Fitting tools - marking tools - specification - grades - uses

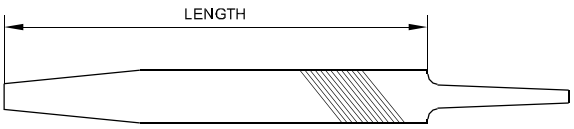
Objectives : At the end of this lesson you shall be able to
- **state the different types of files and their grades, shapes, specification and application.**
- **state the different cuts of files and their uses**
- **state the parts of file**

File : File is a filing tool, which is used to file the rough surface & smooth surface on metals

File specification: Files are specified according to their

- length
- grade
- cut
- shape

Fig 1



Length is the distance from the tip to the heel (Fig 1). It may be 300mm, 250mm, 200mm,150mm or 100mm.

Rough, bastard, second cut, smooth and dead smooth are the different **grades** of files commonly available.

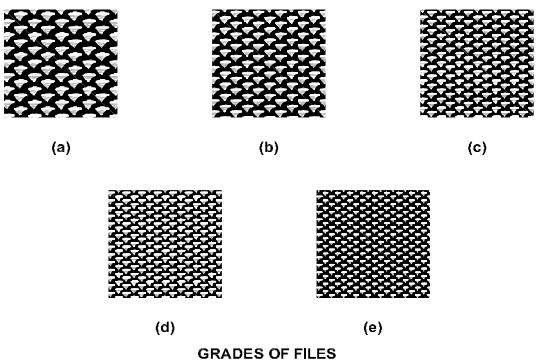
A rough file is used for removing more quantity of metal quickly. (Fig 2a)

A bastard file is used for ordinary filing purposes. (Fig 2b)

A second cut file is used for good finishing purposes. (Fig 2c)

A smooth file is used for removing less metal and for giving good surface finish. (Fig 2d)

Fig 2



A dead smooth file is used for high degree finishing. (Fig 2e)

Cut of file: The rows of teeth determine the cut of a file.

Types of cut

Single cut, double cut, rasp cut and curved cut are the different types of cuts of files.

Single cut: A single cut file has a single row of teeth in one direction on the face of the file at an angle of 60° and this file is used for filing soft material such as lead, tin, aluminium etc. (Figs 3 & 4)

Fig 3

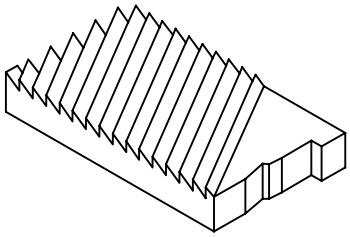
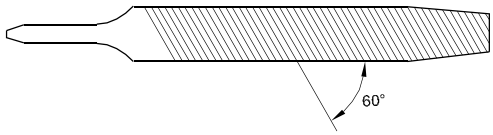
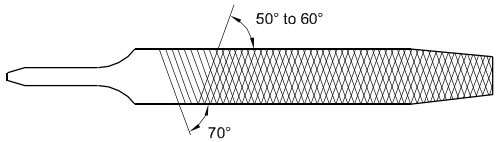


Fig 4



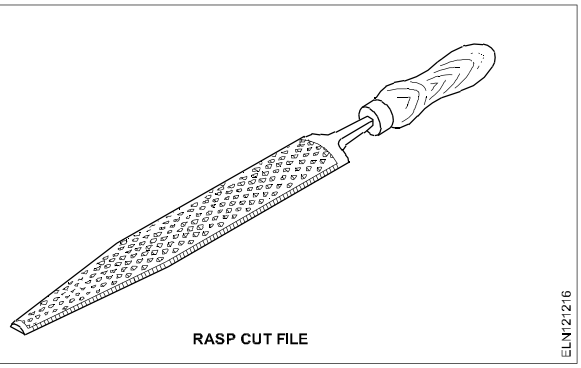
Double cut: A double cut file has rows of teeth in two directions across each other, one at an angle of 50° to 60°, another row at 70° which is used to file hard materials such as steel, brass, bronze, etc. (Fig 5)

Fig 5



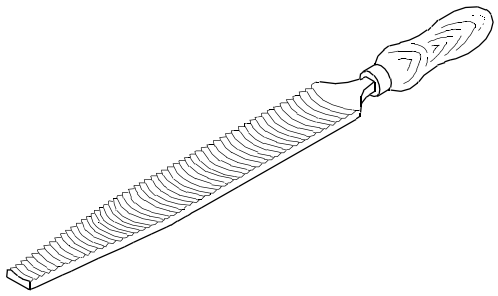
Rasp cut: This has individual, sharp, pointed teeth in a line, and is useful for filing wood, leather and other soft materials. These files are available only in half-round shape. (Fig 6)

Fig 6



Curved cut: These files have deeper cutting action, and are useful for filing soft materials like - aluminium, tin, copper and plastic. These are available only in flat shape. (Fig 7)

Fig 7



CURVED CUT FILE

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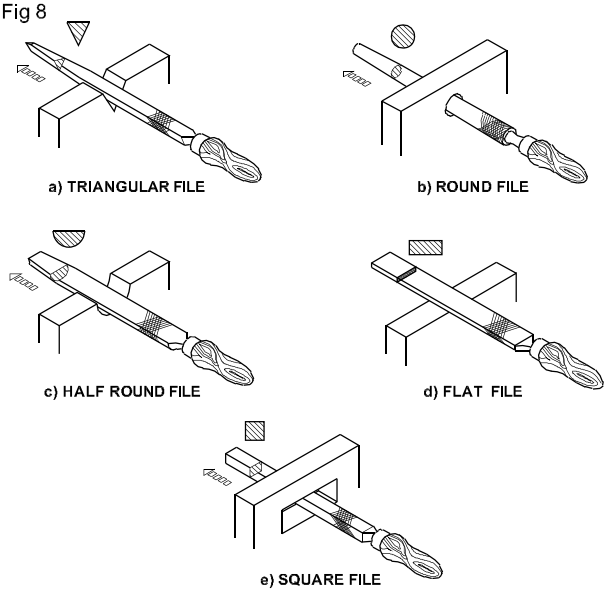
Fig 8



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The selection of the type of cut is based on the material to be filed. Single cut files are used for filing soft materials. But certain special files, for example - those used for sharpening saws, are also of single cut.

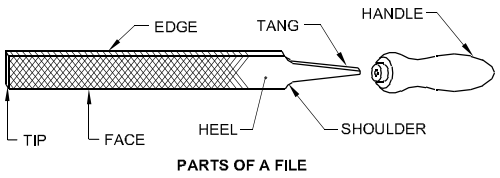
Shape: The various shapes of files with their application are shown below. The cross-section drawn in the file refers to the shape of the file. (Fig 8)

Parts of file

File : A file is a cutting tool with multiple cutting edges used for filing different materials.

Parts of a file (Refer Fig 1 below)

Fig 1



PARTS OF A FILE

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Tip or point: This is the end of the file opposite to tang.

Face or side: The broad part of the file with teeth cut on it.

Edge: The thin part of the file with a simple row of parallel teeth.

Heel: It is the broad part of the file without teeth.

Shoulder : It is the curved part of a file separating the tang from the body.

Tang: Narrow and thin part of a file which fits into the handle.

Handle: The part fitted to the tang to hold and use the file.

Bench vice

Objectives: At the end of this lesson you shall be able to

- **name the parts and state the uses of a bench vice**
- **specify the size of a bench vice**
- **state the uses of vice clamps.**

Bench vice: Vices are used for holding workpieces. They are available in different types.

The vice used for bench work is the bench vice (Engineer's vice).

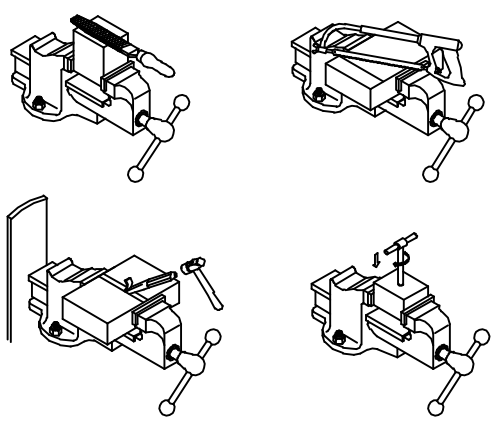
A bench vice is made of cast iron or cast steel, and it is used to hold work for filing, sawing, threading and other hand operations. (Fig 1)

The size of the vice is stated by the width of the jaws.

Parts of a bench vice (Fig 2)

- Fixed jaw (1)
- Movable jaw (2)
- Hard jaw (3)

Fig 1



VICES

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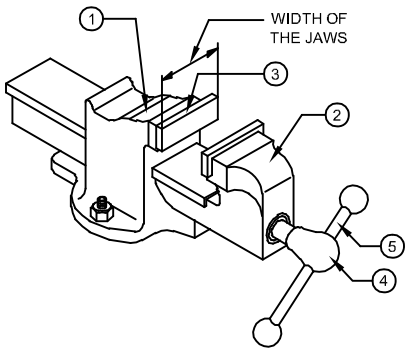
- Spindle (4)
- Handle (5)
- Box nut (6)
- Spring (7)

Fig 2



BENCH VICE

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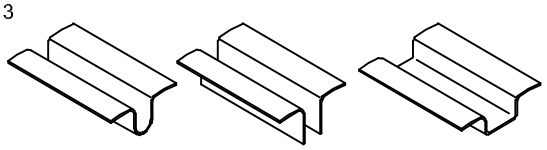
The box nut and the spring are the internal parts.

Vice clamps or soft jaws: To hold a finished work use soft jaws (vice clamps), (Fig 3) made of aluminium over the regular hard jaws. This will protect the work surface from damage. Do not over-tighten the vice so as to prevent damage to the spindle.

Fig 3



VICE CLAMPS

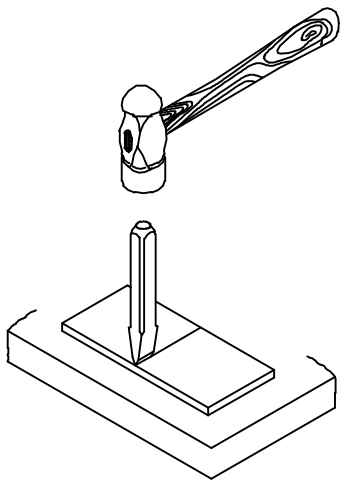
ELN121233

Hammer

Objectives: At the end of this lesson you shall be able to
- **state the uses of an engineer's hammer**
- **name the parts of an engineer's hammer and state their functions**
- **name the types of engineer's hammers with specifications**

Hammer: Engineer's hammer is a hand tool used for various striking purposes like punching, bending, straightening, chipping, forging and riveting. (Fig 1)

Fig 1



STRIKING WITH HAMMER

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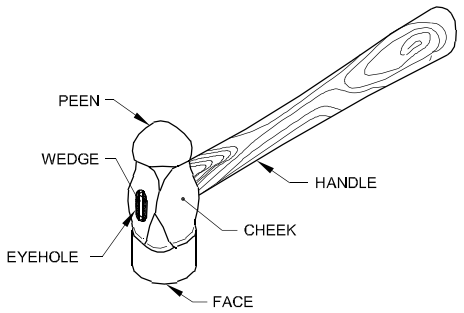
Major parts of a hammer (Fig 2)
- Head
- Handle

The head is made of drop-forged carbon steel, and the wooden handle must be capable of absorbing shock.

The parts of the hammer head are:
- face
- peen

Fig 2



HAMMER

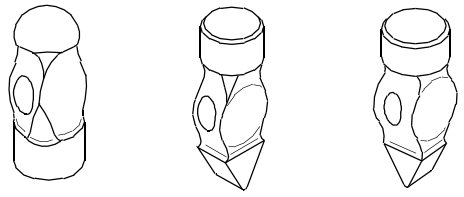
ELN121242

- cheek
- eyehole

Face: Face is the striking portion. A slight convexity is given to it, to avoid digging of the edge.

Peen: Peen is the other end of the head. It is used for shaping and forming work like riveting and bending. The peen is of different shapes. (Fig 3) They are:

Fig 3



BALL PEEN CROSS-PEEN STRAIGHT PEEN

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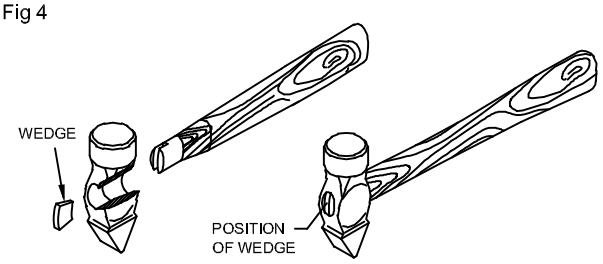
- ball peen
- cross-peen
- straight peen

Cheek: Cheek is the middle portion of the hammer head. The weight of the hammer is stamped here.

Eyehole: Eyehole is meant for fixing the handle. It is shaped to fix the handle rigidly. The wedge fixes the handle in the eyehole. (Fig 4)

Fig 4



HAMMER WEDGE

Specifications: The face and peen are hardened.

The cheek is left soft.

Engineer's hammers are specified by the weight of the head and shape of the peen. The weight varies from 125 gms to 1.5 kg.

The weight of the engineer's hammer used for marking purposes is 250 gms.

The ball peen hammer is used for general work in machine fitting shops.

Before using a hammer:

- make sure the handle is properly fitted
- select the correct weight of hammer suitable for the type of work
- check the head and handle for any crack
- ensure the face of the hammer is free from oil or grease.

