Line a vessel with absorbent paper, and roll the mercury in it, so that any moisture may be taken up. Some recommend placing it in a warm oven, but that, in my opinion, is not a good plan. *To fill the tube.*—Make a paper funnel with a pin hole and place it in the tube; gently knock the tube if it becomes choked. When full, gently heat the tube so as to expand any air bubbles in it and force them to rise to the top. With a hand glass examine the column of mercury to see if any minute bubbles are imprisoned; if so, they must be expelled by heating and gently knocking. When the tube is full, dip the open end in a vessel of mercury, when a portion of the column will fall out, leaving a perfect vacuum at the upper end. To test whether the vacuum is perfect, close the end of the tube with the finger and turn the tube upside down; if the vacuum is perfect the mercury will fall with a distinct click. If air or moisture is present there will be a dull thud, as the air or moisture will form a cushion. Replace the tube in the vessel of mercury as before, and whilst immersed tie a piece of skin or leather over the open end. Take a wide mouth bottle and fill it with mercury and place the tube in it; with a



Barometer.

bit of wire or wood remove the covering from the tube when immersed in the mercury. A cork to fit the bottle with a hole to receive the tube must be slid down the tube and into the bottle to give some support, though care must be taken that the cork is not air tight, as on the pressure of the air on the mercury in the containing vessel will depend the rising or falling of the mercury in the tube. The whole affair must now be firmly fixed to a back, which should be marked off in inches and $\frac{1}{10}$ in. This is the simplest form, and will be subject to errors which the space at my command forbids to explain, further than to say that the larger the area of the vessel, as compared with the bore of the tube, the smaller will be the error. In the second form the tube is sealed at one end whilst the other is bent like a syphon; this plan is adopted in what are called the wheel barometers, where a pointer travels round a circular face. It has to be filled the same as in the other case. No containing vessel with mercury is needed in this as in the other, as the atmosphere will act on the open end of the tube and balance the mercury. In the third type mentioned the glass tube is bent as shown in the diagram. I have never seen but one of this kind; it is not at all ornamental, but is exceedingly sensitive. It will be understood that according to the pressure so the mercury rises perpendicularly. Now it is clear if the mercury rises perpendicularly one inch, and the tube lies at an angle with the perpendicular, then it must travel much more than an inch in the tube to reach an inch perpendicular, and the nearer the bent tube is to a right angle the farther must it travel. By this means it is possible to graduate the scale much smaller. In the figure, if the mercury rises one inch from $a\ a^1$ to $b\ b^1$ it will have travelled in the inclined tube to the dot 2 lying between them, which is much more than an inch from a. When it rises to $c\ c^1$ perpendicularly it will have travelled in the inclined tube to the dot 3. By this means much more minute variations can be read off. I have not the exact measurements of this instrument by me, but will procure them if asked for.—O. B.

