

Introduction to Workshop Practice



The workshop is a combination of two words i.e. Work + Shop

“WORK” means a physical or intellectual effort directed to some useful & meaningful activity.

So, “SHOP” means the place or location or area where this kinda work is efficiently carried out with necessary efforts.

“Workshop is a place or area or location where physical or intellectual or necessary resource gets properly utilized and make it efficient in proper manners for positive output.”

Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops.

Workshop practise gives the basic working knowledge required for the production of various engineering products. It explains the construction, function, use and application of different working tools, equipment, machines as well as the technique of manufacturing a product from its raw material.

It provides the basic working knowledge of the production and properties of different materials used in the industry. It also explains the use of different tools, equipment's, machinery and techniques of manufacturing, which ultimately facilitate shaping of these materials into various usable forms. In general, various mechanical workshops know by long training how to use workshop tools, machine tools and equipment.

The Engineering Workshop laboratory in MANIT has four major sections such as Carpentry shop, Fitting Shop, Welding shop and Moulding shop. The utility of each shop in shaping engineering students in the manufacturing environment are discussed as:

- **Carpentry shop:** Carpentry shop deals with making joints for a variety of applications like door frames, cabinet making furniture, packing etc.
- **Fitting Shop:** The fitting shop is related to assembly of parts, after bringing the dimension or shape to the required size or form, in order to secure the necessary fit.
- **Welding shop:** In welding shop, an engineering student learns the art of joining similar metals by the application of heat, with or without application of pressure or filler metal.
- **Moulding shop:** Moulding shop is the platform where an engineering student learns the art of making of manufacturing by shaping liquid or pliable raw material using a rigid frame called a mould or matrix.

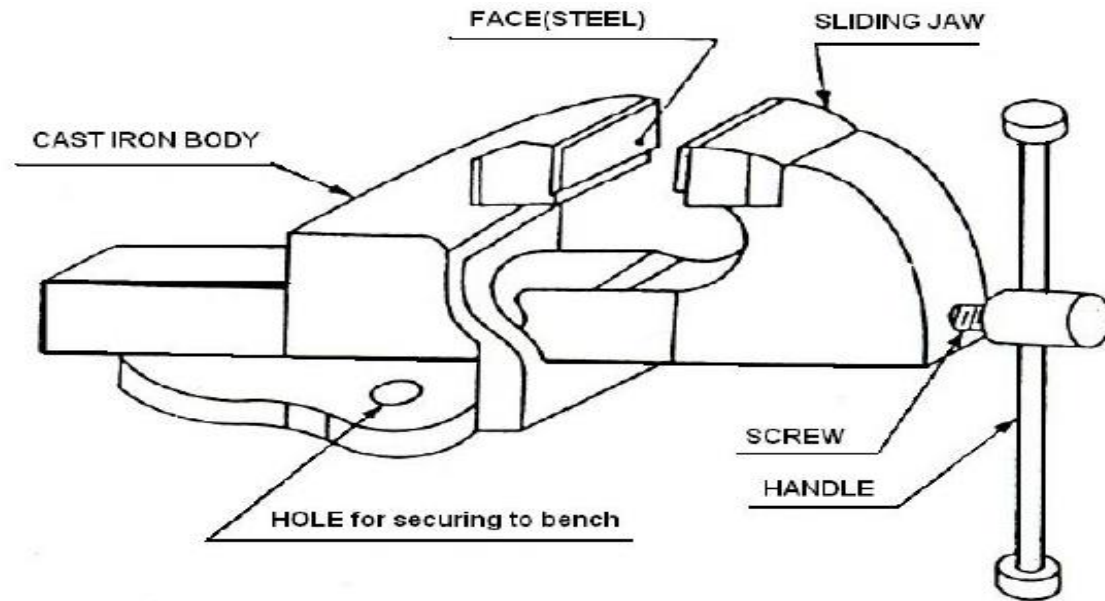
Carpentry Shop

Carpentry may be defined as the process of making wooden goods and components, viz. roofs, floors, partitions, doors, etc., with the help of carpentry tools. It starts from a marketable form of wood and ends with a finished product. It deals with the specific work of a carpenter like making different types of joints to form a finished product. Hence, the term joining is also used commonly for carpentry.



Fitting Shop

Working on components with hand tools and instruments, mostly on work benches is generally referred to as 'Fitting work'. The hand operations in fitting shop include marking, filing, sawing, scraping, drilling, tapping, grinding, etc.



Welding Shop

Welding is a fabrication process whereby two or more parts are fused together by means of heat, pressure or both forming a join as the parts cool.

