WORK

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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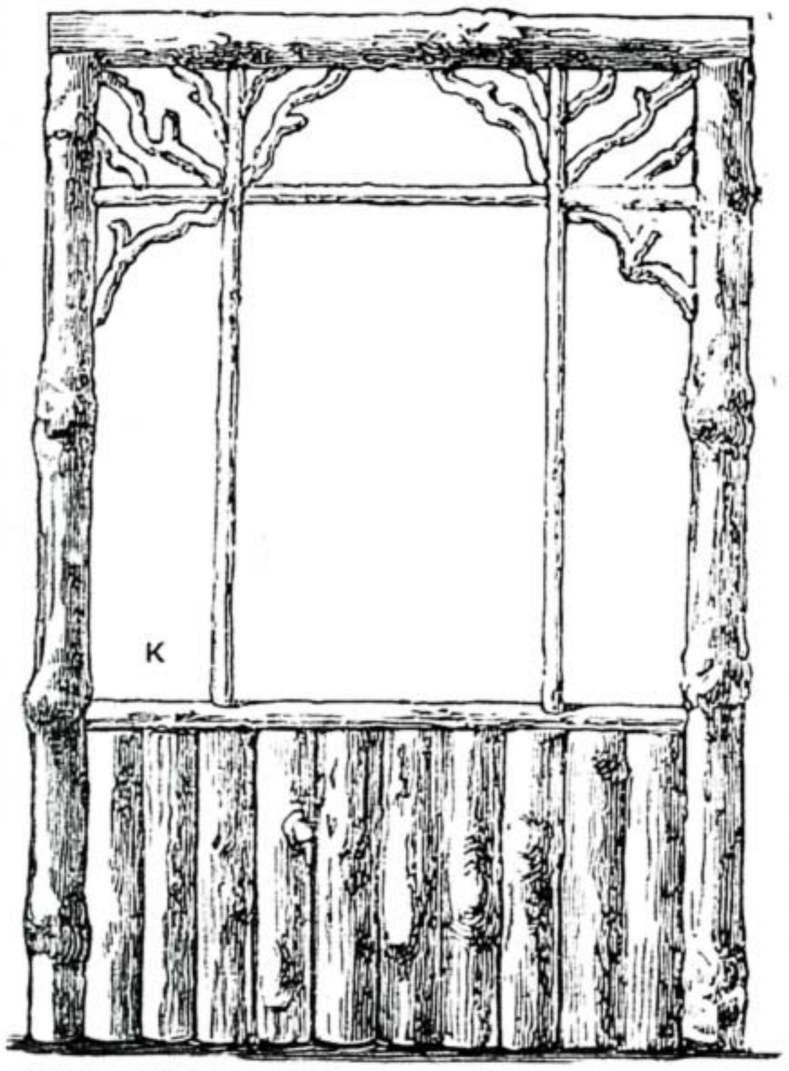


Fig. 1.—Window Side from without (½ in. scale).

AN OCTAGONAL SUMMER-HOUSE;

SUITED TO A GARDEN OF MODERATE SIZE.

BY ARTHUR YORKE.

LAYING OUT THE PLAN—CONSTRUCTION—INTERIOR FITTINGS—RUSTIC MOSAIC—MATERIALS FOR MOSAIC — THATCHED ROOFS — LINING FOR ROOF—MAKING THE FLOOR.

No garden can give its owner the full amount of enjoyment which he has a right to expect from it, or can be called complete, without some sort of summer-house. That people generally are of this opinion is seen in the frequency of buildings of this nature; a great many of these buildings, however, though they doubtless give pleasure to their owners, are far from agreeing with the canons of good taste.

A portion of the questionable taste so shown is perhaps of necessity. Sometimes, especially in suburban neighbourhoods, it is not easy to get really appropriate materials; but the defect oftener lies in the want of proper designs, and in this respect I hope to be able to do some service. The designs which I have to offer are adapted to gardens of different sizes and degrees of pretension — that is, within modest limits. And in our smaller ones that common necessity for doing the best one can with indifferent materials will be a thing borne in mind.

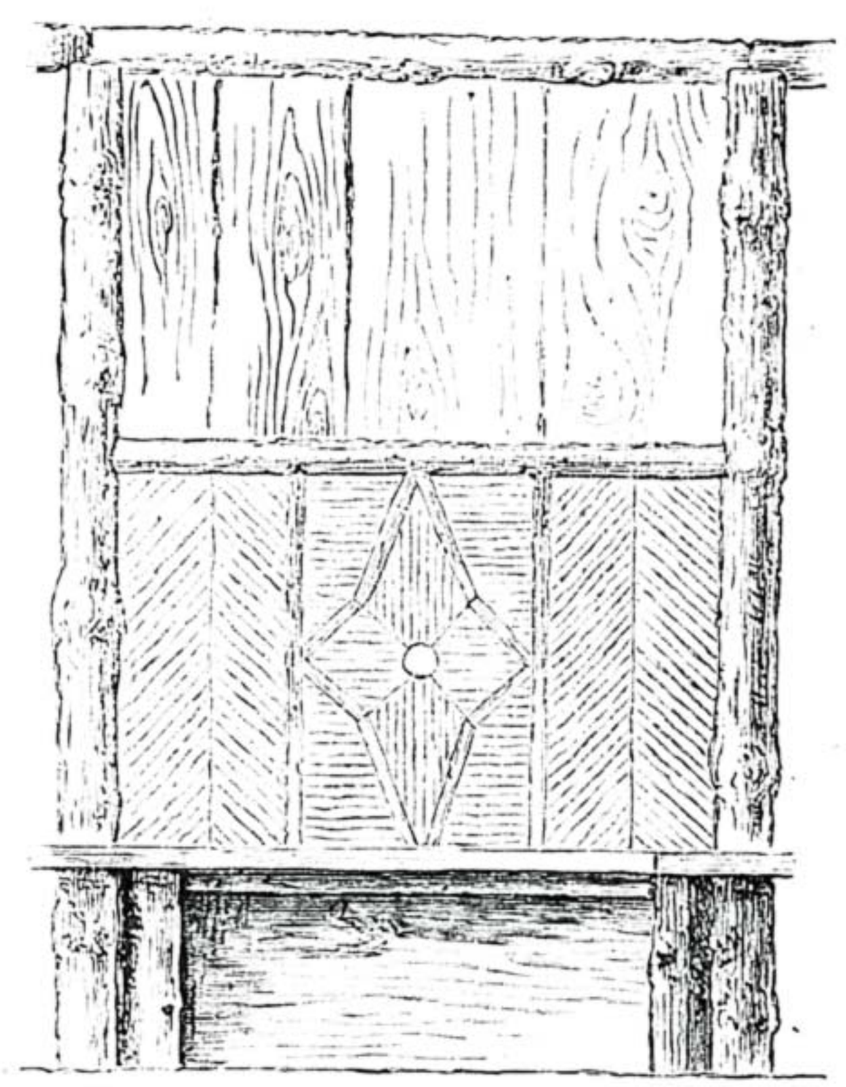


Fig. 2.—Seat Side: interior (½ in. scale).

The summer-house in Fig. 3 is suited to a garden of moderate size, one in which want of space may not necessitate crowding the building close against a wall, and of which the owner may be supposed able to afford the not very costly luxury of proper materials. This octagonal summer-house is not of a size to fit it for the grounds of a palatial mansion, yet it contains a reasonable amount of accommodation, having a continuous seat some 15 ft. long. From side to side each way it measures 10 ft. Fig. 3 is an elevation of the front, and is therefore somewhat more stiff and formal than a perspective view would have been; but it has been given as more useful for practical purposes, since accurate drawing to scale (½ in. to the foot) is thus attained.

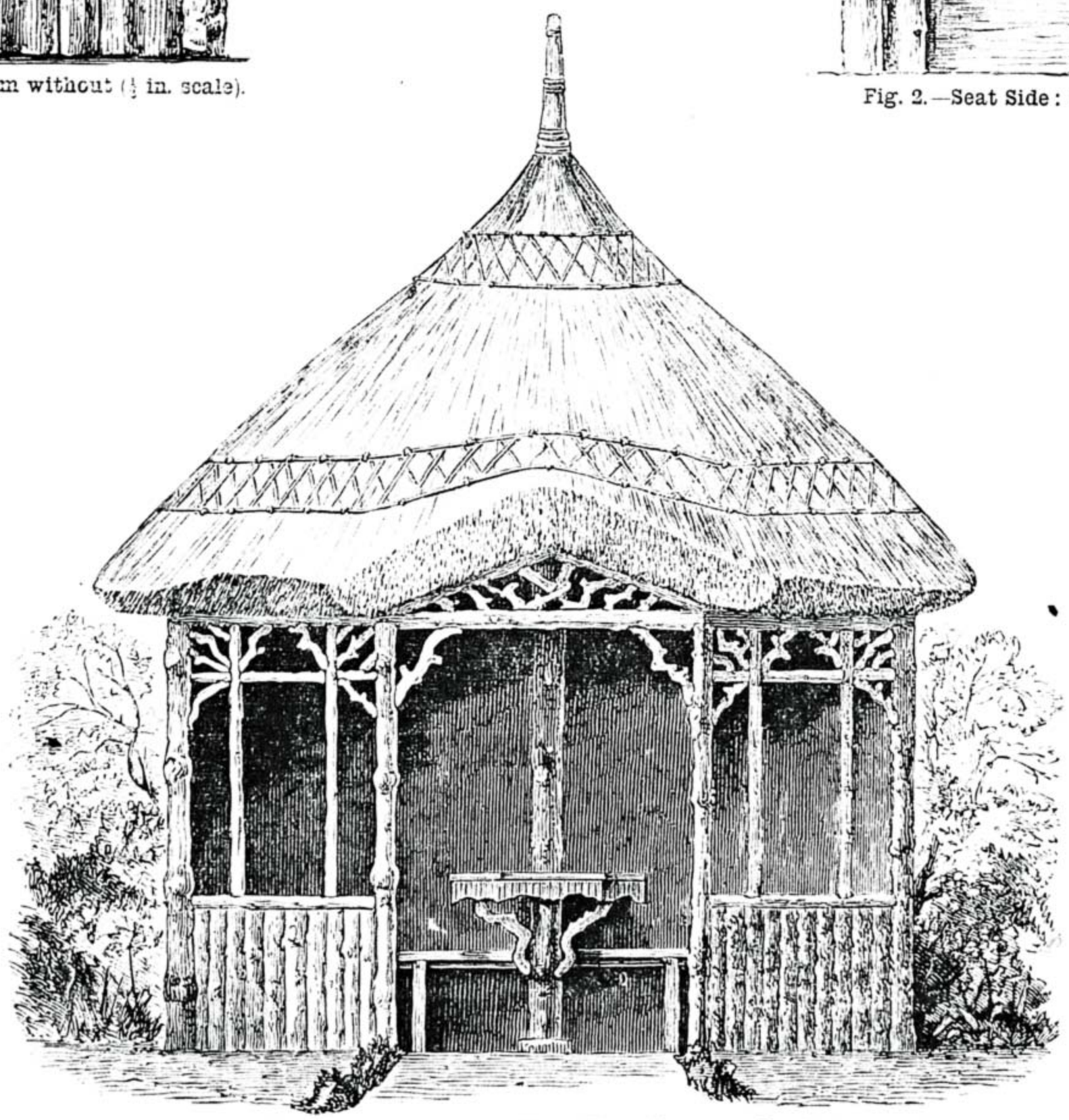


Fig. 3.—Octagonal Summer-House: Front Elevation on scale of ½ in. to 1 ft.

Its framework and the main part of it are of the material advocated for garden purposes in my article on "Some Rustic Carpentry," Vol. I., p. 247: namely, larch poles; other woods are, however, as we shall presently see, used for minor purposes. The roof is of thatch. In the arrangement of this building there is a certain resemblance to a tent. It has a central pillar, not unlike a tent pole, which

sustains much of the weight of the roof. In Figs. 4 and 10 this central pillar is marked A, and in the former diagram a dotted line shows how it is surrounded by a fixed octagonal table. Being of first importance, this pillar is somewhat larger than any of the other timbers—say, 6 in. in diameter near its bottom, and tapering as little as may be. A rod of iron or wood rises from its top to form the centre of the straw pinnacle seen crowning the roof in Fig. 3. This pillar shows a height of 11 ft. 2 in. above ground, and it should not be let less than 3 ft. into the soil; for it will need to be firmly fixed, or it may be forced out of the perpendicular during the erection of the roof; when the roof timbers are once fixed in place it will have little further chance of moving. The diagram Fig. 4 is a ground plan, and Fig. 10 is a section showing the timbers from the interior: both are drawn on a scale of $\frac{1}{4}$ in. to the foot.

The eight collar-posts (B, B, B, Figs. 4 and 10) at the corners of the octagon are of somewhat smaller stuff—say 4 in. They show 6 ft. above ground, and should have 2 ft. below. It will be well to gas-tar all the underground work, as recommended in the former article, cited above.

The ground plan of a building in this shape is readily laid out. The space being levelled, a string is taken which has a loop at each end, and is 5 ft. 2 in. long. With a stake driven through the loop at one end as a centre, and with a stick passed through the loop at the other to serve as the travelling leg of the compasses, a circle is struck 10 ft. 4 in. in diameter, and into this pegs are driven at equal intervals (4 ft. apart) to mark the centres of the eight collar-posts. Whilst digging the holes for the posts, these points are kept by drawing two straight lines on the ground which intersect at the peg.

The cross-pieces which rest on the collar-posts, and which serve as wall-plates, are of a trifle smaller stuff than the posts—say 3 in. Fig. 7 shows how they are cut to fit the tops of the posts, and nailed there. In this building there are no mortises, nor, indeed, anything but such simple carpentry as anybody can do with the simplest tools. On these ends above the posts rest the lower ends of the eight main rafters, D, D, D, the upper ends of which rest against and are nailed to the central pillar. The eight intermediate rafters, E, E, E, rest at bottom on the middles of the side plates, and at top are cut to fit upon and between the tops of the main rafters.

The laths used are in this case in no way particular—any sticks will do: they will not be seen, and under thatch there is no necessity that a level surface should be formed by them, as for slates or tiles. They are nailed 6 in. or 8 in. apart.

It will be seen in Fig. 3 that over the entrance a small gable is formed: how this is arranged is shown in Fig. 6. In this diagram the spectator is supposed to look down upon the roof. The laths, when nailed on, will have to run over the little ridge formed by F, instead of keeping the level, as on the other sides. This will cause no special difficulties in the thatching. The thatcher is an accommodating man, who readily makes up hollows and fits his work to any irregularities.

The walls are of larch poles sawn in half. To split a number of heavy poles with the hand saw is tedious work, and it is better to go to the little extra expense of having them run through by the nearest steam saw. The quantity of half-stuff required may be easily calculated; one of these sides will take about five and a half 6 ft. lengths of 4-in. stuff. The tops of these wall-pieces are sawn obliquely to fit against the round wall-plates to which they are nailed. In their lower parts they are nailed to the lower cross-pieces, G, G, G, Fig. 10.

These latter will best be made of rather large stuff quartered, since their upper sides on which the seat-boards rest should be level, as well as their backs, which go against the wall-pieces. The middle cross-pieces are of smaller half-stuff, and should be nailed to the wall-pieces rather than that the wall-pieces should be nailed to them; for they are in a conspicuous place, and nails driven through them and clenched would be unsightly.

The front supports of the seats are let into the ground some 6 in., and rise $14\frac{1}{2}$ in. above the ground line. The seats themselves it will be advisable to cut from inch board, and about $16\frac{1}{2}$ in. wide. I shall speak presently of the manner in which their edges and upper sides will be ornamented.

In the two window sides of the octagon (see Figs. 1 and 3), the space below the windows is filled with whole poles, their bottoms resting on a sill let in level with the ground, and their tops nailed into through a cross-piece of half-stuff (K, Fig. 1). The mullions and transoms of the windows—if such grand architectural terms may be applied to the mere sticks which pass up and across them—are of small straight larch stuff, but the ornamental filling in above is of crooked branches—oak bangles by preference, though apple-wood would do very well. The latter is particularly mentioned because it often happens that an old apple-tree is cut down in a garden such as that in which we now suppose ourselves to be building, and is at once condemned as firewood; yet its stem may have grotesque knots, and its branches picturesque contortions which would make it valuable for rustic work. Whenever rustic building is contemplated, it is well that such wood should be laid by; a single tree would supply all the small quantity of crooked stuff that is required in the present instance. And indeed, when fruit or ornamental trees of any other kind are cut down, there is no harm in considering whether any part of them might not come in usefully for garden carpentry; even the interlaced stems of ivy, when an old growth has covered a wall, have sometimes been utilised to excellent effect.

It may be observed that any chinks between the pieces beneath the windows, as well as in the walls generally, are most readily and appropriately rendered windproof by neatly stuffing with moss. Fig. 1 gives a full front elevation of one of the window sides (they being only seen obliquely in Fig. 3), and it is on the $\frac{1}{2}$ in. scale.

Four stout crooked pieces are used as struts to support the table (drawn to 1 in. scale in Figs. 5 and 8); $\frac{3}{4}$-in. board will suffice for the top of this table, and it will probably be cut from two widths. To give proper strength to the ornamental border (seen in Fig. 8), a second thickness of the board is attached below each corner, extending 3 or 4 in. to each side, so as to allow each of the longer bits of split rod to be fixed, as shown, with *two* brads.

A really satisfactory material in which to finish the top of a rustic table is not easily found. We require something which will give a level surface, and at the same time be in harmony with its surroundings. Board, planed or painted, oilcloth, or any manufactured material, we feel to be out of place; marble or slate looks cold and hard. We can find nothing absolutely level that satisfies our taste, and have to fall back on that old resource in rustic work—rustic mosaic. By this we mean split rods of wood so bradded down as to form patterns. For our present purpose, however, we need to keep the mosaic more neat and smooth than usual. Fig. 5 shows the top of our table thus treated.

The rods most in favour for rustic mosaic are those of the hazel. They are to be bought cheaply and abundantly when the undergrowth of woods is cut. They have a smooth and pretty bark, and the useful size is from $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. Sticks of other kinds of the same size can also be used: birch and wild cherry may be named among those with smooth bark, and wych elm and maple among those with rough; willow or withy, again, is of most common growth, and exceedingly useful. In river-side neighbourhoods it is often the most cheap and plentiful of all woods. For mosaic work, it is always peeled, for its bark is unattractive, and its light colour when stripped makes it tell well in contrast to the dark bark of other woods. If used, as it often is, for outdoor purposes in garden carpentry, it should always be peeled. Country carpenters have a saying that withy lasts twice as long without its bark as with it; and in this there is much truth, for the loose bark holds the wet to the wood and causes it to rot. To make it peel freely, it should be cut just as the young leaves make their appearance. The like holds good with other woods; but if it is desired that the bark should hold firmly, the wood should be cut down in dead of winter, when all the sap is down.