Cheap Water Filters.—J. S. (*Bullocksmithy*).—The subject of filtering water for drinking purposes is of such paramount importance that a full book of 250 or 300 pages would scarcely suffice for its consideration, much less a condensed reply to a "Shop" correspondent. Firstly, filtration ought (although hitherto it has never been able to) deprive water of all impurities. Water is impregnated, *chemically*, by the strata through which it passes after its fall in the shape of rain, dew, or snow from the clouds as well as *mechanically*, as it rushes in streams, rivulets, and even torrents to fill the artificial reservoirs constructed by man for storage purposes. Dead dogs, cats, rats, etc., must not be left out of the calculation, nor the pollution of rivers poisoning even the poor fish! The simplest form of filter is some porous medium through which the water may percolate to rob it of all impurities in the shape of vegetable matter, such as moss, grass, water plants, and other vegetation, growing either in the bed or on the borders of the tributary stream, which forms the source of, or acts as the channel of, conveyance for the water supply. This vegetation—especially when the water supply consists of the great drainage of moors, uplands, and hills, such as those of Lancashire, at Rivington, in your immediate neighbourhood, and the watershed on the Lancashire side of Derbyshire and Yorkshire, at Woodhead and Dunford Bridge and their neighbourhood, into reservoirs of great extent with double filtration (first through gravel and afterwards beds of sand and stone) from one reservoir into another—is almost all eliminated, as analysis of the Manchester water supply proves; it is the purest in England by far. Liverpool comes next, and when the works for Manchester deriving the supply from the Cumberland and Westmoreland lakes are complete there will be no need of filters for the district supplied. And all this expense, it is worthy of notice to remark, came, not as in London, out of the ratepayers' pockets, but out of the profits (over £30,000 per annum) earned by the gasworks, also a Corporation property, which supplied gas at a lower price than any other gas company, and still yielding a profit enabling the Corporation to construct the finest water works in the world, and to supply the purest water on the largest scale ever known; and by its purity and plenty and constant supply, to reduce the death-rate of an abnormally unhealthy city to a favourable percentage. Where water is derived, not from the drainage of moorland, where vegetable matter is almost the only impurity, and where the excess of ozone in the atmosphere is sufficient to impregnate the so-called surface water, but from springs having their origin in strata, such as iron-ore, gypsum (as in Paris), or carbonates of lime, medicinal springs (such as Malvern), or other sources chemically tainted, mechanical filtration is no longer effectual. Hitherto all household filters have failed to purify water chemically impregnated. They prevent all insoluble particles from passing; all vegetable and animal matter is arrested; but chemicals in solution can only be got out by chemical means, such as precipitation. As water becomes chemically impregnated by the soil through which the water passes as a rivulet, a stream, or river, the strata through which it percolates through the earth as it forms a spring, or the pipes or conduits through which the supply is disseminated to dwellers in towns or cities, or again, in villages and hamlets, by drainings from cemeteries or burial grounds (which our ancestors placed invariably around their beloved parish church on the highest ground they could find in the said parish), seeking their natural escape into wells and springs, it is evident that a perfect filter cannot be designed without first obtaining an analysis of the local water supply. A filter that can render pure the water impregnated by iron salts would be of no use, but positively harmful where lead ore was a component of the soil in contact with the water, or where carbonates of lime or lithia formed the beds of streams and rivulets. Copper, even tin, and other minerals, such as sulphur, barytes, alum, alumina, and other bodies, influence by their partially dissolving in the water flowing over them, the water itself primarily, and the health of those who drink water (which, by-the-bye, I *never* do), as is evidenced by what the Swiss call "goitre," and Matlock people "Derbyshire neck" (a vast and unsightly swelling of that part of the neck between the jaw and the clavicle), attributable solely to the impregnation of the water in both districts by the same chemical salts of lime, which produce also in both Switzerland and the caverns of the Peak of Derbyshire, stalactites and petrifaction. Filtration has no power over water chemically impregnated, unless as a first process other chemical re-agents are introduced which are beforehand known to precipitate such impregnations in an insoluble form. Hence the distinction between chemical and mechanical filtration. Ordinary filtration consists in sieving water and stopping all particles grosser than water from passing through. Chemical filtration means making every soluble, invisible particle passing through unnoticed, even the finest filter known, declare itself in the form of a precipitate which cannot pass. To construct a cheap and really effective filter is very simple. Take a large flower pot, and cement into the bottom hole, either with Portland cement or red lead, a pipe of gutta percha, so that it is water-tight when dry. Into this pot with cement set another about the same size which will only descend about half-way down. Half fill this second pot with sand or gravel well washed in salt and water first and afterwards in pure water. Then fit in, likewise in cement, a third flower pot, which half fill with wood charcoal, and then put into it a fourth flower pot, cemented as before, into No. 3, in the bottom of which place a circular piece of felt, or screw a bit of sponge into the hole in the bottom. This is the complete form of mechanical filter; nay, more, the carbon (charcoal) will eliminate as a disinfectant, any surface impregnation otherwise derived from the atmosphere, and disinfect passing water from all germs of disease. To make this cheap and effective mechanical filter into a chemical filter also, first analyse the water you have to contend with, and having done so, ascertain what other re-agent will precipitate as an insoluble powder, or precipitate the chemical you desire to get rid of. Add this re-agent in the fourth or upper pot and add the water as required. The action will be: firstly, the re-agent will precipitate the obnoxious salt; secondly, the precipitate will not pass the felt or sponge; thirdly,

