HOME-MADE TOOLS.

BY J. H.

I.—AN IRON TRYING PLANE.

INTRODUCTION—PATTERN FOR STOCK—HOW TO MAKE PATTERN—CASTING—TRUEING UP SOLE AND SIDES—FILING—FITTING WOOD BLOCKING—PLANE IRON—FILING MOUTH—WEDGE—POLISHING—LEVER.

IN this series of papers I propose to describe the construction of many of those common tools which, though more or less costly to purchase, amateurs can very well contrive to construct for their own use. There are many such in our workshops — tools which workmen themselves seldom think of purchasing, and which require no very great amount of skill in their construction, but chiefly considerable patience, and much care. I think it well, in the absence of a very strict classification, to divide these tools into four main sections, as follows:—first, planes; second, tools used in measurement; third, miscellaneous tools; fourth, general shop tools. This will be sufficient for our purpose, and in carrying out my plan, as indicated above, I shall keep this arrangement in view and follow it.

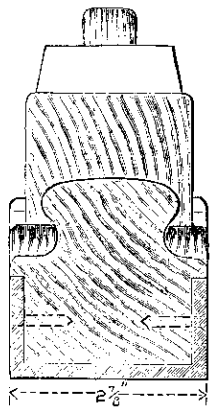


Fig. 2.

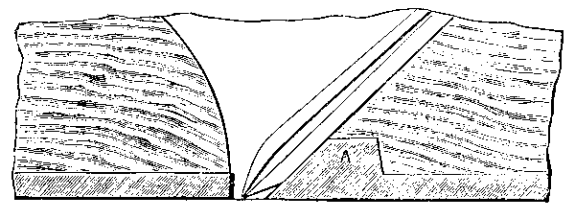


Fig. 3.

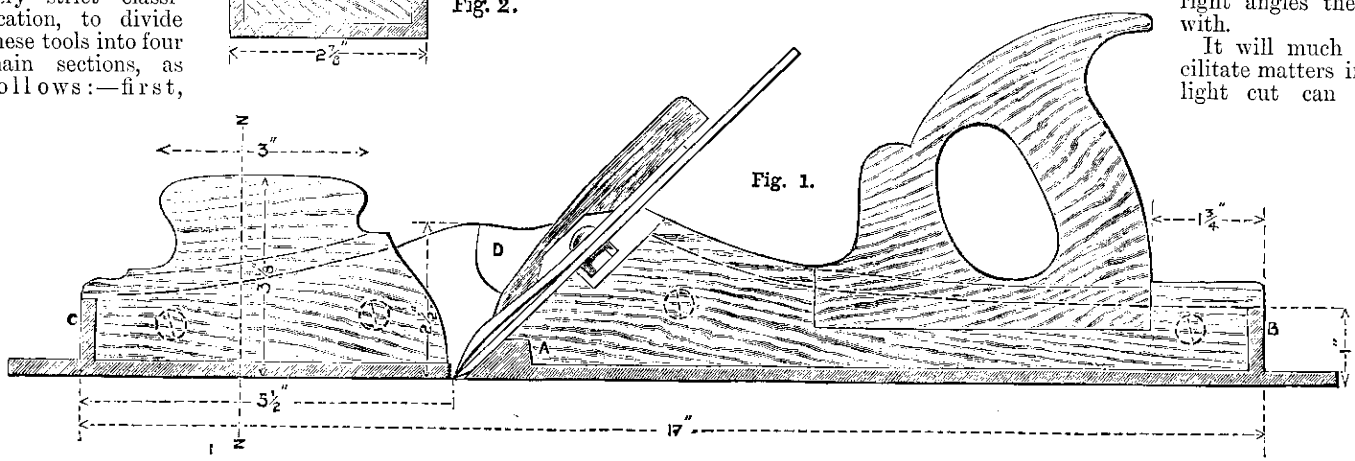


Fig. 1.

Home-Made Tools. Fig. 1.—Iron Trying Plane: Longitudinal Section. Fig. 2.—Ditto: Transverse Section. Fig. 3.—Ditto: Enlarged Section of Mouth.

Let our first example be an iron trying plane, a tool which no wood worker who aspires to do the very best class of work can well afford to be without. Such a plane costs about thirty shillings in the shops, but it can be made for five shillings.

First, we want a pattern for the stock. This should be made of mahogany, planed very true and free from winding to a thickness of $\frac{3}{16}$ in. bare, say $\frac{1}{4}$ in. bare. But keep the bottom of plane *full* $\frac{3}{16}$ in., to have sufficient metal in case of possible curvature of the casting in cooling.

The shape of the pattern is seen in Figs. 1 and 2. The sides will be nailed on the bottom, perfectly square therewith, and the merest trifle of taper should be given to their inside faces, so that their thickness at the upper edge shall show slack by the callipers, when by comparison they are tight at the bottom edge. This taper is for clean delivery in moulding.

A strip, A, is glued across the inside face of the bottom, just behind the mouth, to form a good bedding for the iron, and also as a shoulder for the abutment of the hinder piece of blocking; and two pieces, B, C, at back and front, to terminate and stiffen the ends, and to act as abutments for the blocking. Two pieces, D, are fitted against the sides to take the resistance of the tightening wedge, if a wedge is used. If a lever is employed no such pieces will be required. These will not be fastened into the pattern, since they would then prevent delivery by pulling up the overlying sand in the mould. They must each be fitted with a vertical sliding dovetail, so that they will be left behind in the mould on the withdrawal of the main pattern. They are taken out subsequently sideways from the mould. Clean the pattern off with fine glass paper, varnish, and rub down.

Be careful to take the pattern to a foundry where soft and clean castings are made. A hard, rough casting will be quite useless for the purpose. Stipulate that if the surfaces show blowholes when filed or planed, that the casting shall be replaced free of cost. This precaution is necessary in order to guard against any loss that might otherwise be brought about through the occurrence of a defect of this kind which will sometimes happen in the process of casting.

The most difficult task now follows—that of trueing up the sole and sides of the casting. These, especially the sole, must be straight and free from winding. For use on the shooting board it is also necessary that the sides be truly at right angles therewith.

It will much facilitate matters if a light cut can be taken off all over in the planing machine. But to pay for planing would run up the cost of the plane by about ten shillings. Hence, in most instances, the amateur or cabinet maker will have to true the stock by filing only—not a very severe task after all, provided he is fairly skilful in the use of the file.

