CHAPTER

10

WOOD WORKING HAND TOOLS, PROCESSES AND JOINERY

10.1 CLASSIFICATION

There is a fairly large number of hand tools used in wood-working. A broad classification of these tools, according to their use, is given below :

1. Marking and measuring tools. 2. Holding and supporting tools. 3. Cutting tools. 4. Planing or paring tools 5. Boring tools. 6. Striking tools. 7. Miscellaneous tools.

10.2 MARKING AND MEASURING TOOLS

The common operations performed by these tools include marking, measuring, setting out angles and parallel lines and testing. All tools do not perform every operation but all those tools which do one or more of these operations are grouped together in this category. The tools included in this group are described below :

1. Carpenter's Folding Rule. It is a wooden scale consisting of four pieces, each 6 inches or 15 cm long, joined together by means of hinged joints to make it *folding*. When opened out, its total length measures 2 feet or 60 cm and on being folded it measures equal to one piece length *i.e.*, 6 inch or 15 cm. The inches graduations are divided further into eighths and 16ths, whereas the centimeter divisions are subdivided into millimeters. A good form of this rule is shown in Fig. 10.1. It is mainly used for measuring and setting out dimensions.

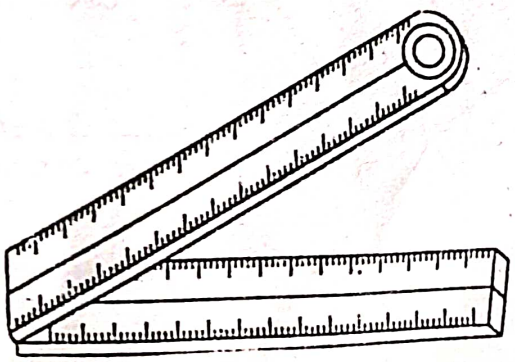

Fig. 10.1. Folding rule.

2. A Steel Rule. It is a stainless steel strip, carrying graduations on both edges, as shown in Fig. 10.2. The graduations can be in cms. and mms. on both edges or in inches and their parts on one edge and centimeters and millimeters on the other. They are available in different lengths from 15 cm to 100 cm, but 15 cm and 30 cm lengths are the most commonly used ones. They are used for direct measurement of lengths.

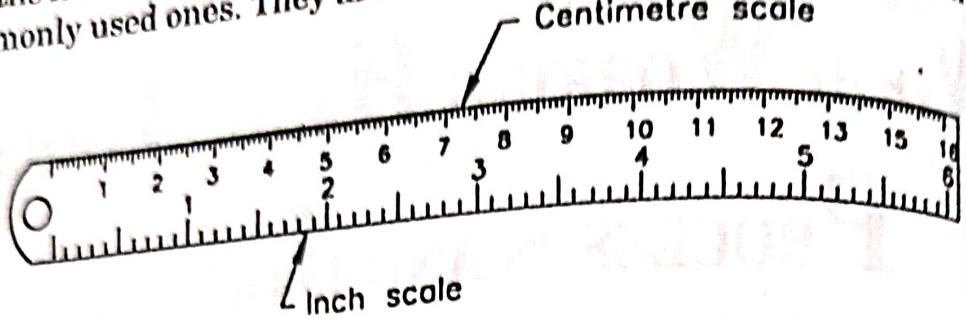

Fig. 10.2. A steel rule.

3. A Folding Tape (Inch Tape). It consists of a **Graduated** *flexible steel strip*, which is wound round a *reel* mounted on a *central pin*. This entire unit is enclosed in a thin *metallic* **Case.** The outer end of the tape carries a *stopper*, which prevents it from entering fully into the case, and also helps in holding this end for pulling it out of the case. One end of the **Central pin** extends outside, on which is mounted a **Crank Handle**, by means of which the pin can be rotated to unfold or fold the tape. (See Fig. 10.3)

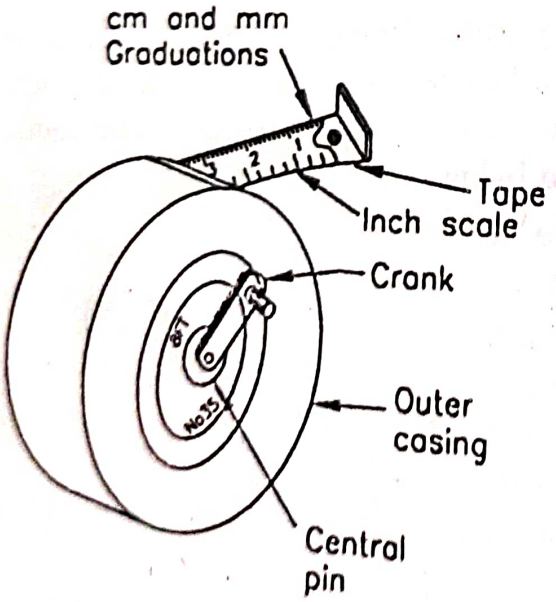

Fig. 10.3. A Folding Tape.

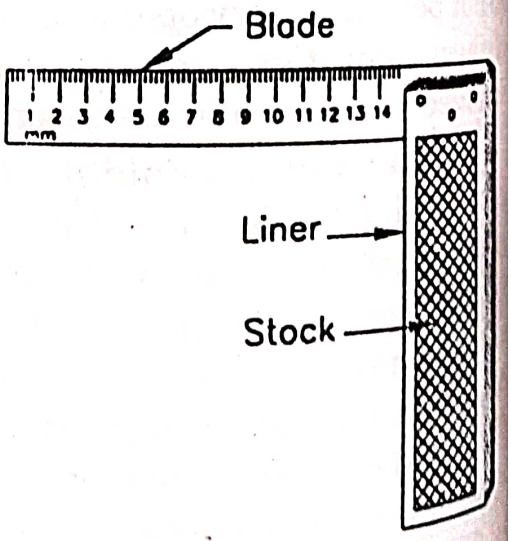

Fig. 10.4. A Try square.

4. Try Square. It is used for measuring and setting out dimensions, testing the finish of a planed surface, draw parallel lines at right angles to a plane surface, draw mutually perpendicular lines over a plane

surface, and test the squareness of two adjacent surfaces. It consists of a steel Blade fitted into a wooden or metallic **Stock** at right angles to it. The inner surface, *i.e.*, the surface which runs against the job during its use, is provided with a *Brass Liner*. The blade carries graduations either in inches and their parts or centimeters and millimeters (See Fig. 10.4).

5. **Straight Edge.** It is used for testing the trueness of surfaces and edges. It is made of either seasoned wood or steel, and its edge is made *bevelled*, as shown in Fig. 10.5. It should be ensured that this edge is perfectly true and straight as it is this edge which is used for testing the trueness of other surfaces.

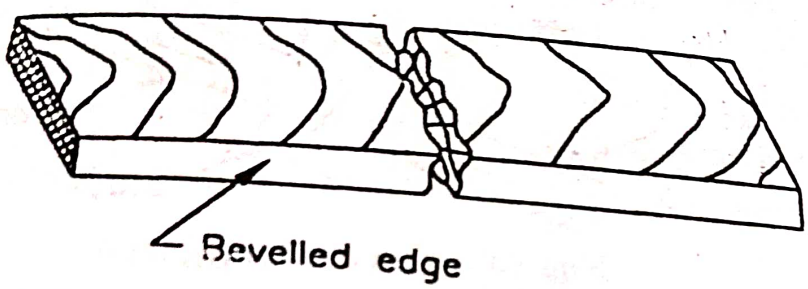

Fig. 10.5. A wooden Straight edge.

6. **Bevel Square.** It is used for setting, duplicating, testing and comparing angles and bevels. It consists of a wooden or metallic *Stock* fitted with a slotted *Blade*. The blade can be adjusted at any point along the slot and at any angle from 0° to 180° with respect to the stock. The *Screw* at the bottom is used to tighten the blade in position after it is set. A common type of Bevel Square is shown in Fig. 10.6.

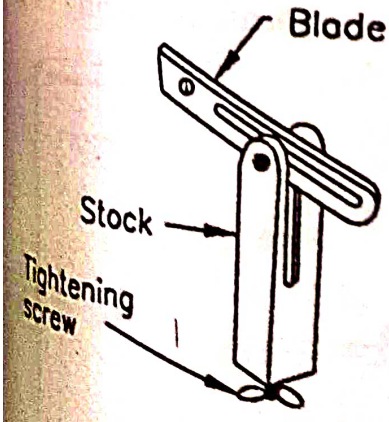

Fig. 10.6. Bevel square.

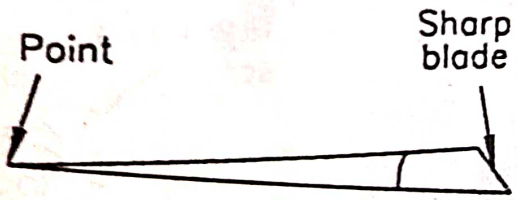

Fig. 10.7. Scriber.

7. **Scriber or Marking Knife.** It is a steel rod having a sharp Point at one end and a *Flat blade* at the other, as shown in Fig. 10.7. It is mainly used for locating and marking points and scribing lines on wood surface.

8. Marking Gauge. It is made of wood and is a very prominent tool for marking. The *Stem* is a long bar of wood of square or rectangular cross-section. The side faces are made a little *curved* as shown in Fig. 10.8. One of the curved side faces carries *graduations*. A sliding piece, called **Stock**, also made of wood, carries a *Brass Liner* at that face of it which is towards the *Scribing Pin* (*Marking Pin*) fitted in the stem. It is this face of the stock which remains in contact with the job surface during marking. The *Thumb Screw* helps in tightening the stock over the stem at any distance from the scribing pin. It is used to scribe lines parallel to and at any desired distance from a finished face or edge.

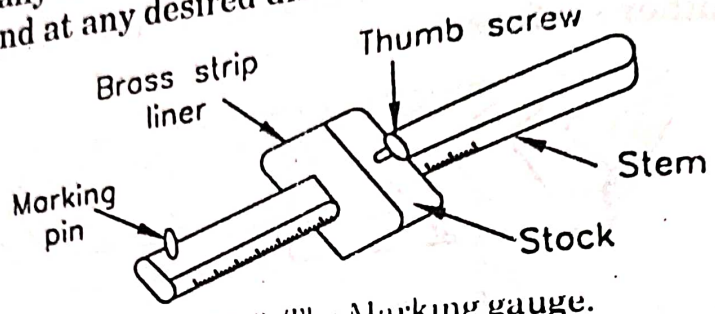

Fig. 10.8. The Marking gauge.

9. Mortise Gauge. It is an improved form of marking gauge. In addition to the provisions of a marking gauge, it carries a significant feature in that instead of only one scribing pin it has two, one of which is *fixed* as usual and the other is movable. The **Movable Pin** can be adjusted at any point between the *Stock* and the *Fixed Pin* by means of a *Thumb Screw* provided at the end of the stem (See Fig. 10.9). Thus, the two pins can be set at any desired distance apart. This enables scribing of two parallel lines, at a required distance from one another and at a desired distance from an edge or surface, in a single operation. Its specific use is in marking *Mortises* and *Tenons* and other similar joints requiring such parallel lines.

