HOW YOUR TOOLS WORK:
THE PLANE

The angle at which the cutter is set in the plane largely controls the working. When it is high the shaving is forced up a steep gradient, and the working is consequently hard, On the other hand it is not so liable to tear out difficult grain. The usual angle of 45 deg. is a compromise between comparative ease of working and freedom from tearing out the grain

IN a sense the plane may be regarded as a sort of chisel held in a block of either wood or metal, the latter serving to guide the tool along the required path and to regulate the thickness of the shaving. There is, however, a difference in the angle at which the cutting edge is presented to the work, and this and other refinements give the plane a special characteristic, although it remains fundamentally a form of chisel.

How the plane first came to be made, nobody knows, but it dates back a very long time. Certainly the Romans used it, for actual examples have been found in this country and elsewhere; and, judging by the characteristics of their work, it was almost certainly used by the Egyptians. The probability is that it was originally a sort of router. A man had to cut a recess in a piece of wood; and, to finish it off, it occurred to him to fix a chisel in a block which would reach down the required depth and no more. He found that it removed chips or shavings, and from this it was but a step to reduce the projection of the cutter so that the thickness of the shaving was controlled, and so came the first plane. This is purely a theory, but it seems feasible.

The Plane a Form of Chisel. Let us consider first the simple plane, one without a back iron. The chisel acts virtually as an inclined plane in that the shavings are forced uphill, so to speak; also it is guided by its flat face. If now we were to fix to the chisel the curious device shown in Fig. 2 it would have two results: it would determine the thickness of the chip in accordance with the difference in level (see A); and it would help in guiding the chisel along a straight line since it would prevent the front from digging in. We have thus virtually produced a plane, though so crude a device would have many drawbacks. For instance, the shavings would always have to be the same thickness, and the edge would be awkward to sharpen. Instead, the plane shown in Fig. 3 has been evolved in which the cutter is quite separate so that it can be fed out or in at will, thus enabling the chip (or shaving as it now becomes) thickness to be varied. This is made clear in Fig. 3, from which it will be seen that fundamentally it is the same as Fig. 2. Since the cutter beds solidly on the frog, it virtually becomes one solid piece.

Strictly speaking, the plane is not perfect in its action because the sole from the cutter backwards should stand down level with the projection of the cutter as in the case of the "chisel plane" in

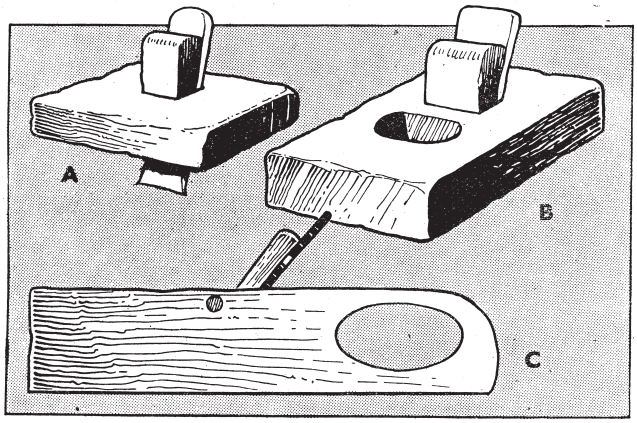

FIG. 1. POSSIBLE EVOLUTION OF PLANE FROM ROUTER
It may be that the router, A, was used originally to make a groove level, and that the cutter with reduced projection and shaving escapement, B, followed. From this the early plane, C, may have come

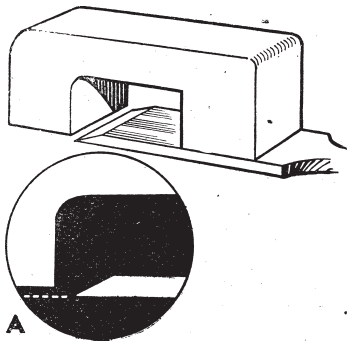

FIG. 2. THE "CHISEL PLANE"
This is not suggested as a practical tool, but rather to suggest the connection with the chisel

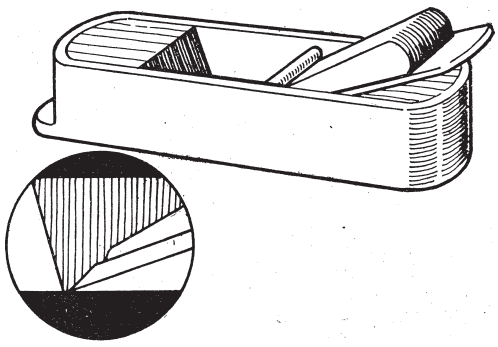

FIG. 3. SKETCH OF SIMPLE BLOCK PLANE
This makes an interesting comparison with the diagram to the left. The principle is similar