Briefly, then, remove the outside hard skin either by grinding, or with an old, nearly worn-out file. Having done so, take a bastard file and go all over the surfaces carefully until they are very approximately level. Their accuracy would be best tested on a fitter's surface plate, supposing the use of one can be obtained. But if not, then a

steel straightedge of sufficient length will answer the purpose, trying the plane lengthways, crossways, and diagonally; the latter for winding. It is quite possible to use a very true mahogany straightedge for this purpose if a steel one is not available. As the later stages of filing are approached, the coincidence of the surfaces of the plane and of the surface plate, or straightedge, is carefully tested by smearing a thin film of red lead and oil made to the consistence of thin paste over the plate or straightedge, and observing the extent of its transference to the faces of the plane. Finer files will afterwards be used, finishing with a dead smooth file. Scraping is hardly necessary.

The most troublesome portion of the work is now accomplished. The next task is the fitting of the wood blocking. This blocking may be conveniently made of rosewood, beech, oak, or hard Honduras mahogany. Whatever wood is used it must be perfectly dry. It ought to have lain in the shop under the bench for two or three years at least. Then, being once fitted, there is no reasonable likelihood of shrinkage and splitting occurring.

The pieces may be fitted flush with the inside faces of the sides of the casting, or they may preferably be shouldered over the edges and made flush with the outside faces. The latter plan is shown in Figs. 1 and 2. The fitting of the blocks into the interior and over the edges should be quite finished before the upper outlines are cut. No hard driving must be done, else the iron will probably become broken. Gentle tapping only must be given, and red lead or chalk may be rubbed over the iron to indicate where contact of the blocking occurs. When fitted, drill and countersink four holes in each side to secure the blocks in place permanently with wood screws. The hinder block will have a handle fitted into a mortise recessed therein, and the end which comes next the mouth will be bevelled to an angle of 45° for the bedding of the iron. This bedding face must be very free from winding, else the iron will rock, and so cause the shavings to choke the mouth of the plane. The end of the front block will be bevelled back as shown for the clearance of the shavings.

At this stage it will be desirable to procure the iron, which should properly be a "gauged" or parallel iron, because, unlike the common or tapered iron, its wearing backwards by regrinding does not cause that enlargement of the mouth of the plane which occurs with the tapered iron.

The filing of the mouth, about which I have said nothing, will be undertaken now that we suppose we have the iron bedded on its block, and both front and back blocks screwed in place, as shown. It must be filed, at both back and front edges, perfectly square with the edges of the plane, and with reference to its own iron and wedge, in such a manner that the slightest possible clearance opening for the shavings shall be permitted. See Fig. 3, showing a section of the mouth enlarged. The wedge is fitted at about the same time, the strips, D, being filed underneath to make good contact.

With this, the essential work of the plane is completed, and the cleaning up with glass paper and the polishing only remains. If the wood is of a light colour, staining will improve its appearance. The polishing not only adds to the beauty of the appearance of the tool, but also protects the wood to some extent from atmospheric influence.

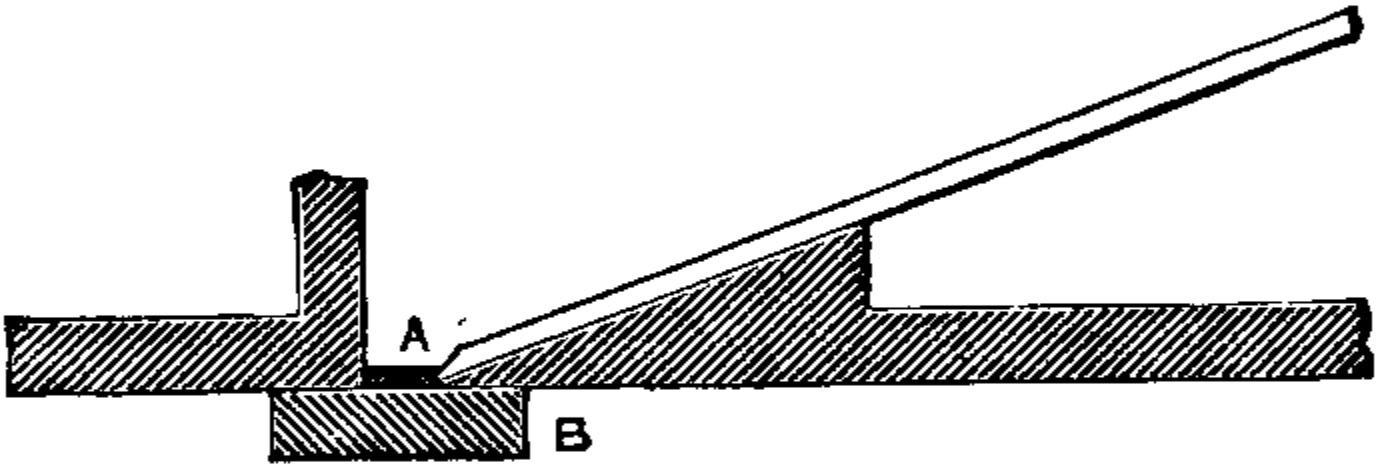
The main points, then, to be regarded in the making of this plane are accuracy in the pattern, a soft, clean casting, free from blowholes, the selection of dry, hard wood for the blocking pieces, good fitting of the same, without such severe driving as would tend to break the casting, good bedding of the iron and wedge on its seat, and the most scrupulous nicety in the width of the mouth.

If we elect to use a lever instead of a wedge, the pieces, D, in Fig. 1 are omitted, and the wedge is made of brass, cast from a pattern. It is pivoted, and tightened on the iron by means of a screw of coarse pitch and large, coarsely milled lead.

This method is preferable to the wedge, but involves more work and slightly more expense. In the next article, however, I will describe a smoothing plane fitted in this manner, and therefore give no details of such fitting here.

(*To be continued.*)

Pattern of Plane for Casting.—E. P. W. writes:—"I have read the article on home-made planes, and I think it is my duty to mention that when a pattern is made for a casting, it should not be cut quite through, and there should be a thin piece glued or tacked on to the pattern where the mouth is to be, because it is difficult to have a clean casting when the mouth is cut through, and the part that forms the bed for the iron, being very thin, cools very



quickly, and is sometimes so hard that a file will not touch it. This will prevent it, and there will be no trouble in chipping or grinding the projection off, and then when the casting has been planed or filed up, as the case may be, the mouth will be through, and there will be no trouble. I hope the writer of the article will not be offended, as I do not write this to offend him, but for the benefit of any one that may be following his instructions, and be fixed, as I have been. I speak from experience."