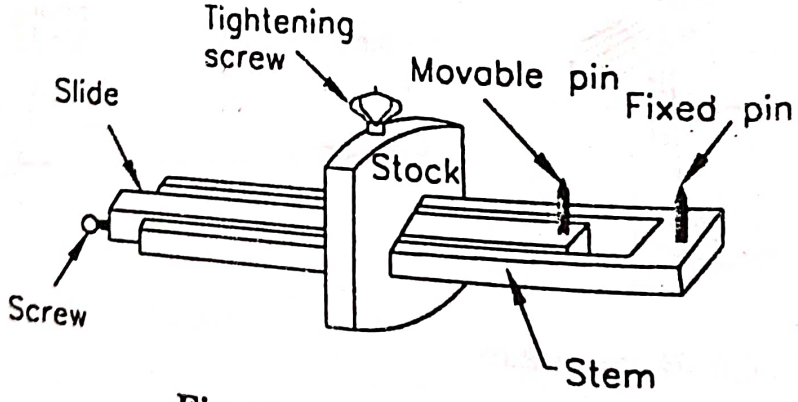

Fig. 10.9. A Mortise gauge.

10. Cutting Gauge. It is similar in construction to a marking gauge with the difference that it carries a **Steel Cutter** fitted in place of the *Marking pin* of the marking gauge. It is mainly used for cutting parallel strips out of thin sheets of wood, upto 3 mm thickness, and for marking deep lines across the grains of the wood in thicker sections.

10.3 HOLDING AND SUPPORTING TOOLS

This category includes those tools which are either used to hold or support, or both, the job while other operations are performed on it. The common tools used for these purposes include the following :

1. **Work Bench.** It is a heavy table of rigid construction, made of hard wood, about 150 to 180 cm in length and nearly 90 cm in width. Two or four **Carpenter's Vices** are fitted on opposite sides to hold the jobs during the operation. One jaw of the vice is secured to the table and the other is kept *movable*. Inside opposite faces of the jaws are fitted with wooden *liners* so as to prevent damaging of the job surfaces, when it is firmly clamped between the jaws. *Shelves* or *Racks* can be provided in the table, below the top, to utilize this space for storing tools, instruments or prepared jobs, etc. A good design of work-bench is shown in Fig. 10.10.

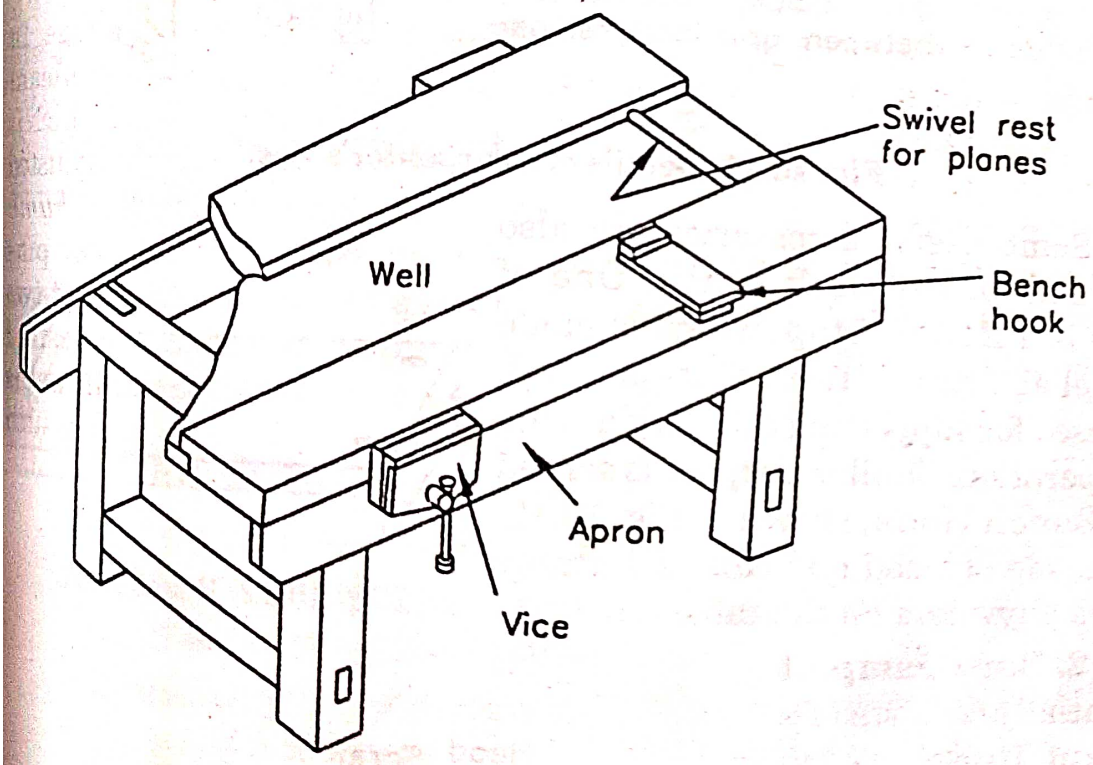

Fig. 10.10. Carpenter's work bench.

Details of a **Carpenter's Vice** are shown in Fig. 10.11. The *movable* ıw is mounted on a *screw* which carries a *handle* outside. The screw orks inside a fixed *half-nut*, which can be engaged or disengaged as eeded. When it is engaged, the jaw movement is affected by rotating ıe screw. A useful design of such a Vice is shown in Fig 10.11.

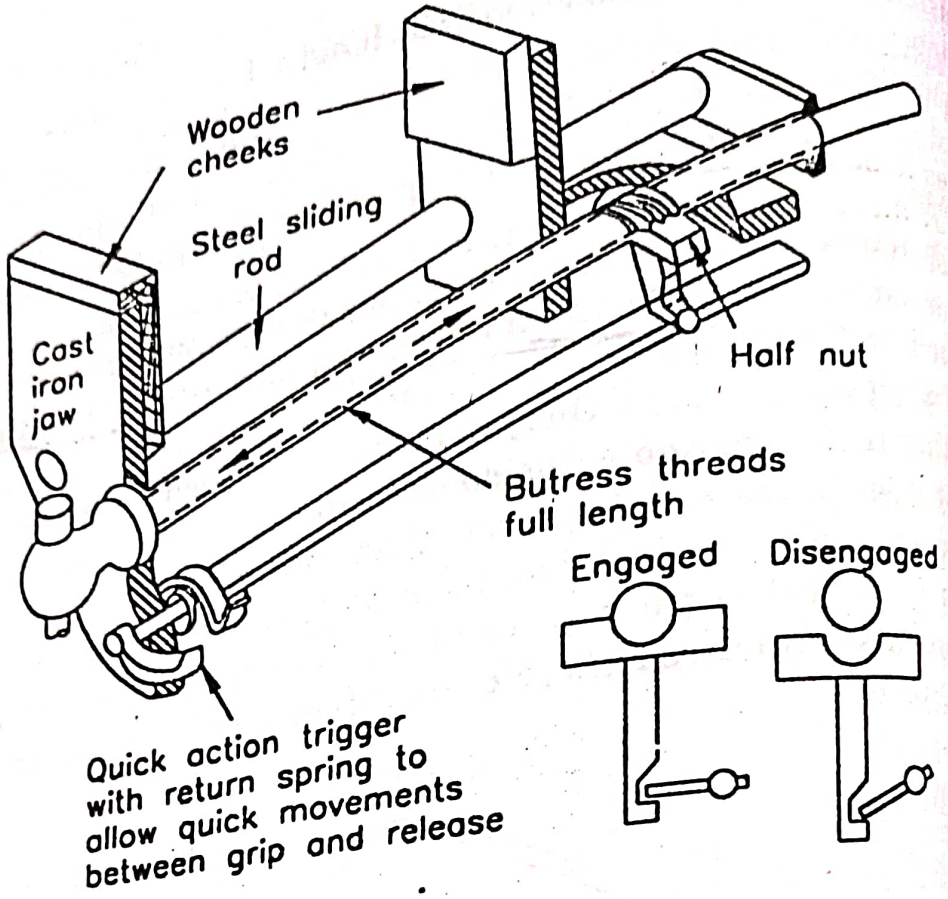

Fig. 10.11. Details of a carpenter's vice.

Some useful accessories are also provided on the work bench. One of these is a **Bench Stop**, which is made of steel and carries teeth at its one end. It is used for supporting the work during the operation. Similar purpose is served by a **Bench Hook**, shown in Fig. 10.12. It is made of wood and can be suitably placed anywhere on the table top.

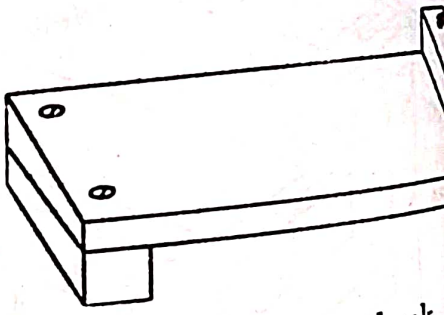

Fig. 10.12. Bench hook.

2. Bar Cramp. It essentially consists of a **T-iron Body**, which carries holes at regular intervals, as shown in Fig. 10.13. One end of the iron is forged to form a *Head* which carries a screw inside. On the outer end of the screw is provided a *Handle*, whereas the other end is

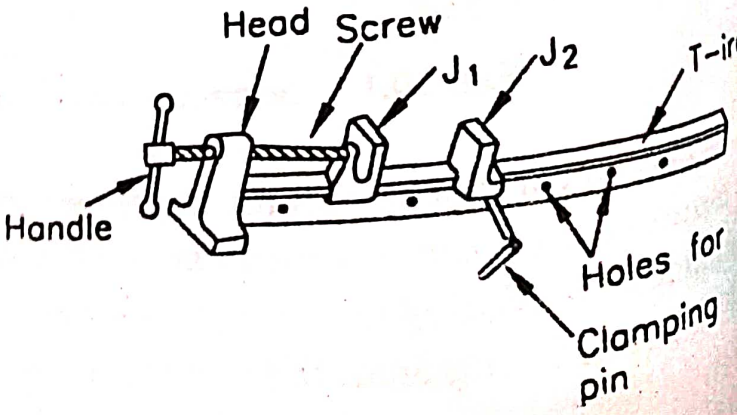

Fig. 10.13. Bar cramp.

attached to jaw J_1. Another jaw J_2 is mounted on the body and can be adjusted anywhere on a hole along its length. For securing it, its bottom is shaped into a fork, the two projections of which carry concentric holes. By passing a pin through the fork holes and the hole on the body, the jaw J_2 can be fixed anywhere along the length of the body. The two pieces to be held tight are inserted between the two jaws and then the jaw J_1 moved, by means of the screw, to apply pressure. The specific use of this tool is in holding the glued pieces tightly or holding firmly two or more unglued pieces for fitting dowels or doing other operations on them in assembled position.

3. Clamps and Screws. Various types of *Clamps and Screws* are used by carpenters for holding and supporting wood pieces in position for carrying out different operations. Two common types, a **'C' clamp** and a **Hand screw,** are shown in Figs. 10.14 and 10.15 respectively. Both of these are available in different commercial sizes.

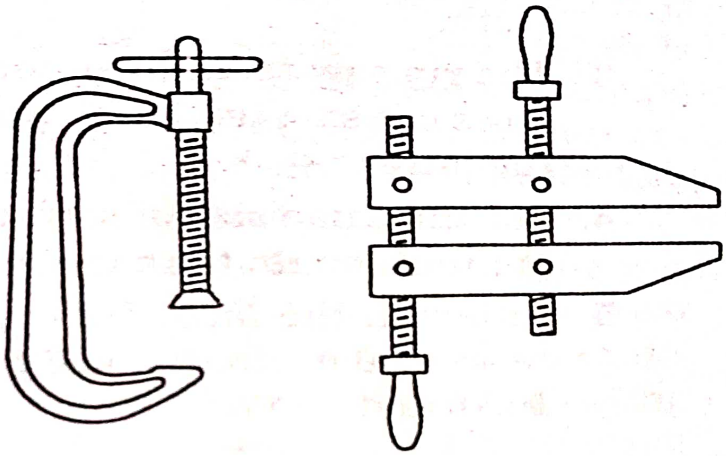

Fig. 10.14. C-clamp. **Fig. 10.15.** Hand screw.