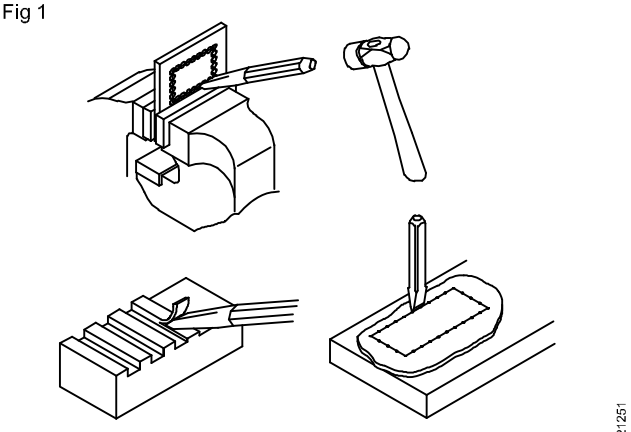
Chisel

Objectives: At the end of this lesson you shall be able to
- **list the uses of a cold chisel**
- **name the parts of a cold chisel and it's types**
- **state the different types of hacksaw frames, blades and their uses.**

The cold chisel is a hand cutting tool used by fitters for chipping and cutting operations.

Chipping is an operation of removing excess metal with the help of a chisel and hammer. (Fig 1) The chipped surfaces being rough, they should be finished by filing.

Fig 1



CHIPPING PROCESS

Parts of a chisel (Refer Fig 2)

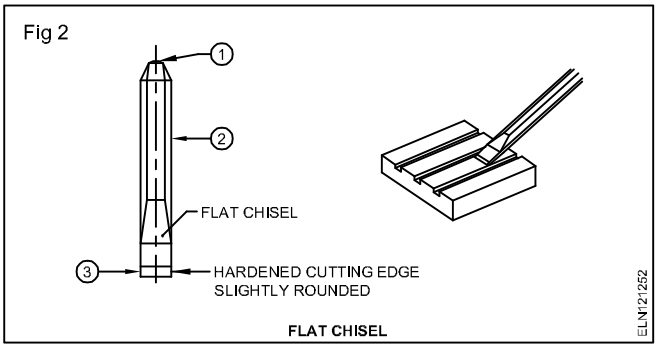
– Head (not hardened) (1)

– Body (2)

– Point or cutting edge (3)

Chisels are made from high carbon steel or chrome-vanadium steel. The cross-section of chisels is usually hexagonal or octagonal.

Fig 2



FLAT CHISEL

Common types of chisels

- Flat chisel
- Cross-cut chisel
- Half-round nose chisel
- Diamond point chisel

Flat chisels are used to:

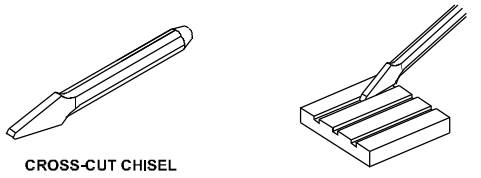
- remove metal from large flat surfaces
- chip excess metal off from welded joints and castings
- part off metal after chain drilling. (Fig 1)

Cross-cut or cape chisels are used for cutting keyways, grooves and slots. (Fig 3)

Half round, nose chisels are used for cutting curved grooves (oil grooves). (Fig 4)

Diamond point chisels are used for squaring materials at the corners. (Fig 5)

Fig 3



CROSS-CUT CHISEL

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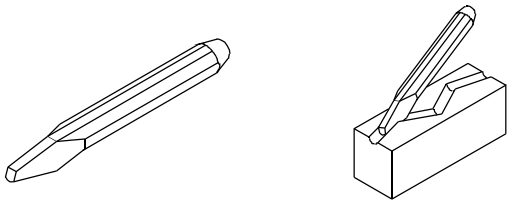
Fig 4



HALF ROUND CHISEL

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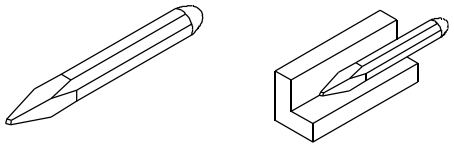
Fig 5



DIAMOND POINT CHISEL

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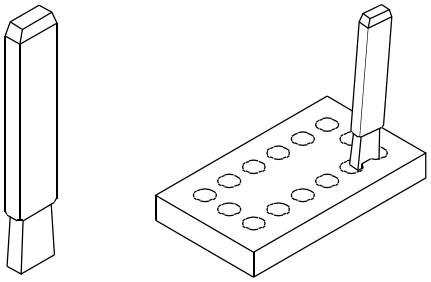
Web chisels/punching chisels are used for separating metals after chain drilling. (Fig 6)

Fig 6



WEB CHISEL

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Chisels are specified according to the:

- length
- width of the cutting edge
- type
- cross-section of the body.

The length of chisels ranges from 150 mm to 400 mm.

The width of the cutting edge varies according to the type of chisels.

Hacksaw frame and blade

The hand hacksaw is used along with a blade to cut metals of different sections. It is also used to cut slots and contours.

Types of hacksaw frames

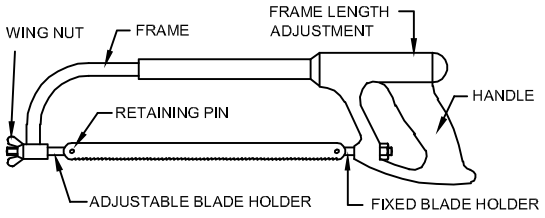
Bold frame: Only a particular standard length of blade can be fitted.

Adjustable frame (flat)**:** Different standard lengths of blades can be fitted.

Adjustable frame tubular type (Fig 1)**:** This is the most commonly used type. It gives a better grip and control while sawing.

Hacksaw blades : The hacksaw blade is a thin, narrow, steel band with teeth and two pin holes at the ends. It is

Fig 1



HACKSHAW FRAME

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used along with a hacksaw frame. These blades are made of either low alloy steel (la) or high speed steel (hs) and are available in standard lengths of 250mm and 300mm.

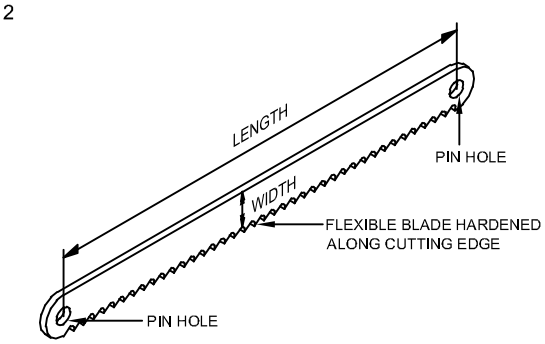
For proper working, it is necessary to have frames of rigid construction.

Types of hacksaw blades

All-hard blades: The width between the pin holes is hardened all allong the length of the blade.

Flexible blades: For these types of blades only the teeth are hardened. Because of their flexibility, these blades are useful for cutting along curved lines (Fig 2).

Fig 2



HACKSHAW BLADE

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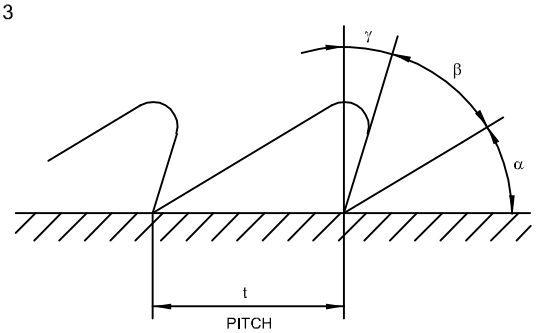
Pitch of the blade: This is the distance between two adjacent teeth. (Refer Fig 3) Hacksaw blades are designated according to length, pitch and the type of blade

Fig 3



PITCH OF BLADE

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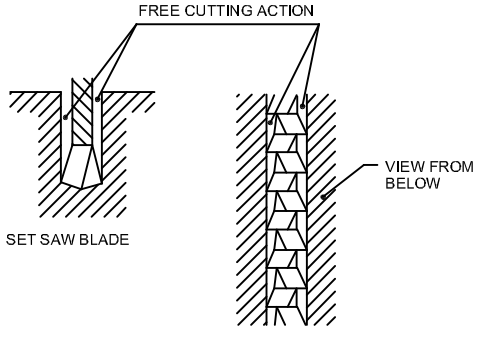
Pitches of blades

Classification	Pitch
Coarse	1.8mm
Medium	1.4 mm & 1.0 mm
Fine	0.8mm

Setting of the saw: To prevent the saw from binding when penetrating into the material and to allow free movement of the blade, the cut is to be broader than the thickness of the saw blade. This is achieved by a proper setting of the saw teeth (Fig 4). There are two types of saw settings.

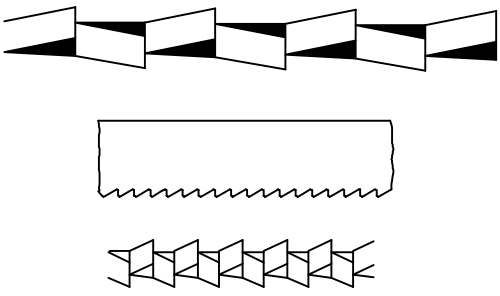
Fig 4



TYPE OF SAW SETTING

Staggered set: Alternate teeth or groups of teeth are staggered. This arrangement helps for free cutting, and provides for good chip clearance. (Fig 5)

Fig 5



STAGGERED SET TEETH

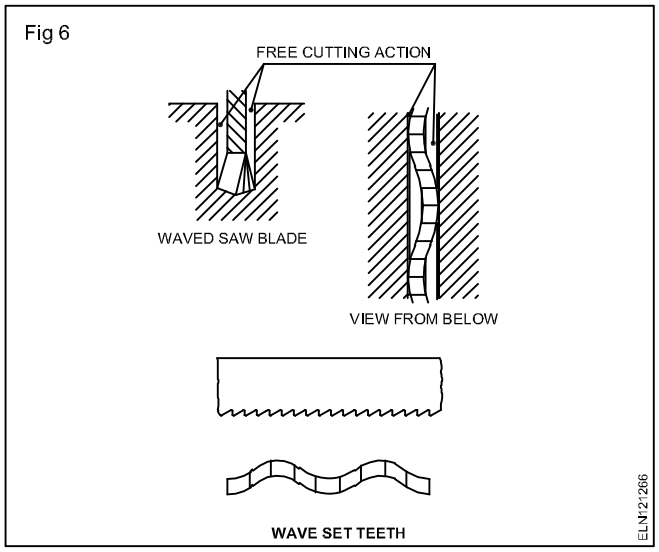
Classification of sets

Pitch	0.8mm	wave set.
Pitch	1.0mm	wave or staggered.
Pitch over	1.0mm	staggered.

Wave set: In this, the, teeth of the blade are arranged in a wave-form. (Fig 6).

For satisfactory results a blade of the correct pitch should be selected and fitted correctly.

Fig 6

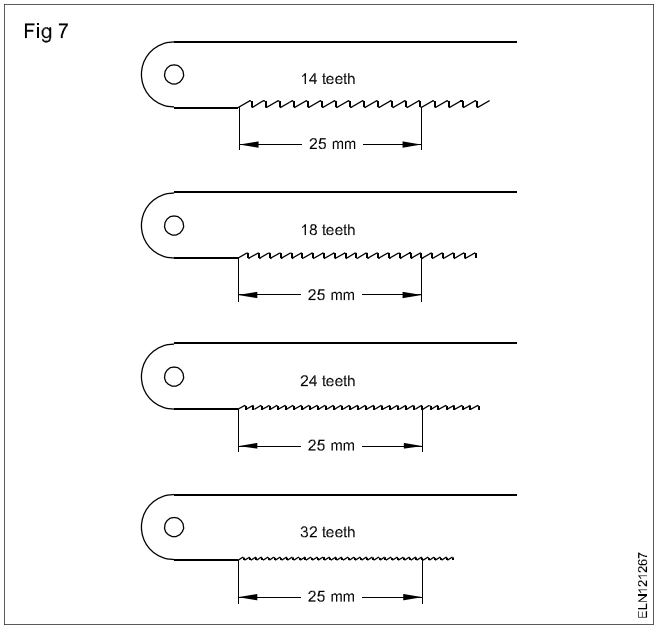


WAVE SET TEETH

Saw blades for hacksaws are available with small and large cutting of teeth, depending on the type and size of material they are to cut. The size of the teeth is directly related to their pitch, which is specified by the number of teeth per 25mm of the cutting edge. Hacksaw blades are avaialable in pitches of: (Fig 7)

- 14 teeth per 25 mm
- 18 teeth per 25 mm
- 24 teeth per 25 mm
- 32 teeth per 25 mm.

Fig 7



Marking tools - steel rule - punches - calipers - try square - gauges

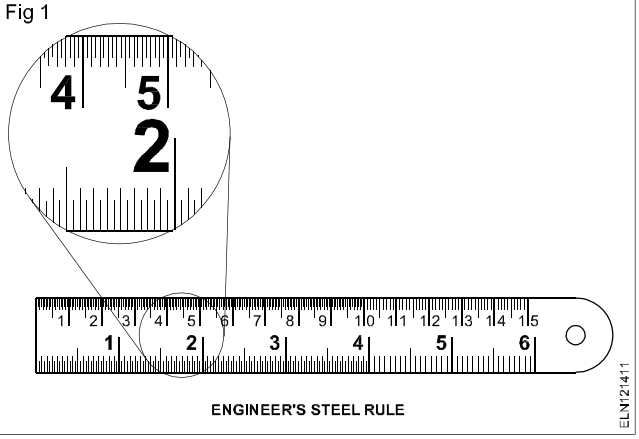
Objectives: At the end of this lesson you shall be able to
- **state the constructional features of an engineer's steel rule**
- **explain the uses of the steel rule**
- **state the maintenance aspects to be considered in respect of the steel rule.**

Engineer's steel rule: When dimensions are given in a drawing without any indication about the tolerance, it has to be assumed that measurements are to be made with a steel rule.