Pattern of Plane for Casting.—A FOREMAN PATTERN MAKER writes in reply to E. P. W. (see page 172):—"Though there is some advantage in casting a piece across the mouth of the plane, I do not think it at all necessary if soft Scotch iron is used. If inferior hard iron is employed, then it is well to thicken the metal. Actually the metal where the iron has to bed would not come to a keen or 'feather edge' in any case, as that edge would be cut off in the pattern, and in addition there would be the allowance of extra thickness for planing on the bottom—say $\frac{1}{16}$ in. or $\frac{3}{32}$ in. Then there is the strip cast across the inside face, to give the iron a bedding above the bevelled facet, and this keeps the metal rather hotter there than elsewhere, and so tends to prevent chilling. As a matter of fact, all the outside surfaces of an iron plane are hard when they leave the mould, but such hardness is only skin deep, and is removed by grinding, previous to using the file. I may add also that I speak from experience, but admit, at the same time, that the class of metal used will have a vital influence on results. I particularly mentioned, however, soft castings in my article, page 50."

Home-made Planes.—BERT writes:—"Having been interested in the article on home-made planes and E. P. W.'s remarks, I think that he is quite right in his idea in having a piece over the mouth of the pattern. I have made two or three dozen of them myself. I am an iron moulder, and I find that to cast them with the mouth left open not only causes them to get hard but causes them to warp, being weak in the middle. And another thing I notice, the writer is very scanty with the taper, as most pattern makers are. He says the merest trifle will do. Now, I say it is not enough; if he wants a clean casting he should give a little more taper, then a moulder has a better chance to get his pattern out without shaking any of what we call the cod down—that is, the inside of the pattern—and if that is left intact he can depend on a good clean casting. I have taken WORK since the beginning, and I am very pleased with it. I see you mean to go in for all trades, but I have been wondering if you will go in for ours. I have taken in two or three journals, but none reached as far as that. If you could give a little about the working of a cupola, it would be very welcome to not only me, but some friends in the trade who take in WORK every week. I may add here that I succeeded in making a table of Mr. Adamson's design in No. 1 of WORK. I hope that my suggestions will not be considered offensive."

HOME-MADE TOOLS.

BY J. H.

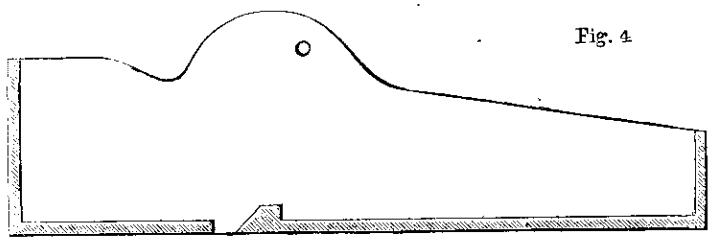
II.—Iron Smoothing Plane—Chariot Plane.

In this article I will describe and illustrate a common iron smoothing plane and a chariot plane.

Fig. 4 shows the casting for an iron plane of the first-named type. There is nothing special to be said about the pattern. It is precisely like its casting. Two curved sides, and two ends, each $\frac{1}{8}$ in. thick, will be

prepared and glued upon the bottom, the merest shade of taper being imparted to the inside faces. The curved sides are properly cut from a piece of stuff which is planed to the depth of the pattern, its curves struck to the radius required, with a pair of trammels, and cut with paring gauge, chisel, and spokeshave. If a thin bit of stuff is planed, and simply bent to the curve, it will be of a less curvature at the top than at the bottom edge, and this will have an unsightly appearance; hence the reason for cutting the sweeped pieces from solid stuff. The bottom will be $\frac{1}{32}$ in. thicker, to allow of trueing up. The mouth will be a trifle narrower than the casting, for the same purpose.

The remarks made in the last article with reference to the soundness of the casting, and the operation of filing, will apply in the main to these examples also, and need not be repeated.



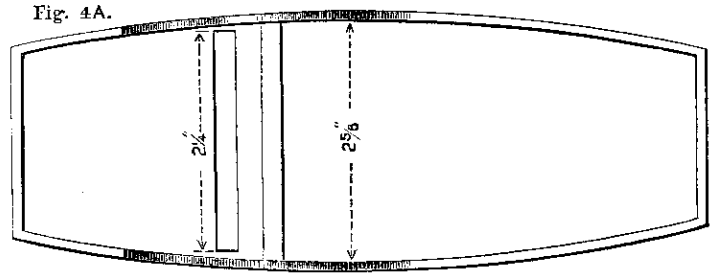


Fig. 4.—Casting for Iron Smoothing Plane: Section. Fig. 4 A.—Ditto: Plan.

In thin patterns such as these, there is risk of the comparatively deep sides becoming rammed somewhat out of truth in moulding, and this not only involves more labour in filing up the outside, but also increases the trouble of fitting the wood-blocking. I need hardly say that the fitting of the blocking needs to be very close, and in its fitting there is the risk of fracture of the casting occurring if the blocks are driven in too hard. But the more accurate the inside faces of the casting, the less risk is there of fracture occurring. If the casting is not very true, therefore, it will be a judicious plan to true and smooth up the inside with a file before commencing to fit the blocks. Of course we cannot do very much in this way, but we can at least obliterate any rough excrescences; and if the space between the sides, measured at the top edge, is slightly less than that at the bottom, we can produce a fair approach to parallelism.

If several men in a shop were to club together to make several of these planes, it would pay to have a metal pattern—casting it first from a wood pattern made as here described. The metal pattern could then be filed all over carefully, and there would be no risk of its becoming rammed out of truth. All castings would be practically alike, the pattern would be everlasting, so that any number of moulds could be taken from it. This is a suggestion which holds good with regard to many other cast-iron or gun-metal planes.

The advantage of the use of an iron pattern is chiefly found, of course, when the pattern is like its casting, as in Fig. 4. When the casting is cored out as in Fig. 7, there is little advantage in the use of a metal pattern.

A pattern for a lever, to be cast in brass or gun metal, will have to be made to the dimensions in Fig. 5, also a pattern for the pinching screw, Fig. 6 A. In each case the dimensions will be slightly in excess of those of the drawings, to allow for filing, turning, and screwing—$\frac{1}{64}$ in. will be a proper allowance on the surfaces of the lever for filing, and $\frac{1}{32}$ in. on the screw for turning and tapping.