the animal and vegetable molecules will be left behind in the fourth pot. The charcoal in the third pot will deprive the water passing through it of all germs of disease, microbes, etc. In the second pot you have placed sand or gravel as a filter to arrest all animal and vegetable matter which may have evaded first and second filtration. In the fourth pot you have provided a reservoir into which the water, having undergone all the ordeals you have provided in the cause of health, may drip as it percolates through to be drawn off as required from the gutta-percha pipe fixed to the hole in the bottom of it; by placing the lower pot upon two bricks laid side by side, with room for the tube between them, this simple filter is completed, a cork or wooden spigot closing the pipe when required. It is necessary to take out the sponge or felt every two or three weeks, and wash both it and the inside of the upper pot, then replacing. It would be better to add the chemical re-agent to the water in a separate vessel, leaving it to precipitate before putting it into the filter; and the proportion must be very accurately ascertained, or the remedy may be worse than the evil itself. In many cases gases, such as carbonic anhydride, passed through the water will effect the precipitation without leaving any taste in the water, especially as the carbon deodorises it and deprives it of taste. Do not paint your flower pots either inside or out, and do not use glazed vessels, as the percolation of water through them "sweating," as it is termed, keeps the water deliciously cool; and do not use the filtered water for a few days, until it loses the slightly earthy taste it will naturally have at first. The cement should be broken away and both gravel and charcoal cleaned and washed about every six months, or oftener if the water is very impure, and re-cemented. Such a filter ought not to cost more than fourteen or fifteen pence.—J. W. H.

Door of Greenhouse.—A. X. E. (*Nottingham*) writes:—"On page 812, Vol. I., *re* 'Door of Greenhouse,' described by G. LE B., there is an illustration given of part of belt rail and diminished stile of above. I think if the illustration had been the other way upwards it would have been more easily understood, narrow part at top, as when hung. Is that so, or am I mistaken?"—You are quite right in your conjecture that the narrow end of the stile should have been uppermost. The printer inadvertently turned the illustration upside down, and this has, no doubt, been the cause of fogging the brains of others besides yourself, for as it appears you would either have to stand on your head or turn the paper upside down to enable you to grasp the meaning of the thing. See reply on same subject to PHI, in "Shop" column of No. 71.—G. LE B.

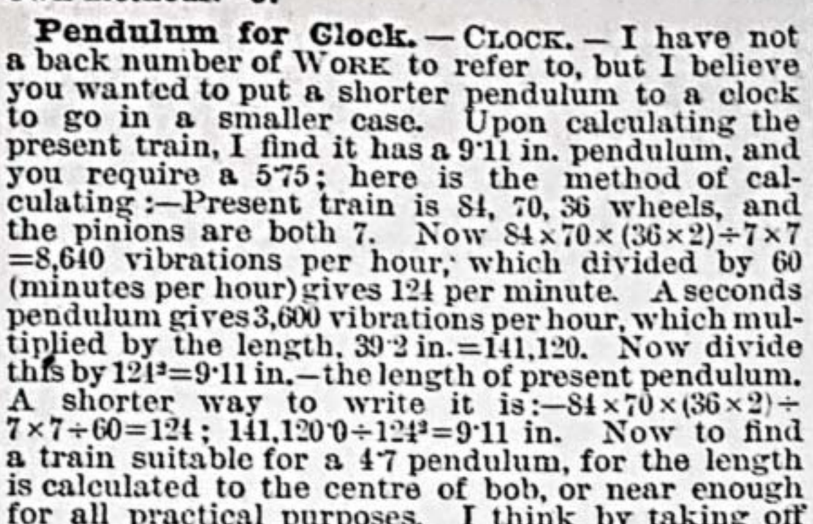
Pebbles.—NOVICE.—I am always glad to read such letters as yours, as I am a thorough believer in "hobbies;" I know every one is happier for having something to take an interest in and devote his spare time to, and not only does it add to his enjoyment, but enlarges his mind, and many of the highest authorities, in their different branches, began the study as a leisure time amusement. As an example in your own particular hobby, Professor Geikie says he "began to learn his geological lessons when a schoolboy; but it was not from books that he learnt them. The mere accident of finding some fossils during a half-holiday excursion turned his thoughts towards such subjects, which soon became the chief employment of his leisure. He can look back upon these country rambles in search of fossils and rocks, not only as among the happiest hours of his life, but as having been of the utmost importance ever since." I hope this may induce you to take up the study of geology. I do not know of any books solely upon pebbles, but why confine yourself to these? Your specimens are in no way extraordinary, and I feel sure you would derive more advantage from the study of the whole than of a small part—that is, of course, if your taste lies in that direction. Get one of the "Science Primers," price 1s., Macmillan & Co.: that upon geology by Professor Geikie; you can afterwards turn to larger works. You will find some excellent lessons upon the subject in "Cassell's Popular Educator." Instructions for forming a collection must stand over just for the present, as I have answered you so fully upon the other parts of your letter; in the meantime, visit a good museum, and that, perhaps, will teach you better than several letters. As for the best means of preparing them, I hardly know what you mean; geological specimens require little or no preparation, but I observe some of your pebbles are partly polished, is that (the polishing) what you require information upon? If so, write again, and I will explain the process.—W. E. D. JR.

