through the centre. Planks sawed tangentially to the annual rings are termed *flatsawn*. Giving a *flat grain*, while radially cut planks are termed *quarter-sawed*, giving an *edge grain*. If the annual rings are approximately at 45° to the face of the plank, the condition is called *angle grain*. *Cross grain* refers to a plank whose fibres are not parallel to the long axis of the plank. Figure 10.2 shows the methods of cutting logs.

10.4 SEASONING OF WOOD

The advantages of seasoning are that it makes the timber lighter in weight, more resilient, and less liable to twist, warp, and split. It is also in a better condition to retain its size and shape after being made into a piece of joinery. Wood increases in strength, hardness and stiffness as it dries. There are two methods of drying or seasoning :

Natural seasoning : This is also known as *air drying*. In this method the balks (roughly squared logs) are stacked under cover with spacers in between, so that a free circulation of air is provided all round them. This method is slow, but gives the best results. A further period of seasoning should take place after the balks are sawn up and converted into planks or boards. This is to help dry out the interior of the timber which has been exposed by sawing.

Artificial seasoning : In the *artificial seasoning* method, the period of seasoning is very much reduced, a matter of two or three weeks being sufficient, according to the size or species of timber to be seasoned. The timber is stacked on a special truck and wheeled into a chamber which is then sealed. Hot air is circulated by fans, and a certain amount of steam is added in order to retain the correct humidity. Samples are tested at intervals to ascertain the percentage of moisture remaining in the timber. Seasoned timber still contains a proportion of moisture, which varies from 16 to 22 per cent according to the seasoning conditions, and this need not be dried out any further if intended for use out-of-doors.

If used for interior work or in a heated atmosphere, the timber should be further conditioned, that is, dried in warm-air kilns, or stored in a similar atmosphere to that in which it will be fixed, until the moisture contents is brought down to the region of 8-12 per cent.

Moisture content is the ratio of amount of water in a sample, and the dry weight of the wood sample itself, expressed as a percentage.

10.5 COMMON DEFECTS IN TIMBER

Seasoning defects : As the moisture evaporates during seasoning, shrinkage of the timber takes place. If a balk is dried too quickly, splits and cracks will appear. Shrinkage in the length is negligible, but it is more

dimensions, the wood-worker must know the use of a large number of different forms to accurate shapes and tools. The principal types which are manipulated by hand are described and illustrated below :

1. Marking &measuring tools.
2. Cutting tools.
3. Planing tools.
4. Boring tools.
5. Striking tools.
6. Holding & miscellaneous tools.

10.9 MARKING AND MEASURING TOOLS

Marking and measuring tools have been developed in order that true and accurate work may be assured. The commonest of such tools are :

Rules. Rules of various sizes and designs are used by wood workers for measuring and setting out dimensions, but they usually work with a *four-fold box-wood rule* ranging from 0 to 60 cm. This is graduated on both side in millimetres and centimetres, and each fold is 15 cm long. All the four pieces are joined with each other by means of hinged joints which make the scale folding.

For larger measurements carpenters use a *flexible measuring rule* of *tape*. Such rules are very useful for measuring curved and angular surfaces. When not in use, the blade is coiled into a small, compact, watch-size, case.

Straight edge. The straight edge (Fig. 10.4) is a machined flat piece made of wood or metal having truly straight and parallel edges. One of the longitudinal edges is generally made leveled. This is used to test the trueness of large surfaces and edges.

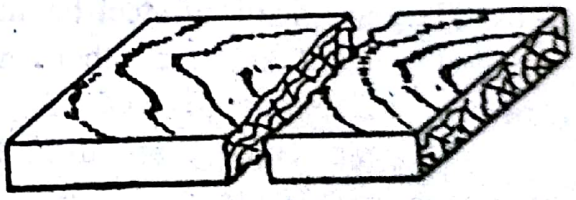


Figure 10.4 Straight edge

Try square. Try squares (Fig. 10.5) are used for marking and testing angles of 90°. It consists of a steel blade, riveted into a hard wood stock which has a protective brass plate on the working surface. Another type is the all-metal square, with steel blade and cast iron stock. Sizes vary from 150 to 300 mm, according to the length of the blade.