Prepare two blocks of beech, rosewood, or ebony, and fit them into the iron carefully, using red lead paste to indicate contact, and tapping very lightly with hammer or mallet, so making a perfect bedding, without risk of fracture of the iron. The blocks should touch on the bottom, and also be shouldered to fit the upper edges neatly. When fitted, put in the wood screws. The screws should be driven in normal to the curve of the plane body, not standing askew; and their heads may stand a trifle above the face to allow of filing off level. Mark the outlines of the blocks, and work them to shape, Fig. 6. Use a parallel iron, as in the trying plane, make its bedding on the hinder block perfect, and notch the block to allow the tightening screw, A, to pass freely down. Mark the centres of the screws upon which the lever pivots, keeping them precisely at right angles with the centre line of the plane, and at equal heights from its base, so that the lever shall not stand askew. Drill holes of $\frac{1}{8}$ in. or $\frac{3}{16}$ in. diameter at these centres, file the lever true and smooth, and mark on its edges corresponding $\frac{1}{8}$ in. or $\frac{3}{16}$ in. "tapping" holes; drill and tap. Two button-headed screws will be preferable to those of the common form, which would require counter-sunk holes for their heads, and so weaken the metal near the edge of the plane. When these screws are inserted and the lever thereby pivoted, try its bedding on the cutting iron, and ease it where necessary, until it beds fair right across the iron.

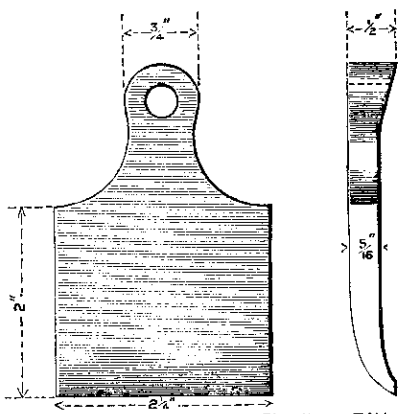


Fig. 5.—Lever: Front View. Fig. 5 A.—Ditto: Side View.

Now take the casting for the screw and chuck it in the lathe—either between centres or in some form of grip chuck—letting the free end run on the poppet centre. Turn first the end which has to be screwed, and then reversing it, turn the head. Mill the head—properly with a milling wheel in the lathe—or if such is not available, the serrations must be laboriously formed with the edge of a slitting or of a half-round file, the sharp edges being then removed with emery cloth. A milling tool used for this purpose consists of a hard steel wheel having a number of hollowed serrations around its circumference, and pivoted on the end of a stiff bit of bar iron so that it is free to revolve. The wheel may be about 1 in. in diameter more or less, by $\frac{1}{4}$ in. or $\frac{5}{16}$ in. in width. These serrations are cut in a lathe before the steel is hardened by means of a "hob," or master tap, set revolving slowly between centres, so gradually cutting the corresponding grooves in the wheel. The hob both turns the wheel and cuts the grooves. After hardening, the wheel is fit to cut a mulled head in a similar fashion. Thus, setting our brass screw revolving between lathe centres with its head next the poppet, support the shank of the mulling tool on the rest, and press the wheel against the edge of the screw head. The wheel will be thus set revolving by contact with the revolving head, and the pressure exercised will cause the hard steel to indent the soft brass, giving the counterpart of its grooves thereto. The latter must be run slowly, and the wheel be held steadily and stiffly to its work, to prevent slip, and the consequent formation of over-

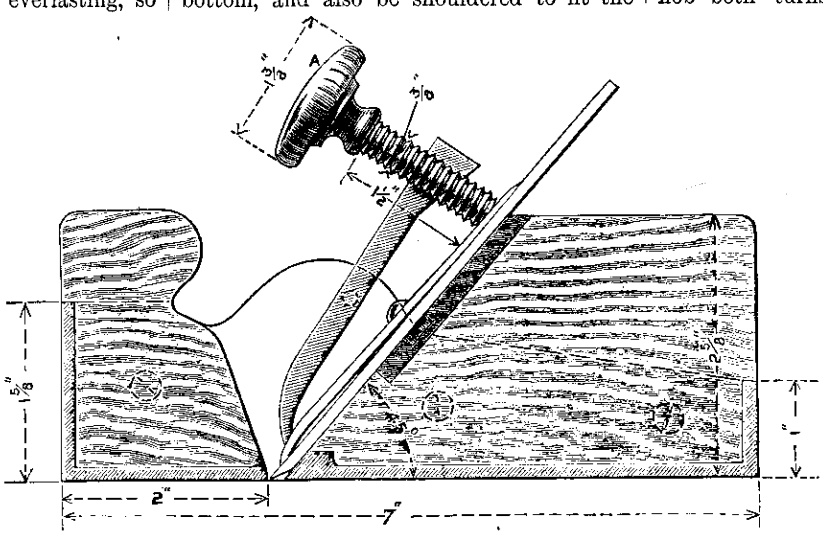


Fig. 6.—Section of Smoothing Plane, Complete.

lapping or of bastard cuts. Use $\frac{3}{8}$-in. dies for the screw. Drill the holes in the wedge to $\frac{5}{16}$ in. bare, and tap, and make the screw fit its tapped hole with as little slackness as possible.

The iron being now bedded, and the lever and screw fitted, slide the iron down into position, tighten it, note the mouth of the plane, and give to it such enlargement as may happen to be necessary to afford room for the escape of the shavings, but not a particle beyond that. Cleaning up the metal work with emery cloth, the wood work with glass paper, and polishing, will finish the plane.

Our next illustration is that form of smoothing plane called sometimes a "chariot plane." These are made in various sizes, but the dimensions given in the illustration, Fig. 7, are the most useful for general bench purposes. This plane differs from each of the forms yet described in this respect: that its pattern cannot easily be made like its casting, because of the presence of the bridge piece which takes the resistance of the wedge, and it is therefore properly cored out —that is, the interior is formed of a core made in dried sand, and prepared in a special box distinct from the pattern itself.