Another type of clamp in common use is a **Column Clamp,** consisting of a *chain* and a *screw*, having right hand threads on one end and left-hand threads on the other. It is very useful when gluing together different wooden pieces to form *Polygonal shapes*.

10.4 CUTTING TOOLS

There are three types of *Cutting Tools* used in wood work :

1. Those which are given a reciprocating motion by hand and carry teeth for cutting the wood—**Saws.**
2. Those which are driven into the wood by the application of blows—**Chisels.**
3. Those which are given a swinging action by one hand or both hands and are struck against the wood for cutting the same—**Adze** and **Axe.**

Saws. All the saws used in wood work essentially consist of two main parts—the **Blade** which carries the cutting teeth and the other, a wooden **Handle** for holding the same during the operation to apply pressure. These saws cut the wood to the desired shape and size either by *pushing forward* or by *pulling backwards*. Those which cut while

being pulled are known as **Pull Saws** or **Draw Saws** and those which cut while being pushed as **Push Saws**. The *Push saws* are in more common use than the *Pull saws*.

Another useful classification of saws is according to their teeth and the direction of grains of the wood. Those which are used to cut along the grains are called **Rip saws** and those across the grains as **Cross-cut saws**. The main differences between these saws are the following:

1. The rip saw teeth have a greater pitch than that of cross-cut saw teeth.
2. The depth of rip saw teeth is more than that of cross-cut saw teeth.
3. The rip saw teeth have more set as compared to the setting of cross cut saw teeth *i.e.*, the former will make a wider cut than the latter.
4. For the same size of saw, a cross cut saw will have more teeth per unit length than the rip saw.
5. Although the *included angle* of the teeth is same in both the cases, the inclinations of the two sides differ, as shown in Figs. 10.16 and 10.17.

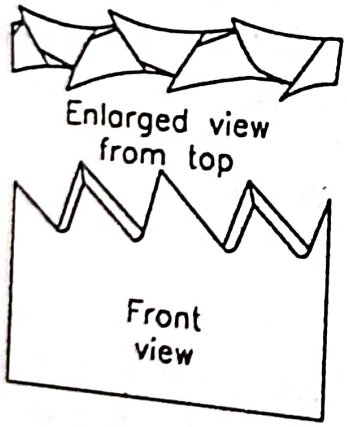

Fig. 10.16. Cross-cut saw teeth.

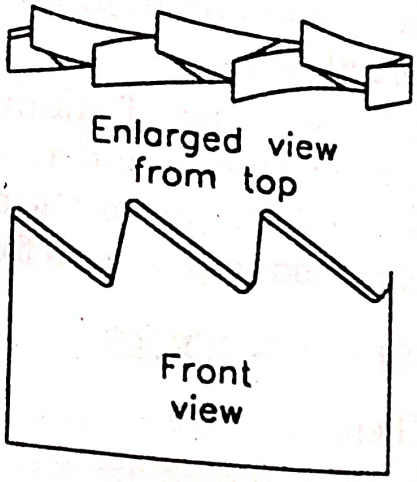

Fig. 10.17. Rip saw teeth.

The common types of saws used in wood work are the following:

1. Rip Saw. Its size is determined by its *length*, which is about 70 cm. The blade is about 12 to 20 cm wide near the handle and about 6 to 10 cm near the tip. It cuts the wood along the grains. The cutting action starts from near the tip and gradually the whole length, or a major part of it, is used in the operation. The pressure is applied in the forward stroke and relieved during the backward stroke. It is normally driven by one-hand though both hands can be used, if required. It carries about 2 teeth per cm length of the blade. A similar, but smaller, saw

having 4 teeth per cm length of blade is known as a **Hand saw**. It is used for the same purpose, but for smaller and medium work. A rip saw is shown in Fig. 10.18.

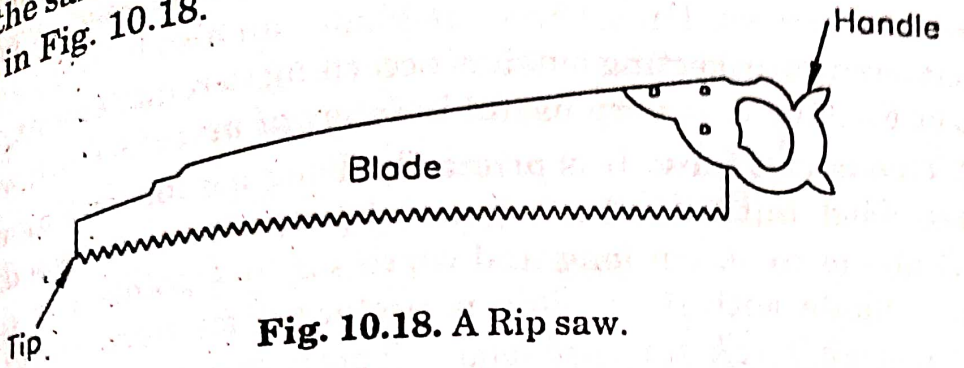

Fig. 10.18. A Rip saw.

2. **Panel Saw.** It is the most commonly used *Hand saw*. It is available in many styles and sizes but the commonly used length is 50 centimeters. It caries 5 to 8 teeth per cm length of the blade. Although a general purpose saw, it is mainly used for cutting *panels* for the door shutters. It may carry either rip or cross cut type teeth and the selection of a particular type will depend upon the requirement.

3. **Compass Saw.** It carries a tapered blade which is long but narrow, as shown in Fig. 10.19. The blade *length* usually varies from 25 to 40 cm and the *width* from 2.5 cm at tip to 5 cm near the handle. The blade is quite flexible and, thus, it can be used easily for taking straight or curved cuts on outside or inside of the wood. For internal cutting, a hole is first drilled and then the saw blade inserted in it to commence the cut. Its blade contains about 12 teeth per cm length.

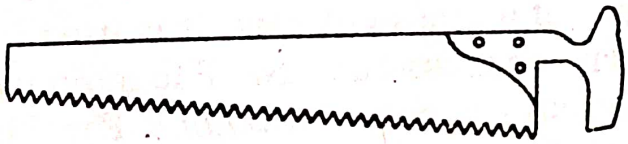

Fig. 10.19. A Compass saw.

4. **Key hole Saw.** It has a 20 cm to 30 cm long blade, which is about 6 mm wide near the handle and 3 mm wide at the tip. A wooden or metallic handle is fitted to this blade. The main feature of this fitting is that the blade is fastened to the handle by means of two screws.

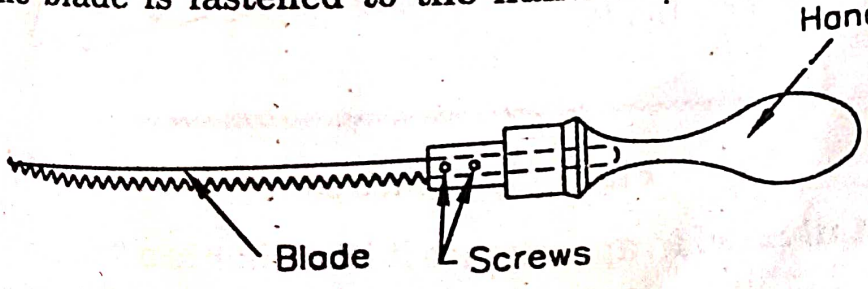

Fig. 10.20. Key hole saw.

Whenever needed, these screws can be unscrewed and a new blade replaced. Thus, the same handle can be used for different lengths of

blades. Moreover, the handle is made hollow from inside so that only the required length of blade projects outside and the remaining is accommodated inside the handle and the blade tightened in position by means of the screws. Thus, the same blade can also be adjusted having different lengths projecting outside, according to requirement. This saw, shown in Fig. 10.20, is very useful in *internal* and *intricate* work.

5. Cross-cut Saw. It is primarily designed for cutting across the grains of wood, but is used as a general purpose saw in wood work. Its blade is 50 cm to 70 cm long and carries 3 to 4 points per centimeter length. A blade with *finer pitch* is preferred for *hard wood* and that having *coarse pitch* for *soft wood*. Teeth are shaped as shown in Fig. 10.16. A common shape of cross-cut saw is shown in Fig. 10.21.

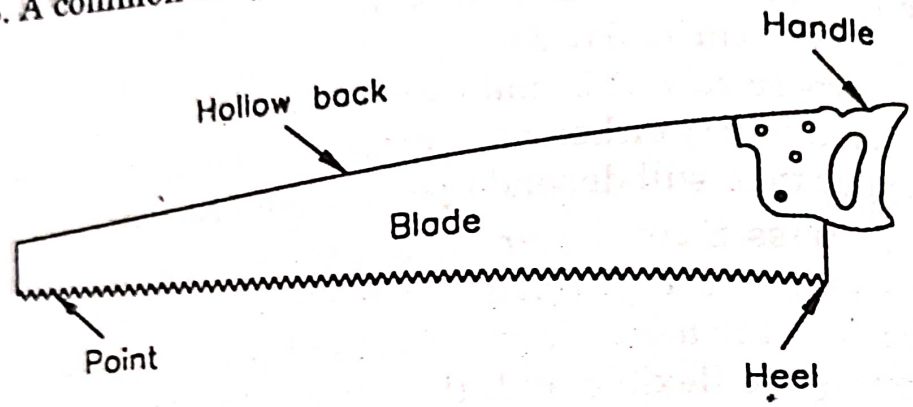

Fig. 10.21. A Cross-cut saw.

6. Tenon Saw or Back Saw. It has a parallel blade, 25 to 40 cm long and, 6 to 10 cm wide, having 5 to 8 points per cm length. Its teeth are designed as those of a cross-cut saw. It is used for finer work than the rip saw, panel saw or cross-cut saw. The main use of this saw is in taking short straight cuts, such as for *tenons*. For this reason, its blade is provided with a reinforcing **strip** or **back** at the top so that the blade does not bend during the operation and a straight cut is obtained (See Fig. 10.22).

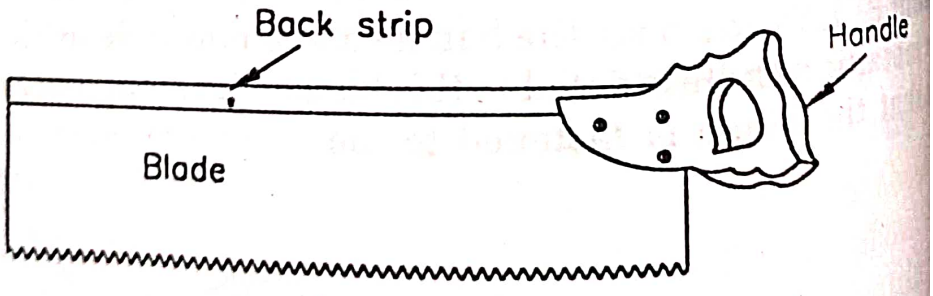

Fig. 10.22. Tenon saw.

7. Dovetail Saw. In appearance it is similar to a *tenon saw*, except that its blade is thinner and narrower than that of the latter and carries no reinforcement at its back. Moreover, its wooden handle is open type to allow a free motion. It is also used for finer work, particularly for cutting *tongues* for *dovetail joints*. The blade length varies from

to 30 centimeters and carries about 6 points per centimeter length. A useful form of this saw is shown in Fig. 10.23.

