HOW TO MAKE WOODWORK TOOLS

CHARLES H. HAYWARD

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FULL WORKING DRAWINGS
OF RELIABLE TOOLS YOU
CAN MAKE YOURSELF

BY

CHARLES H. HAYWARD

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LONDON
EVANS BROTHERS LIMITED
MONTAGUE HOUSE, RUSSELL SQUARE, W.C. 1

ABOUT THIS BOOK

Although it is possible to buy most of the tools used in woodwork, it costs a lot to obtain all that you need. Some, of course, it is not practicable to make yourself—things like chisels and saws, for instance—but those which are largely of wood can generally be made successfully. Apart from the saving in money, there is a lot of satisfaction in making them yourself, and in addition the work is most interesting. One thing is certain; you come to understand their working and are consequently far better able to get the best out of them when they are the work of your own hands.

All of the tools given in this book have been made and are doing good service so that you can be quite sure that they will be really practical and will last you a lifetime. Such things as the cutters you can generally buy, so that for the most part the work is confined to wood, though in some cases special cutters are needed. There is no difficulty about it, however, since there is no tricky metal-working process to be followed.

One point should be noted. All tools require individual fitting and adjustment. If, say, a plane does not work perfectly straightway do not be discouraged. Find where the trouble is by close observation of the working. The main snags are noted in the text, but it is common knowledge that all tools have their own individual peculiarities which have to be considered. Finally, use only good, sound timber. Remember that in its lifetime a tool has to stand up to pretty heavy work, and it is an economy in the long run to use only the best.

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The BENCH

A length of 5 ft. is the minimum for a bench. Smaller work can be done on a shorter one, but when it comes to making, say, a wardrobe a fairly large top is essential to enable long parts to be planed up. For width some 22 in. is about right, and this can include a tray in which small tools can lie. The height of 2 ft. 8 in. is suitable for the average man, though it can be varied an inch or two either way.

ONE important feature a bench must possess is solidity. It must resist all the stresses to which it is liable to be exposed, and when heavy work such as chopping big mortises with chisel and mallet is done it must be free from all spring. This means that the underframing must be of stout stuff put together with strong joints, and the top must be thick and heavy. In good professional benches the top may be as much as 4 or 5 in. thick, but, whilst this is an undoubted advantage, it is not essential for the man who does just occasional evening work. We suggest, however, a minimum of 2 in. thickness. In any case hardwood should be used, beech preferably. It is not simply that a thick top is not so likely to bend and spring, but that its own weight presents a rigid resistance to blows. It is like holding a heavy hammer behind a piece of wood whilst a nail is being driven in. Its weight resists the blow.

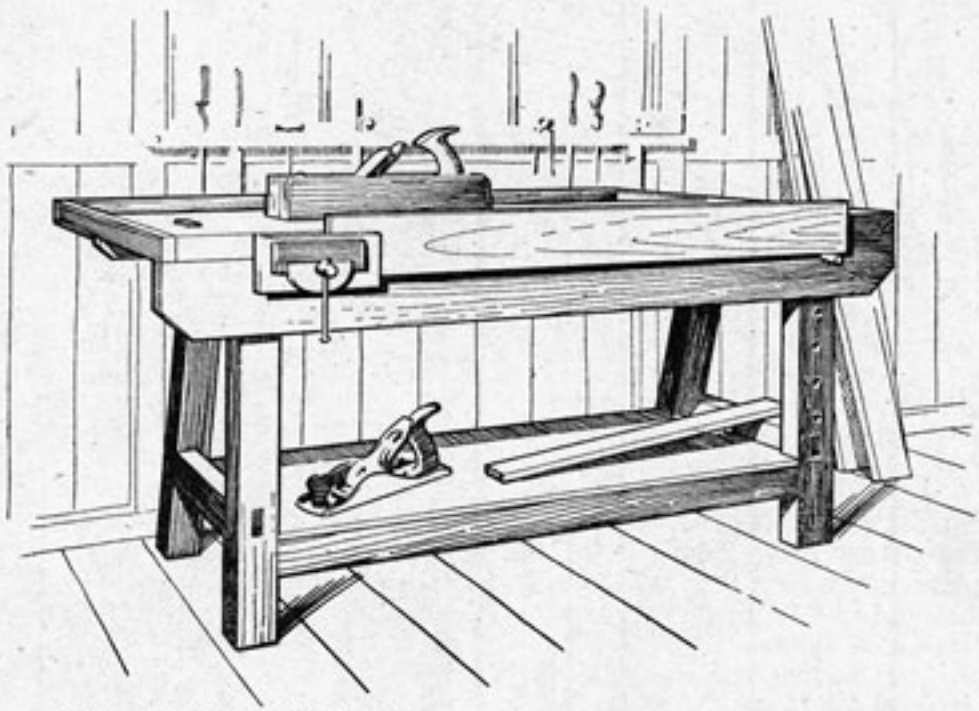


FIG. 1. OF MEDIUM WEIGHT, THIS BENCH IS IDEAL FOR THE HOME WORKSHOP
The suggested sizes are 5 ft. long by 22 in. deep, and 32 in. high, though these could be varied within certain limitations. A solid beech top is certainly advisable, and it should be as thick as possible.

The heavy framing is an obvious necessity, but, unless carefully designed, a great deal of the strength may be wasted. It is the front edge of the bench that has to take the greatest strain, and this should be well supported, not only with heavy legs, but

STIFFEN THE BENCH TO RESIST THE THRUST WHEN PLANING

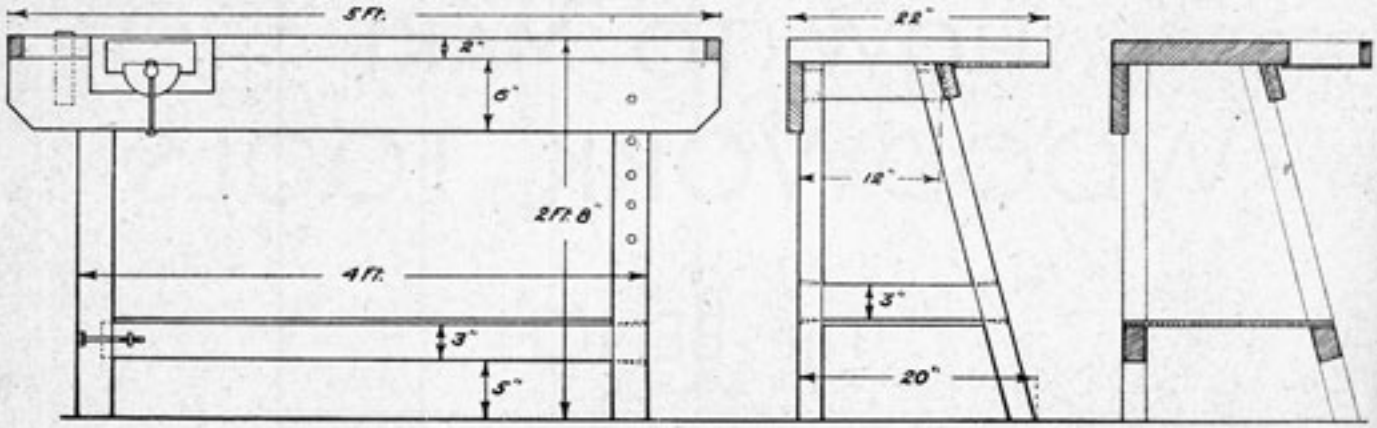


FIG. 2. FRONT AND SIDE ELEVATIONS WITH SIZES. A TALL MAN COULD MAKE IT SLIGHTLY HIGHER

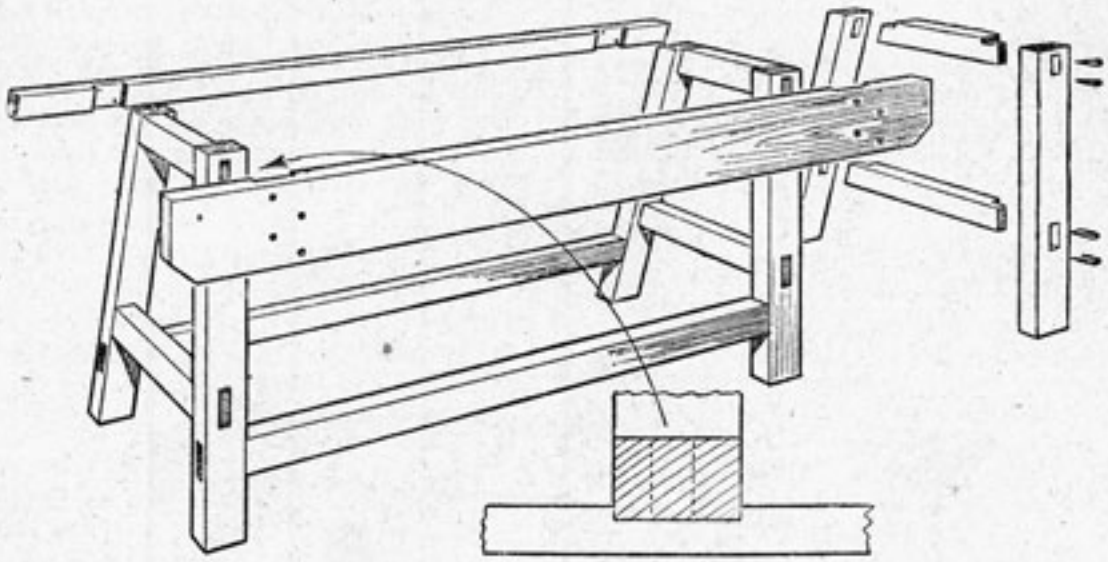


FIG. 3. GENERAL VIEW SHOWING HOW THE PARTS FIT TOGETHER

Note particularly the wide front top rail with its cross-grooves. The last named fit over the legs tightly and thus help to prevent the bench from racketing.

CUTTING LIST

	Long ft.	Wide in.	Thick in.		
1 Top	4	10	15¼	2	Beech
1 Edging	4	10	2⅛	1	Hardwood
2 Ends	1	10½	2⅛	1¼	,,
1 Bottom	5	½	8	¼	Plywood
2 Legs	2	7	3	2	Hardwood
2 ,,	2	9	3	2	,,
1 Rail	5	½	6½	1¼	,,
1 ,,	5	½	3½	1¼	,,
2 ,,	4	½	3	2	,,
2 ,,	1	2	3	2	,,
2 ,,	1	7	3	2	,,
1 Shelf	4	½	18	½	Plywood
1 Stop	0	6	2	1½	Hardwood

1 Bench vice

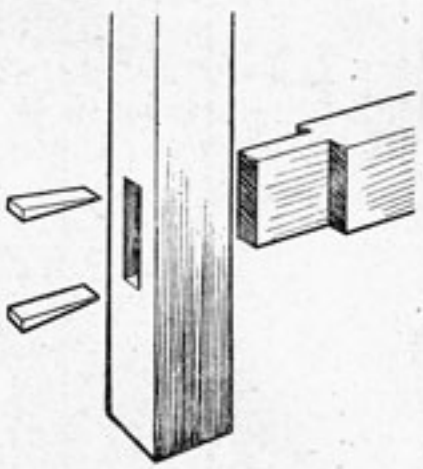


FIG. 4. WEDGED TENON JOINT

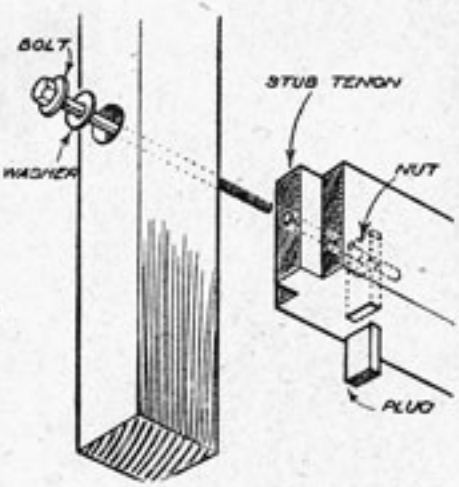


FIG. 5. STUB TENON WITH BOLT

The wedged tenon makes a satisfactory job, though it is not so strong as that with nut and bolt fixing.

also with a thick, wide rail fitted beneath. This will help to make the top more rigid, and its width will stiffen the legs against the inevitable stresses in length caused by such jobs as planing. At the extreme back the rigid support is not so essential, and in fact, if there is a tray, it is better to position the top of the legs so that they are under the back edge of the top proper. Stability at the bottom can be obtained by splaying them backwards.

In regard to general design, there is always a temptation for the home woodworker to fit out the lower portion with cupboards and drawers to hold tools. From one point of view there is an undoubted advantage in this. When the workshop is small, one is glad of the space beneath the top to provide accommodation for tools. As against this a fitted bench is never so successful from the practical point of view. To take just one example, it often happens that a stand of some kind needs to be fixed to the bench with the legs passing beneath the top. This would be obviously impossible with a fitted bench. The provision of a single drawer and a shelf, of course, is no disadvantage in this connection. In fact it should prove very useful.

For similar reasons the fixed bench is generally a mistake. There may be a slight saving in material by fixing it at the back to the garage wall, but this is more than counterbalanced by its awkwardness. Consider the position when a wide table top, or whatever it may be, has to be planed up. There simply is not room for it on the bench. If, however, the bench is movable it is just a matter of pulling it out from the wall, allowing the top to project at the back. One other point in the same connection is that the top must not have any projections of any kind. Some vices are designed to screw at the bench edge, and they stand up above the top. These are a mistake for a permanent bench, because they prevent a wide piece of wood from lying flat.

A 5-ft. Bench.—Fig. 1 shows a useful bench which includes the features mentioned. It has a 2-in. top (this could be increased) with tray at the back, and heavy underframing with strong joints. For the last named an alternative is given. The stronger of the two is the bolted joint which has the additional advantage of taking to pieces, enabling the whole to be stacked away. The wedged tenon, however, will make a perfectly strong job—especially if hardwood is used.

Fig. 2 gives the main sizes. Note specially the wide, front top rail. Being notched over the legs (see Fig. 3) it prevents the bench from racketing from side to side as well as giving good support to the top just where it is needed. The back legs are splayed backwards so that the bench has ample stability, and at the same time give direct support to the thick top.

Joints.—Assuming that the wedged tenon joints are to be used, the two end frames should be made first, and, to enable the exact slope of the shoulders to be obtained, it is advisable to set out the frame in full size. Allow at least ½ in. extra length at the top so that when the wedges are driven in the wood does not split out. Fig. 4 shows the joints in detail. At the top, of course, the tenon must stand down.

Whilst marking out the bottom joints the front and back rails can be marked. Note that these are below the side rails, a ½-in. gap being allowed between so that the plywood shelf can be inserted. It will be realized that all joints have to be squared round, and that about ¼ in. extra at each side has to be allowed, at the outside to enable the wedges to be driven in. Remember that in the back legs the marks for the mortises have to pass through horizontally which means that the adjustable bevel set to the required angle has to be used.

If the bolted joint is being used (it can be used for front and back rails only if desired as these take the greatest strain), stub tenons only are cut as shown in Fig. 5. The bolt head is recessed into the wood, and a hole to take the shank of the bolt is bored right through from outside with the tenon cramped temporarily in position. About 2½ in. from the shoulder a recess is cut at the underside to enable the nut to be passed upwards opposite the bolt hole.

When assembling, the side frames are put together first. The front and back rails then follow, the shelf being slipped in at the same time. The corners of the shelf must be cut to fit around the legs. The top front and back rails have grooves cut across them to fit over the legs, and these must be a tight fit. They are held with screws as in Fig. 3.

Top.—The beech top is 2½ in. short of the over-all length to enable the 1¼ in. end pieces to be nailed on. The back of the tray fits between these end pieces, and the bottom is screwed or nailed on underneath. The stop can be simply a piece of hardwood about 2 in. by 1½ in. in section fitting tightly in a hole cut for the purpose. A hole towards the other end should be bored to enable a bench holdfast to be fitted. Screws driven upwards from underneath hold the top in position. It can be pocket screwed at the front, but all other screws are put right through the rails, the holes being made full to allow for a certain amount of shrinkage.

Various kinds of bench screws can be fitted. The metal type is usually used nowadays, and is very satisfactory. It needs to be cut into the front rail and is generally screwed on underneath. It may need either to be packed up a trifle, or, in the case of a thick top, to be let in somewhat. The holes in the right-hand front leg (Fig. 1) are to enable a peg to be knocked in to support long pieces of wood when being planed.

If desired, a drawer can be added beneath the top rail. Fillets are fixed to the sides at the top, these engaging in rebated bearers screwed beneath the bench rails. A hanging block must be added at back.

The TOOL CHEST

It may be said at once that a carpenter's chest is only worth making if it is to be full size. By "full size" means that it should provide for the accommodation of hand and rip saws, jack and try planes, as well as a kit of ordinary tools. The reason is that it must be convenient as well as soundly made, and to spend time on a chest which, later, may prove too small will result in disappointment.

THE size shown, 3 ft. 2 in. by 2 ft. by 2 ft. over all, may be taken as adequate. In many cases a slight reduction is possible, always remembering that the inside length must accommodate the largest saw. With regard to width and height we would put the minimum at, say, 21 in. by 21 in. Of course, for purely household use, a smaller and lighter chest might be constructed on similar lines.

Carcase.—Excluding the skirting boards, the carcase length is is 3 ft. and the width 22 in. The height of sides, excluding bottom, is also 22 in. Front and back are each made up of four boards grooved and tongued together (see Fig. 2). The ends are similarly made up of four boards; but (as in Fig. 3), in order that the joints do not coincide with those of front and back one board is halved and the two narrow pieces placed top and bottom. Deal or other sound whitewood may be used, and the boards may be of stock 6 in. by 1 in. grooved stuff, or 5½ in. by ⅞ in. stuff will serve if the worker does his own grooving. The four sides are dovetailed together (Fig. 4), using as many tails as may be convenient.

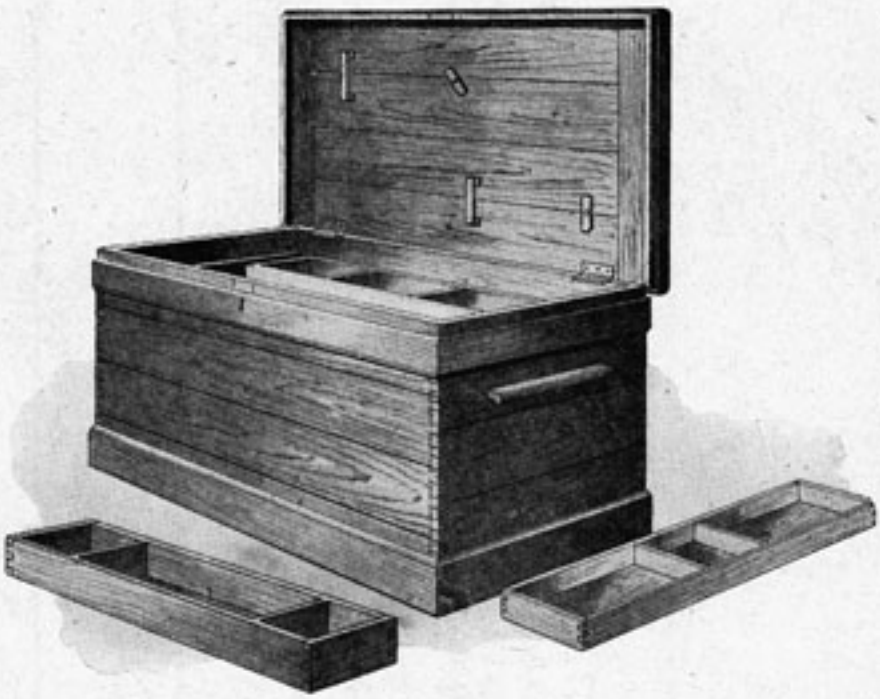


FIG. 1. A COMMODIOUS CHEST WITH AMPLE ACCOMMODATION FOR THE COMPLETE KIT

Main sizes are 3 ft. 2 in. long, by 2 ft. wide, by 2 ft. high. There are three sliding trays in which smaller tools are kept. Below is space for large planes and other items which take up space. Along one side are racks for saws and chisels.

The bottom is made with similar boards, preferably 1 in. thick, these (for strength) being fitted crosswise (Figs. 2 and 4). They are screwed on.

Skirting and Rib.—The skirting is of 5 in. by 1 in. (or ⅞ in.) board. In the strongest way it should be dovetailed at the corners and this joint is strongly recommended. Otherwise it may be mitred. Chamfer the top edge and nail on around to sides and bottom. The rib is a similar piece, but only 3 in. wide. Note that it is placed about ¾ in. down from the top of sides so that the rim of lid closes on it. Like the skirting it is dovetailed (or mitred) at the corners and nailed on.

Lid.—This is 3 ft. 2 in. by 2 ft., overhanging the carcase by 1 in. on all four sides. It is made up of four or more boards tongued together, these being clamped at the ends with 3-in. clamps (see Fig. 4). It is an advantage if the clamps are of hardwood such as birch or ash, and a thickness of 1 in. is better than ⅞ in. For strength it is desirable for the clamps to be grooved with mortises cut (right through) to take half a dozen tenons. In this way there is no risk of the clamps working loose.

It will be seen that the lid has a rim (Figs. 2, 3, and 4) at sides and front which comes over the chest sides and rests on the ribs. This rim may be of hardwood 1 in. by ¾ in. and is grooved in as indicated. On account of the hingeing (X, Fig. 2) there is no rim at the back, and the side rims are rounded off at the back to clear the rib (see X).

For hingeing it is wise to use a pair of 3-in. solid drawn brass butts. These are 1¾ in. wide when open. They are fitted as at X (Fig. 2), beds being cut for both flanges.

Handles.—A strong iron or brass handle may be fitted to the chest at each end. Alternatively, wood handles could be used (see Y, Fig. 6).

Stand.—It is often an advantage to fit a tool chest of the kind on a stool, or stand, so that the top

JOINTS IN SIDES AND ENDS SHOULD BE STAGGERED

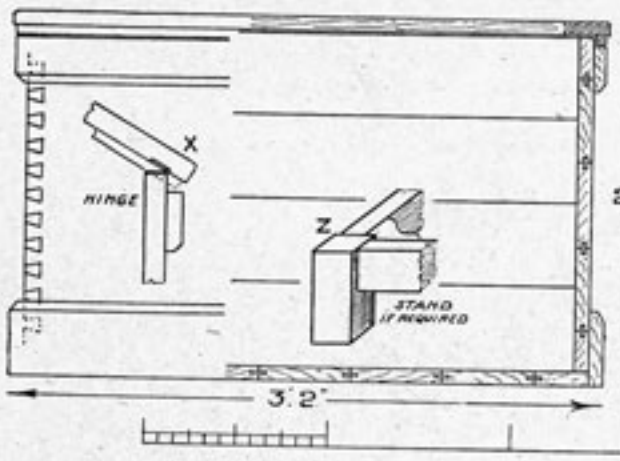


FIG. 2. FRONT ELEVATION WITH SCALE

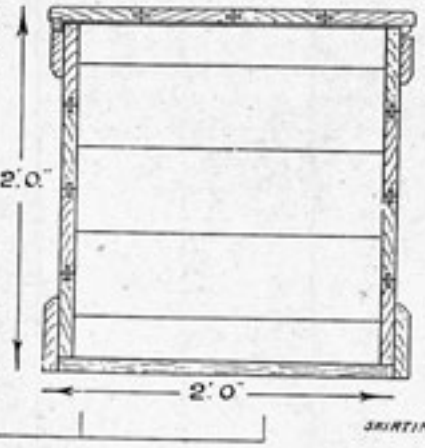


FIG. 3. SECTIONAL END VIEW

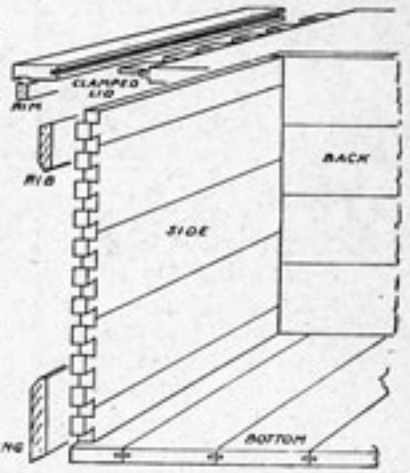


FIG. 4. CARCASE CONSTRUCTION

may be raised to table height (say, 2 ft. 6 in.). Such a stool can be made as at Z (Fig. 2), using legs 6 in. by 2½ in. square and rails 2½ in. by 1½ in. The rails will be tenoned in and braced at the corners. Over-all size may be 3 ft. by 22 in., the chest being held with a few screws through the bottom so that it may be removed at any time.

Interior Fittings.—We do not buy a kit of tools to suit a certain chest; we construct the chest to accommodate our tools. Thus the interior arrangement can only be determined by the worker himself. The suggestions at Figs. 5 and 6 follow what is customary, and modification can be made according to individual requirements. One general principle holds good. Without a regular workshop, wholly our own, tools cannot always be ready at hand. Chests are invaluable for the preservation of our tools; but in planning the interior it is necessary to so scheme that those in everyday use are ready at hand, whilst others less frequently required are stored below.

All such chests have two features. First, provision is made for saws; a special compartment for hand and rip saws, whilst the tenon and dovetail saws are held on the underside of lid. Then, for smaller tools, nails, screws, hinges, and sundries sliding partitioned trays are provided. These, as seen in Fig. 5, slide backwards and forwards so that any one is readily accessible; the contents of two can always be exposed, whilst the third is reached at once simply by sliding the other.

The saw compartment, at front (to hold three hand or rips), may be 4 in. wide. First, a partition (A), about 13 in. high, is fitted lengthways. (And here it may just be said that, if such partitions are fitted between two ¾ in. square fillets instead of being permanently nailed, their positions may be altered at any time.) Then, about 6 in. from each end, two racks (B) are fitted. With three long slots cut as shown, these will hold three saws, two with their handles at one end and one with handle at other side. Provision for tenon saws, etc., on lid can be made as indicated in Fig. 1.

Sliding Trays.—In depth these may be 2½ in., 3½ in., or 4½ in. respectively, but on this point the worker must decide for himself. They are arranged to slide on boards C, D, and E. In cutting the stuff for these allow (1) for the top tray to stand down about ¾ in. from top of chest side; (2) for about ¼ in. clearance between each tray, and (3) for each tray to slide just sufficiently far to clear the contents of the one below. Apart from these points the sketches are self-explanatory. Ledge E is better if in hardwood.

The second and third trays will, of course,

(Continued on page 13)

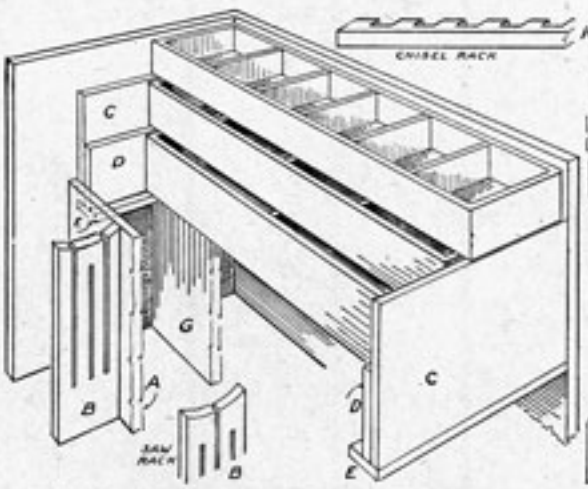


FIG. 5. SUGGESTED INTERIOR FITTINGS

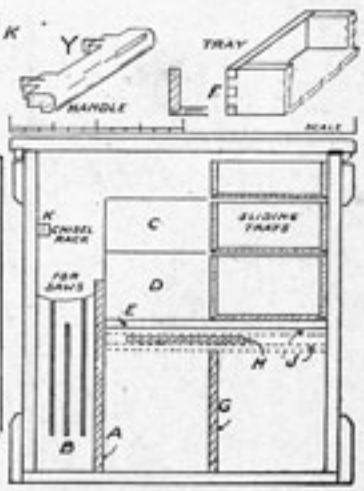


FIG. 6. SECTION OF FITTINGS

PLANES

Jack : Trying : Smoothing

Since the general construction of all wooden planes is much the same, we give on the opposite page details for making a jack plane. These details could be adapted for making either a trying plane or a smoothing plane, though in the latter case it may be desirable slightly to alter the pitch.

IN the simplest way a plane can be made in two halves, these being reinforced with dowels, screws, or bolts. The advantage of this method is that the saw can be used largely in removing the waste. Readers interested in making the plane by this method should turn to page 9 where such a method is described in detail. See also page 12. For a really sound job, however, the better plan is to make the plane out of a solid block of wood. Beech is usually selected but many successful planes are also made in pear wood. If you use beech try to arrange that the medullary rays are as nearly vertical as possible.

Planes may vary in size within a little. For instance a jack plane may have a 2-in. cutter in which case it would be 14 to 16 in. long. If a 2¼-in. cutter is used the length is usually increased to 17 in. Smaller planes than this are not advisable.

Marking Out.—Prepare the block to the finished over-all size and on one side mark out the mouth and escapement positions. The frog or surface on which the cutter lies is marked first, and, as this is at 45 deg., the ordinary mitre square can be used. It is advisable to obtain the cutter with its back iron before starting, because the thickness of this necessarily controls the width of the mouth. Keep the mouth size fine—you can always enlarge it later if necessary. Square the lines across the sole and the top where necessary, and with a gauge mark in the various widths. If you are using a 2-in. cutter the width can be 2⅛ in. at the top. This allows the cutter to be skewed over if it is sharpened slightly out of square. Note how allowance has to be made for the wedge.

Removing Waste.—You will appreciate that the difficulty in this part of the work is that, at the beginning at any rate, it is extremely difficult to use a saw. Professional plane makers have a special saw somewhat in the form of a key-hole saw but much wider and thicker, this being inserted after preliminary holes have been bored. However, the work can be done with a key-hole saw ; it just takes a little longer. First bore away the mouth, using a bit slightly smaller than the mouth width. You will realize that the brace must be held at a slight angle because the surface in front of the mouth slips slightly backwards. Bore the holes as close together as possible—there is no need to take them in more than 1¼ in. because the boring at the escapement at the top can be done with a larger bit and this meets the holes bored from the mouth. This second boring from the top now follows. All of the holes towards the rear will have to be at an angle because of the slope of the frog.

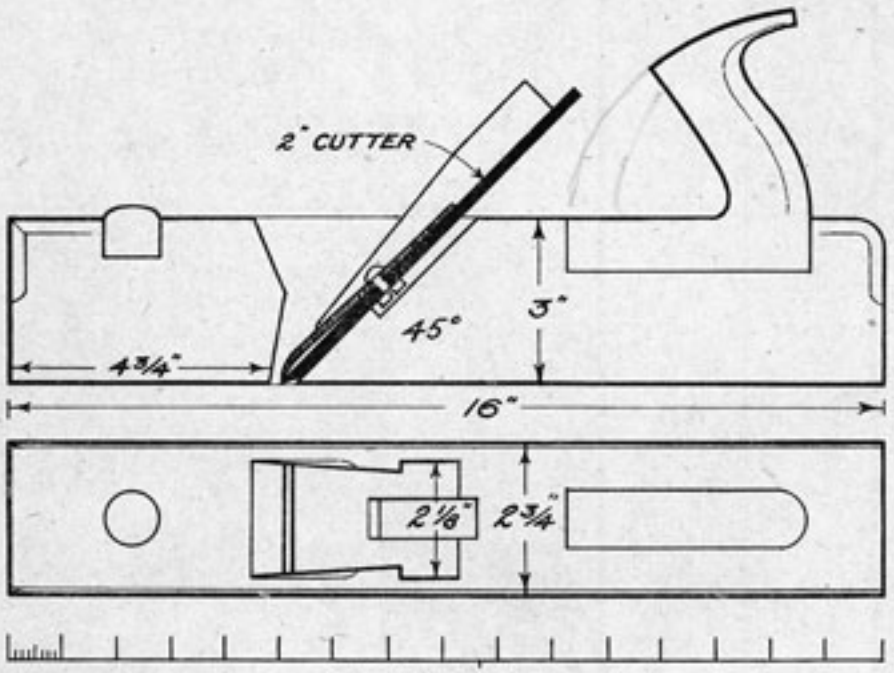
Chopping Out.—Reverse the plane sole upwards and chop away the mouth with chisel and mallet just short of the finished size. This will probably enable you to insert a key-hole saw, and once a cut right through can be made with this the work is considerably simplified. When you reverse the wood and begin chopping from the top ignore the slot for the wedge for the time being. This can be cut in afterwards. One point you will realize is that the frog must be perfectly true, and, since this part of the work must be largely done with the chisel, it is exacting work, especially as the cut is taken largely across the grain. A strong, thick chisel is especially necessary because a thin one is liable to bend and possibly chatter under the strain. As a matter of fact the professional plane maker uses a large chisel with a specially long handle which reaches up to his shoulder, enabling him to exert considerable pressure.