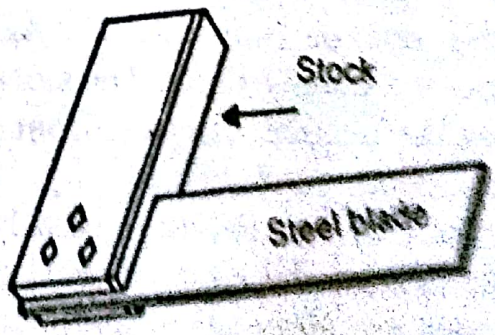


Figure 10.5 Try square

Mitre square. Mitre squares (Fig. 10.6) are used to measure an angle of 45°. They are made of all metal with a nickel-plated finish or with a steel blade, and an ebony or rose-wood stock. The blade varies from 200 mm, 250 mm and so on to a maximum of 300 mm long.

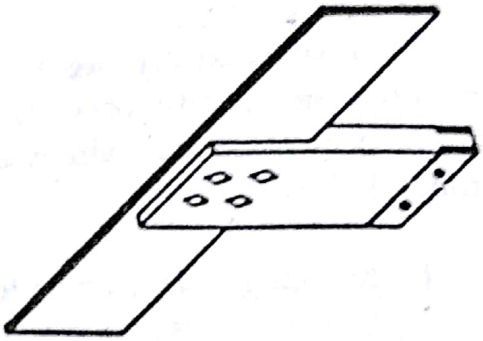


Figure 10.6 Mitre square

Bevel square. The bevel square shown in Fig. 10.7 is similar to the try square but has a blade that may be swivelled to any angle from 0 to 180°. This tool is adjusted by releasing with a turn screw of suitable size in a machine screw running in a slot in the blade.

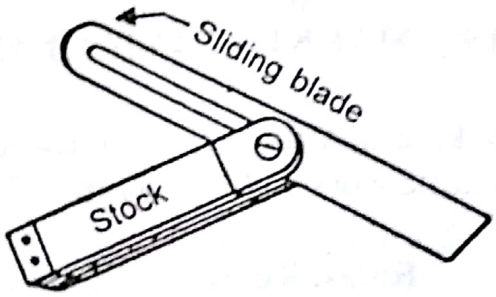
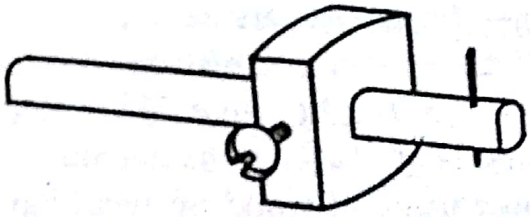


Figure 10.7 Bevel square

Combination square. Some wood workers prefer a combination square which is similar to the combination set used in bench work. It is a combination of a square, 45 - degree bevel, set square, rule, straight edge, and centre finder.

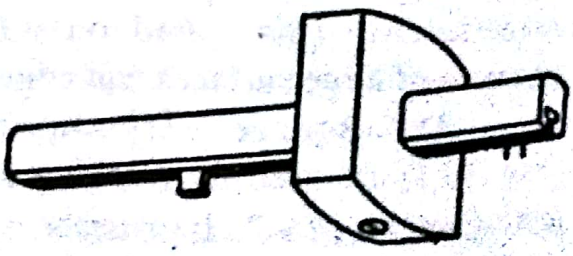
Figure 10.8 Marking knife

Marking knife. Marking knives (Fig. 10.8) are used for converting the pencil lines into cut lines. They are made of steel having one end pointed and the other end formed into a sharp cutting edge.



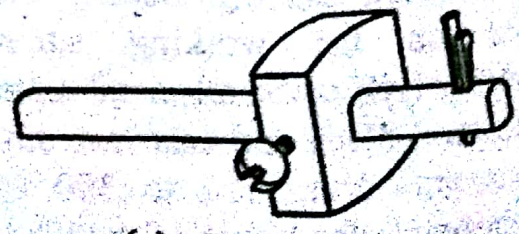
(a) Marking gauge

Gauges. Gauges are used to mark lines parallel to the edge of a piece of wood. It consists of a small stem sliding in s stock. The stem carries one or more steel marking points or a cutting knife. The stock is set to the desired distance from the steel point and fixed by the thumbscrew. The gauge is then held firmly against the edge of the wood and pushed along the sharp steel point marking the line.