The top of our table is supposed to be mainly composed of peeled withy. We can make smoother work with it than with almost anything else. We have in this pattern only the double dark line bounding the star and the single strip round the edge in hazel, and for these we can choose level pieces. So much white will not look amiss in this place, and withy is easily worked. Hazel and most woods twist so much in the grain that it is rarely safe to split them except with the saw, but withy—in short lengths like these, at least—can be split with a hatchet.

In rough carpentry there is no more pretty or interesting work than these mosaics. We have more of them in the backs of the seats (Fig. 2), and on the seats themselves (Fig. 9). On the latter, as on the table top, hazel and withy are contrasted, and form a design in alternate triangles; the separating bands, it may be noticed, have a light strip against the dark, and a dark strip against the light, triangle. Along the edge of the seats one or two strips merely are nailed lengthwise. In such a situation an ornamental edging like that round the table would be too liable to be broken. It is recommended that the back of the seats should be in dark bark-covered woods only, for the mosaic in that position will look better without any mixture of the light-coloured withy.

The upper compartments of the sides with which the backs of those sitting down will not come in contact may be more quickly and yet pleasingly covered with sheets of bark. Elm bark is good for the purpose. It may be peeled in large sheets from the trunks of trees felled in spring, when the sap is rising; and whilst it is drying, should have bricks or stones laid on

it to press it flat. When dried, it is nailed to the walls, and any cracks which appear can be neatly filled with moss. The space beneath the seats is also shown as roughly covered with bark.

The almost conical roof is, it will be observed, a thatched one. In my opinion, no other covering is so pleasing as thatch for a rustic building. Its colour and rough texture harmonise well with the natural wood, and all its associations are of a rustic character; no other covering so effectually excludes the summer heat, and nowhere can one find a retreat so suggestive of coolness, quiet, and repose, as under the low eaves of a thatched building. Thatch has, it must be admitted, certain practical disadvantages — birds and winds are apt to scatter fragments from it in a manner objectionable in a trim garden, and it needs renewing at comparatively short

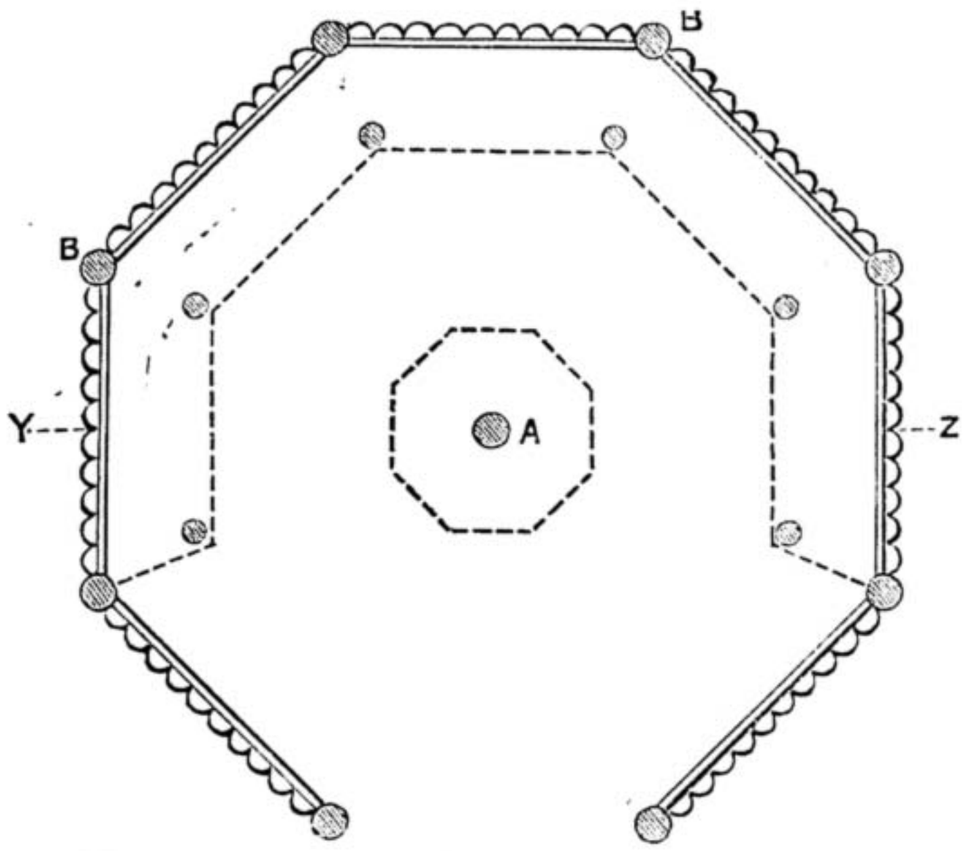


Fig. 4.—Ground Plan of Summer-House (¼ in. scale).

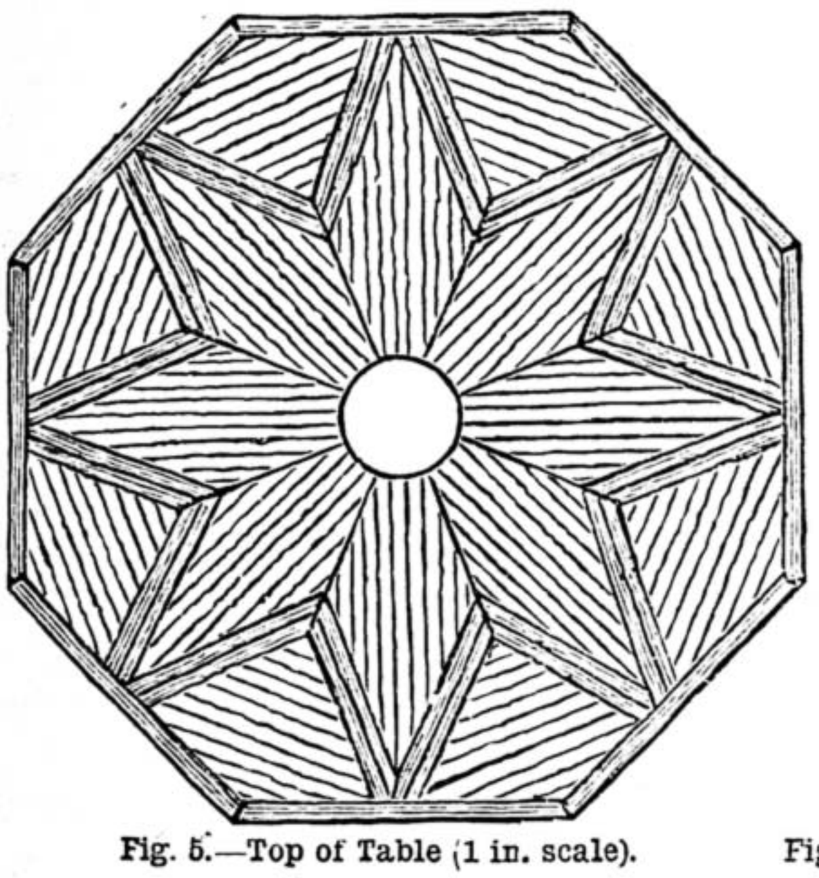


Fig. 5.—Top of Table (1 in. scale).

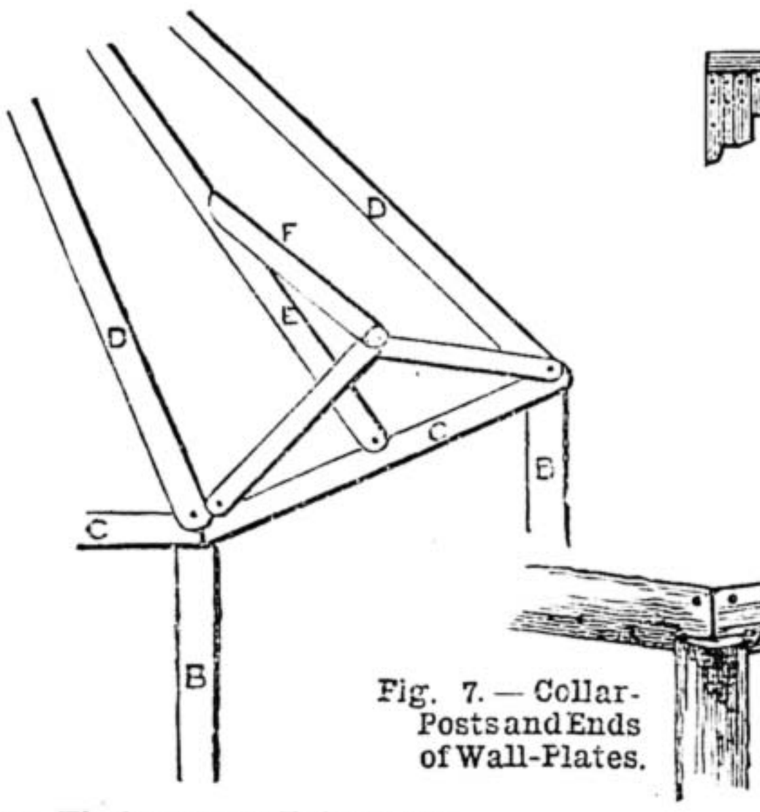


Fig. 6.—Timbers over Entrance.

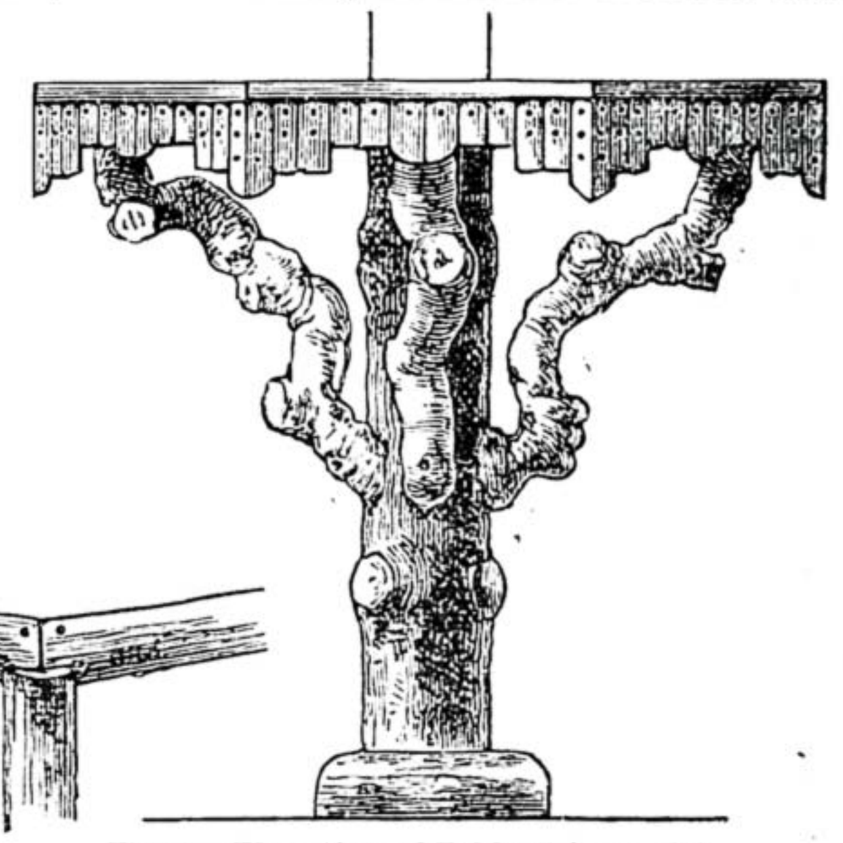


Fig. 7.—Collar-Posts and Ends of Wall-Plates.

Fig. 8.—Elevation of Table (1 in. scale).

intervals. Yet, in spite of these drawbacks, it is hard to imagine any person of cultivated taste accepting any other covering for a summer-house with thatch at his command.

The common saying is that a thatched roof needs re-coating every ten years. Often, no doubt, this is near the truth, yet really good work will frequently stand for almost twenty years. The materials in use in this country are reeds, straw, and stubble. Reeds make a strong thatch, but are not easily to be procured, except in fenny districts. Stubble, which is the lower and stronger part of the wheat stem, stands better than straw, which is its upper and weaker portion; to last properly, however, stubble should be cut immediately after harvest, and should not be left standing, as it frequently is, till the spring, for then the winter rains, collecting in its hollow stems, cause it to rot before it is cut. On small buildings like summer-houses especially, stubble makes a much more compact and sightly roof than straw.

Thatching is not costly or difficult work. In agricultural districts a load of stubble — sufficient to thatch three such buildings as that before us—costs 30s., and a thatcher expects the wages of a first-class labourer only, not those of a mechanic. He needs an assistant, whose business it is to straighten the material into convenient bundles (called

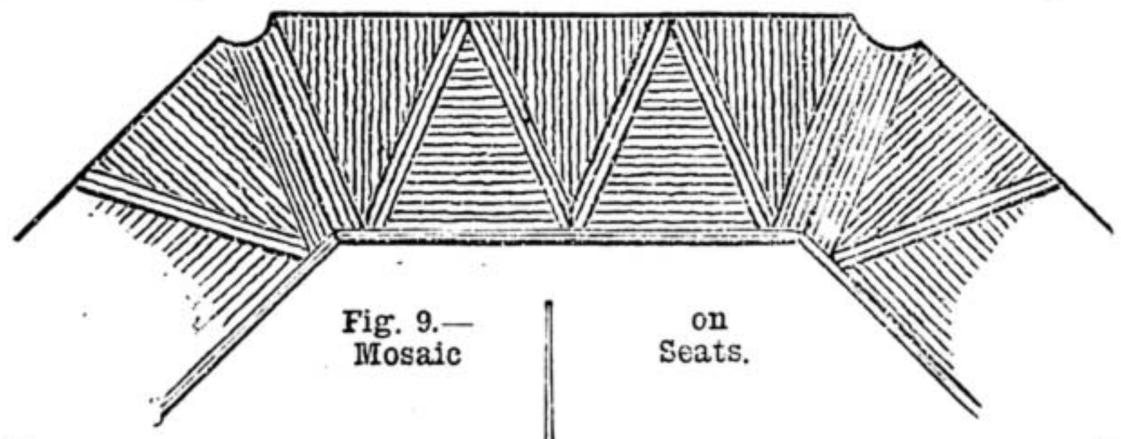


Fig. 9.—Mosaic on Seats.

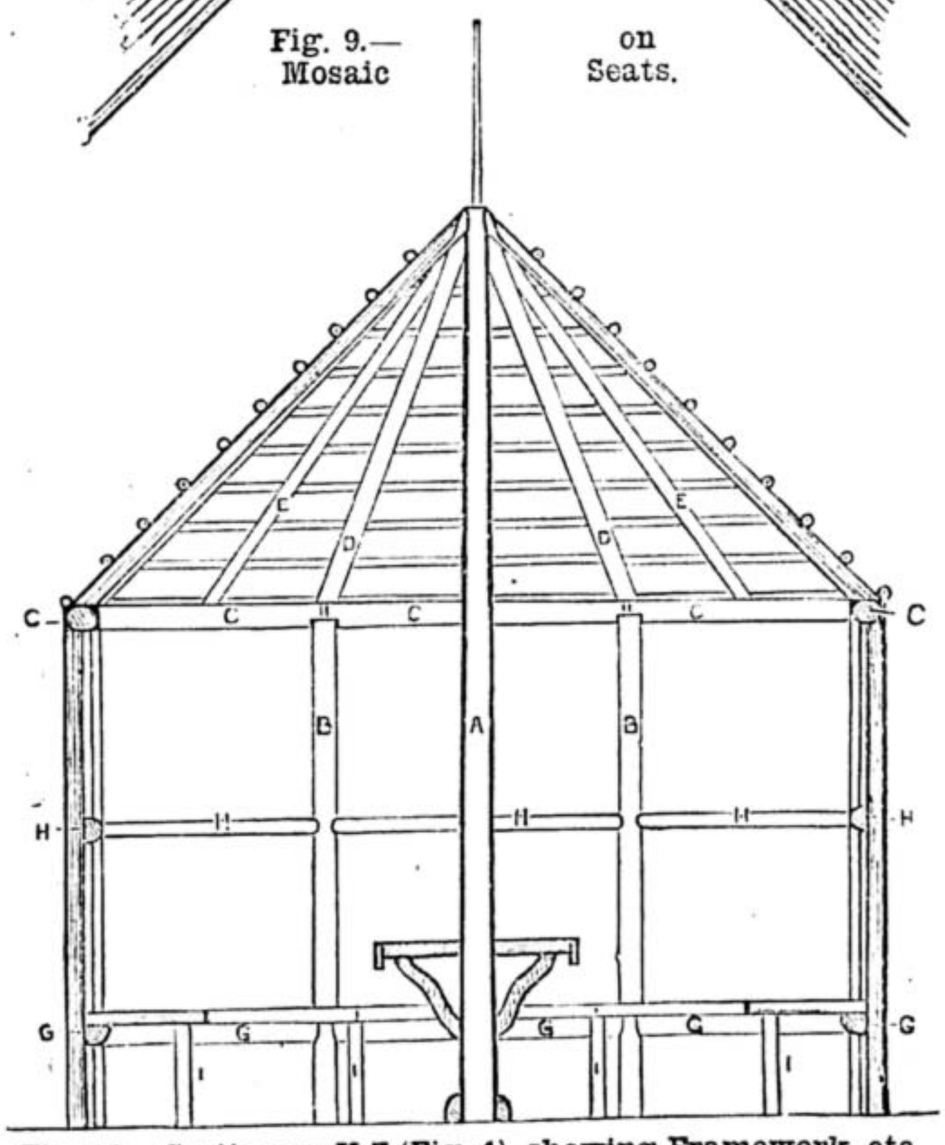


Fig. 10.—Section on Y Z (Fig. 4), showing Framework, etc. (¼ in. scale).

"yelvens"), and to supply him as he requires them. If he is re-thatching an old building, he merely thrusts the ends of his new material into the old thatch with a wooden spud; but if he is covering a new roof, he sews down his "yelvens" to the laths and rafters with a huge needle and stout tarred string. He begins at the eaves, laying as wide a breadth as he can conveniently reach on one side of his ladder, this breadth being called a "stelch." He works upwards, each new layer covering the tar-cord which secures that beneath it; and thus he goes on till he has reached the ridge.

In his second "stelch" he is careful to blend together its edge and the edge of that already laid, so that no rain may find its way between them; and in doing this completely lies much of the superiority of good over bad thatching. When laid, the thatch is smoothed down and straightened with a gigantic comb, like the head of a large rake, one end being without teeth, and serving as a handle. In the present instance, the tops of all the stelches meeting in a point are finished and capped by the little bundle of thatching material forming the pinnacle, and which is tightly bound round the rod of wood or iron in its centre.