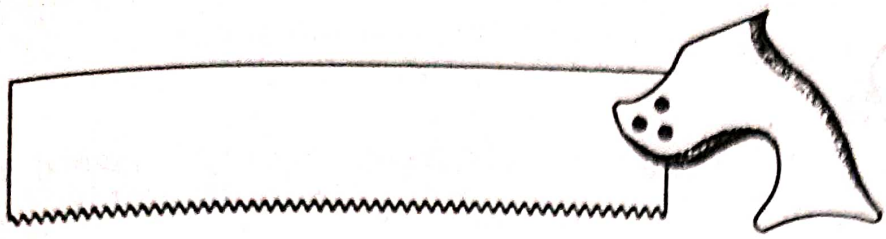

Fig. 10.23. Dovetail saw.

8. Mitre Saw and Mitre Box. It is nothing but a very large *Tenon* saw and is used in conjunction with a **Mitre Box** for making 45° cutting in wooden parts, as shown in Fig. 10.24.

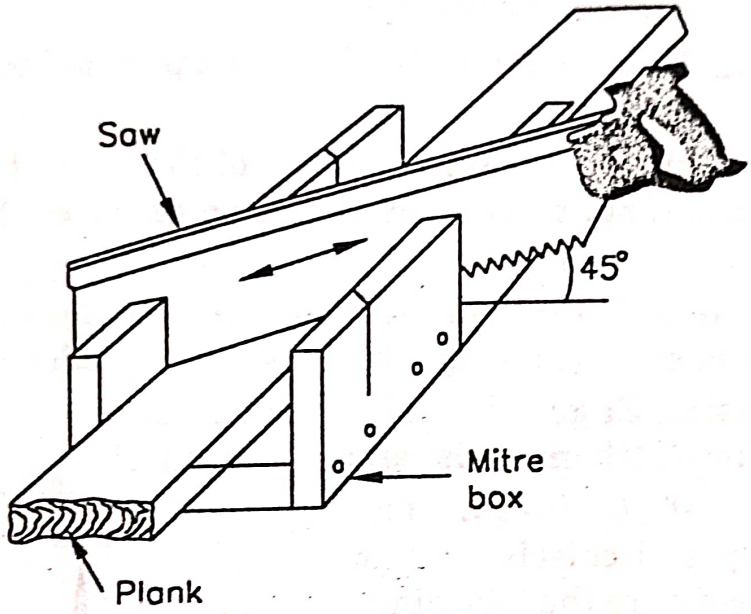

Fig. 10.24. A Mitre saw being used for cutting a plank at 45°.

9. Bow Saw. It consists of a *frame*, made of wood, carrying a connecting bar, a *string, lever* and two *handles* on either side, as shown Fig. 10.25. The blade, as shown, is fastened at the lower end of the

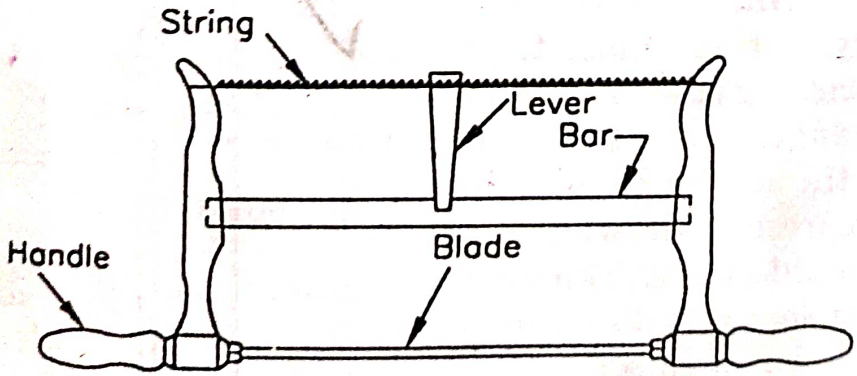

Fig. 10.25. A bow saw.

ame and the tension to the same is provided by twisting the string by eans of the lever, which is then made to rest against the bar to prevent

unwinding of the string. Its blade is thin and narrow and carries a flexible body. This saw is used for the same purpose as a compass saw, but for finer curves and profiles having quick changes.

CHISELS

A fairly large number of **Chisels** are used in wood work for cutting the same in different manners to produce desired shapes and cavities. However, irrespective of their sizes and uses, they essentially consist of the following main parts, as shown in Fig. 10.26.

(*a*) **A Wooden Handle.** Made of hard wood, like shisham.

(*b*) **Ferrule.** An iron or brass *ring* fitted at the bottom of the handle to prevent it from splitting during the operation, as it is constantly subjected to hammering from the top.

(*c*) **Tang.** Made in the shape of a square pyramid to enter the handle to secure the chisel with it.

(*d*) **Bolster.** The enlarged portion of the neck of the chisel blade just below the tang, to prevent excessive entry of the tang into the wooden handle.

(*e*) **Blade or Body.** The main voluminous part of the chisel, made of high carbon steel, carrying a bevelled cutting edge at its bottom.

(*f*) **Cutting Edge.** The main working part of the chisel which cuts the wood. Its **width** gives the **size** of the chisel.

Type of Chisels. The common types of chisels used in carpentry work are the following :

1. Firmer Chisel. It is a general purpose chisel and is used for taking wider cuts and finishing flat surfaces inside the grooves. It carries a wide **Blade**, the common widths varying from 3 mm to 38 mm at the cutting edge. The *blade* has a rectangular cross-section, such that the longer side of the rectangle represents the width and the smaller side the thickness of the blade at that point. Fig. 10.26 illustrates a firmer chisel.

2. Dovetail Chisel (Fig. 10.27). It has a long carbon steel **Blade** with a *bevelled back*, as shown. The bevelled shape enables

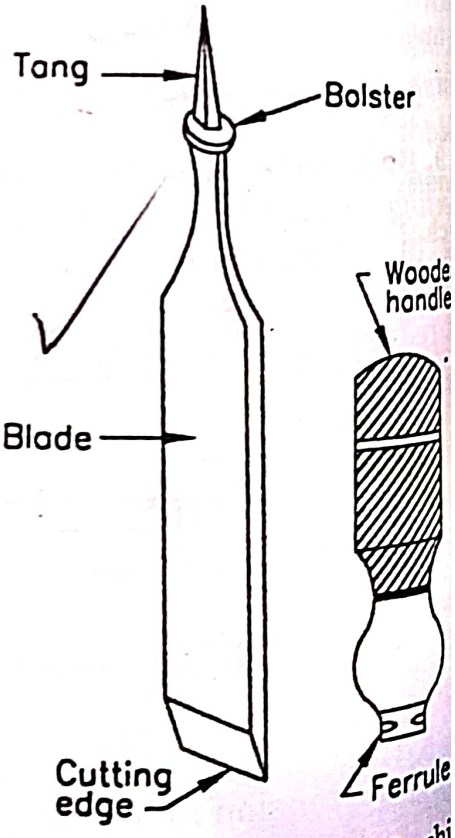

Fig. 10.26. Main parts of a chi

reduction of blade thickness on the sides, due to which it can enter sharp corners to finish them. Such a requirement usually occurs in case of *Dovetail Joints* and other sharp *'V'-grooves*.

Fig. 10.27. A Dovetail chisel.

3. **Mortise Chisel.** It is used for taking heavy and deep cuts resulting in more stock removal, as in case of making *mortises*.

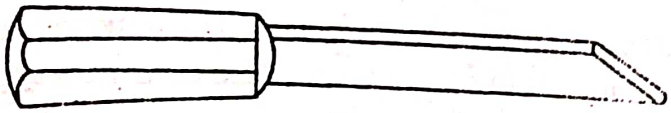

Fig. 10.28. A Mortise chisel.

It is available in various assorted sizes, the maximum width of blade in commonly used chisels being upto 15 mm. The blade thickness varies from 6 mm to 15 mm. Because of more thickness, its blade is stronger than other chisels of same size and is therefore, capable of being subjected to heavy blows. A typical form of *Mortise Chisel* is shown in Fig. 10.28.

4. **Socket Chisel.** When a very heavy stock removal is to be done by the chisel it is bound to result in splitting of the wooden handle due to heavy blows on its top. To prevent this, such chisels are provided with a *Socket type* construction at their top in place of the *tang*. The *wooden handle* is fitted into this socket instead of the tang entering the handle, thus preventing the above splitting. Such chisels are called **Socket Chisels**. Their **blades** may be of a *firmer* or *mortise chisel* type. *Dovetail chisels* are usually not made in socket-type as they are normally not required to do such a heavy work. A typical **Socket Chisel** is illustrated in Fig. 10.29.

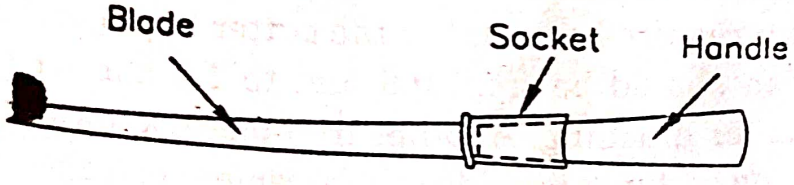

Fig. 10.29. A socket chisel.

5. **Gouge Chisel.** It caries a *hollow* curved *Blade* with a wooden Handle and is used for finishing curved surfaces. In shape, it resembles a gouge used in *Bench Work*. It is shown in Fig. 10.30.

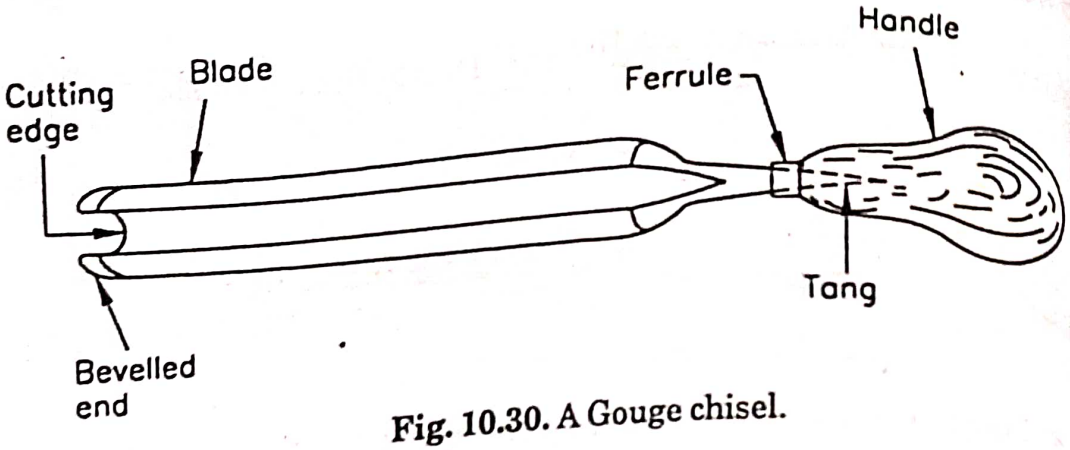

Fig. 10.30. A Gouge chisel.