(b) Mortise gauge

The *marking gauge* (Fig.10.9a)



(c) Cutting gauge

Figure 10.9 Gauges

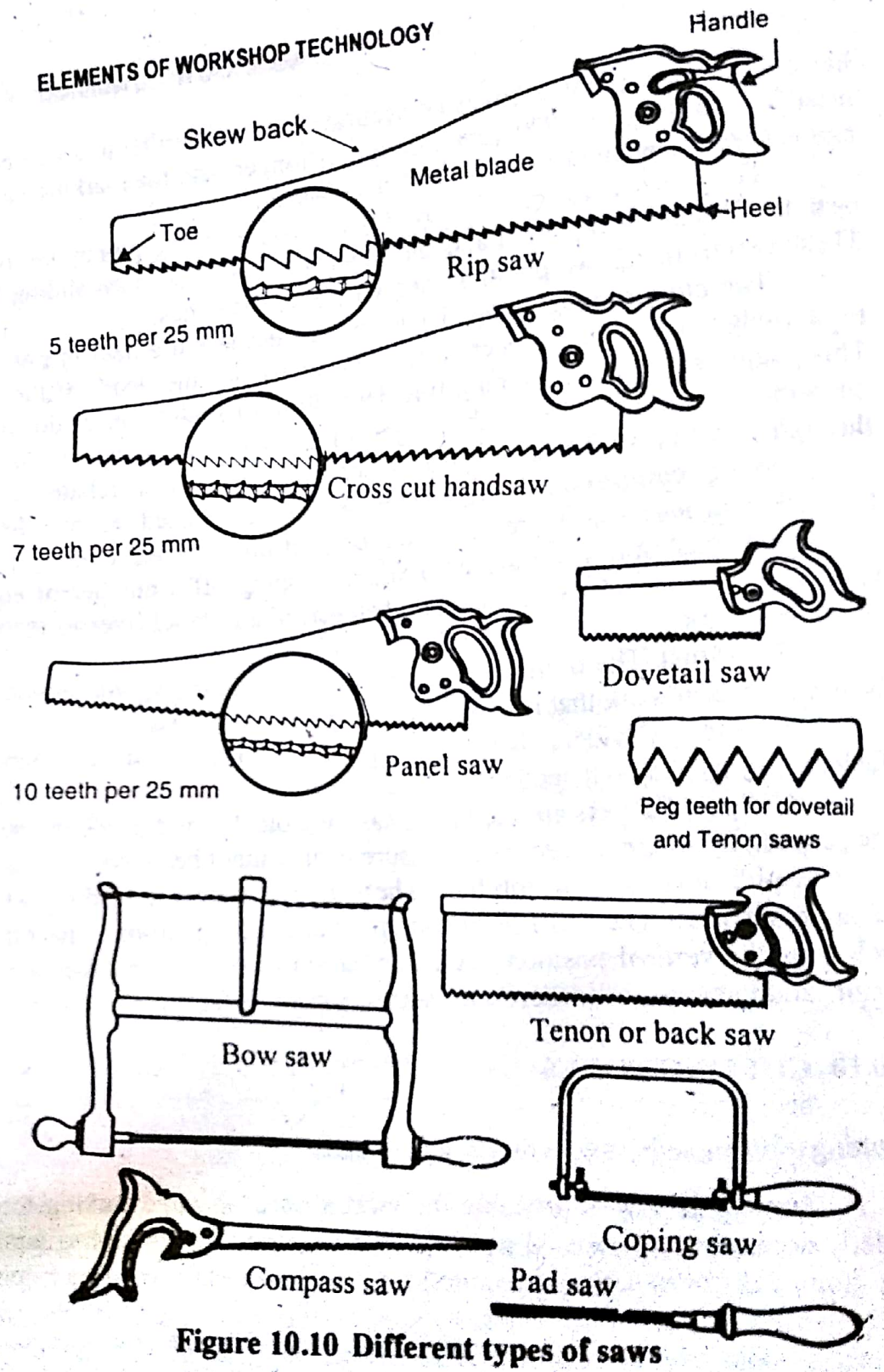


Figure 10.10 Different types of saws

The front or leading edge of the tooth forms a right angle with a line joining the points, and should be filed squared across the saw, with no bevel on front or back of the tooth. The action of these teeth is that of a series of chisels, which tear out shavings each equal to the width of a tooth.

The teeth are bent alternately, one to the right, the next to the left.

Bending the teeth in this manner is called "setting in saw". Please refer Section 14.11. The set of a saw provides clearance to prevent the blade from binding during the sawing operation.

Cross-cut saw. Cross-cut saws, or "hand saws" as they are sometimes called, are used for cutting *across* the grain in thick wood. They are 600 to 650 mm long with 8 to 10 teeth per 25 mm. The action of the teeth is that of a series of knives which sever the fibres and force out the waste wood in the form of saw dust.

Panel saw. A panel saw is about 500 mm long with 10 to 12 teeth per 25 mm and is very much like the cross-cut saw. It has a finer blade and is used for fine work, mostly on the bench. This is often used for ripping as well as cross-cutting. The teeth have slightly more hook than those of a cross-cut saw.