Fig. 8 shows the pattern of this plane with the outlines of the casting indicated thereon. Fig. 9 shows the core box by which the interior is formed. A comparison of the figures will render the following description clear :—

A piece of wood is planed to the thickness, A, corresponding with the inside dimensions of the plane, also to the depth, B, and one end is cut to the shape of the end, C. Upon this block are nailed the two pieces, D, D, forming the plane sides and the end E; and this completes the pattern. The portion marked F is the core print, into whose impression the core made in the box (Fig. 9) is placed. The core box is framed together with grooved ends, as shown in Fig. 9, and its inside length corresponds with the length, G, and its width with the width, A, in Fig. 8. Into this box are fitted the pieces shown, which correspond with the interior faces and fittings of the plane. Some of these, it will be observed, are nailed on the "bottom board," A, which is a piece of wood dowelled on the box bottom specially to carry them. The piece, B, which takes the resistance of the wedge, is slid through holes cut in the box sides, and is drawn out sideways after the core is rammed, and before the box sides are taken apart. Screws, or else wooden clamps, hold the box sides together during the ramming of the core.

I think this description will be quite clear even to those who do not happen to have any knowledge of the processes of pattern making and of moulding.

The pattern might be made equally well by making the core print continuous with the outsides of the plane, in which case the pieces which are to form the plane sides would have to be planed to thickness, cut to outline, and put on the inside faces of the core box.

It is a matter of indifference which method is adopted; the important point in either case is to have absolute coincidence of dimensions in corresponding parts of pattern and core box, so that all thicknesses, etc., shall be accurate in the casting.

The filing and fitting generally will have to be done pretty much on the same lines as in the other examples. The under face of the bridge piece should have careful attention, in order that the wedge shall slide smoothly, and bed equally on the iron. The upper face of the V piece, B, in Fig. 7, must be filed very true also, so that no possible rocking or chattering of the iron, due to imperfect bedding, shall ensue.

In order to prevent the bruising of the plane—which follows on frequent repetition of hammer blows at the hinder end, for the purpose of loosening the wedge or cutting iron—it is a frequent practice to tap a screw into the hinder end. The hammer blows are then delivered upon its head, and the body of the plane need never be struck. A $\frac{1}{4}$-in. button-headed screw will be suitable, and it should be tapped in at about the central portion of the face of the back end of the plane. The screw is turned in until its head beds down firmly upon the face.

It will be noticed that the bevelled facet of the iron is placed upwards in this example, instead of downwards, as in previous examples. This arrangement is frequently followed in iron planes, as tending to sweeter working. The angle at which the iron is set in the block is correspondingly lower, so that there is really no difference in cutting angle in the two cases. In the former, however, while the lower or clearance angle is being constantly varied by resharpening: in this it remains constant, while the angle of top rake varies with the sharpening of the bevelled facet.

The great advantage which iron planes have over those of wood is, first, that they cut sweeter than wood, being more entirely rigid; and the other, that they are unaffected by changes of temperature. For cabinet makers, pattern makers, and joiners they are, therefore, of much service. There is a good deal of elasticity inherent in a plane made of wood which is absent in those of iron. Elasticity

Fig. 7.

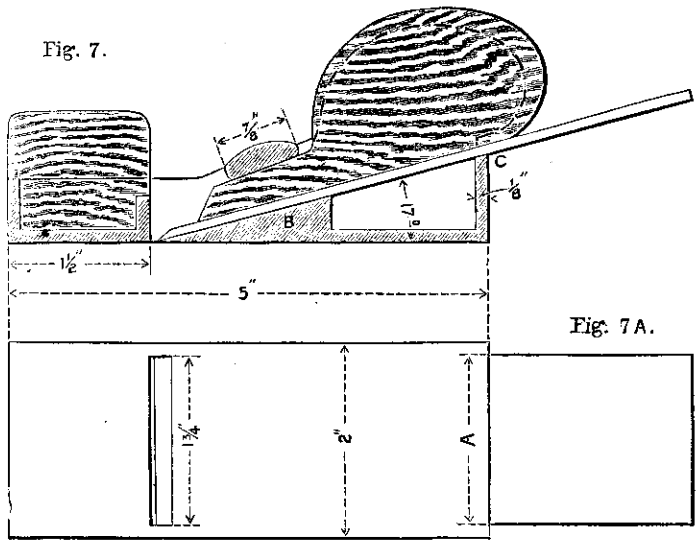


Fig. 7A.

Fig. 7.—Chariot Plane, in Section. Fig. 7 A.—Ditto, in Plan.

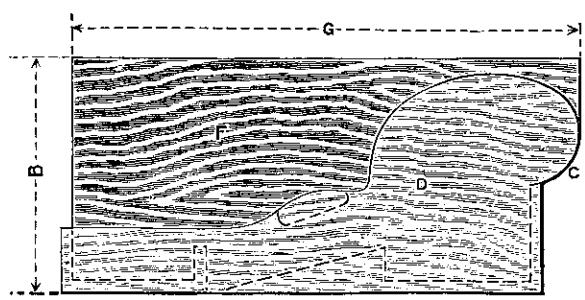


Fig. 8.

Fig. 8A.

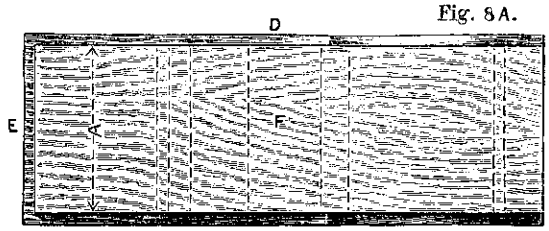


Fig. 8.—Pattern of Chariot Plane. Fig. 8 A.—Ditto: Plan.

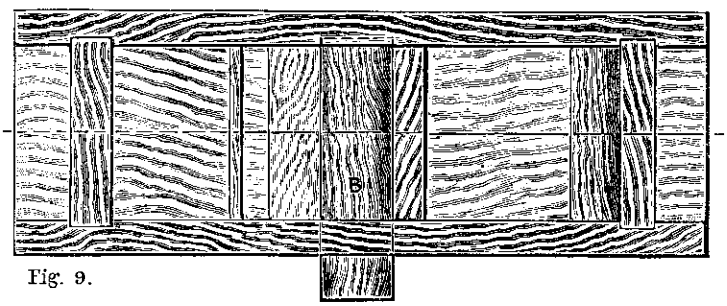


Fig. 9.

Fig. 9A.