Material and sizes of steel rules: Steel rules are made of spring steel or stainless steel. The edges are accurately ground to form a straight line.

Steel rules are available in different lengths; the common sizes are 150mm, 300mm and 600mm. (Refer Fig 1)

Fig 1



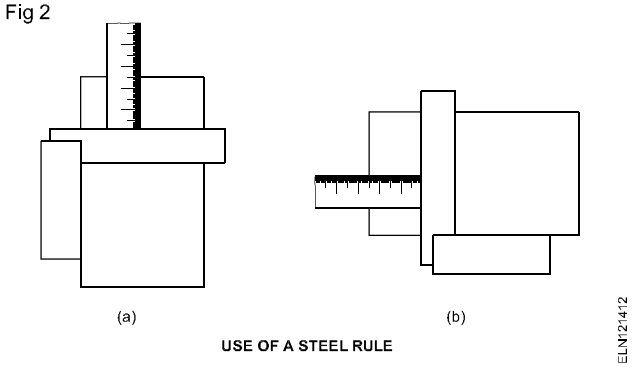
ENGINEER'S STEEL RULE

The surfaces of the steel rules are satin-chrome finished to reduce glare and also to prevent rusting. The engineer's rule is graduated in 10mm, 5mm, 1mm and 0.5mm. Thus the reading accuracy of a steel rule is 0.5mm.

Graduation: The minimum graduation is 0.5mm.

Uses: Use a try square on one datum edge and measure the distance from the other datum edge using a steel rule. (Figs 2a & b)

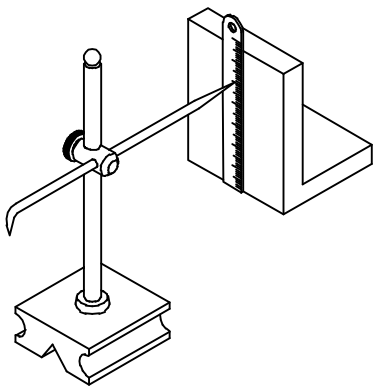
Fig 2



USE OF A STEEL RULE

A steel rule is used to take the desired height for the marking surface gauge. (Fig 3)

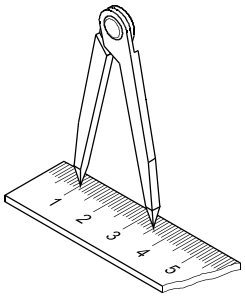
Fig 3



MARKING SURFACE GAUGE

Transfer of measurement from the steel rule to the divider is shown in Fig 4.

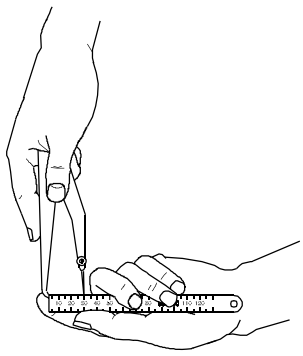
Fig 4



TRANSFER OF MEASUREMENT - DIVIDER

Steel rule is used to transfer measurements from the rule to the odd leg calipers. (Fig 5)

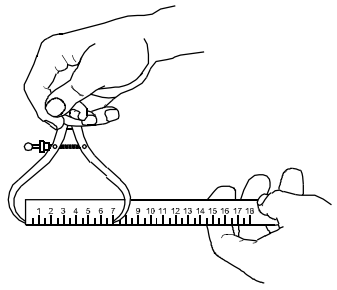
Fig 5



TRANSFER OF MEASUREMENT - ODD LEG CALIPER

Steel rule is used to transfer measurements from the steel rule to outside calipers. (Fig 6)

Fig 6



TRANSFER OF MEASUREMENT - OUTSIDE CALIPER

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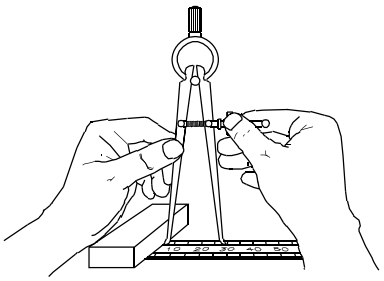
A steel rule is also used to transfer measurements to inside calipers. (Fig 7)

Fig 7



TRANSFER OF MEASUREMENT - INSIDE CALIPER

ELN'21417

Marking media

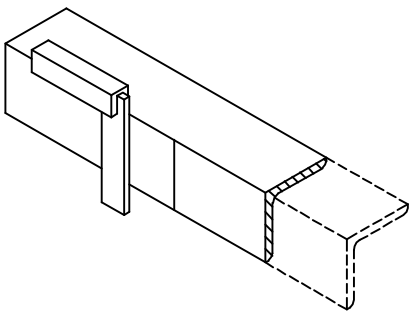
Objectives: At the end of this lesson you shall be able to
- **name the common types of marking media**
- **select the correct marking media for different applications.**

Different types of marking media

Whitewash: This is applied to rough forgings and castings with oxidised surfaces. (Fig 1) Whitewash is prepared in many ways.

- Chalk powder mixed with water
- Chalk mixed with methylated spirit
- White lead powder mixed with turpentine

Fig 1

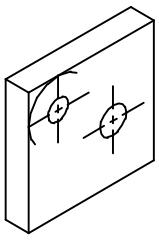


SURFACE MARKING

ELN'21421

Prussian blue: Used on filed or machine-finished surfaces. This will give very clear lines but takes more time for drying than the other marking media. (Fig 2)

Fig 2



MARKED SURFACE

ELN'21422

Copper sulphate: Used on filed or machine-finished surfaces. Copper sulphate sticks to the finished surfaces well. The solution is prepared by mixing copper sulphate in water with a few drops of nitric acid added.

Copper sulplate needs to be handled carefully as it is poisonous. Copper sulphate coating should be dried well before commencing marking as otherwise the solution may stick on the instruments used for marking.

Cellulose lacquer: This is a commercially available marking medium. It is made in different colours and dries very quickly.

The selection of marking media depends on the:

- the surface finish
- the accuracy of the workpiece.

Types of marking punches

Objectives: At the end of this lesson you shall be able to
- **name the different punches used in marking**
- **state the features of each punch and its uses.**

Types of marking punches: In order to make certain dimensional features of the layout permanent, punches are used. There are two types of punches.

Centre punch: The angle of the point is 90°. The punch mark made by this is wide and not very deep. This punch is used for locating holes. The wide punch mark gives a good seating for starting the drill. (Figs 1a)

Prick punch: The angle of the prick punch is 30° or 60° (Fig 1b). The 30° point punch is used for making light punch marks needed to position dividers. The divider leg will get proper seating in this punch mark. The 60° punch is used for Witness Marks. Witness marks should not be too close. (Fig 2)

Fig 1

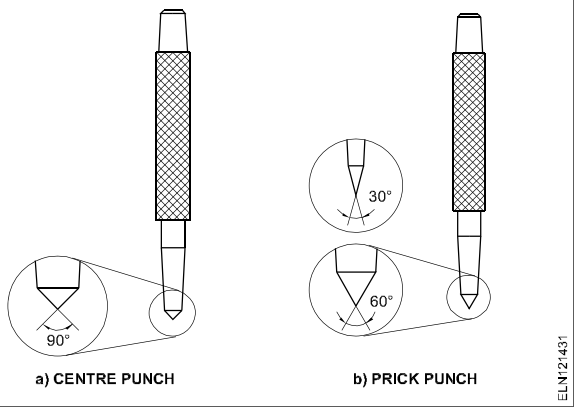
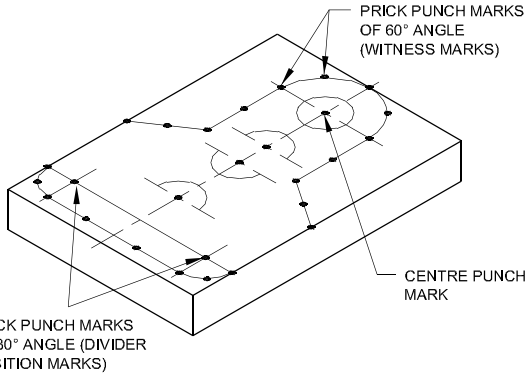


Fig 2



Types of calipers

Objectives: At the end of this lesson you shall be able to

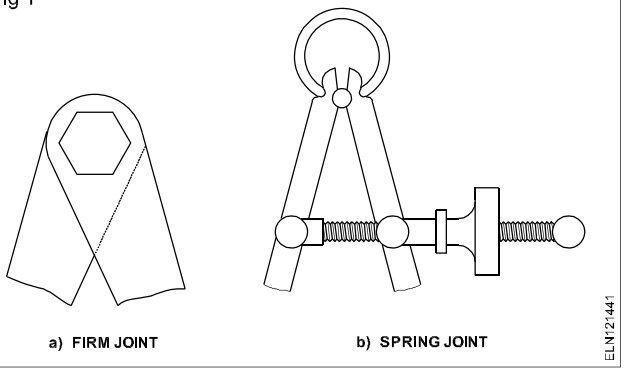
- **name the commonly used calipers**
- **compare the features of firm joint and spring joint calipers**
- **state the advantages of spring joint calipers.**

Calipers (firm and spring joints) : Calipers are simple measuring instruments used to transfer measurements from the steel rule to objects and vice versa.

The commonly used calipers are:

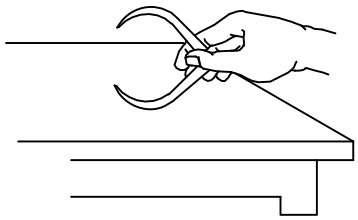
- firm joint calipers (Fig 1a)
- spring joint calipers. (Fig 1b)

Fig 1



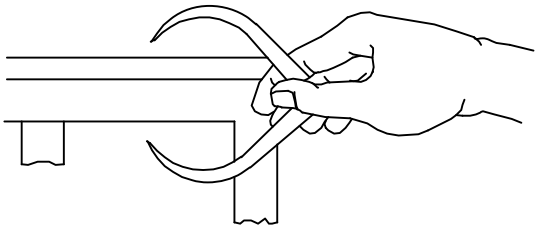
Firm joint calipers : In the case of firm joint calipers both legs are pivoted on one end. To take measurement of the workpiece, it is opened roughly to the size. Fine setting is done by lightly tapping it on a wooden surface. (Figs 2 & 3)

Fig 2



Spring joint calipers: For these type of calipers, the legs are assembled by means of a pivot loaded with a spring. For opening and closing of the caliper legs a screw and nut are provided.

Fig 3



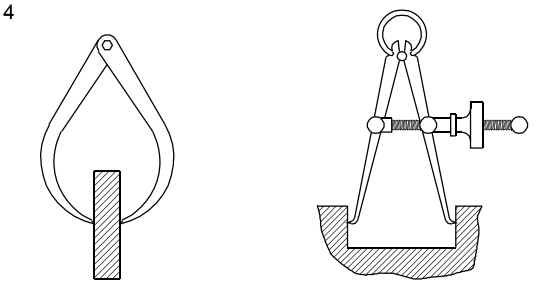
Spring calipers have the advantage of quick setting. The setting made will not change unless the nut is turned. Caliper sizes are specified by the length which is the distance between the pivot centre and the tip of the leg.

Accuracy of the measurement taken depends very much on the sense of `FEEL' or `TOUCH' while measuring the job. You should get the feel when the legs are just touching the surface.

Outside and inside measurements: Calipers used for outside measurements are known as outside calipers while calipers used for internal measurements are the inside calipers. (Figs 4a & 4b)

Calipers are used with steel rules whose accuracy is limited to 0.5 mm; parallelism can be checked with a higher degree of accuracy.

Fig 4



Jenny calipers

Objectives: At the end of this lesson you shall be able to
- **state the constructional features of jenny calipers**
- **name the types of jenny calipers**
- **state the uses of jenny calipers.**

Jenny calipers: Jenny calipers are used for marking and layout work.

These calipers are also known as

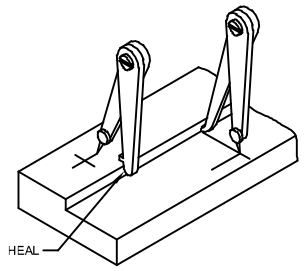
- hermaphrodite calipers
- odd leg calipers
- leg and joint calipers

Jenny calipers have one leg with an adjustable divider point while the other is a bent leg. The legs are joined together to make a firm joint.

Uses

- To mark lines parallel to edges inside and outside. (Fig 1)

Fig 1

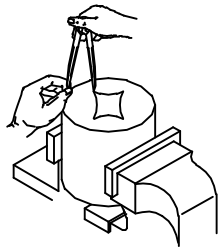


JENNY CALIPERS

ELN121451

- To locate the centre of round bars. (Fig 2)

Fig 2



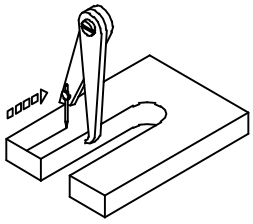
CENTRE LOCATION OF ROUND BAR

ELN121452

Calipers are available with the usual bent leg or with a heel. Calipers with ordinary bent legs are used for drawing lines parallel along an inside edge, while the heel type is used for drawing parallel lines along the outer edges.

Jenny calipers can also be used for scribing lines along curved edges. While setting dimensions and scribing lines, both legs should be of equal length. (Fig 3)

Fig 3

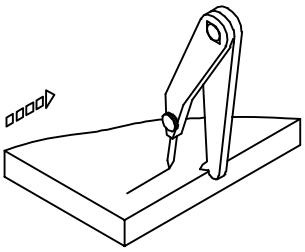


JENNY CALIPER

ELN121453

The jenny caliper should be slightly inclined while scribing lines, Fig 4.