Steel Straightedge.—MEUX QUE ÇA.—Any engineer, or almost any working fitter at home, would do this job for you. Perhaps your best course would be to go to Hindley, of Bourton, being near your home, and ask his price for planing the steel edge. I should get a thoroughly dry bit of stuff, say an old straightedge, screw my strip of steel on it, and then have it *planed in place*—not plane it first and screw it afterwards. Insert screws at distances of every 2 or 2½ in.—J.

Spring for Model.—A. E. W. (*Birmingham*).—A watch and clock maker can supply you with such a spring for a shilling or two.—J.

Ornamental Ironwork.—G. R. (*Dorchester*).—You can work thin sheet iron upon a pitch bed with hammer and punches. A good deal would be also done in the vice, using pliers and hammers; for repetition work, moulds and formers would be prepared; grooves and veinings would be done with sets, hollows, and depressions, with round fullers. For large work, the earthen floor scooped out roughly to shape would form a mould or bed into which the sheet metal would be hammered. Each workman would to a large extent invent his own methods.—J.

Pendulum for Clock.—CLOCK.—I have not a back number of WORK to refer to, but I believe you wanted to put a shorter pendulum to a clock to go in a smaller case. Upon calculating the present train, I find it has a 9·11 in. pendulum, and you require a 5·75; here is the method of calculating:—Present train is 84, 70, 36 wheels, and the pinions are both 7. Now $84\times70\times(36\times2)\div7\times7=8{,}640$ vibrations per hour, which divided by 60 (minutes per hour) gives 124 per minute. A seconds pendulum gives 3,600 vibrations per hour, which multiplied by the length, 39·2 in.=141,120. Now divide this by $121^2=9{\cdot}11$ in.—the length of present pendulum. A shorter way to write it is:—$84\times70\times(36\times2)\div7\times7\div60=124$; $141{,}120{\cdot}0\div124^2=9{\cdot}11$ in. Now to find a train suitable for a 4·7 pendulum, for the length is calculated to the centre of bob, or near enough for all practical purposes. I think by taking off the third wheel of 70, and putting one the same size of 84, then turning the 'scape wheel pinion down a little to suit, you will find a pendulum of 4·7 in. will keep time. To prove it so, calculate thus:—$84\times84\times(36\times2)$(that is twice the number of 'scape teeth)$\div7\times7=10{,}368\div60=172{\cdot}8$; now $141{,}120{\cdot}0\div172{\cdot}8^2=4{\cdot}7$ in. from centre of pendulum spring to centre of ball; let your ball be about 1·5 in. in diameter, and that will suit you, I think, very well; I prefer a heavy to a light ball; the size of the pinion



Pendulum for Clock.

should be 3 full teeth of the wheel, but a little larger or smaller will not hurt, providing it does not butt or bind. Now to calculate the weight required to drive a clock. The following I take from Sauveur, page 600. "In a train of wheels and pinions the *power is to the resistance as the product of the radii of the pinions is to the product of the radii of the wheels*, if we neglect friction; and the approximate *ratio of the power to the resistance, ignoring friction, may be found by measuring the space traversed by the two forces: these forces are to each other inversely as the spaces.*" Let A, B, C, D be a train of wheels; assume a weight of 160 to be suspended to the circumference of A; the radius of B is four times that of its pinion *p*. Thus the force transmitted by B if reduced by ¼ becomes 40; the radii of C and D are 4 or 5 times the radii of their pinions; the force transmitted by C is then only ¼ of 40, or 10, and that by D is ⅛ of 10, or 2; if then a weight of 2 be suspended from D, it will balance a weight of 160 at A: the power is to the resistance :: 1 : 80. By calculating we should have had—Product of radii of wheels $16\times12\times10=1{,}920$; product of radii of pinions $4\times3\times2=24$. Hence P : R :: 24 : 1,920 and we have 24 : 1,920 :: 1 : $x=80$. On calculating the velocities of the wheels, we see that D makes 160 revolutions while A makes 1. To determine the space traversed by a point on the circumference of A in the one revolution, we have $40\times3{\cdot}14\times1=125{\cdot}6$, and for a point on the circumference of D during the 160 revolutions $20\times3{\cdot}14\times160=10{,}048$. But 125·6 : 10,048 :: 1 : 80. The result, then, is the same as above. I trust from the foregoing you will be able to calculate your train and weight. To get a wheel, take off the one next the 'scape wheel, send it to Grimshaw & Co., 35, Goswell Road, Clerkenwell, or Haswell & Sons, 49, Spencer Street, Clerkenwell, and ask them to cut one exactly the same, but 84 teeth instead of 70; then fix it on an old collet and your job is done. That will save altering or making new pallets, which you would have to do if you put a new 'scape wheel. The wheel would cost about 1s. 6d or 2s.; to take it to a clockmaker they would probably charge you from 6s. to 7s., or more if a striking clock, but that would include cleaning, etc. I trust you will be able to do the job yourself, and should be pleased to hear the result, or to advise further.—A. B. C.