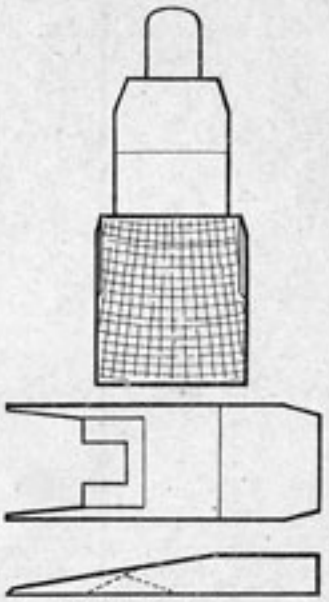
You can buy the handle ready made and cut the slot to accommodate it. At the front a striking pin is desirable and from choice it should be of box wood with the grain vertical. When you make the wedge cut it fully to the sizes shown and fit it with the cutter and back iron in position. The taper must fit all the way down on both sides ; that is to say, there should be no tight or slack parts anywhere.

Finally the truing of the sole should be done with the cutter and wedge in position, the former being knocked in about ⅛ in. so that it does not foul the plane being used. In this way the sole is trimmed with the plane in its working condition under stress from the wedge. You will find, however, that any new plane gives under this stress far more than an old one, and the probability is that having trued the plane one day you will find that the wood behind the cutter at the sole has risen somewhat after a few hours. Further trimming is needed.

In the case of the trying plane, the usual length is 22 in. with a 2½ in. cutter, though some workers prefer a 2⅜ in. cutter. The work is identical with that described for the jack plane. The smoothing plane may have a cutter either 2¼ in. or 2⅜ in. For cabinet-making the latter is generally used. For normal work the pitch of 45 deg. is maintained, but cabinet makers who have to deal with difficult grain which may be liable to tear out often give what is known as " York pitch." This is 50 deg. and gives the plane more of a scraping than a cutting action. All the cutting away of the escapement is done before the sides are rounded.

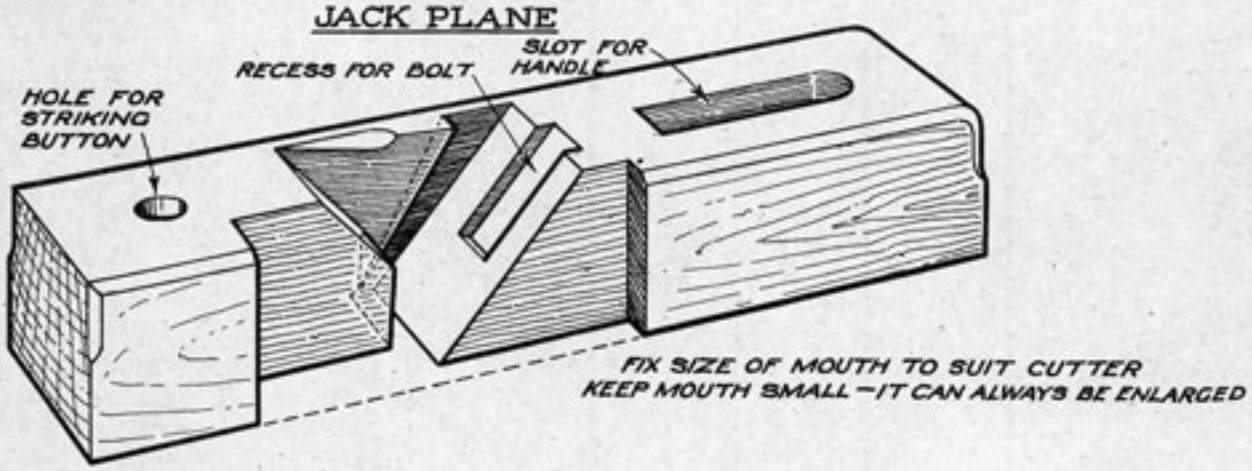
DETAILS OF JACK PLANE, AND SIZES OF SMOOTHING AND TRYING PLANES

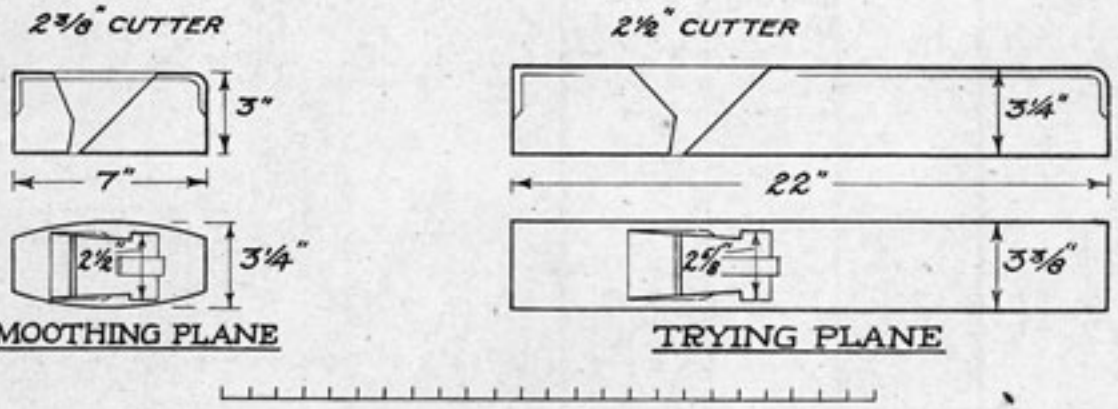




WEDGE

JACK PLANE





SMOOTHING PLANE

TRYING PLANE

ADJUSTABLE CHAMFER PLANE

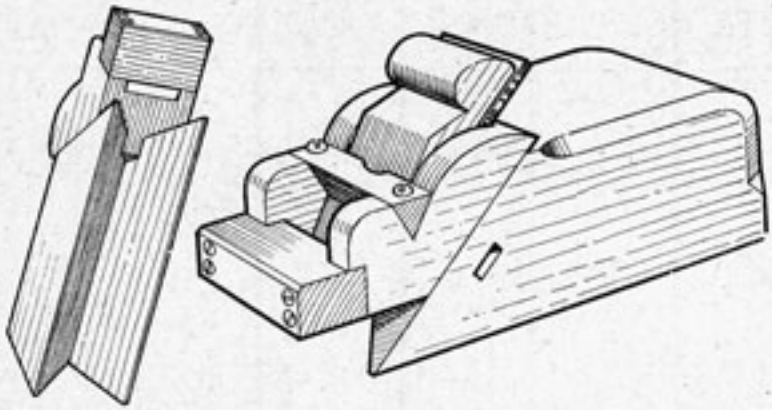


FIG. 1. TWO VIEWS OF THE COMPLETED PLANE
The left-hand drawing shows the plane tilted upwards revealing the sole. It will work any chamfer, at 45 deg., up to the limit of its cutter, 1½ in.

The chief advantage of the chamfer plane is that it enables any number of pieces to be chamfered to exactly the same depth without previous marking out, and all to the same angle. Furthermore it can be used for working stopped chamfers, a special bullnose mouth being fitted for this purpose.

THE main chamfer body is V grooved at the bottom, the sides sloping at 45 deg. and thus meeting at 90 deg. These sides act as fences or guides, ensuring the chamfer being worked at 45 deg. The front is cut at 45 deg., and the plane body (cut at the same angle) is free to slide up and down, being held in position by a tongue. A bolt holds the two parts together in the required position. The cutter, a 1¾-in. Stanley grooving iron, is held by a wedge.

Use.—The plane body is set so that a chamfer of the required size will be produced (it will be realized that the plane ceases to cut automatically when the depth has been reached, since one sloping side of the chamfer body acts as a depth gauge whilst the other forms a fence). The chamfer width is decided by measuring across the plane face the distance between the sloping sides. Having tightened the bolt the cutter is placed in position, sighted, and the wedge knocked in.

When using the plane start at the far end and bring the plane a little farther back at each successive stroke. It is held at an angle, of course, the sloping sides acting as a guide. It is awkward to start a shaving at the near end owing to there being no guide beneath the front of the plane. All you need to do, however, is to reverse the plane and work the opposite way.

In the case of a stopped chamfer a cut about ⅜ in. or ½ in. is chiselled immediately against the stop. Then, when the bullnose mouth is substituted (it is only ¼ in. wide) the plane can run out into this stop. For general working, however, the normal

(Continued on page 11)

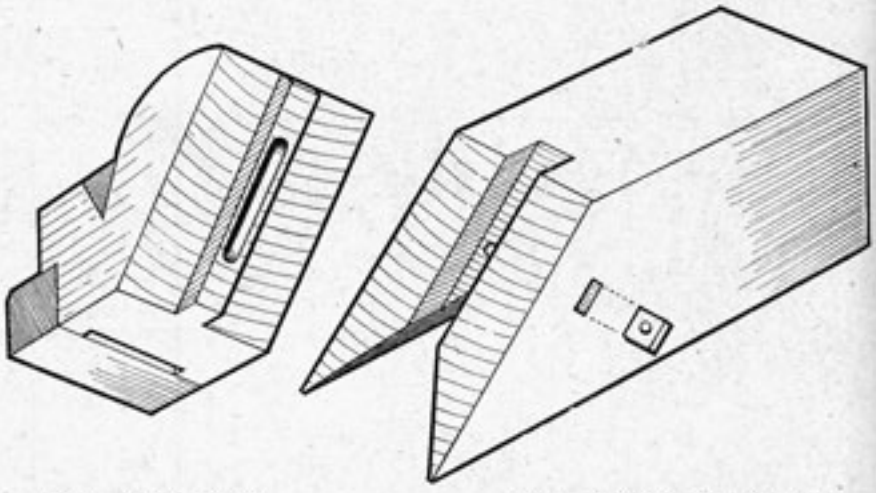


FIG. 2. PLANE BODY

FIG. 3. MAIN CHAMFER BODY

This shows clearly the two main parts and how they fit together. The position of the plane body on the chamfer body fixes the depth of the chamfer. The normal mouth is used for the general run of work, and the bullnose mouth substituted when stopped chamfers are required.

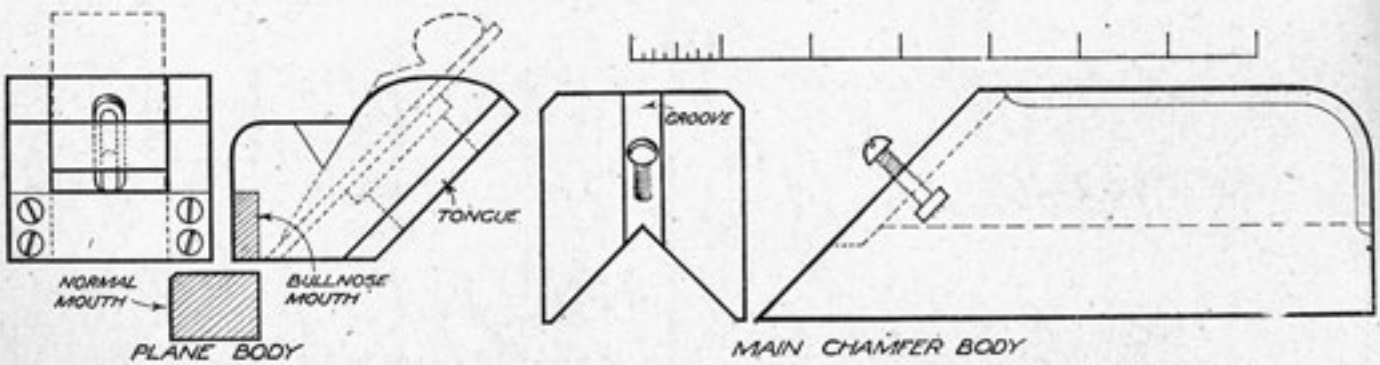


FIG. 4. SCALE ELEVATIONS OF THE PARTS. BEECH OR SOME OTHER RELIABLE HARDWOOD SHOULD BE USED

TOOTHING PLANE

This is invariably made by the craftsman himself, and the method shown here is usually adopted. Actually to cut it out of a solid block makes a better plane, but it takes much longer and is an awkward job at best.

THERE are two main uses of the toothing plane; to roughen the surface to give a key for the glue when veneering or for a wide joint, and to take out the plane marks after the surface has been trued up with the panel or trying plane. It, therefore, has a cutter the back of which is scored with fine grooves so that, when sharpened, the edge presents a fine saw-like appearance. This cuts a series of fine scratches.

In the best work a toothing plane is made in a single block of beech, but you will appreciate that it is an awkward job to cut out the mouth and the escapement because it is practically impossible to insert a saw in the opening. (Plane makers have special saws which they use). This means that the waste has largely to be bored away and then chopped with the chisel. Here, however, we show a simpler alternative in which the plane is made in two halves, the joint running longitudinally from back to front. Dowels are used to strengthen the joint. In this way it is easy to saw down and then chisel away the waste, gluing up the two parts afterwards.

If possible have the grain so that the medullary rays are more or less vertical (Fig. 1). This gives the sole greater resistance to wear. Plane the two pieces square and form a perfect joint, marking face side

(*Continued on page* 11)

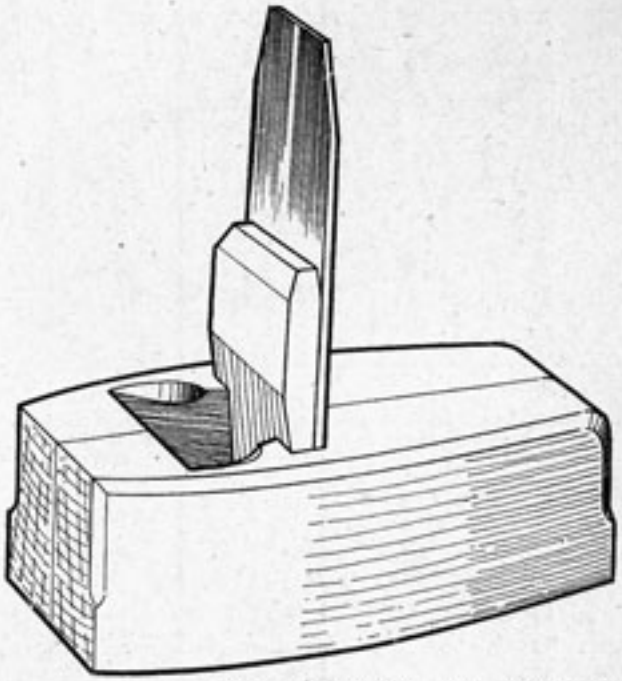
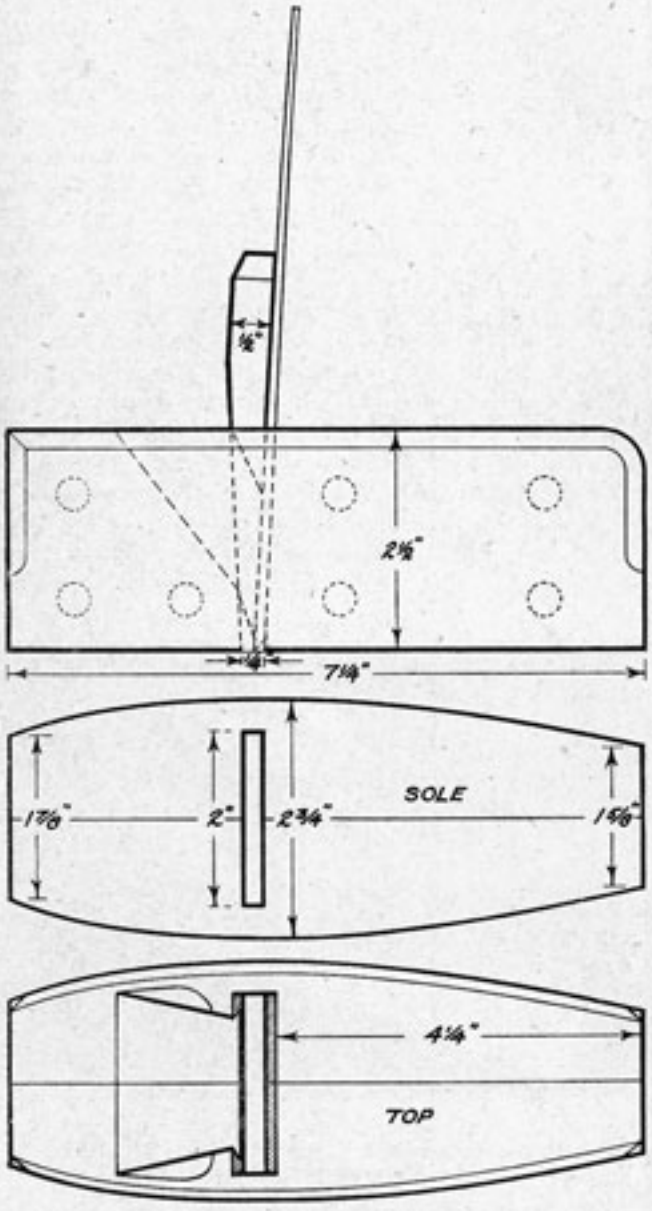


FIG. 1. ESSENTIAL FOR VENEERING
This is used to roughen a surface to provide a key for the glue, and to take out plane marks.



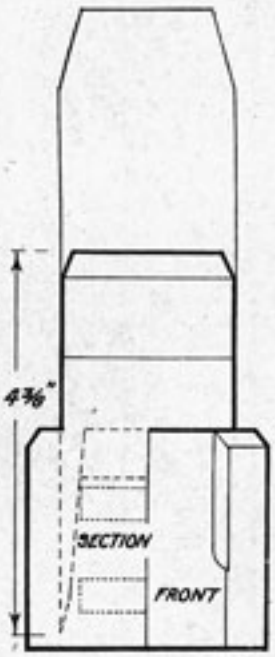


FIG. 2. ELEVATIONS, PLANS, AND FRONT VIEW

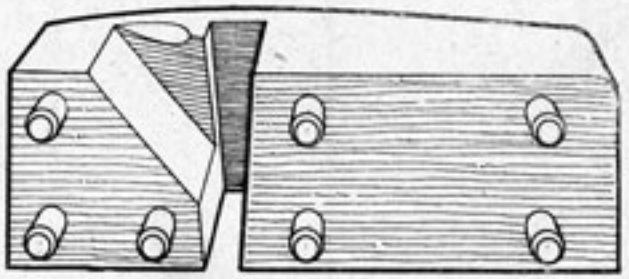


FIG. 3. HOW HALVES ARE JOINTED TOGETHER

SIDE REBATE PLANE

All practical men know how awkward a job it is to increase the width of a groove after it has been cut. The chisel is difficult to manipulate, especially when only a small amount has to be removed, and an ordinary bullnose or rebate plane is useless because it cannot lie on its side in the groove. The plane shown in Fig. 1 is intended specially for this work. The mouth is at the side of the plane instead of underneath, and shavings can thus be taken off the sides of the groove as shown in Fig. 2.

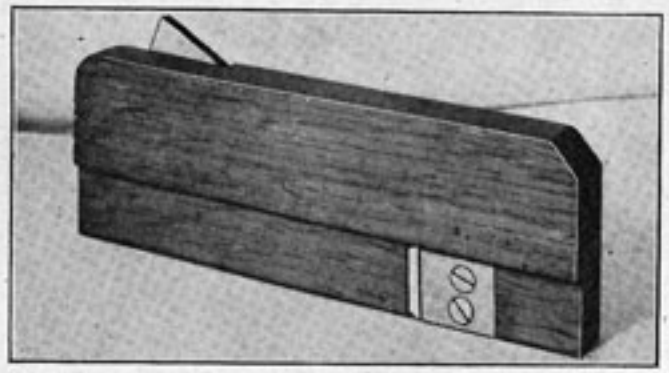


FIG. 1. SIDE VIEW SHOWING THE BRASS MOUTH
Although not essential the brass mouth gives the plane a much sweeter cutting action. It also helps to minimize the wear on the working face.

AN example of the usefulness of this plane is that of fitting shelves to, say, a bookcase in which the ends are grooved. Normally if the shelves were too tight a fit, one would take a shaving off the ends, but complications sometimes arise owing to just one groove being too narrow. To make all the shelves interchangeable all would have to be reduced to suit the narrow groove, and this would mean that they would make a loose fit in the remaining grooves. By using this plane the faulty groove can be corrected.

It is obvious that the plane cannot work in a groove which is narrower than the thickness of its lower part, and this is a point to consider before the plane is started. The plane given has a thickness of $\frac{3}{8}$ in. at the bottom, so that it will work in any groove of greater width than this. This will be found suitable for the vast majority of jobs.

Any hard, reliable hardwood can be used. The plane in Fig. 1 is of oak, and it has given many years of good service. A brass mouth is fitted, as this gives it a cleaner cutting action and reduces wear. The cutter is a $\frac{3}{8}$ in. iron from a Stanley plough plane, but any similar cutter could be used.

Setting out.—Assuming that the sizes in Figs. 3-5 are being followed, there is no need for a drawing to be made because the whole thing can be set out on the wood itself. There is one small complication that may prove a trifle fogging at first, and this is the fact that the sloping groove in which the cutter lies is tilted over at a slight angle, so that one side is deeper than the other when measured at points opposite to each other at right angles. This is because it would otherwise be impossible to set the mouth at right angles with the bottom of the plane. It sounds more complicated than it actually is, for in fact it works out that the depth of the groove is the same at any two *vertically* opposite points. In this way it is obvious that the mouth will be at right angles with the bottom because the top of the mouth is necessarily opposite the bottom.

Cutting the Groove.—First cut out the main stock to the over-all sizes given. The use of the scale in Fig. 3 will show these. Work along one side the rebate where the mouth occurs, and square the latter round all three sides. Mark in the slope of the cutter groove at the side as in Fig. 3, and at the top edge mark its slope. To cut the groove the best plan is to make a saw cut at the mouth and saw in the sides as far as practicable. A quick gouge can be used to remove the majority of the waste, and, the saw cut at the mouth being made, the gouge can run straight into it enabling the waste to separate easily.

It is advisable to make the groove of the same depth at both sides at first, and then gradually ease away the upper side until the correct angle is reached. An excellent plan is to cut a dummy cutter of wood of the same size as the steel one, cutting the end at the correct angle and bevelling it. This can then be laid in the groove and will prove a guide as to when the groove is correct.

It will be found that theoretically the groove will run out to form a feather edge across its width at the mouth. In practice it is as well to allow a very slight thickness as a feather edge is liable to crumble. Most of the waste can be chiselled away after the preliminary gouging, but a file can be used with advantage afterwards to make the bottom perfectly level.

The Mouth and Wedge.—Note from Figs. 3 and 6 that where the brass mouth is fitted the wood is cut well back. This enables the shavings to clear easily. The brass can be $\frac{1}{16}$ in. or more in

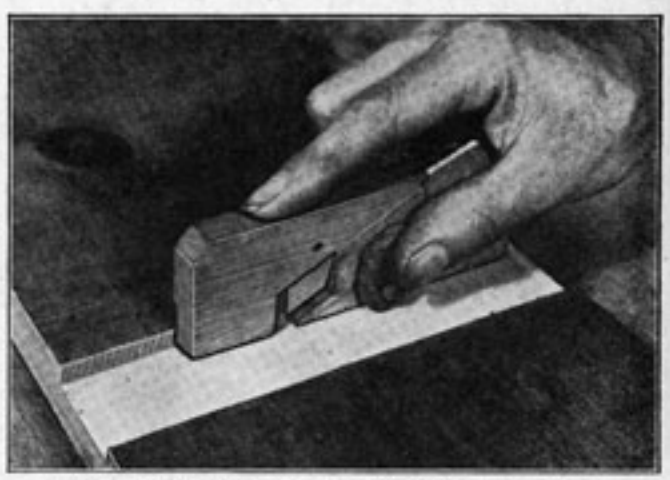


FIG. 2. THE PLANE IN USE TRIMMING A GROOVE
The main use of this plane is in slightly enlarging the width of a groove. To cut away the wood with a chisel is awkward, and no other plane can be used.

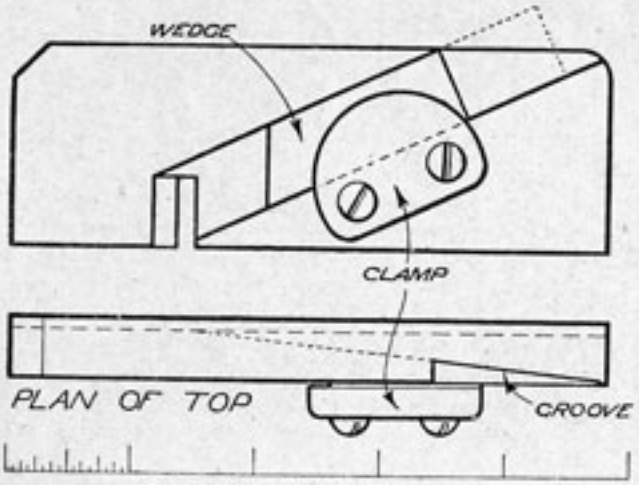


FIG. 3. SIDE AND PLAN VIEWS
Note that the clamp is screwed at the bottom only. Otherwise the pressure is liable to distort the shape.

FIG. 4. FRONT
Showing the angle of the utter.

FIG. 5. SIDE AND UNDER VIEW
This shows clearly how the brass mouth is let into the side of the plane. It is levelled with a file after fixing.

thickness, and a recess is cut to accommodate it. Before this is done, however, the actual cutter should be ground to the required angle and placed in position. It should be adjusted so that it projects from the face the slightest amount. This gives the position of the brass, a gap of about $\frac{1}{64}$ in. being allowed for the mouth. It is screwed on (the screws being well countersunk), and levelled with a file.

To hold the cutter firmly in position a wedge is fitted so that it projects slightly beyond the face, and a clamp piece is screwed on as shown in Fig. 6. In practice the cutter is placed in position, the wedge pushed backward until it is tight, and the screws given a turn each. To remove the cutter the screws are loosened. The wedge must project from the face equally all round, and to ensure this it should be placed in the groove well towards the mouth. A plane passed over the top of it will make it level with the side. Thus when moved upwards to its correct position, it necessarily projects slightly by the same amount all round. Note from Fig. 6 that the clamp is cut away at the inside in the form of a wide, shallow rebate.

CHAMFER PLANE (*Continued from page 8*)

mouth is preferable as, owing to the narrow mouth, the plane is liable to dip in, especially if the back of the plane is raised.

Construction.—Square the block for the chamfer body and work the V groove in the underside. Cut the front at 45 deg., and mark out and cut the groove. Bore the hole for the bolt, and cut in a recess to take the nut at the side.

Prepare squared-up block for plane body, cut end at 45 deg., and work tongue to fit in groove. It should make a hand-tight fit. Mark escapement, saw down sides, and saw away waste as far as possible. Chisel remainder and finish with shoulder plane. Fit the two mouths and shape the sides. Cut slot for bolt and form recess at top for bolt head. A washer should be fitted.

TOOTHING PLANE (*Continued from page 9*)

and edge. Mark out the dowel positions gauging from the sole and squaring the lines across. The exact positions do not matter a great deal but it is obviously necessary to place them so that they clear the escapement. It is a good plan also slightly to countersink the holes so that any dried glue will not interfere with the close cramping of the joint. Put the parts together dry and level the top and bottom. Square across both the position of the mouth, escapement, wedge groove, and so on. Separate them and draw in the lines on the inner faces. Note that the cutter tilts back at a slight angle—it is in fact only a few degrees out of the vertical.

Saw to the line as accurately as possible because it is an awkward job to pare the end grain afterwards with a chisel. Chisel away the waste.

Try the two parts together and if necessary carry out any adjustment with the chisel. You can then glue up. When dry level the joints. Details of the wedge are given in Fig. 2.

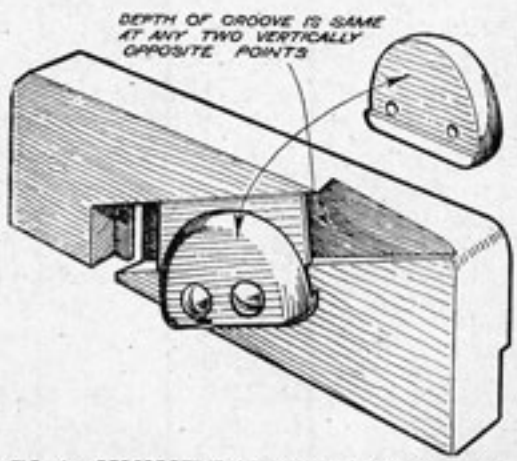
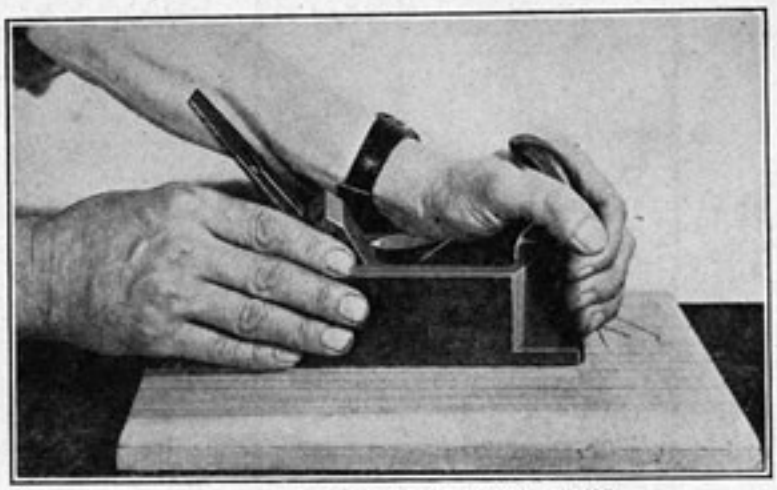


FIG. 6. PERSPECTIVE VIEW SHOWING CUTTER GROOVE
Note that the groove deepens towards the mouth where it emerges at right angles with the bottom edge, so bringing the edge of the cutter perfectly upright.

ROUGHING PLANE

This is a handy tool for all rough planing. A piece of wood with traces of paint on it would inevitably take off the edge of a jack plane, whereas the roughing plane iron, being set very coarse, cuts right under the painted surface and so largely escapes being dulled. Of course, any plane used for such rough work is bound to lose its edge to an extent, but when a plane is reserved specially for such jobs one does not mind the edge being knocked about somewhat.



THE ROUGHING OR SCRUB PLANE IN USE

The cutter of this plane, being given a full projection, cuts right beneath the gritty surface, and the tendency for it to loose its edge is thus largely avoided.

THE plane shown in the photograph above is just over 9 in. long, has a 1½ in. cutter, and is provided with a front handle or horn. A single cutter is all that is needed for a plane doing such rough work, and the mouth is made extra large to give easy clearance to the coarse shavings. To simplify the cutting out of the escapement the plane is made in two pieces joined together along the centre and strengthened with dowels. The saw can thus be used, saving a great deal of awkward chopping out.

Making the Joint.—Practically any hard, reliable wood can be used. Square up the two pieces, mark the face side and edge, and plane the joint perfectly true. The positions of the dowels are marked in, and it is necessary to know within a little the position of the mouth and escapement so that the dowels can be placed accordingly. The mouth need only be sketched in approximately on the one piece. All that need be done then is to fix both pieces together temporarily with a cramp and square the marks across both. The distance up of the dowels is marked with the gauge, this being used from the face edge (that is, the sole) in both cases.