Tenon or back saw. This saw is mostly used for cross-cutting when a finer and more accurate finish is required. The blade, being very thin, is reinforced with a rigid steel back. Tenon saw blades are from 250 to 400 mm in length and generally have 13 teeth per 25 mm. The teeth are shaped in the form of an equilateral triangle and are sometimes termed "peg" teeth.

Dovetail saw. A smaller version of the tenon, this saw is used where the greatest accuracy is needed and fine shallow cuts are to be made. The number of teeth may be from 12 to 18 per 25 mm, while the length may vary from 200 to 350 mm.

Bow saw. The bow saw consists of a narrow blade. 250 to 350 mm long held in a wooden frame. The blade is held in tension by twisting the string with a small wooden lever. These saws are used for cutting quick curves, and, as the handles revolve in their sockets, the blade can be adjusted to any desired position when in use.

Coping saw. The coping saw has a very similar blade, held rigid in spring-metal frame. The blade is tensioned by screwing the handle. This saw is used for small radius curves.

Compass saw. The compass saw is used for sawing small curves in confined spaces and has a narrow tapering blade about 250 to 400 mm long, fixed to an open-type wooden handle. There are two types of compass saw, one having a fixed blade and the other with three interchangeable blades of different widths.

Pad or keyhole saw. This is the joiner's smallest saw, the blade being about 250 mm long. The blade of the pad saw is secured to the handle, through which it passes, by two screws. This arrangement allows the blade to be adjusted to the best length required according to the work. This saw is used for cutting key holes, or the starting of any interior cuts.

Chisels. Wood chisels most commonly in use include firmer chisels, either square of bevel edged, paring chisels, and mortise chisels.

They are usually specified by length and width of the blade.

Firmer chisel. The firmer chisel(Fig. 10.11) is the most useful for general purposes and may be used by hand pressure or mallet. It has a flat blade about 125mm long. The width of the blade varies from 1.5-50 mm.

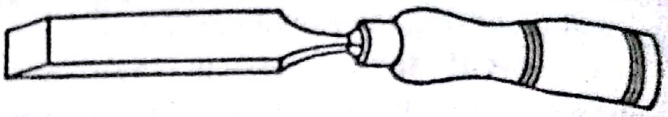


Figure 10.11 Firmer chisel

Figure 10.12 Beveled edge firmer chisel

Beveled edge firmer chisel. The beveled edge firmer chisel (Fig. 10.12) is used for more delicate or fine work. They are useful for getting into corners where the ordinary firmer chisel would be clumsy.

Figure 10.13 Paring chisel

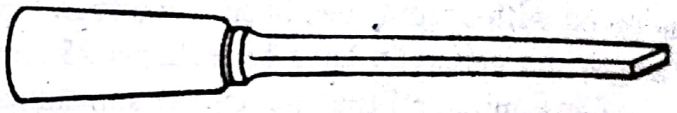


Figure 10.14 Mortise chisel

Paring chisel. Both firmer and beveled edge chisels when they are made with long thin blades are known as paring chisel (Fig. 10.13). This is used for shaping and preparing the surfaces of wood and is manipulated by the hands. The length ranges from 225 to 500 mm and width from 5 -50 mm.

Mortise chisel. The mortise chisel shown in Fig. 10.14, as its name indicates, is used for chopping out mortises. These chisels are designed to withstand heavy work. They are made with a heavy deep (back to front) blade with a generous shoulder or collar to withstand the force of the mallet blows on the oval-sectioned handle. Many mortise chisels are fitted with a leather washer at the shoulder to absorb the hard shocks of the mallet blows. Blades vary in width from 3-16 mm.

Gouges. Gouges (Fig. 10.15) are chisels with curved sections and may be either inside or outside ground. Inside ground gouges are used in exactly the same way for inside curved edges as a chisel would be for straight one ; outside ground gouges are used for curving hollows. Outside ground gouges are known as *firmer gouges* and inside ground gouges are called *scribing gouges*. When the later are made long and thin they are

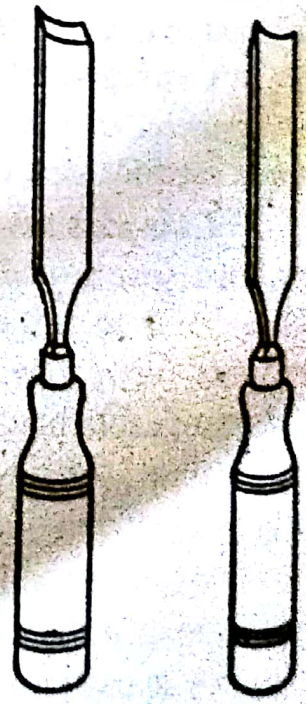


Figure 10.15 Gouges

paring gouges. Gouges are made to a large number of different curves for different work, and the size ranges from 6 mm, with intermediate sizes to a maximum of 40 mm wide.