Electric Time Alarum.—W. J. W. (*Sussex*).—The simple contrivance for an electric time alarum sent by you is very creditable, but your description and diagrams are not sufficiently clear to insert in "Shop."—ED.

Varnish Stain out of Drawing.—This can be done only by an expert; it is impossible to take the varnish stain out without the use of spirit, and with the greatest care the sepia drawing would be so impaired as to require restoring. The best man I can recommend in your district is Tom Wood, printseller, Darlington.—F. B.

McLeod's Practical Hints for Draughtsmen.—W. L. V. (*Penge*).—I never heard of the book you inquire about. Write, however, to Messrs. Lockwood & Co., Stationers' Hall Court, London, E.C., who publish Weale's technical books, and they might obtain it for you.—J. W. H.

Soldering Fountain.—E. H. B. (*Stoke Newington, N.*).—If you are "easily able to make a joint where the two pieces are of one metal," you will have no difficulty in soldering diverse metals, as there is no material difference in the process, except in the fluxing—that is to say, for brass you must use "killed" spirits of salts, while for zinc you use raw spirits of salts. You will not need to dip the legs of fountain at all. Mark the position of the joint, and tin a ring of solder at that point; then just touch the surface of the zinc with the raw spirits, and solder up together.—C. M. W.

Fountain.—F. R. H. (*Andover*).—The cost of the self-acting fountain described in No. 69 of WORK would depend upon the kind of workman employed; the materials would cost about 7s. 6d., exclusive of ferns. I am unable to give you the name of any one in these columns who would make one.—C. M. W.

Tent Making.—LONDON.—The easiest tent to make and use, on the whole, is what is termed a "canopy" tent, and while presenting an attractive appearance is sufficiently substantial for garden purposes. It is square in plan, tapering to a square shoulder and thence to a point. Striped canvas forms a suitable material, and is shower proof. For three or four persons, a convenient size would be 6 ft. each way at base, 3 ft. each way at shoulder; height from base to shoulder, 6 ft. 6 in.; height from shoulder to point, 2 ft. 6 in.; the centre pole 9 ft. 9 in., allowing 6 in. to go into the ground and 3 in. projecting through the top. One side of the canvas is detached up to the shoulder, and is held up open by two poles to required height, forming a canopy in front of tent. The canvas at base should be made fast to equal size lengths of wood on the inside, and provision made for pegging down the same. No outside lines are required. Of course, this is intended as a fine weather tent, and not to stand much wind, and is easily put up or taken down, the shoulder frame being hinged to the pole: thus when opened it assumes its proper shape, by being bulged out at that point.—C. M. W.

Work on Bricks and Tiles.—T. H. W. (*Leytonstone*).—You should get the following books:—"Manufacture of Bricks, Tiles, Terra-cotta, etc." by C. T. Davis, 8vo, 25s. (Low): "Bricks and Tiles: Rudimentary Treatise," by E. Dobson, 3s. (Lockwood).

