smoothing planes and scraped, it is traversed (generally with the grain) by the *rubber*. This is a piece of cork round which is wrapped a piece of glass-paper. This abrading material is a strong paper, one side of which is coated with powdered glass, glue being used as the adhesive; it is obtainable in various grades and usually application of two or three of the grades is necessary before the surface is completed. Mahogany and certain other hardwoods should be "damped down" (*i.e.*, the surface is damped with a little hot water) and allowed to dry before the finer grade of glass-paper is applied; this is necessary to "raise the grain" which has been depressed by the action of the coarser paper.

Grindstone.—Plane irons, chisels, etc., have to be ground before being finally sharpened on the oilstone. A hard grit stone or carborundum, etc. disc, which is caused to rotate during the grinding operation, is generally provided in the shop for this purpose.

Oilstone and *Box* (see 25).—There are several natural and artificial oil-stones and these vary considerably in degree of fineness; well-known varieties are the Arkansas, Carborundum, India, Washita, and Turkey; a good quality oil (preferably neatsfoot) should only be used when sharpening the tools. The hardwood (mahogany) box to receive the stone, and the lid should be made out of the solid.

Slip Stone (see 27).—These are of similar materials to oilstones and are used for sharpening gouges; sizes vary from 4 to 6-in. long, 1 to 2¼-in. wide and $\frac{7}{16}$-$\frac{5}{16}$-in. to ⅜-⅜-in. thick.

(6) Cramping and Holding Appliances include T-cramps, G-cramps, bench holdfasts and mitre blocks.

T-*cramp*.—This has been described on p. 106 and is shown at J, Fig. 55; it is used to cramp up framings, etc., during the gluing and wedging process.

G-*cramp* (see 41).—This metal cramp is convenient for small work; the sizes vary from 5 to 12-in. (distance between the end of the screw and the opposite leg); a lighter but similar cramp with a thumb-screw instead of the lever handle and having a maximum clearance of 8-in. is also used.

Bench Holdfast or Clamp (see 6).—Is of wrought iron with a steel screw and malleable arm and shoe; the arm varies from 10 to 14-in. long and from ⅜ to 1¼-in. diameter; its object is to grip the stuff on the joiners' bench during the process of working; the bench top is holed to receive the bar, the work is gripped by the shoe, and the screw is tightened to cause the bar to cant over and grip the sides of the hole; this forces the shoe down on the work and makes it rigid whilst the joiner is engaged in doing the necessary labours.

Handscrew (see 52).—This consists of two hornbeam, beech or metal screws with two beech jaws; it is one of the best appliances for cramping light stuff during the actual hand operations and after the work has been glued, as the comparatively large jaws do not damage the stuff.

Mitre Block (see 51).—Used in forming mitres on architrave and panel mouldings, etc.; it consists of two pieces of wood which have been carefully dressed and glued together; two 45° marks are accurately set out by using the bevel (see 3) and try-square (2), and the two cuts or *kerfs* are carefully formed with a tenon saw (13); sometimes a square cut is also formed for butt joints. In cutting the mitre, the length of moulding is placed on the block with the moulded face outwards, the saw is placed in the cut, and the moulding is sawn with the kerf serving as a guide.

A *mitre box* (which is in the form of a channel and consists of two 1-in. vertical pieces of wood secured to a wood bed piece) is sometimes used for large mouldings; mitre cuts are made down the two vertical pieces. The large moulded piece is placed within the box and made rigid by wedges; the tenon saw is placed across the box and engaged in the two short cuts, and the mitre is sawn down the moulding.

A *mitre templet* (used for trimming the mitres after being cut) and *shooting and jointing boards*—used for planing mitres and edges with the trying plane (see 26)—are other forms of equipment.

(7) Miscellaneous Tools and Equipment.—The following are necessary in a joiner's tool chest:—

Cold Chisel.—This is a strong steel tool, about ½-in. wide, which is used for the removal of superfluous plaster, etc. prior to the fixing of architraves, skirtings, etc.

Pincers (see 24).—This illustrates the older type, and, as the claw is seldom used, the newer form which is not provided with a claw and knob is sometimes preferred as it is considered to give a better grip.

Axe.—This is useful for rough carpentry work.