Marking the mouth follows after boring the holes (⅜ in.); both mouth and escapement can be marked. To ensure both sides being alike, dowels can be placed temporarily in the holes, the two pieces fitted together, and the marks squared across the two. The sizes can be taken from Figs. 1, 2, and 3 by using the scale. A good plan is to mark the opening in its entirety on one piece, and transfer the marks to the other by squaring across. Begin with the two marks for the mouth, and strike in the bed upon which the cutter will lie at 45 deg. The mouth at the front slopes at a slight angle as in Fig. 2 up to about half-way through, when it reverses its slope. The groove for the wedge is shown in Figs. 2 and 4.

Having transferred the marks and gauged in the depth (note that the wood in front of the wedge groove tapers away towards the bottom), the various surfaces can be sawn in. Four cuts are needed; one at each side of the wedge groove, and the two at the front. Be careful not to take the saw down too deeply. For instance, you will see that the cut forming the front of the mouth does not reach down so far at the top as at the bottom because of the slope of the wood in front of the wedge groove. Pare all the surfaces down to a nice clean finish and cut the tapered chamfer at the top. The whole thing is now ready for gluing up.

Fitting Up.—At the front a notch can be cut to enable the horn to be fitted. Cut it square and prepare the block for the horn. This is in plain rectangular form, and at one side a notch is cut so that it fits over the front of the plane. Three dowels are used to form a joint. To position them a piece of cardboard of the exact size of the front of the plane is prepared and the three holes pricked in this. It is then just a matter of placing it against each of the parts and boring the holes accordingly.

After fitting, the curve can be marked in as shown in Fig. 5. Cut right through in both directions and then round off the corners. At the top it is practically completely round in section, and gradually forms a square towards the bottom. Even here, however, the sharp corners are taken off. The gluing on of the horn, and the chamfering of the edges practically completes the main stock except for truing the sole. This latter is best done after the wedge is in position.

Fig. 6 shows the shape of the wedge. Place the cutter in position and carefully fit the wedge, making sure that it beds closely throughout its length and is as tight one side as the other.

The cutter should be well rounded when being sharpened. It always has a coarse setting, and if too flat the corners are liable to dig in and form a series of ridges which will have to be removed. Keep the sole well greased or oiled when the plane is in use.

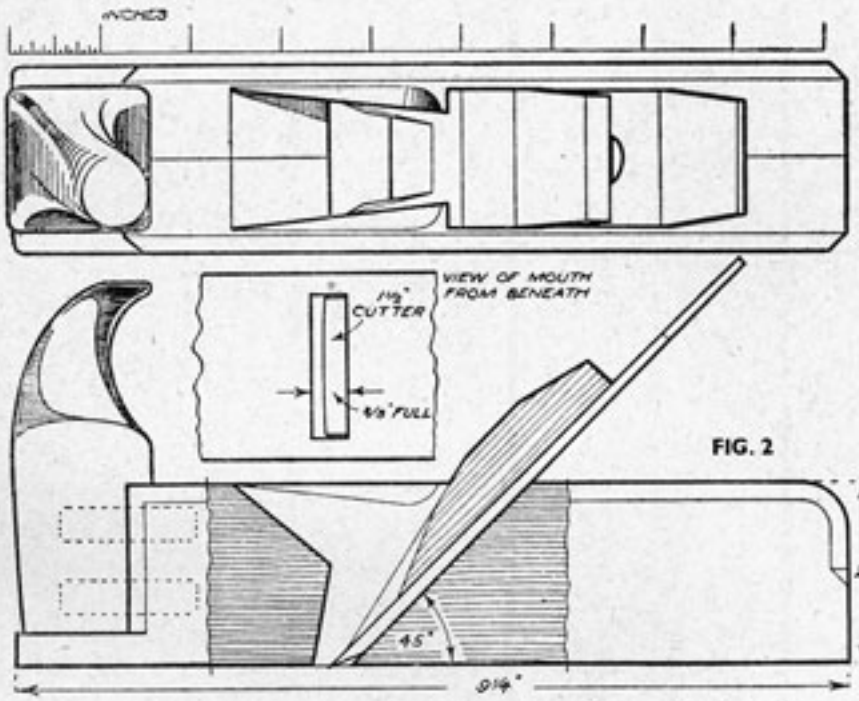


FIG. 1

FIG. 2

FIG. 3

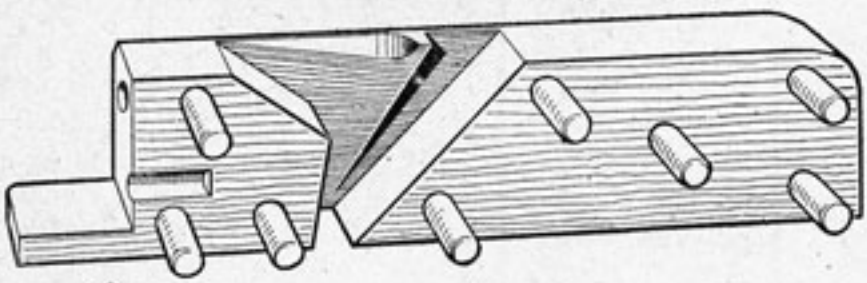


FIG. 4

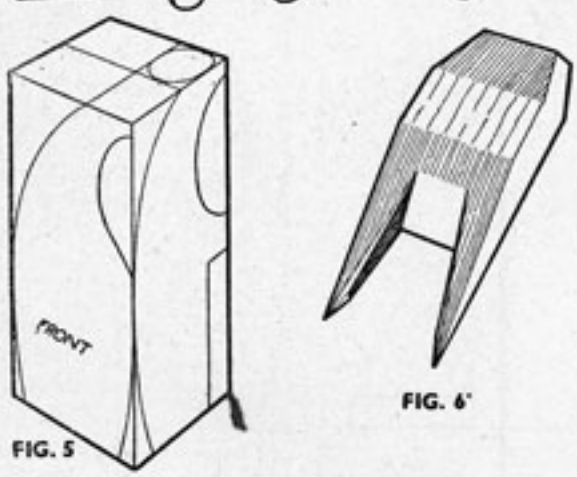


FIG. 5

FIG. 6

FIG. 1. PLAN VIEW WITH SCALE

FIG. 2. SIDE ELEVATION AND MOUTH DETAIL

FIG. 3. FRONT ELEVATION SHOWING HORN OR HANDLE

FIG. 4. ONE HALF BEFORE JOINTING, SHOWING DETAIL OF ESCAPEMENT AND DOWELS

FIG. 5. HOW SHAPE OF HORN IS MARKED OUT AND CUT

FIG. 6. SHAPE OF WEDGE

TOOL CHEST

(*Continued from page 5*)

diminish in length according to the thickness of boards C and D, which act as guides. Tray sides will be ¾ in., dovetailed or lapped at the corners (F). Bottoms may be of ½ in. plywood, rebated in.

Underneath the trays there is ample space for tools in less frequent use. This space is usually divided by a partition (G), which may run up to the ledge (E) below bottom tray; but here many chests are fitted with lids (H, Fig. 6) which slide between fillets (J). The chief advantage of this lid is that it provides an extra shelf for temporary storage purposes. If introduced, clamp the lid with hardwood ends.

Chisel and gouge racks (K) may be fitted above the saw compartment where they will be ready at hand.

EDGE PLANE

In all probability some readers have never come across this type of plane at all ; certainly it is uncommon. Many woodworking trades never use it at all, but there are occasions when it can be very handy. It is used mostly by piano makers for working right up to a corner, and in this connection it can frequently be used where any other type of plane would be impossible.

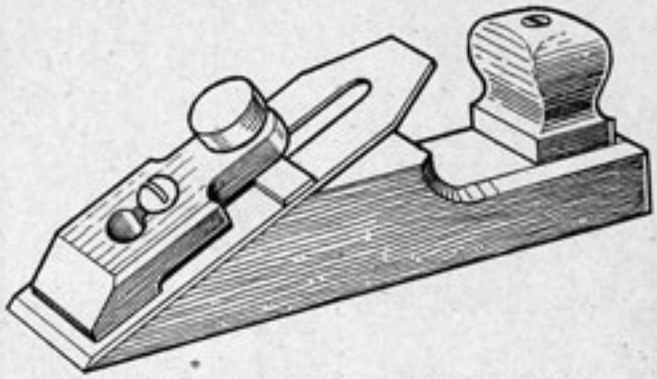


FIG. 1. WHAT THE FINISHED PLANE LOOKS LIKE
The exact length is not important, but it should not be much shorter than 9 in. as it may be liable to dig in. This plane is 10 in. long with a 1¾-in. cutter.

TWO ways in which the plane would come in handy are shown in Fig. 2. In the one the plane is smoothing right up to an internal corner, and in the other is a stopped chamfer in which the plane could work right up to the stop. Many other uses will suggest themselves—such as trimming a stopped rebate.

It will be realized that it cannot be used in place of the more normal type of plane ; it would dig in and fail to produce a flat surface. Furthermore, it could not be started. It is suitable only for working into a corner after the main surface has been planed. The great secret of its successful use is to press well down on the handle. Only in this way is it possible to avoid digging in. Then, the cutter must be set fine—sometimes without any projection at all—and gradually fed forwards. It usually happens in this sort of work that the corner is high, and that is why the plane will sometimes cut when there is no projection to the cutter at all.

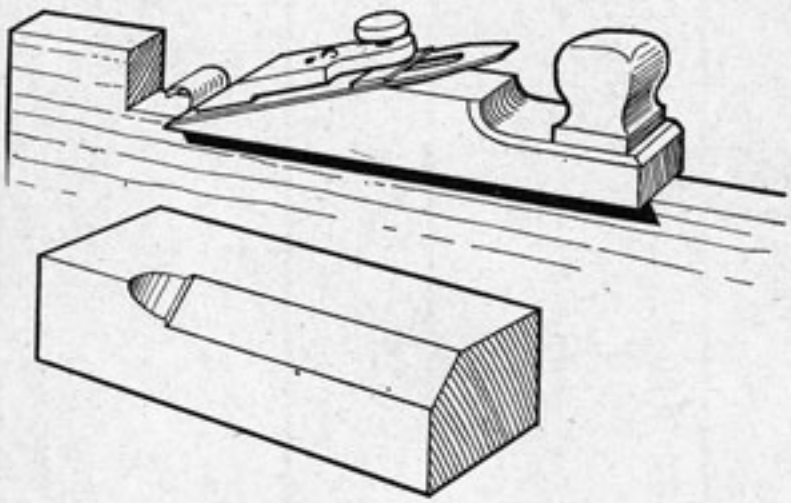


FIG. 2. EXAMPLES OF WORK FOR WHICH PLANE IS SUITABLE
Note that a strip of metal is placed beneath the thumb-screw to cover the slot in the cutter. The knob is either square as shown or it can be turned.

Fig. 3 shows the plane to scale. The main stock, which should be of hardwood, finishes 10 in. by 1⅝ in. square. Allow the width a trifle full for trimming and cut the front to an angle of 20 deg. Also shape the back. Finish neatly with a chamfer. The clamp is 4¼ in. by 1½ in. by ½ in. It has a hole and slot cut through it to enable it to be slipped over screw head and pushed forward into place. The thumbscrew can be any convenient screw, the hole for it having the thread forced in it. Bore a hole to the narrowest part of the thread and force the screw into it.

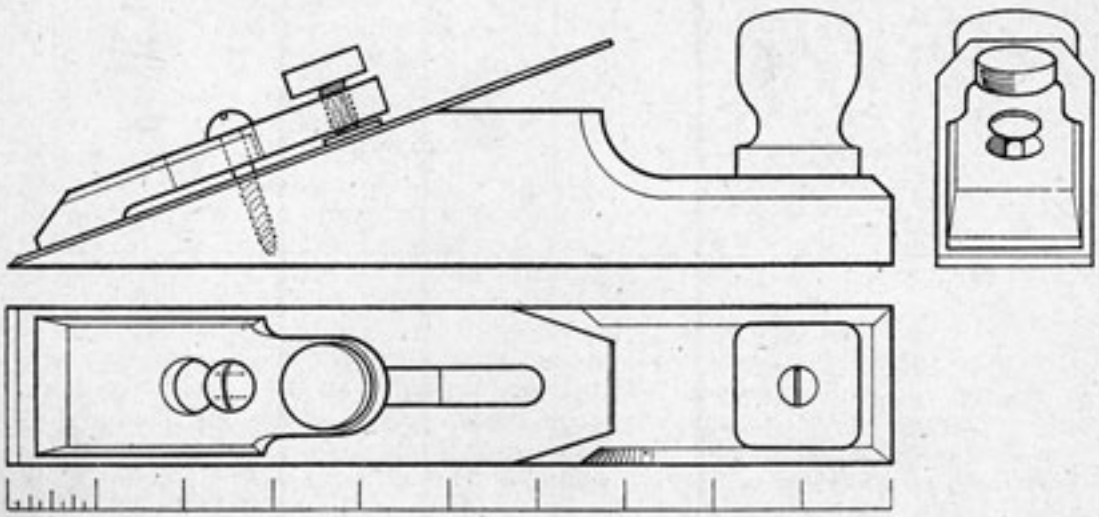


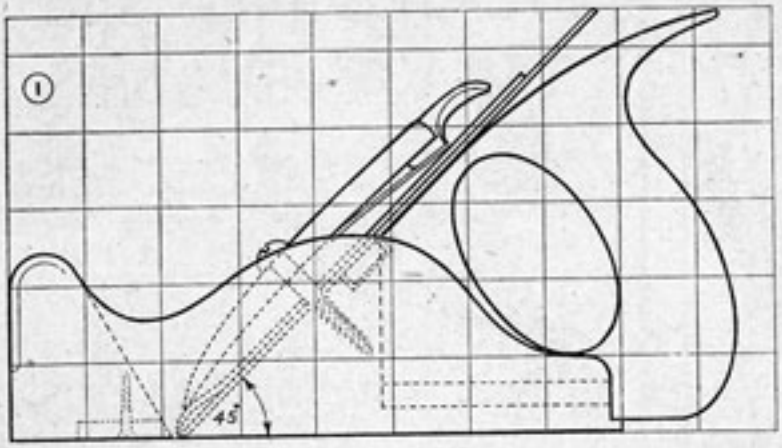
FIG. 3. SIDE AND FRONT ELEVATIONS AND PLAN. SIZES CAN BE TAKEN FROM SCALE

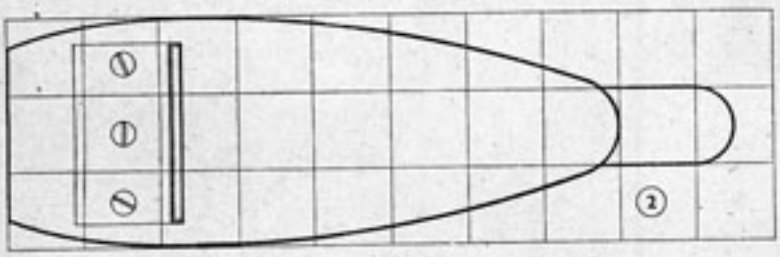
The whole of the plane, with the exception of the sole, should be given one or two coats of french polish. Most plane makers recommend this rather than soaking with linseed oil.

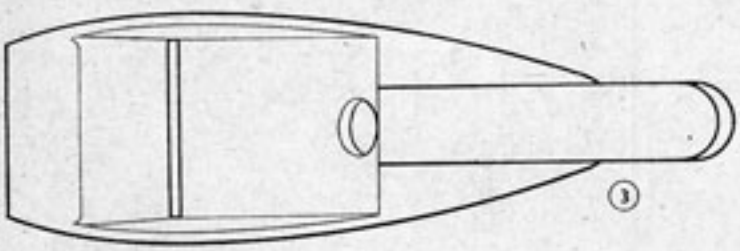
HOME-MADE SMOOTHING PLANE

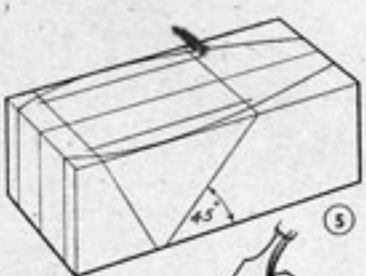
FITTED WITH 2¼ in. STANLEY OR RECORD PATTERN CUTTER, BACK IRON, AND LEVER CAP

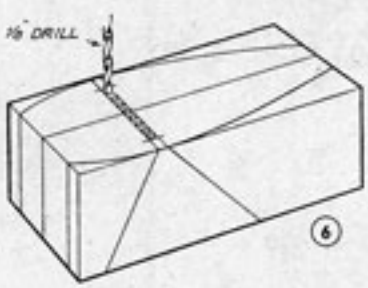
This is cut out of the solid in any close-grained, heavy hardwood. A metal mouth as shown is quite effective and has the advantage that it can be filed from any oddment of mild steel. If preferred an all-metal sole can be fitted. This should be obtained first so that the shape can be followed.

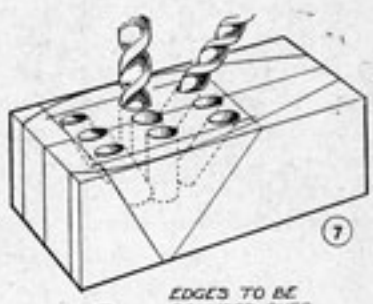


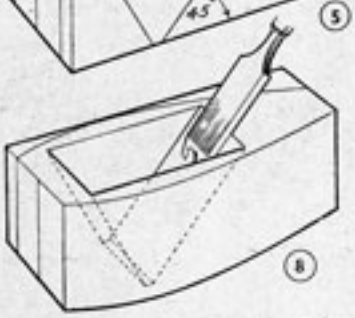


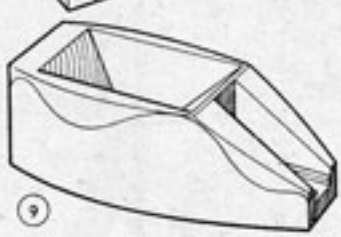








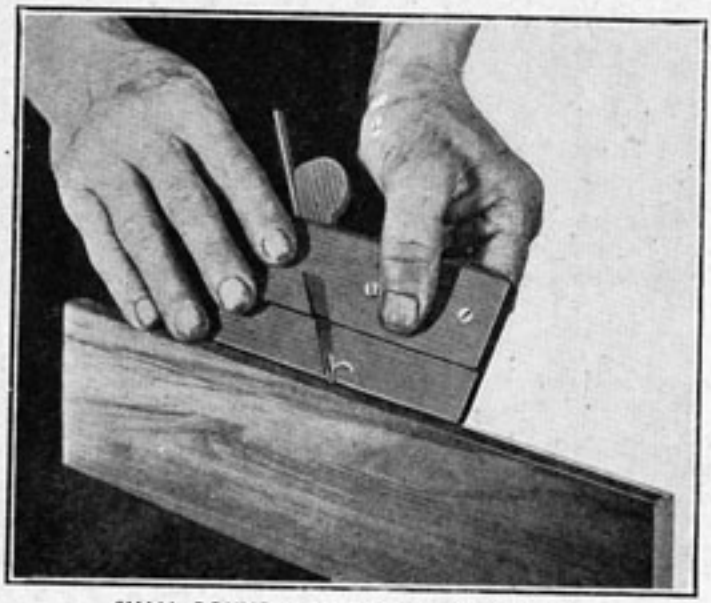




CUT out main block 8 in. long, 3 in. wide, 2⅝ in. high and mark out as in Fig. 5. Drill holes at mouth (Fig. 6) and bore holes in escapement as Fig. 7. Chisel away waste as in Fig. 8, making frog dead flat, and round over the sides. Cut away rear and chop recess with dovetail at bottom, Fig. 9. Finish off as Fig. 10 and fit handle. This continues line of frog so that cutter is supported behind top of lever cap. Bore hole to allow for back iron nut, and insert round-head screw for fixing. Adjust with cutter, back iron, and lever cap in position. No adjustment is fitted. Set as ordinary wood smoothing plane.

MOULDING and REBATE PLANES

Although it is possible to obtain ready made a wide selection of planes to work various mouldings, there are certain sections for which no planes are available, in particular the small sections often required in little cabinets, boxes, and so on. We show here a simple way of making them.



SMALL ROUND MOULDING PLANE IN USE

To work a hollow at an edge it is best to plane a chamfer first, the width of which is equal to the hollow. This forms a convenient surface upon which the moulding plane can be worked.

IN making any kind of plane the chief difficulty is that of cutting the hole for the mouth and escapement, and the difficulty is greater with a small plane because there is less room in which to manipulate the tool. The reason for its being an awkward job is that the saw cannot be used ; it is necessary to bore a hole and then cut the final shape with a small chisel. By following the method of construction given here, however, the saw can be used to cut in the sides. To enable this to be done the planes described here are designed so that one side is open. The hole is thus really a tapered groove, the sides of which can be sawn. A separate piece is fixed on at this side, so enclosing it and making it virtually like an ordinary plane made in a solid block. In practice the method has proved very successful.

Small Round Plane.—A particularly useful type of plane is a small round to work a hollow of anything from about $\frac{1}{8}$ in. up to $\frac{1}{4}$ in. such as that shown in Fig. 1. It consists of a main stock which includes the whole of the working part of the plane, and a side piece screwed on as shown. It could be made in a very short time and at practically no cost. The plane is shown in use above.

Another plane, similar in that it works a hollow, is that in Fig. 2. It differs, however, in that it is provided with a fence and depth stop, making it suitable for running around the edges of, say, a small table top or panel, the fence and stop ensuring that the resulting hollow is of exactly the same section throughout. Apart from these points the work involved is identical with the plane in Fig. 1. One point to note is that the plane is intended to be held at an angle after the manner of most English moulding planes, the advantage of this being that the shavings are enabled to clear more easily. It means, however, that the shape of the round and the stop and fence have to be set out at an angle as shown in the end view in Fig. 2.

The wood used for a moulding plane is not specially important providing that it is hard and reliable. Beech, sycamore, one of the harder varieties of mahogany, or any similar wood can be used with success. Oak could be used, but it has the disadvantage of being rather coarse in the grain, making it unsuitable for working a very small section. If possible it should be radially cut—that is the medullary rays should run from top to bottom. Wood cut in this way is more reliable, and the ends of the rays are exposed at the sole and offer greater resistance to wear. This is shown clearly in Fig. 8.

Marking Out.—A convenient size for the main stock of the plane in Fig. 2 is 7 in. long by $2\frac{1}{2}$ in. high, by $\frac{5}{8}$ in. thick, and the first thing to be done is to plane up the wood perfectly true to these sizes. At the front end the shape of the sole is marked out. An adjustable bevel is handy when doing this as it enables the various faces to be marked exactly at right angles with each other. A in Fig. 4 shows the marking out. The exact angle is not specially important ; that at X (A Fig. 4) could be 25 or 30 deg. ; but it is essential that the other two lines are at right angles with it. This is automatic when the adjustable bevel is used for marking. The curve of the round is marked out at the intersection of the lines. In the present case the curve has a radius of a bare $\frac{3}{16}$ in., but this could be varied within a little one way or the other.

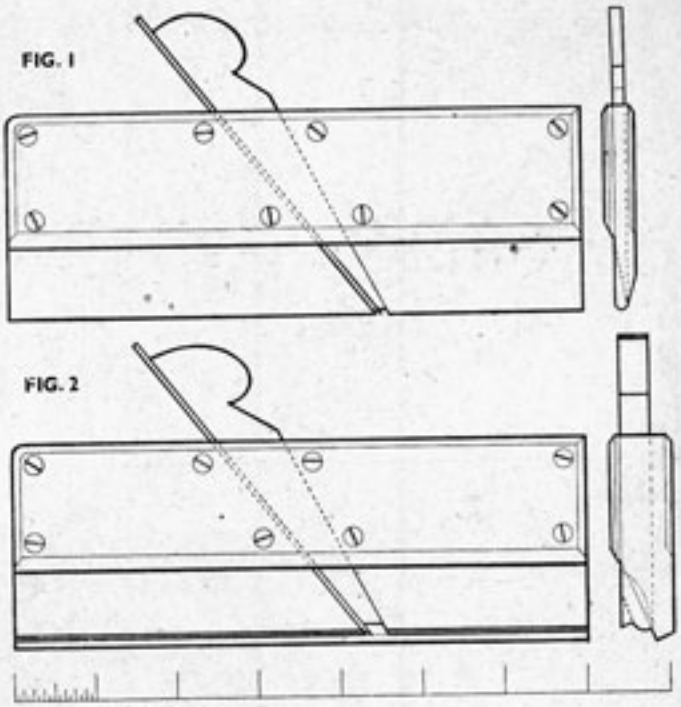
Having marked the front, the position of the members can be gauged in as a guide when working the shape. In fact the position of the centre from which the curve is struck could be transferred by gauging first up from below, and then in from the side. It will be realized that in the practical working of the contour the wood is removed first in the form of two rebates which are square with the sides as at B, Fig. 4. The gauge marks should therefore be those of these rebates. It is just a matter of setting the gauge from the side to the places where the curve intersects the straight lines, and gauging the sole. These marks are shown at the end in Fig. 3.

The Mouth.—Before cutting the shape it is advisable to mark out the groove which forms the mouth. The angle of the cutter could be about 50 deg. with the sole, and the line at the front of the wedge about 60 deg. The width of the mouth is of some importance. It should be as small as practical working will allow, and the chief consideration here is in allowing sufficient clearance for the shavings. A distance of about $\frac{1}{16}$ in. from the edge of the cutter to the mouth is about right. The actual width of the groove at this point depends upon the thickness of the cutter. A quite good cutter can be filed up from an old piece of bandsaw blade, especially the thicker kind. This might vary from $\frac{1}{16}$ in. up to $\frac{3}{32}$ in., and the wood must be marked out accordingly. Cutters, too, can be made from those supplied for small grooving planes. They are excellent for the purpose, but being only some $3\frac{1}{2}$ in. in length they are rather awkward to set because they project only slightly at the top of the plane. If this type of cutter is used it is better to cut down the height of the plane from $2\frac{1}{2}$ in. to 2 in. The thickness of the cutter is about $\frac{1}{8}$ in. Their special advantage is that the greater thickness prevents any possibility of chatter due to any give in the substance of the cutter itself.

It will be seen from the end view in Fig. 2 that although the width of the cut is not more than $\frac{3}{16}$ in., the actual cutter is considerably wider. This is partly because of the angle at which the sole is set, and partly because it is desirable for the cutter to be nearly as wide as the wedge so that the latter has plenty to bear against.

Cutting the Shape.—There is no special point about working the shape of the sole. B, Fig. 4, shows the stages in the process. Two rebates are worked first, and then a scratch is filed to a reverse of the shape and this used to finish off. Remember when filing the scratch that the plane has to be used at an angle. To prevent accidents it is an excellent plan to use a scratch having two fences which bear at each side of the plane. They prevent the scratch from digging in. A thorough rubbing with glasspaper follows, the latter being wrapped around a rubber. It is obviously important that great care is taken in cutting the mouth because the cutter must bed down true. To help in this respect the marks can be cut in with a chisel so that a small sloping groove can be chiselled on the waste side, this providing a channel in which the saw can run. Cut down the sides with a fine saw, and chisel away the waste, taking care to make the bottom as flat and as true as possible. This is especially important at the lower end because gashes may cause choking owing to shavings forcing their way under the wedge.

At this stage the wedge should be cut out and fitted. Place the cutter in position and plane the wedge until it fits accurately for the whole of its length down the groove. The lower end is



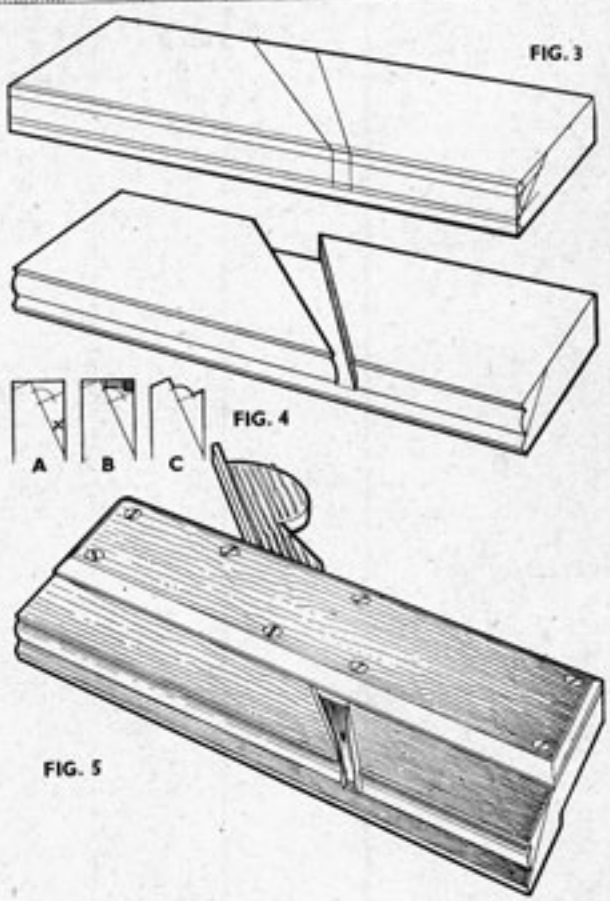


FIG. 1. SIDE AND END OF ROUND MOULDING PLANE
Note the side piece screwed on to simplify the grooving.

FIG. 2. VIEWS OF SCOTIA PLANE WITH FENCE
This is used at an angle as shown by the line at the end.

FIG. 3. FIRST STAGE, THE MAIN BLOCK MARKED OUT
The lines are gauged to intersect the quirks of the shape.

FIG. 4. SHAPE OF SOLE WORKED AND THE GROOVE CUT
Be careful to avoid unevenness in the groove.

FIG. 5. THE COMPLETED PLANE READY FOR USE
Note shape of wedge to throw out shavings.

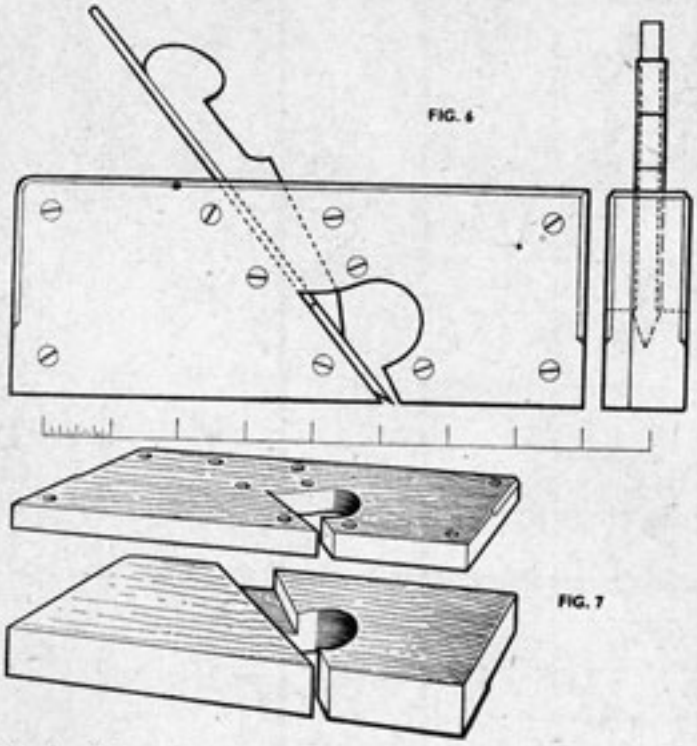


FIG. 6. SIDE AND END ELEVATIONS OF REBATE PLANE
Note that the joint occurs at one side of the wedge groove, not in the middle: thus a groove has to be cut in one of the blocks only.

FIG. 7. THE TWO BLOCKS READY FOR GLUING
The shape is cut full in the thinner upper block so that it can be levelled after gluing together.

hollowed out as shown in Figs. 2 and 5 so that the shavings are automatically thrown out. It is better to do this part of the work after the plane is completed, however, because the knocking home of the wedge creates a certain amount of compression which alters the final position of the wedge, and this in turn controls the distance up that the hollow reaches.