Fig 4

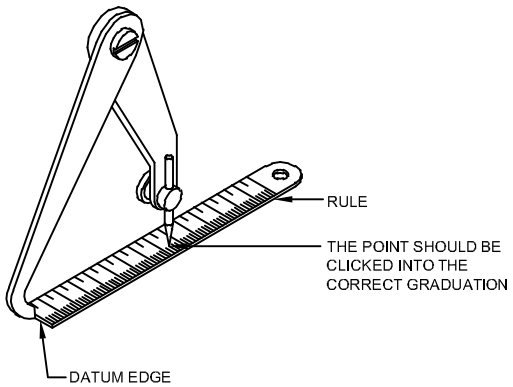


SCRIBING WITH JENNY CALIPER

ELN121454

While setting dimensions for accurate setting, the jenny caliper's point should `click' into the graduation, Fig 5.

Fig 5



ACCURATE MEASUREMENT SETTING

ELN121455

Length measurement

Objectives: At the end of this lesson you shall be able to
- **name the base unit of length measurement as per SI (System of International)**
- **state the multiples of metre and their values.**

Length measurement SI units: When we measure an object we are actually comparing it with a known standard of measurement.

The base unit of length as per SI is the metre.

Length: SI unit and multiples

Base unit: The base unit of length as per the System Internationale is the metre.

Metre (m)	=	1000 mm
Centimetre (cm)	=	10 mm
Millimetre (mm)	= 0.001 m	= 10^{-3} m
1 Micrometre μm	= 10^{-6} m	= 0.000001 m
1 Micrometer	= 10^{-3} mm	= 0.001 mm

Measurement in engineering practice: Usually, in engineering practice, the preferred unit of length measurement is the millimetre. Both large and small dimensions are stated in millimetres.

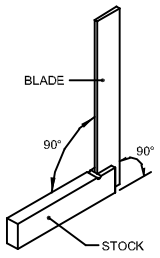
The British system of length measurement: The other system of length measurement is the British system. In this system the base unit is the imperial standard yard. Most countries including Great Britain have, however, switched over to the SI units in recent years.

Try square

Objectives: At the end of this lesson you shall be able to
- **name the parts of a try square**
- **state the uses of a try square.**

Try square: The try square is a precision instrument which is used to check squareness (angles of 90°). The accuracy is about 0.002 mm per 10 mm length, which is accurate enough for most workshop purposes. The try square has a blade with parallel surfaces. The blade is fixed in the stock at 90°. (Fig 1)

Fig 1



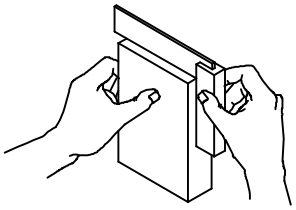
TRY SQUARE

ELN121461

The try square is used to

- check the squareness of machined or filed surfaces. (Fig 2)

Fig 2

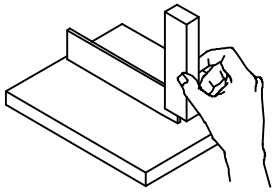


CHECKING SQUARENESS

ELN121462

- check the flatness of surfaces (Fig 3)

Fig 3

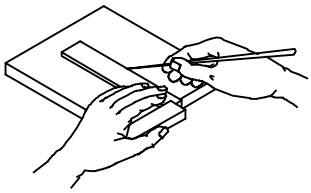


CHECKING FLATNESS

ELN121463

- mark lines at 90° to the edges of workpieces (Fig 4)

Fig 4

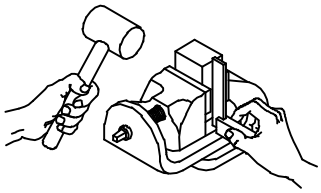


MARKING LINES

ELN121464

- set workpieces at right angles on work-holding devices. (Fig 5)

Fig 5



RIGHT ANGLES ON WORK HOLDING DEVICES

ELN121465

Try squares are made of hardened steel.

Try sqaures are specified according to the length of the blade i.e. 100 mm, 150 mm, 200 mm.

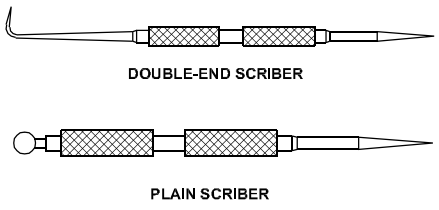
Scriber, divider

Objectives: At the end of this lesson you shall be able to
- **state the features of scribers and dividers**
- **state the uses of scribers and dividers.**

Scriber: A scriber is a sharp, pointed, steel tool made from carbon tool steel. There are two types of scribers.

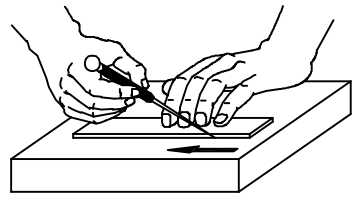
- Double end and plain scribers (Fig 1)

Fig 1



Uses: Used for scribing lines on the metal being laid out. (Fig 2)

Fig 2

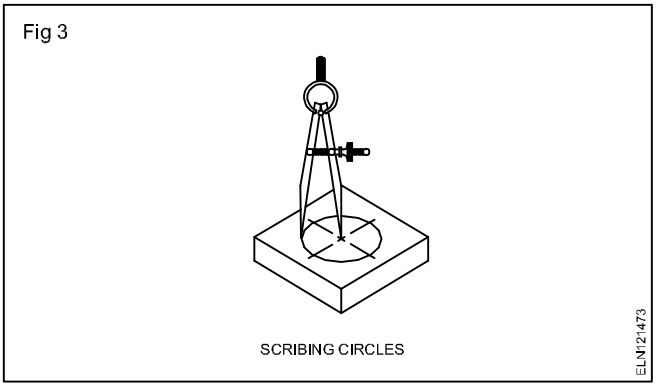


Divider: A divider consists of a pair of steel legs adjusted by a screw and nut, and held together by a circular spring at one end. A handle is inserted on the spring.

Uses: A divider is used for

- measuring distances between points
- transferring measurements directly from a rule
- scribing circles and arcs on metals. (Fig 3)

Fig 3



Radius gauges

Objectives: At the end of this lesson you shall be able to
- **state the uses of radius gauges**
- **state the features of radius gauges.**

Radius gauges: Radius gauges are used to check the internal and external radius of workpieces.

These gauges are made of high quality steel sheets and are finished to accurate radius.

The radius of parts are checked by comparing the radius of the gauges.

Radius gauges are available in sets of several blades held in a holder. Each blade can be separately pulled out of the holder when in use.

The size of the radius is marked on individual blades of the gauges. (Fig 1)

Fig 1

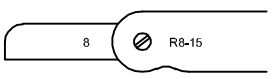
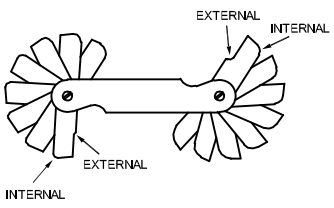


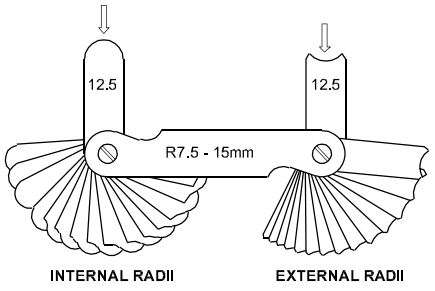
Fig 2



The radius gauges are available in different combinations.

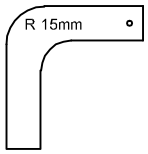
– Sets with internal and external radius.(Figs 2 & 3)

Fig 3



– Individual gauges for each radius. (Fig 4)

Fig 4



Before using radius gauges:

- ensure the gauges are perfectly clean
- remove burrs, if any, from the workpiece
- check and make sure there is no damage to the profile of the gauge.

Universal surface gauge

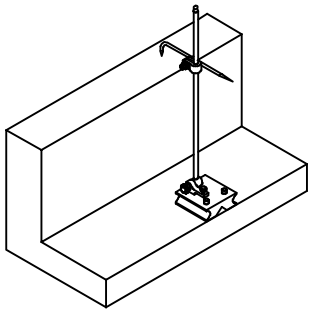
Objectives: At the end of this lesson you shall be able to

- **state the constructional features of surface gauges**
- **name the different types of surface gauges**
- **state the uses of surface gauges**
- **state the advantages of universal surface gauges.**

Universal surface gauge : A surface gauge is one of the most common marking tools used for:

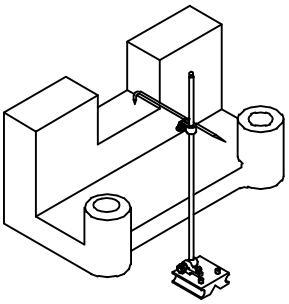
- scribing lines parallel to a datum surface (Fig 1)

Fig 1



- setting jobs on machines parallel to a datum surface (Fig 2)

Fig 2

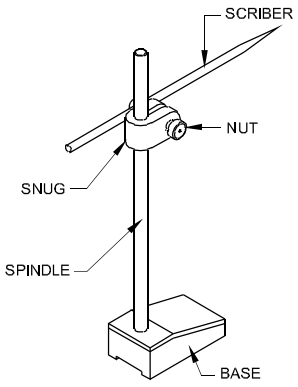


- checking the height and parallelism of jobs
- setting jobs concentric to the machine spindle.

Types of surface gauges: A surface gauge/scribing block is of two types.

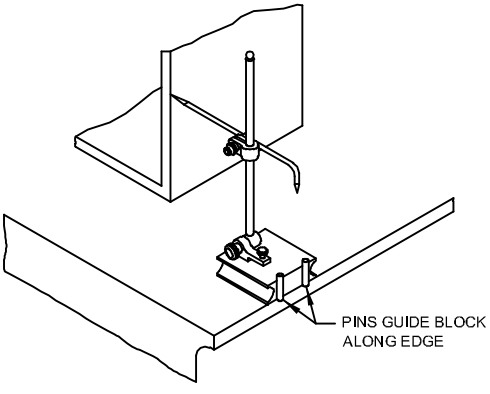
- Fixed Surface gauge (Fig 3)

Fig 3



- Universal Surface gauge(Fig 4)

Fig 4



Surface gauge (fixed type)**:** This consists of a heavy flat base and a spindle, fixed upright to which a scriber is attached with a snug and a clamp nut.

Universal surface gauge: This has the following additional features.

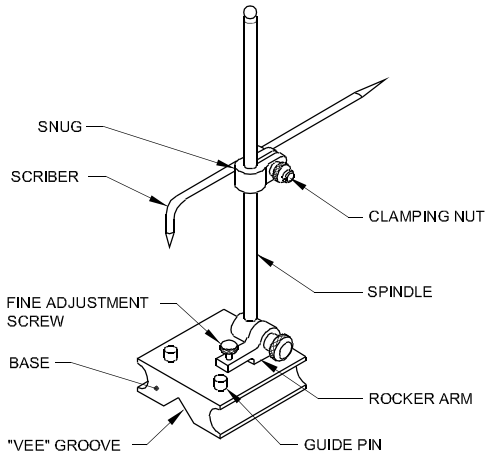
- The spindle can be set to any position.
- Fine adjustments can be made quickly.
- Can also be used on cylindrical surfaces.
- Parallel lines can be scribed from any datum edge with the help of guide pins.(Fig 4)

Parts and functions of a universal surface gauge (Fig 5)

Base: The base is made of steel or cast iron with a `Vee' groove at the bottom. The `Vee' helps to seat on the circular work. The guide pins fitted in the base are helpful for scribing lines from any datum edge.

Rocker arm: A rocker arm is attached to the base along with a spring and a fine adjustment screw. This is used for fine adjustments.

Fig 5



UNIVERSAL SURFACE GAUGE

ELN1214S5

Spindle: The spindle is attached to the rocker arm.

Scriber: The scriber can be clamped in any position on the spindle with the help of a snug and clamp nut.

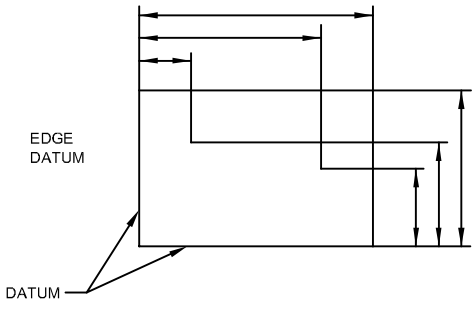
Datum

Objectives: At the end of this lesson you shall be able to
- **state the need for datum while marking**
- **name the different datum points, surfaces or lines**
- **state the basis of determining the datum while marking.**

Datum: The height of a person is measured from the floor on which he stands. The floor becomes the common basis for measurement, i.e. it becomes the DATUM.