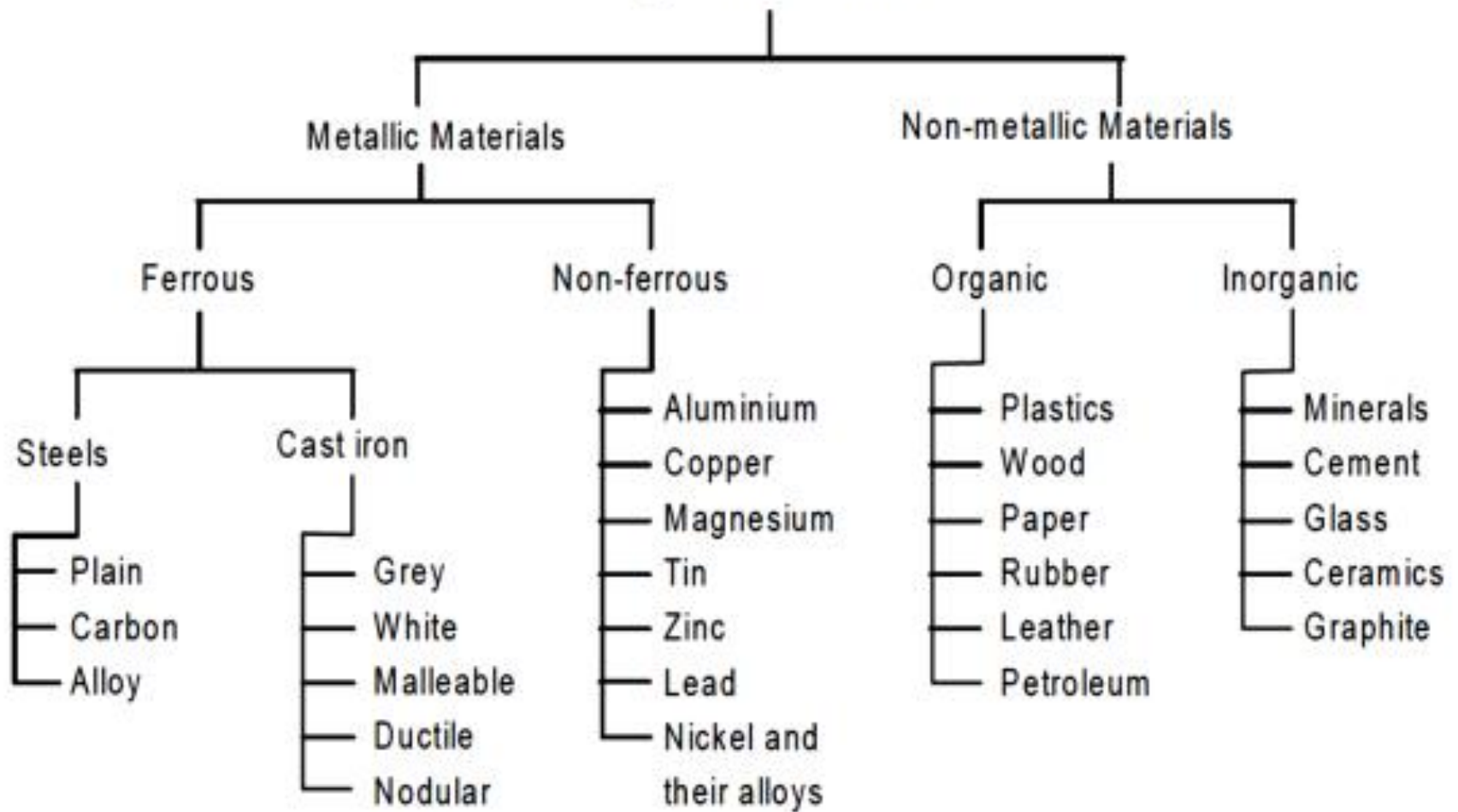


Foundry Shop

Foundry technology involves molding, melting, and casting of parts; that is, producing castings by filling the prepared molds with molten metal alloys (mostly aluminum).



Engineering Materials



Mechanical properties engineering materials

- **Strength:** Strength is the ability of material to resist external applied force without breaking.
- **Elasticity:** Elasticity is the property of material to regain its original shape after deformation when external force is removed.
- **Plasticity:** It is the property of material which retains its deformation produced under load permanently.
- **Stiffness:** It is the ability of material to resist deformation under stress.
- **Brittleness:** Brittleness is the property of breaking of a material with little permanent distortion.
- **Ductility:** It is the property of material enabling it to be drawn into wire with the application of tensile force.

- **Malleability:** It is the property of material to be rolled or hammered into thin sheets.
- **Toughness:** Toughness is the property of material to resist fracture due to high impact load.
- **Resilience:** It is the property of material to absorb energy and to resist shock and Impact loads.
- **Creep:** When a machine part is subjected to a constant stress at high temperature for a long period of time, then it will undergo a slow and permanent deformation.
- **Fatigue:** When a part is subjected to repeated stresses, then it fails at a stresses below the yield point stresses.
- **Hardness:** It is the property of material to resist wear, scratching deformation and machinability. It also means the ability to cut another metal.

Workshop safety and rules

- Student affected by drugs or alcohol are not permitted in the workshop.
- Do not wear baggy, loose, and otherwise ill-fitting clothing in your workshop.
- Do not wear jewellery or any other loose hanging items.
- No food or drink is allowed in the workshop.
- wear safety equipment
- Wear the correct protective equipment for the tools you are using – ask if in doubt.
- Keep Your Workshop Clean
- Immediately notify the workshop supervisor of any faulty or broken equipment.
- Please ask how to use the tools safely.
- Avoid Unnecessary Distractions
- Make sure your work piece is fixed securely before work commences.
- Wash hands after using equipment and materials.

Introduction to Carpentry Workshop

Carpentry may be defined as the process of making wooden goods and components, viz. roofs, floors, partitions, doors, etc., with the help of carpentry tools. It starts from a marketable form of wood and ends with a finished product. It deals with the specific work of a carpenter like making different types of joints to form a finished product. Hence, the term joining is also used commonly for carpentry.

Materials Used in Carpentry:

Basic materials used in carpentry shop are timber and plywood. Auxiliary materials used are nails, screws, adhesives, paints, varnishes, etc.

Timber:

Timber is a type of wood which has been processed into beams and planks. It is also known as “lumber” in US and Canada. Basically, timber or Lumber is a wood or firewood of growing trees. Any wood capable of yielding a minimum dimensional size can be termed as a timber or lumber. It is a stage in the process of wood production. Timbers are used for the structural purpose. Those woods which are adapted for building purposes are timbers. Finished timber is supplied in standard sizes for the industry. Timber is used for building houses and making furniture.

Timber is available in market in various shapes and size. The common shapes and sizes are given below:

- 1. Log:** This is the trunk of die tree which is free from branches.
- 2. Balk:** This is the log after sawing roughly to square cross section.
- 3. Deal:** This is the log after sawing into rectangular cross section of width about 225 mm and thickness up to 100 mm.

4. Plank: This is the timber piece having width more than 275 mm and thickness 50 to 150 mm.

5. Board: This is the timber piece below 50 mm in thickness and above 125 mm in width,

6. Batten: This is the timber piece below 175 mm in width and thickness between 30 mm to 50 mm in thickness.

7. Scantlings: These are timber pieces of various assorted and nonstandard sizes other than the types given above.

Advantages of Timber

Timber has the following advantages over the other materials:

1. It is cheaper and easily available.
2. It is lighter and stronger than most of the materials used in construction work.
3. It is very easy to work on it by the help of different tools for getting required shapes.
4. Cost of construction and workmanship is low.
5. Structural construction and joints can be easily made in timber.
6. It has high salvage value.
7. It responds very well to polishing and painting, etc.
8. It is suitable for making soundproof constructions.
9. It is a non-conductor of heat and electricity.
10. It is very suitable for making doors, windows, cabinet work, decorative designs and fitting, etc.

