

travel of the table, the scribing being the last operation as a rule. An adjustable *drunken saw* (so called because it appears to wobble when rotating) is used for double tenoning; this is attached to the bottom scribing spindle and replaces the bottom scribing block.

11. **DOUBLE-DIMENSION SAW BENCH.**—This is used for various classes of work (including ripping, cross-cutting, mitreing, grooving, rebating, bevelling and cutting compound angles) requiring accuracy in sawing to dimensions. The 44-in. by 40-in. table can be canted to 45°. A revolving frame carries two saws (usually a rip saw and a hollow ground cross-cut saw); that required for use is raised to the required height by turning a wheel; this operation lowers the other saw. The main fence can be accurately adjusted in any position and can be canted to 45° or swivelled to 30°. The front portion of the table can be moved laterally as required for cross-cutting, etc., and carries a mitreing and cross-cutting fence which is set to the required angle on reference to a graduated arc marked on the table or fence.

A *single-dimension saw bench* is similar to the above, but carries only one saw. This saw can be interchanged.

12. **DOVETAILING MACHINE.**—Dovetailing of timber for drawers and similar work is performed by an automatic single spindle dovetailing machine consisting of a vertical or horizontal rotary cutting spindle, mounted on a slide, and a travelling table to which the timber is cramped. The movement of the table conforms with the reciprocating motion of the spindle as the latter enters and leaves the wood to form dovetails at the required spacing. One type of multiple spindle dovetailing machine for repetition work has a table (which accommodates two boards to be jointed at right angles to each other) fitted with an automatic mechanism for spacing the dovetails at the required pitch, and a complete dovetail joint is formed as the table moves past a series of cutters.

13. **LATHE.**—This is used for wood turning, examples being turned balusters, moulded newel caps and drops, legs of furniture, etc. The essential components are a fast headstock and a loose tailstock. These may be fixed on a wood bench or on a metal bed supported by legs. The headstock, usually fixed on the left-hand side, carries a short horizontal revolving spindle having a forked chuck to grip the timber and a three or four speed pulley. The tailstock is at the opposite end of the bench or bed and has a sliding horizontal spindle (carrying a tail centre which slightly penetrates and supports the end of the timber), operated by a handwheel; it can be moved and locked in any position along the bench.

The piece of wood to be turned is fixed horizontally between the stocks. The shaping of the wood is performed by a chisel or gouge of suitable shape which is fitted in a tool-holder and held against the wood as it revolves at a high speed; the cutting tool is held stationary or traverses the length of the timber as required during the shaving process. The tool, fixed in a holder and provided with an adjustable slide, may be used for turning long pieces; this is fitted to a sliding carriage which traverses the length of the bed.

For hand turning the tool is held and manipulated by hand, supported by a rest, various sizes and shapes of chisels and gouges being used in the process.

14. **MITREING MACHINE.**—This machine, used for cutting mitres and squaring edges of timbers, is not power driven. It consists of a pedestal which supports a table and a knife which is operated by a hand lever. The timber is placed on the table, with one edge against a pivoting fence which has been adjusted to the required angle according to a graduated arc marked on the table, and the edge is cut by the knife on a downward stroke of the lever.

15. **SAND-PAPERING MACHINE OR SANDER.**—Planned surfaces, especially if they have been prepared by rotary cutters, are uneven due to the presence of a series of ridges (see U, Fig. 6, and p. 28). In order to eliminate these ripples and give a smooth finish it is necessary to apply an abrasive paper (glass or sand-paper) to the surfaces. The hand application of this abrasive is referred to on p. 129, Vol. I. This slow and tedious process is gradually being superseded by the machine. There are three classes of sanders, *i.e.*, (a) drum, (b) belt and (c) disc.

(a) *Drum or Cylinder Sanders.*—One type, suitable for large outputs, consists of three horizontal drums which have a combined rotary and oscillating motion. Sand-paper is fixed to each drum, coarse grade paper being used to cover the first drum, medium grade the second and fine grade the third. These drums are superimposed over the feed mechanism, which may consist of a travelling endless belt or eight rollers. The timber is placed on the belt or feed rollers and suitable pressure bars or rollers ensure that it comes

into intimate contact with the abrasive. The minimum rate of feed is 27-in. ft. per min. One or more hoods are fitted over the drums and are connected by a pipe to an exhaust fan which extracts the dust from the machine.