A datum is a reference surface, line or point and its purpose is to provide a common position from which measurements may be taken. The datum may be an edge or centre line depending on the shape of the work. For positioning a point, two datum references are required. (Figs 1 and 2)

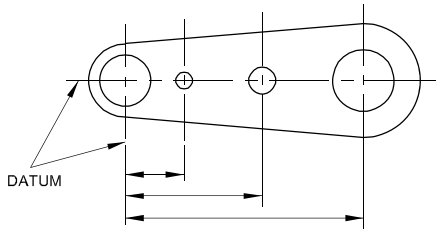
Fig 1



DATUM EDGE LINE

ELN1214A1

Fig 2

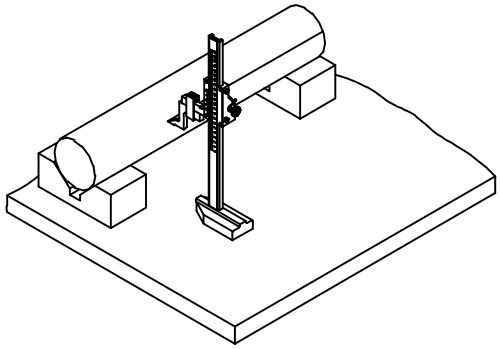


DATUM CENTRE LINE

ELN1214A2

Marking table, surface plate, angle, plate, vee blocks and parallel blocks - all these serve as datum references. (Figs 3 and 4)

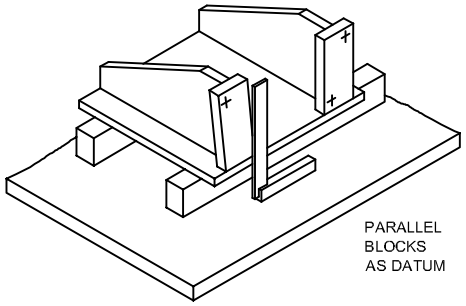
Fig 3



DATUM MARKING ANGLE

ELN1214A3

Fig 4



DATUM MARKING PLATE

ELN1214A4

The datum should be indicated in the drawing.

The same datum must be used for transferring dimensions to the workpiece.

Carpenter tools - wood saws - planes - wooden joints

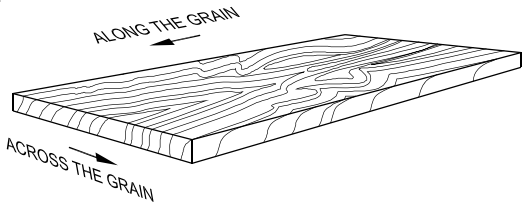
Objective : At the end of this lesson you shall be able to
- **state about the timber**
- **state the grain direction of wood and the common defects in timber**

Timber is a raw material used for manufacturing wooden articles. Timber is a product of a tree.

Wood is made up of numerous tube like cells packed closely together. During the growth of the tree, these cells are positioned in a certain direction. The direction of these cells is referred to as the `grain'. The direction of the grain can be identified by the visible lines on the surface of the timber.

Any operation performed in the grain direction is called an operation `along the grain'. (Fig 1)

Fig 1



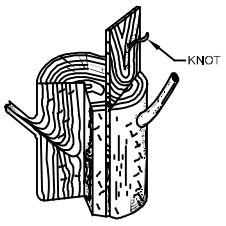
GRAIN DIRECTION IN WOOD

Any operation performed at right angle to the grain direction is called `across the grain'.

Any irregularity occuring in the timber is a defect in the timber. These defects in the timber reduce its strength, durability and utility value.

Common defects in timber : A knot is caused due to the growth of branches on the tree. It appears on the surface of planks and on boards when the logs are sawn. (Fig 2)

Fig 2

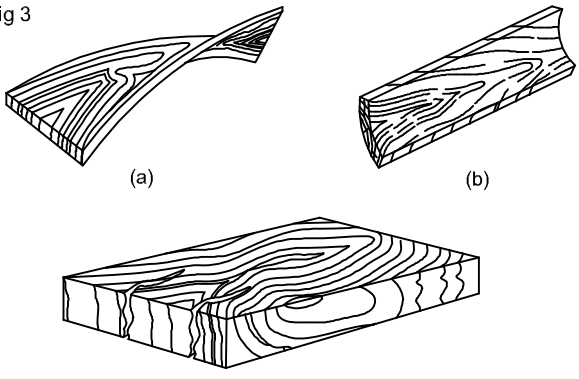


TIMBER WITH KNOT

The following defects are caused due to uneven shrinkage, improper seasoning and defective storage.

- Twisting (Fig 3a)
- Cupping (Fig 3b)
- Cracking (Fig 3c)

Fig 3



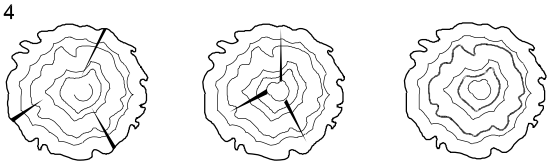
DEFECTS IN TIMBER

Shakes

- Radial shake (Fig 4a)
- Star shake (Fig 4b)
- Cup shake (Fig 4c)

Avoid defective pieces while selecting timber to get better results.

Fig 4



Marking and measuring tools

Objectives : At the end of this lesson you shall be able to
- **name the marking and measuring tools and their functions**
- **state the functions of straight edge, marking gauge and wooden folding rule**

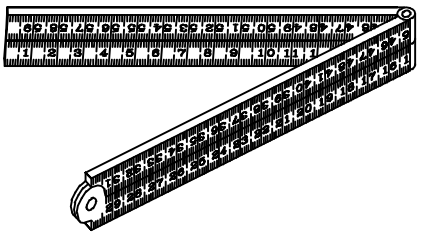
Marking and measuring tools are used in woodwork for marking, measuring and checking the work at various stages.

Common marking tools

- Wooden folding rule
- Steel rule

Wooden folding rule: A wooden folding rule is graduated both in centimetres and inches. The most commonly used is the two feet, 4-fold wood rule which is shown in Fig 1.

Fig 1



WOODEN FOLDING RULE

ELN121521

It is used for taking linear measurements, to an accuracy of 1 mm or 1/16th of an inch.

Steel rule : It is graduated in centimetres/inches with their subdivisions. The reading accuracy is 0.5 mm.

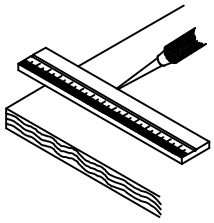
Common marking tools

They are:

- straight edge
- marking gauge
- try square.

Straight edge: It is made of steel with perfect straight and parallel edges. It is normally used for drawing straight lines on a job. It can also be used for testing flatness of a surface and straightness of an edge. (Fig 2)

Fig 2



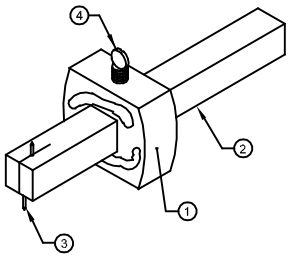
STRAIGHT EDGE

ELN121522

Marking gauge: It is a marking tool,consisting of (1)stock,(2)stem ,(3)spur and (4) thumb (locking) screw as shown in Fig 3.

The stock can be adjusted over the stem to set the required distance between the spur and the face of the stock. The thumb screw is tightened to retain the measurement. The spur, a pointed steel, inscribes lines on the surface of the wood.

Fig 3

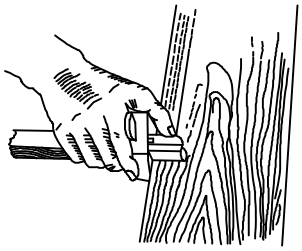


MARKING GAUGE

ELN121523

It is used for marking lines parallel to the face or edges. (Fig 4)

Fig 4



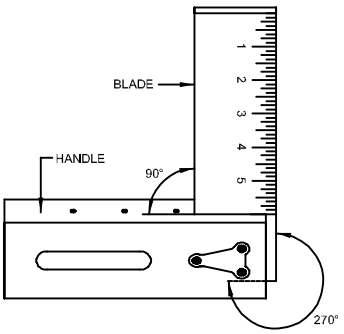
MARKING LINES WITH MARKING GAUGE

ELN121524

Try square : It is used for checking marking lines at right angles. It is also used for checking right angles and flatness of surfaces.

The parts of a try square are shown in Fig 5. It is available in different sizes, from 150 mm to 800 mm.

Fig 5



TRY SQUARE

ELN121525

Remember: Keep these tools separately from the other tools to prevent damage.

Avoid dropping or knocking them off the workbench.

The mallet

Objectives: At the end of this lesson you shall be able to
- **state the constructional feature of mallet**
- **state the use of mallets**
- **state specification of mallets.**

The mallets are made of hard wood and it is used in place of hammer. But the difference is head only.

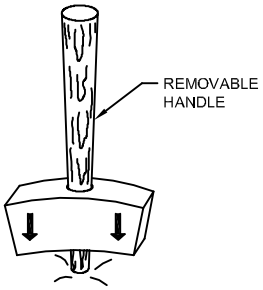
Mallet are used for driving wood chisels and for adjusting wooden planes. It is used for assembling and dismantling wooden works and for adjusting stop dogs in the work bench.

The handle is made of beech or ash with straight grained fibres. The head is made of hard wood with twisted fibres. This prevents splitting of the wood.

A special type of mallet is made of 'Ligno stone' which is made of special wood that is treated with heat and high pressure.

Some mallets have removable handles (Fig 1) which can be taken out of the head easily so that parts can be stored easily. Fig 2.

Fig 1



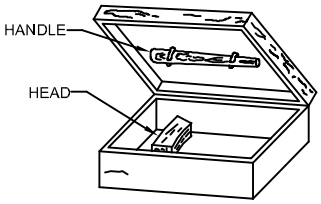
REMOVABLE HANDLE MALLET

ELN121531

The striking faces of mallet heads are so bevelled so that they can hit the chisel. For most purposes a head of 110 mm long, 80mm wide and 60 mm thick is suitable. The handle is driven in from the top and is tapered in its width. Its head is either round or square. (Fig 3)

The mallet is held upside down and dropped once or twice on the work bench, the head of the mallet will be tightened on the handle.

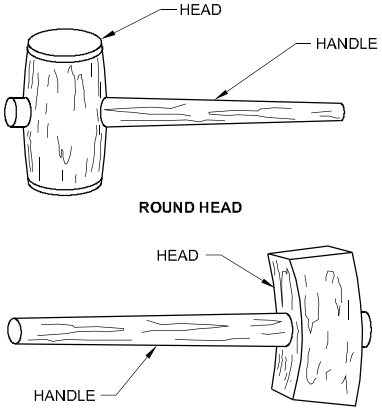
Fig 2



STORING OF MALLET

ELN121532

Fig 3



ROUND HEAD

SQUARE HEAD

ELN121533

Carpenter's hammer

Objectives : At the end of this lesson you shall be able to
- **state the uses of an carpenter's hammer**
- **name the parts of a carpenter's hammer and state their function**
- **name the type of carpenter's hammers with specification**

A carpenter's hammer is a hand tool used for striking purpose while

1 punching

2 striking

3 pulling

- The major parts of a hammer are a head and a handle
- The head is made of drop-forged carbon steel
- The wooden handle must be capable of absorbing shock.

Parts of hammer head (Fig 1)

Handle

Pein

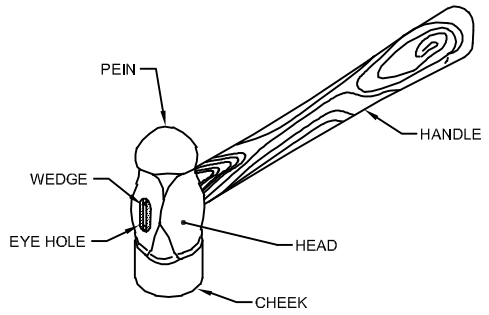
Cheek

Eye hole

Cheek

The cheek is the striking portion slight convexly is given to it to avoid digging of the edge.

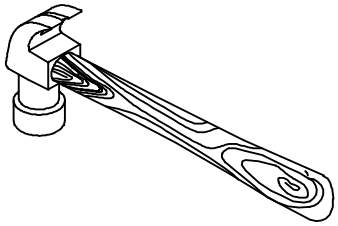
Fig 1



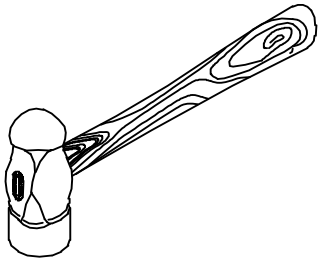
HAMMER HEAD PARTS

ELN121541

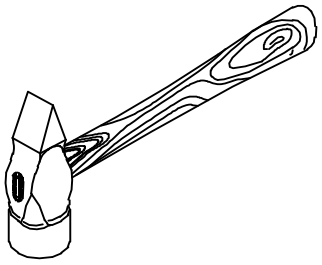
Fig 2



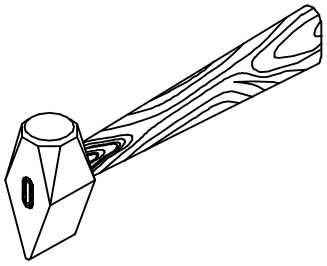
CLAW HAMMER



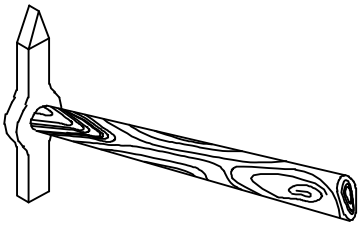
BALL PEIN HAMMER



CROSS PEIN HAMMER



STRAIGHT PEIN HAMMER



TACKS HAMMER

TYPES OF HAMMERS

ELN121542

Pein (Fig 2)

The pein is the other end of the head.

It is used for shapping and forming. Work like Rivetting and bending the pein is of different shapes like (Fig 2)

1 Ball pein (hammer)

2 Cross pein (hammer)

3 Straight pein (hammer)

4 Claw (hammer)

5 Tacks (hammer)

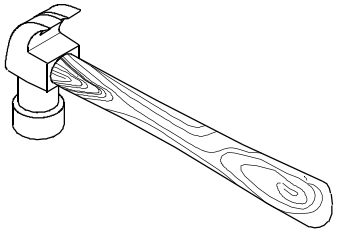
Eye hole

An eye hole is meant for the handle. It is shaped to fit the handle rigidly. The wedges fix the handle in the eye hole.