Finishing Off.—It now remains but to screw on the loose side. Screw it on dry to see that it makes a good fit, and then tooth the joining faces, glue, and screw on again. Glue is necessary because otherwise the pressure of the wedge may tend to draw the plane into a curve. Take special care to avoid surplus glue in the groove. A little linseed oil rubbed in it will enable the inevitable squeezed-out glue to be removed easily.

A slight amount of adjustment may be necessary afterwards, but this is usually only at the wedge. The important point is to see that there is no gap either underneath or at the side, because this would cause shavings to wedge themselves in and cause choking. Except for the shape of the sole the round plane in Fig. 1 is made in exactly the same way.

A Rebate Plane.—This plane is similar to the the moulding planes, but it differs in that both sides have to be completely open so that it can be used at either side. The same principle of making it in two parts is followed to enable the hole for the wedge to be cut easily. The lower part of the opening of course can be pierced right through both pieces since shavings have to escape from both sides. These details are shown clearly in Figs. 6 and 7.

A good, all-round size for the cutter is 1¾ in., and it is advisable to obtain this at the outset and work to it. Not only is the width controlled by it, but the height of the shoulders affects the size of opening. Begin by preparing the two blocks to the over-all size. One of them is ⅜ in. thick and the other ⅞ in., the reason for the difference being that the joint occurs at one side of the wedge hole instead of in the centre. This saves having to cut a groove in both pieces.

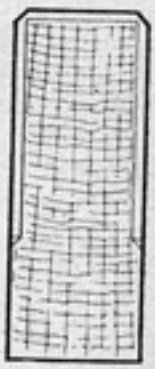


FIG. 8
VIEW AT END
Note that the medullary rays are upright.

On the thick piece mark out the groove and the escapement opening. The angle can be 50 deg. for the cutter. Cut in the sides of the groove and remove the waste with the chisel. When the escapement is being sawn it is very important that the bed on which the cutter rests continues in a straight line with the groove. When satisfactory screw on the thinner block, and with a pencil mark round the escapement. If a machine band or jig saw is available the opening can be pierced through after gluing up, but if done by hand it is better to separate first. Cut in a trifle full everywhere to allow for trimming.

Now thoroughly tooth the joining surfaces, heat well, and glue up, driving in the screws as quickly as possible. The sole should be shot with the wedge in and with the cutter slightly withdrawn.

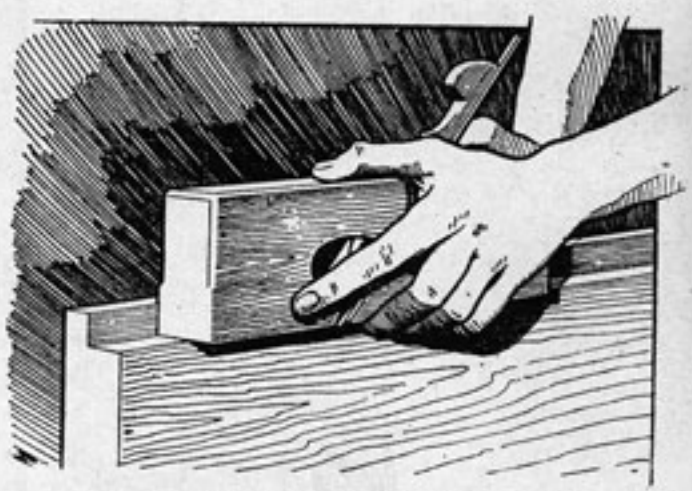
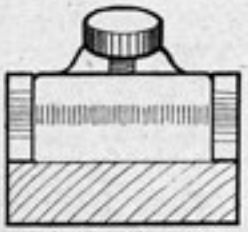
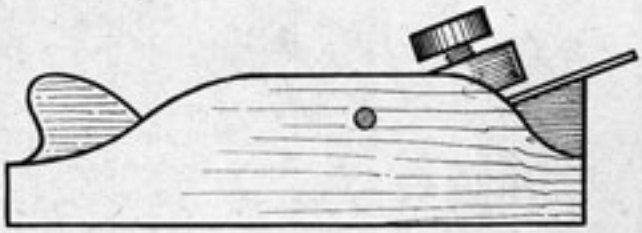


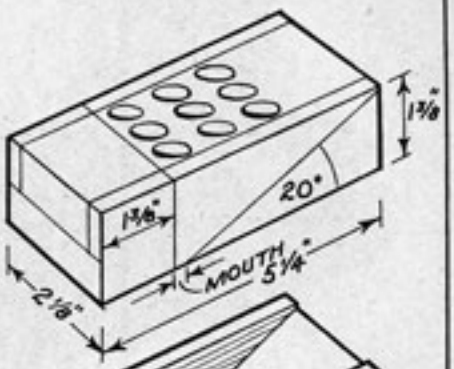
FIG. 9. HOW THE REBATE PLANE IS HELD IN USE
All the planes described here are made in two parts to be glued together. This greatly simplifies the cutting of the groove as it enables the saw to be used.



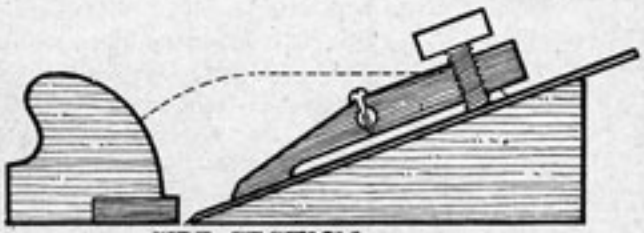
FRONT ELEVATION



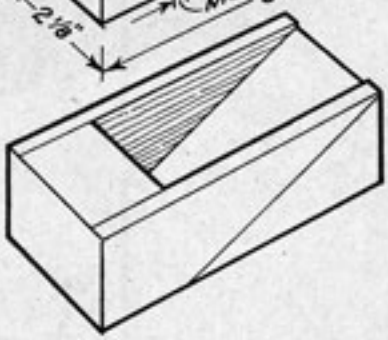
SIDE ELEVATION

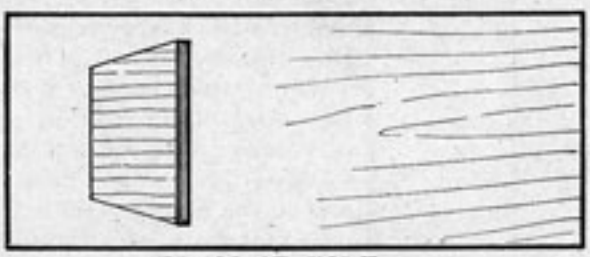


BACK ELEVATION

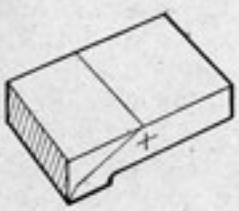


SIDE SECTION

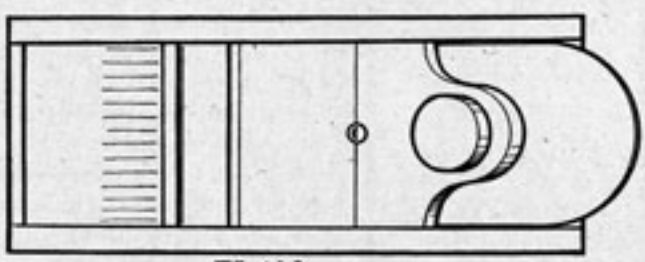




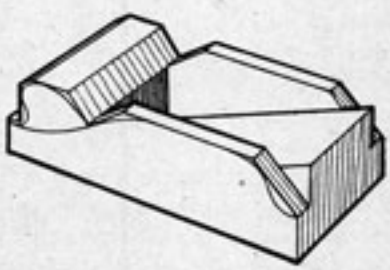
PLAN OF SOLE

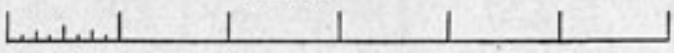


CLAMP



PLAN

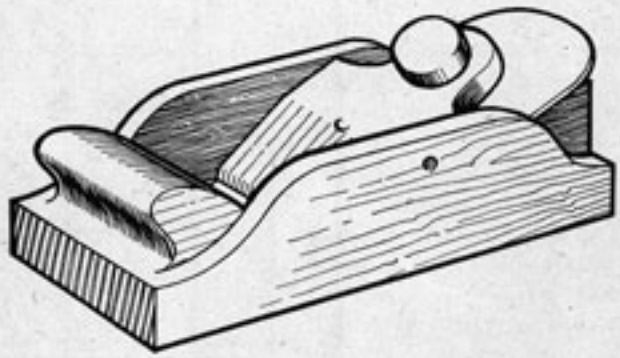




BLOCK PLANE

This plane has proved a complete success and will tackle any of the jobs for which the more usual iron plane is used. The only cost is that of the cutter.

Mark out block of close-grained, heavy hardwood to sizes given (English oak does very well). Mouth can be about ⅜ in. wide, giving room for chisel to be used. It is closed later with a separate mouthpiece. Remove part waste by boring and chisel remainder. Fit a 1⅜ in. block plane cutter. Cut mouth recess and fit hard mouth (boxwood is ideal). Finish main shaping and prepare clamp. This pivots on a ⅛ in. rod (a 4-in. french nail cut down does quite well). Clamp screw is any convenient thumb-screw forced into hole in clamp so cutting its own thread. Make sure that cutter beds well down at mouth. Plane is excellent for any fine, small trimming work.



COMPOUND COMPASS PLANE

Although this particular plane is made with its sole curved in both length and width, thus making it suitable for such work as model ship building, curved mouldings, and so on, it could just as easily be made with a flat sole or with just a single curve in either length or width. It is an extremely handy tool and works very sweetly. The front horn or handle enables it to be grasped with two hands, and the frog is continued well up, so providing a comfortable grip and preventing all possibility of chatter. It is made in a single piece from boxwood, and is a most interesting job to do.

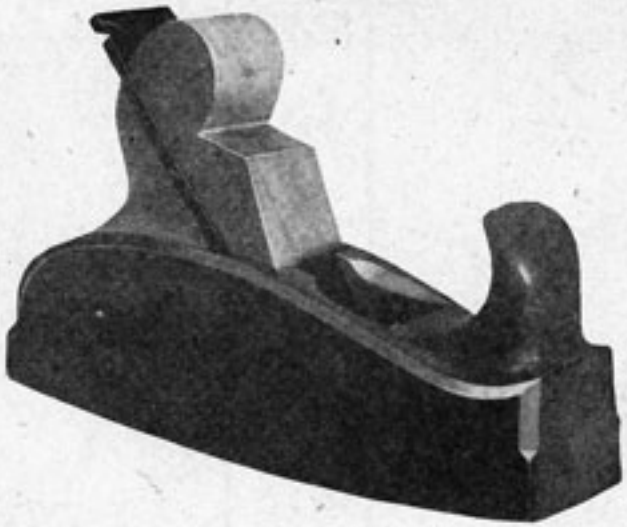


FIG. 1. MADE IN BOX OR SIMILAR HARDWOOD
The length of the plane is 4½ in. though a little more or less would not make much difference. The mouth should be kept small.

IT is important to make an accurate full-size drawing first, and this necessitates having the cutter so that the mouth can be set out properly. A small mouth is most desirable because it minimizes any tendency to tear out. A cutter from a Stanley pattern plough plane ¾ in. wide was used for the plane in Fig. 1. It is at 47 deg.

Setting out.—Plane a piece of boxwood to a rectangular shape large enough to include the whole shape (see dotted lines in Fig. 2), and carry out all subsequent marking out from the sole as far as possible. This sole is left straight and square until the whole of the rest is finished. The mouth and escapement is one of the first jobs, but before you cut this it is necessary to cut away some of the waste wood at the top as shown in Fig. 2. At the rear a saw cut can be made a trifle full of the slope of the frog ; at the front the cut can just clear the handle, whilst the horizontal line is made parallel with the sole. True up this surface with the chisel. All lines giving the slope of the cutter, wedge, and escapement front should be taken across both sides and then squared across at the top. With the gauge mark the mouth width at both sole and top, draw in the wedge, and the taper of the escapement.

Chiselling the Escapement.—You will have to rely largely upon the chisel for cutting away the waste since it is practically impossible to use the saw, except at the sides of the mouth where the thin end of the keyhole-saw can be used to an extent. Begin by boring a series of holes straight across the mouth and right through, taking particular care to slope the brace so that no wood is removed which should remain. At the top a few more holes can be bored, but these obviously cannot be taken right through. The writer found that the best plan was to cut the tapering channel occupied by the cutter and wedge in its entirety first. It proved a slow job cutting away the wood with a small chisel, but once a start had been made it was possible to use the end of the keyhole-saw. The slope forming the frog on which the cutter was to bed was chiselled approximately true, but was pared dead accurate later. After this the rest of the escapement was chiselled. It will be realized that if the latter is cut first and the wedge channel later, the short grain is liable to crumble.

When the complete escapement is finished the form of the handles can be cut. A file is handy for reducing down to shape, this being followed by scraper and glasspaper. Finally the chamfers can be cut, and the sole worked to the required shape, any adjustment to the mouth then being made. It is advisable to true the sole with the wedge driven in, the cutter being pulled in a trifle so that it does not foul the plane being used.

In all tool making it is advisable to obtain the cutter before beginning the woodwork. Otherwise it may necessitate alterations if a cutter of the intended size is not available.

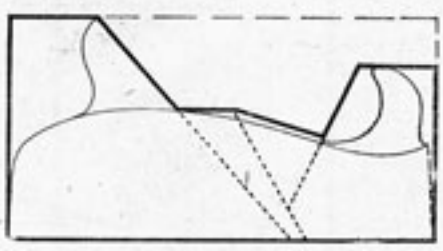


FIG. 2. PRELIMINARY SHAPING

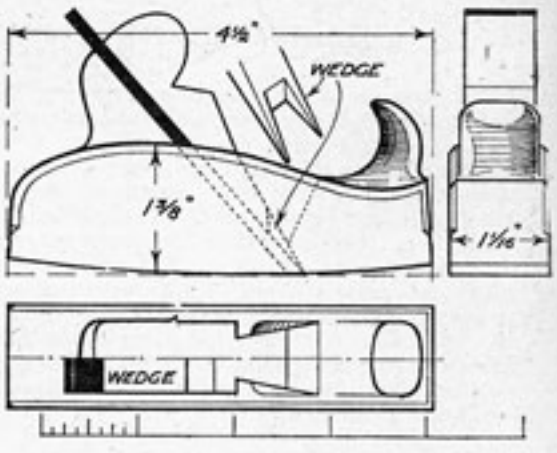


FIG 3. ELEVATIONS AND PLAN

ADJUSTABLE SCRAPER PLANE

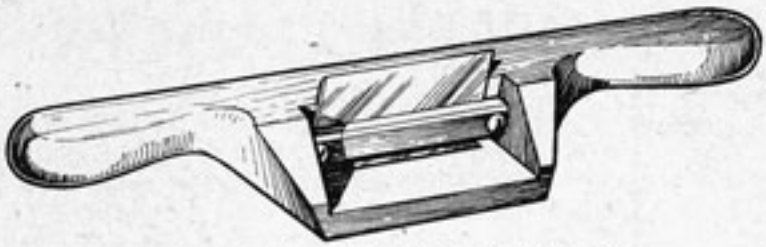


FIG. 1. THE COMPLETED SCRAPER PLANE
This is a splendid tool for cleaning up large surfaces. It can be used even against the grain, and will take out tears and inequalities. It should be in hardwood.

Do your thumbs become burnt when you use the ordinary steel scraper? It is usually only the professional cabinet maker who can use it for any length of time. He develops blisters which act as a protection. This plane enables you to scrape a surface without the slightest discomfort. In fact the tool virtually is more like a superfine plane.

THE tool is rather like a spokeshave in that it has a projecting handle at each side, but the sole is broad and long—about 4¼ in. by 3 in. It is made entirely in wood with the exception of the cutter which is a 2¾ in. Stanley pattern scraper cutter. A clamp held by two screws holds the cutter in position, and an adjustment screw sets the latter fine or coarse.

Use.—To sharpen the cutter the edge is sharpened on the oilstone at an angle of about 45 deg. (not at right angles like the ordinary steel scraper). It is then fixed upright in the vice and the edge turned with a rounded steel tool such as a gouge. Feel the bevel, raise the hands a trifle, and make one stroke. Raise the hands a trifle more and make a second stroke. Finally bring the gouge up until it is about 15 deg. below the horizontal. The edge can be turned once or twice in this way before rubbing down becomes necessary again. A file can be used providing it is followed by the oilstone.

To set the tool loosen all screws, pass in the blade, and put the whole sole downwards on a flat board so that the cutter drops down flush. Tighten the clamp screws, and then turn the adjustment screw a trifle. Try the tool and give

(*Continued on page 23*)

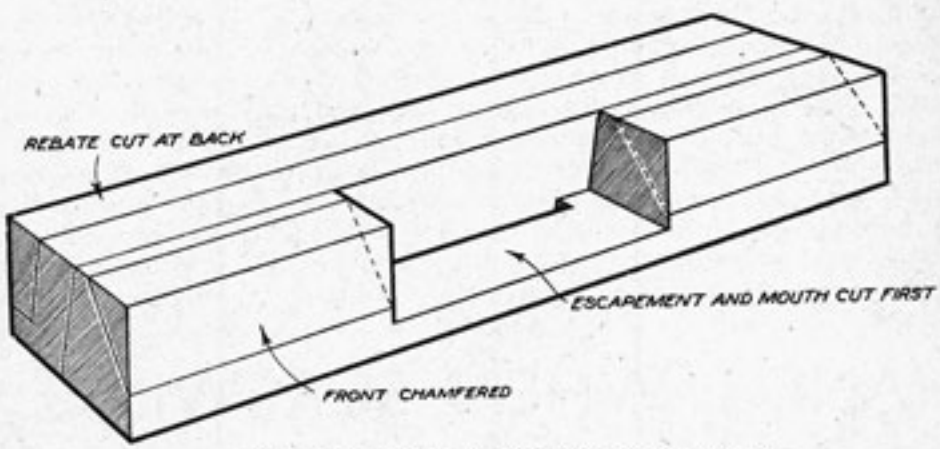


FIG. 2. FIRST STAGE IN CUTTING OUT THE BLOCK

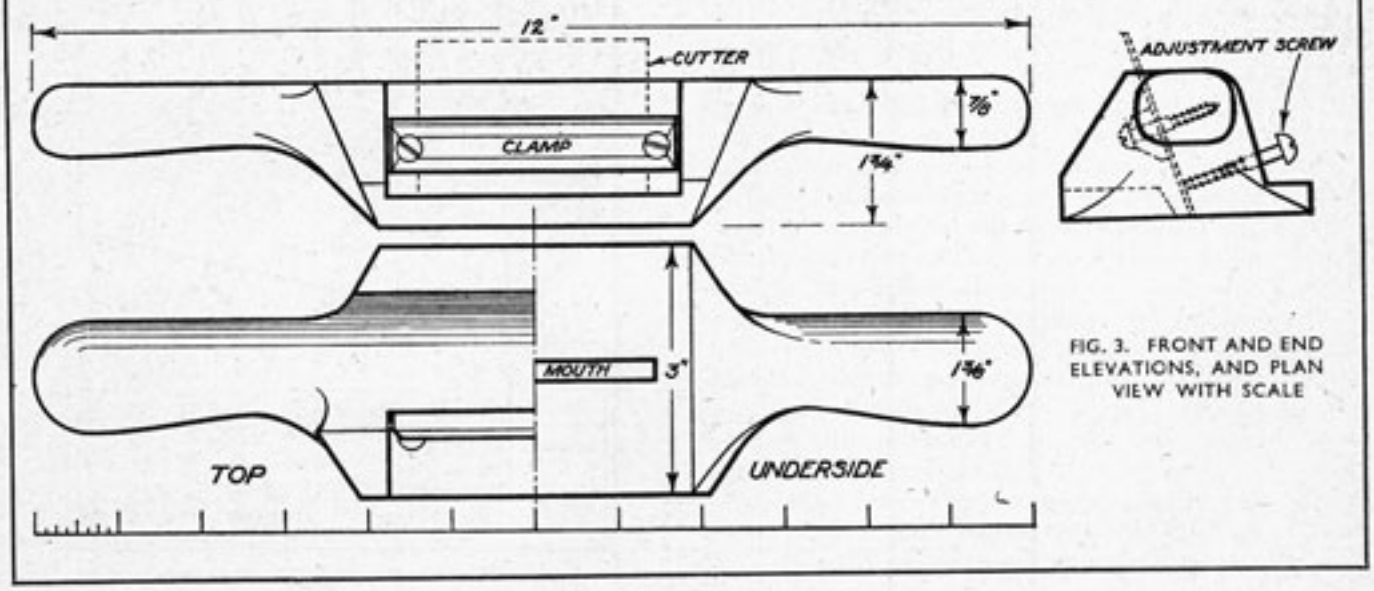
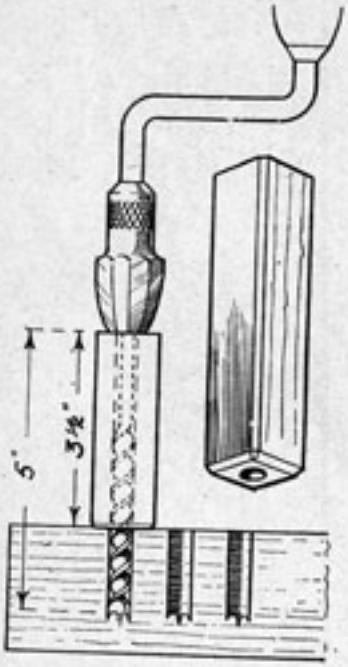


FIG. 3. FRONT AND END ELEVATIONS, AND PLAN VIEW WITH SCALE

DEPTH GAUGES



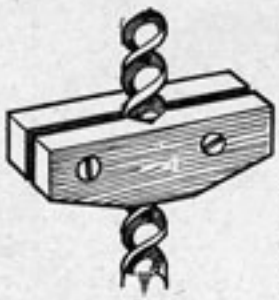


FIG. 1 (above)
ADJUSTABLE GAUGE

FIG. 2 (*left*)
SIMPLE FORM OF BLOCK GAUGE

THE sole purpose of the depth gauge, of course, is to regulate the depth of a hole to be bored in a piece of wood. It has various applications, however. In the first place it enables any number of holes to be bored all to the same depth without the bother of counting the turns of the brace. This is a special advantage in such work as dowelling where it is essential that all holes are alike in size. Then, it enables a hole to be bored as deeply as the size of the wood allows without the point of the bit emerging at the back. Thus the necessity of testing the depth with a pencil is obviated, and so, too, is all guess work, since the gauge is set to the exact position before boring begins. A last advantage is the time saved since, once set, no further testing is needed.

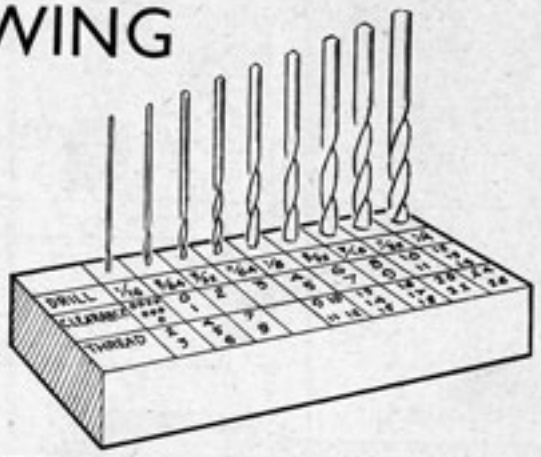
Block Gauge.—Perhaps the simplest is the rather crude device in Fig. 2. It is effective up to a point, but is not perfectly reliable. The way in which it works is fairly obvious. A square of wood is cut out, the length being equal to the projection of the bit from the chuck less the depth of the required hole. A hole is bored right through it with the bit to be used (this is best done half-way from each end). Thus in Fig. 2 a hole 1½ in. deep is needed, and the bit projects 5 in. up to the cutters, necessitating a block 3½ in. long. It is clear that the bit will cease to cut as the block reaches the surface of the wood.

The weakness of this gauge is that the bit is liable to move slightly in or out of the chuck, and this upsets the calculation. Furthermore, a fresh one has to be made for each job.

Adjustable Wood Gauge.—A better type of home-made gauge is that in Fig. 1. Two pieces of wood about 2 in. by ¾ in. by ½ in. are screwed together and trimmed to the shape shown. A centre line is squared across them, after which they are separated and the centre line is squared across the meeting faces. A "V" cut is made across these centre lines. It will thus fit any twist bit from ¼ in. up to, say, ½ in., and can be fixed at any position along the bit. For larger bits a larger gauge should be made. For really big bits —1 in. or more—four screws should be used, the wood being wider to take them.

HANDY WHEN SCREWING

THIS most handy and time-saving piece of apparatus you can knock up yourself. It is a means of enabling you to pick out without hesitation the right sizes of drills for both the clearance and the thread holes for any size of screw from 2 up to 14. What you need is a series of drills from $\frac{1}{16}$ in. up to ¼ in. The metalwork type are excellent for the purpose; they will fit in either a breast drill or in the usual brace. These stand in holes drilled at the back of the stand. In front are marked the sizes of the drills, and in front of these again are numbers referring to the sizes of the screws. Suppose you have a No. 8 screw to put in. It is obvious that the two drills you need are $\frac{5}{32}$ in. and $\frac{9}{64}$ in. For a No. 12 in. screw you need the ⅛ in. and the $\frac{7}{64}$ in. These are the correct drills for softwood. If driving screws into, say, hard oak you may in some cases need to use the next largest drill for the thread hole. The figures are best marked out on a piece of cardboard.



	○	○	○	○	○	○	○	○	○
DRILL	1/16	5/64	3/32	7/64	1/8	5/32	3/16	7/32	1/4
CLEARANCE	0000 000 0	0 1	2	3	4 5	6 7	8 9	10 11	12 13 14
THREAD	2 3	4 5 6	7 8		9 10 11 12	13 14 15	16 17 18	20 22	24 26

DRILL STAND AND ITS MARKINGS

SCREWDRIVER

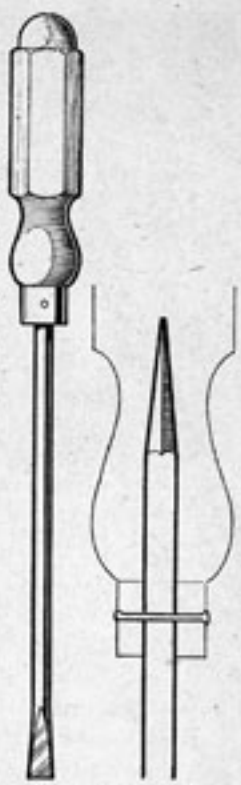
THIS screwdriver was made by the writer some ten years ago, and it has been in continuous use ever since. It will deal with large screws—12s and 14s. It is made from a rod of $\frac{5}{16}$ in. diameter silver steel or carbon steel, and is fitted with a large octagonal boxwood chisel handle. The rod is first filed at the handle end to a tapered shape to form either three or four flat faces. This is important because these faces, in fitting against corresponding faces in the handle, resist any tendency for the rod to twist inside the handle.

The opposite end is shaped to form the edge. Since this should be about $\frac{3}{8}$ in. across the rod must be beaten out on a block of iron to spread it. Heat the end to a cherry red and without loss of time beat it out with the heaviest hammer you have, turning it first one side, then the other. This has the effect of toughening the steel as well as spreading it. When cool, file down the bevel on each side—or use a grindstone if one is handy. File up the sides, too, to bring a nice even shape.

Tempering follows. Heat to a cherry red and quench in cold water. This will make the steel dead hard. Polish with a piece of emery cloth and heat with a flame about $1\frac{1}{2}$ in. from the end. Gradually colours will appear on the surface, and these will travel towards the end away from the flame, first a light yellow, followed by a deep yellow, brown, purple, and finally blue. The correct colour at which to quench a screwdriver is a deep purple. Wait then until this colour has travelled down to the actual edge, then quench. If quenched before this it will be too hard and be liable to crack and splinter; if left too long it will be soft and burr over.

It is now fitted to the handle. If necessary enlarge the hole in the latter to $\frac{5}{16}$ in. (the rod diameter) and sink in about 2 in. To produce flat faces against which the rod can bed, heat the end to a dull red and force the handle rapidly on. Don't rock the handle, but push straight on. To prevent the heat from travelling down the rod and so spoiling the temper at the point end, a damp swab should be held round it. With-

(*Continued on page 26*)

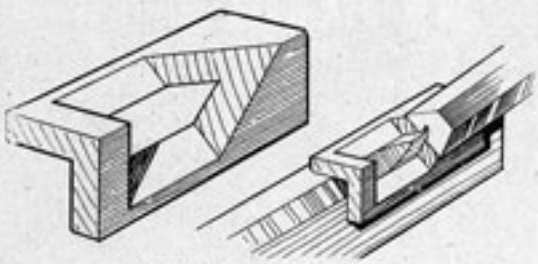


AN INVALUABLE TOOL

The rod is filed square at the end to resist turning in the handle. It is also riveted.

FOR STOPPED CHAMFERS

TO finish off the stop of a chamfer, using the chisel is not easy. It is specially important to hold the chisel at the correct angle, particularly when there are several stops on the job. This simple device will enable you to cut the exact angle without marking or testing, and it will



USEFUL APPLIANCE TO MAKE

certainly enable you to do the work much more rapidly. It is easily made, as in the left-hand sketch. A block of wood is rebated as shown, and a chamfer cut at the opposite corner, the depth of this being arranged in accordance with that of the required chamfer. At one end a 45 deg. angle is cut, and at the other a right angle. The second sketch shows how the appliance is used. It is placed over the work which has already been chamfered, the ends being merely run out. The chisel lies flat on the sloping surface, this providing a definite guide. The opposite end, of course, enables square stops to be cut.

Men who have much of this stop chamfering to do soon accumulate a number of these templates to suit the various sizes of work they do. When an odd size is needed, use the next largest size and glue strips of paper or card in the rebate.

SCRAPER PLANE

(*Continued from page 21*)

the adjustment screw another *slight* turn if a heavier cut is needed.

Making.—Prepare a hardwood block 12 in. by 3 in. by $1\frac{3}{4}$ in. and mark out the mouth. It is $\frac{5}{16}$ in. wide and slopes at about 72 deg. It is necessary to mark out this angle at the ends to enable the line to be transferred to the top (see Fig. 2). Cut away the mouth and escapement first and work the front chamfer and the rebate at the back. Mark out and cut plan of handles, and cut away underside where handles are raised from sole. Clean up with file whilst in the square, and round over afterwards, finishing with scraper and glass-paper. Fitting of the clamp and adjustment screw is obvious. Always tighten the clamp screws first, making sure that the adjustment screw is not bearing on the cutter.

WOOD ROUTER
or the
Old Woman's Tooth

The chief use of the router is in levelling the bottom of a groove or other recess, and its advantage in this type of work is that it makes the groove of exactly the same depth throughout. What happens in practice is that the groove is chopped out with the chisel to a depth slightly less than that required, and the router used to finish off.

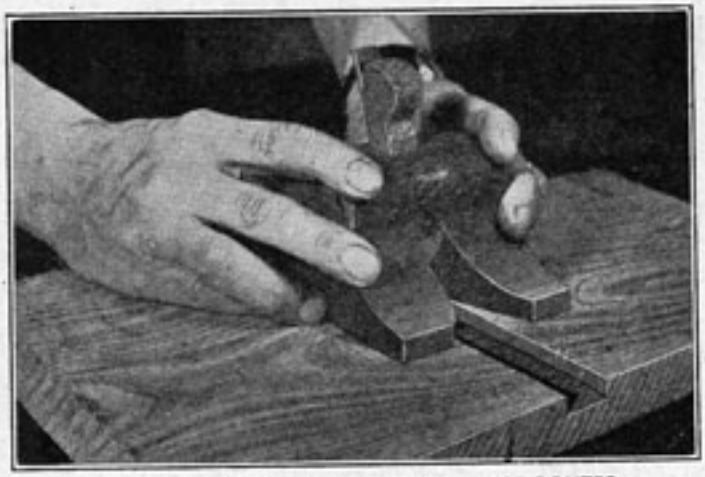


FIG. 1 FINISHING GROOVE WITH LARGE ROUTER

This router is of the open mouth type, the particular advantage of which is that it enables the waste to clear easily. A whole range of cutters of various sizes can be fitted.