Photo-zinco Blocks.—AMATEUR (*Dover*).—I should advise AMATEUR, if he wants a fairly good zinco block, to send to Mr. John Swain, Farringdon Street, or to Hare & Co., Limited, Bride Lane, Fleet Street, his photo of shop front. If he prefers to try this process himself, he will have to undergo a long series of experiments before he succeeds at all. Any description of it, to be of any value at all to AMATEUR, would be too long and intricate for "Shop," but he will find it carefully and minutely described in one of Wyman's "Technical Series," "Zincography," by Josef Bock, 2s 6d., of any bookseller, or by post from 65, Chancery Lane.—J. W. H.

Heliographs.—W. C. Y. C. (*Walthamstow*).—A paper on this subject is in preparation, and as not only it would "rob its sails of the wind," but would also involve far too long a description for the space in "Shop" at my disposal to give it now, please wait as patiently as you can.—J. W. H.

Parcel Labels.—C. Y. H. O. (*Birmingham*).—Apply for prices, etc., to any large firm of wholesale stationers in your town, or write to Waterlow and Sons, London Wall, E.C.—J. W. H.

Telephone.—B. S. (*Reading*).—It was quite a pleasure to receive your letter. I am glad you have succeeded in making your telephones from the instructions given in No. 28 of WORK. If you will turn up that article again you will find that two such instruments were simply joined together, and that no battery was used, and that by applying one of them to the ear a feeble imitation of the distant speaker's voice was heard, providing, of course, that some one was speaking at the other end. Try joining up your telephones in this way and note the effects. In telephone practice, however, the case is quite different, for the sound emitted by the receiver is much too feeble to be of any practical use. A transmitter, generally of carbon, a modification of Professor Hughes's instrument given in the telephone article, is used for intensifying the sound, and with this arrangement a battery is required. See recent numbers for telephone transmitters, especially No. 55, page 45. These, with the receivers, are generally mounted on a switch-board, which has also a call bell included for convenience. An article containing instructions for this part of the subject is in the Editor's hands, and will, no doubt, be a help to you. By the way, however, you will be infringing upon the rights of the Bell Telephone Company by using the combination referred to for business purposes.—W. D.

Cells for Electric Bells.—A. B. (*Battersea*).—In calculating the number of cells needed to ring a certain number of bells in a house, it is necessary to take into consideration the total resistance of the circuit together with the volume of current required to ring the bells. A great variation exists in electric bells: some will ring well with 0·25 ampère, others take 0·50 or even 0·75 ampère of current to ring them. Much of this depends upon the size and length of wire used on the magnets. We must, therefore, place enough cells in series to furnish sufficient pushing power to force the requisite volume of current through the resistances of line, fittings, and bells. First find the total resistance of the circuit in ohms, and add to this the resistance of each cell in the proposed battery; divide the total sum by 1·50, and thus find the approximate number of cells. Next multiply 1·50 by the number of cells to be used, and divide the sum by the total resistances. The result will give the volume of current in ampères, and we shall then know whether we have enough to ring the bell or not. If not, we must add more cells in series. When a large number of bells are to be fixed in a house, as in the examples given in your letter, it is only necessary to estimate the total resistance of the circuit for the most distant bell, or that offering the most resistance. As all the others will be branches of the main lines their resistances may be disregarded. If it is supposed that several bells will be rung at one and the same time we must employ a battery with large cells, or couple the cells in parallel to furnish the necessary volume of current. The largest size Leclanché cells should be used where a number of bells are employed. A battery of three or four cells in series is usually enough for all purposes, but any number may be used in parallel if it is desired to build up a strong battery to meet the demand for a large volume of current.—G. E. B.

Electrotyping Bath.—A. H. O. (*Lewisham*).—An electrotyping bath gets out of order from standing idle, because the sulphate of copper solution has a greater density than the free acid and water in the bath. The solution settles down into stratas of different density, with too much free acid near the surface. The remedy is to well stir up the bath with a clean stick two or three times before commencing the work, allowing the sediment to settle down between each operation. If it has lost some of its bulk by evaporation, add enough rain water to make it up to its original bulk.—G. E. B.

Bicycle Gearing Method.—A WELL-WISHER.—The rule to find the gearing up or down of a safety bicycle or tricycle is a very simple arithmetical one. Take the diameter of the driving wheel, say 30 in., multiply this by the number of teeth on the chain wheel, that is the bottom bracket chain wheel, then divide the sum thus obtained by the number of teeth on the driving hub cog; the result will give the geared up diameter. Example 1—

Driving wheel	30 in.	
Lower chain wheel teeth	18	
	240	
	30	
Hub cog teeth	9)540	
Result	60 in., or geared double.	