Specification

Carpenter's hammer's are specified by their weight and the shape of the pein. Their weight varies from 125gms to 1500gms.

Fig 3



CLAW HAMMER

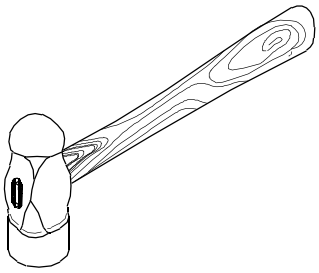
ELN121543

Claw hammer (Fig 3)

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 nail into the wood and other striking purposes and the claw is used for extracting the nails out of the wood. Its size is designated by its weight and it varies from 0.25kg to 0.75 kg.

Ball pein hammer (Fig 4)

Fig 4



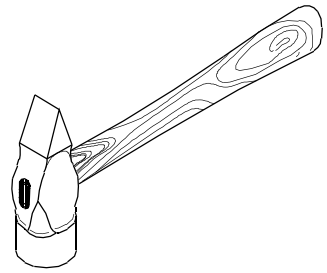
BALL PEIN HAMMER

ELN121544

It is made of cast steel and weight of about 110 gm to 910 grams. It is also called as engineers' hammer. One side of it is in the shape of ball and hence the name it is also used for riveting.

Cross pein hammer (Fig 5)

Fig 5



CROSS PEIN HAMMER

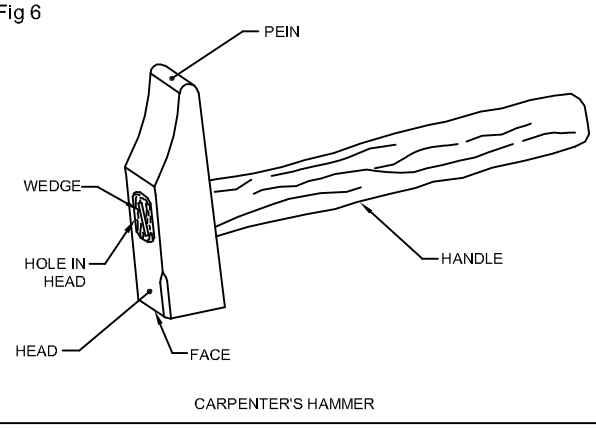
ELN121545

The head part of this hammer is across the handle and hence the name. It is used for all light works.

Due to this magnetism nails and screws are taken easily and is used to hammer or strike very thin nails. Some times it is called as pin hammer. It is weight is 100gms.

Carpenters' hammer (Fig 6)

Fig 6



CARPENTER'S HAMMER

ELN121546

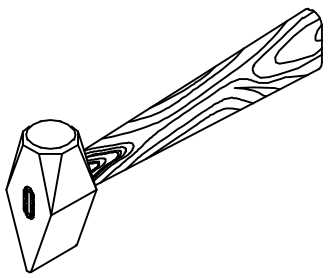
The hammer head has a rectangular or oval hole which is tapered on the inside. The shape of this hole offers a good hold for the handle when wedged.

The handle must firmly be secured in the head to prevent accidents. The wedge is driven diagonally into the end of the handle. The wood splits and is pressed against the inner wall of the hole.

In carpenter shop it is called as warrington hammer. To extend the iron frames, for bending and for other works it is used. Its weight varies from 220gms to 910gms.

Straight pein hammer (Fig 7)

Fig 7



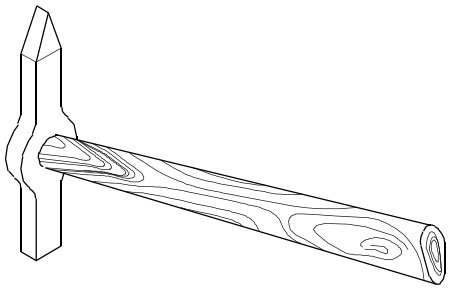
STRAIGHT PEIN HAMMER

ELN121547

The hammer head is straight to the hammer handle. The bottom part of the head is large and tapering towards end side. It is used in rivetting and to extend metal frames. Its weight is 110gm and varies up to 900gms.

Tacks hammer (Fig 8)

Fig 8



TACKS HAMMER

ELN121548

It is lesser in weight than all other hammers. The hammer head is straightly fitted to the handle of hammer. It has slight magnetic properties.

Precaution

Make sure the handle is properly fitted. Select a hammer with correct weight suitable for the job.

Check the head and handle for any cracks. Ensure the face of the hammer is free from oil and grease.

Wood working saws

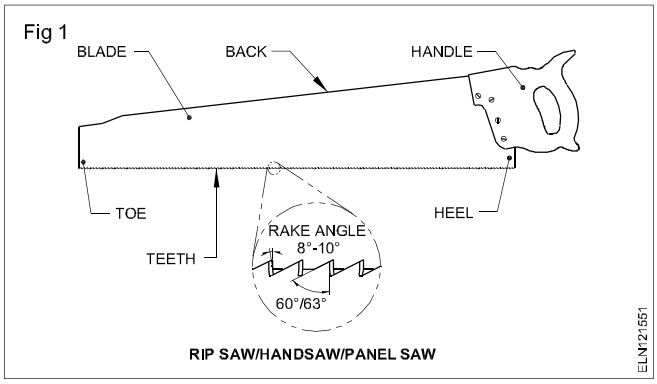
Objectives: At the end of this lesson you shall be able to
- **state the functions and use of a handsaw**
- **distinguish between a tenon-saw and a handsaw**
- **illustrate the setting of the teeth of a saw.**
- **name the various holding tools and their application**

The saws are used to cut the timber to the required shapes and sizes.

The saws most commonly used by an electrician are:

- handsaw
- tenon-saw.

Handsaw: Figure 1 shows the parts of a handsaw. They are the handle and the blade.



Handle: It is generally made of wood.

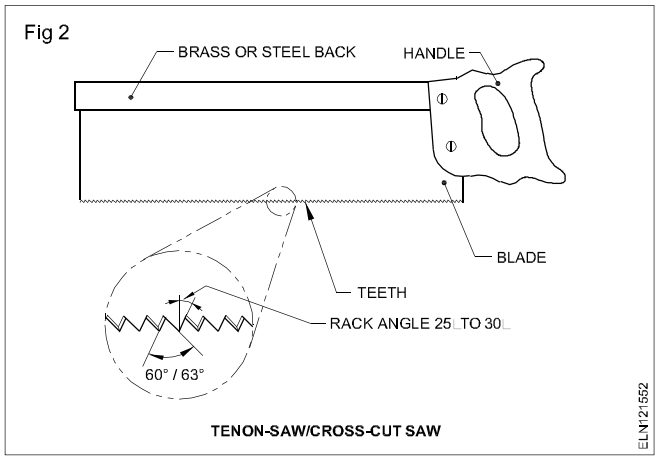
Blade: It is made of tempered steel having teeth on the lower edge. The best quality saws are made from spring steel which decreases in thickness slightly from the teeth to the back.

The blade is about 66cm (26 inches) long, and normally has 2 1/4 teeth per cm (6tpi). The number of teeth of a handsaw varies up to 4 teeth per cm (10tpi).

A saw blade with less number of teeth per inch has bigger teeth. Therefore, it is used for rough work as it cuts quickly.

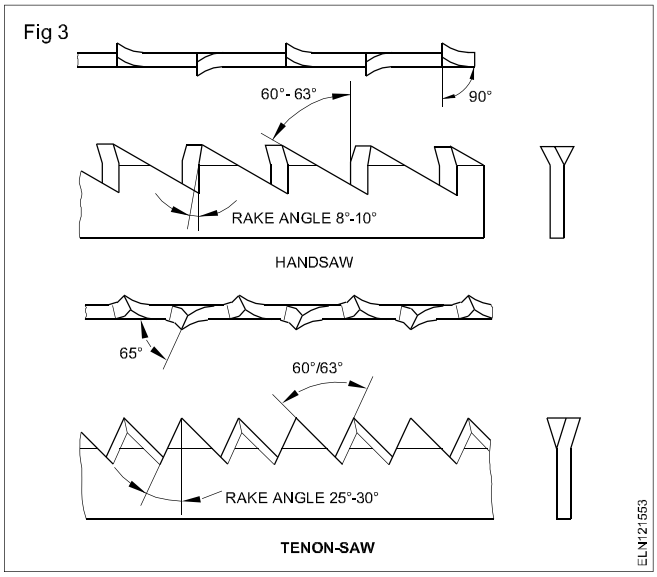
Tenon-saw: The tenon-saw is intended for finer work and is manufactured with a thinner blade. It is used for general bench work such as joint construction, where more accuracy is needed.

This saw is also known as the back saw. (Fig 2)



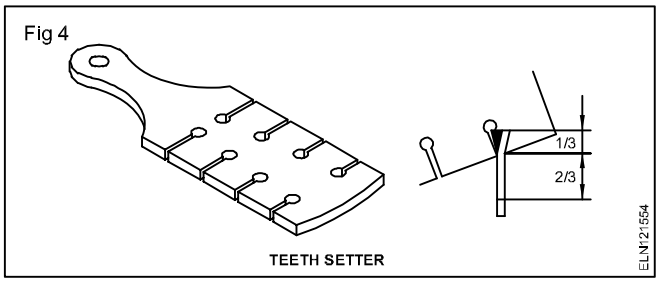
The blade is stiffened with a brass or steel back. The blade is about 30cm (12 inch) long. The number of teeth of a tenon-saw is 12 to 14 per inch.

Tooth geometry: The angle between the trailing edge of one tooth and the leading edge of another is constant at about 60° - 63° on all styles of saws. The angle on the leading edge of the tooth varies according to the style of saw, and the purpose for which it is designed. (Fig 3)

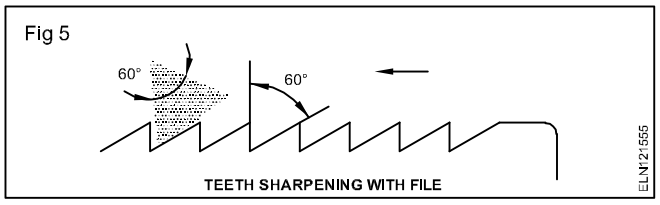


The hand saw has a rake angle of 8° to 10°. The tenon-saw has a rake angle of 25° to 30°.

Setting of teeth: The teeth are set using setters as shown in Fig 4. It helps to keep the blade free in the cut slit.



Sharpening the blunt teeth is done with a triangular file as shown in Fig 5.



Uses: This saw is used for cutting tenons, sawing sides of trenches and for general bench work and for cutting in round blocks and T.W. battens and T.W. boards for wiring purposes.

Always use the right saw for the right job.

Do not apply excessive force to the saw while cutting as very little effort is required to operate a sharpened saw.

Holding devices

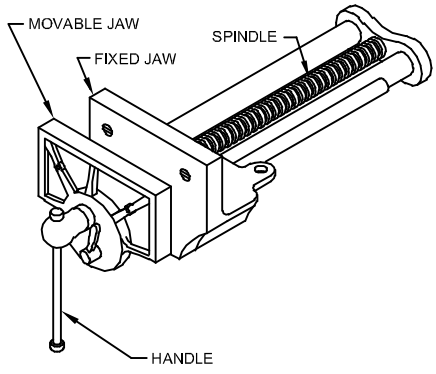
In woodwork various holding devices are used to hold thewhile performing different operations such as planing, chiselling, sawing and filing.

The common holding tools are:

- woodworker's vice/carpenter's vice.
- `G' clamp.
- bench hook.

Woodworker's vice (Fig 1)**:** It is made of metal and is fitted to the workbench. It is available in various sizes.

Fig 1

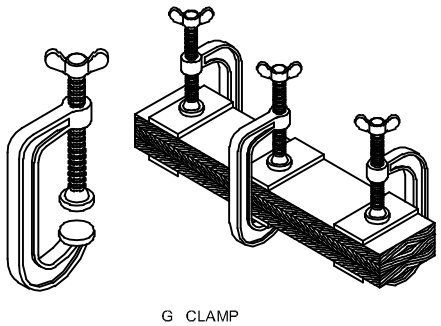


WOOD WORKER'S VICE

It consists of two jaws - movable and fixed. The anticlock-wise rotation of the handle, attached to the spindle, causes the movable jaw to open. The job is held between the two jaws by rotating the handle in the clockwise direction.

G Clamp (Fig 2)**:** It is a metal clamp in the shape of the letter`G' used for holding the job to the bench, while sawing or chiselling. It is also used to hold small parts of a job for gluing.

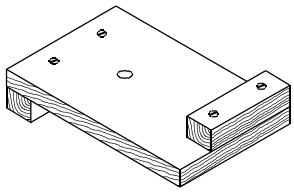
Fig 2



G CLAMP

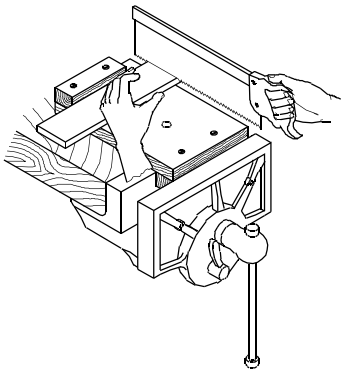
Bench hook: It is also known as cutting board and made of hardwood. (Fig 3) It is used to hold the job while sawing or chiselling and at the same time protecting the workbench and surface from damages. (Fig 4)

Fig 3



BENCH HOOK OR EARTHING BOARD

Fig 4



THE USE OF BENCH HOOK WHEN SAWING SMALL PIECES

Using a tenon-saw and a bench hook

- Position the bottom rail of the bench hook against the edge of the bench or hold it in the vice.
- Place the timber against the top rail of the hook, the cutting mark just clear of the edge.
- Grip the timber and the top rail together. Use the thumb to act as a guide for the saw at the start of the cut.