10.5 PLANING OR PARING TOOLS

This category of wood-working tools includes various types of *planes*, *spoke shaves* and *draw knives*, etc. The common types of **Planes** used i carpentry work are the following :

1. Wooden Jack Plane. It is the most commonly used plane in carpentry. Its main parts, as shown in Fig. 10.31, include a wooden *Body* or *stock* and, a wooden *Handle* for holding the plane during the operation. The bottom face of the stock, called *Sole*, is made perfectly smooth and level. The main cuttin part, known as *Blade* or *Iron Cutter*, is fitted in the *Stock* such that remains inclined at an angle of 45° with the *Sole*. For this purpose th stock is provided with a through slot, having its back surface tapered 45° with the sole, so that the blade after being fitted rests against thi surface and thus gets the desired inclination automatically. The blad or **cutter** is made of high carbon steel. A tapered wooden **wedge** is als inserted in the slot to hold the iron cutter at a desired position in orde to allow only a required amount of the cutter to project below the sol This projection should be from 0.8 mm to 1.6 mm for roughing an below 0.8 mm for finishing. Another iron piece, known as **cap iron**, fitted to the iron cutter to provide reinforcement to it against the cuttin forces and prevent its edge from bending under the action of these force These two are secured to one another by means of a set screw, whic passes through a longitudinal slot made in the body of *iron cutter* an

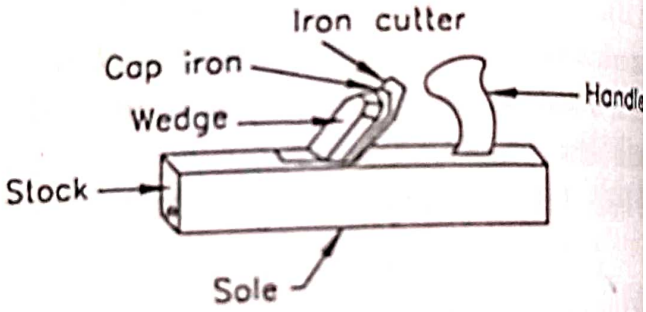

Fig. 10.31. Wooden Jack plane.

engages into a *nut* formed in the cap iron. Due to the above slot the cap iron can be adjusted at different positions along the length of the blade, as required. The commonly used sizes are 30 to 46 cm length and 6 to 7 cm square cross-section of stock.

2. **Iron Jack Plane.** It is also used for the same purpose as a wooden Jack plane, but it gives a better finish than the latter.

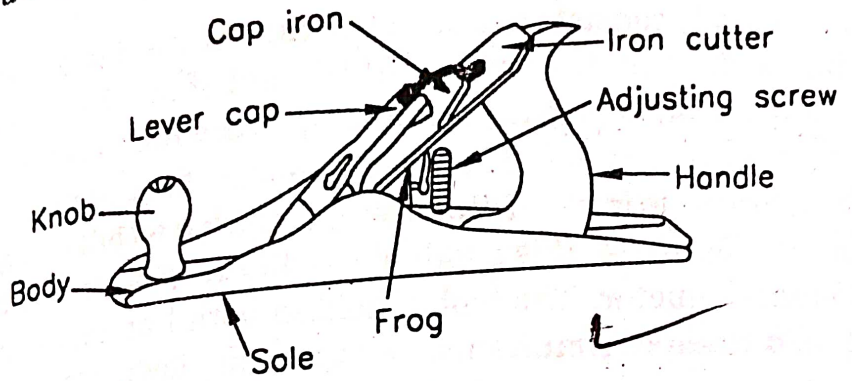

Fig. 10.32. Iron Jack plane.

Its whole body is made of *cast iron*, provided with a wooden **handle** at the back and a wooden **knob** at the front for holding it by both hands. Both these wooden parts are fastened to the **body** of the plane by means of long screws passing through them. All the main parts of this plane are shown in Fig. 10.32. The other parts include the **iron cutter**, the cap iron for reinforcement, the **lever cap**, the **frog** and the **adjusting screw**. This plane, obviously, carries a more rigid body than the wooden plane and has longer life than the latter, but is equally costly also. It is also available in different sizes.

3. **Trying Plane.** It is nothing but a longer *Wooden Jack Plane*. The length of its stock varies from 50 to 76 cm and the cross-section is equal to that of jack plane body. It is applied after the surface has been planed by a jack plane in order to make it a true and flat surface. The *iron cutter* used in this plane is about 6 cm in width.

4. **Smoothing Plane.** It is nothing but a smaller wooden jack plane without handle. In operation, its stock itself is held in both hands. Its length varies from 20 to 25 cm. It is used for providing better finish and smoothness to the surfaces already planed by a jack plane. Its specific use is in those places where lack of space will prohibit the use of a jack plane. A *Smoothing Plane* is shown in Fig. 10.33.

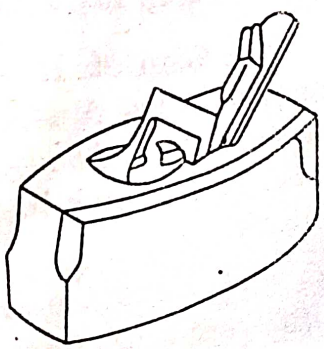

Fig. 10.33. Smoothing plane.

5. Special Planes. A large number of other types of plane used in wood working which are described in detail later on in Ch 12 on *Pattern Making*. Similarly, **Spoke shave** and **Draw knife** also described later in chapter 12.

10.6 BORING TOOLS

These tools are used to produce holes in wood and some comm used tools for this purpose are the following :

1. Auger. It consists of a *steel bar* carrying a *fluted body* for a half of its length from the bottom. At the end of the flutes, that is a bottom of the tool, is provided a *Screw point* which acts as a pilot helps in centering the tool. The upper portion of the bar is left plain its top end forged to form an *eye* through which a wooden handle pas as shown in Fig. 10.34. It is available in different sizes to produce h upto 25 mm diameter. The tool is held in both hands, by gripping handle, and rotated, simultaneously pressing downwards.

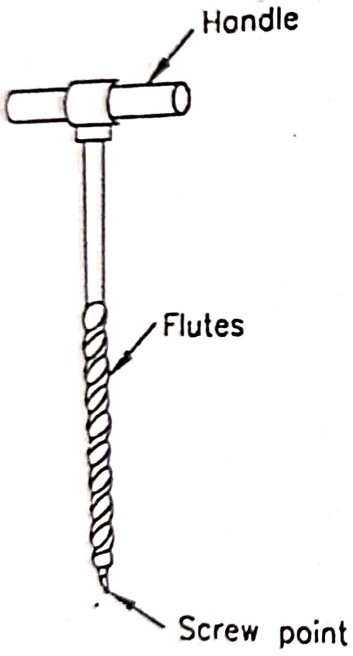

Fig. 10.34. An Auger.

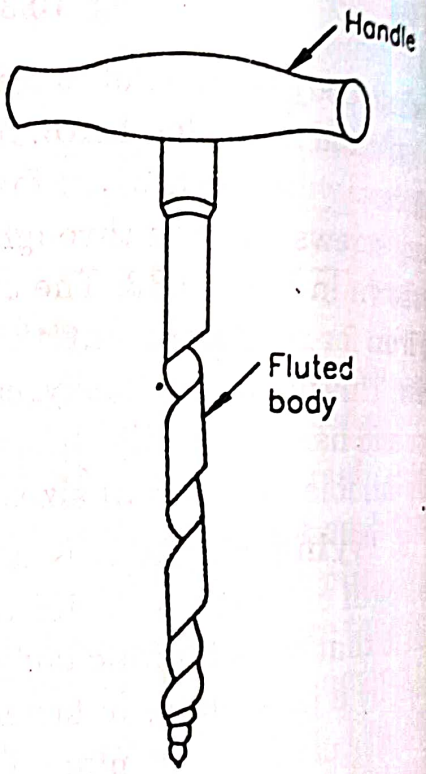

Fig. 10.35. A Gimlet.

2. Gimlet. It is a smaller form of auger for producing relati smaller holes. A useful form of this tool, shown in Fig. 10.35 consis a *Spiral Fluted body*, to the top of which is fitted a wooden *Handle*. also held in both hands in operation and used in the same way as auger.

3. Braces and Bits. A **Brace** is an appliance used for hold different types and sizes of bits or producing holes in wood. The m useful of all the braces is a **Ratchet Brace** shown in Fig. 10.36

essentially consists of a *Crank*, made of steel, provided with a wooden hemispherical *Head* at the top, a wooden *Handle* in its middle and a *Chuck* at the bottom end. A *Ratchet Arrangement* is provided a little above the chuck. It facilitates rotation of the bit in only one direction, and when the crank is rotated in a reverse direction the bit does not rotate. This helps in using the brace in such places where the lack of space prevents the crank from taking a complete turn. In operation, the proper size and type of bit is fitted in the chuck and the same placed over the spot where the hole is to be made. The head of the brace is pressed downwards by one hand and the crank rotated by the other hand by holding the handle and pushing. The common type of **Bits** used in conjunction with a **Brace** are the following :

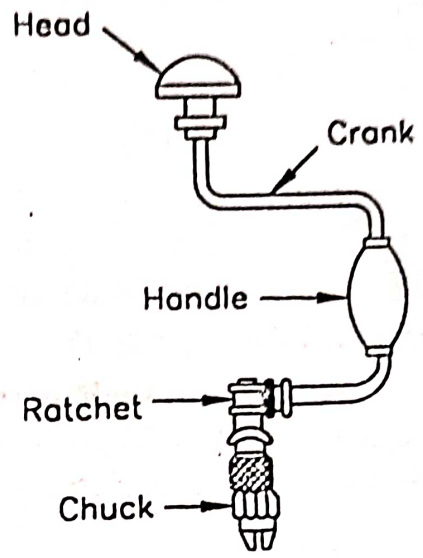

Fig. 10.36. A Ratchet brace.

(*i*) **Centre Bit. [Fig. 10.37].** It is used for drilling large holes across the fibres of the wood. It is available in different sizes to drill holes of 3 mm to 38 mm diameter. At its bottom it carries a *Screw Point,* a *Cutting Edge* and a *Spur.* The cutting edge does the primary cutting operation whereas the spur helps in cleaning the holes. Very deep holes cannot be drilled with a centre bit.

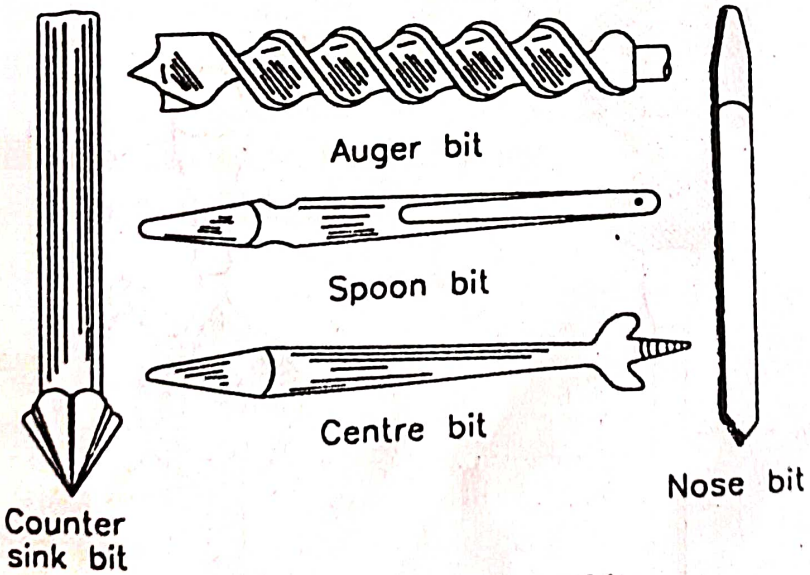

Fig. 10.37. Different types of bits.

(*ii*) **Auger Bit. [Fig. 10.37].** It has a *Fluted Body* having two cutting *lips* and a *Screw point* at its bottom. One of the cutting lips does the cutting work and the other, called *spur*, cleans the hole and thus

prevents the fluted body from clogging to the wood. Since removal pieces of wood or its shavings is easier, due to the whole body fluted, this bit is used for drilling deep holes.