Classification of timber

According to the manner of growth of trees, timber can be classified as

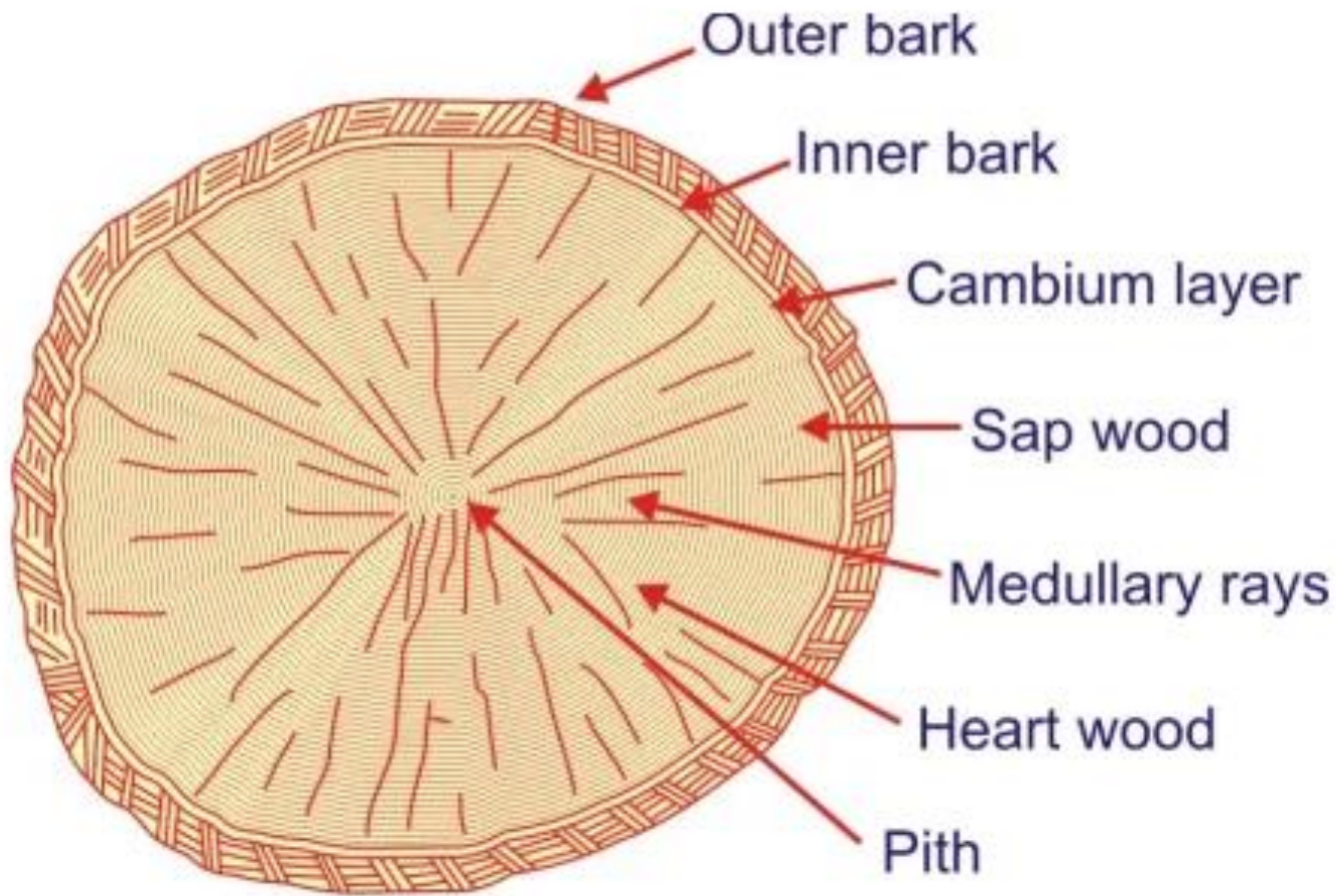
1. Exogenous or out-ward growing
2. Endogenous or in-ward growing

Exogenous or out ward growing

In these trees, the growth is outward from the centre, by adding almost concentric layers of fresh wood every year known as annual rings. After the full growth, these trees are cut and sawed to convert into rectangular sections of various sizes for engineering purposes. These varieties of trees are suitable for building and other engineering uses the exogenous trees are again classified as

- **Conifers or ever green trees:** Pines, firs, spruce trees
- **Deciduous or broad leaf trees**

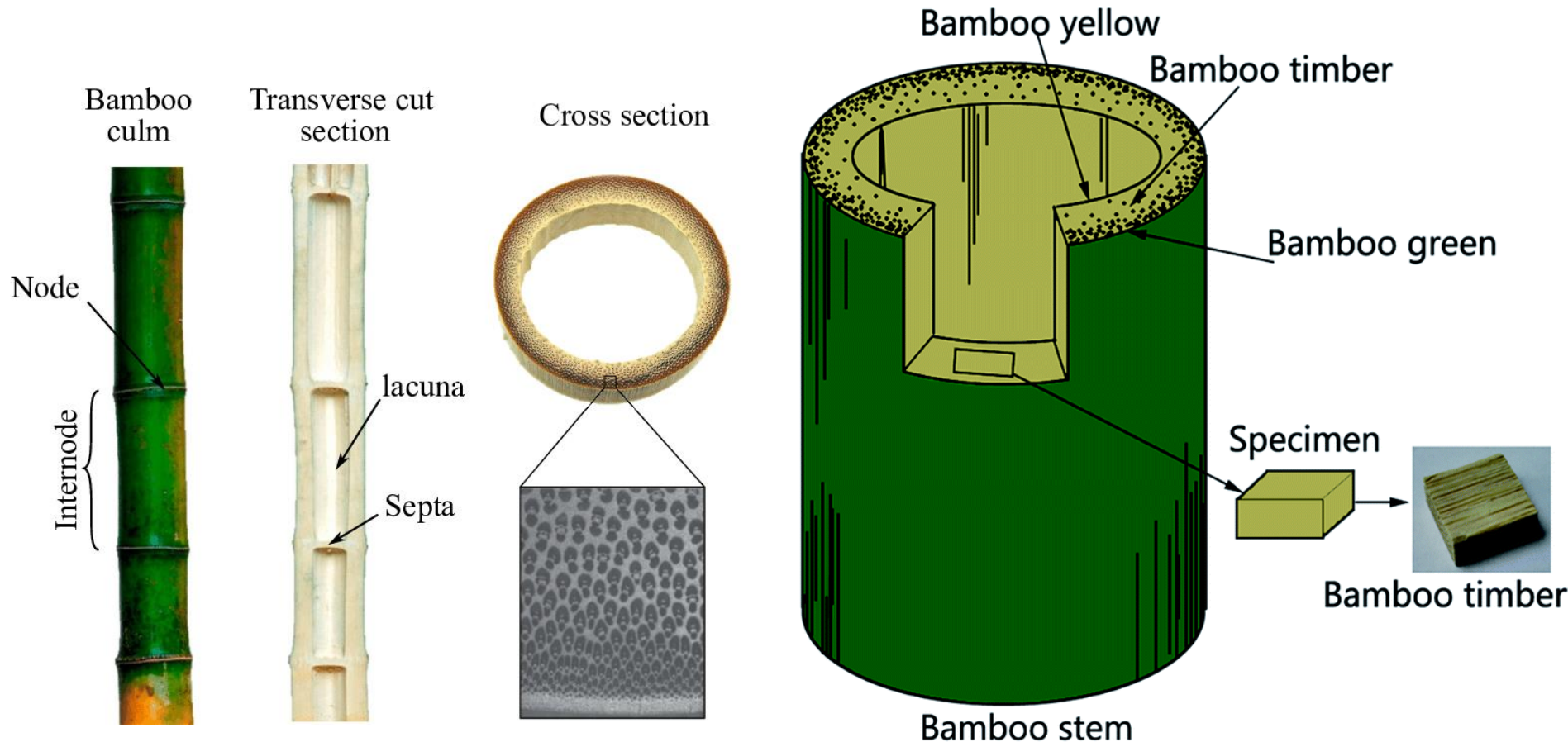
The conifer give soft woods and the deciduous gives hard wood common example of hard wood are Sal, teak, rose wood, sandal, shisham, oak beach, ash ebony, mango, neem, babool, etc.



