Toothing Plane.—Is a useful tool for preparing surfaces of timber which are to be glued together, such as is required for veneering; its 2-in. wide single iron has a serrated edge; the surface to be toothed is levelled by a jack plane, traversed with the toothing plane diagonally in opposite directions and finally with the grain to give a flat rough surface.

Tonguing and Grooving Planes (also known as *matching planes*).—Used to form tongues and grooves on the edges of boards required for match-boarding, battened doors, etc. Although most of such work is done by machinery, these planes are occasionally required, especially when preparing work during fixing.

(*b*) METAL PLANES.—Most of the wood planes described above are also obtainable in metal, such as cast steel, gunmetal, malleable iron or aluminium. Some of them are an improvement upon the wood planes, but the wood jack plane especially is still considered to be the best for its purpose. The metal planes are more fragile than those in wood, and therefore the jack and trying planes are better able to withstand the somewhat rough usage to which they are often subjected. Metal planes are also more expensive than wood planes. Very accurate work, especially in hardwood, can be produced by metal planes, and their various adjustments can be readily affected. The sole of a metal plane is not subjected to the wearing action common to the wood plane.

Metal Smooth Plane (see 42).—This is a very useful tool, especially for smoothing the surfaces of hardwoods of best quality which have been previously dressed with the jack and trying planes. The cap secures the two irons (called the *cutter*) by a screw which passes through to the frog that supports them; the cap is adjusted by the lever "X"; the lever "Y" adjusts the cutter sideways, the frog is adjusted either forward or backward by an adjusting screw, and the large screw or milled nut behind the frog adjusts the edge of the cutter to regulate the thickness of shaving. This tool is the Stanley "Bed Rock" smoothing plane, and is obtainable in sizes varying from 5½ to 10-in. in length of sole with cutters which are from 1¼ to 2⅜-in. wide; a somewhat similar tool, called the English steel smoothing plane and having a width of iron up to 2¼-in., is very satisfactory, although it is not so readily adjusted as that described above.

Block Plane (see 44).—This is a very desirable tool, especially for small work which is not readily accessible and for preparing mitres of hardwood mouldings; it is well suited for planing across the grain, and on account of its small size it can be easily gripped and controlled with one hand; it has only a single iron or cutter which is inclined at 12° to 20°—compared with the 45° pitch of the cutting iron of the wood jack, etc. planes (see J); unlike the cutting iron of the wood bench plane, the bevel of the cutter of the block plane is uppermost. The type shown is a Stanley plane, and to assemble it, the iron (which has a central slot) is placed over the small projecting lever cap screw, the cap (which has a knuckle joint) is fitted over it, and when correctly placed, pressure on the cap springs it into position; the edge of the cutter is brought parallel with the mouth (barely ¼-in. wide) by lateral movement of the lever and the distance between the edge of the cutter and the front of the mouth is regulated as required by the milled screw or nut shown below the lever. The width of the iron is 1⅝-in.

Other varieties of metal planes include the *bullnose plane* (the edge of the iron is close up to the nose of the plane and is therefore useful for planing surfaces at the ends of rebates, etc.) and the *shoulder plane* (which is a form of rebate plane used for planing rebates in hardwood and particularly the ends of members such as the shoulders of rails).

(3) BORING TOOLS.—These include the brace and bits, auger, gimlet and bradawl.

Brace and Bits (see 45 to 50).—A brace is a handle or stock to which is attached a cutter or bit used for boring holes; hand pressure on the head of the brace assists the boring action of the bit whilst the brace (gripped by the handle) is revolved; that shown at 45 is of the *ratchet* type and is the best, for when desired the turning movement of the handle may be restricted to a small arc to allow boring in confined positions; when the ratchet is suitably adjusted, the bit only bores into the wood when the brace is turned clockwise through a part of a circle, and the bit remains stationary when the brace is turned backwards; the brace with the screwdriver bit attached is also employed to force in screws when pressure on the ordinary screwdriver (see 40) would be inadequate; the chuck contains steel spring jaws into which the shank of the bit is inserted and securely gripped by rotation of the chuck; the sweep of the brace is of steel, the head and handle are of hardwood, and in the best tool the head, handle and ratchet head have ball bearings providing easy action.