Fig. 2, but this is not practicable, and as it happens the plane works perfectly well with a straight sole. In fact, there is an advantage in that the plane tends to make the work slightly hollow, the amount depending upon the length of the plane and the projection of the cutter, as shown in Fig. 5. Fig. 4 explains the point about the plane not being perfect, and it will be seen that when an edge is being planed either the plane must be pressed down at the front, leaving the rear unsupported (A), or the back must be pressed down so that the front sticks up (B). Of course, the thing is complicated by the fact that the cutter does not extend over the entire width of the plane, but, as we say, the point is not worth bothering with because the plane as it has been evolved works perfectly well.

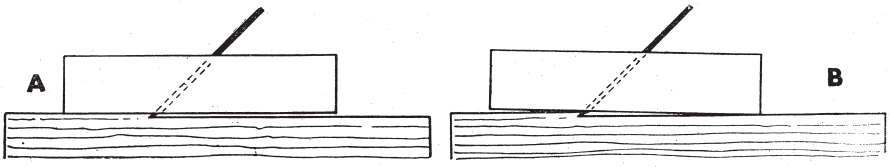

FIG. 4. WHY THE PLANE IS NOT PERFECT IN PRINCIPLE
The shaving thickness is exaggerated for clearness

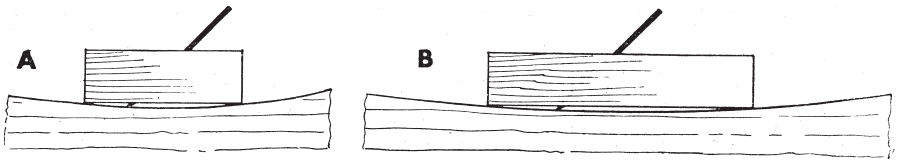

FIG. 5. HOW LENGTH OF PLANE AND CUTTER PROJECTION AFFECTS WORKING
The shorter the plane the more liable it is to dip into the wood. The shaving thickness is exaggerated for clearness

Cutting Angle. It is clear from the foregoing that the angle at which the cutter is set necessarily affects its working. When steep the shavings are forced uphill at a steep gradient, and this means that the plane is considerably harder to push (see Fig. 6). On the other hand, the higher it is set the more akin its action becomes to scraping rather than cutting, and this means that it is less liable to tear out difficult grain. Experience has shown that 45 deg. is the best compromise for allround purposes, though cabinet makers sometimes use a smoothing plane with an extra high pitch because much of their wood is liable to tear out. This is known as York pitch and is 50 deg. Half pitch (55 deg.) and middle pitch (60 deg.) are used chiefly for moulding and rebate planes, since neither of these tools can be fitted with a back iron.

If all wood had straight grain the cutter could be fitted at the lowest practicable angle, and all would be well. But it hasn't, and various devices (apart from the pitch) have therefore been incorporated in the plane to lessen the liability of the grain to tear out when working against the grain. We have first to realise what happens in the latter case. Glance at A, Fig. 7. As the plane is moved forward, the shaving, in being raised, causes a split to develop in line with the grain in front of the cutting edge. It does this by virtue of its own strength and stiffness, and it is clear that, after the initial raising