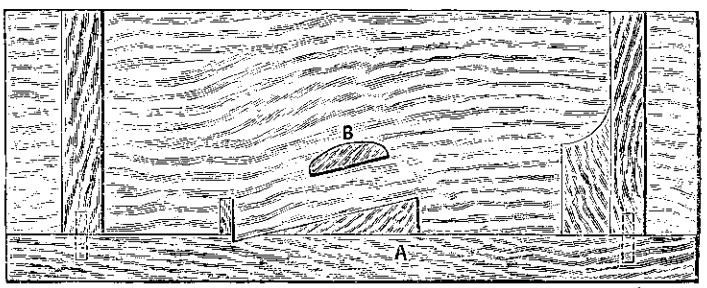


Fig. 9.—Core Box, viewed from Top. Fig. 9 A.—View of Side and Section.

of wood tends to produce more or less of chattering and choking, especially on working hard, cross-grained timber. A good iron plane having its cutting iron well fitted, well bedded, and secured, will operate in any direction or condition of the grain in a superior manner to the best wood plane.

If any workman finds difficulty in following out the instructions I have given, I trust he will communicate with the Editor and so give me an opportunity of putting him in "Shop." I shall also be glad to hear from any workman who may be desirous of information on the method that he may best follow in making any special tool that he may require. I shall always be ready to help to the best of my power.

A BLOCK PLANE AND PLANE WITH LEVER ADJUSTMENT.

BY A FOREMAN PATTERN MAKER.

A WORD IN SEASON—SHELL OF BLOCK PLANE—PATTERNS—METAL AND WOODEN BOSS—SCREW—QUALITIES OF SHOP PLANES—PIN AS FULCRUM FOR LEVER—LEVER FITTINGS—CUTTING IRON—MERITS OF WOODEN AND IRON PLANES—METAL PLATE ON SOLE OF WOODEN PLANE.

I HAVE noticed once or twice in "Shop" expressions very nearly amounting to strictures with reference to instructions given on the methods to be followed in making certain tools at home, when the tools that are described may be purchased of most hardware merchants and dealers in tools. Others again show as much desire as others evince disinclination for papers such as I am now about to write, and declare that the information that they derive from them is alike useful and welcome. Doubtless there is much to be said on both sides, inasmuch as some have neither time nor inclination to do anything of the kind for themselves, and others are better pleased to use anything that has cost them both time and trouble to make better than the best of its kind that can be purchased at the tool shops. I think myself, however, that the time spent in reading the article is by no means lost, nor the space that is taken up by it in the magazine to be regarded as wasted, for due comprehension of the construction of a tool invariably leads up to better ability to use it. It is far from likely that every reader can find equal satisfaction or benefit from the perusal of every paper, but it is possible to rest contented even with that which may not be immediately profitable to himself when he remembers their importance and utility to others.

Figs. 1 and 2 represent in plan and section the shell of a block plane, which is made either in iron or in gun metal, in various sizes, and under various modifications. It is, however, only worth the trouble of making when not of very small size; useful dimensions would average from 6 in. to 8 in. in length.

I do not show the plane complete, because the wedge and screw are precisely like those shown in Fig. 3, and the same description will apply to both. The latter, Fig. 3, shows a very neat little plane with a lever adjustment for the setting of the iron, and one that can be made without much difficulty. These are to be bought in the shops, but any one possessing a moderate degree of skill in metal working can make two or three of different dimensions for home use.

In each case construct the patterns exactly like their castings, except, that in Fig. 3, the little socketed recess in the piece A will be left to be afterwards drilled and countersunk, as also will the small holes at B and C. Lest the very thin sides should become rammed inwards or outwards by the moulder, plane up a temporary bridge of wood to just fit between the sides. This will preserve their parallelism, and when the sand is rammed sufficiently around the sides the moulder will remove it, and complete the work without risk of getting the sides away from their correct positions.

In Fig. 2 a common wood screw is cast in the metal boss, B, to receive the circular wooden boss, C, which is struck with the hammer in order to release the iron. The pattern of the arched lever, D, Fig. 3, will be cut from a bit of hard close-grained wood, also like its casting. A pattern is also made for the screw, E, whose head is milled in the

lathe. If made in gun metal the screw and head may be in one piece; if formed in cast iron the screw should be cast into the head. That portion of the screw around which the milled head is cast is made angular, square, or otherwise, to prevent it from working slack with use.

The planes sold in the shops are almost always cast in iron. But the iron is of a specially soft and tough quality such as cannot be always procured in ordinary foundries. In such cases it is much better to use gun metal which will not easily fracture. In such light castings the cost is very little in excess of iron because the labour counts for more than the metal. In any case I should have the lever, D, made in gun metal; even when made of good iron, these levers will often break when a slight excess of pressure is imparted in turning the screw for tightening the iron. I should also have the screw and milled head cast in one in gun metal, rather than cast the screw into the milled head, the screw being apt to work loose in its casting in the course of time.

When cast, file the faces, and drill the various holes required.

A pin is made to bridge across the casting at B in order to afford the necessary fulcrum for the lever. This is riveted in holes which are slightly countersunk.

For the lever fittings in Fig. 3, get a bit of steel bent round, and file it to the outlines in F, Fig. 3, and Fig. 4, filing out also the recess through which the lever, G, operates. Drill the holes, C, H; prepare the lever, G, Figs. 3 and 4; pivot it in place, and then pass the pin, C, through, which attaches the rocking lever, F, to the plane.

The assistance of a smith must be obtained for the cutting iron, Fig. 5, which will be ground to size and serrated while yet untempered. These serrations, as well as those on the rocking piece, will have to be done very carefully and regularly. They number about five or six to the ⅛ in., and are sunk to about $\frac{1}{32}$ below the level of the under face of the plane iron.

To cut these serrations, get a cold chisel of the same width, and ground slightly keener than the ordinary chisel. Lay the iron on a piece of metal, and, holding the chisel transversely at right angles with the edge of the iron, strike it a smart but dead blow. That will not only indent the metal, but will raise a burr or ridge formed by the displaced metal. This ridge will guide the chisel for the next blow, and so on in succession like file cutting. If the chisel becomes only slightly dulled, re-grind. It will be as well to practise the cutting first on a bit of wrought iron or steel before tackling the actual plane iron. A shorter but otherwise similar series of serrations will be cut upon the top of the rocking piece, Fig. 4, and care must be taken that they are both at right angles, and at the proper pitch or distance, as otherwise they will not enter and mutually coincide.

The only fitting about the lever is that involved in the coincidence of the groove, Fig. 3 B, Fig. 6 A, with the pin, and that of the front edge upon the iron.

