

the vertical log band mill (p. 6) in that the band saw is strained over two pulleys placed one above the other. The diameter of the pulleys is 30, 36, 42 or 48-in., a useful size for general purposes being the 36-in. machine. The saw blade varies in width from $\frac{1}{4}$ to 1 $\frac{1}{2}$ -in. The timber is hand-fed on a 3-ft. square table which is about 3-ft. above the floor. This machine is used for shaping pieces by straight or circular cuts. The table may be canted and locked in position when required for bevel cutting.

PLANING AND MOULDING MACHINES.—There is a big similarity between these two classes of machines, as the function of both is to reduce each sawn piece of timber to accurate size and to produce a smooth and true finish to one or more surfaces. The planing machine shaves or planes flat surfaces, and, as implied, the moulding machine forms a moulded surface. Planing is achieved by steel knives or cutters. There are two kinds of cutters, i.e., (a) rotary and (b) fixed.

(a) **Rotary Cutters.**—This type consists of knives bolted in a steel block, called a cutterblock, fixed on a rotating spindle, the latter being mounted on bearings. Cutterblocks are either square or circular in section.

A square cutterblock is shown at T, Fig. 6, and has either four knives or cutters, one bolted on each face, or two knives mounted on a pair of opposite faces. A square cutterblock, with the knives omitted, is shown in position at B, Fig. 5. A diagrammatic view showing the cutting action of rotary cutters (in this case fixed above the timber) is shown at U, Fig. 6. As the cutterblock rotates at a high speed, the projecting edges of the knives cut shavings or chips from the advancing wood. The portion of wood, shown black, indicates the chip which would be removed by knife "Y," as it rotates. It will be seen that the planed surface is composed of waves or ripples; the quality of the surface is improved as the number of knives or the speed of the spindle is increased.

Circular cutterblocks are shown at C, D and E, Fig. 5; each carries two (as shown) or more knives. The cutterblocks are placed horizontally in some machines (see E and H), vertically in others (see B), and certain machines, such as moulding machines (see next column), have both horizontal and vertical cutterblocks. The cutting action of the knives of a circular cutterblock is shown at E.

(b) **Fixed Knives or Cutters.**—These are fixed on certain machines, i.e., the planing and matching machine (p. 29), at the bottom and sides. They shave the wood and produce a superior finish to the surfaces. The result is similar to that produced by the hand plane (see J, Fig. 67, Vol. I), but as the knives are fixed, the timber must be pressed against them as it is guided rapidly past. The speedier the feed the better the finish.

Most planing machines are designed to perform additional labours, including moulding, thickening, grooving, beading, chamfering, etc. (see below). Whilst a combined planing and moulding machine is an advantage in a workshop having a small mixed output, it is desirable to have an independent moulding machine when the output is large. Three reasons for this are: (a) The fast feed speed required on a planing machine is not desirable on a moulder when the mouldings are required to have fine surfaces; (b) a common cutterblock cannot be conveniently used for both purposes; and (c) the feed rollers best for flat planing are not of the type most desirable for working mouldings.

3. **PLANING AND SURFACING OR PLANING AND JOINTING MACHINE** (see H, Fig. 5).—This consists of back and front tables, a cutterblock and an adjustable fence. The overall length of the tables varies from 6 to 10-ft., the larger type of machine being capable of planing timber of a maximum width of 30-in. An enlargement of the cutterblock, containing two knives, is shown at D and a section is shown at E. The tables can be adjusted by the hand-wheels to enable the back table to support the timber and the front table to regulate the depth of the cut. The section E shows a piece of timber partially planed as the cutterblock rotates in the direction of the arrow at a speed of 4,000 revs. per min. The cutterblock has a guard (not shown) to protect the operator. The fence can be canted for chamfering and bevelling. This simple hand-fed machine is used for planing, surfacing, jointing, bevelling, rebating and chamfering. If a face and edge of a piece of timber are to be planed, it is first placed flat and pressed against the table (or held down by two springs similar to those shown at B) and passed over the rotating cutter; the piece is then edged in a similar manner with the dressed face against the fence.

This machine can also be obtained with a mechanical feed. This feed unit is superimposed over the table and consists of two endless travelling chains having projecting steel points. These points grip the timber and guide it forward over the cutterblock. The maximum rate of feed is 55-lin. ft. per min.