Example 2—

Driving wheel	30 in.	
Lower chain wheel teeth	15	
	150	
	30	
Hub cog teeth	9)450	
Result	50 in.	

Example 3—

Driving wheel	32 in.	
Lower chain wheel teeth	16	
	192	
	32	
Hub cog teeth	8)512	
Result	64 in.	A. S. P.

WORK Index and Covers.—A. J. T. (*Holborn*).—These are and will be issued by Messrs. Cassell & Co., Limited, on the completion of each volume, and are obtainable from the publishers or of any bookseller.

Machine Book.—F. G. H. (*Erith*).—I do not think there is such a book. May I suggest that possibly one of the following is in your mind:—"The Complete Practical Machinist," by Joshua Rose, price 2 dollars 50 cents. "The Modern Practice of American Machinists and Engineers," price 2 dollars 50 cents. These can be obtained through Trübner of Ludgate Hill, E.C. "The Mechanician and Constructor," by C. Knight, price 18s., published by Spon.—J.

Glass Silvering.—C. H. G. (*Liverpool*).—You ask for directions to silver glass, but do not say if you want to do it upon a large scale, such as for trade purposes, or only as an amateur; I conclude the latter, but if I am not right, kindly let me know through "Shop," explaining fully what size pieces you wish to do, and whether plate, crown, or window glass. The following is a cheap and simple method of silvering small pieces of glass for common purposes:—Take a piece of glass the size wanted (window glass will do if only a small size is required), wash and clean thoroughly, as every dirty spot will show only too plainly when finished. Take a piece of tin-foil; cut it a little larger than the glass, say ½ in. or 1 in. larger each way; smooth all the creases out, and lay upon a flat board or table; cover it all over with mercury (quicksilver); now cover it with a piece of clean paper, then lay the glass on the paper, and, holding it firm with one hand, draw the paper out with the other, when it will bring away the greater part of the mercury, together with the air bubbles and dirt; weight it down, and let it lay until the next day; then lean it against the wall with a piece of foil underneath, to draw all the mercury out, and let it be a little longer to set. Cheap glasses are also silvered with chemicals, but I do not think you would succeed so well; but if you wish to try I will give you a recipe if you write again.—W. E. D., JR.

Cutting Patterns.—TINNER.—I will endeavour to meet your requirements at some period of the articles now appearing on sheet metal work, but cannot state precisely when it will appear.—R. A.

Guitar Making.—C. R.—I will give instructions how to make a guitar as soon as possible; I must polish off the banjo article first. You might get some information if you read the article on mandoline making in WORK No. 66, page 229. The information will apply to the guitar in nearly everything excepting shape.—J. G. W.

Silver for Banjo.—W. H. B. (*Leicester*).—You can purchase sheet German silver from Mr. Hillcocks, 20, Endell Street, Long Acre, London, W.C. You had better write to him for prices, which I have no doubt he will be pleased to give you. The harp is not in my line.—J. G. W.

Antimonial Lead.—JAY DEE.—One part of antimony to four to eight parts of lead will suit your purpose. Guettier's "Practical Guide for the Manufacture of Metallic Alloys," published by Sampson, Low & Marston, London, is perhaps the best practical book on the subject. I do not know the price of it: probably about 3s. 6d. Another good book is Bloxam's "Metals; their Properties and Treatment," published by Longmans, Green, & Co., London, price 3s. 6d. A large and complete book on the subject is Phillips' "Elements of Metallurgy," published by Charles Griffin & Co., Exeter Street, Strand, London, at 36s. Write to Cassell & Co., London, E.C., who will send you a catalogue of their books post free.—F. B. C.

Gas Meter.—H. E. (*Clapham*).—The top dial as a rule only indicates single feet, that is to say, that when the hand has gone from 1 to 2 the meter has registered one foot of gas, and so on. It is useful for testing an escape, as you surmise, in this way. If it is feared that there is an escape or leakage, see that there are no lights burning, and then examine the top dial, and if the hand moves you may be sure there is something wrong somewhere. A simple way for you to test what I say would be to light a burner that you know the number of—for instance, one that has 5 rings turned on the brass just below the earthenware shows that it is supposed to burn 5 ft. per hour, and so on, but the burners are mostly marked with a figure instead. After lighting the gas, take the state of the top dial of the meter, letting the gas burn for half an hour, and if at the end of half an hour the hand is somewhere between 2 and 3, you can take it that there is nothing much amiss—that is, if you have used a No. 5 burner.—E. D.