Plumb-bob (see p. 29).—A lead, brass or iron plumb-bob, attached to a length of string, is essential for testing work that is being fixed.

Spirit Level (see 17, Fig. 19).—This is necessary when fixing certain carpentry and joinery work.

Oil Can.—The "non-leak" cone-shaped type is preferred.

Portable Power Tools.—These small tools have been developed comparatively recently for use by the woodworker. They are electrically operated, and therefore, if electricity is available these tools can be used on outside jobs besides in workshops. Portable electric tools are much speedier than hand tools and consequently they are capable of substantially increasing output; whilst somewhat heavier than ordinary hand tools, power tools are easily handled with much less fatigue to the operator. Each power tool is provided with a switch, usually in the handle and therefore conveniently operated, to which the cable from the motor is connected. Portable power tools chiefly used for woodworking include saws, planes, screwdrivers, drills and sanders.

Portable Electric Saws.—These are provided with *circular* saw blades similar to those described on pp. 24–27, Vol. III; the size varies from 6 to 12-in. diameter and the corresponding cuts that can be formed are from 1⅞ to 4⅜-in. deep. Each saw is provided with two handles, one at the rear and one on top. The blade is provided with an automatic telescopic guard which covers the teeth, the lower half, being spring-hinged, rotates backwards as the tool is operated and closes with a snap immediately the cut is completed or the tool withdrawn; the safety of the operator is thus assured. A small fence is provided and this can be regulated to give the desired width of timber to be cut. The blade can be tilted to give bevel cuts up to 45°. Rip, cross-cut and special blades are interchangeable, and hence the tool can be used for sawing with and across the grain as desired. It is claimed that a portable electric saw can cut ten times faster than the ordinary handsaw.

Portable Electric Planers.—These are metal planes, one type having a sole which is approximately 22-in. by 7-in. and a cutting iron or cutter blade of 4-in. width. It has two handles, one near the heel and the other or pressure handle near and above the nose. A trigger switch is housed in the heel handle, and the blade is readily adjusted for depth of cut by means of a thumb screw and fixed by a wing locking nut. This electric planer planes ten times as fast as the jack plane described on p. 128.

Electric Screwdrivers.—This power tool, pistol-like in appearance, has a trigger switch in the handle with an adjustable clutch at the opposite end which grips the blade. It is eminently suited for mass produced work, as it is capable of driving screws home at a very high speed. The screwing operation is facilitated and the splitting of the timber avoided if pilot holes are first made by means of an electric drill (see below) to receive the screws.

Portable Electric Drills.—These are employed for forming holes of varying diameters; like the brace and bit (p. 129) an electric drill has a chuck which tightly grips the bit of size and shape required, a secure grip being assured by rotating the chuck by means of a small key. As mentioned above, the drill is used for boring small diameter pilot holes for screws, but much larger holes can be drilled and, by fixing a special attachment, the size of hole can be up to 4-in. diameter. The smaller type is one-handed, but larger drills have end and side (or two side) handles and, in addition, the more powerful tool is suitably dish-shaped on top to permit of breast-pressure.

Portable Electric Sanders.—These are used to produce a smooth finish to planed surfaces. The laborious hand operation of scraping and sand-papering described above is obviated when the portable power sander is available. There are two classes of this sander, i.e., the *belt* sander and the *disc* sander. The belt sander, which is used for flat surfaces, has an endless belt (to which the sandpaper is attached) which passes over two pulleys at a very high speed; belts from 2¼ to 4¼-in. wide are easily interchangeable; the sander is pressed down on the timber during the sanding operation; the better type of sander is provided with a vacuum dust collector or bag fixed at the rear to receive the dust during sanding. The disc sander is useful for curved or irregular surfaces; the size of disc varies from 5 to 9-in. diameter; the abrasive paper is fixed to the disc and the latter rotates at a high speed as the tool is pressed against the work. The more powerful sand-papering machines are described on p. 30, Vol. III.

Some of these portable electric tools can be used to eliminate hand labours on materials other than wood. Thus, the saw can be provided with special blades or abrasive discs for cutting bricks, stone and marble slabs, tiles, etc., electric drills are used for forming holes in metal, and sanders with belts to which suitable abrasives are attached are employed for smoothing stone, etc. surfaces.