10.11 PLANES

The plane can be likened to the chisel fastened into a block of metal or wood, and its blade cuts exactly like a wide chisel. The planes, in general use, are the jack, trying, and smoothing planes, and are known as bench planes. Besides, there are other planes which are used for special work.

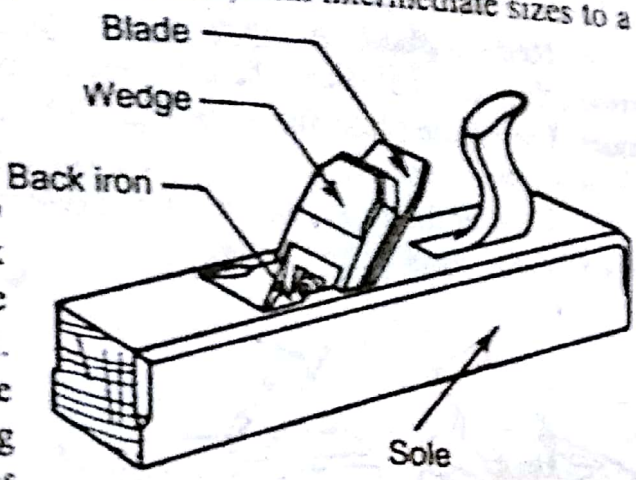


Figure 10.16 Jack plane

Jack plane. A jack plane shown in Fig. 10.16 is the commonest and is used for the first truing-up of a piece of wood.

It consists of a block of wood into which the blade is fixed by a wooden wedge. The blade is set at an angle of 45° to the sole. On the cutting blade another blade is fixed called cap iron or back iron. This does not cut, but stiffens the blade near its cutting edge to prevent chattering and partially breaks the shaving as it is made. It is the back iron which causes the shavings to be curled when they come out of the plane. Some types of planes do not have a cap iron. Jack planes are obtainable from 350 to 425 mm in length and with blades 50 to 75 mm wide.

Trying plane. The trying plane (Fig. 10.17) is a finishing plane, and is set with a very fine cut . It is used for producing as true surface or edge as possible, and is set to cut a shaving as thin as the smoothing plane. The length of the plane varies from 550 to 650 mm and the section of the body is 85 mm by 85 mm, with irons 60 mm wide.

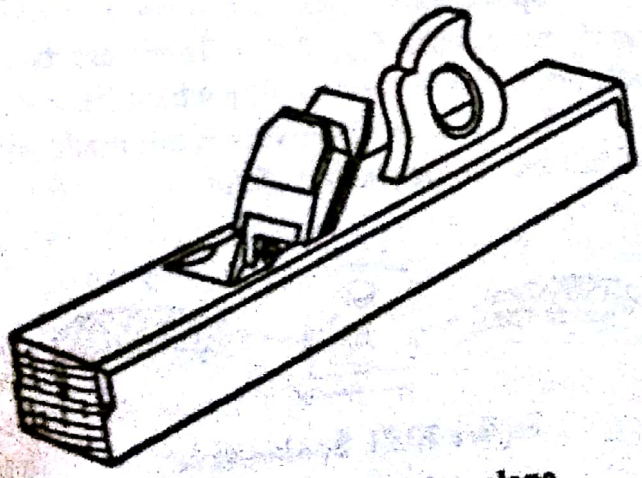


Figure 10.17 Trying plane

Smoothing plane. The plane (Fig. 10.18) is similar in action to a jack plane, except that it is set to cut a much thinner shaving. A smoothing plane, as its name indicates, is used for smoothing or finishing after a jack plane. The cutting edge of the latter is slightly curved, but a smoothing

plane has a straight cutting edge. It is 200 to 250 mm long having a blade of 70 mm wide.

Rebate plane. A rebate is a recess along the edge of a piece of wood ; this forms a ledge which is used for positioning glass in frames and doors. The rebate plane shown in Fig. 10.19 is used for sinking one surface below another, and shouldering one piece into another. The blade is open at both sides of the plane, and must be perfectly straight at the cutting edge. Widths range from 12 to 50 mm.