Toy Balloons.—R. K. (*Burnley*).—The toy balloons require the very thinnest paper and nice work in the making. I do not know why yours failed; according to your account you were very nearly successful, so I can only recommend you to try again, bearing the above remarks well in mind.—OPIFEX.

Advertisements in WORK.—G. H. M. (*Lower Clapton*).—Thanks for your long letter. At present the question of arrangement of the pages of WORK as regards advertisements must be left with the publishers.

Brass Castings.—C. W. J. (*Clapham Common*).—Articles on brass castings will form a portion of a series on "Moulding" to be taken up at some future time. The only book I can confidently recommend is Spretson's "Casting and Founding," published by Spon, 18s., but brass work occupies a small portion only of the work. There are others, but not of much value.—J.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—H. R. (*Chelmsford*); G. F. R. (*Barking*); G. G. H. R. (*Norfolk*); G. M. (*Duffield*); H. D. B. (*Enfield*); J. C. M. (*Exeter*); T. H. (*Tooting*); W. L. T. (*Leeds*); A. E. T. (*London, E.C.*); A. L. (*York*); S. B. E.; STEREOTYPE; J. M. J. (*Edinburgh*); J. S. (*Ilminster*); J. K. (*London, E.*); H. P. C. (*Blackrock*); READER OF "WORK"; W. N. (*London, N.*); A. M. (*London, W.*); H. F. (*London, W.*); T. J. O. (*London, W.*); F. G. (*Essex*); E. A. W. (*London, W.*); S. P. (*Middlesboro'*); J. McL. (*Govan*); N. H. (*Manchester*); C. E. S. (*Shipley*); J. E. N. B. (*Keighley*); T. C. (*Yeovil*); A. G. (*Plaistow*); F. H. (*Streatham Hill*); R. A. (*Islington*); R. B. (*Hertford*); T. A. W. (*Kilburn*); A. C. (*Peterboro'*); F. D. (*Dartmouth*); SOUTH STAFFORDSHIRE; J. M. K. (*Openshaw*); F. A. (*Peckham*); H. H. (*London, E.C.*); G. A. DE R. (*Forest Gate*); H. E. (*London, S.W.*); J. H. H. (*Manchester*); J. R. H. (*Carnforth*); SIDE LEVER; J. L. (*New Wigan*); HUBO; ENGINEER; AQUA; J. B. (*Darlington*); G. C. (*Salford*); AMATEUR; CONSTANT READER; G. A. D. (*Bradford*); E. W. M. (*Kentish Town*); W. B. (*Hull*); R. V. (*Box*); A. S. B. (*Corstorphine*); R. A. (*Islington*); R. H. P. (*Redruth*); W. C. C. (*Finsbury Park*); G. H. (*London, E.C.*); G. H. L. (*Bradford*); ELECTRO; R. J. W. (*Fulham*); H. S. GREENFIELD; FISHPONDS; STUDENT; ENGINEER; F. J. P. (*West Bromwich*); CARINO; G. A. B. (*Sunningdale*); J. P. (*Byker-on-Tyne*); "AB UNO DISCE OMNES"; BLACKSMITH; A. H. F. (*Cheltenham*); TELEPHONE; A. S. (*Musselburgh*); W. V. (*Birmingham*).

"WORK" EXHIBITION.

(1890-91).

For Classification, Prize List, etc., see WORK Nos. 70 and 78.

IMPORTANT PRIZE COMPETITION IN CONNECTION WITH THE ABOVE-NAMED EXHIBITION.

The Publishers of WORK have much pleasure in offering the following Prizes for Designs for the Medal and Certificate of Merit, to be awarded to Successful Exhibitors in the various Groups and Classes as set forth in pages 290 and 418 of this Magazine:—

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LA BELLE SAUVAGE,
LUDGATE HILL,
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N.B.—Any Competitor, whether successful or not, is at liberty to exhibit his designs at the forthcoming WORK Exhibition, on filling in the proper application form for space; and success in this Competition will be held to be no bar to his receiving honours if awarded by the Jurors in addition to the above Prizes, but such forms must be filled in and forwarded previous to the 30th of Sept. to the Secretary, WORK Exhibition, as above.

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