It is usual to bind thatching down with at least two belts of buckles and runners. In our summer-house (Fig. 3) I show two double belts. The buckles have some resemblance to ladies' hair-pins on a colossal scale. They are made of slips of withy, twisted and doubled in their middles and pointed at their ends; the runners are long straight slips of the same. These latter are laid across the thatch, and the buckles, being placed over them, are pushed tightly into it—their points being driven upwards, that wet may not be let into the roof by them. The short diagonal runners seen in the illustration crossing each other between the horizontal lines are used in ornamental thatching only, and are rather for appearance than for use. Lastly, the eaves are cut to shape, and trimmed with paring-knife and shears.

A roof like that before us looks most pretty and cosy within if lined with ling. The ling is fixed in a way somewhat akin to thatching. A layer is placed along the bottom opposite to

the eaves, and secured by a strip of wood nailed from rafter to rafter; the layer next above hides this strip, and so the work is carried on to the apex, where a knot cut from an apple-tree trunk, a bunch of fir-cones fastened together, or some such matter, finishes the whole. In districts where ling is not to be had, gorse or furze in short pieces may serve instead, but stout gloves are required to handle it; or the ends of fir branches may do, if nothing better offers.

It is not always easy to decide on the best way of forming a floor. Boards would look out of place, and are not to be thought of. A pitching of pebbles is more in character: it is dry and cleanly, and especially if some variety of colour is obtainable, and the stones are arranged in some geometrical design, it may add to the ornamental effect. Pebbles are not, however, pleasing to the feet of those who wear thin shoes. Gravel, where it is always dry, is apt to become dusty, and to disagree with ladies' dresses. If, however, gravel should be used, perhaps the best plan to prevent the rising of damp, and to obviate dust as far as possible, is to asphalt it: on the foundation of broken stones and a layer of coarse gravel to put a course of asphalt or of ordinary gas tar, and on this to sift enough fine *washed* gravel to hide it. Yet a wood pavement of small larch poles, cut into 5 or 6 in. billets, and pitched with some attention to geometrical arrangement, will make the most dry and comfortable of floors, and one which will not harmonise badly with any of the decorative work of our summer-house.

BRICKLAYERS' WORK.

BY MUNIO.

Fire Bricks.

Fire bricks are used for lining furnaces, kilns, etc., where intense heat is generated, which ordinary bricks would not stand. They are built with ground fire clay mixed to a paste, as ordinary mortar will not stand the heat. They are of a pale yellow or brown colour; when mottled with black spots, it indicates the presence of particles of iron, and the quality of the bricks is not so good. Those made at Stourbridge are considered the best; but very good fire bricks are made in Wales, various parts of England, and Scotland.

They are made from fire clay, which is found throughout the coal measures. It is composed of silica, alumina, and water; it is called a refractory clay, and owes this quality to its comparative freedom from lime, magnesia, and metallic oxides, which act as fluxes. The composition and quality of this clay also vary very much, even in the same district. When the clay is brought from the mine, it is laid in a heap for a year or more, which causes it to crumble, and the stones and other impurities are picked out; it is then broken up, and ground between edge-stones 6 ft. or more in diameter; a fine grating is fixed in the pan, through which the ground clay falls into the elevators (which are iron buckets running on a chain over pulleys), and carried into a revolving cylinder covered with wire gauze; the fine clay, falling through the wire, is carried into the pug mill and mixed with water, and forced out at the bottom of the pug mill ready for moulding—the rougher portion falls out of the end of the cylinder, and is carried back under the rolls.

The bricks are moulded by hand—the moulding being a combination of slop and pallet moulding—the mould being dipped into water, and the bricks being carried off between two boards. The bricks are dried in a shed, under the floor of which flues are formed, heated by furnaces. When dry, the bricks are walled into hacks till ready for burning.

The kilns are oblong, with fires at one end. An average-sized kiln will burn off in a week.

Quarries for the flooring of kilns are moulded in wooden moulds on the floor of the drying shed, and burnt with the bricks.

Fire bricks are also pressed for facing of walls in a similar manner to red bricks, and moulded bricks for cornices are also made in fire clay, the clay being ground finer than for ordinary bricks; they are also enamelled in various colours, for lining passages, dairies, etc.—the bricks being partially burnt; the enamel is spread on in a liquid state, and burnt in.

Tiles.

Tiles are manufactured in a similar manner to bricks, the principal difference being that as tiles are thinner, more care must be employed in the manufacture, and the clay must be stronger and purer. There are three classes of tiles—viz: paving or flooring tiles, roofing tiles, and drain tiles.

Paving and Encaustic Tiles.

Paving tiles are moulded in a similar manner to bricks, and when half dry, are dressed by hand; then burnt in kilns.

Encaustic tiles are used for the flooring of churches, halls, passages, etc., and are made smaller and of a finer quality than ordinary flooring tiles. They are made in various colours, and laid in ornamental patterns—some have flowers, figures, and ornamental patterns painted on the surface, and burnt in; while in the richer kinds the surface is stamped or pressed into ornamental forms, and the indentations filled in with different coloured clays in a liquid state, and the whole burnt in.

These tiles are manufactured in Staffordshire, Worcestershire, and other parts of England. In most cases the clay for the tiles of plain colours, such as red or buff, is found on the site; while for other colours the clays are brought from another part of the country, or various stains may be mixed with the clay to colour it—thus the addition of manganese gives black, and of cobalt blue.

The plain coloured tiles are made from dry clay, pressed in a very powerful press, from whence they are dried and fired. Surface ornamented tiles are made from plain tiles, the pattern being painted on, and fired when dry.

The encaustic tiles are made from a much finer kind of clay, which has been washed, strained, and boiled. About half the thickness of the tile is formed of this clay in a metal mould, in which it is pressed to receive the pattern or indentation on the face; the remaining half of the mould at the back is then filled with a coarser clay, and the whole is then pressed to receive the proper amount of solidity. The tile is then taken from the press, and the various indentations filled with different coloured clays to form the pattern, and after remaining a few days to stiffen, the surface is scraped level, which brings out the pattern; it is then dried and fired.

Should the surface or any portion of it require to be glazed, the glaze is next applied in a liquid state and burnt in.

The clays for encaustic tiles require very careful selection and manufacture, as if there is any unequal shrinking in drying or burning the face of the tile will be cracked.

Roofing Tiles.

The clay for roofing tiles, after passing through the pug mill, except it be very pure, is cut into slices, to remove any stones that may be in it. Plain tiles are made in a mould, with either one or two nibs or holes on the top, to hang them on the laths of the roof. Pantiles are moulded flat, with one nib on the top; they are then laid on the wash-off frame, and moulded to the curved shape on a block of suitable form; then laid in the blocks (which are wooden shelves about 4 in. apart, running the full length of shed) till half dry; then laid on the thwacking frame and beaten, to correct any irregularity in drying, and the edges trimmed with a knife; then replaced in the blocks till ready for the kiln; they are then piled in the kiln on their ends, and burnt in the same manner as bricks. Hip, ridge, and valley tiles, are made in moulds.

Drain Tiles.

These are tubes 12 in. long and from 2 in. bore upwards; they are used for agricultural drains, and are sometimes made by hand, but generally in a machine worked either by hand or steam power. The clay is forced through a die in the end of a box, and the tiles cut off with a wire, dried, and burnt.

Sanitary Pipes.

These are used for house drains and sewers, and are generally made from fire-clay in the North, and glazed. One end is formed into a socket, and the pipes are put together with spigot and faucet joints, and made tight with cement or puddled clay. The clay for making these pipes must be ground very fine, and washed through gratings with very fine meshes, and run into the "slip" kiln, where it is boiled till it is of a suitable consistency for moulding. The pipes are moulded by steam or hydraulic pressure. The clay is put into a cylinder, at the bottom of which is a circular die the size of the pipe. Outside the die is fixed a metal box, in two halves, for making the sockets, which can be opened and closed by a lever and rods. A movable table is fixed at a suitable distance under the die, which can be raised or lowered by the foot. A cylinder of wood, the diameter of the inside of the pipe and the length of the pipe, is fixed on its end on the table, which is now raised till the top end of the cylinder is against the die; the metal box is now closed, and the piston worked till it is filled with clay; the box is then opened, the piston set in motion again, and the moulded pipe forced through the die and down the cylinder, the socket having been formed in the box. As soon as the end of the pipe reaches the table the piston is stopped, the pipe cut off, the table lowered, and the pipe is carried away on the cylinder to the drying shed, another cylinder being fixed, and the table raised for another pipe.

Junction pipes are made by cutting a piece out of the side of a pipe while soft, and moulding into it by hand the branch pipe. Traps, gulleys, chimney-pots, etc., are moulded by hand.

The kilns for burning the pipes are of a circular form, with domed tops. When the pipes are at a high temperature a quantity of salt is thrown into the kiln, and this, coming in contact with the hot clay, forms a glaze on the surface of the pipes.

PRACTICAL DETAILS OF BOOKBINDING.

BY GILBERT CLARKSON.

INTRODUCTION—EARLY BOOKBINDING.

IN the articles upon the "Art of Bookbinding," which I purpose to lay before the readers of this paper, I hope to introduce matter which will be interesting alike to the amateur, tradesman, and the lover of books. I am fully aware that no series of magazine articles, however practically and explicitly written, will convert the amateur into a full-fledged tradesman, and thus enable him to take his place in the workshop beside those who have served an apprenticeship of seven years.

That such a thing is not intended by magazine articles is a patent fact, the object in view being simply to give to the intelligent amateur such practical knowledge, not to be had elsewhere, as will enable him to take a delight in his hobby.

There is plenty of room in this world for the amateur as well as the tradesman. I do not think the two classes will ever clash together—that the tradesman will ever find his occupation gone because of another man *trying* to make his own tables and chairs, to build his organ, to fit up an engine for his own use, or to bind his own books.

I will therefore endeavour to give such information as clearly as possible as will enable the amateur to make a fair job of his books without the aid of the workshop appliances in use at the present day.

And to my fellow-tradesman who may know all about the things to be described, I come with outstretched hand, and looking him straight in the face, will ask him to have a little patience with me while I write a little "shop," for the benefit of those who may not have had a city training, and who, from necessity, may have to carry a book through all the successive stages of binding without the aid of a professional folder, sewer, marbler, or gilder.

I have already intimated that I want to interest the lover of books in these articles. And why should I not? He is the man upon whom our trade for a great part depends. He comes into our shops and picks out our best leather, talks in an intelligent manner about the styles, insists on an artistic ornamentation for his books, gives a reasonable time for the execution of his order, pays for it when done, and is so delighted to have it done so nicely that he forgets to ask for discount on his bill. What a pleasure to work for such a man! Would that we had more such customers to deal with. There would then be less talk about the inferiority of the bindings of the present day when compared with the bindings of the "good old days" in the fourteenth and fifteenth centuries. Only the other day I got an old book to rebind; in looking over it, I remarked that this one was bound in the good old days. I fully expected the following question: "Can you tell me why books cannot be so well bound now as they were long ago?" I answered, with just a trifle of annoyance in the tone, "If people were as willing to pay for their binding now as they were then—in the *good old days*—we could do them just as well, and a great deal better." With the advance of civilisation bookbinding has not fallen behind; it is just as able to keep its place in the race as any other handicraft, trade, or profession.

Bookbinding as an art is of very ancient origin. Its rise is involved in obscurity. For all we know to the contrary, the germ of the idea may have been in the minds of our first parents when they sewed the fig leaves together, that first dark morning in the Garden of Eden. This much we do know, that the ancient Hebrews and Greeks had many methods of binding their parchments to preserve them from loss and decay and to enable them to transmit them to posterity. But it was not until after the invention of printing that bookbinding, as we know it, began to be practised.

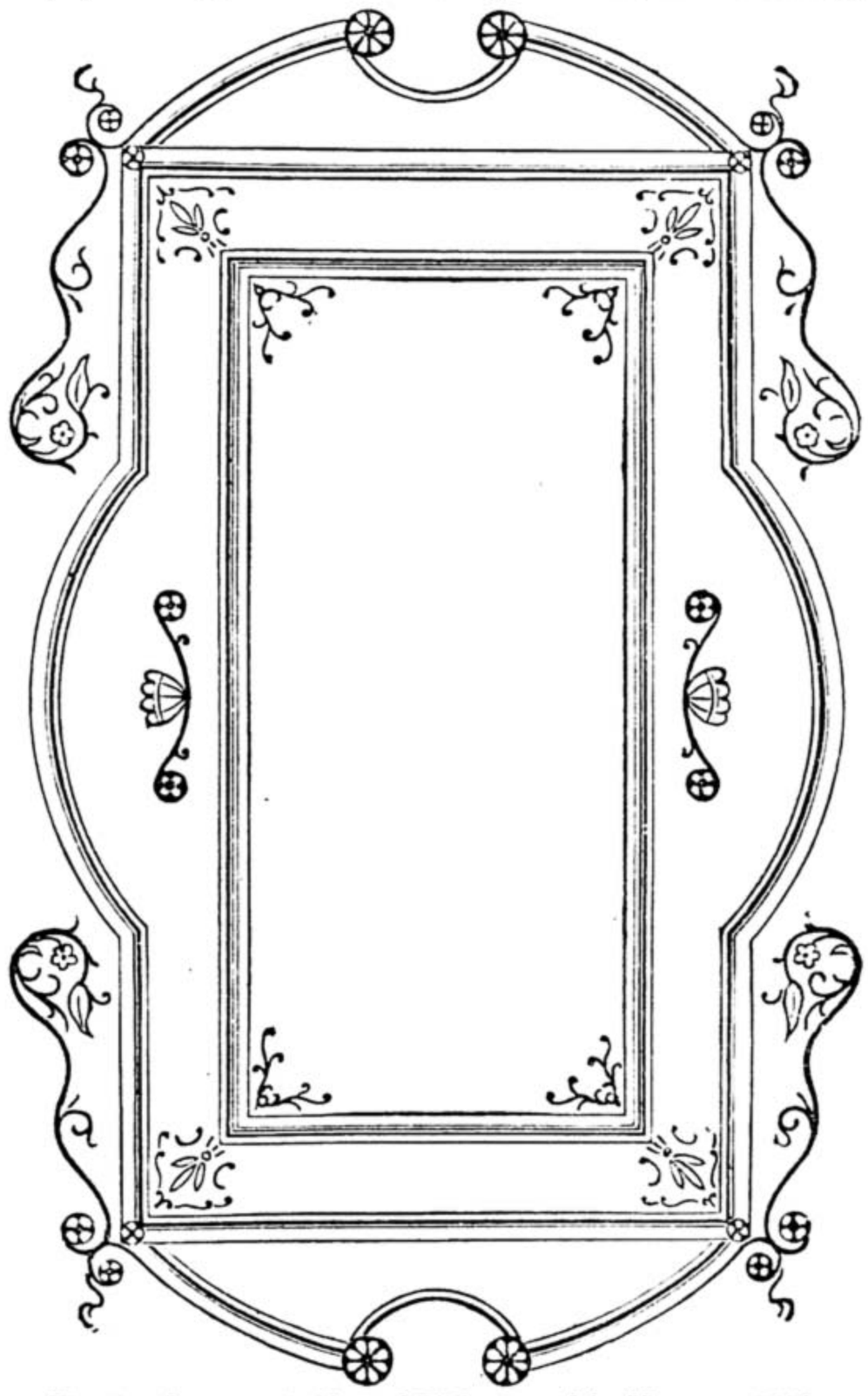


Fig. 1.—Ornamentation of Bible bound in Morocco, 1659.

Printing was introduced into England by William Caxton in the year 1473. It was then a very slow process, and continued to be so for a great many years, consequently the number of books was not very great, and every process belonging to a printed book was included under the general denomination of printing. It seems also from historical data that the binding as well as the printing was executed by the same person. Caxton was a binder as well as a printer, and Wynkyn de Worde, Caxton's successor, left by will some of his plant to Norvell the bookbinder in Shoe Lane. This Norvell seems to have been a bookbinder only; he was what we would now call a publisher's binder, *i.e.*, he bound for the trade; yet Wynkyn de Worde seems to have kept him almost fully employed.

The common cover for early printed books was a kind of parchment or forrel; but velvet was largely used by the nobility and gentry, and some of them caused their books to be adorned with all the splendour the best materials and state of the art could give to them.

The magnificence of these early bindings far exceeds anything known in our day. They were, as I have said, chiefly executed in velvet, which was of different colours, the most common being red ornamented with gold and silver, with pearls and precious stones. A description of one which may be seen in the British Museum, originally belonging to Henry VII., will sufficiently illustrate the point at issue. It is a book of indentures made between him and the abbot and convent of St. Peter's, Westminster, for the celebration of certain masses to be performed in Henry VII.'s chapel then intended to be built. The cover is of crimson Genoese velvet, edged with crimson silk and gold thread, and with tassels of the same material at each corner. The inside is lined with crimson damask. On each side of the cover are five bosses made of silver wrought and gilt; those in the middle have the arms and supporters of Henry VII., with his crown and supporters of silver gilt and enamelled; in the others at each corner are so many portcullises, also gilt and enamelled. It is fastened by two hasps made of silver, and splendidly enamelled with the red rose of the house of Lancaster.

The following quotation from a poet of this period will still further illustrate our point. Speaking of a book, he seems to have become enraptured with its appearance when it was shown to him.

"With that of the book lozende were the clasps,
The margin was illumined all with golden rails;
And bice empictured with grass-oppes and waspes,
With butterflies and fresh pecocke tailes,
Englored with flowers and slymy snayles,
Envyved pictures well touched and quickly.
It would have made a man whole that had been right sickly,
To behold how it was garnished and bound.
Encovered over with gold and tissue fine,
The claspes and bullions were worth a M pounde,
With balassis and carbuncles the border did shine,
With *Aurum Mosaicum* every other line," etc.

But velvet was not the only material used for binding during this period. Silk and damask were also in general use for that purpose, and the highest and fairest in the land were very fond of employing some of their leisure hours in working embroidery for the covers.

Vellum appears to have been introduced for binding in the early part of the fifteenth century, and towards the end of that, or the beginning of the sixteenth century, the art of stamping seems to have arisen.

At the same period, or perhaps earlier, leather was made use of, and it has continued in use until the present day.

Of these stamped bindings many specimens are to be seen in various libraries and among the stocks of old booksellers, and although they are much spoken about, and command very high prices should they happen to be on sale, I must confess that I cannot go into ecstasy over them, for I fail to see any great beauty in them. Perhaps my taste is not sufficiently *cultivated* to appreciate that which is beautiful in art. But, dear me! there is not much to appreciate in a clumsy representation of some saint, or a pseudo-portrait of some king or

queen, and this, for the most part, constituted the ornamentation of the books bound in the "good old days."

But you must not misunderstand me, for there are some very nice examples to be met with, and, before passing on, I will give a drawing of the decorative part of the side of a folio Bible printed at Cambridge. The design is just a trifle straggly, but it displays a degree of taste not often met with in the bindings of that time (Fig. 1).

It will be altogether unnecessary for our present purpose to continue the history of binding. Enough has been written to show that bookbinding is of very ancient origin, and that it was an art of no mean consequence hundreds of years ago.

THE CONSTRUCTION AND MANAGEMENT OF BAND SAWING MACHINES.