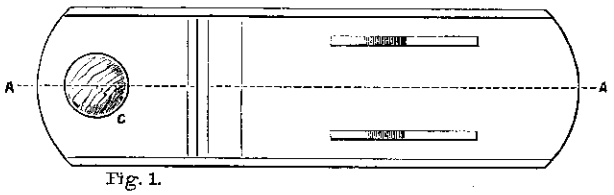


Fig. 1.

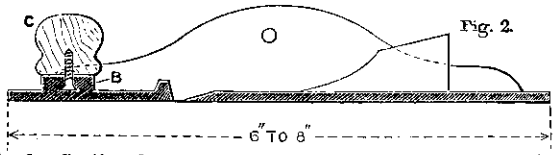


Fig. 2.

Fig. 1.—Casting for Block Plane. Fig. 2.—Section through A A.

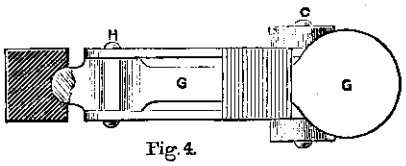


Fig. 4.

Fig. 3.

Fig. 3.—Section through Lever Plane. Fig. 4.—Plan of Lever Fittings.

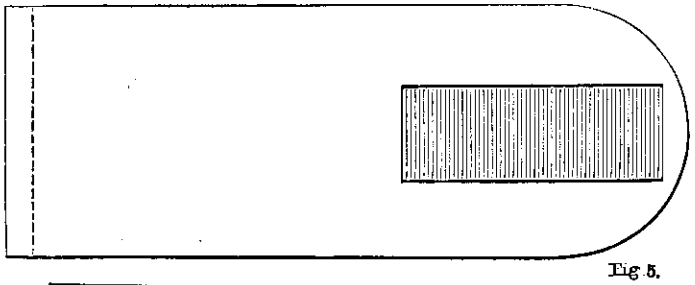


Fig. 5.

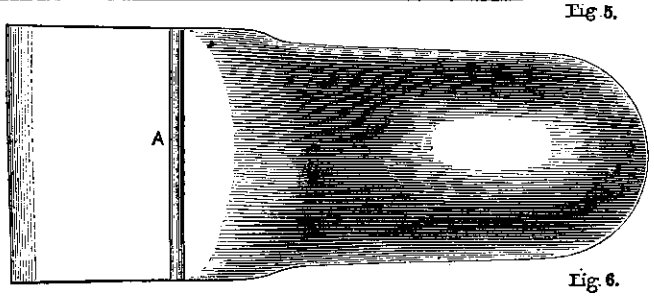


Fig. 6.

Fig. 5.—Cutting Iron. Fig. 6.—Plan of Lever.

When the iron is set approximately flush with the face of the plane, the milled wheel, E, is turned, tightening the iron. Then by the simple movement of the lever, C, upwards the iron is thrust forward, increasing the thickness of shaving: by its movement downwards the iron is drawn back for removing finer shavings. Thus no hammer is ever used on the plane.

A great deal of difference of opinion exists respecting the relative merits of wooden and of iron planes. The reason is not far to seek. Many of the planes sold are such utter rubbish that they will not stand ordinary wear and tear. A broken wedge, due to an extra turn of the screw, and a broken body due to a fall, are not unfrequent accidents. The reason is that they are too often made of the commonest cast iron; and so a tool having good inherent qualities has been consequently brought into some disrepute. But this certainly does not apply to the best iron planes, although, even in these, more care is necessary than in those of wood. An amateur also making his own planes will see to it that good metal is put into them, or will have them cast in brass. For the best indoor bench work, as cabinet making, joinery, pattern making, etc., iron planes have their own special value.

Speaking of the writer's own trade, he would deem it quite exceptional to find a workman destitute of at least two or three metal planes. One of the advantages of these tools consists in their weight, another in the greater rigidity of metal over wood, by virtue of which they readily remove fine shavings and operate on cross-grained timber; another is that the sole does not become worn out of truth so rapidly as wood, and lastly they are not affected by heat or moisture. For the lighter and best classes of work, therefore, and for some special purposes, these planes are of service, and I have preferred to describe the making of planes of metal rather than those of wood, because the latter, as a rule, do not offer the same difficulties to amateurs and workmen as the former.

Sometimes a compromise is made in the case of wooden smoothing planes by screwing a plate of metal to the wooden sole, but this has obviously only a limited application.

Referring once more to the manufacture of home-made tools, it is, of course, infinitely easier for the majority of men to work in wood than in metal; and it is this facility in wood working, as compared with dealing with metal, that inclines most men to work in the former rather than in the latter. This, however, should not altogether tend to induce men to discard metal for wood because the former happens to be more intractable.

AN IRON REBATE PLANE.

BY A FOREMAN PATTERN MAKER.

PURPOSE OF REBATE PLANE—WHY SKEW-MOUTHED—EFFECT OF SKEW-MOUTH—PATTERN FOR REBATE PLANE—CORE BOX—PRINTS—MOUTH—FILLING IN BLOCKS—DIMENSIONS—SPECIAL REBATE PLANES.

HITHERTO I have treated only of those planes which are used for working over broad surfaces, the planes being traversed sideways at will to operate on any portions of these surfaces. In another and larger class of planes the action is entirely localised in the direction of the breadth, so that they remove a narrow zone of material only. These embrace the rebates, rounds, and hollows, fillisters, ploughs, beading, and other planes. They constitute by far the largest portion of the kit of a joiner and cabinet maker, and are mostly made in wood. The simplest of all is the rebate, because it operates only on flat surfaces, the irons of the other planes, the plough excepted, being mostly of various sectional forms. In few of these is the cutting action so good as in the common bench planes; first, because they have single irons only, and second, because in many cases, as for example in the moulding planes, the proper cutting action degenerates into scraping at certain sections towards the sides of the planes, where the angle which the iron makes in relation to the sole, and which should properly be normal at every portion of the curve, cannot be maintained. Moreover, all these irons are very slight in themselves, and apt to chatter on their seats.

It is to obviate somewhat the tendency of the rebate plane to chatter that it is usually made skew-mouthed. The skewing is not great, but it has the effect of causing the iron to sever the grain fibres in detail, in the same way as a chisel when directed obliquely cuts more sweetly than when it is thrust straightforward through the stuff. Making the body of the plane of metal instead of wood extra weight is obtained, and the best results possible from the rebate plane are secured.