THERE are routers in which the cutter is cranked so that it lies at a very low angle to the wood it is to cut. Undoubtedly there is an advantage in this in that it makes for easy cutting, since it has more the action of a chisel. On the other hand, the grain of certain woods is liable to tear out. Glance for a moment at Fig. 3. If the grain were running at a slight angle, the router would have to be worked against it in certain parts because otherwise the side could not be reached. The slope of the cutter gives it a tendency to tear out the grain; also if care were not taken the cutting edge would strike against the sides of the groove, and so damage them.

With the wooden router of the form shown in Fig. 1 there is very little tendency to tear out the grain because it has more of a scraping action than a cutting one as seen in Fig. 4. The cutter slopes back at an angle of no more than 20 deg. out of the vertical. It makes the working rather harder, but, as the majority of the waste has already been chopped away, this does not matter a great deal. Then, if the cutter does strike against the side it will do little harm because it is set at so high an angle.

Yet another advantage is the fact that it will work in a considerably smaller space than the metal type. In Fig. 3 it is obvious that the cutter will not enter a space less than its own horizontal length, see X, and it cannot be used effectively in a recess which is less than double this size, because otherwise the cutting edge will not reach the centre (see Y). The smaller space that the wood router will negotiate is shown in Fig. 4. However, the cranked type is better for some work, especially for straight grained wood which is not liable to tear out.

Two routers are given here, and the difference is chiefly one of size, though the one has an open, and the other a closed mouth. There is not very much in the latter detail. Possibly the waste clears more easily in the open mouth type, whereas the closed mouth is better for a groove, say, on the edge of a board where the narrowness makes the support at the front of the mouth desirable. But both work perfectly well. A reliable hardwood such as beech should be used for making them. A brittle wood is not suitable because it is liable to split under pressure of the wedge.

The Large Router.—This can conveniently be about 4½ in. long, by 2½ in. high, by just over 3 in. wide, but these sizes need not be followed exactly. The shape is one which experience has shown to give a good, comfortable grip. The first step is to prepare the wood in the form of a rectangular block to the over-all sizes, and mark out upon it the slot in which the cutter and wedge fit. Fig. 2

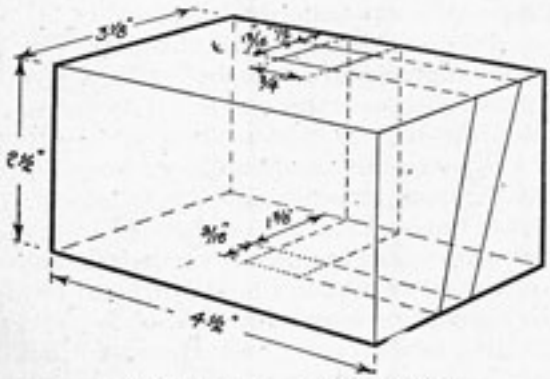


FIG. 2 (above). HOW BLOCK FOR LARGE ROUTER IN FIG. 1 IS MARKED OUT

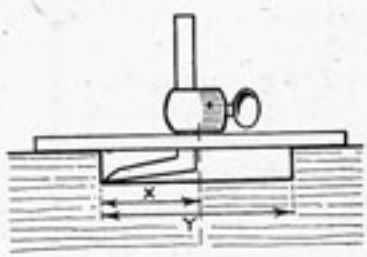


FIG. 3. LIMITATION OF METAL ROUTER WITH CRANKED IRON

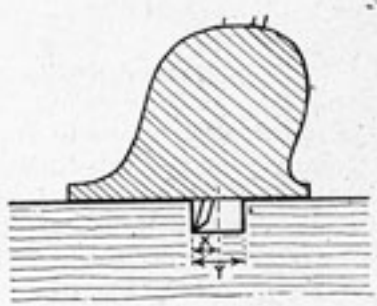


FIG. 4. HOW STRAIGHT CUTTER ENABLES SMALL RECESS TO BE CUT

AN INVALUABLE TOOL FOR HOUSED JOINTS

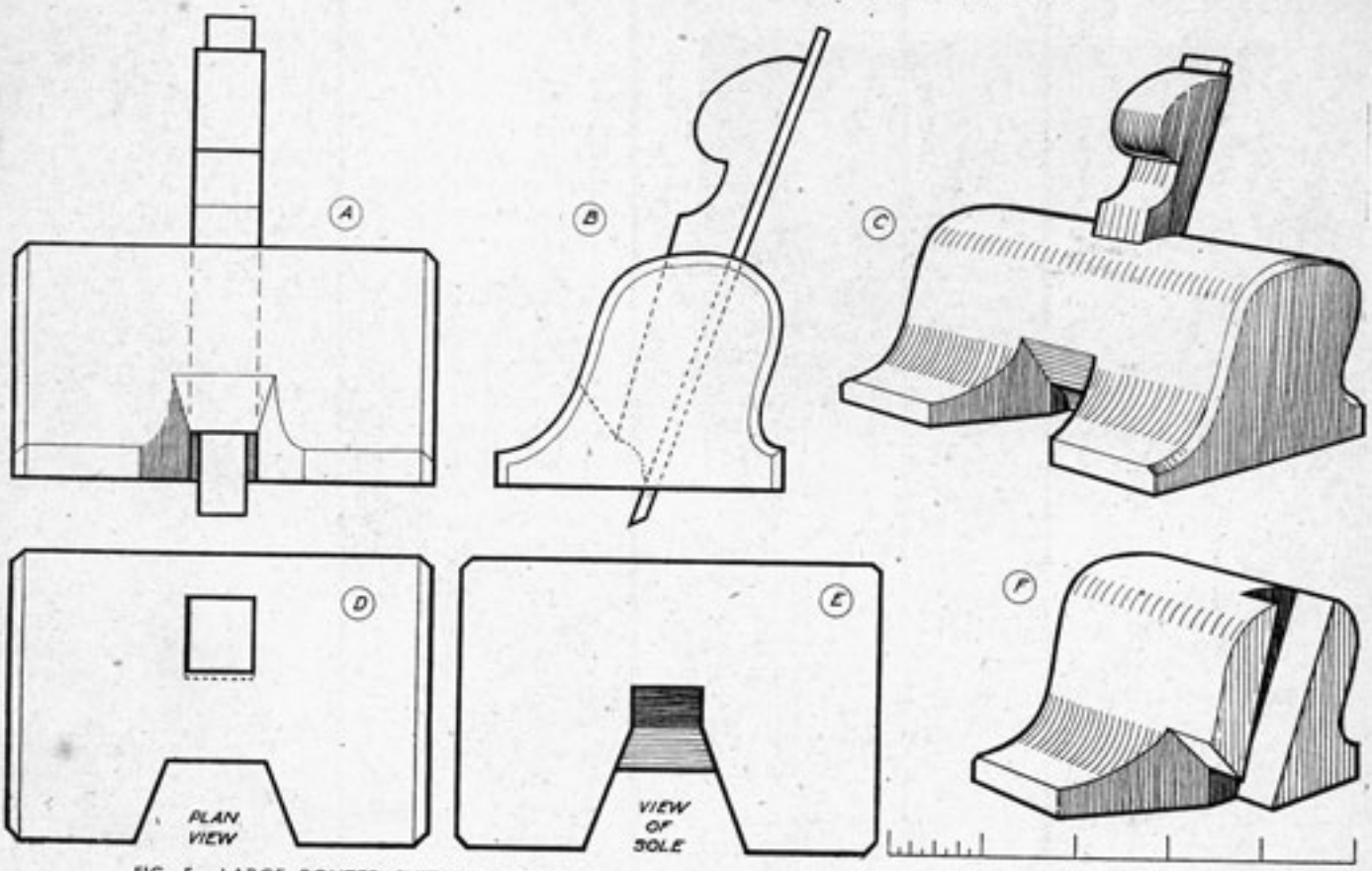


FIG 5. LARGE ROUTER SUITABLE FOR SUCH WORK AS CLEANING OUT SHELF GROOVES AND SO ON
A. Front elevation. B. Side elevation. C. Perspective sketch of completed router. D. View from above. E. Router seen from beneath. F. Cut-away view of router showing the slot for the cutter and wedge, and the splayed, open mouth.

shows how this is done. The block must be planed square because otherwise the marking out will be thrown out of truth. In the centre of the top the slot is marked and the lines are squared round the back to the underside, as shown. A gauge is used to mark the lines parallel with the front, at both top and bottom, but it is as well to draw in also the sloping lines at the end because they are a guide when the hole is being bored.

A ½ in. twist bit is suitable for boring. Fix the block in the vice so that the brace can be held upright when being used. The hole should be bored half-way through from each side. A chisel is used to finish off, and the important thing here is to make the sides perfectly flat and straight, especially the back one upon which the cutter lies. If anything it can be the merest trifle hollow. Roundness must be avoided because it will cause chattering.

The exact curve of the end shape is not very important. It can be sketched in freehand, and a cardboard template or tracing made to enable the other end to be marked. A great deal of the waste can be sawn away, and the shape finished off with a round moulding plane and ordinary plane, followed by filing and glasspapering. When completed the chamfer all round can be cut to make the grip comfortable. The mouth runs into the cutter slot as shown at D and E, Fig. 5. The sides can be sawn in and the waste chiselled away.

The wedge should make a close fit throughout its length, and it should be arranged that its lower end projects a trifle beyond the upper slope of the mouth as shown by the dotted lines at B, Fig. 5. This may vary a trifle as different cutters are used, a thin cutter giving it a greater projection, but this does not matter. What should be avoided is a short wedge, because shavings are then liable to be forced up into the slot and so cause choking. In any case the wedge end is cut at an angle to throw the shavings forward. A convenient form of cutter for the router is an iron such as that used in a metal plough plane.

Small Router.—Details of this are given in Fig. 7. The rather fanciful shape is not essential in any way, though it certainly gives a good grip for the fingers. A rectangular block with the corners taken off would answer the purpose well, but readers who take a pride in their tools will probably prefer to go to the trouble of working the shape given. It is a good example of the persistence of a trade tradition. The writer remembers in the days of his apprenticeship how every boy made his own routers, and the curious

CARVERS OFTEN USE A SMALL ROUTER LIKE THIS

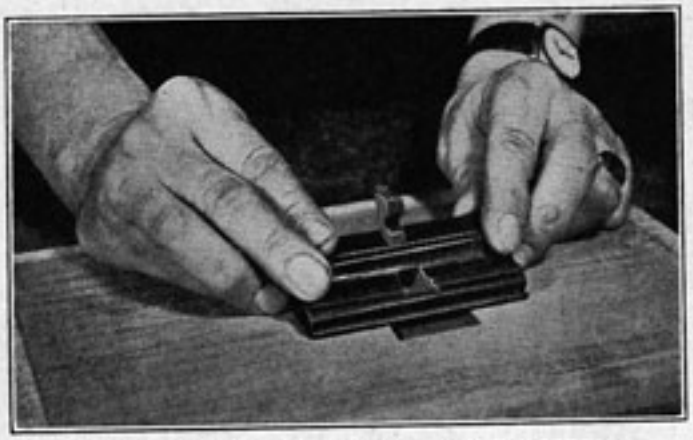


FIG. 6. SMALL ROUTER CLEANING OUT A RECESS

Of the closed mouth variety, this router has the advantage of having ample support at the front. The choice of an open or closed mouth, however, is largely one of personal preference.

thing was that in a workshop of, say, twenty cabinet makers, every router, except for small variations of detail and size, would approximate to the same shape.

The work involved is practically a repetition of that already described for the large router. The marking-out is done whilst the block is rectangular, and, if a wide bevel is taken off the top front edge, the mouth or escapement can be cut for the greater part. Rebate and moulding planes are used to work the moulded shape. If it is desired to convert it to the open-mouth type it is necessary only to make a saw cut at each side. Either a plough iron of the type already mentioned, or the blade of a small broken chisel can be used.

You can use a router for making stopped grooves if you fix a fence to the sole and work this against the edge of the wood.

SCREWDRIVER (Continued from page 23)

draw the rod, wait till cool, replace, and tap well on with the mallet, the rod held in the vice.

Drill a $\frac{1}{16}$ in. hole right through the ferrule, through the rod, and out the other side. Tap in a little piece of iron to make a tight fit (a panel pin does very well), cut off about $\frac{1}{32}$ in. full, and rivet over. Finally clean up the rod with emery cloth and it is ready for use.

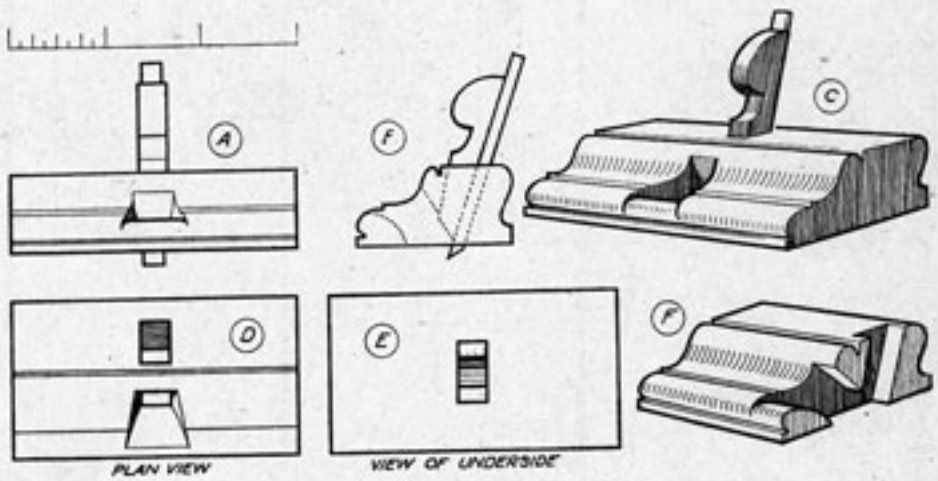


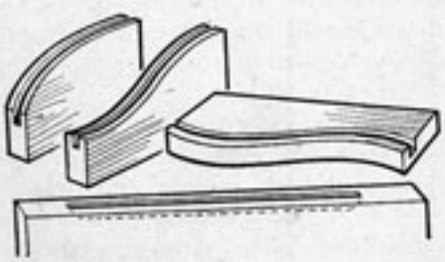
FIG. 7. DETAILS OF SMALL ROUTER

A. Front elevation. B. Side elevation. C. Complete router. D. View from above. E. Router from below. F. Cut-away view.

QUIRK ROUTER (Continued from page 27)

Cut the elongated hole to enable the fence to be adjusted. Washers are used to prevent the nut and bolt head from damaging the wood.

Cutter.—This measures $2\frac{3}{4}$ in. by $\frac{3}{4}$ in. by $\frac{1}{8}$ in. It should be made in tool steel which can be obtained in strip form. It is soft when obtained and is tempered after being cut to shape. Mark a centre line and bore a $\frac{3}{8}$-in. hole with the centre $\frac{5}{16}$ in. from one end. Open this out as shown in Fig. 2 and file one cutter with a three-cornered file to form the "V" groove. The other is bevelled. It is an advantage if the edges of the cutter are thinner than the middle, as it gives clearance for shaped work. Four $\frac{5}{16}$-in. holes are drilled above. Heat the end to a bright cherry red and quench in cold water. Clean with emery paper and, heating the cutter at about the middle, allow the colours to pass down to the end. Light yellow merging into brown, then to purple and finally to blue is the order. When a medium brown has reached the end quench in water. Final sharpening of the cutter is with a small oilstone slip. Keep it keen.



SOME OF THE WORK THIS TOOL WILL DO

The QUIRK ROUTER

The strange feature about this tool is that it is now practically unobtainable. It used to be made in metal, and in form was something like a spokeshave, but is now no longer in production. Fortunately, it can be made successfully in wood. Its chief purpose is for working grooves around curves. For instance, in shaped mouldings it is invaluable for the preliminary setting-in of the members. It has other uses, however, chief amongst which is that of working stopped grooves and rebates. It will work a groove up to within about $\frac{1}{8}$ in. of the stop. A feature that will appeal to many is that it can be used for straight as well as curved work.

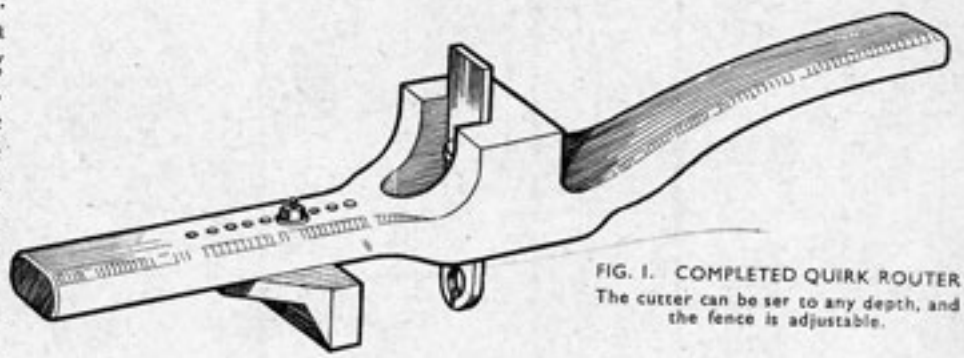


FIG. 1. COMPLETED QUIRK ROUTER
The cutter can be set to any depth, and the fence is adjustable.

THE cutter is really double. The front portion has a "V" groove in it leaving a knife-like edge at each side. It thus cuts the sides of the groove, a necessary feature when working cross grain. It also serves as a sort of face since it bears on the wood and prevents the second cutter from digging deeply into the wood. This second cutter removes the shavings. A bolt holds the cutter in position, the projection being allowed in accordance with the depth of groove to be worked. A fence enables the groove to be worked at any desired distance from the edge. For curves another fence is fixed, this having a rounded face.

Use.—The cutter being set to the required depth and the fence at the distance from the edge, the tool is grasped by the two handles and worked back and forth with the fence kept tightly up against the edge of the wood. For the first cut it is advisable to tilt the router slightly forward so that the sides of the groove are cut. Otherwise the second or following cutter may dig in before the grain is cut, and tearing-out may result.

Construction.—A block of hardwood finishing 12 in. by $1\frac{3}{4}$ in. by $1\frac{1}{2}$ in. is needed. Square it and mark the cutter position and escapement in top and bottom surfaces. A $\frac{3}{4}$ in. hole can be bored half-way through from each side and made square and slightly enlarged at the cutter side. Now work the elevation shape and remove the unwanted wood by making a series of saw cuts nearly down to the line and chiselling away the waste. This will enable the slot to be cut through which the cutter-fixing bolt passes.

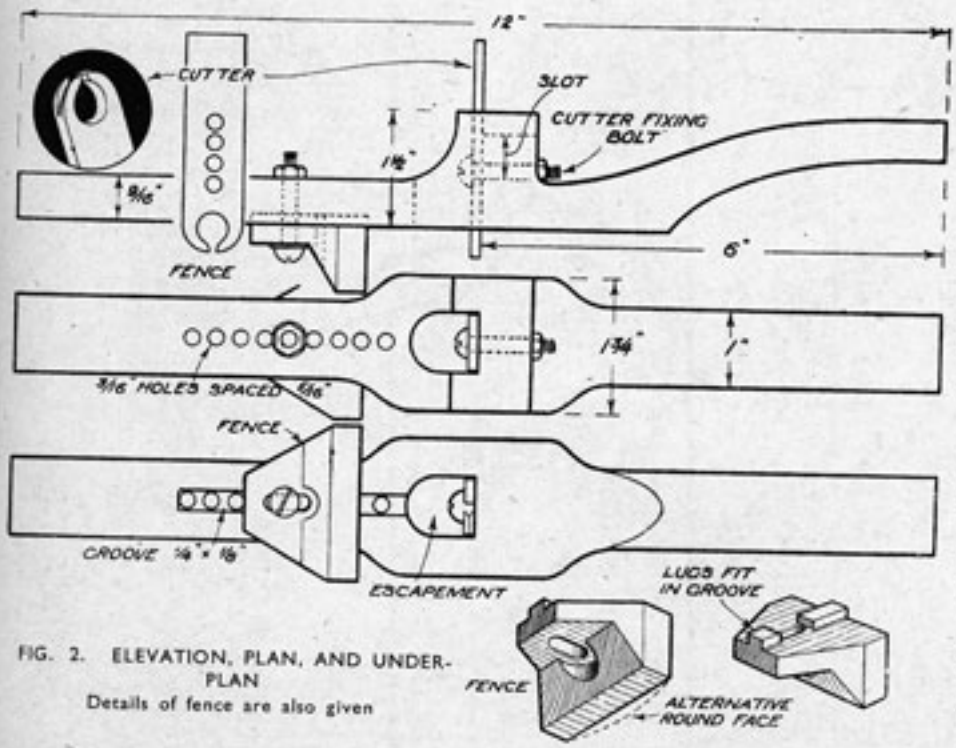


FIG. 2. ELEVATION, PLAN, AND UNDER-PLAN
Details of fence are also given

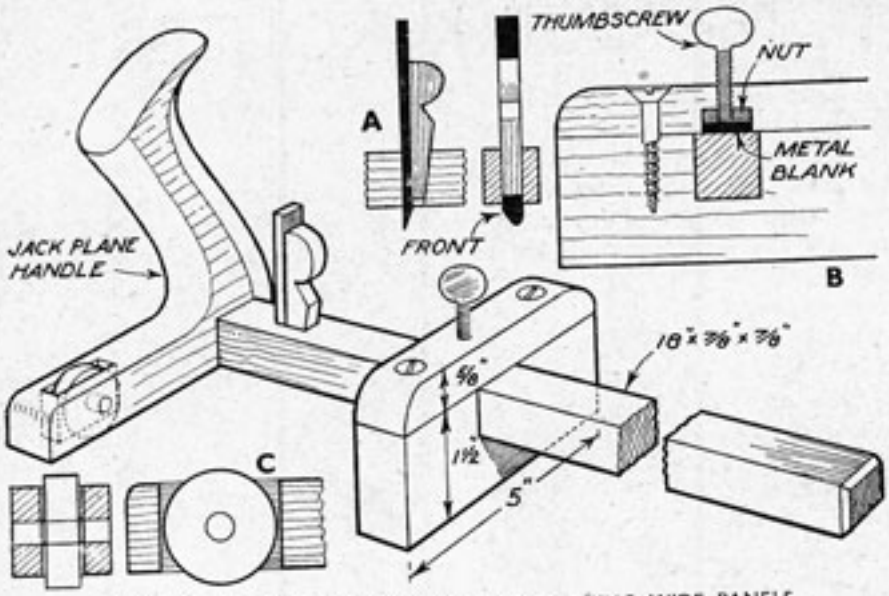
Through the straight handle a series of $\frac{3}{16}$ in. holes is bored $\frac{5}{16}$ in. from centre to centre. If they are bored from each side any splitting-out will be avoided. Along the underside and in line with the holes a groove $\frac{1}{4}$ in. wide by $\frac{1}{8}$ in. deep is cut, this forming a guide for the lugs of the fence. Cutting the plan shape and rounding the corners completes the main body.

Fence.—This is $1\frac{1}{2}$ in. long by 2 in. wide by 1 in. thick, and is cut to the shape given in Fig. 2. Make the lugs a comfortable working fit in the groove, free from slackness.

(*Continued on page 26*)

PANEL SLITTING GAUGE

When you have to cut a thin panel to width or to cut a series of strips in thin wood it is much quicker and more economical to use a slitting tool rather than a saw. The wood has only to be cramped down and a cut made from each side with this slitting gauge.



THIS GAUGE CAN ALSO BE USED FOR MARKING WIDE PANELS

Hardwoods up to about ⅜ in. thick can be cut with this. Even ½ in. boards in softwood can be slit if free from knots. Note that bevel of cutter faces fence (A). Fence details are at B, and wheel section at C.

ANY reliable hardwood can be used for this gauge. The only part requiring a really hard wood is the wheel in the handle which should be of boxwood, ebony, lignum vitae, or some similar wood—or of metal. The handle is an ordinary jack plane handle, though it could easily be shaped from hardwood. Mark on it a through mortise to take the main stem, splaying it at the outside so that the tenon can be wedged. Mark out and bore a ¼-in. hole to take the axle of the wheel, and afterwards cut a vertical mortise 1⅜ in. long by $\frac{7}{16}$ in. wide to take the wheel itself, which is 1¼ in. diameter by ⅜ in. thick. If a lathe is available the wheel can be turned, but it is easily shaped by hand. Make it to revolve freely on its axle without undue wobble. The axle is glued to the handle only.

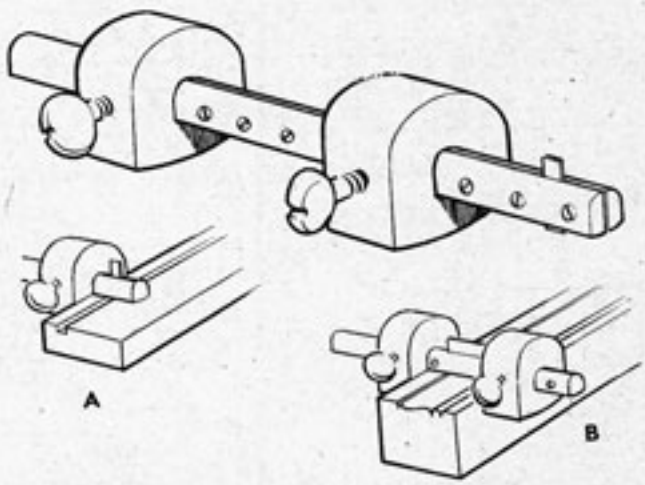
Cut the tenon on the stem and sink a mortise to hold the cutter and its wedge. An old broken $\frac{5}{16}$-in. chisel was used for the gauge described, but any old tool of a similar kind could be used. The exact size does not matter.

The fence is in two parts screwed together, a square hole to take the stem being cut in the lower portion. This should allow the fence to slide freely but without side play. A hole is bored in the upper piece for the thumbscrew, and a square or hexagonal is cut in the underside to take the nut. A metal blank is fitted beneath to prevent the screw from biting into the wood.

HANDY SCRATCH

THIS scratch is easily adjusted. It is made from a marking gauge and can be provided with either one or two fences. The advantage of two is that when a wide moulding is being worked on a leg or rail with parallel sides the second fence effectively prevents any tendency for the scratch to drift from the edge. A and B show the single and double fences in use.

Remove the fence from the gauge and withdraw the marker. If only one fence is to be used, make a saw cut with the tenon saw along the stem about 2½ in. down. If there are to be two fences the cut will have to extend about 6 in. Two $\frac{3}{16}$-in. or ¼-in. bolts are used to hold the cutter in position, and at least three holes are needed near the end so as to allow cutters of varying size to be fixed. Another three are needed at the middle if two fences are to be used. The nuts, which should preferably be square, must be recessed so that they do not turn when the bolt is tightened. Washers are needed beneath the bolt heads. It is advisable to recess bolts as well as nuts so that the fence is free to pass right over them. Any piece of old band-saw blade can be filed to form a cutter.



INVALUABLE FOR INLAYING OR FOR MOULDINGS

Either the single or double fence can be used according to circumstances. The advantage of two fences is that the scratch is not so liable to wobble from side to side.

ROUTER
with cranked cutter

Being fitted with a cranked cutter this router is very powerful, since the cutting edge is almost flat on the work and cuts similarly to a chisel.

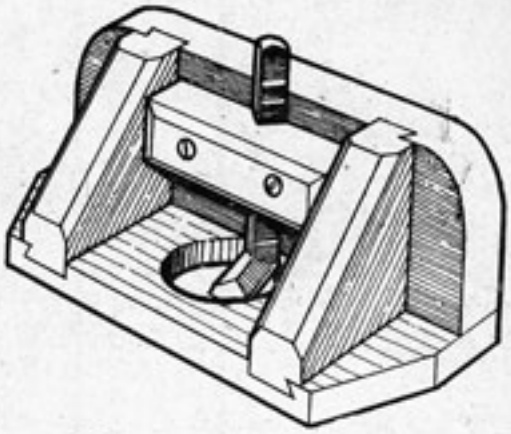


FIG 1. IDEAL FOR HEAVY WORK

Those able to obtain a large block of hardwood could cut the whole thing in the solid. In this case there would be no need to hollow out the corners. Only the general shape would be followed.

THE usual router made by the woodworker has its cutter set at a steep angle, round about 70 deg. An example is given on page 24. Its high pitch gives it more of a scraping than a cutting action and this means that it is not liable to tear out the grain. On the other hand it presents considerable resistance, and for this reason some workers prefer the router with a cranked cutter. This lies over only a few degrees out of the horizontal, and its action is thus practically that of the chisel.

Those who prefer could make the main stock out of a solid block of hardwood. As, however, many readers will not have a large enough section of wood, a built-up stock is given here. There is a $\frac{1}{2}$-in. sole, a $\frac{7}{8}$-in. back, and two $1\frac{1}{8}$-in. angle blocks.

Cut out the parts to finish to these sizes : sole, 6 in. by $2\frac{7}{8}$ in. ; back, 6 in. by $2\frac{1}{8}$ in. ; angle blocks, $2\frac{5}{16}$ in. by $2\frac{5}{16}$ in. (note that the grain of the last named runs diagonally). Mark the centre hole ($1\frac{1}{2}$ in. diam.) in the sole and note that at the back it is cut out at a right angle to accommodate the cutter stem. Gauge the thickness of the back along the back edge and set out the dovetail slots. These are barefaced, and it is a good plan to taper them. The advantage is that they then are tight only when pushed right home, and this simplifies the fitting. It will be realized that as blocks are dovetailed to the back also they must project beyond the gauge line to the extent of the dovetail depth.

Having completed the sole joints, transfer the marks to the back and cut these joints also. Arrange the taper so that the back slips down from the top. Continue the "V" groove up the back. When assembling, the parts must go together in the correct order ; the angle blocks into the base, and the back lastly. When dry level any inequalities in the "V" groove and fit the cutter-holding block. This has also a "V" groove, the depth of which is arranged so that there is a slight gap between the block and the back when the cutter is in position. Fix with a couple of screws.

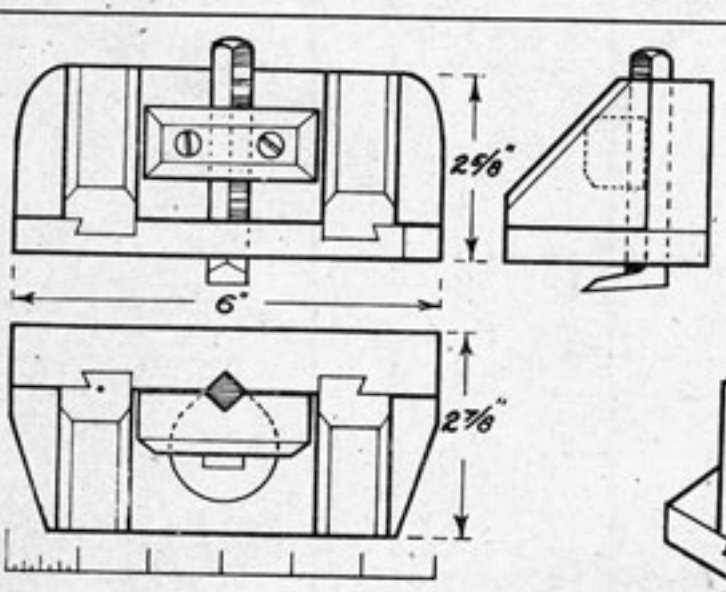


FIG. 2. SCALE ELEVATIONS AND PLAN

This can be made with a hardwood sole and cutter-holding block, the rest of the parts being in a softwood.