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

Author of "Wood-working Machinery," "Saw-mills," etc.

In the first place, it may be as well to consider briefly the points to be desired in a really efficient band sawing machine; this is the more necessary as many machines of an inferior description, both as regards design and construction, are placed before users, the result being a considerable increase in the breakage of saw blades and a lessened output of worse quality. It is generally concluded, to make a really efficient machine, the main framing should be rigid and cast in one piece, and of a height not greater than is absolutely required for working. Hollow or "box" framing is to be preferred, but for light machines a stout flange casting may be sufficient; the base of the machine should be extended, and, given these, freedom from excessive vibration in working may be secured.

To ensure easy manipulation of the wood, it will be necessary to bow the main frame sufficiently to allow of ample space between it and the saw. The next most important point is the construction of the saw wheels. These should be of as large a diameter as may be convenient, and combine strength with lightness in the highest possible degree, and be perfectly in balance. An elastic rubber band or cushion must also be provided for the saw to ride on.

In the best practice the old cast iron flanged wheels have given place to light steel or wrought iron ones, made somewhat after the fashion of bicycle wheels and without flanges. The top wheel is arranged to cant, thus directing the saw to run on any part of the periphery and equalising the wear on the elastic covering. The top saw wheel must be mounted elastically, and the author has found for heavy machines two pairs of bearings—mounted in a slide for the top wheel and in standards or pedestals for the bottom wheel—to be preferable to single bearings or the plan of mounting the wheel to run on studs. To keep the saw to its proper tension, and lessen the breakage of the blades, a weighted counterbalance lever, or a spring arrangement, must in all cases be fitted to the top slide. An extremely important matter is the guiding and supporting of the saw blade as it enters and leaves the wood; this may be done by fitting in the table metallic friction guide wheels to receive the back thrust of the saw, an adjustable wooden guide immediately beneath the table—apple or pear wood soaked in oil can be recommended—and a similar guide fitted in an adjustable counterbalanced slide fixed immediately above the surface of the wood. If the work is very difficult and the saw runs out of line, two pairs of movable steel rollers placed immediately above the cut and immediately below the table can be used. With these revolving rollers the friction is very little, and the saw is supported and kept in line. In sawing resinous woods, when it is necessary to keep the blade clean by lubricating it, the author has used with advantage an oil box guide; this consists in forming in a gun-metal guide two oil boxes, one on either side of the saw. The sides of the boxes nearest the saw blade are made adjustable and drilled with a number of small holes through which the oil can percolate; small hard bushes to sweep the saw can also be fitted with advantage, as also saw and chip guards and striking gear.

The table must, of course, be arranged to set to angle: this is usually done by means of a slotted quadrant and stud, but the trouble of unslacking the nut and uncertainty of fixing the table may be obviated by forming a worm on the quadrant, and working it by a worm and hand wheel. The table can thus be set to any desired angle with the greatest nicety.

Before commencing work, the machine should be carefully fixed to a dead level, and it would be well to place beneath the base-plate a sheet of felt, as this has a tendency to absorb and lessen the vibration in working, especially if the machine be placed on an upper floor.

Why do band saws break? that is the question.

Our friend Jones, who considers himself clever, will probably say because they are not strong enough; but when we consider that the limit of endurance of a jointed and strained band saw blade is not less than 180 lbs. for every $\frac{1}{16}$th of its width, something beyond fair usage must account for their constant breakage. I take it the chief causes of breakage may be set down as follows:—

(1) Improperly or badly constructed machines.

(2) Bad saws.

(3) Saws of too thick a gauge for the diameter of the wheels.

(4) Saw wheels too small, too heavy, or out of balance.

(5) Want of elastic tension in mounting the saw wheels.

(6) Too great or sudden a tension, or wheel covering worn, or out of order.

(7) In overcoming the inertia of starting the top wheel, and from the top wheel overrunning the bottom wheel and saw.

(8) From the expansion of working and the omission to loosen the saw blade as it contracts after finishing work.

(9) Improper method of receiving the back thrust of the saw.

(10) From imperfect brazing and the joint being thicker than the other part of the blade.

(11) From chips dropping between the blade and the bottom saw wheel.

(12) Insufficient guides for the saw as it enters or leaves the cut.

(13) Improper teeth or width of blade for the wood or work to be done.

(14) Improper and uneven sharpening and setting.

(15) Improper speed.

(16) Improper working, such as forcing the saw, using dull saws, etc.

There may be other reasons for breakage than above, but these are the chief ones the writer can call to mind at the moment; practical readers can add to the list.

Referring to cause of breakage (No. 1) on the list, we have already given some notes on the points to be desired in a well-constructed machine which will sufficiently answer this.

With reference to band saws (No. 2), the user has to a great extent to place himself in the hands of the saw-maker, as it is difficult to distinguish by inspection the quality or temper of a saw blade. By bending the blade or by setting some of the teeth coarsely you can in a degree judge its elasticity as to its temper, as, should it be too hard, it would probably crack. A blade either too hard or too soft is useless; what is required in a band saw is toughness, and a certain degree of hardness combined. (3) A fruitful cause of breakage of the blades is the use of band saws of too thick a gauge for the size of the saw wheels on which they run. The blades when in work are subjected to several severe strains, the chief of which are bending and torsional; this is particularly the case where thick saws are run on wheels of small diameter, as the arc of contact of the saw and wheel is too sharp. It is a mistake to use thick saws; *a thin gauge saw will stand better than a thick one.*

Although the author is aware that they are thinner than those usually employed, he can recommend the following gauges as most suitable for sawing pine and the softer woods of the *Pinus* family. The lengths of the blades are given in feet, and the thicknesses by Birmingham wire gauge:—Saws up to 14 ft. long, of any width, 22 gauge; 17 ft. long, 21 gauge; 20 ft. long, 20 gauge; 24 ft. long, 19 gauge; 30 ft. long *t.* or 18 gauge *c.* These figures must not be considered arbitrary, but can be modified slightly according to circumstances.

Speaking generally, the smaller the diameter of the saw wheel, so should in ratio the gauge of the saw be reduced. Long blades will stand better than short ones. For cutting the harder and close-grained woods, such as oak, beech, etc., the thickness of the saw should be increased about one gauge.

(4) As we have elsewhere remarked, saw wheels of small diameter are to be avoided; it is also important that the wheels be perfectly balanced: should they be the least out of balance, especially where the wheels are heavy ones, the centrifugal force set in motion when they are running causes a constant lurching or jumping motion on the wheels, which is often sufficient to break the best saw blades. The author prefers to run wheels without flanges on them. (5) A very important point in working band saws is to secure a constant and even tension on the saw blade; at the same time the tension should be elastic, and not rigid, to allow for the expansion and contraction of the saw, as the friction of working sets up heat, which causes the blade to expand, and when the machine is at rest, and the blade becomes cool, it contracts again. Should the saw catch in a knot or nail and give a jump, if the top saw wheel is mounted rigidly it will almost invariably snap, but should it be elastically mounted it will give with the saw, and so save its fracture.

(6) Some operators run their saws at too great a tension, and should this be suddenly increased by the saw striking some hard substance, fracture is the result; or if the elastic saw wheel covering is allowed to get worn the saw becomes twisted in running and breakage often ensues. This latter can

be avoided by arranging the top saw wheel to cant, and so leading the saw to any part of the periphery, and thus equalising the wear on the rubber covering. Should saws be run at too great tension, the excessive friction rapidly alters the granular structure of the steel, which becomes crystallised and soon cracks and fractures.

(7) In working band sawing machines it is important that they should be set in motion gradually, more particularly where the wheels are of the old-fashioned type and heavy, as it takes a little time to overcome the inertia of the top saw wheel, and if the power is applied all at once there is a considerable tendency to snap the blade from the sudden strain put upon it. To overcome this, striking or belt gear can be worked by means of a very coarse screw. This can also be applied to the starting of heavy planing machines with decided advantage.

A fruitful cause of breakage of the blades is the overrunning by the top wheel of the bottom or driving wheel of the saw, and also of the saw itself. When the top saw wheel is running at full speed it necessarily acquires a considerable momentum, and acts somewhat after the fashion of a fly wheel; consequently, when the speed of the saw blade is suddenly checked by its entry into the wood as it commences to saw, the acquired momentum of the top wheel not being checked in a like proportion overruns the saw and the driving wheel, and creeps, so to speak, up the back of the saw, and consequently buckles or breaks it at the point of resistance, viz., where the saw enters the wood. The remedy for this is to construct the top saw wheel as light as possible, make it in perfect balance, mount it elastically, and cover it with a thick band—say ¾ in.—of vulcanised indiarubber. These arrangements will neutralise to a considerable degree the sudden strain put on the saw at starting, and largely obviate the overrunning above alluded to.

(8) *Saw blades should in all cases be slackened out after finishing work.* Notwithstanding the small area of the blade in frictional contact with the wood and the constant cooling action of the air through which the saw passes, a considerable amount of heat is often engendered in the blade, especially in sawing resinous or difficult woods. Consequently, the blade expands considerably, and the slack is taken up by the operator. When work is over, and the friction on the blade removed, it immediately commences to contract. Should it not be at liberty to do this, from the tension not being removed, cracks at the roots of the teeth are the result; consequently, when the saw is started again it flies. When rubbers are put on the wheels new they may give sufficiently to allow of the necessary contraction, but when they become worn and hard or where leather coverings are used the above is usually the result.

(9) Another cause of the breakage of the blades is an improper method of receiving their back thrust. The best way to do this has been the subject of considerable discussion. The author prefers to fit revolving steel discs for this purpose, as the back of the saw blade does not so readily cut into them as with fixed ones. If a disc is allowed to get deeply grooved, the blade gets buckled and twisted, and often breaks.

(10) Imperfect brazing is another cause of breakage. To secure a steady and even motion on the saw blade, it is important that the brazing be carefully and neatly done. There are several methods of brazing: the author can recommend the following as a very satisfactory one:—Take each end of the blade and file down a taper on the opposite side of the saw of about three teeth points, so that where the two ends of the saw are made to overlap each other, the joint, when cleaned off, will be of the same thickness as the rest of the blade. Secure the overlapping ends of the saw well together by a pair of small hand vices, and tie them with fine iron wire. Over this bind tightly with brass wire the full length of the overlap. Moisten the joint with water and cover it with powdered borax. Either take a large pair of tongs and make it red hot, or place the saw in a small forge fire made of charcoal, and keep it there till the brass is well melted. Let the saw cool gradually, file the joint to the same gauge as the rest of the blade, and finish it with emery cloth. If this operation is well performed, the joint will be scarcely distinguishable. Care must be taken that when brazed the overlapping ends of the saw press well together.

(11) Chips may be prevented dropping between the saw blade and the bottom wheel by attaching an angular guard to the frame of the machine.

(12) No comment is needed with respect to insufficient guides.

(13) The proper shape and pitch of the teeth is a matter of great moment in the successful working of band saws. Should teeth be used unsuited to the wood being cut a largely increased friction on the blade is set up, the teeth are rapidly dulled or broken, and the work turned out is inferior. For sawing all ordinary woods of the *Pinus* family ordinary hand saw teeth are suitable, except for pitch pine; for working this wood coarsely spaced and set teeth are suitable.* We can recommend for durability saws with gullet teeth, that is rounded at the root, as they are less liable to fracture than saws with the roots running to an angle, as the fracture in the blade is found almost invariably to commence at the point of this angle. Owing, however, to small gullet teeth being more troublesome to sharpen, the hand saw teeth are now largely employed. For sawing oak, ash, elm, and hard woods generally, more teeth, or points, say, five or six to the inch, should be used, and these filed further back. For heavy sawing, peg teeth with round gullets are to be preferred. For woods of woolly fibre, such as English poplar, saws with deep teeth should be used, with coarse space, and set to allow an easy clearance for the sawdust and overcome its clinging properties. Saws of a width suited to the work should be used, and wide saws should never be twisted round sharp curves, or they will buckle and run out of truth. For straight work a wider saw may be used with advantage.

(14) Care must be taken that the saw teeth are uniformly set and sharpened. Uneven and improper setting causes a considerable amount of tension to the saw blade, increased friction crystallising the steel, and consequent breakage. The teeth of band saws should by preference be set by light, carefully given blows, instead of bending, which, unless very carefully performed, is more liable to buckle the blades and prevent them running true. Several little machines are now made, by which saws can be accurately set to any desired coarseness by a blow similar to that given by a hammer instead of by a bending pressure. A band saw sharpening machine has also been constructed, which automatically sharpens all the teeth alike. By improving the quality of the work and reducing the friction on, and consequent breakage of, the saw blades, these machines should very rapidly earn their first cost.

(15) The speed at which the saw blade travels has much to do with its cutting efficiency. Saws running on small wheels, say, below 3 ft. diameter, cannot be run with safety so fast as on larger wheels. Speaking generally, saw blades working on wheels up to 3 ft. diameter can be run up to 4,500 ft. per minute for soft and medium woods, that is, presupposing a well-constructed machine to be used. For sawing hard woods up to 3,500 ft. per minute, with saw wheels above 3 ft. diameter, these speeds may be increased.

(16) We need hardly say a bad workman may break any amount of saws by forcing them, bending them edgeways, using dull saws, or saws too wide or stout for the work, etc. If in working a properly sharpened and set blade should have a tendency to bind, it probably arises from insufficiency of throat room in the teeth. It would be well, therefore, to try a saw with the teeth set a little further apart: this will not cut quite so fast, but the sawdust will have time to escape, and the binding should be done away with.

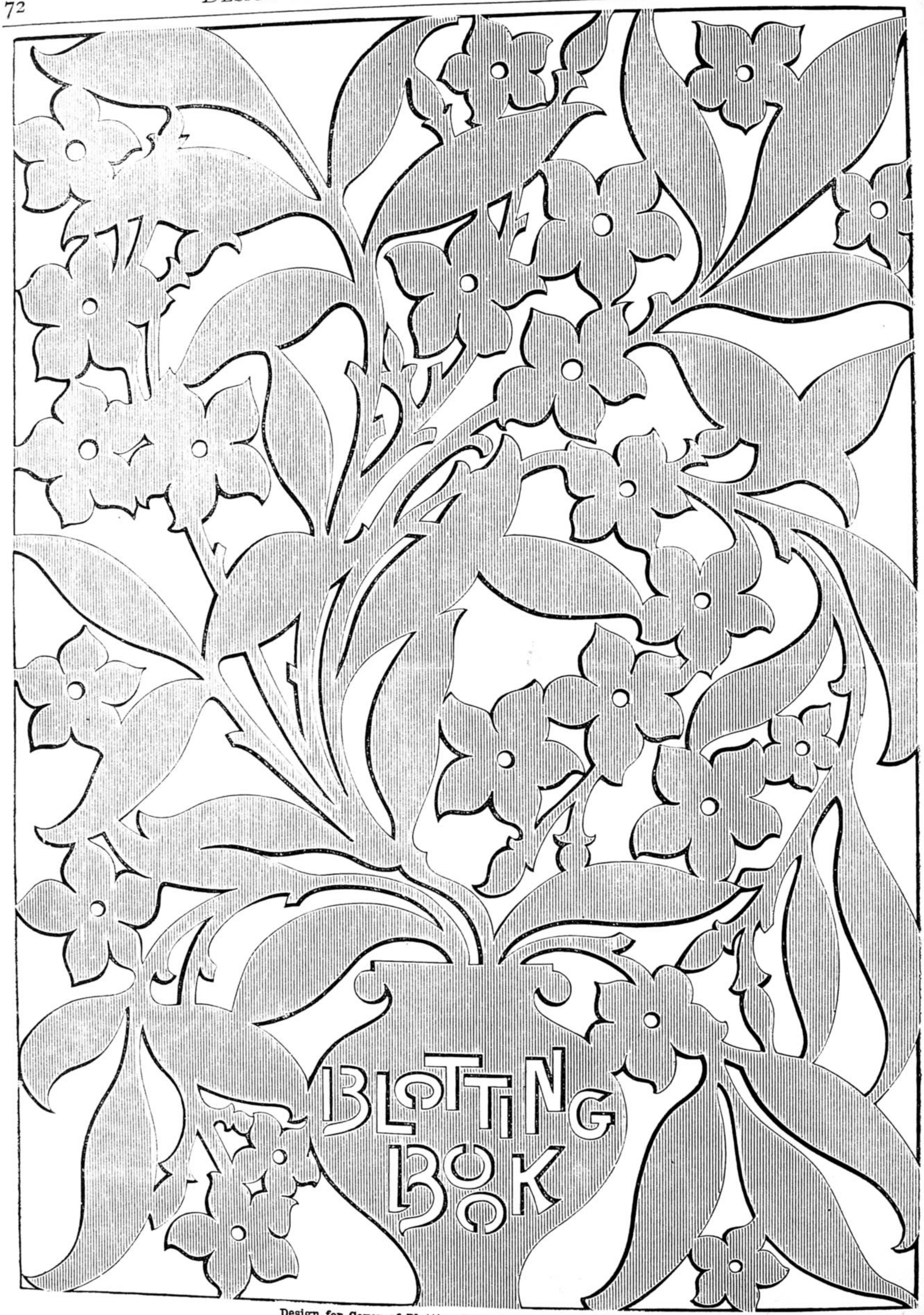
In concluding our remarks on working band saws, there is little doubt that—given in the first instance a well-constructed machine, a careful operator, and a saw blade uniform in gauge, width, toothing, sharpening, setting, and temper—a band sawing machine is one of the most money-earning and valuable of all wood-working machines, not only for the ordinary carved work, for which it is generally used, but for breaking down heavy logs, upon which we may have something to say at a future time.

* For illustrations, etc., of these and other teeth, see "Saw-mills: their Arrangement and Management," by M. Powis Bale.

DESIGN FOR A BLOTTING-BOOK IN FRETWORK.

BY J. W. GLEESON-WHITE.

It is a curious fact that on comparing the record of the virtues and vices, the latter show by far the longest pedigree. Most, if not all, modern vices are practically identical with those that roused the passions of the oldest cave-men; but of the virtues, some are yet so modern that if we cannot identify their inventor, we can at least discover periods when they were absolutely unthought of, much less practised. The supremely feminine virtue Tidiness (if it be indeed a virtue at all) may be fairly considered as a late development in the scale of virtues that belong to humanity, for we find it in no great request among nomadic races or man-eating savage tribes. Of course those primitive societies knew nothing of the thousand-and-one odds and ends that distract, while they delight the highly artificial routine of to-day. But Tidiness, although held by its admirers to be a branch of the great law of order (of which the first word was spoken in Paradise itself), is yet (speaking entirely from the blind and foolish standpoint of the head of the household) a specious pretender at the best. For the vice of Tidiness—I beg its pardon: I should say the virtue—has little sympathy with that routine order which distinguishes the male worker. When the most skilful mixing machine ever invented—the common or parlour-housemaid—tidies my papers (the personal case is too deeply felt to project an imaginary one), there is no hint of order in



Design for Cover of Blotting-Book, to be cut in Fretwork.

her mad manipulation of them. When the fatal disease yclept "spring-cleaning" tidies away my pamphlets, sketches, unanswered letters, and the rest of the elaborate chaos of my writing table, the masculine belief in the sacred law of order (that, like the mystic word OM of the Buddhists, can only be grasped to the full of its pregnant meaning by fellow mystics) tempts one to utter brave, swelling words of righteous indignation at the petty tidiness that has made havoc of what, in spite of all appearances to the contrary, was not *really* out of order, but at most — well — untidy.