There are many varieties and sizes of bits. The *centre bit* (46) is employed for boring; the cutting edge P cuts out the circumference of the hole as the bit is rotated by the brace and the turned back cutting edge Q removes the waste material from the hole; its diameter varies from ⅛ to 1½-in. The *shell bit* resembles the gouge (compare 50 with 39), the *spoon bit* (which resembles the gouge, but pointed), the *nose bit* (like the shell bit but with a cutting edge at the point) and the *screw bit* or *twist bit* (which has a screw thread at its point) are used for producing small holes from ⅛ to ½-in. diameter. *Auger* or *twist bits* produce holes which are cleaner and more accurate than those formed by the above varieties; there are many patterns, *e.g.*, Russell Jenning's (48), Gedge's and Irwin's (49); these are in two lengths, the shorter being known as dowel bits, and the diameters increase by $\frac{1}{16}$-in. from ¼ to 1½-in. The *Forstner bit* is unlike the twisted bits as the end has a circular rim instead of a point, and the larger bits have only plain and not spiral shanks; it is useful for boring in any direction. The *expansion bit* is provided with adjustable cutters of different sizes, thus in one range the cutter can be adjusted to bore holes varying from ½ to 1½-in. diameter. The *screwdriver bit* (45) is an important tool and has already been referred to. *Countersink bits* are used to prepare shallow sinkings to receive heads of countersunk screws (see K, Fig. 66), etc.; the *rose* countersink bit (47) is suitable for both hardwoods and metals, the *snail* countersink bit (similar to the rose but having a sharper point and a grooved end) is used for wood only, and the *flat* countersink bit (having a flat end which is tapered to a point) is only suitable for boring through metal. *Rimers* are tapered bits which are used for either preparing tapered or conical-shaped holes or for increasing the size of holes.

Auger.—This has a steel stem, about 2-ft. long (although this may be exceeded), having a round eye at one end to receive a wood cross handle; the other end is shaped like the bits of this name; is used for deep borings up to 2-in. diameter.

Gimlet.—This small tool is useful for boring holes to mark the position and facilitate the insertion of screws. The various patterns include the *twist gimlet* (8), *shell gimlet* (resembles a gouge with a screw end) and the *auger gimlet* which has an augered shank.

Bradawl (see 22).—The small steel blade has a sharpened end; is used for making small holes.

(4) IMPELLING TOOLS include hammers, mallets, screwdrivers and nail punches.

Hammers.—That shown at 11 is called the *Warrington hammer*; the head (usually of cast steel with a tempered steel face and pene) is wedged to the shaped ash or hickory shaft; of the many sizes, that with the head weighing approximately 1-lb. is most used for general purposes. The *claw hammer* (14) is made with heads weighing from 7 to 28-oz.; the claw is useful for levering back or withdrawing nails.

Mallet (see 23).—Used for driving chisels and knocking framing together; the tapered mortice in the beech head receives the slightly tapered ash or beech shaft.

Screwdrivers.—There are two forms, *i.e.*, the fixed-blade type and the *ratchet* driver (40); the former is obtainable with the length of blade varying from 3 to 12-in. and is the firmer tool to employ for heavier framing; the ratchet screwdriver, by adjusting the slide, can be turned right or left without releasing the hand pressure; it can also be converted to the rigid type.

Nail Punches (see 10).—These vary in size and shape and are used to punch the heads of nails below the surface of the wood.

(5) ABRADING TOOLS include scrapers and rasps.

Scraper (see 53).—The two longer edges of this steel plate (which does not exceed $\frac{1}{16}$-in. in thickness) are turned over to form a slight burr on each side; it is used on a hardwood surface after the latter has been levelled and smoothed by planing; the scraper is gripped by both hands and a burred edge is drawn or pushed over the surface of the wood in varying directions (finishing with the grain) until any defects left by the planes have been scraped out.

Rasps.—Two grades of the steel half-round rasp shown at 43 are used to remove bumps on curved surfaces; the coarse and fine files are about 10 and 8-in. long respectively; the fine file eliminates the marks left by the coarser file; flat rasps are also obtainable.

Glass-papering, also termed *sand-papering*, is the final process applied to good hardwood surfaces. Thus, after the surface has been planed by the jack, trying and