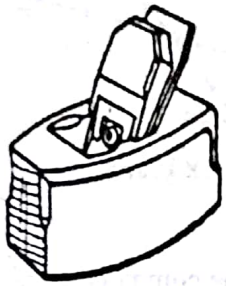


Figure 10.18
Smoothing plane

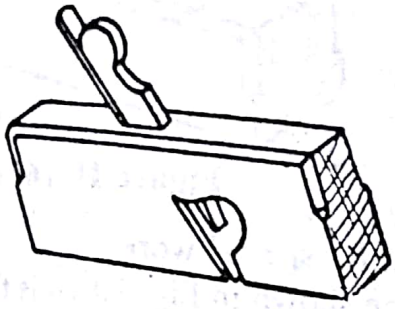


Figure 10.19
Rebate plane

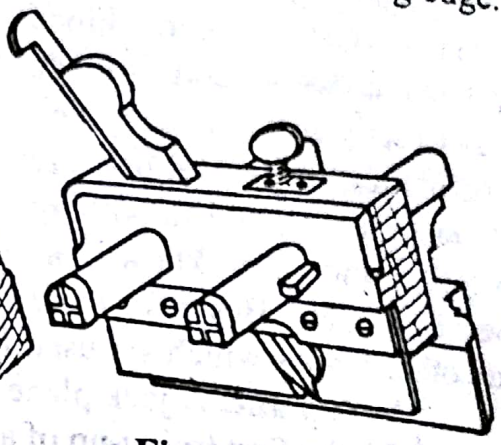


Figure 10.20
Plough plane

Plough plane. Where a panel is needed in a door it is used to fit it into a groove, not into a rebate. The plough plane illustrated in Fig.10.20 is used to cut these grooves. The depth of groove is controlled by a depth gauge which is fixed on the body of the plane and operated by a thumbscrew. These planes are usually supplied with eight to nine blades, vary in width from 3 to 15 mm and, of course, they are all interchangeable.

Spokeshave. This is a form of small plane used for cleaning up quick curves (See Fig.10.21) .There are two types, one which has a flat sole for outside curves and one which has a curved sole for inside curves.

Now-a-days, spokeshaves are made of iron, and some have a screw adjustment for the amount of cut.

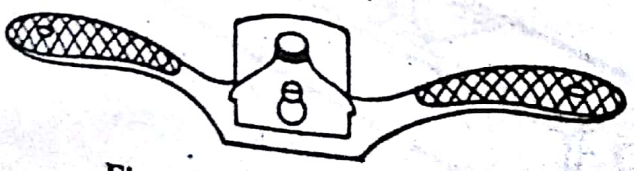


Figure 10.21 Spokeshave

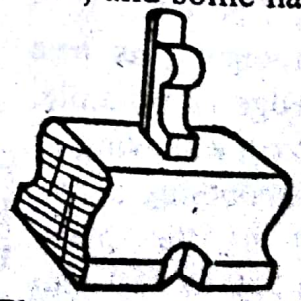


Figure 10.22 Router

Router. The router plane (Fig. 10.22) does not resemble other planes. This is used for cleaning out and levelling the bottom of grooves or trenches to a constant depth, after the bulk of the waste material has been taken out with saw and chisel.

Metal plane. Metal planes serve the same purpose as the wooden planes but facilitate a smoother operation and better finish. The body of a

metal plane is made from a gray iron casting, with the side and sole machined and ground to a bright finish. The thickness of the shaving removed is governed by a fine screw adjustment, and a lever is used for adjusting the blade at right angles. A metal jack plane us shown in Fig. 10.23

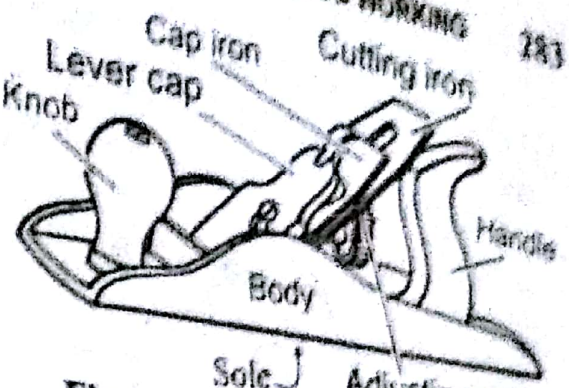


Figure 10.23 Metal jack plane

Special plane. In addition to those described above there are a number of special planes used by the woodworker to do special work. They include *compass* or *circular plane* for planing curves ; *bull nose rebate plane* for cleaning into rebates and corners inaccessible with other planes ; *shoulder plane* for planing across the end grain or hardwood shoulders ; *block plane* for planing small parts, especially when model making ; and *moulding plane* for producing a particular size and shape of moulding.