(*iii*) **Counter sink Bit. [Fig. 10.37].** It is also known as Ro and is used for *counter sinking* previously drilled holes to accomm *countersunk heads* of wood screws. It consists of a long steel ba bottom of which is conical, and the outer surface of this conical str is provided with the cutting edges.

(*iv*) **Nose Bit.** It is in the form of a flat steel piece, provide the *Cutting Edges* on the tapered sides at the bottom. It is us drilling deep holes along the grains of the wood, but very wide cannot be drilled by it.

(*v*) **Spoon or Router Bit. [Fig. 10.37].** It is a very fine type used for drilling very small holes, such as for fitting *pins* and *d* Its body is made of a thin steel bar, shaped to have concave groov a gouge.

4. **Bradawl.** It is a small replica of a *Screw Driver*. It car solid *body (Stem)* made from steel and properly hardened. One e the *Stem* is flattened and ground to get a sharp *cutting edge* an other end is fitted with a **Handle**, as shown in Fig. 10.38. It is us make small holes in wood, usually by *pressing* and *rotating* by ha required, a *mallet* may also be used to apply pressure.

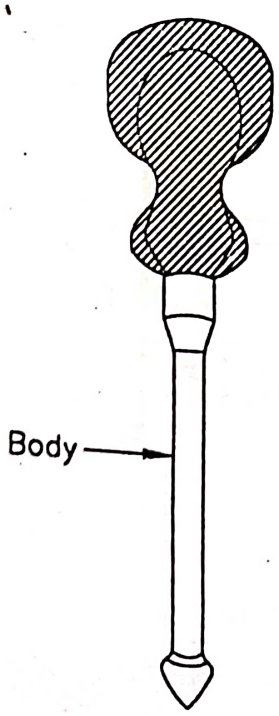

Fig. 10.38. Bradawl.

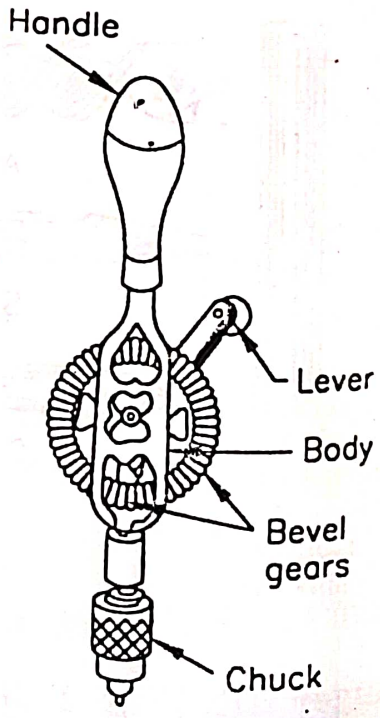

Fig. 10.39. A Hand drill.

5. Hand Drill. It serves the same purpose as a brace, but on a smaller scale. It is used for drilling small holes only. It consists of a forged *Body*, on the top of which is provided a wooden **handle** and at the bottom a **chuck**. Two *bevel gears* are provided in it, as shown in Fig. 10.39. The larger wheel is fitted with a **crank** on the same shaft. The *bit* is held in the chuck and pressed against the wood by one hand, which also holds and balances the drill simultaneously. By means of the other hand, the *crank* is rotated, which rotates the *larger wheel* along with it. This, in turn, rotates the *smaller gear* and, therefore, the **spindle** since the same is directly mounted on the spindle, which carries the *chuck* at its bottom.

10.7 STRIKING TOOLS

Various wood working tools and other items like *chisels* and *nails* need striking from the top to drive them into the wood. Also, during assembly of different parts striking is quite frequently needed. The tools used for this purpose are light **Hand Hammers**, **Mallet** and **Claw Hammer**. The hammers used in carpentry are similar to those used in smithy work, but are lighter and smaller.

1. A Mallet. It is made of hard wood and is rectangular or round in shape, provided with a wooden handle. It is used for striking the *cutting tools*, which have a wooden handle. A typical form is shown in Fig. 10.40.

2. Claw Hammer. [Fig. 10.41] It is made of cast steel and carries the *Striking Face* at one end and the *Claw* at the other. The face is used to drive the nails into the wood and other striking purposes and claw for extracting nails out of the wood. Its size is designated by its weight and it varies from 0.25 kg to 0.75 kg.

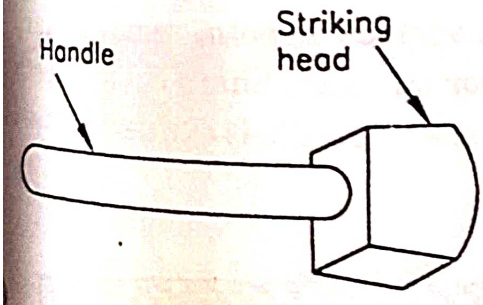

Fig. 10.40. A Mallet.

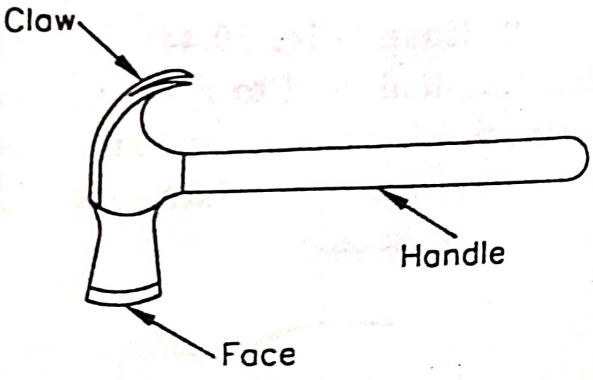

Fig. 10.41. A claw hammer.

10.8 MISCELLANEOUS TOOLS

There are many other tools used in wood work, which do not fa any of the above categories. A few commonly used of these are following :

1. Screw Driver. It is used for driving the wood screws into wood or unscrewing them. Since *Screws* are quite frequently used fastening wooden parts and other fittings, this tool is equally requi It consists of a wooden or plastic *Handle* and a *Steel Blade*, shape the end as shown in Fig. 10.42. The flat end of the tool is inserted the slot provided on the head of the screw for rotating it. *Screw Dri* are made in various sizes to suit the corresponding sizes of the slot the screw heads.

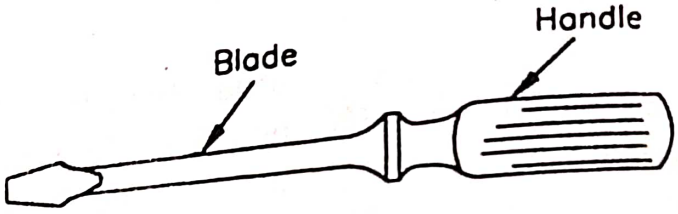

Fig. 10.42. A screw driver.

2. Pincer [Fig. 10.43]. It is made of steel, having a hinged j The two *Jaws* are bevelled inside and their outer surfaces are pl Thus, the contact surfaces of the two jaws have a *Sharp Edge*. Its n use is in pulling out small nails from wood.

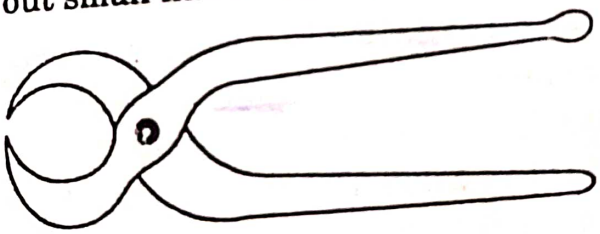

Fig. 10.43. A pincer.

3. Rasp [Fig. 10.44]. It is also known as a **Rasp File**. It finishing tool used to make the wood surface smooth, remove s edges, finishing fillets and other interior surfaces. Sharp cutting t are provided on its surface for this purpose. This file is exclusively in wood-work only.

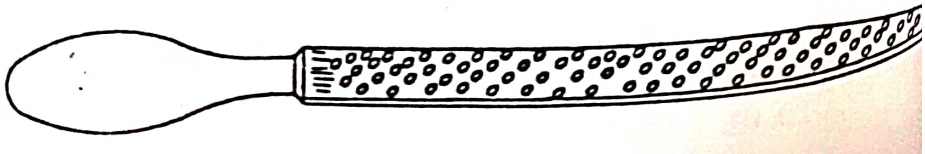

Fig. 10.44. A rasp file.

4. Axes and Adze

(*a*) **An Axe.** It is mainly used to split wood along the grains, cutting standing trees, cutting away branches from the main trunk of the tree, etc. Made of **High Carbon Steel**, its *Blade* is tapered from both sides to form the *Cutting Edge* as shown in Fig. 10.45.

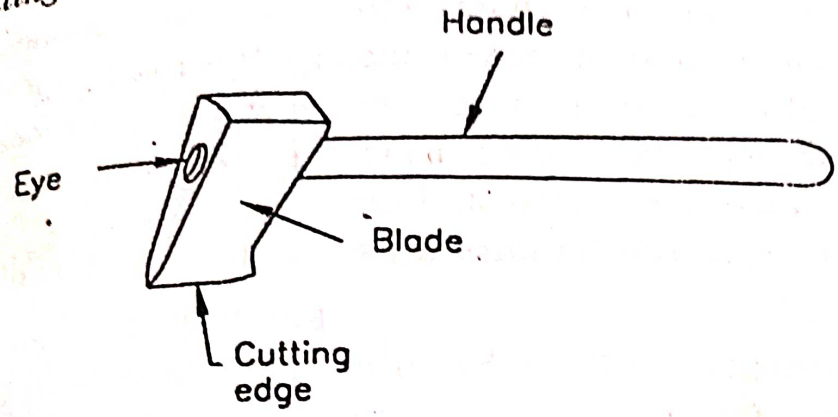

Fig. 10.45. An Axe.

(*b*) **Side Axe.** It is mainly used for heavy removal of material and, thus, make a wooden surface roughly plane. One of the surface faces of its *blade* is plain and the other tapered to form the *Cutting Edge*, as shown in Fig. 10.46. A *Wooden Handle* is fitted in the *Head* of the *Blade*.

(*c*) **Adze.** It is used to cut away excess material from a wooden stock to roughly produce a desired shape. It is held in one hand and then struck on the stock surface. The stock may be held in the other hand. Its use requires special skill and practice and that is why every workman cannot handle it. It is also made of *High Carbon Steel* and shaped through forging, as shown in Fig. 10.47.

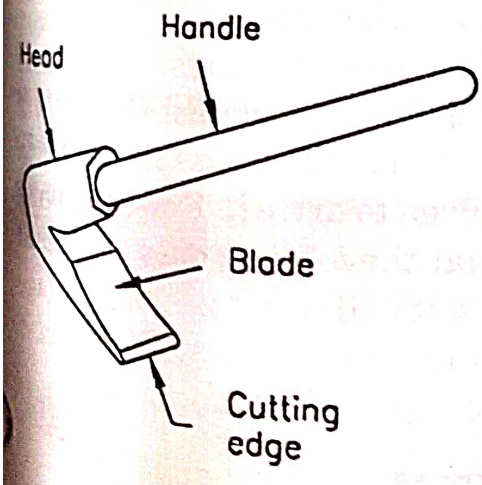

Fig. 10.46. A side Axe.