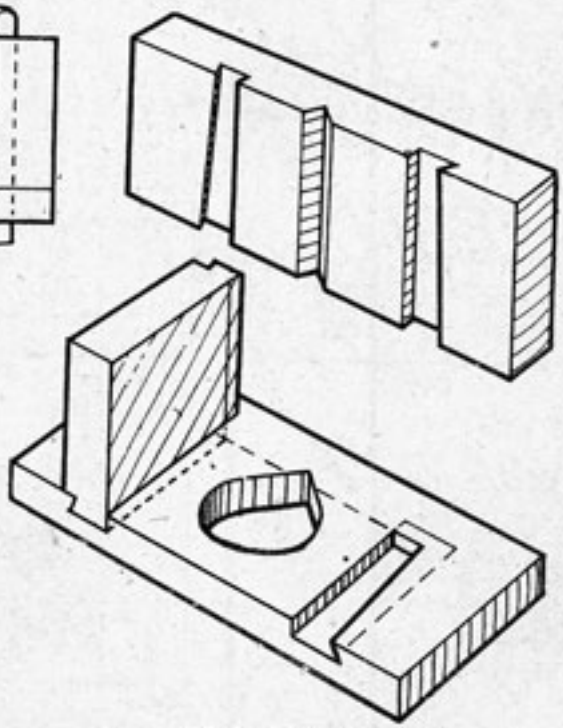


FIG. 3. DETAIL OF JOINTS

THREE-DIMENSION HINGE GAUGE

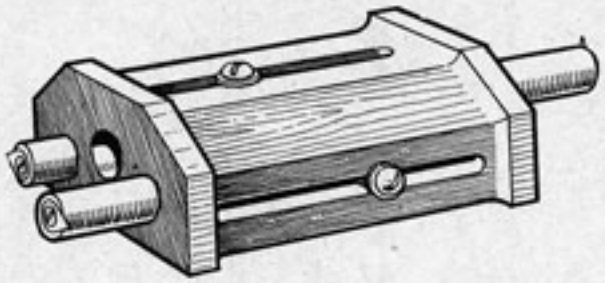


FIG. 1. IDEAL FOR HINGES, LOCKS, AND FITTINGS
You can set one, two, or three sizes on this gauge. The special advantage is in fixing butts for which three sizes are often needed.

When you hinge a door which is flush at the front you need two gauges, one for the thickness of the knuckle and the other for the depth. If the door is set in, as in Fig. 2, you have either to reset one gauge or use another to give the third dimension (B). This hinge gauge, which you can make yourself, gives all three sizes. Furthermore, since the markers are fixed right at the end of the bars, the gauge can be used to mark close up in a rebate as in Fig. 3. This is usually impossible with the ordinary gauge because the end of the bar projects beyond the marker.

THE gauge consists of a main stock in which three round bars slide. At the end of each bar is a steel marker. To enable the bars to be fixed in any desired position bolts are let in, these sliding along slots cut in the main stock. To use the gauge set the bar so that the marker projects the required amount (put the hinge against the bar or use the rule) and use the gauge in the normal way as in Fig. 6. Note that all three markers point in different directions so that it is impossible to make two marks at the same time. It is a quite good idea to put a distinguishing mark on each, such as C for carcase, D for door, and T for thickness. In this way there is no danger of the wrong marker being used. This is not likely to happen in the case of T because this is always much less than the others, but C and D have often not more than $\frac{1}{8}$ in. difference, and it is then that the distinguishing marks are handy.

Construction.—Cut out the main stock from a piece of hardwood to finish $3\frac{1}{2}$ in. by $2\frac{3}{4}$ in. by $1\frac{3}{8}$-in. With the gauge mark the positions of the holes at ends, using the gauge from the same edges to ensure both ends being alike. Put on a handscrew to prevent possible splitting, and bore the holes ($\frac{1}{2}$ in.) half-way in from each end. Care is obviously necessary to keep them upright. Chamfer the two corners, and work the hollowed-out depression running around the five sides. A gouge is useful for removing the bulk of the waste, whilst a rebate or shoulder plane is handy for finishing

(Continued on page 31)

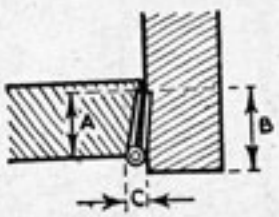


FIG. 2. THE SIZES YOU NEED WHEN HINGEING

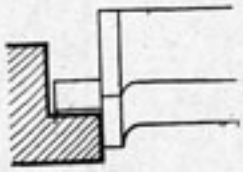


FIG. 3. GAUGE USED IN REBATE

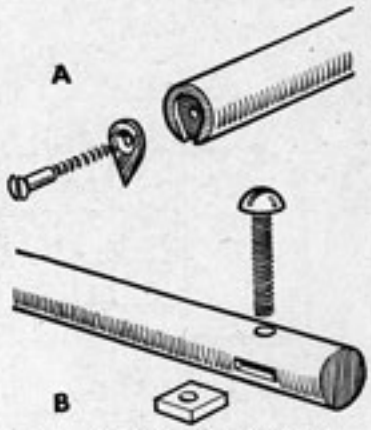


FIG. 5. A. DETAIL OF MARKER
B. FIXING NUT AND BOLT

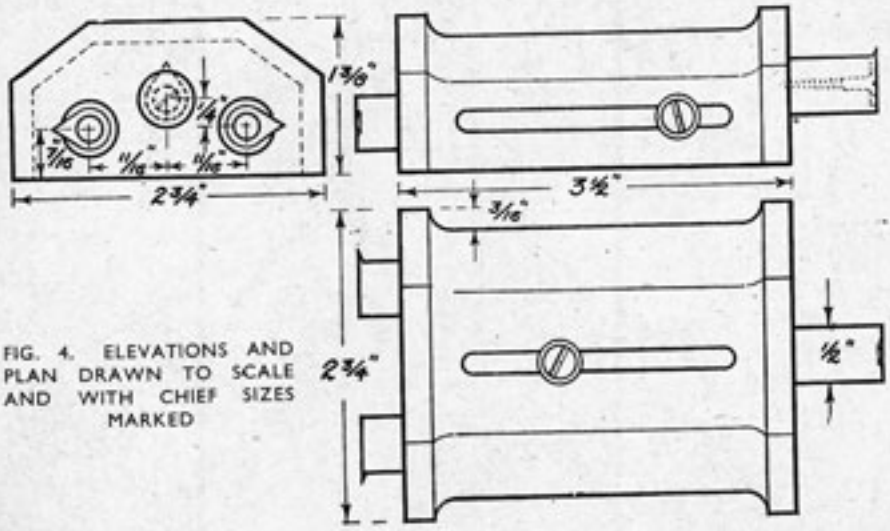


FIG. 4. ELEVATIONS AND PLAN DRAWN TO SCALE AND WITH CHIEF SIZES MARKED

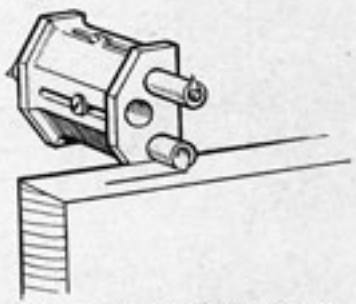


FIG. 6. HOW GAUGE IS USED

LARGE PANEL GAUGE

Exact sizes are not important. The main stem should not be unduly heavy, but it should be rigid. About 1 in. or ⅞ in. square in section is about right.

THE purpose of this is fairly obvious; it enables wide pieces of wood such as tops, carcase ends, etc., to be marked perfectly parallel. A length of 30 in. for the main stem is suggested since few items in cabinet work are larger than this. If, however, your work involves dealing with extra wide parts, you could increase the length to 3 ft. or even more. In this case the length of the fence might be 8 in. to prevent possibility of racketing.

Either a steel marker can be used or a pencil can be inserted in a hole. Some workers prefer one; some the other. The marker gives a more exact line, whilst the pencil mark is more easily seen, especially on light woods. If you decide on the pencil you can either make the latter a tight fit, or you can arrange to fit a small wedge to one side.

Use a reliable hardwood throughout. Cut the fence to an oblong shape and mark in the centre mortise with its slot above for the wedge. Note that the top of the slot must slope to conform to that of the wedge. At the bottom work the rebate and finally shape the top edge and smooth it.

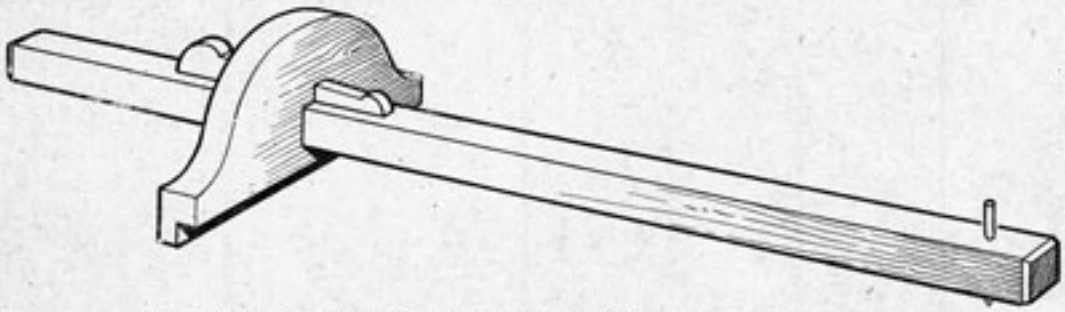


FIG. 1. INVALUABLE FOR GAUGING LARGE PANELS TO WIDTH ACCURATELY
You can fit either a steel marker or a pencil to this gauge. The rebate in the fence is desirable as it ensures the gauge being held parallel with the wood.

The rebate is worked along the edge of the panel and this ensures that it is kept at the same height. To vary this might give a false reading. Note that the curved ends of the wedge are to prevent it from slipping out and becoming lost. To assemble the gauge it is essential to insert the wedge first. Push it to its thinnest part, and then enter the stem.

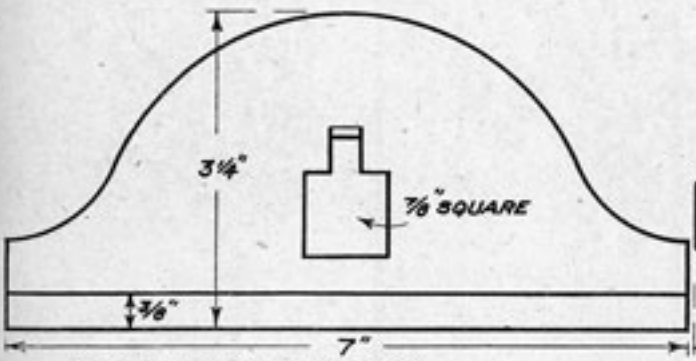


FIG. 2. MAIN SIZES OF THE FENCE

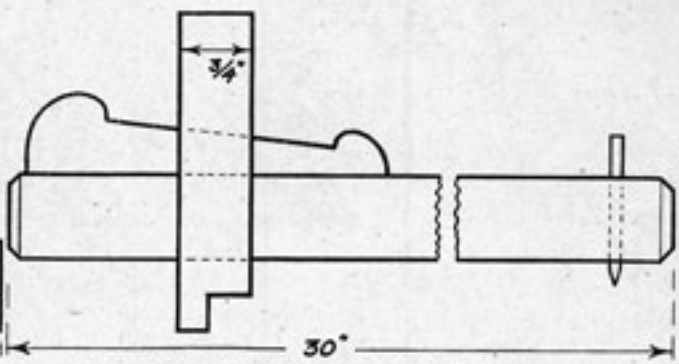


FIG. 3. SIDE VIEW SHOWING THE WEDGE

HINGE GAUGE

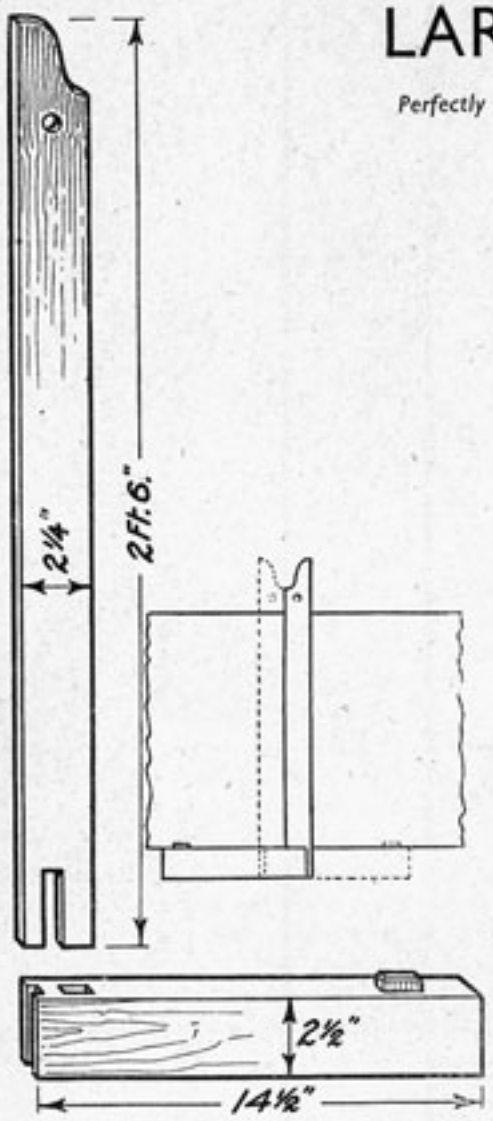
(*Continued from page 30*)

off. Mark in the three bolt slots, each exactly central with its hole, and cut. The main waste can be drilled, a narrow chisel being used to finish off. As this operation may tend to splinter the wood at the hole, an excellent plan is to put a ½ in. dowel in the hole and chop down on to this. The wood is thus supported.

The bars are round lengths of rod ½ in. diameter with a marker at one end and bolt at the other. Fig. 5, A, shows the shape of the marker and how it is let in flush. Any piece of steel can be used. The writer used an old hacksaw blade, making this red-hot and allowing to cool slowly to lower the temper. This enables the screw hole to be drilled and the shape cut. The pointed end is bevelled beneath to give a cutting edge. Note how it is recessed into the wood. This prevents it from twisting when the gauge is in use. At the other end a nut and bolt fixing is arranged as at B, Fig. 5. When assembling the gauge put a washer beneath each bolt head to prevent the latter from biting into the wood.

LARGE WOOD TRY SQUARE

Perfectly successful squares can be made in wood providing seasoned stuff is used. The great thing is to keep the tool as light as is consistent with strength.



MAIN SIZES OF THE SQUARE AND METHOD OF TESTING

EXACT sizes are not very important in this square ; they can be varied to suit the class of work usually tackled. The square shown here has proved suitable for use in general cabinet making. A reliable hardwood is essential.

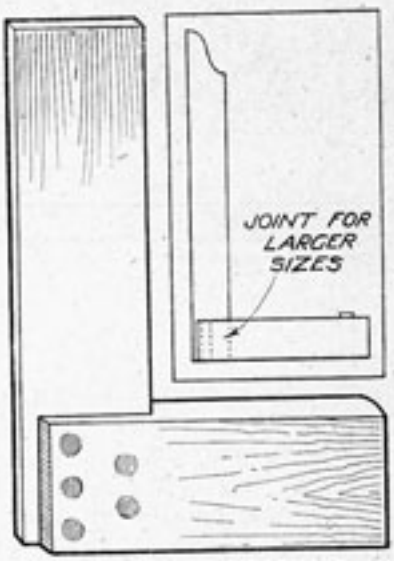
The construction is clear, the blade being tenoned into the stock and having a tongue which fits in a groove cut at the end. A small guide piece is let into the stock to enable the latter to be kept parallel with the surface. The important point about the whole thing is that the main joint must be cut to a nicety, so that the blade is held firmly quite apart from the grip of the glue. This, of course, involves accurate marking out.

Cut out the material, allowing the stock an extra inch so that there is no danger of the wood being split whilst the mortise chisel is used. Mark the mortise position, carry the marks round to the opposite edge, and chop half way from each side. The mortise gauge as used should be retained with the same setting so that the groove can be marked after the end has been cut to the finished size. The small slot for the guide piece can also be marked.

When gluing up test the inner edge either with another square known to be true, or by squaring in a line across a board having a perfectly straight edge. When reversed the opposite way (see sketch) the edge should coincide exactly with the pencil line. Note that the inner edge is tested because it would be difficult to correct this after gluing up, whereas a shaving can always be removed from the outer edge. It is well to make the outer edge of the butt perfectly true also as this is sometimes useful for testing internal angles.

SMALL TRY SQUARE

THIS has a rather different construction from the large square above. Instead of the mortise and slot an open mortise is cut and the blade glued in. The joint is well cramped, and after the glue has set five ¼-in. holes are bored and dowels glued in. The blade might be 6 in. by 1½ in. by ¼ in. and the stock 4 in. by 1½ in. by ⅞ in. Larger squares up to a 12-in. would be larger in proportion except that the same thicknesses would be retained.



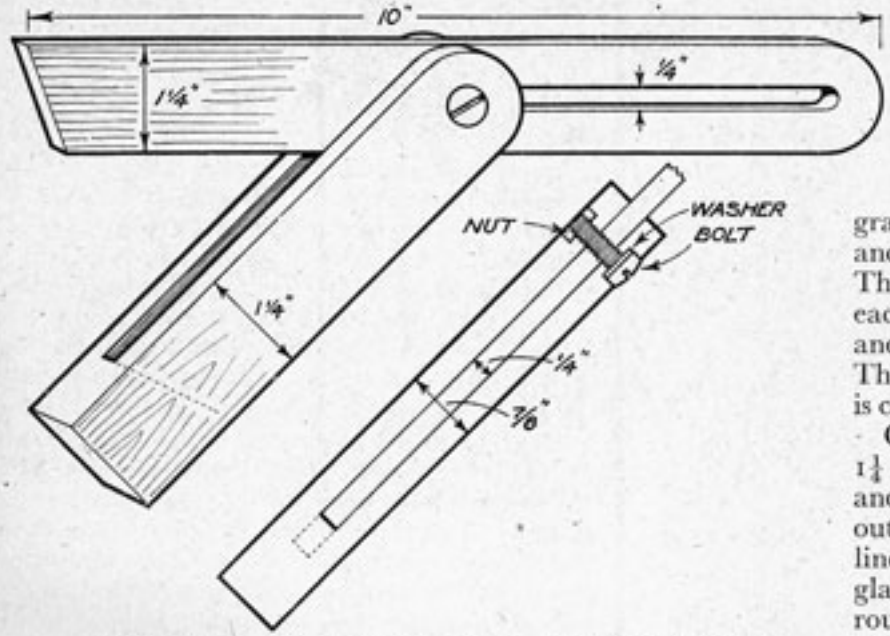
USEFUL WOOD TRY SQUARE

HANDY TOOLS (*Continued from page* 36)

any position along the rebate so formed. At the near end a strip of wood is held by a holding screw. Thus in use the wood to be worked is placed in the rebate, the lower strip being arranged so that it will not interfere with the working of the fence of the grooving plane. The stop is positioned so that the near end of the wood projects about ⅛ in. Thus by tightening the holding screw the end strip bears against the wood being worked.

The Scratch.—A rather more convenient type of scratch than the plain hooked type is that made from an ordinary marking gauge as shown at (Q) The marking pin is removed and a saw cut made down the end of the stock. Bolts are passed through the stock so that the cutter is held firmly in position.

SLIDING BEVEL

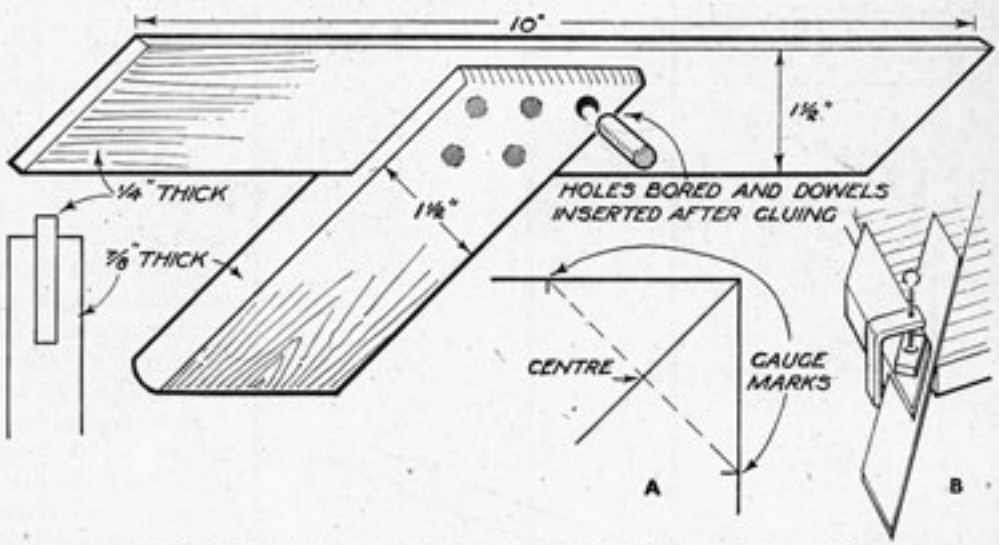


MAIN SIZES OF THE SLIDING BEVEL AND SIDE SECTION
With the exception of the bolt the whole thing is made in wood throughout.

THIS tool invariably has a metal blade when obtained in a shop, and the thinness of this can be an advantage. The wooden blade shown here is perfectly satisfactory for general bench work, however. Cut it from a close-grained hardwood to finish ¼ in. thick, and form the ¼-in. slot along its length. The best way is to bore a ¼-in. hole at each end, gauge the sides, saw down, and finish with chisel and glasspaper. The slot end is rounded whilst the other is cut off at an angle to enable it to open.

Cut the stock to finish 6½ in. by 1¼ in. by ⅞ in. Bore the ¼-in. nut hole, and saw the slot. This is best marked out with the gauge, sawn bare of the line, and finished with file and finally glasspaper. The bolt should have a round head, whilst the nut should be either square or hexagonal. Both are recessed as shown, and a washer is inserted beneath the head. Make the blade to move freely without slackness. The whole blade and slot of the stock can be rubbed well with candle-grease or wax to give free movement. Finish all parts with french polish before waxing.

MITRE SQUARE



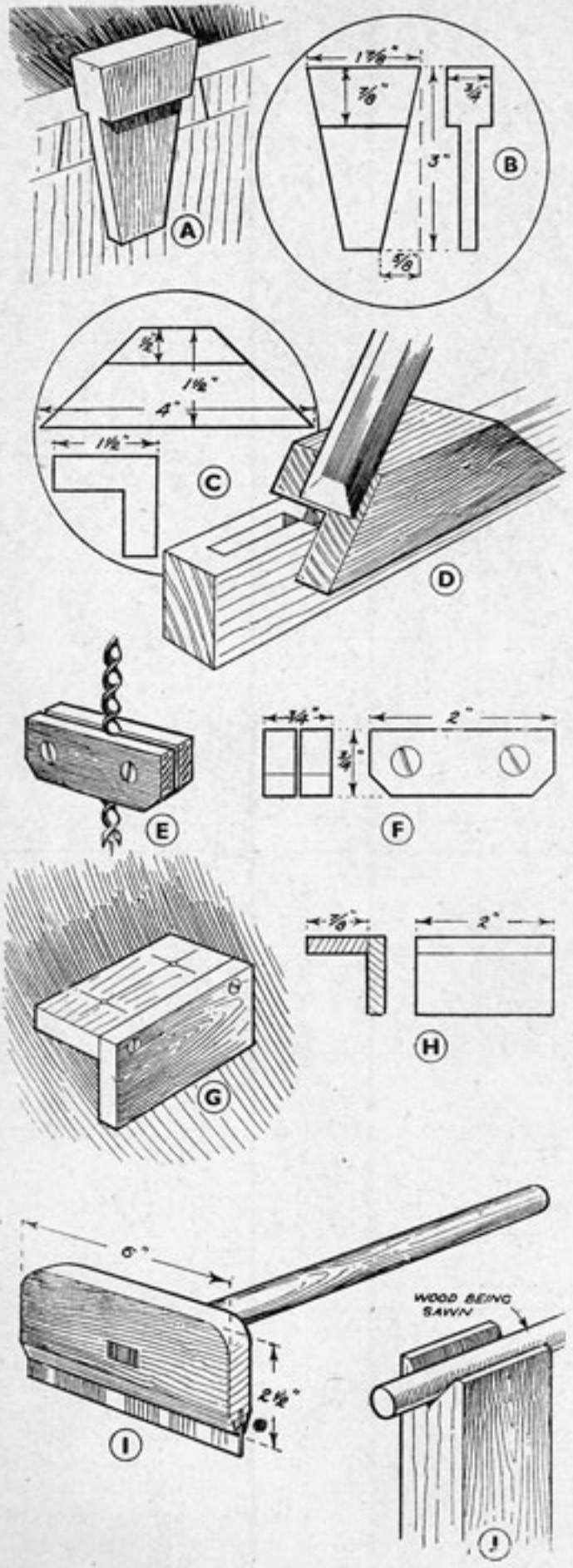
CONSTRUCTION OF MITRE SQUARE AND METHOD OF TESTING
In both these squares the blade is glued to the stock and the dowel holes bored afterwards.

PREPARE both blade and stock to the sizes given, trimming the ends of both to 45 deg. Mark the slot in the stock with the gauge, and saw carefully down on the waste side. Probably a little local correction with the file will be needed after the core has been chiselled away. Take care to make the bottom of the slot perfectly flat. If anything it might be *slightly* hollowed. Glue the blade in position as shown at B, testing it to a line drawn at 45 deg. on a square corner. A shows how to mark a line at the exact angle. Mark any convenient distance with the gauge along both sides, working the gauge from the corner. Join the marks (dotted line) and mark the centre of this. A line from the corner to this centre is at 45 deg. if the corner is truly square. Five ¼-in. holes are bored through when the glue has set and dowels glued in and levelled. Of course, if the slot in the stock has been accurately cut the blade should be at the correct angle. If it is not when tested dry, correct the slot with the chisel before gluing.

A coat of french polish not only preserves the tool also but prevents glue from adhering.

ELEVEN
HANDY TOOLS

DOVETAIL MARKER : DEPTH GAUGE
MITRE TEMPLATE : VENEERING HAMMER
DOWEL MARKER : SCRAPER SPOKESHAVE
SAWING "V" : WINDING STRIPS
MARKING OR CUTTING GAUGE : PLANING BOARD
THE SCRATCH



WE give here a group of simple tools, some of which you probably know about, though it may not have occurred to you to make them yourself.

Dovetail Marker.—There is first a dovetail marker (A), which gives the correct angle at which dovetails should slope. It is so simple that it scarcely needs any description. The sizes are not specially important so long as the same slope is maintained. The notches form shoulders which enable the marker to fit squarely against the edge of the work to be marked out. Actually only one notch need be cut, though, owing to a curious convention, two are invariably cut in a marker made in a workshop. When marking the slope of the sides, the only dimensions that matter are the 3 in. and the $\frac{5}{8}$ in. which fix the angle. So long as the angle fixed by these sizes is maintained the marker can be any size. In use the usual plan is to gauge in the dovetail depth, and then roughly pencil in the positions of the cuts. The gauge is shifted to each in turn and the necessary mark made.

Mitre Template.—Here again little need be said about the template. Its chief use of course is in paring down the moulding of a door framework to form the mitred corners as at (D). In use it is preferable to the metal kind because in the latter there is little bearing surface for the chisel and the edge is usually spoilt. The wooden kind cannot harm the chisel, and if care is taken there is no risk of the latter digging into the surface. Even if this should happen the template is easily trued up with the plane.

The sizes given at (C) need not be followed closely. The only important point is that the angles are planed at 45 deg. exactly. A still simpler way of making the tool is to glue and screw two pieces together, so saving the work of rebating.

Depth Gauge.—When boring dowel holes—in fact any holes bored with the twist bit—a depth gauge is handy. It is more positive than counting the turns made by the brace. A

A. DOVETAIL MARKER. B. MAIN SIZES.
C. SIZES OF MITRE TEMPLATE. D. HOW IT IS USED.
E. DEPTH GAUGE FOR BORING. F. ELEVATIONS.
G. DOWEL MARKER. H. FRONT AND SIDE VIEWS.
I. VENEERING HAMMER WITH BRASS STRIP.
J. HANDY SAWING "V"

simple form as shown at (E). It consists of two pieces of $\frac{3}{8}$-in. stuff screwed together with a slight depression across the centre in which the bit fits. When making it the two pieces should be screwed together and the bottom edges levelled afterwards, thus ensuring the lower surface being level. For extra large bits rather thicker wood can be used so that the depression can be made deeper.

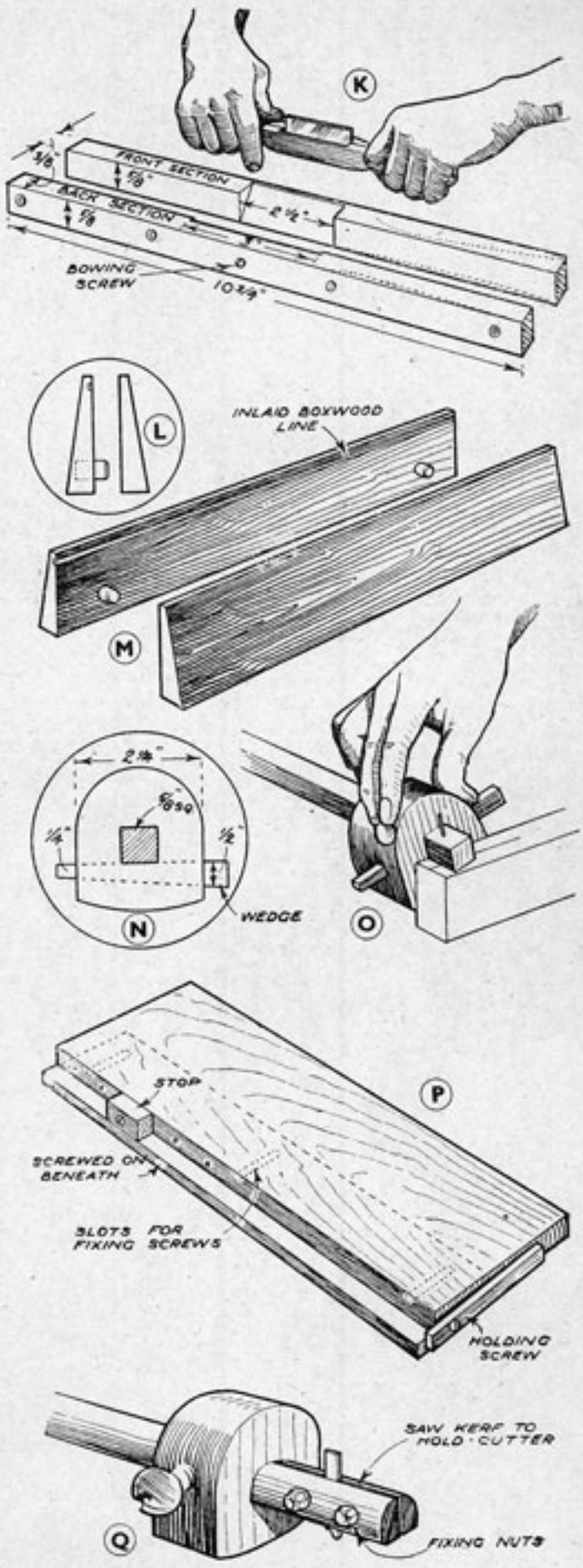
Dowel Marker.—A great deal of time can be saved when marking out the positions of dowels in, say, a framework by using this simple appliance. Assuming the stuff for the framework to be 2 in. by $\frac{7}{8}$ in. in section, the marker is made to the sizes given at (H). Two very fine holes are drilled through the top piece in the positions in which the dowels are to be. Thus to mark out all that you need to do is to place the marker at the squared ends of the rails, making sure that it is level with the edges, and prick through with an awl. In the case of the stiles the marker is placed over the squared pencil marks giving the rail positions. The marker must always be used from the face side.

When a job requiring a framework of different section is needed, a fresh marker can be made. Eventually a whole range of markers will be accumulated so that there is always one available for every job.