Structure of Exogenous tree.

Endogenous or in ward growing timber

These trees grow in wards i.e. every fresh layer of sap wood is added inside instead of outside. Examples: Cane, bamboo, coconut.



Seasoning

A newly felled tree contains considerable moisture content. If this is not removed, the timber is likely to warp, shrink, crack or decay. Seasoning is the art of extracting the moisture content under controlled conditions, at a uniform rate, from all the parts of the timber. Only seasoned wood should be used for all carpentry works. Seasoning makes the wood resilient and lighter. Further, it ensures that the wood will not distort after it is made into an object.

Different methods of seasoning

1. Air seasoning or Natural seasoning
2. Water seasoning
3. Electrical seasoning
4. Kiln seasoning
5. Chemical Seasoning

Natural or Air Seasoning - This is as yet the most common process of seasoning of timber used throughout the world. In this process, timber sleepers, planks, etc., cut from the wood logs are stacked in the open air.

This method requires careful preparation of;

(a) Stock ground: It should be level, free from debris and on dry land. It may be a few “cm” below the ground level.

(b) Stack Pillars: These are constructed at regular intervals out of bricks or masonry or concrete and may be of 50 cm height from the ground level. Their top surfaces should be flat and level with each other.

(c) Stack Proper. These are made of sawn timber shapes (sleepers, planks). One stack should have timber of one shape and same length and width.

The timber shape to be seasoned is stacked in layers in such a manner that:

1. enough space is left between one layer and another layer above it;
2. enough space is left between one part and another part in the same layer;
3. enough space is left between one stack and another stack.

The stack length and height depend upon the length of the wood part being seasoned. A single stack may be 3 to 4 meters in height. The most essential consideration in making such a stack is ensuring free circulation of air around each part of the wood placed in a stack. It is also essential that the stack should be safe from direct winds and direct scorching heat. This is because, in air seasoning of timber, the loss of water is due to evaporation.

The rate of evaporation will depend to a great extent on the atmospheric conditions. Efforts should be made to maintain a uniform rate of evaporation. Scorching heat and strong winds can cause excessive evaporation that may lead to the development of shrinkage cracks. The seasoning stack should also be protected from rains because wood being hygroscopic material can absorb moisture quickly.



The advantages of natural (air) seasoning are:

1. It is highly economical;
2. It requires little supervision;
3. It is applicable to thicker timber parts as well as a thin section.

Disadvantages of Air Seasoning:

1. It is a very slow process;
2. It keeps the valuable land and timber blocked for longer periods (and hence in some cases may be uneconomical).
3. Moisture content cannot be brought below a certain limit (16-17 percent).
4. Seasoning is not always uniform in all the sections of timber.