Keep your thumb clear off the saw teeth.

Bench planes

Objectives: At the end of this lesson you shall be able to
- **state the different types of planes and their functions**
- **state the purpose of setting the jack plane blade.**
- **state the parts and function of a rebate plane**

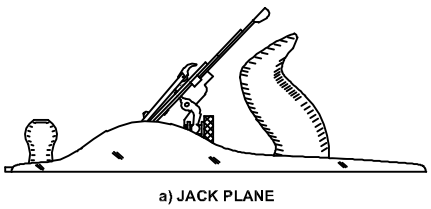
Planes are used for producing flat and smooth surfaces by taking off thin shavings of wood. Different types of planes are used for this purpose.

Types of planes

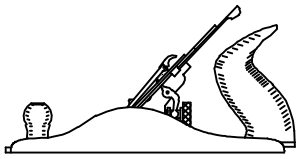
The most commonly available types of planes are:

- jack plane (Fig 1a)
- smoothing plane (Fig 1b)
- rebate plane. (Fig 1c)

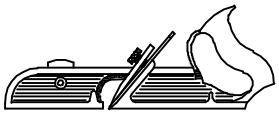
Fig 1



a) JACK PLANE



b) SMOOTHING PLANE



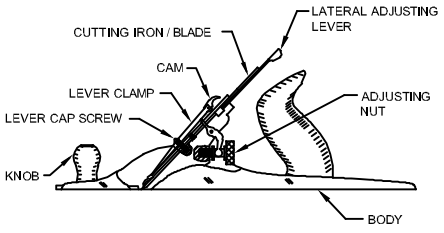
c) REBATE PLANE

TYPES OF PLANES

ELN121571

Jack plane: It is used for initial planing of timber to bring the size nearer to the required measurements. Its main parts are indicated in Fig 2.

Fig 2



JACK PLANE

ELN121572

These parts are made of different materials as listed below.

Body	–	iron
Handle	–	wood
Knob	–	wood
Cutting iron/blade	–	tungsten steel
All other parts	–	metal

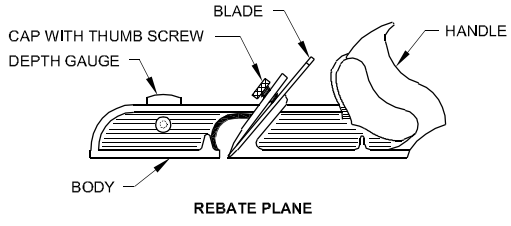
The size of the plane commonly used by an electrician is 350 mm long with a 50 mm blade.

Smoothing plane: It is used for finishing the job to the required size, and for planing small wooden pieces/parts of the job. It is shorter in length as compared to the jack plane. (Fig 1b)

The parts of a smoothing plane are similar to those of the jack plane. (Fig 2)

Rebate plane: It is used for planing or finishing rebates i.e. rectangular recesses cut along or across the edge. Its main parts are shown in Fig 3.

Fig 3



REBATE PLANE

ELN121573

The width of the plane and blade is less as compared to that of the jack plane.

Ensure that the blades are well sharpened before use. Always use the approporiate type of plane for a given job.

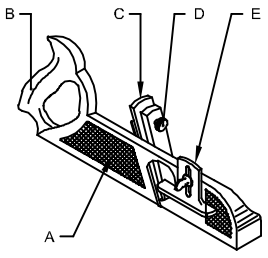
Rebate plane - parts and their functions

A rebate plane is used for planing and finishing the rebates.

Parts of a rebate plane

A metal rebate plane: A metal rebate plane consists of the following parts. (Fig 1)

Fig 1



REBATE PLANE

ELN121581

A **Body:** Made of metal with its face perfectly flat.

B **Handle:** It is the integral part of the body.

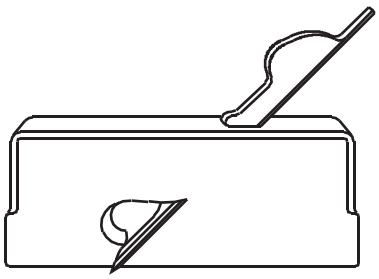
C **Blade:** It is made of well tempered steel.

D **Cap with thumb screw:** It is made of metal and it holds the cutter in position.

E **Depth gauge:** It is made of metal attached to one side of the plane, and it can be adjusted according to the depth of the rebate.

Wooden rebate plane: It consists of the following parts. (Fig 2)

Fig 2



WOODEN REBATE PLANE

ELN121582

Body: made of wood and holds the other parts.

Blade: made of well tempered steel.

Wedge: made of wood to hold the blade in the body to a set position.

Be sure that the blade is sharp and it is set squarely to its base before use.

Drill bits - Types and sizes

Objectives: At the end of this lesson you shall be able to
- **state the different types of drill bits, and their uses**
- **state the parts of a drill bit.**
- **state the different types of nails, wood screws and their uses**

For marking round holes in different types of materials, such as metal, wood, plastic etc. drills are used.

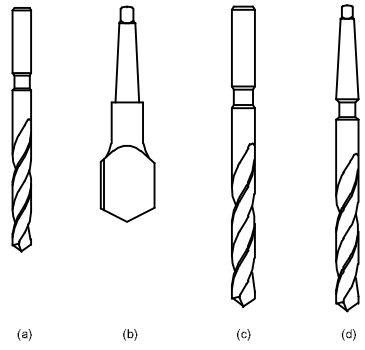
Types of drill bits

The most common drill bits are (a) twist drill and (b) flat drill.

Twist drills may be:

- parallel shank
- taper shank drills. (Fig 1)

Fig 1



TAPER SHANK DRILLS

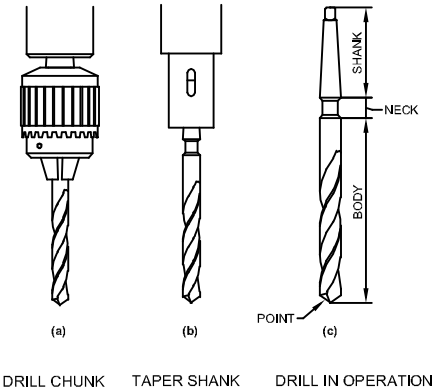
ELN121591

Parallel or straight shank drills are held in the drill chuck. (Fig 2a)

Taper shank drills are held in taper sockets in the drilling machine. (Fig 2b)

Parts of a twist drill: A twist drill consists of a body, point, neck and shank. The point comprises the cutting elements, while the body guides the drill in operation. (Fig 2c)

Fig 2

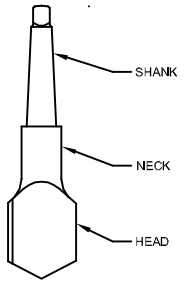


DRILL CHUNK TAPER SHANK DRILL IN OPERATION

ELN121592

Parts of a flat drill: The flat drill consists of a head, neck and shank. It has a tapered shank. (Fig 3)

Fig 3



FLAT DRILL

ELN121593

Flat drill is used for drilling shallow holes in heavy works.

Sizes of the drill bits: Drills are available in various sizes. The size of the drill is indicated on the plain portion of its shank.

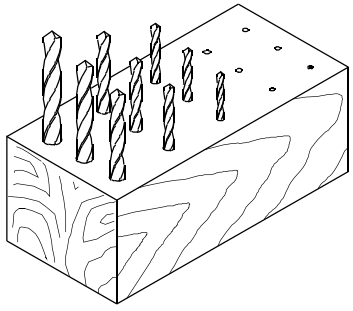
Parallel shank drills are available in small sizes up to 12mm diameter.

Taper shank drills are available in sizes from 3mm to 50mm dia.

To protect the twist drill bits from damage, place them separately in small boxes/containers. (Fig 4)

These chill bits are attached to either hand drilling machine or electric drilling machine to drill holes.

Fig 4



DRILL BIT-BOX

ELN121594

Types of nails and wood screws

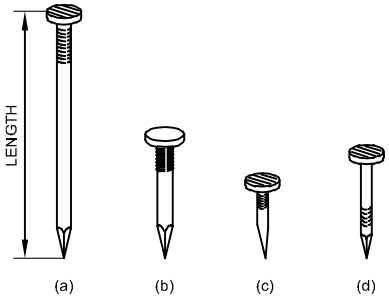
Both nails and screws are used as fasteners in woodwork. Nails are used for cheaper types of work, and screws are used for a better class of work where additional strength and durability is a must.

Specification of nails: Nails are specified stating their

- length,
- type, and
- gauge number.

Length in the case of nail includes the head of the nail. (Fig 1)

Fig 1



NAILS

ELN1215A1

`Type' includes shape of the head, cross-section, purpose, and the metal the nail is made of.

Gauge is indicated by a number in accordance with the standard wire gauge, where higher gauge number indicates a smaller diameter of nail and vice versa.

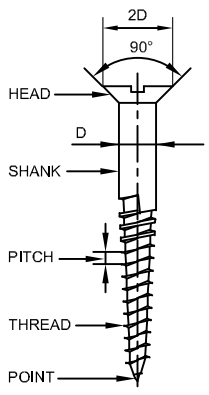
Types of nails: There are different types of nails made for different purposes. Those that are generally used in electrical work are:

- wire nail (Fig 1a)
- wire clout nail (Fig 1b)
- cut tack or stud (Fig 1c)
- wire tack. (Fig 1d)

Specification of screws: Screws also are specified in a similar way as nails are i.e. stating their length, designation number, type and the metal they are made of.

Parts of a wood screw: The parts of a wood screw are shown in Fig 2.

Fig 2



WOOD SCREW

ELN1215A2

Head : Uppermost part

Shank : Plain or unthreaded portion of 1/3 of the length of the screw.

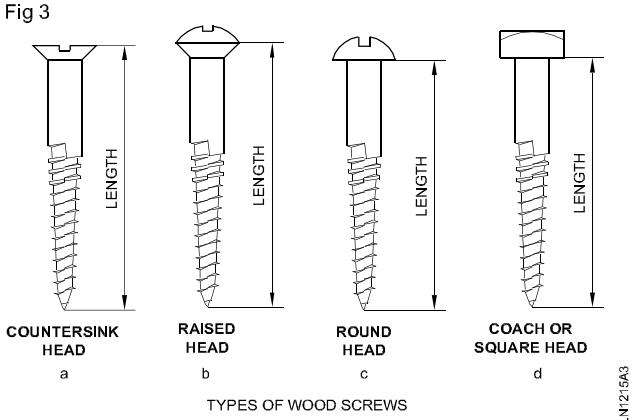
Pitch : It is the distance between adjacent threads

Point : The sharp edge of the screw end.

Thread : A special ridge around the core.

Length is measured from the point of the screw to the portion it can enter the timber. (Fig 3)

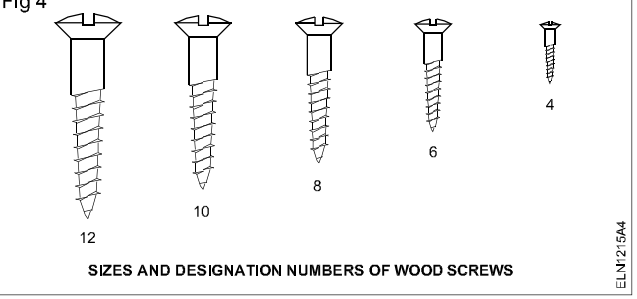
Fig 3



TYPES OF WOOD SCREWS

The designation number of a screw indicates the diameter of the unthreaded shank. The screw number and the corresponding diameter of the shank are given in IS 6739, 6736 and 6760. The screw number is the screw designation. It is different from the SWG of wire nails. (Fig 4)

Fig 4



SIZES AND DESIGNATION NUMBERS OF WOOD SCREWS

Types of screws

According to the shape of the head, screws are classified into:

- **slotted countersunk (flat) head wood screw (Fig 3a)**
  - used for general purpose (IS:6760-1972)
- **slotted countersunk raised head wood screw (Fig 3b)**
  - used for fixing thick sheets to woods (IS:6736-1972)
- **slotted round head screw (Fig 3c)**
  - It is used for fixing thin sheets to woodwork. (IS:6739-1972)
- **coach or square head screw (Fig 3d)**
  - is used for heavy duty work. It is tightened using spanner.

Availability: Wood screws are generally made of mild steel, aluminium and brass, and are from 8 mm to 200 mm length, with the screw numbers ranging from 0 to 24.

The chart of preferred lengths and screw number combinations for wood screws is available in the relevant IS.

The screws commonly used by electricians are from screw No. 4 to 12 and 12 mm to 50 mm in length.

Wood screws are available in packets of 100 and 200 numbers. The size and number of the screw are indicated on the packet.

Mild steel screws are most commonly used for general work. Brass and aluminium screws are used to match the metal fitting and also to prevent rust under damp conditions.

Ratchet brace

Objective: At the end of this lesson you shall be able to
- **name the parts of a ratchet brace and state their functions.**
- **state the countersunk bits sizes**

One of the tools for holding various types of bits for making holes of various diameters in wood by manual operation is the ratchet brace.

It is used for jobs that require slow speed and high torque operation.

Parts and their functions (Fig 1)

Head: The head is made of wood and is fitted to the upper end of the crank with ball bearings. It is used to hold the brace in an upright position by one hand, and also apply the required force during operation.