Probably many readers of WORK suffer or enjoy a similar kindly despotism, that in a well-intentioned whirlwind sweeps away the last number of their beloved journal, never to be seen again until some cataclysmal disorganisation, such as moving house, ejects the hidden thing from its concealment.

Therefore both reading cases and blotting-books may be pleaded as evidence of man's inherent law of order, as opposed to woman's passion for the worthless imitation called Tidiness.

Having said my say, as the phrase goes, and avenged myself to a certain extent on my especial belongings in the shape of woman for her merciless onslaughts on what she is pleased to call the dirt and disorder of my sanctum, much to the disgust of utilitarian readers of the Gradgrind school, to whom social sermonettes such as the above are about as unpalatable as holy water is said to be to a grim personality whom I will not name, I will make at once for the end of this matter and release all such from any further necessity.

Though history does and may repeat itself, I may not; so for the modes and methods that can be followed in making the blotting-case, which is shown *sans margin* in the accompanying illustration, I am compelled to refer my readers to page 8 of this volume, where I have said everything for their guidance that it is absolutely necessary to say.

It may be as well to remind readers who are fond of fret cutting, but do not wish to cut a cover for a book or for a blotting-case, that the design can be utilised as a panel in fretwork, or even as a panel in carved work in low relief. The words "blotting-book" on the vase being omitted, and the vase itself left plain, the design may also be used for glass painting.

HOW TO MAKE A TOWEL-HORSE.

BY L. IVOR POOLE.

A TOWEL-HORSE, rail, or airer—for the article forming the subject of this paper is known indifferently by any of these names—may seem such a commonplace piece of furniture that no directions about its construction can be needed. I venture, however, to think that few amateurs if they were asked would be able to give an answer off-hand how to make a convenient and serviceable towel-horse. No doubt they could contrive something which would answer the purpose, but lots of little unexpected difficulties would crop up—questions about the substance of the wood, dimensions, and so on—before arriving at a satisfactory decision. If you doubt this assertion, just try—without taking the trouble to step into a bedroom to get a few hints from the thing itself—to formulate a plan with all the necessary measurements. But you may, perhaps, be inclined to ask: Are all towel-airers made of the same size or even pattern, from which no variation may be attempted? To imagine

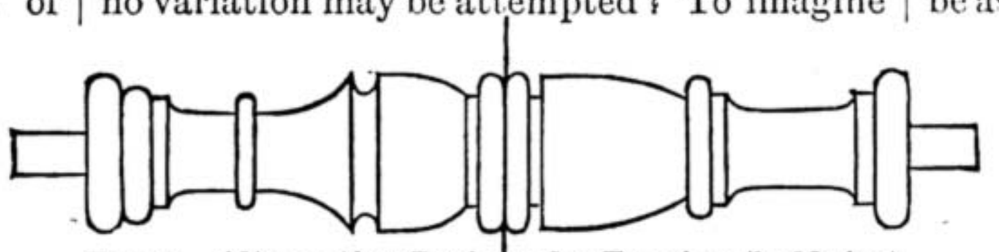


Fig. 3.—Alternative Designs for Turning (half size).

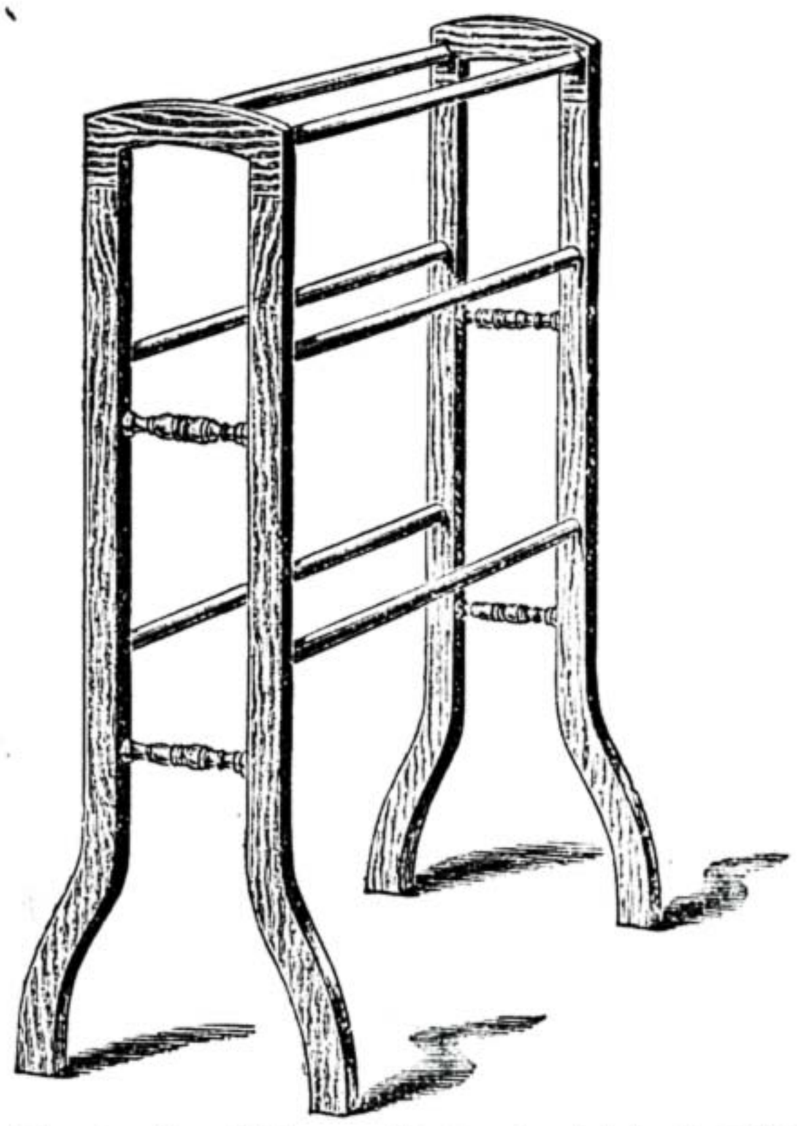


Fig. 1.—Towel-Horse. (Scale, about 1 in. to 1 ft.)

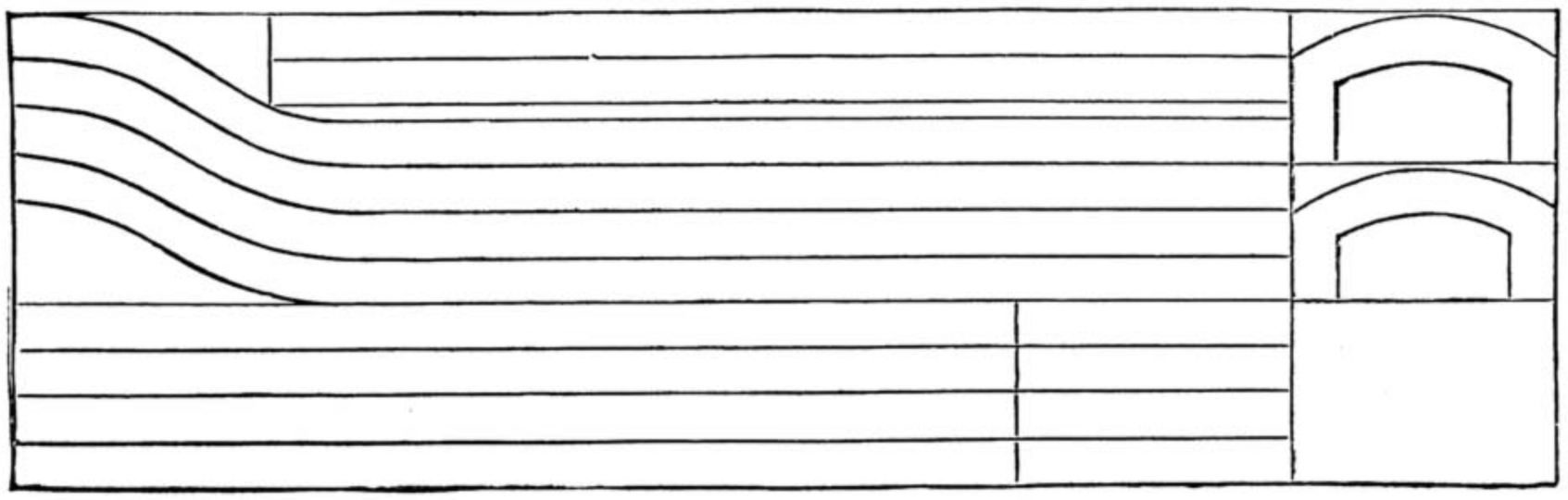


Fig. 2.—Board set out for Pieces. (Scale, 1½ in. to 1 ft.)

uniformity in them any more than in any other piece of furniture as being compulsory is of course absurd, but still convenience must be consulted, and a towel-rail which has stood the test of experience may very well be taken as our model. The design given in Fig. 1 probably will not please every one, but it is a good all-round pattern, that is to say, it will not look out of place with most of the styles of ordinary bedroom furniture which are usually met with. It will go equally well with the round-cornered wardrobe and ugly toilets of twenty years ago, or their more sensible counterparts of the present day, without being obviously out of harmony with any of them. Naturally, modification of detail may be made to render it more in accord with the furniture it is to go with. For example, if the edges of this are stop-chamfered, the edges of the ends into which the rails are fixed may be finished in the same way instead of being left square. The rails themselves may also be octagonal instead of round, and the top piece of the ends be straight instead of curved. Thus, by slightly altering details, a towel-airer constructed on the lines laid down may be made to match in general character the remainder of the furniture. Perhaps, before going any further, it may be as well just to enumerate the principal features of a useful towel-horse by way of suggesting to the novice in furniture work what principles to apply in designing, or let us say rather setting out, not only a towel-horse, but anything else he may wish to make. It must be adapted for the purpose to which it is intended, so utility must be studied as it is of primary consideration. To be useful it must have accommodation for more than one towel, then it must be of a convenient height and length. We don't want a thing five or six feet long in an ordinary bedroom, nor would it be pleasant to pull a towel down from a great height, or to stoop to pick one up. For various reasons which there can be no occasion to mention, the airer should not occupy too much space, but it must be sufficiently wide at the base to stand firmly on the ground, and last, but not least, the various parts should be so put together that they will stand fair wear and tear. As we proceed the reader will be able to see how far these conditions are complied with in our present example, the size of which is about as follows:—Length, 2 ft. 2 in.; height, 3 ft.; width at upper part, 7 in.; and at bottom, 1 ft.

Any departures which it may be deemed advisable to make from these will probably be in length or height. Of both it may be said that an increase or decrease of 6 in. would make either an unusually large or an unusually small airer, though it may happen that in exceptional cases something either greater or less is required. If so, I would merely remark that measurements in furniture are not like the laws of the Medes and Persians.

The kind of wood will naturally depend on that of the more important furniture of the room, so nothing need be said about it, beyond reiterating the caution that it must be sound and dry, and as free from knots as possible. Indeed, it may be said that no part of the airer should have a knot in it. Even if there are any in the wood from which the pieces are cut, they can easily be avoided by a little care in setting out.

Fig. 2 shows how all the pieces may be got out of a plank not over 3 ft. 6 in. long by 1 ft. wide, but of course it would be too much to say that they must necessarily be cut from one board. If there are odd lengths and widths from which they may be prepared, by all means use them, only it should not be forgotten that it is false economy to cut to waste when it is avoidable. For instance, the shaped end pieces can be got much more economically from a single piece than from four pieces. In the latter case we require four pieces, each 3¾ in. wide, being the

spread of the foot end and the width of the straight part, making fifteen inches of width altogether as against eight inches in the former. Certainly the superfluous wood taken from four pieces may come in for something else, but, as a rule, these "short ends" have a tendency to accumulate, and it is better, when practicable, to have but few of them remaining over from any given piece of work. However, this may seem a digression from our immediate subject, so without further delay, let it be said that all the wood required will be a piece of full 1-in. stuff, measuring 3 ft. 6 in. by 1 ft., which, so far as the end of the rail is concerned, should be capable of being cleaned up as little under ⅞ in. as possible. A thin piece of wood should be shaped to the curve of the foot to serve as a guide in setting out these parts of the ends. As there is no taper in these, *i.e.*, they are of the same width and thickness throughout, it will be unnecessary to shape more than one edge of this mould or template. The straight lines need no directions about marking them. As the width of the pieces forming the ends is to be a little over an inch, the lines should be drawn say 1¼ in. distant from each other, which will allow plenty for the saw kerf and cleaning up. The arched top pieces should also be set out from a template, keeping the straight portions an inch or so long on the inner side. This will be better than cutting them off flush at the finish of the curve, although the cross grain in continuation of the uprights may not appear quite the thing. Still the weakness caused by this construction is more apparent than real, as the dowel pin which connects these portions runs through the cross grain piece, and consequently adds to its strength. And as a further justification, if any be needed, of having the top pieces made as directed, it may be said that in this form of tower-rail it is the best construction, as space must be given for the insertion of the ends of the two top rails. Whether theoretically the construction is the best possible for towel-airers is another matter altogether, but as I have said it answers well, and can be justified from experience, we need not trouble ourselves just now about theory. In addition to the parts already referred to, there are six bars or rails connecting the ends, and four short pieces to act as stays or braces between the two main parts of the ends. These will be seen in Fig. 2, and their positions in the completed article will easily be recognised in Fig. 1. The cutting of the straight lines on the board will require no remark, beyond stating that they will, of course, be done with the ripping or band saw, but possibly the curves may seem a difficulty to novices. They may be sawn with the band saw, but as this is hardly likely to form part of the outfit, let it be said that the work may be done with the ordinary hand frame or with a good fret machine. If this be used, however, it must not be expected that the ordinary saw blades will do, for they are not strong enough. Specially large and strong blades, such as those prepared by the Britannia Company of Colchester, for use with their No. 8 fret machine, will be required. In case the distance from saw to arm may seem an obstacle to cutting such long pieces, let me say that I don't think it is sufficiently well understood by amateur fret workers that the cutting edge of the saw can be made to face in any direction in the machine above referred to, as well as in some others, consequently it is only necessary to arrange the saw so that it may cut material fed to it from either right or left, as may be most convenient, instead of from the front only. The short ornamental end rails will, of course, be turned in the lathe, but those who do not possess one, may either leave them square or simply round them. For those who want a suggestion for the pattern of the turning, Fig. 3, showing two designs, is given. The ends must in any case be worked down to a pin as shown, some ⅜ in. long for insertion in the uprights, and, of course, the length between the shoulders must be just equal to the width of the opening in the arched top. A very easy way of enriching the appearance of the horse will no doubt suggest itself, viz., by means of an increased number of the ornamental turned rails, which, whether few or many, are fixed by means of glue into the uprights. If only two are used, appropriate heights for them from the ground will be for the bottom one about fourteen inches, and for the upper one about double that distance. While alluding to them it may be well to direct attention to the position of the longer bars, being about a couple of inches above the short rail. The arched top pieces can be put on after the uprights have been connected. They are fastened by short pins one at each joint, let into both pieces and glued. Before gluing, it will, however, be as well in this instance, as in more important furniture, to fit the parts together "dry" in order that any inaccuracy may be seen and rectified before finally fixing up. We may now suppose that both ends are ready, and it merely remains to connect them by the six rails, which should be turned down to a pin at the end and fixed in precisely the same way as the shorter or stay rails. A word of caution may be advisable to the beginner about the absolute necessity of having all the long rails of exactly the same length, otherwise the parts cannot be properly fitted together. The pins should also fit very tightly into the holes for them; and naturally, though as it hardly comes under the head of "making," and need not therefore be enlarged on, polishing of some kind will be required before the job can be considered finished. To prevent disappointment it may, however, be said that wax polishing is quite unsuited for such a thing as a towel-horse on account of it not resisting damp. French polish either bright or dull should be preferred to varnish, which, if the rail, so far as joinery is concerned, is well finished, will quite spoil the work in the eyes of any one who happens to know the difference between the two.

With these remarks, the directions how to make a good though plain towel-horse must be concluded, leaving other and perhaps more ornate varieties for consideration in the sweet by-and-by. I may, however, before I bring my paper to a close, say that I have been led to write this article on account of the demand that exists among many of our readers for instructions on the manufacture of plain strong articles of furniture for use and home. Ornamental wall cabinets and sideboards involving a good deal of careful and elaborate work are all very well, they say, and, indeed, much to be desired; but it is also desirable to have diagrams and working drawings, together with hints on the method of going to work in order to turn out some strong and well-made articles of household furniture of creditable appearance. So in this I have given a sample paper in this direction, and I shall follow it very quickly, the Editor permitting, with one on the kitchen dresser.

OUR GUIDE TO GOOD THINGS.

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

7.—Some Useful Technical Books.

I am sorry to say that the exigencies of space have compelled me to keep several useful technical books waiting for a notice for some time. I will do my best to introduce some of them to my readers on the present occasion, and I will promise to make mention of those that may remain unacknowledged at the first available opportunity.

"**Slöjd**" (Cassell & Company, Limited; 6d.).—What Slöjd may be is still, I fear, a mystery to many people in the United Kingdom who are possessed of a good all-round knowledge of things in general. It is a Swedish term, implying the training of artistic, skilful capacity, or general dexterity, and the training, briefly and broadly speaking, is imparted by causing the children to give their attention to some simple operations in carpentry by which certain models are placed before them with scrupulous care, neatness, and exactness. For further acquaintance with the principles of Slöjd (pronounced Sloyd) as a means of teaching the essential elements of education, I must refer all who are interested in it to the clear and well-written pamphlet (so-called) from the pen of Miss Emily Lord.

"**Forty Lessons in Carpentry Workshop Practice**" (Cassell & Company, Limited; 1s.).—A most excellent volume, exhibiting most clearly, by illustration and precept, the method of performing most of the operations in carpentry involved in preparing and putting stuff together, and the mode of making various appliances, such as the carpenter's bench, mitre box, etc. To the apprentice and amateur it is simply invaluable. It forms one of the capital "Polytechnic Series" of technical works recently commenced by the firm, and is written by Mr. Charles F. Mitchell, Lecturer on Carpentry and Joinery, Polytechnic Institute, 309, Regent Street, W.; and revised by Mr. George Campion Pope, Teacher of Practical Carpentry, Handrail, and Staircase Work at the same institution.