A common iron plane is shown in section in Fig. 1, the pattern in Figs. 4 and 5, and the core box in Figs. 2 and 3. In Figs. 4 and 5, the print, A, of the pattern is of the same thickness as the width between the inside faces of the casting. This print is planed to gauged thickness first of all, and upon it the pieces, B, which are of the same thickness as the sides of the castings, are nailed. The thickness of these sides when finished should be $\frac{1}{8}$ in. In the pattern they may be $\frac{3}{16}$ in., or a trifle more if it is intended to plane the sides in preference to filing them.

Before being fastened on, the holes through which the shavings have to escape are cut out, and usually the top edges are shaped to an ornamental outline, somewhat as shown in the figure. Note the great breadth of the print, which is quite double that of the pattern itself, in order to enable it to balance the core properly, the pattern moulding upon its side. Being so shallow it is not necessary to make any taper in the sides of either pattern or print. If made dead square, the rapping will cause it to deliver freely. This is a case where coring out is quite necessary, because the deep and narrow body of sand between the sides would not deliver from a pattern made just like its casting, except by imparting an extravagant amount of taper thereto.

The actual mouth for the iron cannot be cut in the pattern, because it would not mould properly. This must be cut through in the casting, either with a slitting file, or with a hack saw, and finished by filing to the size required.

The core box (Fig. 2) is simply a rectangular open framed box having its ends grooved into the sides in the usual way, and having a piece, A, bridging across it to act as a stop for the wedge, and also a triangular bit, B, forming a bedding for the lower end of the iron which comes just above the bevelled facet.

The filling in blocks shown at A A (Fig. 1), made of any suitable hard wood, are fitted carefully in place, using red lead to test the accuracy, or otherwise, of their contact. Before fitting them, it will be necessary to rough file the inside faces of the casting, and to check their parallelism with internal callipers, to be sure that the width at the upper portion is not less, but of the two slightly greater than the width lower down. As in the previous examples, see that the fit is perfect everywhere, and also that the bedding of the iron on its seat, and of the wedge on its iron, are perfect, in order to diminish risk of choking and chattering. The section (Fig. 1) shows the relative arrangements of blocks, iron, and wedge so clearly that further explanatory remarks are unnecessary.

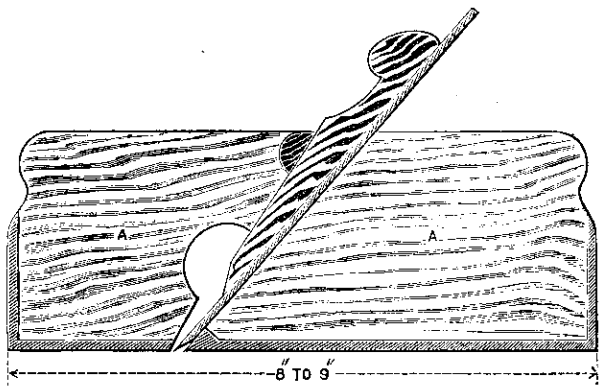


Fig. 1.—Section through Rebate Plane.

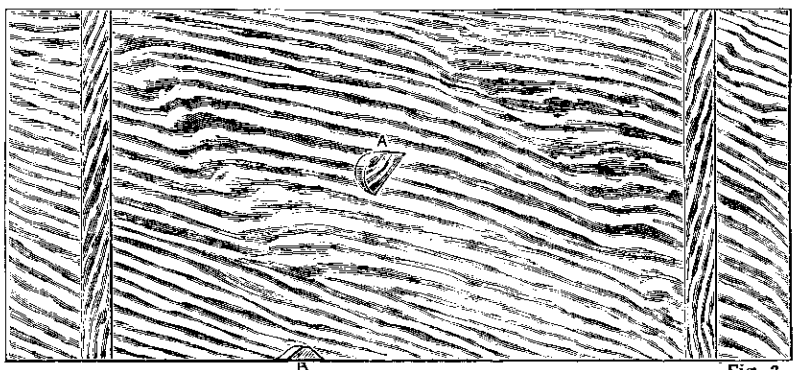


Fig. 2. Fig. 3.

Fig. 2.—Core Box for Rebate Plane: Plan. Fig. 3.—Ditto: Section.

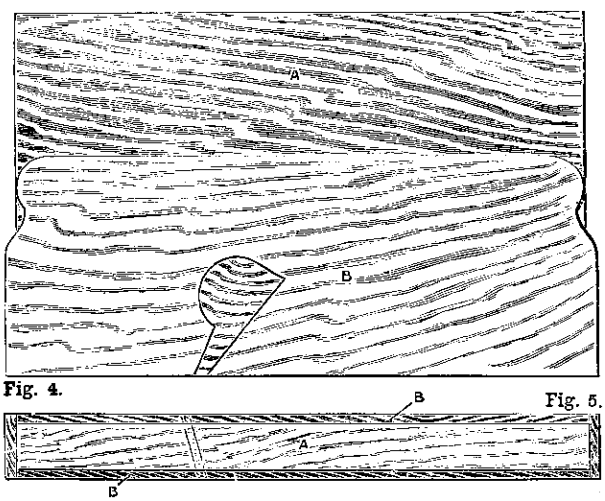


Fig. 4. Fig. 5.

Fig. 4.—Pattern of Iron Rebate Plane: Elevation.
Fig. 5.—Ditto: Plan.

I have not given many dimensions in this instance, because the drawings are proportional, and all measurements can be scaled. An ordinary rebate plane is about 9 in or $9\frac{1}{2}$ in. long. The width for an iron plane may range from 1 in. to $1\frac{1}{2}$ in.

It is not advisable to exceed $1\frac{1}{2}$ in., nor is it well to go below 1 in. in an iron plane; though in wood we may go to $\frac{1}{2}$ in. and $\frac{3}{8}$ in.

In rebates, as in smoothing planes, it is often convenient to bring the iron close to the front, for the purpose of working right up to a shouldered end. This cannot be done in a plane made of wood, because of the weakness of the short grain. But such a plane is easily made in metal. The one here figured might be modified in such a way, but usually the tool is made altogether smaller. One of this special type will be described in a future paper.

It has been advanced that no one who can buy a tool will make one; but this is by no means the case, as many a professional workman will be found who will not only make, but even contrive special tools for special purposes. Moreover, the methods of making tools described in this and other papers on the subject are useful as forming a stepping-stone to the art of pattern making, which will eventually be treated in a more comprehensive manner.