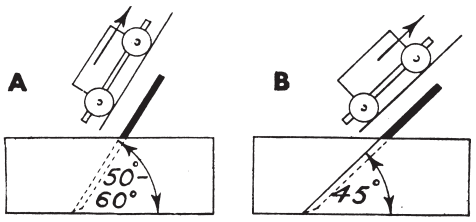

FIG. 6. WHY A HIGH CUTTING ANGLE OFFERS GREATER RESISTANCE

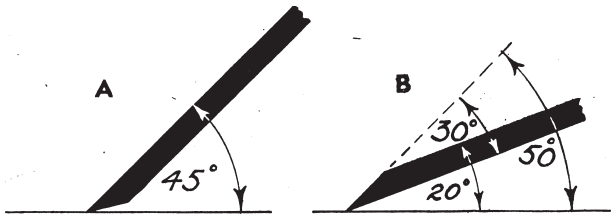

FIG. 7. ALTHOUGH BLOCK PLANE CUTTER, B, IS SET AT LOWER ANGLE, CUTTING ANGLE IS USUALLY GREATER

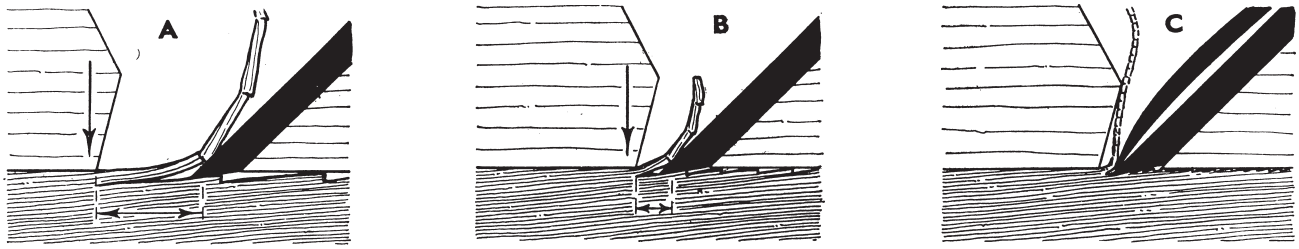

FIG. 8. HOW WIDTH OF MOUTH AND BACK IRON AFFECT WORKING OF PLANE
Wide mouth allows the split in front of cutting edge to extend as at A. By cutting down the mouth width the split is restricted as at B. The back iron, C, breaks the shaving and robs it of its strength. The shavings shown here are thicker than would be possible for practical working, but are so shown for clearness

of the shaving, the cutting edge ceases to cut until it catches up the shaving, when it severs or breaks it, and starts another cycle of events. Note that the shaving cannot be levered up at a point farther forward than the front of the mouth because the sole maintains a downward pressure (see arrow). If, then, we make the mouth narrower as at B, Fig. 8, the split or tear cannot develop so far in front of the cutting edge and the tearing out will not be so great.

Back Iron. If now we add a back iron, and set it near the cutting edge, the shaving, in being forced against it, will be broken almost as soon as it is raised (see C). It thus loses its strength and is unable to lever up the wood far in front of the cutting edge. The conditions for giving a fine finish to wood with difficult grain, then, are a fine-set cutter, close-set back-iron, and small mouth. Remember, however, that the back iron sets up considerable resistance, so that, for general planing as distinct from cleaning up, it should be set not so fine.

It will be noted from the examples given that in some cases the cutter has its bevel downwards and in others, upwards. This sometimes leads to some confusion as to what the cutting angle actually is. It is always the forward slope, that up which the shaving has to be forced. At A, Fig. 7, for instance, it is the flat surface, 45 deg., whilst at B the sharpening bevel is the cutting angle. It thus often happens that a block plane, the cutter of which is set at 20 deg. as compared with the 45 deg. of the normal plane, has a higher cutting angle. This is made clear in Fig. 7, in which the cutting angle of the normal plane is 45 deg., whilst in the block plane it is 50 deg.

THE CUTTING ACTION OF THE PLANE

To get the best out of a tool one needs to understand just what happens when it works. It often enables one to correct faults and improve the working. This article explains the principle of the plane

THE chief uses of the plane are to true up a piece of wood, to smooth it, and to reduce its size, and the various special types of planes have been evolved to meet any or all of these requirements.

Originally, after a log had been sawn or cleft, the craftsmen had only a rather curious tool known as an adze with which to do all their smoothing, and, although they became very skilled in its use, they must have felt the desirability of having a tool which would do its work in a more positive way. The adze was a long-handled tool, something like an axe, but with the blade turned at right angles with the shaft. In use, the craftsman stood above the log and brought the blade downwards as shown in Fig. 1, so removing a chip. Each successive stroke formed a facet an inch or two in length, and the finished result was rather like a panel finished with flat carving tools, beautiful enough in its own particular way, but not lending itself to fine, true work.

THAT MOST FASCINATING TOOL, THE PLANE
A good plane, well sharpened and set, is a joy to use. A faulty one is demoralising

It occurred to some ingenious man that, if he could in some way control the thickness of the chip, the process would lose a great deal of its haphazard nature, and he could take off chips of great length, so getting an altogether truer surface. He adopted the plan of fixing the cutter to a block of wood and making an opening in the latter through which the chips, or shavings as they were now called, could escape. In this way the plane came into being, and in this simple form it remained for many centuries.

Length of the Plane. Fig. 2 is a diagrammatic view of this elementary form of plane, from which it will be seen that the projection of the cutter from the sole controls the thickness of shaving it removes. From this it might seem that all the essentials had been provided for, and that there was nothing else that could be done with advantage. A little reflection shows, however, that, although it would do its work well enough in ordinary, simple circumstances, there would be serious disadvantages in certain kinds of work.

In the first place it has to be realised that the plane is not really perfect in principle. Turn for a moment to Fig. 3.