"**Practical Plane and Solid Geometry, including Graphic Arithmetic**" (Cassell & Company, Limited; 3s.).—This is another volume of the "Polytechnic Series," written by Prof. Henry J. Spooner, C.E., F.G.S., Director of the Polytechnic School of Civil and Mechanical Engineering, etc. It has reached a third edition in the present issue. It deals exhaustively and intelligibly with every department of plane and solid geometry, and takes up and thoroughly explains a species of arithmetic known as "graphic" arithmetic, because the abstract arithmetical processes — addition, subtraction, multiplication, division, involution, and evolution—are, by its means, worked graphically or by geometry. The great charm of this volume lies in the combined brevity and lucidity of the text, and the excellence of the diagrams, with which the text is abundantly illustrated.

"**Forty Lessons in Engineering Workshop Practice**" (Cassell & Company, Limited; 1s. 6d.).—This is the third volume of the "Polytechnic Series," in which precisely the same is done for the young engineer as was done for the young carpenter in "Carpentry Workshop Practice." Its authors—Messrs. C. F. Mitchell and Mr. E. G. Davey, of the Polytechnic Day Schools—have given a clear description of the various operations that are performed by beginners in engineering, and the mode of making many of the tools that it falls to their lot to use.

THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

NOTICE TO CORRESPONDENTS.

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

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

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Upholstering in Leather. — CAB HAMMER (*Cork*).—Ere this appears you will have seen that your former letter, which you assume has been overlooked, was being replied to in due course. Rest assured that every question for these columns receives prompt attention, but, from the necessity of going to press some time before publication, answers cannot possibly appear immediately.—D. A.

Polishing Doors.—J. T. P. (*Ledbury*).—The process you have adopted is that known as wax polishing. You are more likely to get a good appearance with it than with French polishing, as you are not accustomed to this kind of work. In experienced hands, French polishing is capable of greater brilliancy being imparted to it, otherwise wax polishing is better. I am glad to hear you have taken in WORK since its commencement, but what a pity you do not read it, as you would then have seen fairly full directions in "Shop" for polishing mahogany.—D. A.

Transparent Glue.—J. B. (*Poole*).—Any good glue properly prepared in a clean pot is transparent. If it is opaque, the glue is either of an inferior quality or it has been melted in a dirty vessel. Possibly you may mean colourless glue, but for such work as you allude to—mitres of frames and open situations—there is no advantage in using it, even for the sake of appearance, and it is not as a rule so strong. You must be aware, if you have read all our back numbers, especially those containing the articles on jointing-up, that the line between two boards glued together is all but imperceptible in good work, to which you specially refer. If the glue shows at all, then you must consider that the work is defective, either from the joint not fitting closely at all parts, or that the glue has not been sufficiently pressed out.—D. A.

Small Cornish Boiler.—AMATEUR (*Bermondsey*).—I cannot recommend boiler making for amateurs. It is often dangerous for professionals, but if you are bent upon it then I would advise you to make it all of copper, about 6 in. diameter, and 20 to 24 in. long. You could make the shell of a piece of copper pipe and the flue also of about 12 gauge. The ends might be slightly thicker. The flue should be about 2¾ in. diameter. The ends must be flanged or dished outwards for riveting to shell and inwards for riveting to flue. The flue and ends must first be riveted together and afterwards the shell. All the joints should be tinned before riveting, and well sweated with solder afterwards. The pressure should not exceed 20 or 25 lbs., and a good safety valve and pressure gauge should be fitted. Shall be pleased to help you further, but advise you if you are not a coppersmith or brass finisher to get a coppersmith to do it for you and test it before steaming. It should be tested to twice your working pressure.—OLLA PODRIDA.

Reversing Valves.—J. E. J. (*Middlesboro'*).—With regard to the reversing valves you ask about, please say if your cylinders are single or double acting. If the former, then all you have to do is to change the direction of the steam and exhaust. If you have the cylinders by you it would simplify matters if you gave me a rough sketch of one of them showing the arrangement of steam ports. I could then help you with more facility.—OLLA PODRIDA.

Steel Surface and Steel Etching.—W. E. M. asks (1) "for a receipt for a solution which, applied cold by means of a brush or dipping into the bath of solution, will turn the surface of highly polished steel a nice permanent brass colour." (2) "The proper method of etching names on cutlery as it is done in Sheffield." I have had no experience in either of these matters, but I have secured information from what I believe to be valuable sources, and trust it will meet W. E. M.'s requirements. Lacquer for steel work:—Two gallons spirits of wine, 1 lb. of fine pale shellac, 3 ozs. Cape aloes, cut small, and 1 oz. of gamboge, cut small, will make a fine pale brass lacquer. As different depths of colour may be required it will be best to prepare the several ingredients in separate bottles and mix for the colour required. Etching on steel.—Print the design on unglazed and unsized paper with a composition of beeswax and resin. The article is made warm and the paper adheres to it. The paper is then damped with acid, which eats into the metal. When sufficiently bitten into wash the paper off. It will be necessary to have the design engraved in copper and then transfer it to the paper as ordinary copperplate printing.—O. B.

Electrotype Stripping.—SILVIO (*Greenwich*).—Silvio's bath may be in proper working order, but his battery may be wrong, or it may be too strong for the work, or too weak for the work. Like most of the questioners who write to WORK, SILVIO tells us absolutely nothing, asks us to guess from vague premises what is the matter, and to give a cure. Correspondents should remember that we are not omniscient, and give us every detail, however apparently unimportant, to enable us to give useful advice, as any misconception by us of the true state of affairs renders our counsel valueless. If the battery is too acid and the deposit of copper too quickly given off, the copper is hard and "strippy," but a similar effect may be caused when the bath gets too quickly exhausted of its metallic base. SILVIO should first ascertain what is the cause, and then it can be corrected by making the battery (he does not say what battery he uses) right, or by suspending a plate of pure copper opposite to his moulds, so that if the bath solution has parted with too much copper, the pure copper may be chemically absorbed and again given off as required according to the speed of decomposition which the strength of the battery determines. If SILVIO cannot succeed with the necessarily imperfect advice we give, let him write a fully detailed case upon which we can definitely reply.—J. W. H.

Transferring Wood.—KESSIE (*Bristol*).—(1) If KESSIE will look up our reply to a YOUNG CABINET MAKER (see page 781, Vol. I.), he will find the process of transferring lithographs to wood fully explained. (2) Veneers are usually cut from the very best timber and are not intended to be stained; if they must be stained black, such portions should be stained first, before the glue has closed the pores of the wood. The cellular tissue ought to be filled in with the colouring matter, "to go right through," as you express it. I should select the pieces with as little "figure" as possible, and use ordinary writing ink, dipping it and drying it a few times till the black becomes quite dense. There are several recipes in our replies to correspondents for ebony stains, but we find this to be the simplest and most permanent. Then glue the veneer into its place, whether as an inlay or solid all over, clean off, set in oil, and polish.—J. W. H.

Slide Valve Engine.—G. N. (*Maidstone*).—I do not know of any book bearing specially on the horizontal engine. There is one published by Lockwood, entitled, "The Model Engineer's Handy Book," by P. N. Hasluck, which should be of assistance to you. You should send to Stevens' Model Dockyard, 22, Aldgate, London; R. A. Lee, 76a, High Holborn, London, W.C.; Messrs. Cannon and Weld, 155, Fenchurch Street, London, E.C.; or Bateman, Strand, for lists and prices. The first named publishes a book of instructions which might be useful to you, and any of them would be pleased to allow you to examine their goods, which in itself would prove a most instructive lesson. — OLLA PODRIDA.

Boiler for Engine.—SHOPITE (*Ditton*).—A vertical boiler would be most suitable for your purpose, as it would occupy little space and cost nothing for setting. You would require one about 20 in. in diameter and 30 in. to 36 in. high, not any smaller. If you could get a larger one, say 22 in. diameter, and same height, so much the better. The cost will depend upon pressure and make. You might get a second-hand one for about £12 or £15, or perhaps less, but it would be better to get a new one. Write to C. D. Philips, Engineer, Newport, Mon., and enclose six stamps for his Machinery Register, asking at same time if he has a boiler on his hands likely to suit. A small second-hand launch boiler would do very well, but in any case make sure that you are getting your money's worth. Boilers are hard bargains as a rule.—OLLA PODRIDA.

Model Locomotive. — W. S. W. (*Wigan*).—Kindly say whether you intend your cylinders to be outside or inside, as the arrangement you require will differ greatly for each case. I may say that the inside arrangement will be best and snuggest if it will suit your intentions.—OLLA PODRIDA.

Size of Boiler.—JACK OF ALL TRADES.—A boiler about 7 in. diameter by 15 in. long or high, as the case may be, would meet your needs. The safety valve might be made about ⅝ of an inch in diameter and loaded with a dead weight if the pressure at which you intend working the boiler is not high, say about 20 or 30 lbs. on the square inch; this is the simplest form of valve to make and set, but you should also fit a steam gauge on the boiler for safety.—OLLA PODRIDA.

Imitation Ivory.—R. F. W.—It will not answer your purpose to make this for inlaying. Ivorine is the best substitute. It can be bought from the Xylonite Company or from any of the principal dealers, such as Harger Bros., in fretwork materials. When inlaid it is scarcely distinguishable from ivory. White holly is sometimes used instead of ivory.—D. A.

Inlaying.—R. N. (*Grays*).—Only one letter has been received from you. I do not think you can do better than get "The Amateur" from H. Zilles and Co., as you are fond of fretwork, or there is my own book, "The Art of Fret Sawing and Marquetry Cutting," published by Ward, Lock, & Co. Inlaying as done by professional marquetry cutters will be described in WORK later on.—D. A.

Upholstering Hints.—W. E. (*Howden*).—You do not give any idea of the shape or description of the couch you are making, so that I am unable to do more than give a general outline of how you should proceed. The webbing, which is the foundation of the upholstery, must be thoroughly stretched and securely fastened. Springs are sewn to this. Above the springs a cover is tacked to the frame. On this cover the stuffing is laid, and finally the outer covering. To give all the details necessary to enable any one unacquainted with upholstery to form a correct idea of the work is out of the question in the limited space of "Shop." The subject is a large one, and could not be treated adequately without taking up several pages of the magazine. Articles on upholstery will be given from time to time. It is quite impossible for this answer to appear by the date you name. You ask us to publish it within eleven days from the date of your letter.—D. A.

Polishing Hatstand.—J. T. (*Dulwich*).—I do not know what the stuff which you call "French varnish" is, but as you have had some experience in French polishing, and know what polish looks like, I suppose the liquids are very much alike in appearance. If they had not been you would probably have discovered that you had got hold of the wrong stuff sooner than you did. If I am right in my assumption, the French varnish is very likely spirit varnish. This as used by French polishers is much the same thing as French polish, but with a little more body in it. Perhaps you now see that the varnish can be removed by washing with spirit, and consequently redissolving the lac. This, however, is both a tedious and somewhat expensive method which need only be resorted to in mouldings and other work which cannot very well be cleaned by scraping. There are also other liquids which will remove the varnish, but I refrain from naming them as I do not know the wood of which your hatstand is made. By using some solvents you might stain the wood, which would be a pity. The methylated spirit being neutral will not effect the colour, so that it may be used on any wood. As there is generally a good deal of plain flat surface on a hall stand you may be able to remove most of the varnish by scraping, and if you can do so it will save your time. An ordinary scraper will do very well. If I knew the design of your stand more definite directions might be given, though you will not go far wrong by availing yourself of these hints. I must repeat what I have previously said, viz., that it is almost impossible to answer any questions connected with polishing or staining satisfactorily unless inquirers will state the kind of wood. If you don't find sufficient information in the above to enable you to do what you want, kindly write again with fuller details.—D. A.

Sideboard Material.—TIMBER (*Birmingham*).—If you buy the wood well and of medium quality, it should not cost you over £3. Choice varieties would be considerably more expensive. I am glad to hear you are wishing to become a worker, but surely you do not intend to make your first attempt at cabinet making with a sideboard. If this has been your idea, take *Punch's* advice—"Don't." Begin with something easy, for unless you are fairly well up in wood-working, your sideboard when finished will be anything but satisfactory. I am almost inclined to say it never will be finished, for you will soon find unsuspected difficulties crop up, and get disgusted with the work. I hope you will not take this advice amiss, as it is meant to prevent discouragement and waste of money on wood which will be spoilt.—D. A.

Pattern Makers' Tools.—E. R. (*Halifax*).—A pattern maker is an omnivorous animal, laying many tools under contribution in the pursuit of the varied tasks which he is called upon to perform. He employs the tools of the carpenter, joiner, cabinet maker, turner, fitter, and draughtsman. I will, however, give you a simple list of such as should constitute the equipment of an apprentice: Jack, trying, and smoothing planes, two skew mouth rebate planes, half a dozen rounds, a couple of small iron planes, and a couple of spokeshaves, one hand saw, one tenon saw, one dovetail saw, a large and a small screwdriver, a couple of working gauges, a pair of wing compasses, a pair of spring dividers, two pairs of callipers, one internal the other external; half a dozen assorted gimlets, the same number of bradawls, a hatchet, a brace and set of bits numbering from thirty to thirty-six, a pair of pincers, a bench hammer, a contraction rule, two feet long, a Charnley Forest hone, a couple of Charnley Forest gouge slips, two or three trying squares of different sizes, and a bevel. For edged tools select half a dozen each of paring chisels and paring gouges, each ranging from a quarter inch to inch and a half in width—the gouges must be selected of different sweeps, embracing the flat, the middle flat, and quick curves; half a dozen assorted firmer chisels and gouges will be required, two or three turning-gouges, and as many turning chisels, a couple of round-nosed tools, and a diamond point. Additions will be made to these in the course of time until this list may become doubled or trebled. But there are plenty of pattern makers who work with a list not more extensive than this; the cost of such a set will differ very considerably according to the quality of tools selected, but you may average it at about £6.—J.

Reed Boards.—REGULAR SUBSCRIBER.—Reed boards fitted with reeds can be obtained from the American Organ Agency, 2, Oseney Crescent, N.W. The cost per five octave set is 10s. 6d. unvoiced, and they can be had already voiced for about 7s. 6d. more.

Any other fittings pertaining to reed instruments, American organs, harmoniums, etc., may be had there, and by sending a drawing of any special kind of keys or coupling mechanism, a free estimate of the cost of making such will be given.—G. N.

Plumbing and Electric Lighting.—EAGER (*Hammersmith*).—Both these subjects will be treated in WORK, but it is impossible to say exactly when the papers will appear.—ED.

Bamboo Fastening.—W. S. (*Bolton*).—Joints in bamboo work are very simple, and pending more detailed description in forthcoming articles on the construction of bamboo furniture, I think the following hints will enable you to do what you want. When you want to join two pieces together as in your first sketch, a hole must be bored through one side of the piece, either to admit the end of the other, if it is of small enough size, or a dowel stuck into the hollow end. This dowel should fit tightly into both pieces. In one of them it may be fastened with glue or a wire nail. In the other you will see that the latter must be used. In the case of the triplicate joint, you must to a great extent be guided by the remainder of the design, with stretchers connecting the pieces at top and bottom; no joinery is needed at the centre. If everything depends on the joint, here notch the pieces and connect with wire. That such little trifles are not usually very strongly put together I daresay you know. Tying with a piece of fancy cord is sometimes considered sufficient.—D. A.

Spring Mattress.—M. DE R. (*Bolton*).—It can scarcely be said that either the woven wire or spiral spring mattress is best, for each has merits of its own to recommend it for use. For purposes of home construction, however, there is no comparison between the two, as the woven wire mattresses are not at all suitable for amateur craftsmen to make. You are correct in supposing that the construction of a spiral spring mattress is not very difficult, especially in the ordinary or box form, still it requires an aptitude for a knowledge of upholstery besides a little joinery. To give minute directions in "Shop" is of course impossible, but at some future date I hope to describe the construction in detail. There are many different methods of making up and finishing, but briefly the constituents of a box spring mattress are a frame to which the laths supporting the springs are fastened at the bottom, some stuffing above the springs, and an outer covering of ticking. There is no fixed rule for springs, as before these can be determined on various points such as cost have to be considered. For your purpose I should recommend 10-in. springs, of any of the ordinary gauges, distributed equally within the frame at the rate of one for every 1½ ft. super of the mattress.—D. A.

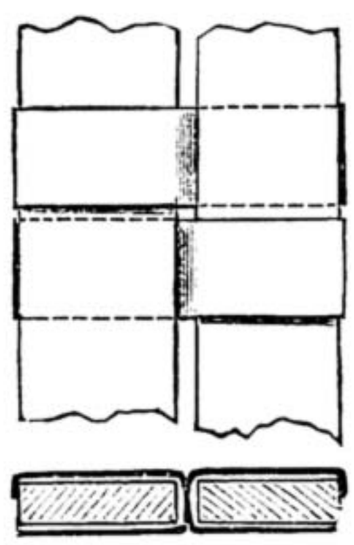
Chair Inlaying, etc.—S. S. (*Salford*).—Kindly repeat your inquiry about inlaying chairs, for in the form you have put it I am sorry to say I am so obtuse as not to understand clearly what you want to know. Are you in a difficulty with regard to the inlaying or the polishing of an inlaid chair? The colours to be used with the brush, in other words, staining new work to match old, depends a good deal on circumstances. Some artists use a great many colours, while others use only a few to get similar results in a picture, and the same applies to polishing. For the woods you name, burr, walnut, and pollard oak, I do not think you can use as a base for matching up anything better than gas black and red polish. It is not so much, however, on what is used as how it is applied that the appearance depends. All the processes to which you refer will be considered in due course, for to omit most of them would be like *Hamlet* without the title rôle.—D. A.

Brass Castings.—AMATEUR (*London, S.W.*).—You can melt brass in small quantities in an ordinary kitchen fire, provided the grate is tolerably large. You must first get a piece of sheet iron and place in front of the upper bars, so that all the draught shall pass through the lower bars, make up a good fire of coke, and place the crucible containing the metal right down into the centre, and heap fresh coke well over it. Unless the grate is of ample area you will find it necessary to use bellows or a blower. The best crucibles, as I think, are those of "Salamander" brand, sold by the Morgan Crucible Company, Battersea. The sands used in different districts vary, and your only plan is to go and beg a bucketful at the nearest brass founder, for which he will only charge you a few pence. But under any circumstances the making of brass castings at home is a tedious and costly process, considerably more costly than purchasing them at a foundry.—J.

Books on Joinery.—G. H. (*Burton-on-Trent*).—There are few trades on which more books have been written than on joinery, so that the difficulty is not to find, but to select suitable books out of some dozens; you may make selection from the following:—"Joints in Woodwork," by H. Adams, published by Spon, 1s.; "Elementary Carpentry and Joinery," published by Ward & Lock; "Carpentry," by R. S. Burn, two vols., one text the other plates, published by Collins, 6s. 6d.; "Drawing for Carpenters and Joiners," published by Cassell and Co., 3s. 6d.; "Treatise on Handrailing," by Collins, published by Lockwood, 1s. 6d.; "Circular Work in Carpentry and Joinery," published by Lockwood, 2s. 6d.; "Handrailing and Staircasing" by Creswell, published by Cassell & Co., 3s. 6d.; "Carpenters' and Joiners' Assistant," by Newlands, published by Blackie, in twenty parts at 2s. each; and there is Peter Nicholson's old work, which you can frequently pick up second-hand, or which you can buy new of Lockwood for 21s. Trübner, of Ludgate Hill, publishes several excellent works also.—J.