10.12 BORING TOOLS

Boring tools are frequently necessary to make round holes in wood, and they are selected according to the type and purpose of the hole. They include bradawl, gimlet, brace, bit and drill.

Bradawl and gimlet. The bradawl and the gimlet illustrated in Fig. 10.24 are hand-operated tools, and are used to bore small holes, such as for starting a screw or large nail.

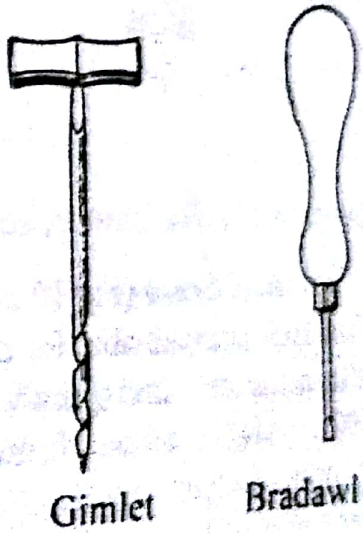


Figure 10.24 Bradawl & gimlet

Brace. The brace is a tool used for holding and turning a bit for boring holes. It has two jaws, which grip the specially shaped end of the bit. There are two types of braces in common use – ratchet brace and wheel brace. The *ratchet brace* is most useful for turning bits and drills of all kinds, being adaptable (a) for working in confined situations, and (b) for when the cut is particularly heavy and it is desirable to pull the handle through a quarter-turn only. A ratchet brace is shown in Fig. 10.25.

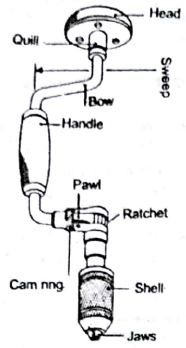


Figure 10.25 Ratchet brace

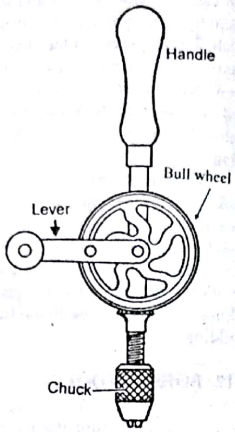


Figure 10.26 Wheel brace

The *wheel brace* (Fig.10.26) is used to hold round and parallel-shanked drills. This tool is invaluable for cutting small hole, accurately and quickly.

Bit. Most other forms of boring tools consist of "bits". The common types of bits used are shown in Fig. 10.27 and described below :

Shell bit. This bit is used for boring holes unto 12 mm diameter and which do not require a high degree of finish or size.

Twist bit or auger bit. It has a screw point and a helical or twisted stem. This bit produces a long, clean, and accurate hole either with or across the grain. This may be obtained in sizes from 6 to 35 mm diameter. The shorter type is called "dowel" bits and is used for preparing true and accurate holes to receive dowels.

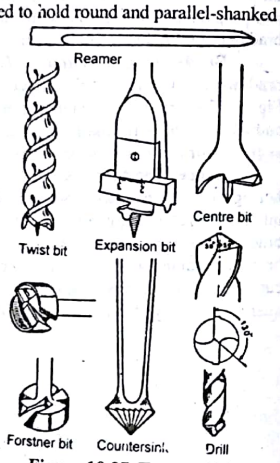


Figure 10.27 Types of bits

Expansive bit. In an expansive bit the main cutter can be adjusted to varying diameter within a certain range. It is fixed to the desired mark on the scale, and clamped in position by the plate and screw. Expansive bits are made in four sizes with interchangeable cutter for boring holes from 12 to a maximum of 125 mm diameter.

Centre bit. The centre bit is the most common. It is used for forming shallow holes across the grain. Centre bits produce an accurate and clean hole and may vary from 3 to 35 mm in diameter.

Forstner bit. It is extremely useful for sinking clean hole partly through a piece of wood and for cleaning out recesses. It has a small centre point for commencing and is then guided by its outer rim.

Countersink bit. It is used to shape a hole to fit the head of a countersunk headed screw.

In addition to the foregoing there are, of less importance, *nose bit, spoon bit, lip* and *spur bit, screw driver bit,* etc.

Drill. Morse drills are very convenient for making screwholes, especially when used with a wheel brace. This is adapted for drilling holes when wood working bits would be spoiled.

Reamers are tapered bits shaped like shell bits and used for enlarging holes.

10.13 STRIKING TOOLS

Striking tools include hammers and mallets.