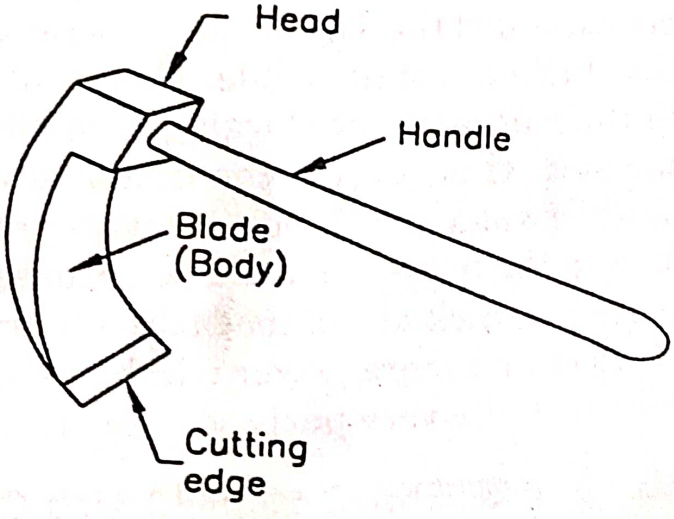

Fig. 10.47. An Adze.

10.9 SHARPENING A SAW

After constant use for a long time the saw teeth become blunt a need resharpening and resetting. Sharpening of the said teeth is do in stages as follows :

1. The saw is held with its teeth upwards in a saw sharpening vice and by means of a *flat file* its teeth are levelled such that their tops come in the same plane as shown in Fig. 10.48. This operation is known as **Topping.**

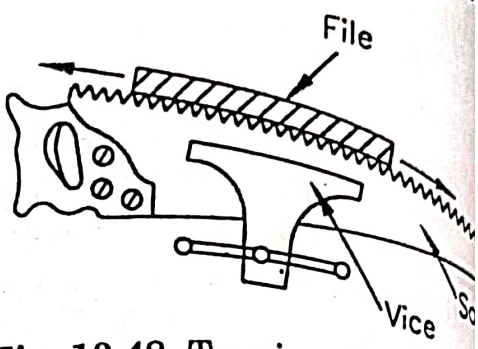

Fig. 10.48. Topping the saw teet

2. The next operation is **Shaping**. The topped teeth are shaped means of a *triangular file* to give them required *depth* and *angle* a make the teeth sharp at *tips*. The file is held at right angles to the pla of the saw blade and moved in a straight line, forward and backwar

3. The next operation is **Setting of Teeth,** described in article 10.

4. After setting, the sides of the teeth are **dressed** to remove a *burrs* etc. by means of an *oil stone.*

5. Finally, the triangular file is again used to finish the teeth the saw to have required *included angles,* shown in Figs. 10.14 a 10.15.

10.10 SETTING OF SAW TEETH

The operation of *bending* the *alternate teeth* of a saw in oppos directions is known as **Setting of Teeth** and the teeth so bent are kno to have been Set. A special tool known as **Saw Set** is used for t purpose. As a result of this setting, the width of the blade at the cutt edges, called the **Total Set,** is increased which enables a wider cut th the thickness of the blade. This results in a free movement of the bl in the slot, without clogging of teeth and rubbing against the walls the slot. This reduces the frictional resistance between the saw bl and the wood and, hence, the power required to drive it. However, wh setting the teeth, it should be ensured that the *total set* does not exc twice the thickness of the blade, otherwise it will result in more wast of wood and more power will be needed to drive the saw. If *less* se provided, the very purpose of setting the teeth will be forfeited.

10.11. SHARPENING CHISELS AND CUTTERS

All the **chisels** and **iron cutters** of planes are provided wit bevelled surface at their back and a *cutting edge* at their end. Both, t surface as well as the cutting

10.13 MARKING AND LAYING OUT

It involves all the *marking* and *measuring* operations carried out collectively to set out the given dimensions of the product on the wood. The markings so made guide the operator in further operations, avoiding the need of frequent measuring during the said operation. A working drawing or an existing model of the product is used for giving the dimensions which are to be laid. The tools used for this purpose have already been described. It needs no emphasis, but is quite obvious, that in order to transfer the dimensions from the model to the wood, a wood worker should possess a good practice of reading and interpreting drawings. Enough care should be taken to ensure that the marking is done accurately, since inaccurate or wrong marking will always result in an inaccurate and ill-dimensioned product. Marking is required to be done at several stages. It is done in the beginning to cut wood pieces approximately conforming to the overall dimensions of the component. Two sides of it are then planed and other dimensions and interior details marked with respect to these finished surfaces (See Fig. 10.51).

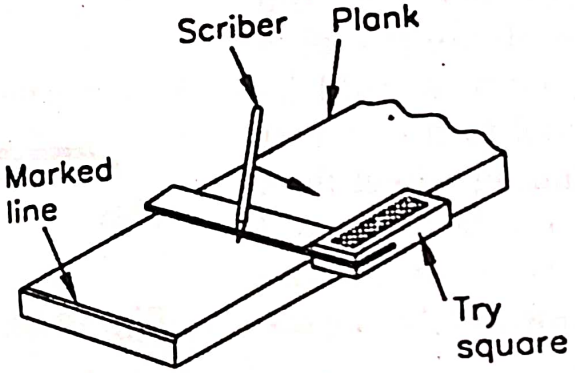

Fig. 10.51. Measuring and Marking Process.

10.14 SAWING

Sawing is done to cut the wood into pieces of required sizes and shapes. In **joinery** it is done to remove excess material and in many other cases sawing is required to cut the wood at an angle or in curved shapes. The *shape* and *size* of the job to be made are always the guiding factors. On the selection of a proper saw for a particular sawing operation depends the efficiency of the operation. These details have already been explained in connection with the different saws described earlier. Initially, the cut should be started from near the tip of the saw and gradually the whole length of the saw should be brought into operation.

The **rip saw** should be held *inclined* and **cross-cut saw** *parallel* to the surface on which the cut is being made. The job being sawn should be gripped properly in a vice or some other suitable device. This operation is shown in Fig. 10.52.

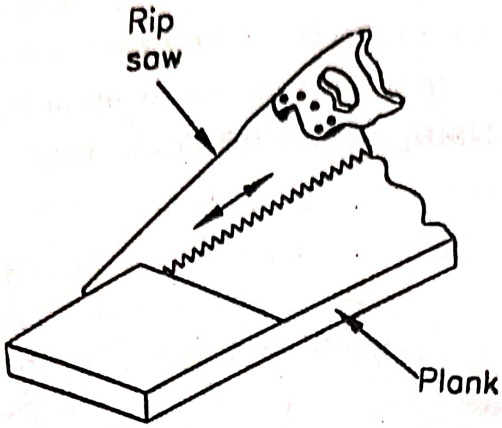

Fig. 10.52. The Sawing operation.

10.15 PLANING (Fig. 10.53)

Through this operation the wood surface is made perfectly smooth and plane with the application of a suitable **Plane**. Usually, a **Jack** plane is the first to be applied, followed by a **Trying plane** or **Smoothing plane** to finish the surface. Other planes can be made to follow to produce different shapes on the planed surface or edge. Before starting planing, the direction of the wood grains should be checked and planing done only along the grains.

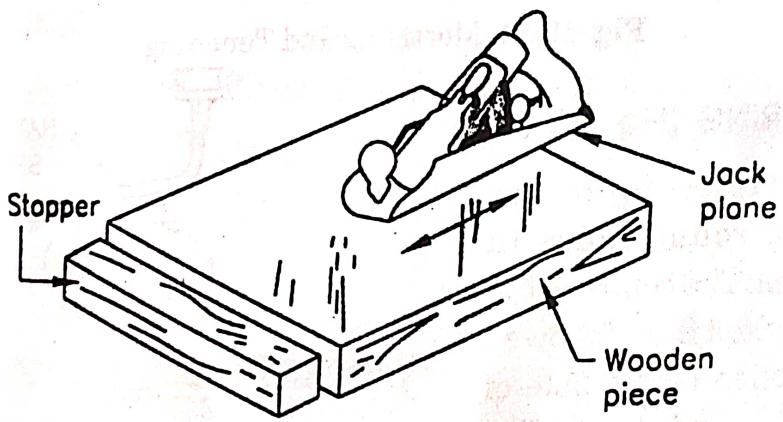

Fig. 10.53. The planing operation.

10.16 MORTISING AND TENONING (Fig. 10.54)

Mortise is a cavity or slot made in a wood piece and the **Tenon** is the corresponding projection provided on another piece such that the two will fit each other on assembly to form what is known as a **Mortise and Tenon Joint**. The process employed to produce the mortise is

called **Mortising** and that used for making a tenon is known **Tenoning**. For both, a *Mortise gauge*, or if it is not available, a *marki gauge* is used to set the width. A *Tenon saw* is used for cutting excess wood on the sides to produce the tenon. For producing a *Mort* the firmer and mortise chisels are used. The wood is excavated for ab half the depth of cavity from one side and the remaining from the oppo side of the wood in order to prevent splitting of the wood at the fa Alternatively, a **Mortising Machine** can be used to make the *morti*

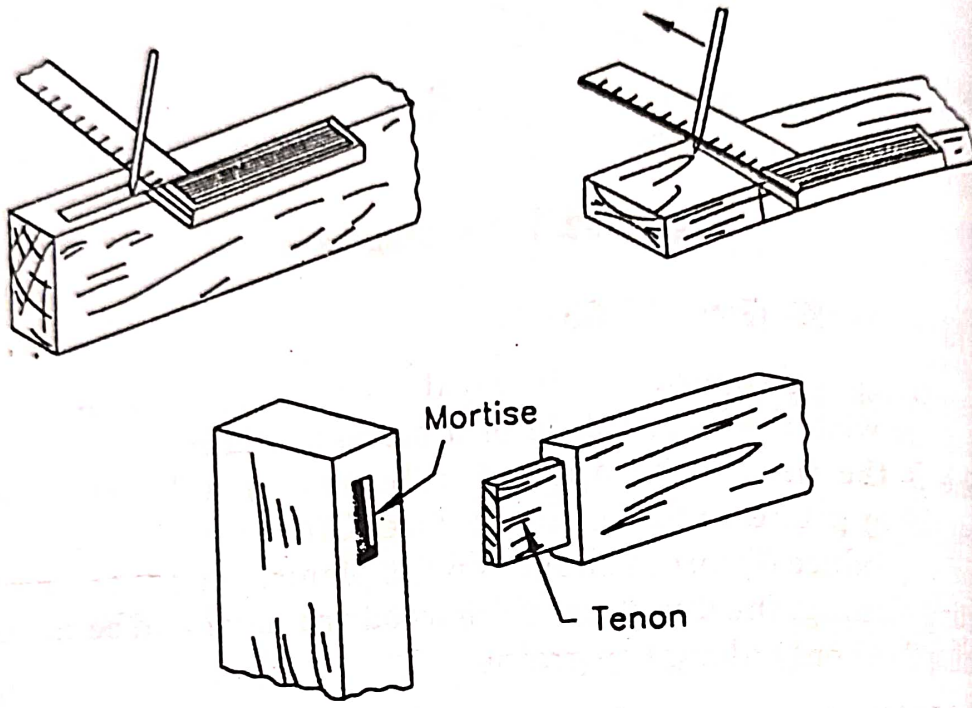

Fig. 10.54. Mortising and Tenoning.

10.17 BORING (Fig. 10.55)

This process is used for producing round holes in wood pieces. The centre of the hole is marked first, followed by production of the hole of desired size and depth. The *tools* and *bits* used for this purpose have been described earlier in this chapter.