A smaller machine is provided with either one or two drums.

(b) *Belt Sander.*—This comprises a travelling table, 8-ft. long and a 6 or 8-in. wide endless belt above, which passes over two pulleys and travels the full length of the table. The timber is placed on the table, and the belt, with abrasive paper attached, is pressed down for close contact by means of a pad. This machine is suitable for medium outputs.

A smaller machine consists of a 7-ft. by 2-ft. table with two vertical rollers near the ends, on which an 8-in. high belt travels. The timber is laid on the table and pressed against the belt by hand.

(c) *Disc Sander.*—One type consists of a pillar which supports a short revolving spindle at each end of which is a disc which varies from 20 to 36-in. in diameter. A small table, which can be canted, is fixed opposite to each disc. Abrasive paper is fixed to the outer face of each disc and the work is held against it during rotation.

A combined machine, known as a *disc and bobbin sander*, carries a disc with a table, as described above, and a vertical spindle called a bobbin. The latter operates in the centre of a table and has a vertical reciprocating and rotary motion. Both tables can be canted. The bobbin, which is covered with abrasive paper, is useful for curved work.

16. **UNIVERSAL WOODWORKER OR GENERAL JOINER.**—This is a general utility machine capable of satisfying the requirements of smaller establishments where different classes of work are dealt with and the output is insufficient to justify the provision of separate machinery.

One type consists of two sections. The front half comprises a horizontal rotary cutter-block, front and back tables and adjustable fence (somewhat similar to those shown at U, Fig. 5) for planing, surfacing, chamfering and jointing timber up to 12-in. wide. In addition, a vertical rotary cutter spindle arranged to rise and fall as required, is fitted in the middle of the front table and thus resembles B, Fig. 5; this is used for moulding circular and irregularly shaped pieces of timber up to 3½-in. thick. A further addition consists of a small rise and fall table in front of this half-section for hollow chisel mortising, boring and slot mortising; the chisel is fixed horizontally to the end of the horizontal cutter-block and overhangs the small table; the timber is fixed by a vertical clamp to the table, which can be moved longitudinally and transversely; the chisel is replaced by either the boring bit or slot mortising auger as required.

The back half of the machine consists of a rise and fall table, fence and a spindle to which is attached either a circular saw or a horizontal rotary cutterblock. The maximum size of saw is 24-in. diameter and will saw up to 9-in. deep; cross-cutting, mitreing and dimension sawing may be performed, as a steel plate to carry the timber and adjustable fence can be fitted to slide in a groove along the edge of the table. When required for tonguing, grooving, thicknessing and moulding, the saw is replaced by a horizontal cutterblock (5-in. long) carrying suitable knives. The table is lowered to bring it to the desired level below the cutterblock when the timber is to be moulded and thicknessed; the timber is first surfaced on one side and edge, and then thicknessed or moulded on the upper and opposite side; a power feed apparatus and pressures are provided for this purpose. The cutterblock is replaced by a suitable tenoning cutterblock for forming tenons, the maximum length of which is 5-in.; the timber is fixed transversely by a clamp to a plate and passed horizontally under the rotary cutter to form the upper portion of the tenon; the table, with plate and timber still attached, is then raised to the required height above the cutter over which the timber is passed to cut the opposite side of the tenon. Tonguing and grooving are performed when the cutterblock, with suitable cutters attached, is rotated against the timber, which is fixed to the table at a suitable height. For sand-papering, the cutterblock is replaced on the spindle by a small drum covered with sand-paper, and the operation is performed with the table adjusted at a suitable height.

17. **SHARPENING MACHINES.**—There are many machines for conditioning saws, cutters, etc. These include—

Automatic Saw Sharpening Machine.—This is used for sharpening circular saws, the sharpening and gulleting (re-cutting the gullets to the correct shape, see G, Fig. 6) being done by a grinding machine which automatically grinds the whole profile of each tooth at one operation. The teeth can be ground square across or at any desired bevel. The grinding wheel, 8 or 12-in. in diameter, is fitted to a spindle which is provided with