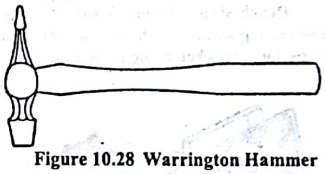


Figure 10.28 Warrington Hammer

Hammer. Engineers use ball-peened hammers, woodworkers cross-peened and claw hammers. The *Warrington hammer* shown in Fig. 10.29 is the type mostly used for bench work and all light Jobs. The head is cast steel, the face and peen being tempered ; the shaft which is wedged tightly into the head is made of wood or bamboo. These hammers are identified by size numbers and weight, No. 00, 200 gm up to No. 6,550 gm.

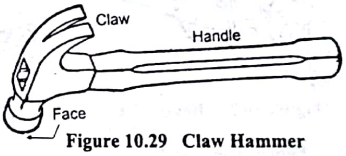


Figure 10.29 Claw Hammer

The carpenter more often favours the *claw hammer* (Fig. 10.28) because it serves the dual purpose of a hammer and a pair of pincers. The claw is used for pulling out any nails accidentally bent in driving. These hammers are made in numbers sizes from 1 to 4, weighing 375, 450, 550 and 675 gm.

Mallet. The mallet shown in Fig. 10.30 is a wooden-headed hammer of round or rectangular cross-section. The striking face is made flat to the work. A mallet is used to give light blows to the cutting tools having wooden handle such as chisels, and gouges.

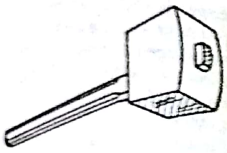


Figure 10.30 Mallet

10.14 HOLDING TOOLS

To enable the woodworker to cut his wood accurately, it must be held steady. There are a number of tools and devices to hold wood having its own purpose according to the kind of cutting to be done.

Bench vice. The bench vice illustrated in Fig. 10.31 is the most commonly used. Its one jaw is fixed to the side of the table while the other is kept movable by means of a screw and a handle. The whole vice is made of iron and steel, the jaws being lined with hardwood face which do not mark and which can be renewed as required.

Bench stop. The bench stop is simply a block of wood projecting above the top surface of the bench. This is used to prevent the wood from moving forward when being planed.

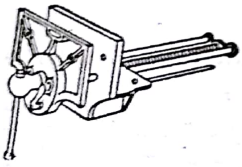


Figure 10.31 Bench vice

Figure 10.32 Bench holdfast

Bench holdfast. The bench holdfast shown in Fig. 10.32 is made with a cast iron pillar, square-cut screw threads on a steel bar, with a light vice handle and a drop-forged steel arm. By boring a series of holes through the top of the bench, holdfasts can secure the work in any desired position. This is useful for holding a piece of wood down on the bench when a vice is not advisable.

Sash cramp. The sash cramp or bar cramp in Fig. 10.33 is made up of a steel bar of rectangular section, with malleable iron fittings and a steel screw. This is used for holding wide work such as frames or tops.

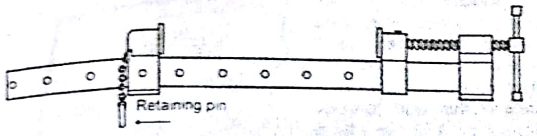


Figure 10.33 Sash cramp

G-cramp. The G-cramp in Fig. 10.34 is used for smaller work. It consists of a malleable iron frame that can be swivelled and a steel screw to which is fitted a thumbscrew.

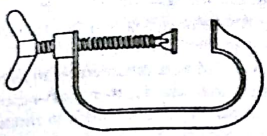


Figure 10.34 G-cramp

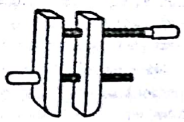
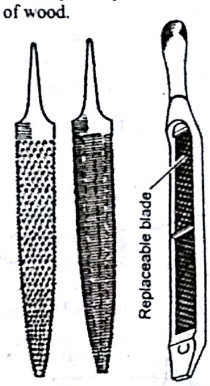


Figure 10.35 Hand screw

Hand screw. The hand screw in Fig. 10.35 is used where a wider area of pressure than that provided by a G-cramp is required. It consists of two steel screws fitted to two jaws made of wood.

10.15 MISCELLANEOUS TOOLS

Rasps and files. These are useful for cleaning up some curved surfaces. For instance, certain concave shapes are so small that the spokeshave cannot enter them and here a file is invaluable. Scratches left by the file can be removed with the scraper and glass paper. Surform tools introduced by Stanley Tools contain many small cutting teeth, each of which acts rather like a chisel or small plane. The teeth are not inclined to choke easily. The blades are disposable and when blunt must be replaced. Flat, convex and round blades are available. Illustrations are given in Fig. 10.36.



Rasp File Surform tool

Figure 10.36 Rasp, file and Surform tool