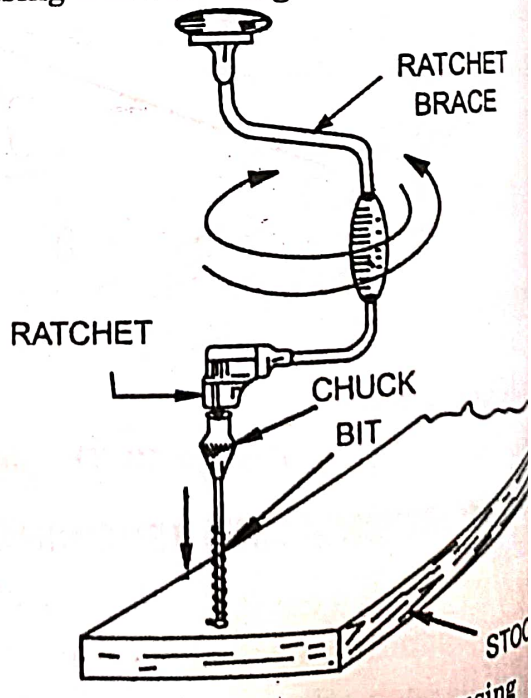

Fig. 10.55. Boring operation, using a Ratchet Brace.

10.18 GROOVING AND TONGUEING

When very wide planks are needed, it is normally not possible to procure them commercially. Also, it may be very costly to do so. For this, the planks of standard widths are taken and joined to form the desired width. Common examples can be seen in table tops and drawing boards. For this purpose, one of the planks is provided with a **groove** on its longitudinal face and adjacent plank with a corresponding projection called **tongue** (See Fig. 10.56), the two fitting with one another to give the increased width. Similarly, this process may be continued to join other planks to them so long as the desired width is not obtained.

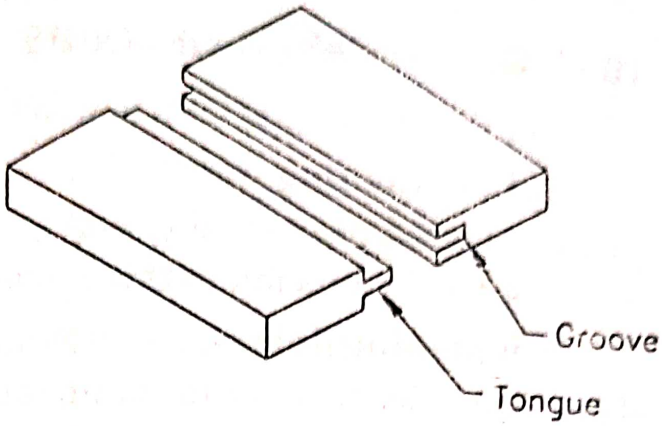

Fig. 10.56. Details of a groove and tongue joint.

10.19 MOULDING

Through this process different *decorative shapes* are produced along the periphery of wood pieces by using the *Moulding plane*. Moulding machines are also available for this purpose.

10.20 REBATING

It involves the use of a **Rebating Plane** to produce a *step* along the edge of a plank, either longitudinal or cross or both. Example can be seen in door panels.

10.21 RECESSING

It is a sort of mortising operation with the difference that the cavity produced is *blind* and not through as is done in mortising.

10.22 JOINERY WORK

The term **Joinery** involves connecting of different wooden parts together by means of properly made **Joints**. However, a lasting sturdiness and firm securing of the joined wood pieces cannot be expected by simply connecting them to one another and then leaving them as they are. In order to achieve such lasting results, the **Joints** made in wood-work are usually secured firmly by means of suitable **fasteners** of which *glue*, *dowels*, *nails*, *screws*, *bolts* and *nuts* etc., are the most popular

common ones. Detailed description of these fasteners has already been given in the foregoing chapter.

10.23 CLASSIFICATION OF JOINTS

The various **Joints** used in wood-work can be classified as follows:

1. Lengthening Joints. These joints are used for joining two lengths of wood-pieces end to end to obtain large lengths. Many *Butt* and *Scarf* joints fall in this category.

2. Widening Joints. These joints are used for joining wood pieces along their sides in order to obtain increased width. *Rebated*, *Butt*, *Tongue* and *Groove* joints are quite commonly used for this purpose.

3. Framing Joints. These joints are used to connect wood pieces at desired inclinations and are commonly employed in frame-work. This category includes *Mortise* and *Tenon*, *Briddle*, *Rafter*, *Mitre*, *Dovetail*, *Notched* and *Scarf* joints.

4. Box Joints. These joints enable joining of wooden planks or scantlings at desired inclinations, so as to obtain box-shaped structures and wooden cases. *Lap-rebated*, *Open* and *Secret Dovetail*, *Corner Halving Mitre*, *Haunched Mortise* and *Tenon* and *Corner Locking* joints are commonly used for this purpose.

5. Circular Joints. These joints are used for connecting wooden pieces to form a hollow cylindrical structure. The joints commonly used for this purpose are *Butt*, *Hammer Head Key*, *Blind Mortise* and *Tenon*, *Scarf* and *Dowelled* joints.

Some prominent ones of the above joints are shown is Figs. 10.57 to 10.67. The diagrams are self-explanatory and practice of these joints is advised in class-work.

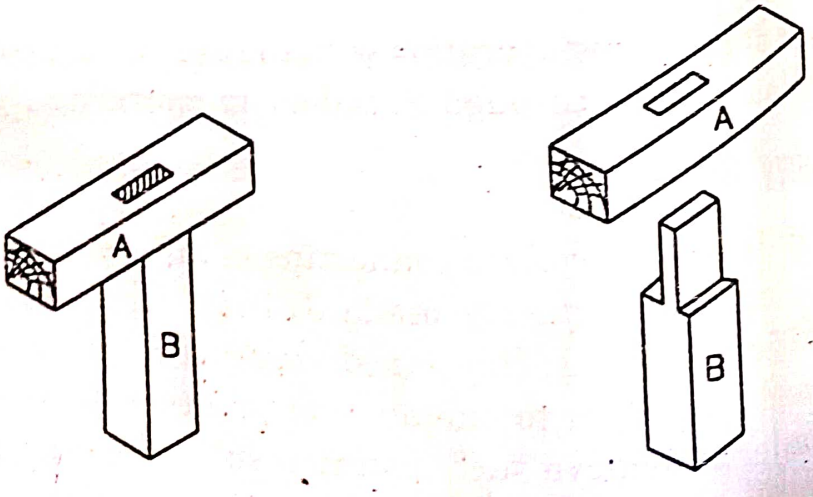

Fig. 10.57. Shoulder angle (M and T) joint.

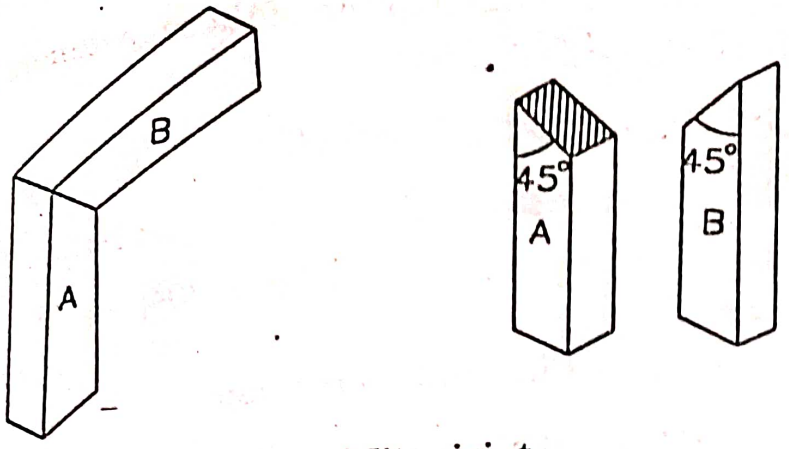

Fig. 10.58. Mitre joint.

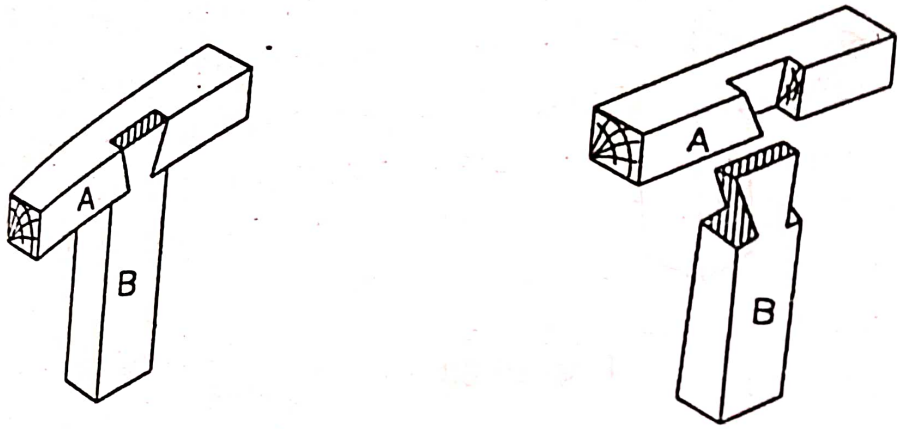

Fig. 10.59. Lap-dovetail joint.

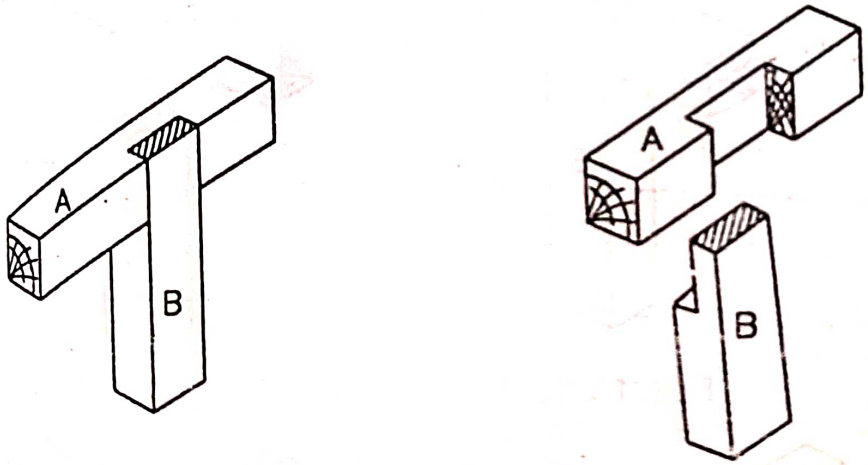

Fig. 10.60. T-lap joint.

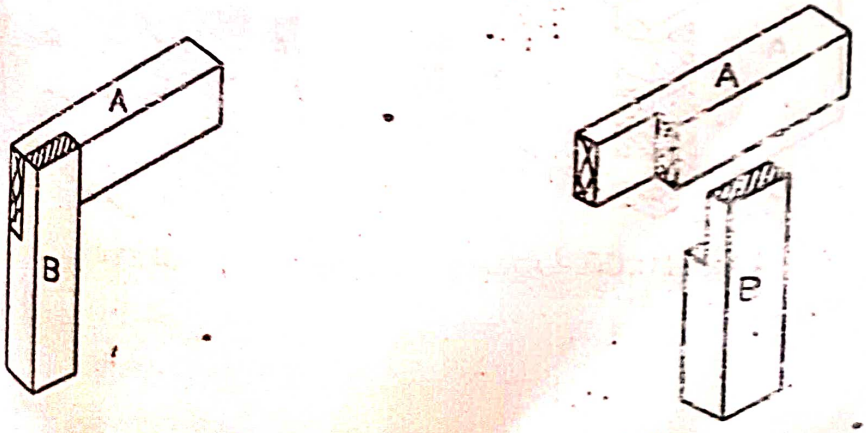

Fig. 10.61. Corner lap joint.