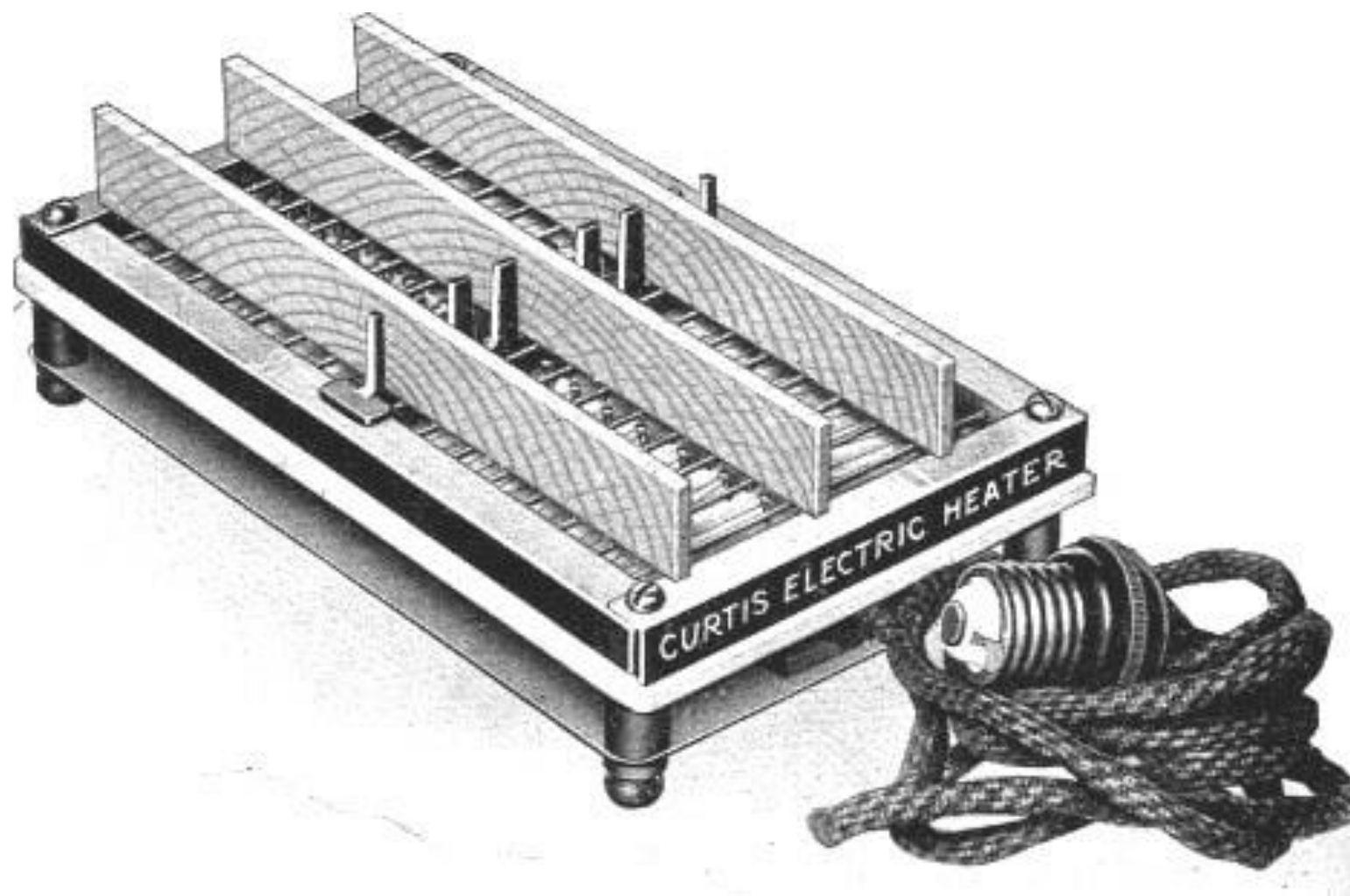
Water Seasoning

Water seasoning is the process in which timber is immersed in water flow which helps to remove the sap present in the timber. It will take 2 to 4 weeks of time and after that the timber is allowed to dry. Well-seasoned timber is ready to use.



Electrical Seasoning

In the method of electrical seasoning timber is subjected to high frequency alternating currents. The resistance of timber against electricity is measured at every interval of time. When the required resistance is reached seasoning process is stopped because resistance of timber increases by reducing moisture content in it. It is also called as rapid seasoning and it is uneconomical.



Kiln Seasoning

In this method timber is subjected to hot air in air tight chamber. The hot air circulates in between the timber logs and reduces the moisture content. The temperature inside the chamber is raised with the help of heating coils. When the required temperature is obtained moisture content and relative humidity gets reduced and timber gets seasoned. Even though it is costly process it will give good results strength wise.



Chemical Seasoning

In case of chemical seasoning, timber is stored in suitable salt solution for some time. The salt solution used has the tendency to absorb water from the timber. So, the moisture content is removed and then timber is allowed to drying. It affects the strength of the timber.



Characteristics of Good Timber

1. It should have minimum moisture content, i.e., the timber should be well seasoned.
2. The grains of wood should be straight and long.
3. It must retain its straightness after seasoning.
4. It should produce near metallic sound on hammering.
5. It should be free from knots or cracks.
6. It should be of uniform colour, throughout the part of the wood.
7. It should respond well to the finishing and polishing operations.
8. During driving the nails and screws, it should not split easily.

Classification of Wood

The timber used for commercial purposes can be divided into two classes as soft wood and hard wood.

<i>S. No.</i>	<i>Soft Wood</i>	<i>Hard Wood</i>
1	It is light in colour.	It is dark in colour.
2	It is lighter in weight.	It is heavier in weight.
3	It has straight fibers and fine texture.	Its fibers are quite closer and compact.
4	It has good tensile resistance and shear resistance	Poor shear resistance.
5	It is relatively less durable.	It is more durable.
6	It catches fire easily and cannot.	It does not catch fire easily and has withstand high temperature.
7	It is easy to work	It is difficult to work.

Plywood

Thick sheet formed by pasting veneers of wood is called ply. Three or more plys joined by glues is called plywood. The grains of adjacent layers are kept at right angle to each other in order to get better strengthening in both directions. The outer layer are called facing plys and good hard wood veneers are used for this inner ones are called core plys. Ply wood is made by either cold pressing or hot pressing.

Carpentry Tools

Carpentry tools are used to produce components to an exact size.

The types of carpentry tools are as follows.

1. Marking tools
2. Measuring tools
3. Holding tools
4. Cutting tools
5. Planning tools
6. Boring tools

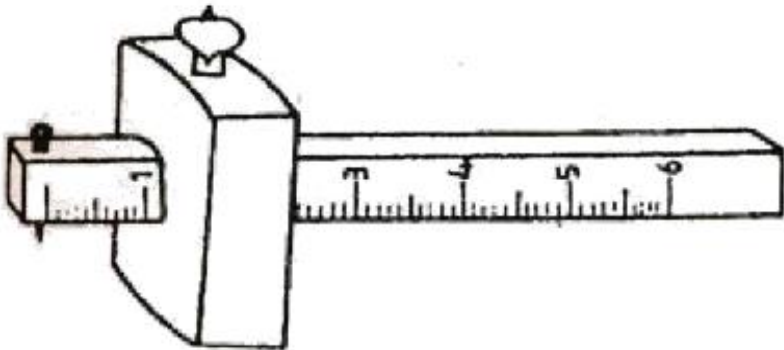
Marking tools

It is used to marking lines parallel to the edges of a wooden piece.