Veneering Hammer.—This (I) can be made from any scraps of hardwood. The handle is tenoned at one end and is wedged as shown. The blade portion is a strip of brass of about $\frac{1}{16}$ in. thickness with the lower edge rounded with glasspaper or a file. Glue alone should hold it in the saw kerf in the stock if it is a fairly tight fit, but if it tends to work loose a little Venice turpentine can be added to the glue. Alternatively small holes can be drilled and a couple of brass pins driven through.

Sawing "V."—It is often awkward to hold steady small pieces of wood when sawing, especially rounded shapes such as dowels. The simple arrangement at (J) is handy for such jobs. It is a plain piece of wood with a V-shaped notch cut at the top. In use the appliance is placed in the vice and the wood being sawn is held in the groove at the top.

Scraper Spokeshave.—The ordinary type of wood spokeshave is somewhat inclined to tear out the grain because the cutter lies at so low an angle to the wood—it is in fact actually parallel with it. The scraper type shown at (K) is much better in this respect, especially when working woods with a difficult grain. It naturally will



K. SCRAPER SPOKESHAVE USED FOR TRICKY GRAIN
L. SECTION OF PARALLEL STRIPS. M. DETAILS
N. END VIEW OF GAUGE
O. GAUGE IN USE
P. PLANING BOARD FOR SMALL WORK
Q. GAUGE CONVERTED TO SCRATCH.

not take so heavy a cut as the ordinary type. That at (K) is the type used a great deal by chairmakers.

All that you need to make it are two strips of hardwood of the sizes given, a short length of scraper iron 3 in. long by 1 in. broad, and four ⅝ in. No. 5 screws.

Plane the pieces of wood to size, and on the front section, mark "face" on the broad side and "top" on the narrow side. Find the centre on top of the front section and measure out on each side to give a space of 2½ in. Square lines on top and back, and saw through the corners diagonally to within $\frac{1}{16}$ in. of the face; clean out this recess between the lines to allow a gap for the shavings.

On the back section measure 3 in. in the centre on the side which clamps to the front section, and cut a recess slightly less deep than the thickness of the iron to be used. A bevel is filed on the cutting edge of the iron, and the wire edge, left after filing, is rubbed off on the set stone, then returned with a burnisher drawn smoothly along the bevel.

With the bevel towards the back, place the iron between the two sections and fix together with four screws. It may be necessary to widen the mouth of the scraper, and to do this remove the iron and file the front recess. When this is satisfactory, shape the wood as illustrated. To regulate the bow of the iron, screw a ½-in. No. 5 screw behind the blade.

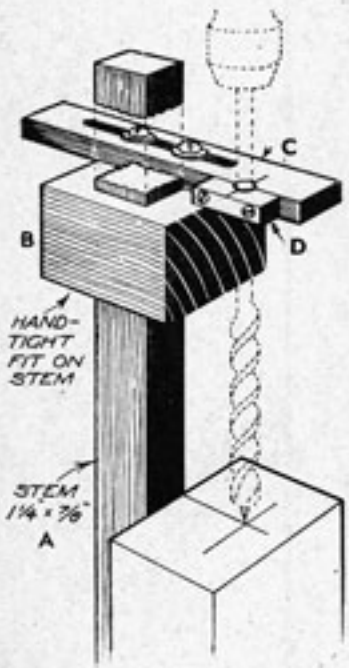
Winding Strips.—To test whether a piece of wood is free from winding the use of winding strips offers the most satisfactory method. They are placed one at each end of the wood and a sight taken. To simplify this either a dark wood is used or it is stained a dark shade, and a light line of inlay is let in near the top edge. (M) shows the idea. Obviously both pieces must be planed parallel, but as a safeguard the scratch working the groove for the inlay should be worked from the lower edge. The dowels are merely for the purpose of holding together the two parts.

Marking or Cutting Gauge.—These tools are cheap enough to buy, but some workers prefer to make their own tools when possible. (O) shows a simple gauge suggested by a reader in which the fence is held by means of a wedge. The stock and fence are cut to the sizes given at (N), and, in addition to the hole to take the stock, a second hole is cut in the fence to enable the wedge to be driven in. The latter need not be more than ½ in. thick. All the parts must be of hardwood. The marker can be a piece of steel wire or even a nail driven in and filed to a point.

Planing Board.—We all know how awkward it is to work, say, a rebate or groove in a length of wood of small section. The trouble is that cramps cannot be put on because they would be in the way, and the wood is too small to be held in the vice. In any case the latter would probably foul the fence of the rebate plane. The board at (P) consists of a plain board about 12 in. by 5 in. by ½ in. with a strip of ⅜-in. stuff fixed below with screws. Slots in the strip to hold the screws enable it to slide in or out according to the size of stuff being planed. The stop can be fixed in

(*Continued on page 32*)

FOR BORING ACCURATE HOLES



USEFUL DEVICE WHEN BORING ELECTRIC LAMP STANDARDS

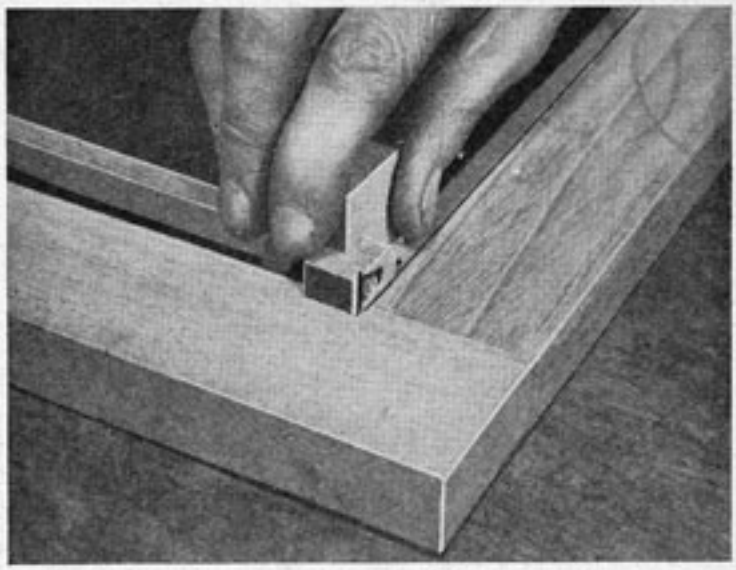
The stem is put level with the mark. The arm C is adjustable.

THERE are many occasions when it is necessary to bore a hole which is perfectly true; the hole running through a lamp standard, and the dowelling of a large turned foot to a leg are examples. The simple device shown here enables you to do without assistance. It consists of a main stem A, upon which a block B (about 2 in. by 2 in. by 1½ in.) fits with a hand-tight fit. To block B an arm C, about 4½ in. by ¾ in. by ⅜ in., is fixed with round-head screws, these passing through a slot cut parallel with the length. To one end of the arm the piece D is screwed, and a hole large enough to take the shank of the bit is bored through the joint.

In use the position of the hole is marked out on the wood with the gauge in the usual way. The arm C is set so that the centre of the hole is the same distance from the stem as the hole is to be from the edge. The side of the stem is set level with the mark and parallel with the wood and is held with a handscrew or is fixed in the vice. The hole in arm C is thus exactly vertically above the position in which the hole is required to be. You have simply to pass the shank of the bit through its hole (first slackening the fixing screws), put the point of the bit in position, and bore the hole. When the hole is to be extra deep you have merely to push the block B farther down the stem. Incidentally it can be used as a depth gauge. It can be set to a pencil mark on the stem, and the boring stopped when the end of the brace reaches arm C. Note when making the device that the arm C touches the stem A at the inside. The hole in block B is out of centre to allow room for the arm C.

THE "AWKWARD JOB" GAUGE

For straightforward work the marking gauge is satisfactory, but suppose you have a frame and wish to mark a rebate around the inner edge as at X (Fig. 2). The ordinary gauge could not reach into the corners because the fence would be in the way as in Fig. 3. The use of this special gauge enables the mark to be taken completely round as in Fig. 4.



THE fence of the gauge (C) is flush with the stem (A) at one side, except for a thin cross-piece (D). This means that the stem can reach close up to the edge of the wood without the fence fouling it (see Y and Z). In addition, the stem has a projection (B) at one end to which the cutter is fixed. Thus the cutter can reach beyond the corner by the amount of the projection. As given in Fig. 6 this projection is $\frac{1}{8}$ in., but it could be increased if a rebate wider than $\frac{1}{4}$ in. were wanted.

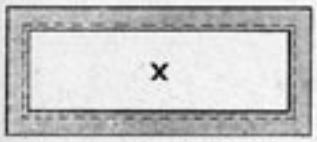


FIG. 2. FRAMEWORK TO BE MARKED AS SHOWN BY DOTTED LINE

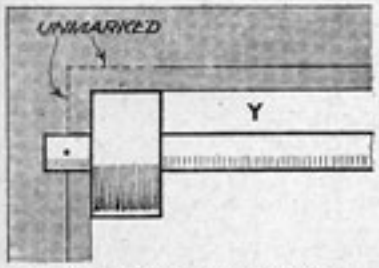


FIG. 3. LIMITATIONS OF NORMAL MARKING GAUGE

Note that the cutter (E) is double, having two marking points. This enables it to reach in from either right or left. It is obviously imperative that the cutter is square so that both points project the same amount from the fence.

Stem.—Since only narrow rebates will have to be gauged, the stem need be no more than 4 in. long. The projection at the end stands out $\frac{5}{16}$ in., this (allowing $\frac{1}{16}$ in. for the cross-piece D) enabling rebates up to $\frac{1}{4}$ in. wide to be marked.

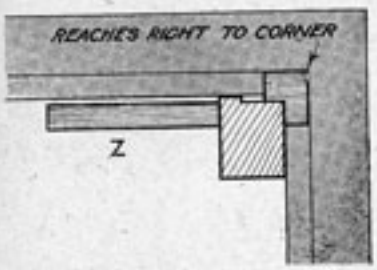


FIG. 4. HOW THIS GAUGE MARKS INTERNAL CORNERS

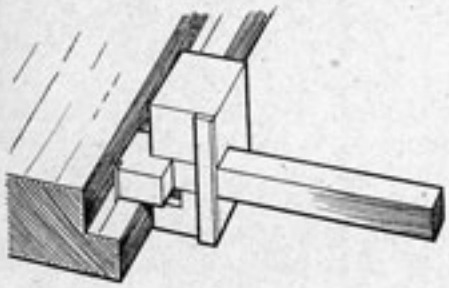


FIG. 5 (*left*) GAUGE USED FOR MARKING INSIDE A REBATE

Fence is 1⅛ in. by 1 in. by ¼ in. Stem is 4 in. by ⅜ in. square.

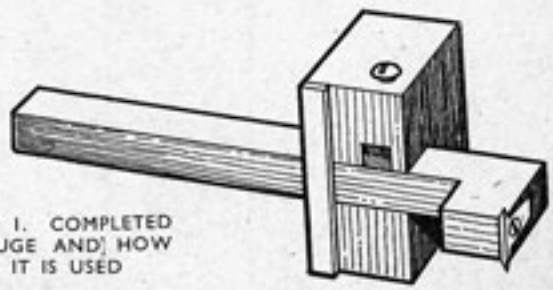


FIG. 1. COMPLETED GAUGE AND HOW IT IS USED

Cut the stem to length, plane to the over-all size, and mark the part to be cut away with gauge and square. Prepare the cutter from a piece of old saw blade or scraper, and bore the fixing hole, countersinking it at one side. Place it in position, drive in the screw to hold it, and mark round. Remove screw and cut recess. Replace and see that it is square.

Fence.—Plane to finished size and cut stem notch to enable stem to move freely without play. Glue and pin cross-piece D to bottom edge. To hold the fence in position a nut G and bolt H are used. To prevent damage to the stem a little block F is fitted beneath the end of the bolt.

Cut the recess for the nut and block, and finally bore the hole for the bolt. The latter might be $\frac{1}{8}$ in. or $\frac{5}{16}$ in.

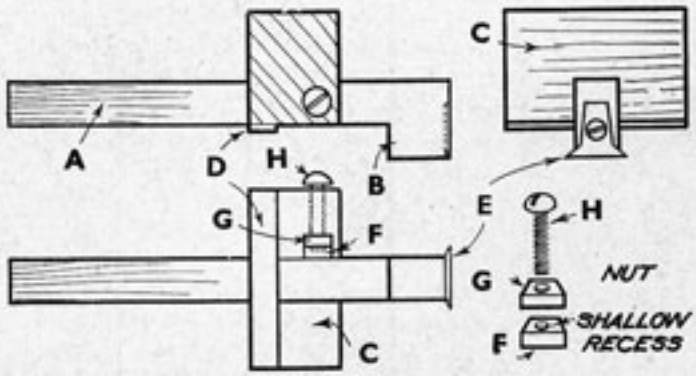


FIG. 6. ELEVATIONS AND PLAN HALF SIZE

MITRE SHOOTING BLOCK

Every experienced man knows how awkward a job it is to reduce the length of a piece of moulding mitred at both ends which has been cut somewhat full. The use of the shooting block enables this to be done without the slightest difficulty and with the assurance that the mitre will be dead true.

THE most useful form of block is that shown in Fig. 1, which can trim at the usual mitreing angle of 45 deg., and also at 90 deg. Some workers prefer to substitute an angle of 67½ deg. because this is the mitreing angle for 135 deg., which is a right angle plus 45 deg. It is also the correct angle for making octagonal frames.

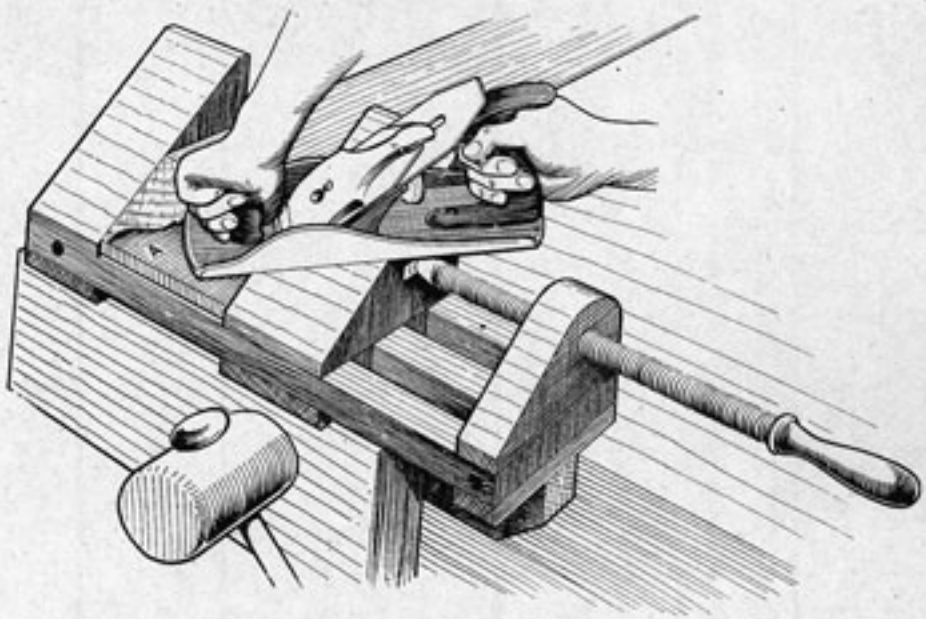


FIG. 1. AN INVALUABLE PIECE OF APPARATUS WHEN MITREING MOULDINGS
One side of the block is at 45 degrees, the most usual mitreing angle, and the other is at 90 degrees, handy for squaring up. If desired an angle of 67½ degrees can be substituted for the right angle, this being handy for mitreing angles of 135 degrees which is a right angle plus 45 degrees. This occurs often in cabinet work.

It consists of a main framework with two blocks fitted above, one fixed and the other free to slide up to and away from it. A threaded screw of either wood or metal controls the movable block and enables wood to be fixed firmly whilst being planed as in Fig. 1. Any well-seasoned piece of reliable hardwood can be used.

Framework.—The main framework is made up first. It consists of three strips of 1¼ in. by ⅞ in. stuff, with 1 in. by ⅞ in. pieces between as at D, Fig. 2. These last-named pieces should be prepared in two lengths, each long enough to include also the guide pieces screwed beneath the fixed and movable blocks. It is obviously important that they are planed parallel so that there will be a good sliding fit. Made in this way the grain of all the parts runs in the same direction, and if any shrinkage takes place it will affect all in the same way so that there will not be any danger of the block either binding or working loose. The joints can be strengthened with a bolt as at D, Fig. 2. The bolt should be countersunk to avoid gashing the plane iron. When the glue has set the surfaces are planed dead true.

Blocks.—The blocks are now prepared. To minimize the effect of warping it is advisable to build them up as shown at C, Fig. 2. The heart sides in the joining pieces face opposite ways. Each layer can be glued up complete in itself, and then jointed to the next when the glue has set. Both blocks are made in a single piece, and are separated later. Having planed the angle the block is placed in position on the frame and the guiding pieces screwed up underneath. They will have to stop short midway under the fixed end because of the strips in the framework. A single saw cut then separates the blocks after which the fixed block can be glued and screwed permanently in position.

Three pieces of ½ in. stuff are now prepared to fit under the framework. Two are screwed on, one at each end, and the third is screwed to the movable block to prevent it from lifting (see D, Fig. 2). This latter piece should be planed a trifle thinner than the others to enable it to clear the vice piece screwed underneath. The latter is of 3 in. by 2 in. stuff and its purpose is to enable the whole thing to be fixed in the vice. The movable

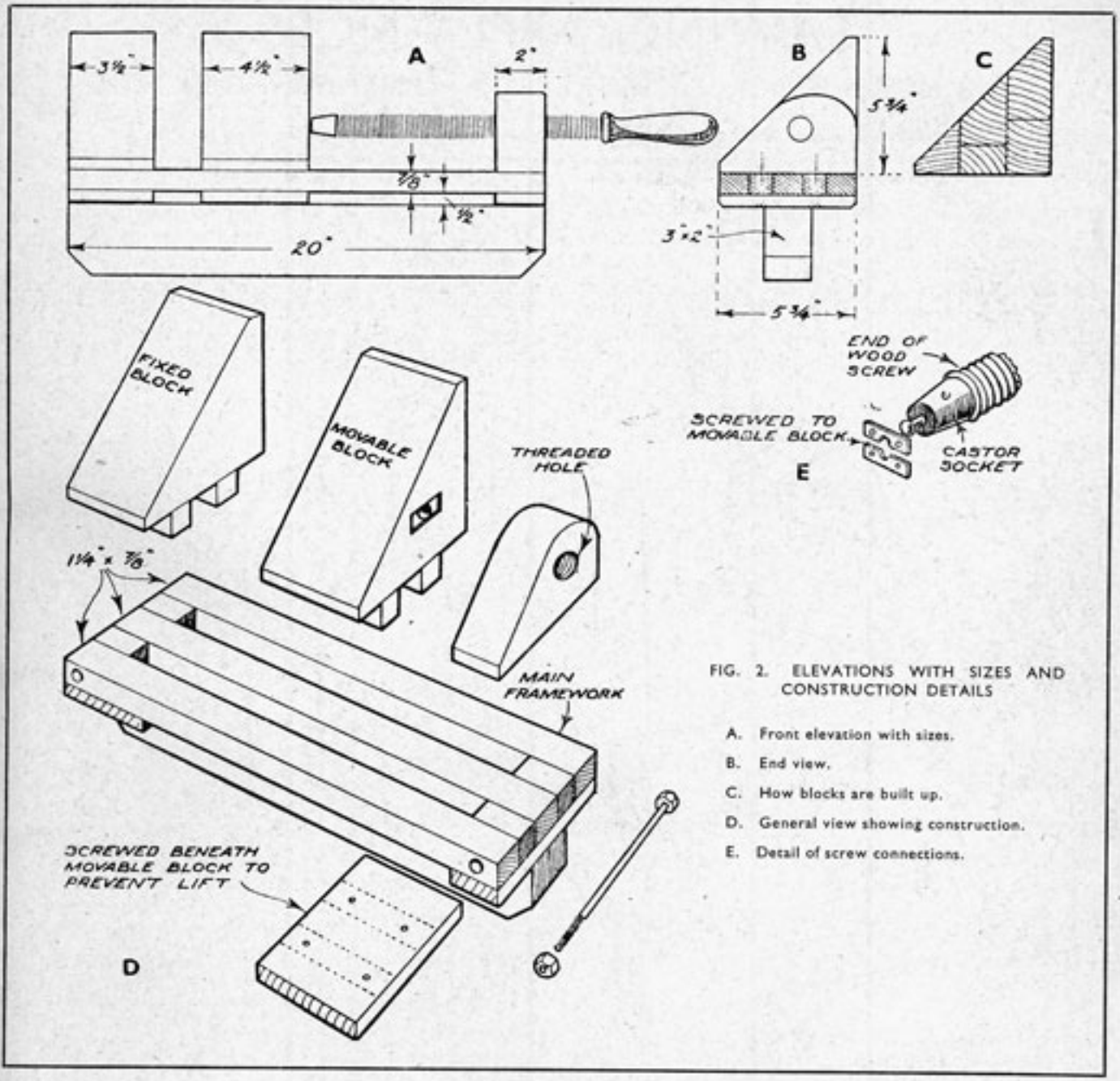


FIG. 2. ELEVATIONS WITH SIZES AND CONSTRUCTION DETAILS

A. Front elevation with sizes.
B. End view.
C. How blocks are built up.
D. General view showing construction.
E. Detail of screw connections.

block should be able to move without undue stiffness, but there should be no suggestion of looseness. After fitting, the bearing parts can be well rubbed with candle-grease.

At the right-hand end another block is needed to enable the screw to be added. It is shown at D, Fig. 2. Screws are used to fix it. If a wood screw is used the hole should be tapped, but in the event of a metal screw being used a nut should be let into a recess cut in the top of the block. The older type of bedstead used to have this nut and bolt fixing for joining the wooden sides to the head and foot. A convenient fitting for the end of the wood screw is given at E, Fig. 2. It is simply a cup-castor socket with the pin filed to the shape shown. The two metal pieces engage the pin, and, being screwed to the movable block, enable the latter to be pulled sideways. In the case of a metal screw it is merely necessary to turn a slot at the end in which the metal pieces can engage.

When the whole thing is finished, a finely set plane can be passed over the surface of the block to take out any small inequality. Afterwards pieces of thin card can be glued to all the faces. These can be renewed at any time, and save the face of the blocks from being damaged by the plane. One point to note is that a piece of waste wood a trifle thicker than the square left at the front of the blocks should always be placed beneath the moulding as shown at A, Fig. 1. It can be a trifle narrower than the moulding so as not to interfere with the tightening up of the block. If it is not used the end of the moulding will project and be unsupported.

SAWING APPLIANCES

MITRE BLOCK : MITRE BOX : BENCH HOOK

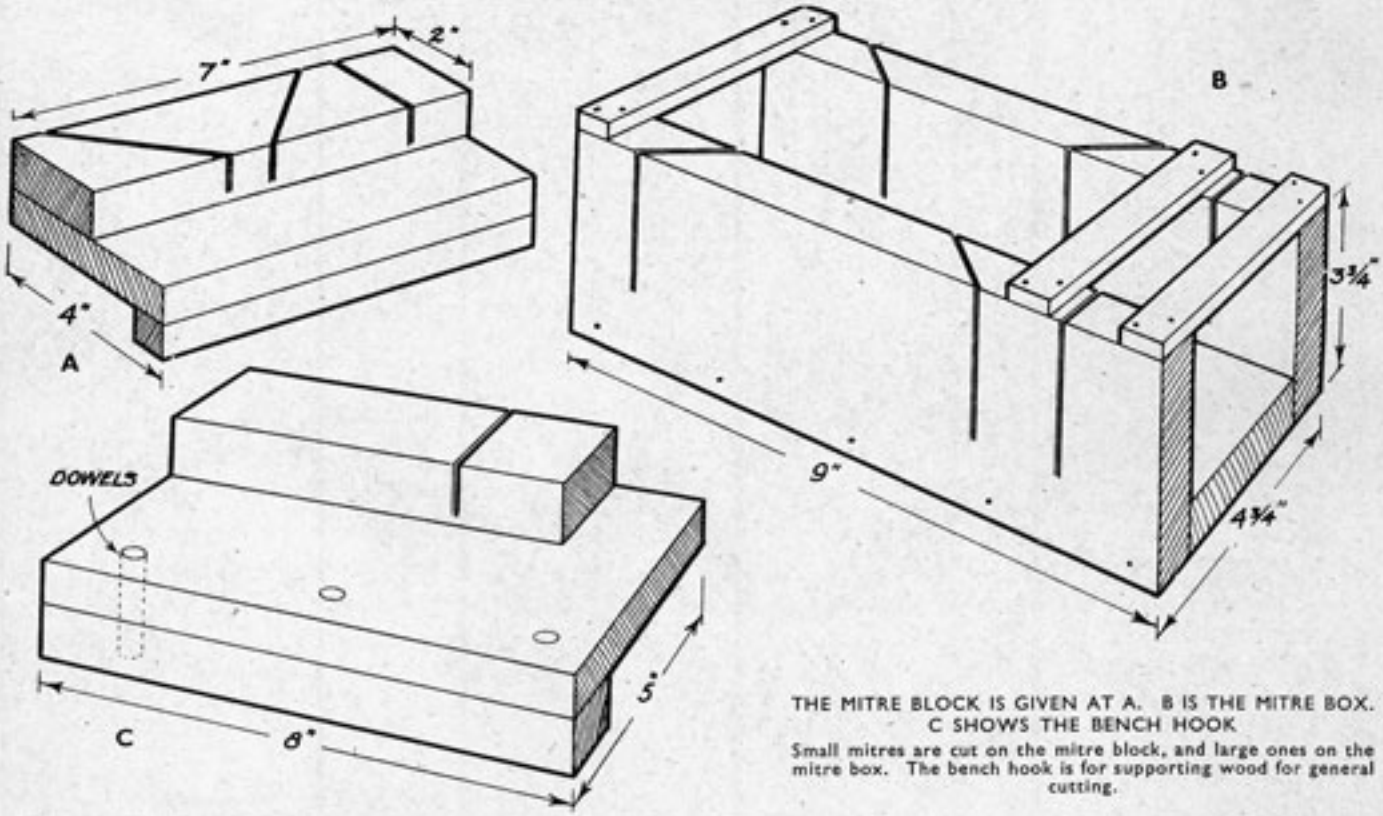
Every woodworker needs these three items. A sound hardwood is essential because, apart from wear, they must remain true as otherwise the saw cuts will be distorted.

EVERY man needs a mitre block. It is really essential for mitreing mouldings, etc., and it is quite easy to make.

Mitre Block.—A shows how the top kerfed piece is glued down on to the base. It is a quite good plan to fix another strip beneath the front edge to engage the bench edge and thus serve to steady the whole thing. Exact sizes need not be followed. Those given in the illustration may be taken as an approximate guide.

Mark out the 45 deg. and 90 deg. cuts on the top of the guide block and square them down at the edge. To ensure that the saw follows the lines exactly they can be cut in with chisel or marking knife and a sloping groove cut at one side. This will form a channel in which the saw can run. It will be noted that the saw kerfs do not run quite to the bottom of the guide block. The reason for this is that if they did they would sever the guide block entirely. It is true that the latter is glued to the base but it involves a possible weakness. In use a strip of wood is placed along the base of the block and the saw is thus able to reach right to the bottom of the moulding. An additional advantage is that it saves the saw cutting into the base.

The 90 deg. cut, of course, is useful when it is necessary to cut the end of a piece of wood perfectly square. In addition a fourth cut at 67½ deg. is sometimes made. This is the true mitreing angle for 135 deg. which consists of a right angle plus 45 deg., an arrangement which often occurs in cabinet making (Jacobean work for instance).



THE MITRE BLOCK IS GIVEN AT A. B IS THE MITRE BOX. C SHOWS THE BENCH HOOK

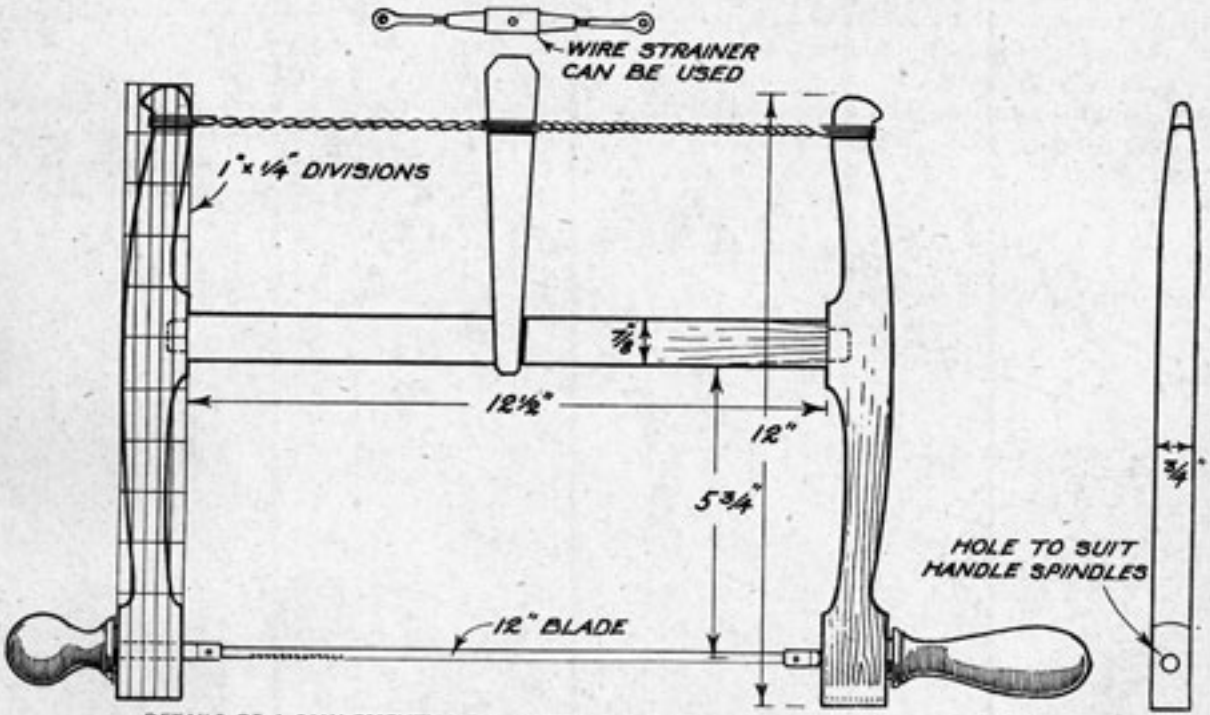
Small mitres are cut on the mitre block, and large ones on the mitre box. The bench hook is for supporting wood for general cutting.

Mitre Box.—This is required for the larger mouldings such as cornice mouldings, etc. It is essential that it is made from a sound hardwood because the cutting of the mitre kerfs weakens the sides considerably and they might be liable to curl. Plane up the three parts and fix the two sides to the base with glue and nails. It is, of course, essential that the top edges are perfectly parallel with the bottom. Across the top edges mark out the 45 deg. and the 90 deg. lines and square them down across the outside faces. For cutting the kerfs you should use the same saw that you will normally use for mitreing, either the tenon saw or a finely toothed panel saw. Fix the work down on to the bench and, placing the saw on the line, begin to cut. The toe of the saw must, of course, be exactly on the line at the far side of the box, but it should not

(*Continued on page 41*)

BOW SAW

There are various sizes in which this saw can be made. The blades vary from 8 in. up to 16 in. and the framework is made accordingly. That shown here is for a 12-in. blade which is a useful all-round size. For the larger sizes the length of the arms might be increased from 1 in. to 2 in. In addition to the blade the handles must be purchased. These are already fitted with brass spindles which fit through holes in the arms.



DETAILS OF A SAW ESSENTIAL FOR CUTTING CURVES. BLADE LENGTH CAN BE VARIED

The shape of the arms is set out in "squares" 1 in. by ½ in. A good hardwood such as beech should be used. Bore the holes and chop the mortises before working the shape. Handles with brass spindles can be obtained ready made.

IT is essential that hardwood is used because the frame has to stand up to considerable strain when tension is applied. Note that the centre bar has tenons at the ends fitting into corresponding mortises. These joints, of course, are not glued; their purpose is rather to act as pivots when the blade is put into tension by means of the cord at the top.