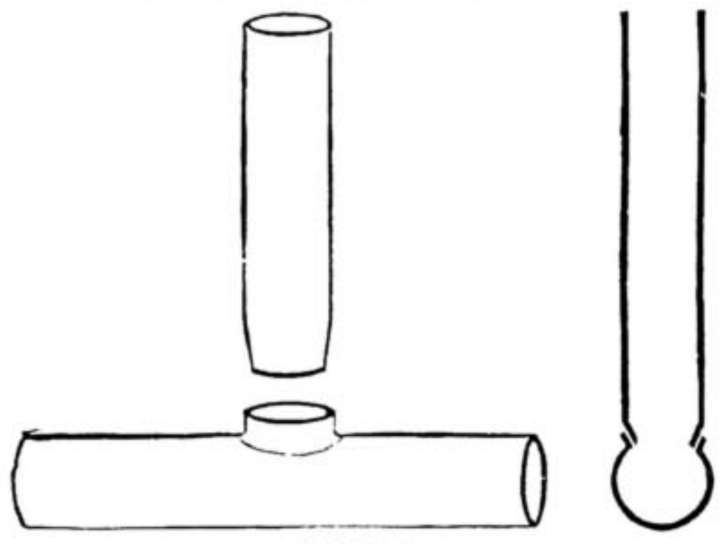
Hygienic Folding Chair.—M. H. (*Bristol*).—This chair, for which you desire instructions and dimensions, is a patented article, and it would scarcely be fair to the inventor to assist any one to infringe his protected design. Mr. J. T. Moore, Macclesfield, is the manufacturer of these chairs, but they can be procured through any upholsterer, and I think your best plan would be to purchase, and give up the idea of making. I do not know the prices asked, but a note to the inventor will bring you particulars of the "Hygienic," and also of the "Waverley," another chair of a similar character.—G. LE B.

Hingeing for Screen.—T. H. (*Leeds*).—Undoubtedly the best arrangement for allowing screens to be folded in any direction is the double-acting screen hinge. These hinges are now to be bought at a very much lower price than was the case a few years ago. Melhuish sells them at a very reasonable figure, but if you want something cheaper why not attach the folds with pieces of webbing? If you have a folding clothes horse for airing linen on you will see exactly what is wanted, as it is probably made to fold either way. In case, however, you have not, I think the illustration will make everything clear. You will see each hinge is formed of two pieces of web which cross each other. They should be strongly fastened with tacks to the inner edges of the frames. In case you do not like this arrangement, there is another one which you can make yourself, though for some reasons it is not so good. It may be sufficiently explained by saying that it consists of hinges fastened on or let into the top and bottom edges of the frame. Hinges of this sort can be bought, but something answering the same purpose can be easily made.—D. D.



Hingeing for Screen.

T-Joint.—D. M. J. (*Portsmouth*).—I am not offended at criticism when in such kindly and courteous terms as yours. I like your idea of the T-joint, and reproduce it for the benefit of readers. Bore a small hole in the horizontal pipe with the end of the pliers, or a taper tool; work the metal



T-Joint.

away at the sides, forming a kind of T in the pipe itself. If it only comes up ¼ it will be sufficient, but a little more will be better. The upright pipe is then prepared the same as for any other joint, etc. The advantages are a full way in the pipe and a stronger joint. The diagram will explain clearly what is meant.—R. A.

Frame Tools.—PHONO (*Nelson*).—The subject of picture-frame making is one which comes within the scope of WORK, so that you and others interested may rely on its receiving due attention. With regard to your inquiry about wholesale dealers, I can only repeat what has been said before in these pages, viz., that wholesale houses do not care as a rule to supply retail consumers, and that when they do so it is generally entirely as a matter of personal favour or at prices equal to those of a retailer. I can understand your desire to purchase at as low figures as you can, but you would save little or nothing by going to wholesale firms. Of course, if you are a retail tradesman in the articles you name you will know without any aid from me who to deal with, and I cannot undertake to name one or more firms to the exclusion of others equally good, perhaps, though unknown to me.—D. A.

Scales for Organ Pipes.—AMATEUR ORGAN BUILDER (*Arundel*).—The only book I know of giving scales, etc., for organ pipes, suitable for amateurs is "Organ Building for Amateurs" (Ward, Lock & Co., London), price 3s. 6d. There are many hints on the subject in the back volumes of the *English Mechanic*. As regards the 8 ft. stop on the pedals, a violoncello would, I think, suit your purpose. Scale about 2½ in. or 2⅝ in. for longest pipe.—M. W.

Westinghouse Brake, etc.—F. W. R. (*Norfolk*).—(1) The brake story is probably inaccurate. The individual may have projected an air-brake, but the Westinghouse brake has only been perfected after years of experience. If you are interested in the matter and have the man's address, why not apply to him direct? (2) If the spokes are broken in below the surface you will have to drill them out. (3) Copal varnish will suit your purpose. If you want a very fine finish lay it on, coat after coat, until you have a good thickness (¼th of an inch about), then when it has got perfectly hard throughout rub the surface down with fine pumice stone and water, and then polish with putty powder and chamois skin. To prepare the varnish, dissolve 1 oz. camphor in one quart alcohol and add 8 ozs. copal in small pieces and at a moderate heat until solution is complete; the heat should not be greater than that which will allow the bubbles to be counted as they rise from the bottom.—F. C.

American Organ Bass Notes.—W. F. (*New Ross*).—To soften the bass of your American organ each reed tongue must be curved, so that its vibrating point may dip into the frame, while the curve given to it is sufficient, at two-thirds of its length from the rivet, to allow the blade of a penknife to be passed between it and the frame. The curve must also be twisted in such a way, that on looking at the point of the tongue endways, the left-hand corner is dipping into the frame, while the right-hand corner is cocked up. The curve must be less pronounced towards the treble, and should disappear entirely about an octave from the top in the eight feet set. This bending is done with a small pair of flat-nosed pliers, the jaws of which should be filed smooth, in order that the reed may not be damaged. It is not by any means an easy matter for an amateur to voice reeds satisfactorily, but I hope to devote a special paper to that subject in my series of articles on American reed organ making. The pipe-like tone of the American organ depends almost entirely on this process of curving the reeds. The size of the wind chest, the construction of the swell shutters, and the weight of spring in the "exhauster" are of course points which help to produce a good tone, but they are useless unless the reeds are properly voiced. I have never heard an American organ in which the harmonics were so pronounced as to produce an unpleasant effect. Organ pipes have been adapted to reed organs with more or less success, but so far as the trade is concerned they are considered unsatisfactory. If you wish to adapt them, choose a soft-voiced Dulciana for a metal stop, or a Clarabella for a wood stop, as these would go better with the free reeds. There are many makers of organ pipes who lay claim to being the best, so that it would be difficult for me to answer this last query of yours with any degree of certainty. Write to Willis, organ builders, in the Minories, E.C., for a price list of organ pipes. I believe their work is fairly good.—G. N.

Organ Tuning Cones and Cups.—ORGAN BUILDER.—I am afraid you will experience some difficulty in getting a second-hand set of turning cones and cups, and if you did happen to come across a set, they would most probably fetch a good price, unless the seller was ignorant of their worth. Why not buy a new set; they can hardly be considered expensive, when one set will last a man's lifetime. There is a Mr. Newman, of 78, Augustus Street, Regent's Park, London, who is a maker of these tools; you would be able to get them from him at first cost. I think he charges something like 26s. for a set consisting of three cones and two cups; these would be quite sufficient for all ordinary work. If you write to him, ask if he has a second-hand set by him, and mention the name of the firm of organ builders with which you are connected.—G. N.

House Painting.—N. F. (*Wolverhampton*).—Your desire for assistance is one that has the fullest sympathy of WORK, especially in the good cause you mention. Concerning the promised articles, they can only appear at intervals. When completed, however, you will find them most useful for practical work or reference. The elementary part now in hand will commend itself to your requirements especially. The late Charles Reade, in *It's Never too Late to Mend*, makes the reformed Tom Robinson to accomplish some remarkable achievements in graining, when this character wanted to raise some money honestly in Bathurst. That famed novelist was far from being alone in such mistaken notions of the process and practice of painting. In no other craft can so much show be made with only a superficial knowledge, whilst on the other hand the painter has never done learning, and each job or undertaking brings something fresh or new to him. The articles in WORK are written not only for reading, such as the above, for instance, but chiefly for working from, and therefore the writers aim at a workmanlike system of explanation and direction. A complete answer to your questions can only be gathered by the course pointed out—patient study, and by mastering the entire sets of papers. By the time this appears, much that concerns you will have been published, but I hope the subjoined will considerably aid you. I take it that your first query refers to new or unpapered walls. If having colouring on them, you must wash or scrape it off, and, when dry, coat with glue size or patent size, used warm and of good strength. For making paste, beat up the flour with cold water in a suitable vessel, so that no lumps are in, and it is in the form of a stiff batter; then pour in quickly boiling water, stirring meanwhile until it turns. A little piece of alum about 1 oz. to a gallon—put into the saucepan of water keeps the paste when made from souring. If properly made, this should be, when cold, so stiff that it could be

put up in paper, being thinned for ordinary use with cold water. "What colours harmonise?" is a question entirely outside consideration herein. It would present a good test subject for a professional essay. Harmony of colour is as intricate a matter to explain as harmony of music, and is to some extent analogous. For your ordinary requirements, confine yourself to greys, buffs, and soft greens. Your two last questions are altogether too vague and general for "Shop," space in which, compared to the demands made upon it, is very limited. The preparation of walls and woodwork will shortly be considered in a proper and useful manner, in order that the worker may understand his task, and use brains as well as fingers. The present time is certainly one in which "tips" and "scraps" are much written and affected; but, when 'tis a question of competence and utility, careful and painstaking directions are absolutely necessary, and experience advises us to confine "scrappy" literature to its more rational sphere of fiction and pastime. Several answers to queries concerning mixing paint, colouring, etc., have recently appeared since the receipt of your letter; these will be useful to you. We shall be pleased to assist you in any particular item, and to hear of your success in the future, through the medium of "Shop."—F. P.

Regilding Frames. — ECONOMIST (*Birmingham*).—During the interval between the receipt of your letter and the appearance of these few lines, several queries similar to yours will have been fully answered. In justice to readers and staff alike, it is necessary to avoid, where possible, any such repetition. In this case I believe the answers alluded to will fully meet your wants. All gilders' tools and material can be purchased at a dealer in painters' brushes and material. Gilding will be fully treated later on. Write again, giving more definite questions, if you require aid beyond this.—F. P.

Eccentric Fixing. — STEAM. — To obtain the maximum of power, fix the eccentric so that the valve shall open the port to its full width to steam. When the piston rod is right out, the eccentric ought to be 90° in advance of the crank pin, plus the amount of lap and lead. Size and power of boiler depend on type. But a very small one would answer, say one equivalent to ¼ h.p. It is always best to have ample boiler power, so that I should not have one less than 1 ft. diameter.—J.

Lathe Cutting Tools.—N. C. (*Homerton*).—You ask what kind of cutting tools are used for lathes, and how and where to obtain them. There is *no end* to the different tools used. Begin with wood, go to a large ironmonger and ask for turners' chisels and gouges, pick out two chisels, say one ¾ in. and one ½ in. wide, also two gouges of about the same size, which four tools will, I suppose, cost you about 4s. This is all you want to begin with: till you have had some practice with these it is of no use to go further. A fret saw requires firmly fixing into the clamps at each end, which is always done with a screw and not with a spring.—F. A. M.

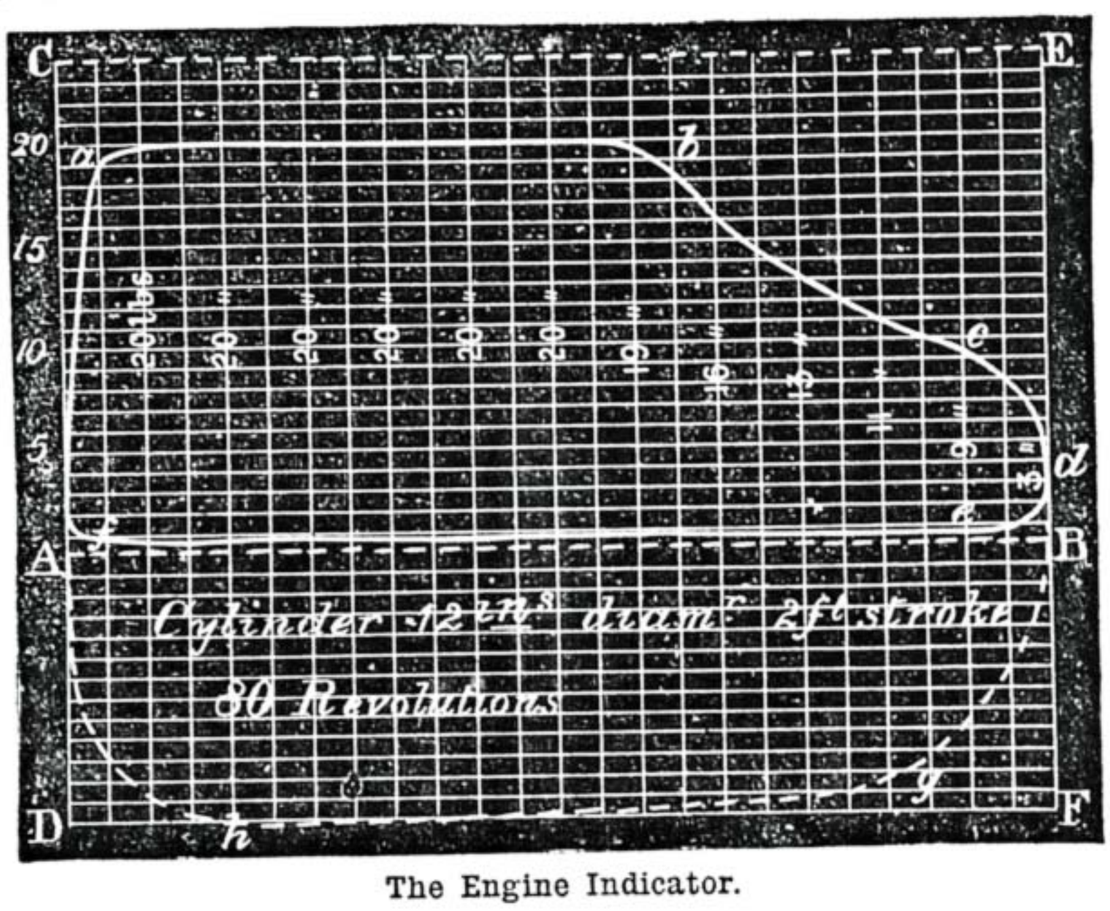
Colouring Photo Slides.—H. A. N. R. (*Bishopstown*).—There is no preliminary application required. Transparent oil colours being used, as sold for this special purpose, they are practically coloured varnishes that lie well and dry rapidly. If water colours are used, any slight greasiness that repels the tint may be got rid of by brushing a little oxgall and water over the plate and letting it dry, or the admixture of a little oxgall with the colour, completing the process by giving the whole a coat of white varnish.—E. D.

Tempering Brass Wire. — BRASSEY (*Glasgow*).—The only tempering which brass wire receives is that imparted in drawing. Soft wire is that which is annealed several times during the process of drawing, perhaps six, eight, or ten times, according to the number of times which it is drawn through the plates; hard wire is that which is either annealed fewer times, or not at all. To case-harden iron you must put it in an iron pot enclosed, and covered over with a quantity of nitrogenous matters, such as bones, horns, hoofs, leather cuttings, and such like; and lute on a cover, and expose it to the heat of a reverberatory or other suitable furnace for the space of from twelve to thirty-six hours, after which the contents will be withdrawn and thrown into water. The depth to which the case-hardening will reach will extend from about $\frac{1}{64}$ of an inch in the first period named, to $\frac{1}{16}$ or $\frac{3}{32}$ in the second period, the latter being amply deep enough for most purposes; the deeper the case-hardening, it must be remembered, the more liable is the forging to become warped. For a mere surface hardening whose depth will be no thicker than that of a piece of writing paper, it is sufficient to heat the iron red hot and roll it in powdered yellow prussiate of potash.—J.

Sailcloth Watertight.—R. C. (*Glasgow*).—I do not think there is any waterproof that would do for sailcloth that would not crack, and I am not aware of any better mode of joining than seaming.—BING.

Merits on an Idea.—A. W. (*Newcastle-on-Tyne*).—If you will submit your ideas I will endeavour to get you an opinion thereupon in the manner you wish. Send a stamped addressed envelope.—ED.