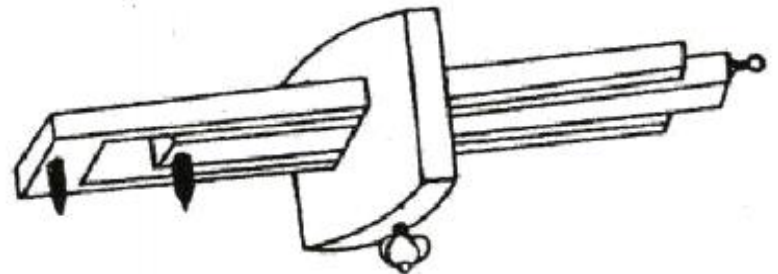
- Marking Gauge
- Try - Square
- Compass and Divider
- Scriber or Marking Knife

Marking Gauge

It is a tool used to mark lines parallel to the edge of a wooden piece. It consists of a square wooden stem with a sliding wooden stock (head) on it. On the stem is fitted a marking pin, made of steel. The stock is set at any desired distance from the marking point and fixed in position by a screw. It must be ensured that the marking pin projects through the stem, about 3 mm and the end are sharp enough to make a very fine line. A mortise gauge consists of two pins. In this, it is possible to adjust the distance between the pins, to draw two parallel lines on the stock.



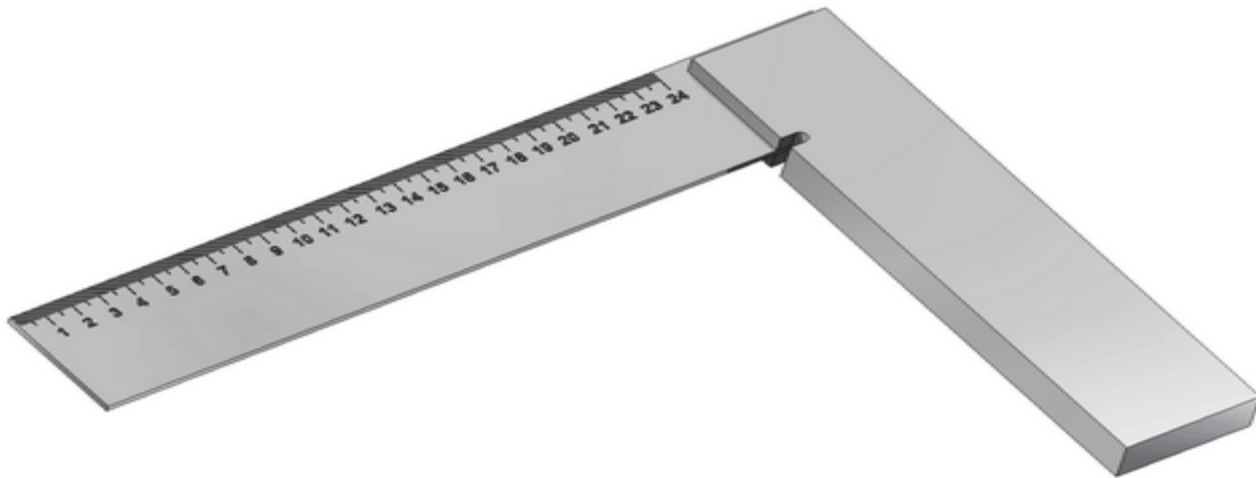
Marking gauge



Mortise gauge

Try - Square

It is used for marking and testing the squareness and straightness of planed surfaces. It consists of a steel blade, fitted in a cast iron stock. It is also used for checking the planed surfaces for flatness. Its size varies from 150 to 300 mm, according to the length of the blade. It is less accurate when compared to the try-square used in the fitting shop.



Compass and Divider

Compass and divider, are used for marking arcs and circles on the planed surfaces of the wood.



Scriber or Marking Knife

It is used for marking on timber. It is made of steel having one end pointed and the other end formed into a sharp cutting edge.



Measuring tools

Accurate marking and measurement is very essential in carpentry work, to produce parts to exact size. To transfer dimensions onto the work;

The carpentry measuring tools are classified as follows

1. Steel tape
2. Steel rule
3. Calipers

Steel rule is a simple measuring instrument consisting of a long, thin metal strip with a marked scale of unit divisions. It is an important tool for linear measurement. Steel tape is used for large measurements, such as marking on boards and checking the overall dimensions of the work.

Calipers are used for the precision measurement of cylindrical surface. Inside calipers are used for measuring outside diameter and outside calipers are used to measure inner diameter of a pipe.

Calipers



Holding Tools:

Carpenter's Vice

It is used as a work holding device in a carpenter shop. Its one jaw is fixed to the side of the table while the other is movable by means of a screw and a handle. The Carpenter's vice jaws are lined with hard wooden faces.



C-Clamp

It is used for holding small works.



Bar Cramp

It is made of steel bar of T-section, with malleable iron fittings and a steel screw. It is used for holding wide works such as frames or tops.



Planing Tools:

Planing is the operation used to produce flat surfaces on wood. A plane is a hand tool used for this purpose. The cutting blade used in a plane is very similar to a chisel. The blade of a plane is fitted in a wooden or metallic block, at an angle.

Different types of planing tools are:

- Jack Plane
- Smoothing Plane
- Rebate Plane
- Plough Plane

Jack Plane

It is the most commonly used general purpose plane. It is about 35 cm long. The cutting iron (blade) should have a cutting edge of slight curvature. It is used for quick removal of material on rough work and is also used in oblique planning.