The setting-out of the arms can be done easily by following the left-hand diagram in which the shape is plotted out into 1 in. by ¼-in. divisions. It is merely a matter of drawing in the shape map-fashion. First, however, the centre mortises must be cut and the spindle holes bored. Both arms should be fixed together temporarily side by side with a cramp, and the marks squared across both. You can form the shape easily by sawing down across the grain just short of the line and chiselling away the waste. This can be followed by spoke-shaving and filing. Finally all marks should be removed with the scraper and a thorough glass-papering given.

The tenons of the centre bar should be a hand-tight fit. An alternative to using cord for the tourniquet is the wire strainer shown. These can be obtained at various shops nowadays and are similar to those used for straining the wires in biplanes. In this case wire is fitted and the simple operation of turning the centre casing tightens the blade.

SAWING APPLIANCES

(Continued from page 40)

cut in far. The sawing should be mainly on the near side. The handle of the saw just drops considerably as the cut progresses. Afterwards the box is reversed and the cut completed down the other side. It is far easier to control the saw when it follows the front cut only and all risk of the saw wandering at the far side is avoided.

Note that the cuts stop short about ½ in. from the bottom of the box. Strips of wood can be glued and nailed across the top afterwards to prevent any tendency for them to curl.

Bench Hook.—The uses of this are fairly obvious. It simply serves to hold wood whilst being sawn on the bench. Once again sizes can vary considerably. One essential point is that the piece fixed beneath the front edge must be dowelled on, not screwed or nailed. It is inevitable that after considerable use the wood of the base becomes deeply furrowed with saw cuts, and eventually the nail or screw might be uncovered and the saw jarred upon it. The use of dowels prevents this.

APPLIANCES FOR PLANING

SHOOTING BOARD : MITRE SHOOTING BOARD : DONKEY'S EAR BOARD

You will certainly need the square and the mitre shooting boards. The donkey's ear shooting board is handy for special work.

PERHAPS the most obvious amongst these is the shooting board and its size may vary from 2 ft. long up to 10 ft. or so. It is used partly for planing joints in thin wood and partly for trimming the ends of wood square.

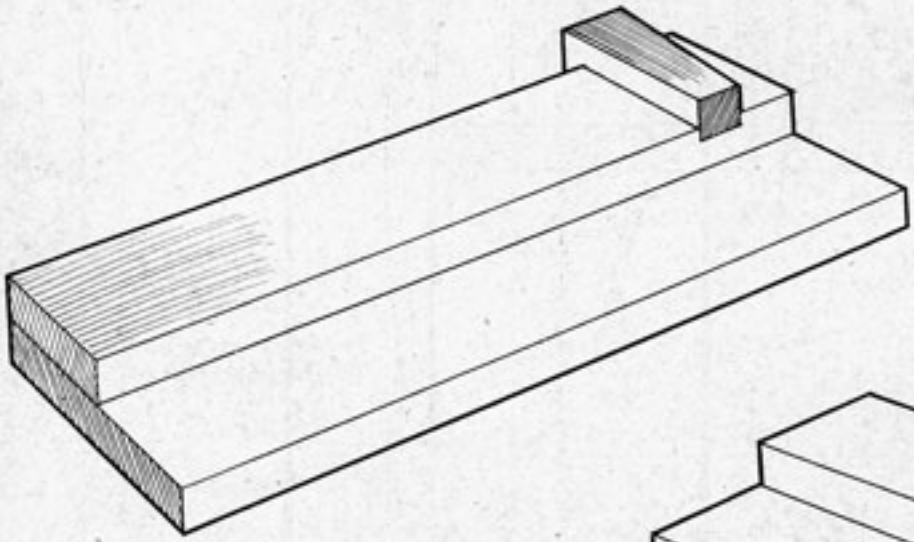


FIG. 1. SIMPLE SHOOTING BOARD

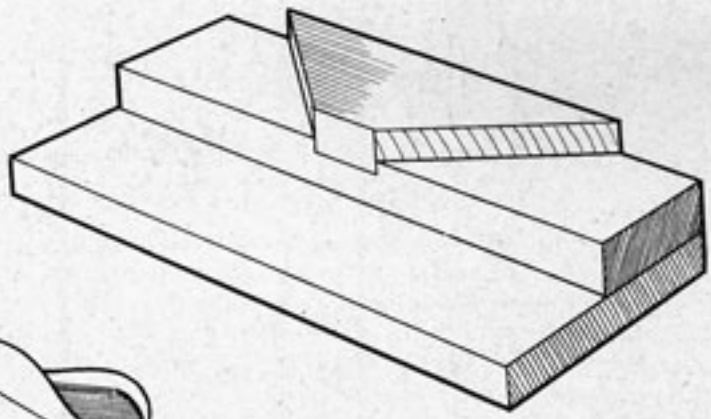


FIG. 2. MITRE SHOOTING BOARD

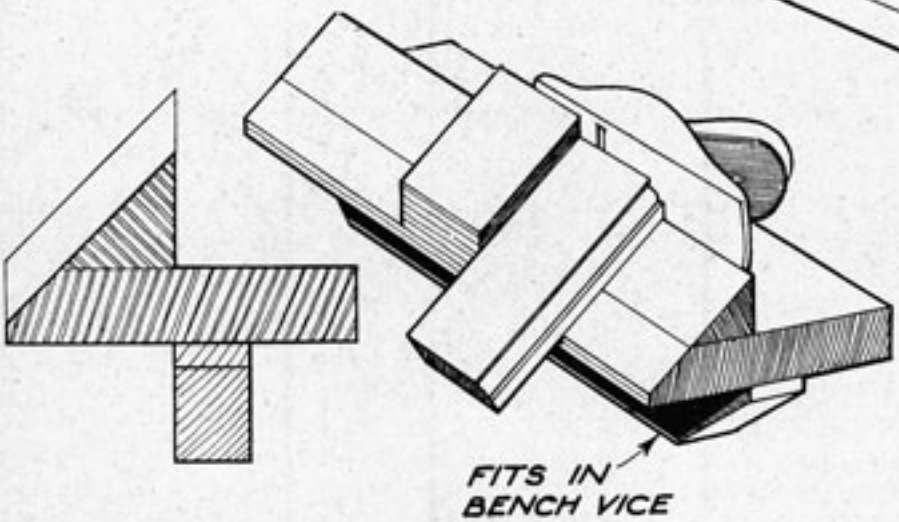


FIG. 3. THE DONKEY'S EAR SHOOTING BOARD

Shooting Board.—It can be made as shown in Fig. 1. A softwood is suitable if sound and seasoned. It is advisable, however, to have the heart side on the two pieces facing in opposite directions so that any tendency to warp in the one piece is countered by that in the other. The edge of the top piece must be perfectly straight, but is planed over at a very slight angle, otherwise when the plane is used the cutter will remove shavings from it. Note that the lower corner is planed off at about 45 deg. This is to form a dust groove. If it is not made dust is liable to accumulate in the corner and this will prevent the plane from running true.

The stop is best if tapered somewhat. It fits in a groove, the front edge of which is perfectly square with the running edge of the board. It is then tapped tightly home and the projecting end sawn off. A single screw can be driven in to hold it, but it is not essential because the taper makes a tight fit and in any case the taper is so slight that there is no tendency for the block to work loose.

It is a good idea to use the shooting board also as a panel board. You can use the reverse side for this. Plane it perfectly flat and either fit a thin strip of wood in a groove to act as a stop, or drive in one or two screws to act for the same purpose. It is frequently necessary to plane thin wood, and to make this true it is essential that it lies upon a flat surface.

Mitre Shooting Board.—This, Fig. 2, is on

(*Continued on page 43*)

STROP AND SLIPS

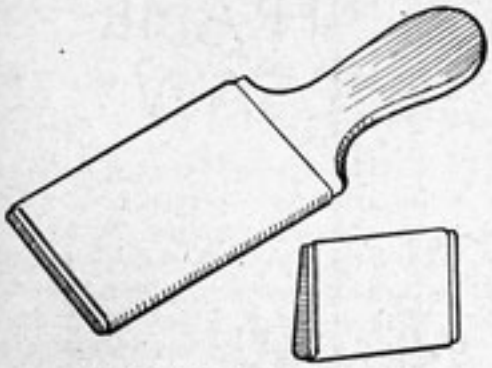


FIG. 1. USEFUL SHARPENING ITEMS
The use of a strop frequently saves having to sharpen a chisel upon the oilstone and thus saves time.

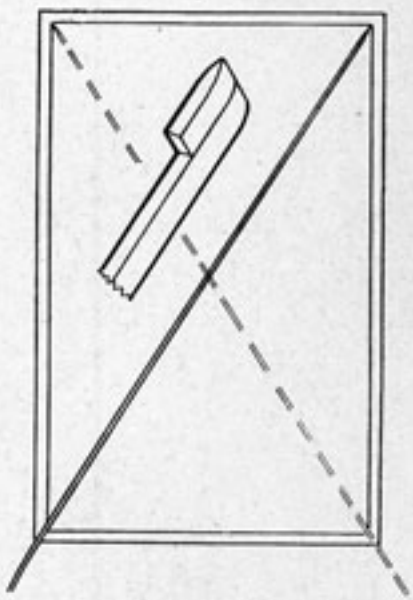
Not every woodworker realizes the great advantage of stropping his tools in addition to sharpening them on the oilstone. There are two advantages. One is that the stropping imparts an extremely fine edge to the tool, and this enables it to keep its edge far longer than a coarsely sharpened edge. The second point is that if you keep a strop handy an occasional rub upon it will enable a chisel to retain its edge, and save having to rub down on the oilstone. Wood carvers, of course, realize the value of this and they keep a whole range of specially shaped strops. These may not be necessary for the general woodworker but one or two for rubbing the insides of gouges and other sharp tools should be handy.

FIG. 1 shows the normal everyday strop. It is a plain piece of $\frac{3}{8}$ or $\frac{1}{2}$-in. wood shaped to form a handle at one end and with the edges lightly rounded. It is a good plan to make one edge more acutely rounded than the other; the advantage is that these edges can then be used as strops for gouges, etc. A piece of leather (the sheepskin variety is excellent but not essential) is turned over at the edges and is glued at the back. A dressing of the finest emery powder mixed with vaseline is smeared over the leather—this gives it a bite. Valve grinding paste of the fine variety can also be used.

In the case of the shaped strops you can make the section of these to suit the gouges or other tools for which they will be used. The illustration makes obvious the way they are made. If they are tapered one strop will be suitable for two different gouges.

DIAGONAL STRIP

THIS handy tool is used for testing the squareness of a carcase when being glued up. The general principle of its use is explained in the diagram. The point is placed in one corner of the carcase, the strip passed to the diagonally opposite corner, and the length marked with a pencil. If when reversed into the opposite corners the same length is registered the carcase is square. The enlarged sketch shows how the end is made. It is brought to a point so that it fits right into the corner and a piece is glued to one side also pointed, so that it lies across the face perfectly square.



DIAGONAL STRIP DETAILS
The use of this enables the squareness of a carcase to be tested when assembling.

APPLIANCES FOR PLANING

(*Continued from page 42*)

similar lines to the square shooting board, but the stop is planed 45 deg. at its edges. It need be only quite small, say about 12-14 in. long because it is used only for the ends of mouldings and other narrow pieces of wood. The block fits in a recess cut in the upper board. It should be made a close fit and glued down. Afterwards three screws can be driven in to make it secure. The dust groove is required as before.

Donkey's Ear Shooting Board.—Whilst the mitre shooting board is suitable for small, narrow mouldings, it is of little value for planing say a wide piece such as that which would be required for, say, a plinth. To plane this you need the donkey's ear shooting board. It is shown in Fig. 3. Note how it is built up. The surface on which the moulding lies is at 45 deg. exactly and the stop is fixed in a groove cut across it. To the underside it is advisable to screw a strip which will enable the whole appliance to be fixed in the bench vice.

Those requiring full information on the choice, use, and sharpening of tools generally should see WOODWORK TOOLS, an Evans Brothers book by the same author. It is published at 7s. 6d. net, and can be obtained through any bookseller or direct from the publishers.

FRAME SAW

This saw is specially interesting because it has two stays, this having a distinct advantage over the single stay. In the first place they make a stiffer frame, and they give greater clearance, although they meet the arms in the same place. This is due to the diagonal position they take up. The blade is the lightning cross-cut type, measuring 2 ft. between the fixing holes. Tightening is by means of a wire strainer such as those used in the older types of biplane. Many stores sell them—they are mostly old, unused stock. Hardwood should be used preferably, but deal, if free from knots, will serve the purpose. The actual frame shown here was made in deal and was perfectly successful. If in a tough hardwood, however, the thickness could well be cut down to 1 in. or even ¾ in.

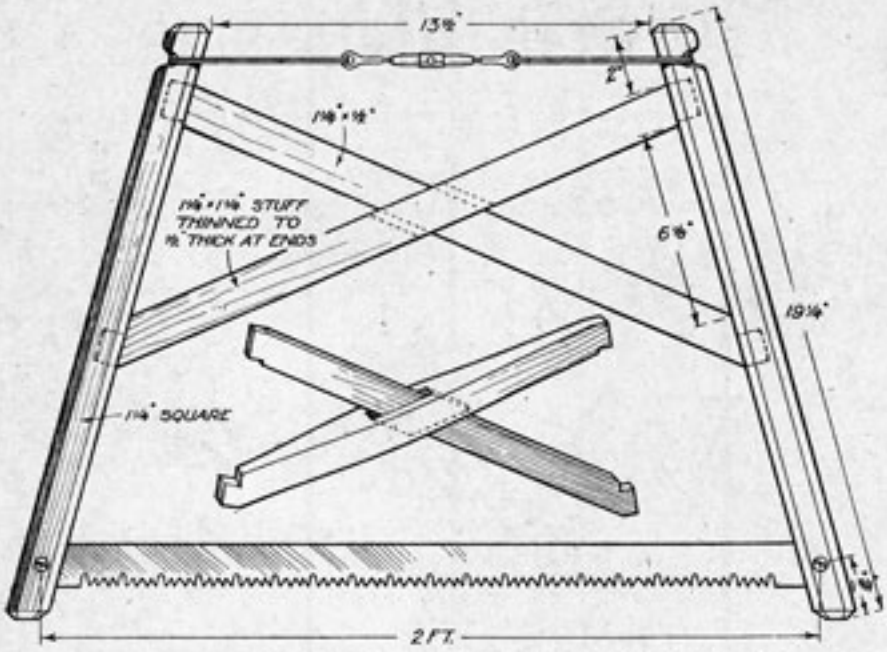


FIG. 1. MAIN SIZES OF SAW AND DETAIL OF THE JOINTS, ETC.
The joints make a hand-tight fit in their thickness, but are slack in length to allow for the movement when the strainer at the top is tightened. A blade with smaller teeth could be fitted for finer work.

IT is essential to draw out the saw in full size because of the awkward angles. Obtain the saw blade first, however, in case there is any variation in size. The joints, though fitting hand-tight in their width, are fairly free in length. The reason for this is that they have to turn slightly as the screw at the top is tightened. For the same reason the mortise where the two stays intersect is cut very full because there has to be decided play. Fig. 2 makes clear how the arms and struts are free to move.

Arms.—Note that the mortises are cut in square, and that their length is so arranged that the tenons can be cut in the width of the struts. The mortises are exactly ¾ in. deep, the tenons bedding down at the bottom. At the bottom, holes for the screws holding the blade are bored, and a saw cut made enabling the blade to be slipped in.

Stays.—Prepare the two stays, one finishing 1¼ in. square, and the other 1¼ in. by ½ in. in section. Mark the centre of each and set out the tenons (they are barefaced, there being no side shoulders). Set an adjustable bevel to give the slope at the ends, noting that the one end is different from the other. Cut the end shoulders. Set out and cut the sloping mortise in the thicker piece, boring away the bulk of the waste. Thin down the ends to ½ in. thick, giving a serpentine-shaped sweep so that the tenons are parallel in thickness, not tapered. Fit the joints and try together, and see that the frame is free to work, as in Fig. 2. Bevel the arms, and fit the strainer, putting stout wire at the ends to fit in notches cut in the arms. In use the saw is gripped just above the blade.

If the saw is to be used for green timber it should have ample set to the teeth to give easy clearance.

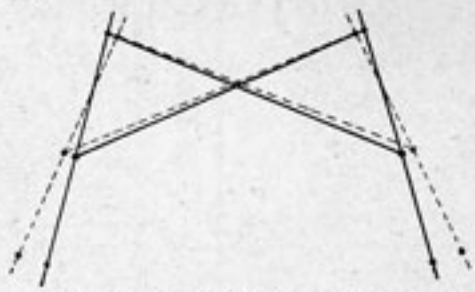


FIG. 2. DIAGRAM SHOWING MOVEMENT

CHAMFERING SPOKESHAVE

(*Continued from page 45*)

used when worn well away with sharpening. It is necessary to recess the head of the bolt at the bottom. Fig. 3 shows how the wedge or clamp piece is shaped.

The Fences.—Fig. 2 shows how each of these is shaped. The face is sloped at 45 deg. and a slot is cut at the outer end to enable the fixing bolt to pass through. This slot provides for adjustment. Two holes are bored through the handle of the tool, and using one or other of these enables chamfers from a minimum of $\frac{1}{16}$ in. up to 2 in. to be formed.

A companion to this volume that you will find invaluable is the A B C of Woodwork, details of which appear on the inside front cover. It deals with fundamental woodwork joints, tools and their use, and the various processes involved in woodwork.

CHAMFERING SPOKESHAVE

The purpose of this tool is to enable chamfers to be worked to an exact depth and exactly at 45 deg. It can be used for either straight or convex curves. For a concave curve, however, the sole would have to be rounded and this would necessitate shaping the movable fences to suit. It will work close up to a stop: in fact, if the wood is cut away locally at the stop the spokeshave can be taken right through.

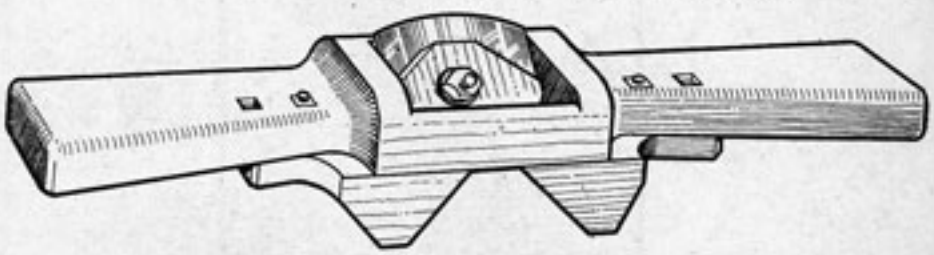


FIG. 1. AN INVALUABLE TOOL WITH MANY USES IN THE WORKSHOP
Although intended primarily for working chamfers, this tool can be used for ordinary spokeshave work if desired. In this case the sliding fences are detached. It takes a 2⅛ in. cutter.

THE tool is rather like a spokeshave but has a cutter such as is used in the metal spokeshave. Fences, of course, ensure that the chamfer, or any number of chamfers, will be worked all to exactly the same depth. This is achieved by regulating their positions. Since the fences are provided with a projection which works along a groove (see Fig. 2), they are bound to remain exactly at right angles with the sole.

Construction.—The mouth size must accommodate a 2⅛-in. cutter. Prepare a piece of wood to finish 12 in. by 1¾ in. by 1 in. Mark the surface which will be the sole and upon it draw in the mouth lines. These work out at ⅛ in. apart, the front one being $\frac{5}{16}$ in. from the front. Since the cutter slopes back at 45 deg. it is simple to mark the opening of the escapement at the top by drawing a line at the end at 45 deg. and carrying it through to the top.

Bore a series of holes from the mouth right through the wood, using a bit slightly under ⅛ in. Now chop away the waste from the mouth and escapement. Finish off with a keen chisel, making the surface on which the cutter beds perfectly flat.

Using a $\frac{3}{16}$ in. cutter, work a groove from end to end on the sole surface. It might be ⅛ in. deep. Bore a hole through the bed to take the bolt which fixes the cutter in position. Position it so that the cutter can be fitted generously forward. Thus the cutter can still be

(*Continued on page 44*)

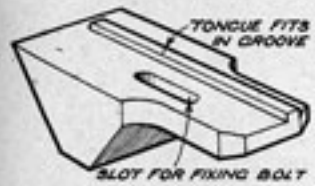


FIG. 2. DETAILS OF THE SLIDING FENCES

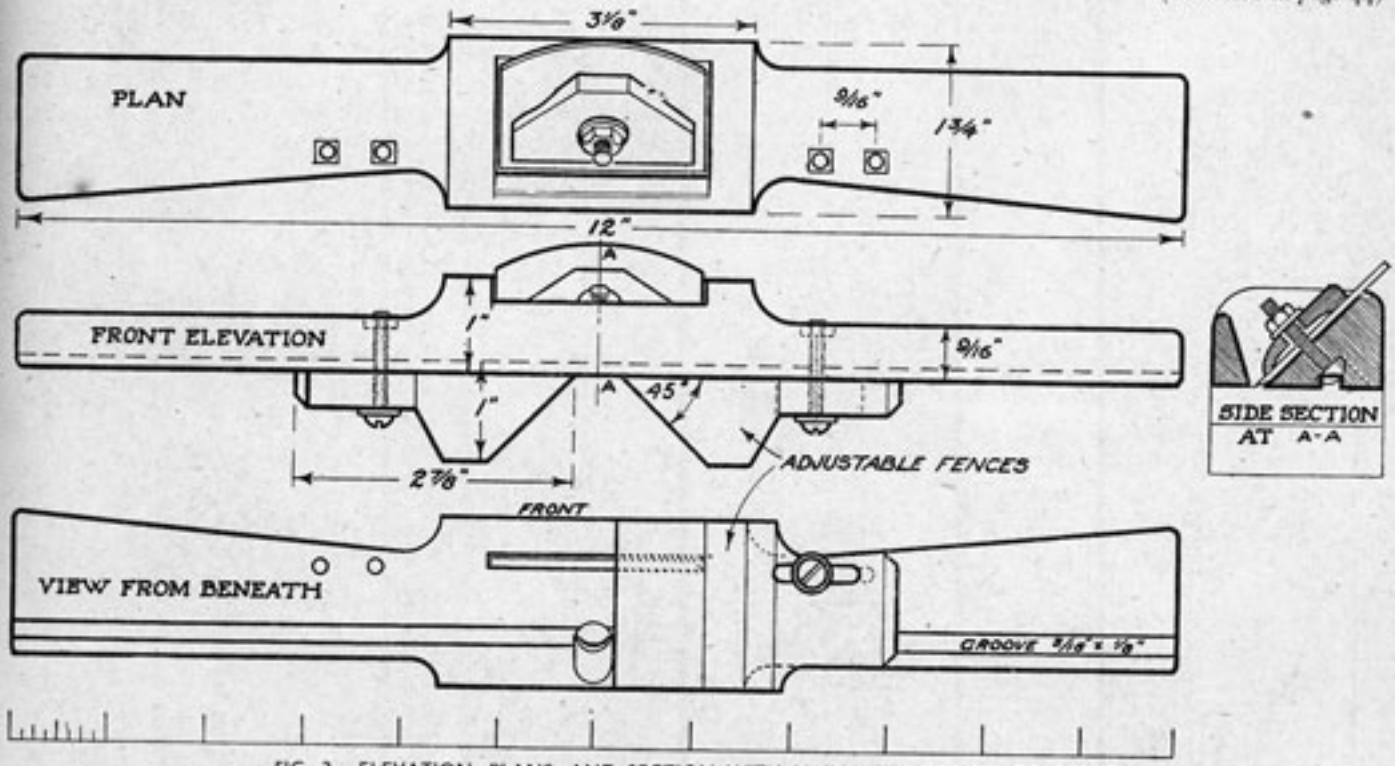


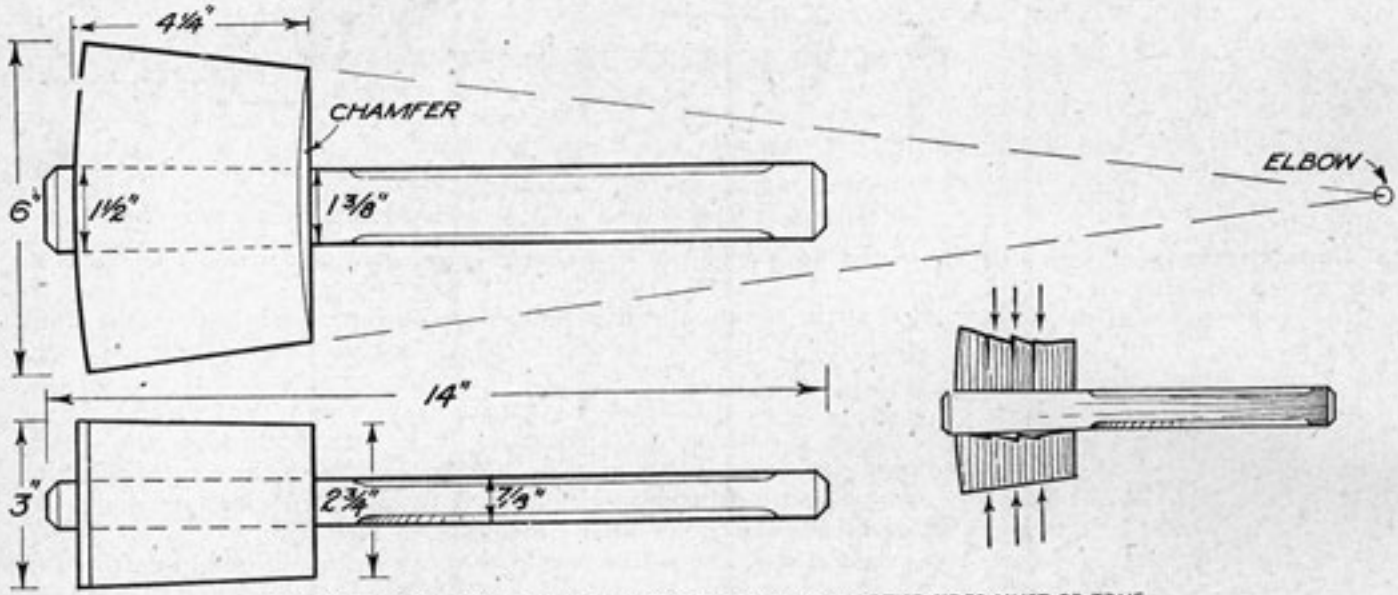
FIG. 3. ELEVATION, PLANS, AND SECTION WITH MAIN SIZES DRAWN TO SCALE

BEECHWOOD MALLET

There is no need to keep to definite sizes in making a mallet, in fact the sizes you can fix, partly in accordance with the wood you have available, and partly to suit the weight you have in mind. Generally for carpentry you need a heavier mallet than one for cabinet work. Beech is the wood generally used.

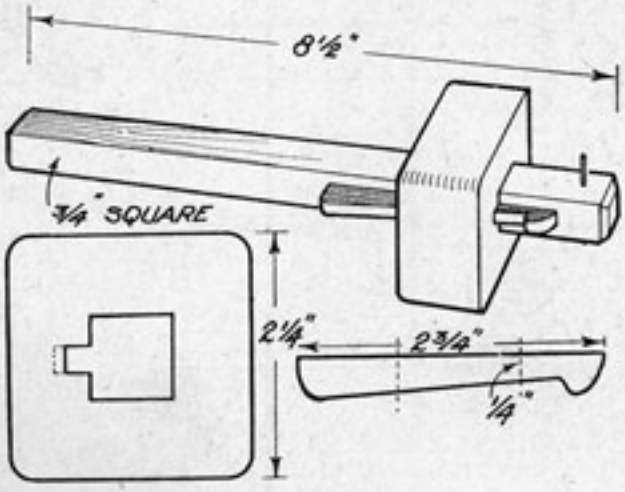
YOU will see from the drawing that the handle passes right through the head and is kept in position by its tapered shape. Prepare the main block for the head as shown below. Note that the striking faces slope inwards towards the bottom. The extent of these slopes should be arranged so that they converge approximately to the elbow when the mallet is in use. In this way they strike the tool at right angles as suggested here. The side faces can also converge slightly towards the bottom. Before planing the sides, however, mark on the top the position of the mortise for the handle and square the lines around the sides on to the bottom face. Across the sides draw the taper of the handle and mark in accordingly on the bottom face.

The mortises can now be chopped, the bulk of the waste being removed by boring with a twist bit. You will realize that it is essential that the handle makes a close fit right along the length of the mortise. In other words the sides of the mortises must be exactly straight and flat. The reason for this is that if you make the mortise hollow the wood on the striking face will eventually be knocked in as suggested above. It is necessary, therefore, to test with a straight-edge frequently.



SIDE AND END VIEWS OF MALLET, AND REASON WHY MORTISE SIDES MUST BE TRUE
The slope of the striking faces is arranged so that the tool swings from the elbow.

The taper of the handle is obvious. You can plane it away approximately and then finally fit it by actual trial in the mortise. In its thickness it need be no more than a hand-tight fit. Note that, although it is rounded beneath the mortise so as to give a comfortable grip for the hand, a square is left at the bottom. This helps to minimise any tendency for the whole thing to fly out of the hand when in use. Finally any sharp edges or corners are bevelled.

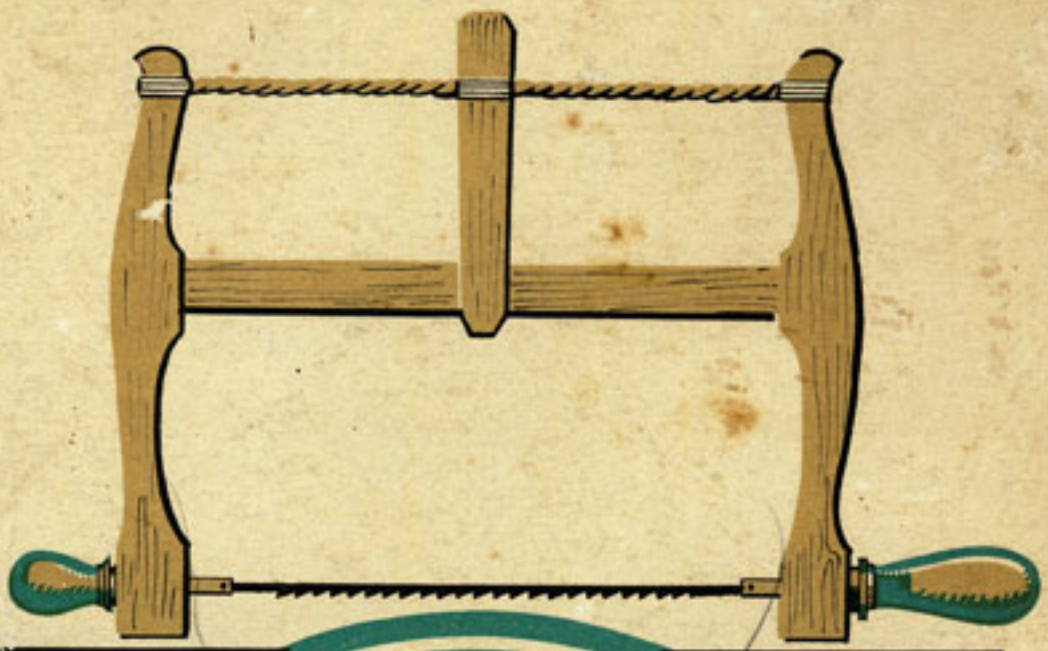


MAIN SIZES AND DETAILS OF GAUGE

MARKING GAUGE

THE construction of this is obvious from the diagram. The stem should make a hand-tight fit in the mortise. Note that the small notch at the side is wedge-shaped. The wedge should fit closely throughout its length.

Printed in Great Britain by The Campfield Press, St. Albans



SAVE MONEY BY MAKING YOUR OWN WOODWORK TOOLS

Full instructions for making:

PLANES—jack, try, smoothing, chamfer, side rebate, toothing, roughing, edge, moulding, rebate, block, compass, scraper, etc.

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