The Engine Indicator.—W. F. (*Belvedere*).—I fear it would be difficult to give you the information you require in the "Shop" column. The subject is a large one. The book I used is "Description of Richard's Improved Steam Engine Indicator," published by Longmans, at 5s., in 1868. The indicator was invented by Watt. It measures and records the pressure in the cylinder at every part of the stroke. Suppose you drilled a hole into the cover of an engine cylinder, so as to communicate with the inside, and into this hole you screwed a steam gauge. Now, as the engine worked, the finger of the gauge would move according to the varying pressure within. For instance, at the beginning of the stroke, at the moment when the slide-valve admitted the steam, the finger would suddenly jerk up to, say, 40 lbs., or nearly boiler pressure; it would continue there till the slide or expansion valve began to cut off the steam, when it would sink down, etc. Evidently, however, the movements of the finger or index of the gauge would be useless, unless some method of recording them were contrived, and this is what is done in the indicator. Instead of the steam gauge there is



The Engine Indicator.

screwed into the engine cylinder a small cylinder, having a diameter of about ¾ in., fitted with a piston made lightly, and having no packing, so that it can move with perfect freedom: above the piston there is a spring so regulated that for every lb. per square inch that comes upon the piston it will rise some definite distance such as $\frac{1}{16}$ in. If, then, there be fixed to the rod of this small piston a pencil, then, as the engine moves, the point of the pencil will rise and fall $\frac{1}{16}$ in. for every pound per square inch of pressure on the small piston, which being connected with the inside of the main cylinder will indicate the varying pressures in the engine at every part of the stroke. To obtain a register of the movements of the pencil, we have only to place in front of the point a piece of paper which shall move to and fro with the movement of the piston of the engine. It is not necessary that the paper should move as far—that is, should have as long a stroke as the engine piston: the engine may have a stroke of 2 ft., for instance, whilst the movement of the paper might be 3 in., we could still divide the 3 in. into twenty-four equal parts to find the pressure at every inch of the stroke. Looking at the figure, we see a piece of paper ruled by cross lines; this represents the indicator card, which moves in front of the pencil point, being drawn to and fro by the motion of the piston. Let us first suppose that the indicator piston is not open to the cylinder, but only communicates with the air; the little piston, then, will remain stationary while the card moves to right and left, and a straight line, A B, will be traced on the paper or card. Now, suppose the connection between the card and the piston of the engine be broken so that it will no longer move to and fro, but that the connection between the engine cylinder and the indicator piston be reopened: the card, therefore, will remain still, whilst the pencil moves up and down; it will now trace such a line as A C or B D. Having then traced the effect of each of these movements separately, we shall be able to follow the two whilst they move simultaneously. Whilst the card is moving to and fro by the action of the engine, the pencil tracing and retracing the line, A B, and the indicator piston being open to the air, at the moment the pencil reaches A, open the indicator tap to connect it with the cylinder; the pencil will instantly shoot up to a position, *a*, rising almost vertically, then, as the card moves to the left, it will maintain its position till it reaches the point *b*, where the cut-off begins; it rounds down here because the valve does not shut suddenly. From *b* to *c* no more enters, but the steam expands in the cylinder and continues to drive forward the piston, though with lessening force, till the point *c* is reached, when the fall is rapid, owing to the opening of the exhaust, which occurs before the card reaches the end of its movement at *d*. From this point, *d*, the card returns backwards, as does the engine piston, and the line, *d e f*, shows the path of the pencil whilst the return stroke is being made; the height of this line above the first line, A B, representing the back pressure in the exhaust pipe, which in this case appears as one pound. Were the engine fitted with a condenser, this line would fall below the atmospheric line, as dotted at *d g h*. The indicator diagram being traced, we take off the card, and since the distance, A B, represents the 2 ft. stroke, we may, if we like, divide that into 24. Since every $\frac{1}{16}$ of vertical height represents 1 lb., we draw upon the card parallel lines $\frac{1}{16}$ apart, beginning from the atmospheric line, A B, upwards only, if the engine is high pressure only, and downwards also, if it is condensing. The dotted line, C E, is added to represent the boiler pressure as read from the steam gauge, which we have supposed to be 24 lb., showing a loss of pressure in the steam passages and throttle valve of 4 lb. To complete the card we write on it the particulars of the engine, thus:—Cylinder, 12 in. diameter; 2 ft. stroke; 80 revolutions per minute. Then from the card the mean pressure can be obtained by taking the average height of the vertical lines, or of every other one, as written upon the figure; except that 1 lb. must be deducted for back pressure 19, 19, 19, 19, 19, 19, 18, 15, 12, 10, 8, 2; twelve figures, which added together give 179; dividing this by 12 to find the average, we get 16 as the mean pressure throughout the stroke. Now if the diameter of the piston be 12 in., its area is 113 square in., which multiplied by 16 gives 1,808 lb. for the pressure on the piston. A 2 ft. stroke at 80 revolutions per minute makes 320 ft. per minute for the speed of the piston, and this multiplied by 1,808 gives 578,560 foot-lbs. per minute for the power of the engine. Dividing this by 33,000 we get 17 as the indicated horse-power of the engine.—F. A. M.

The Clock Jobbers' Handy Book: Where to get it.—READER.—Order the book you name of the nearest bookseller, and tell him it is published by Messrs. Crosby Lockwood & Co., and that its price is 2s. This is all he will want to know, and the book will soon be in your possession.

Photographic Developer.—A. V. J. (*Brixham*).—The following will be found an excellent developer for wet plates (negatives) for ordinary work: proto-sulphate of iron, ¼ ounce; glacial acetic acid, ¼ ounce; alcohol, ½ ounce; pure water, 8 ounces; dissolve. For positives the following modification is required: sulphate of iron, 1½ ounces; nitrate of baryta, 1 ounce; alcohol, 1 ounce; nitric acid, 40 drops; water, 1 pint; dissolve and filter. With regard to the deposit in the toning bath, it proceeds from the gold being reduced to a metallic state, the solution consequently becoming useless for toning purposes. Why use lead compounds at all? Try the following: gold chloride, 1 grain; acetate of soda, 30 grains; boiling water, 8 ounces. Let this stand in the dark for a day or two before use; add a drop or two of chloride of gold solution (of a strength of 1 grain gold chloride to 1 drachm of water) if it tones too slowly, also add one drachm of the gold solution for every sheet of paper toned. Well wash the prints before toning. It is a good plan to pass the ready sensitised paper through a bath containing about an ounce of carbonate of soda to the gallon of water, washing out the carbonate of soda before putting the prints in the toning bath. Be careful not to overtone. As a guide tear a print in two pieces, tone one piece, and keep the other at hand for comparison untoned. You will then easily see how far the process has gone; all prints dry up darker in colour than they appear when wet. Iodized collodium usually contains bromide as well as iodide. A pint of collodium may be properly iodized by the addition of forty grains each of iodide of ammonium and cadmium with twenty grains of bromide of cadmium. These salts are to be dissolved in a portion of the alcohol and ether, and added to the rest in which pyroxyline has been dissolved. Shake them well together and allow the preparation to stand undisturbed until perfectly bright and clear, then pour off the clear portion for use.—E. D.

Spiriting off Burr Walnut.—J. P. (*Hackney*).—As you refer only to your difficulty in getting a permanent bright polish on burr walnut it may be assumed that you can French polish the ordinary run of stuff, and that you understand generally how to do the spiriting off. The dulness which your polished burr shows after a week or two may arise from a variety of causes, the precise reasons being difficult to tell by any one who has neither seen the work nor yet your mode of manipulation. I can therefore only hint at a few of the more probable. First of all you may have used too much oil and not sufficiently got rid of it when applying the polish. In this case the remedy is obvious. Then you may have spirited off too much, though this seems in your case hardly likely. I am almost inclined to attribute the defect to the bodying in being imperfectly done. Suppose you were to do this more carefully in your next job and not content yourself with one bodying up. The polish sinks so much in burr that the dull surface may be from this cause, so go over it two or three times with your polish rubber after intervals of a day or two before spiriting. Of course

you must be careful not to get too thick a coating of the shellac (or polish), for this should be kept as thin as possible. Are you sure that your polish is good? If you are in doubt try Fordham's (Curtain Road), or any other maker of established repute. There are one or two text books on the subject, but there is none that I would care to unreservedly recommend. The best, perhaps, is that published by Wyman & Sons, Long Acre. Articles on polishing are in hand and will appear, but I cannot say definitely when. In the meantime, when you meet with any difficulty you can always write to "Shop" and have your own needs specially commented on. I do not know whether I need remind you that burr walnut requires more skill in polishing than many other woods, and that a man must be well up in the work before he can get the best results. No doubt you think you are troubling too much. The very object of "Shop" is to assist workers in any branch of manual operations, and none of the staff, from Editor downwards, regard inquiries coming within our scope with any other feeling than that of sympathy and a desire to remove difficulties or suggest improved methods.—D. A.

Patent.—INVENTOR (*Liverpool*).—Respecting the prior provisional protection you refer to, it is not necessary that you take cognisance of it, though the purchaser of your protection rights may run some risks. When the prior provisional protection is "completed," you will be able to take objection if any points are included in the complete specification which were not foreshadowed in the provisional specification. In your own interest you should ascertain when the complete patent is accepted for the prior invention, and when this acceptation is notified you should at once inspect the specifications at the Patent Office, Southampton Buildings, London, where you will be able, any time within two months, to lodge an objection to the grant of the patent, upon the forms specially arranged for this purpose. In the event of the earlier provisional specification not being completed, the matter may be considered void.—R. & C.

Apprenticeship.—'PRENTICE.—There is no doubt that to become a competent marine engineer you must go through the shops of some marine engine works; but I doubt, unless you have friendly influence, your getting into any works on the terms you mention. Your best plan will be to apply direct to some firm of marine engine builders, when you will doubtless get all information.—F. C.

Photo Telescopes.—A. S. H. (*Yorks*).—Your question arises from a misapprehension of the matter. Telescopes may be applied to photography in several ways, as, for instance, in photographing astronomical subjects. In this case a camera is adopted to the telescope, the sensitive plate taking the place of the eyepiece. In this manner different nebulæ have been photographed. At this time, extensive operations are in progress, making star charts of the southern hemisphere. Many leading astronomers in various parts of the world adopt this method of securing records of the heavens. Another adaptation of the telescope to photography is to have a telescopic arrangement attached to cameras, in order to ascertain the proper focus of an object at sea, where no guides exist that enable the distance to be correctly estimated.—E. D.

Firing Glass Facias.—The firing of glass facias and lettered glass is undertaken by James, 78, High Street, Camden Town, who has some of the largest kilns in London, capable of holding very large sheets. He also undertakes the firing of china plates, vases, tea cups, etc. The cheapest and best kiln for firing glass is Thompson's patent gas kiln (Leeds). The heat is under control, and it is possible to have a gas kiln fixed up in a shop, whereas, the old coke kilns require to be in a separate building. The query as to building kilns has been answered (see page 46, Vol. II.). Unless you have a good deal of work to fire, we strongly advise you to go to a professional kilnman to get it done, as you will save both money and trouble by so doing. "Glass Painting," in Wyman's "Technical Series," can be consulted on the subject; also "Pottery Painting," in the same series.—F. M.

Gongs.—W. E. W. (*London, W.C.*) has seen thin plates of metal suspended by two cords to be struck and used as bells or gongs, and asks in reference thereto what size the several plates should be, with the thickness, and also the kind of metal—bell metal or otherwise—to produce an octavo of tones. If W. E. W. has seen the plates, has he no idea from the colour what is the probable kind of metal? I am sorry I can give no direct answer to these queries. The nearest approach to the article that I have seen is a set of steel tubes which was exhibited at the "Inventions;" they gave a magnificent tone, and occupied but little space; the largest was, perhaps, about 5 ft. long and 8 in. in diameter; the tone was exceedingly deep and rich. Bars of steel are also used instead of bells, and these produce a fine effect, and can be more readily tuned than bells, but plates I have not seen or heard of before. Venturing an opinion, I should say weight for weight steel will give the deeper tone. I am afraid that on such a subject the exact diameter and thickness can only be determined either by measuring existing plates or experimenting. One thing I think will be seen: that with a decrease in size there must be a decrease in thickness.—O. B.

Paquelin Lamp.—F. L. W. (*Salford*), JACK (*London*), and others.—In reply to your inquiries, I send herewith some sketches, dimensions, and particulars of the Paquelin lamp. Body of sheet brass 22 or 24 wire gauge wired round the bottom, with 9 $\frac{3}{16}$ holes punched round close to the wire for admitting air. This is in one piece in the original, but you could not make it like that. Central tube is brass, of a diameter to allow the inner bent tube to fit nicely in it. This is brazed round where I have marked B in the sketch and soldered at the bottom, S. Inner bent tube: $\frac{7}{8}$ brass with a slot of sufficient width to enable it to slip over a hollow cross-bar of oblong section, $\frac{5}{16}$ by $\frac{1}{4}$; this cross-bar is fixed $\frac{3}{16}$ below the top edge of central tube, which said tube must

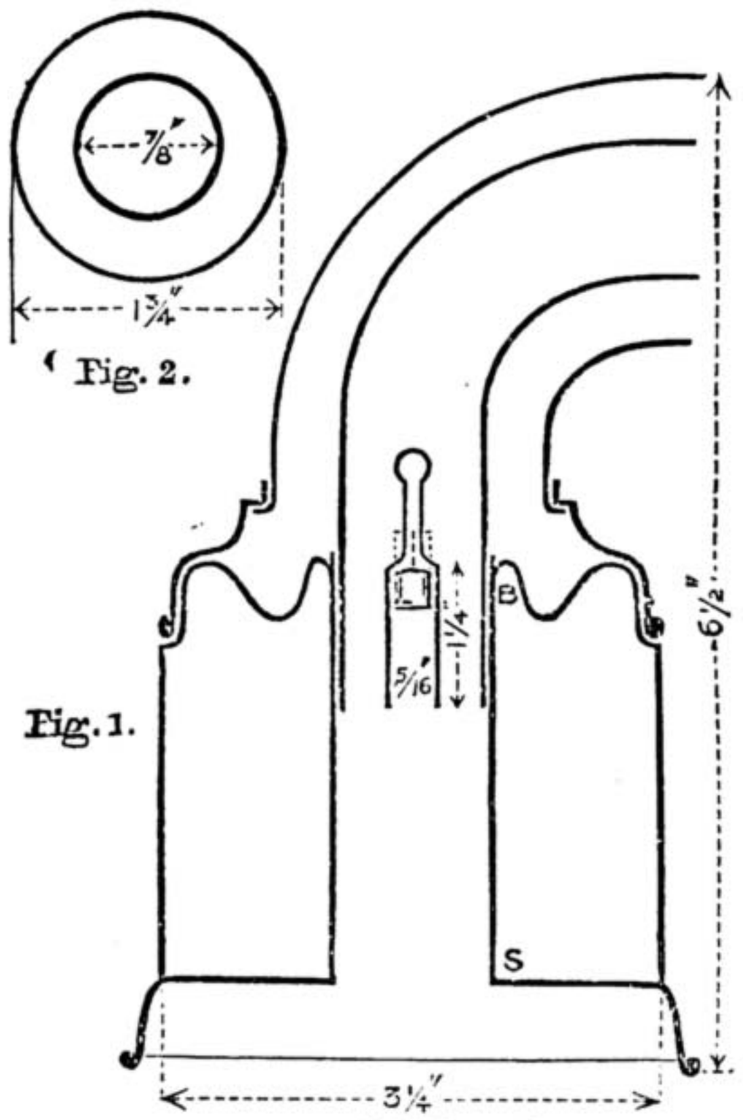


Fig. 2.

Fig. 1.

Fig. 4.

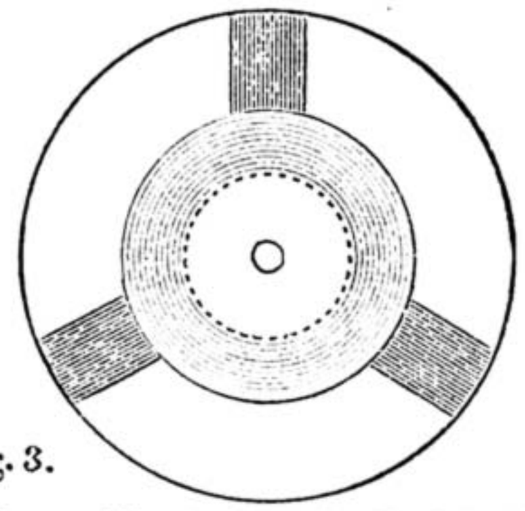


Fig. 3.

Paquelin Lamp. Fig. 1.—Longitudinal Section of Lamp. Fig. 2.—Plan of inner and outer Tubes. Fig. 3.—Triangle under bottom. Fig. 4.—Nipple (full size).

of course have two holes made in it, before fixing in the body. A nipple (Fig. 4) is screwed into this cross-piece with a very fine hole, and the drilling of this hole will, I expect, be the crux for you; it is as fine as the hair of your head, and if it is made too large the thing will not go. This hole gets choked sometimes in using, and the best thing I can clear it with is the fine point of a thin shred of tin such as a tinman trims off a bottom that is a shade large. Outer bent tube: thin sheet iron riveted to the brass ogee moulded top, which has fifteen $\frac{3}{16}$ holes round it, and two bayonet notches cut in it to fasten on two little studs on the sides of the body. The bottom is soldered in, and so is the triangle underneath the bottom. The filling screw is soldered in and the handle also. The interior, as far as I can see, consists only of a piece of lamp wick bound round the central tube. You will soon see which are the vital parts of the affair, and what parts you can modify to make it easier. For instance, instead of the two bent tubes you might make them to an angle, taking care that it was sufficiently obtuse, so that the outer tube would take off and on when the inner one is in position. I hope this, with the drawing already given, will make all clear.—R. A.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—S. C. & SONS (*Salop*); H. B. S.; J. M. (*Manchester*); J. R. (*Huntley*); J. H. M. (*Beau Pare*); H. B. (*Jarrow*); W. W. NELSON; GLESCA NOKEL; NIGER; ENQUIRER (*Jersey*); B. H. T. (*Liverpool*); FURNITURE; ENQUIRER (*Herne Hill*); A. N. F. C. (*Christchurch*); T. M. & SONS (*Glasgow*); CONSTANT READER; W. H. (*St. Leonards-on-Sea*); J. O. (*Manchester*); VERITAS (*Reading*); READER (*Blackburn*); H. J. (*Southampton*); T. W. (*Brighton*); F. W. C. (*Stratford*); F. C. (*Cardiff*); J. J. A. (*British Guana*); MEDICAL (*Hampstead*); A DISAPPOINTED READER; E. L. R. (*Oxford*); ECONOMY; AMATEUR; B J. T. (*Stafford*); YOUNG SHIPWRIGHT; H. W. D. (*Lincoln*); ENQUIRER (*Walton-on-Thames*); G. B. (*Accrington*); KING BRUCE; READER; J. H. (*Leicester*); P. P. (*Waterford*); F. R (*Streatham Hill*); PHOTOGRAPHER; S. W. (*Bristol*); GALA; G. P. (*Elgin*); B. S. (*Reading*); G. K. (*Glasgow*); A. R. (*Scorrier Saw Mills*); WINDMILL; C. L. F. (*Brighton*); W. D. E. (*Perth*); R. H. (*Accrington*); CARBON.

Trade Note.

MESSRS. STEVEN & STRUTHERS, brass founders, Glasgow, have successfully completed the first of several phosphor-bronze castings, which are interesting in view of their size and weight. It will be remembered that it was decided by the Admiralty to have several of the second-class cruisers recently ordered wood sheathed and copper-bottomed. As the copper would result in the corrosion of steel by galvanic action, it is necessary to make the stem and stern posts of phosphor bronze. The London and Glasgow Company are building at Govan three of the wood-sheathed cruisers, and three others are being built by Messrs. Palmer, on the Tyne, and for these Messrs. Steven & Struthers are supplying the castings. The stem of one of the vessels has been completed. It weighs over 10 tons, and from the connection with the built keel to the point of the ram the measurement is 23 ft. 6 in., while the height from the ram to the top of the stem is 20 ft., making the length from tip to tip 43 ft. 6 in. The stiffening bracket in connection with the ram forms part of the casting, and is not, as is usually the case, separate and bolted to the stem. At its broadest part the stem is 3 ft., and is scarped for the steel plates and teak planking. The principal casting of the stern framing, the first of which is now in progress, will weigh 12 tons 5 cwt. To it are fixed two brackets for the propeller shafting tubes, each bracket being 4 tons 10 cwt; while the rudder, on the balance principle, will be 10 tons, making in all 31 tons 5 cwt. The larger casting in connection with the stern post measures, from point to point, 35 ft. 6 in. The rudder is cast in frame, and plated with bronze sheeting $\frac{3}{8}$ in. thick. It may be added that the metal is composed of 90 per cent. copper, 9·5 per cent. tin, and 5 per cent. phosphor. The castings for each ship will cost about £2,200.

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