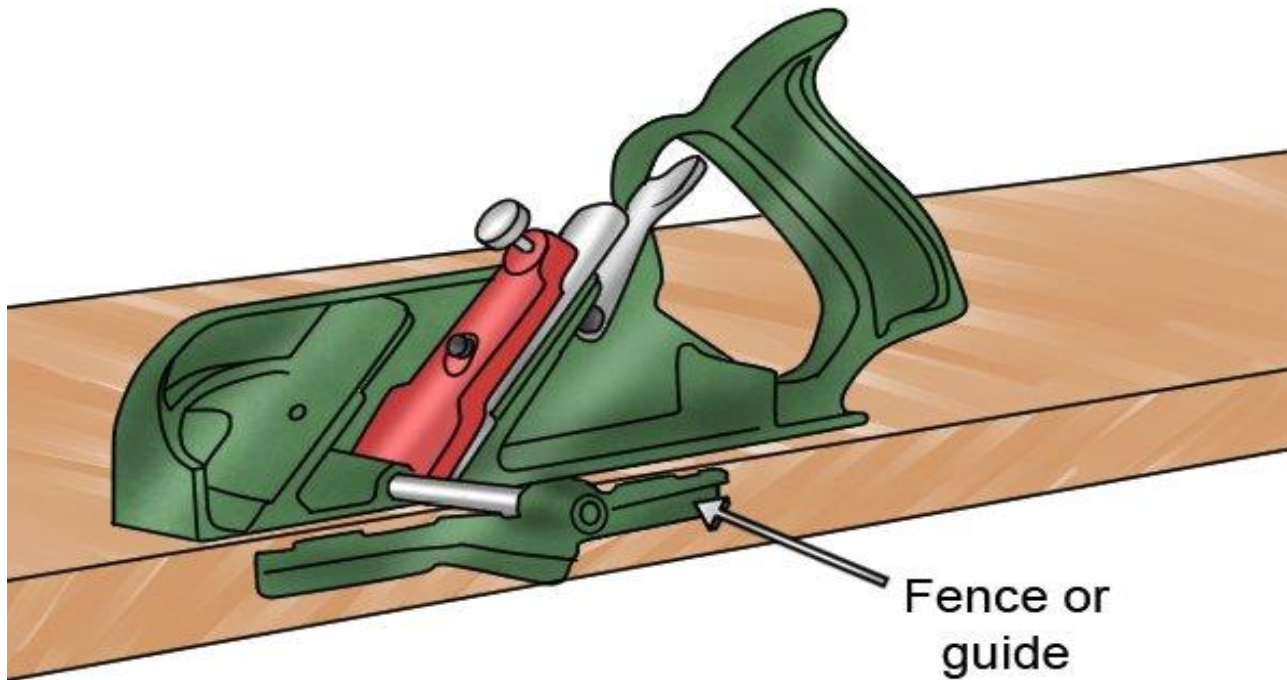
Smoothing Plane

It is used for finishing work and hence, the blade should have a straight cutting edge. It is about 20 to 25 cm long. Being short, it can follow even the slight depressions in the stock, better than the jack plane. It is used after using the jack plane.



Rebate Plane

It is used for making a rebate. A rebate is a recess along the edge of a piece of wood, which is generally used for positioning glass in frames and doors.



Plough Plane

It is used to cut grooves, which are used to fix panels in a door.



Cutting Tools:

Saws

A saw is used to cut wood into pieces. There are different types of saws, designed to suit different purposes. A saw is specified by the length of its toothed edge.

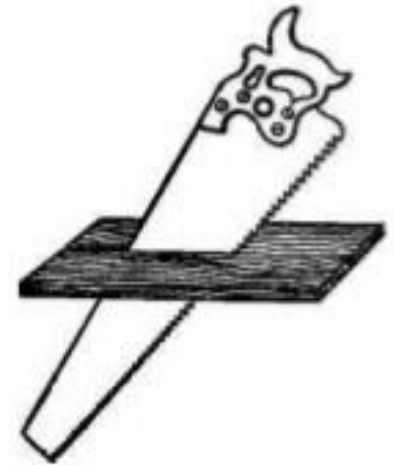
Types of Saws:

Tenon or back saw

Rip Saw

Cross Cut saw

- Rip saw



- Cross-cut saw



- Tenon saw



Rip Saw

It is used for cutting timber along the grains. The teeth of rip saw are chisel-shaped and are set alternately to the right and left. A 24" long point saw is a good for sawing work.

Cross cut Saw

Cross cut saw is similar to rip saw in shape. It is primarily designed for cutting across the grains of wood. The teeth are knife shaped and bent alternately to the right and left for making the saw to cut wider than the blade.

Tenon Saw

It is used for cutting the stock either along or across the grains. It is used for cutting tenons and in fine cabinet work. However, it is used for small and thin cuts. The blade of this saw is very thin and so it is stiffened with a thick back steel strip. Hence, this is sometimes called as back-saw. In this, the teeth are shaped like those of cross-cut saw.

Chisels:

Chisels are used for cutting and shaping wood accurately. Wood chisels are made in various blade widths, ranging from 3 to 50 mm. They are also made in different blade lengths. Most of the wood chisels are made into tang type, having a steel shank which fits inside the handle. These are made of forged steel or tool steel blades.

Types of Chisels:

Firmer Chisel

The word 'firmer' means 'stronger' and hence firmer chisel is stronger than other chisels.

It is a general purpose chisel and is used either by hand pressure or by a mallet. The blade of a firmer chisel is flat, as shown in figure.



Dovetail Chisel

It has a blade with a beveled back, as shown in Figure, due to which it can enter sharp corners for finishing, as in dovetail joints.



Mortise Chisel

It is used for cutting mortises and chipping inside holes, etc. The cross-section of the mortise chisel is proportioned to withstand heavy blows during mortising. Further, the cross-section is made stronger near the shank.