4. **SURFACE-PLANING AND THICKENING MACHINE.**—The object of this machine is to reduce the timber to a parallel thickness in addition to planing its surfaces. It resembles machine H with the addition of a second table, situated below the back and front tables. The bottom table can be raised or lowered as required, the vertical distance between the upper surface of the bottom table and the edge of the knife in the cutterblock (when immediately below its centre) being equal to the required finished thickness of the timber. If a piece of timber is to be thickened and planed on all four sides, an edge and one face are first planed on the top table, as explained in the preceding column, after which the piece is placed with the dressed face resting on the bottom table, and the upper face is dressed by the cutterblock as the timber is fed mechanically by the rollers. The second edge is finally dressed in a similar manner, a process known as *widthing*. The maximum size of timber which can be dealt with is 30-in. by 9-in. and the maximum rate of feed is 46-lin. ft. per min.

5. **PANEL PLANING AND THICKENING MACHINE.**—One form of this powerful machine consists of a table, a cutterblock having three, four or six knives, a mechanical feed of rollers, pressure bars to hold the timber firmly down on the table and a *chipbreaker* to break up and discharge the chippings. One of the heavier types is capable of dealing with timber of 36-in. maximum width and up to 9-in. thick. The cutterblock, being above the table, planes the upper face and reduces the thickness of the timber. The maximum rate of feed is 90-lin. ft. per min.

Another form of this machine is provided with two cutterblocks, a bottom one (at table level) near the front, and a top cutterblock near the back. Two surfaces can be dealt with at the same time, and thus the machine acts as a double surfacer. In addition, two side vertical cutterblocks can be fitted near the back end of the machine; it thus acts as a *four-cutter planing and thickening machine* and is capable of planing all four sides at once.

6. **MOULDING MACHINE.**—There are several types of machines used for forming moulded surfaces. The cutterblocks and cutterheads are provided with cutters shaped according to the moulded section of timber to be produced. A moulding of complicated design will require more than one cutter to form it. Moulding machines may have either four, five or six rotary cutterblocks. Thus, a *six-cutter* has the following at intervals, commencing near the feed end: A bottom cutterblock, two side cutterblocks (one at each side), a top cutterblock, a second top cutterblock or *profile head*, and a second bottom or end cutterblock or *beading head* near the back end; this is suitable for large mouldings. A *five-cutter* is similar but without either one of the bottom or top cutterblocks; the side cutterblocks may either precede or be between the two top cutterblocks. A *four-cutter* has bottom and top cutterblocks and two side cutterblocks.

The feed is by means of two pairs of rollers (the first being fluted) through which the timber is guided and propelled; the rollers are driven by gearing controlled by a three, four, six or nine speed gearbox, depending upon the type of machine. The timber is pressed against the table and/or fence by pressures such as smooth rollers or pads over or adjacent to the various cutters. A chipbreaker is provided. The maximum size of timber which can be dealt with varies; thus, one type of six-cutter can deal with sections up to 15-in. by 6-in., whilst another is designed to take a maximum size of 12-in. by 4-in.; the capacity of some four-cutters is limited to 4-in. by 2-in. stuff.

There is a big variation in the feed-speeds; thus, one six-cutter machine has a range of speeds up to 160-lin. ft. per min., whilst some four-cutters have a maximum feed-speed of 45-lin. ft. per min. only. The speed depends upon many factors, such as the size, kind and quality of the timber, number of cutters, quality of finish required, power available, etc. As mouldings of high finish are usually required, it is customary to feed the machines at much lower speeds than the maximum, otherwise ridges or "ripple marks" (see U, Fig. 6) will be more pronounced.

The latest type of "high-speed" planing and moulding machine which can be built up with either four, five or six rotary cutterblocks in addition to fixed knives, has six rates of speed varying from 25 to 200-lin. ft. per min. The fixed knives, which produce a high quality finish, consist of two bottom knives and two side knives, and are situated between the first cutterblock and the side cutterblocks. It is necessary to use an *automatic feeding table* in order to obtain the maximum output from this high-speed machine. This may be 20-ft. long by 2 to 2 $\frac{1}{2}$ -ft. wide, and has six grooved bottom rollers at intervals along its length, with two top rollers at the planing machine end; it has a fence along one side and a sloping board along the other, on to which the pieces of timber are dropped