Boring Tools

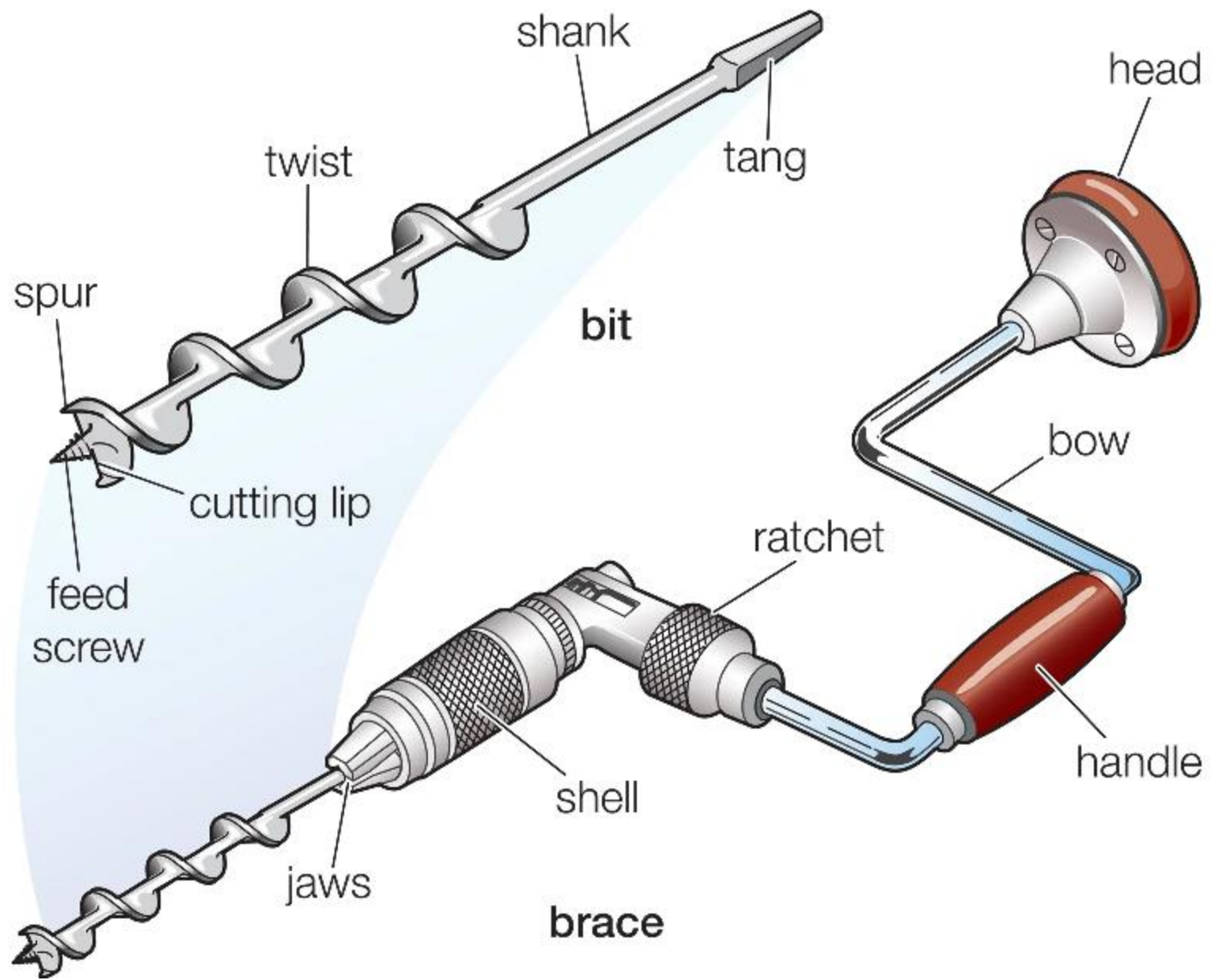
Boring tools are used to make holes in wood .Common types of boring tools are as follows.

1. Bradawl
2. Gimlet
3. Brace
4. Bit and drill

A brace holds and turns the bit and boring of a hole is obtained. A brace having two jaws is used for holding the bit in one end. It has two types, namely ratchet brace and wheel brace.

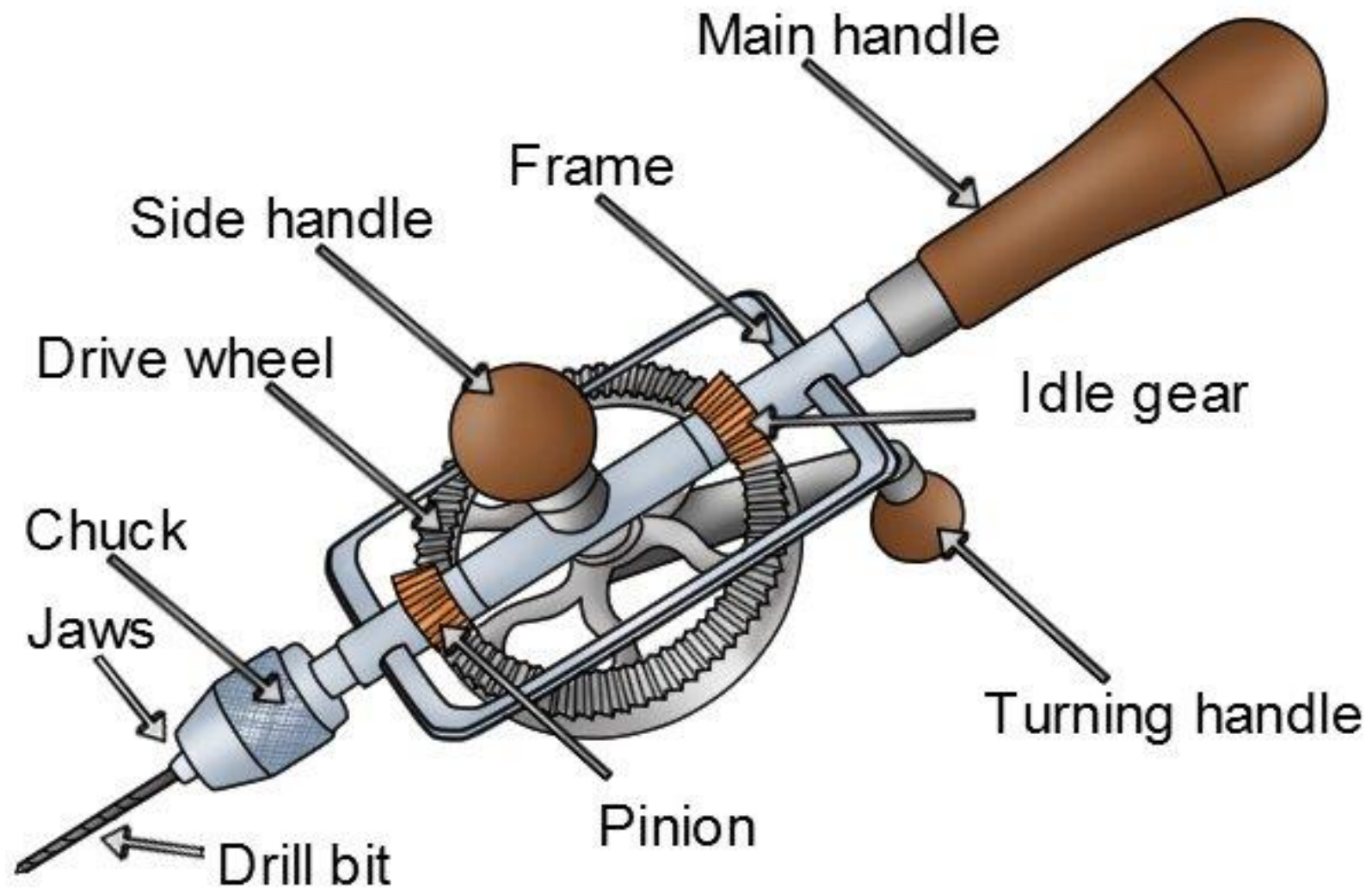
A bradawl is a wood working hand tool with a blade similar to that of a straight screwdriver and a handle made from wood or plastic.





A gimlet is a hand tool for drilling small holes, mainly in wood, without splitting.





***Thank
You***