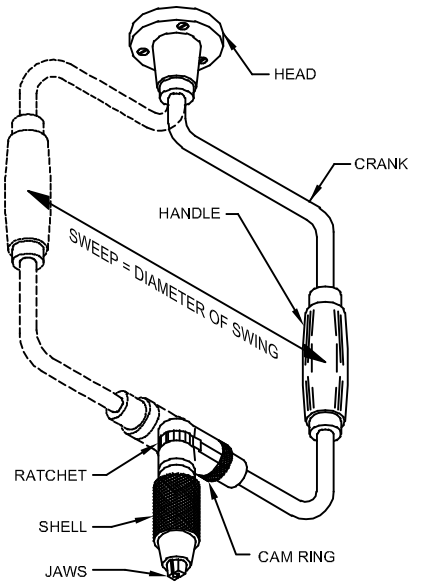
Crank: It is a metal rod bent to the form shown in Fig 1.

Ratchet braces with different sweep sizes of crank are available. The size mostly used is one of 250mm sweep. A wooden handle is provided to rotate the crank by the hand that is free.

Chuck: It is fitted at the lower end of the crank. It has two jaws for holding square shank bits, and a shell for tightening and slackening jaws.

Ratchet: It permits the chuck to rotate in only one selected direction. The selection of direction is done by turning the cam ring. This allows to rotate the bit continuously, and in confined spaces as well where the full sweep of the crank is restricted. (Fig 1)

Fig 1

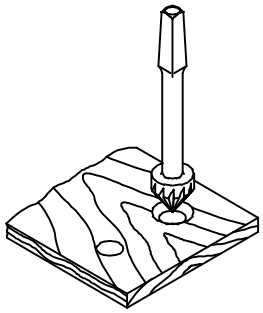


RATCHET BRACE

Countersunk bits - types - sizes

Countersunking is done on a drilled screw hole to accommodate the countersunk head of the wood screw. The process of removing out material round a hole at its surface up to a depth to match the CS screw head is known as countersinking. (Fig 1)

Fig 1



COUNTERSUNK BITS

Variation of the size of head CS screws with the screw number makes it necessary to select the suitable CS bit.

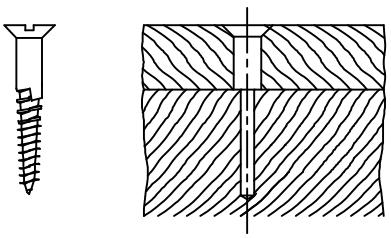
Sizes of countersunk bits: The countersunk bit size is specified by the rim diameter.

The general size of the bit varies from 10 mm to 25 mm.

The 82^{o} cutting angle CS bits are used because wood screws always bear 90^{o} slope.

Method of selection: Select the countersunk bit of the next higher dia. size to that of the wood screws head diameter. With the head of screw ensure the required depth while countersunking. (Fig 2)

Fig 2

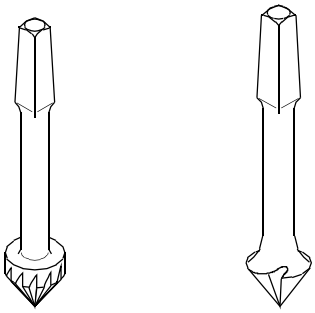


HEAD OF WOOD SCREW FOR COUNTER SUNKING

Types: The two types of bits are:

- Rose countersunk bit (Fig 3a) which is a multi-cutting edge tool
- Nail countersunk bit (Fig 3b) which has a single-cutting edge.

Fig 3



Screwdrivers used in woodwork

Objective: At the end of this lesson you shall be able to
- **name the various types of screwdrivers, and state their sizes and uses.**

Screwdrivers are available in different sizes and patterns according to their application.

Types of screwdrivers: London pattern is a heavy screwdriver having a size of 75 to 350mm with a flat shank. It is used for general woodwork. (Fig 1a)

Cabinet pattern is a medium screwdriver having a size of 75 to 350mm. It is used for cabinet works. (Fig 1b)

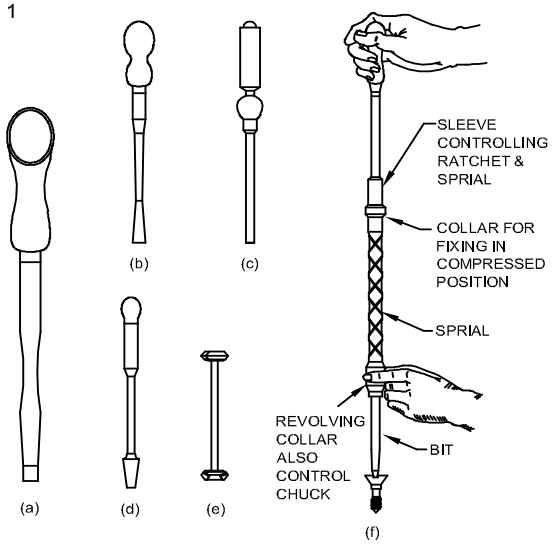
Electrician pattern is a common type of screwdriver used by electricians. It is available from 100mm to 300mm size. The handle is made of either wood or plastic. The shank is either insulated or non-insulated. (Fig 1c)

In the **ratchet type of a screwdriver**, a ratchet is fitted within the handle. The blade of the screwdriver can be set to different positions i.e for clockwise or anti-clockwise revolution of the screwdriver blade. It can also be set to a neutral position (locked). It is used for general purposes and is available in sizes ranging from 50mm to 200mm. (Fig 1d)

A cranked screwdriver is a special type used where normal screwdrivers cannot be applied. (Fig 1e)

A spiral ratchet works on rotary action. It is used with interchangeable blades of different sizes and patterns available in 300, 500, 600mm length. Only downward pressure need be applied while using this type of screwdrivers. This type of screwdriver can also be set in both clock and anticlockwise revolution for screwing and unscrewing purposes. (Fig 1f)

Fig 1

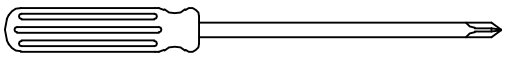


SCREW DRIVERS

ELN1215D1

A Phillips screwdriver is used to drive Phillips head screws. It is a special purpose screwdriver available in 75 to 200mm sizes. The Phillips screwdriver (Fig 2) will not slip and burr the head of the screw if a proper size is selected.

Fig 2



A PHILLIPS SCREW DRIVER

ELN1215D2

Sharpening and setting of saw teeth

Objective: At the end of this lesson you shall be able to
- **describe the steps involved in `sharpening and setting' of the saw teeth**
- **explain the methods of re-sharpening jack plane blade**

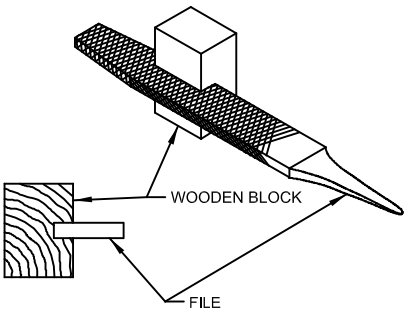
To perform the sawing operations with ease and accuracy, the saw must be in good condition with its teeth sharpened and well set.
Sharpening of a saw involves 4 steps which are as follows.

Topping or jointing: This is done to bring down the points of all the teeth to the same level. A flat file is held in a wooden block and rubbed over the teeth until the lowest tooth touches the file face. (Fig 1)

Reshaping: It is necessary to restore the tips of the teeth. Therefore the gullet of each tooth is filed down using a suitable size triangular file. Care is taken to maintain a uniform depth of gullets, pitch and angles of teeth. (Fig 2)

Setting: Setting is a process of bending every alternate tooth to the opposite direction. This is carried out by using a saw-set pliers. (Fig 3)

Fig 1



TOPPING OF FILE

ELN1215E1

Fig 2

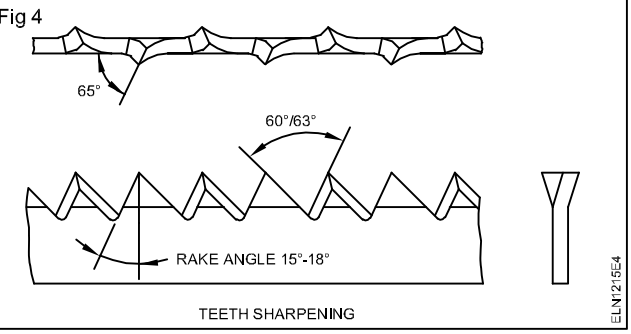
TEETH RESHAPING WITH FILE

ELN1215E2

Fig 3

Sharpening: This is the final step in which the gullet of each tooth of the saw is filed to produce a keen cutting edge, using a suitable size of a triangular file. (Fig 4)

Fig 4



Topping is necessary only when the saw teeth have become uneven in their height, and re-sharpening follows it.

Re-sharpening of a plane blade

Sharpening of a plane blade is necessary to produce a keen cutting edge for good surface finish, and perfect planing with minimum effort.

Sharpening and honing: The process of sharpening is carried out on an oilstone by rubbing the blade with its bevel down, maintaining a constant and correct angle, 25° to 30°. (Fig 1) This rubbing is continued until a burr or wire edge is produced.

The burr is removed by rubbing the back of the flat face of the plane blade on the oilstone, keeping its bevel up. (Fig 2)

During sharpening, oil is used to minimise the heat caused due to friction and to float off the metal particles from the pores of the oilstone so as to prevent clogging of the oilstone.

Fig 1

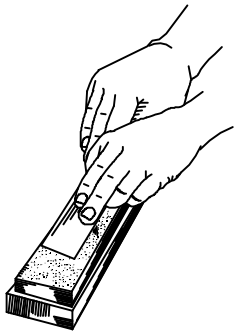
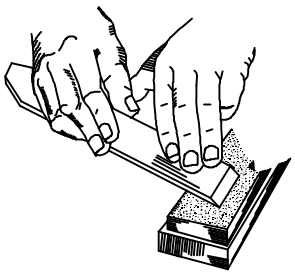
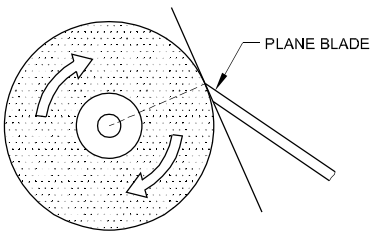


Fig 2



Because of the continuous use and numerous sharpenings, the bevel of the blade is likely to become shortened or rounded. The correct bevel is restored by grinding it over an emery wheel or grindstone. (Fig 3)

Fig 3



Chisel - parts - types - uses

Objectives: At the end of this lesson you shall be able to
- **state the parts of firmer chisel and their types**
- **name the specific use of each chisel.**

Chisels are used for shaping and finishing the parts of wood joints. They are also used for shaping different profiles in woodwork. The size of the chisel is determined by the width of the blade.

Parts of a chisel

A chisel has the following parts. (Fig 1)

Handle : made of wood.

Ferrule : fitted to the handle.

Tang : tapered end of the blade.

Shoulder : the lower end of tang.

Neck : shaped portion beneath the shoulder.

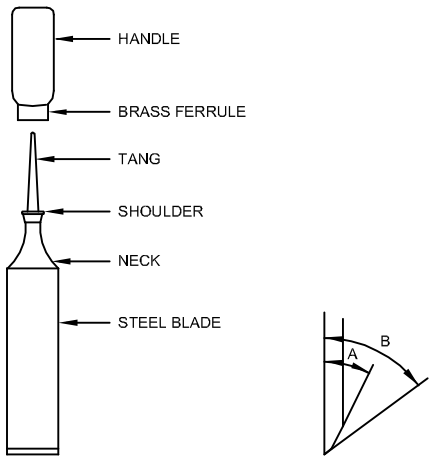
Blade : the portion beneath the neck up to the cutting edge.

Types of chisels

Firmer chisel (Fig 2a) **:** It posseses a rectangular-sectioned steel blade, the size (width of blade) being 3 mm to 50 mm. It is used for general chiselling work.

Bevel-edge firmer chisel (Fig 2b) **:** Its edges are bevelled

Fig 1



CHISEL PARTS

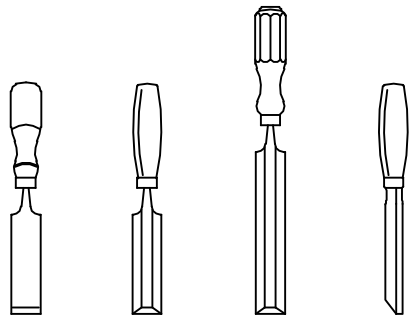
ELN1215F4

along the length. It is used for light chiselling and to clean sharp corners where the edges of a normal firmer chisel may not reach.

Paring chisel (Fig 2c) **:** It has an extra long, thin blade with the edges bevelled. It is used for paring and finishing joints.

Mortise chisel (Fig 2d) **:** It posseses a stronger, square-sectional blade.It is used for mortising i.e. making rectangular holes in wood.

Fig 2



TYPES OF CHISELS

ELN1215F5

Half- lap joints - types - uses

Objectives: At the end of this lesson you shall be able to
- **state the necessity of lap joints**
- **state the types of lap joints.**

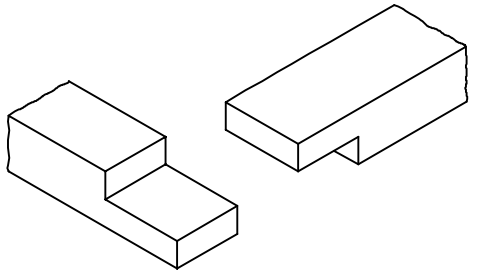
Necessity of lap Joint:

Half-lap joints are employed in frame construction where two parts of a job meet either near the ends or at a distance. To keep them flush, laps are made equal to half the thickness in each part. These joints are strengthened by fixing screws.

Types of half-lap joints

End-lap joint (Fig 1)**:** This joint is used where two parts of a job cross each other at the ends, say at the corners.

Fig 1

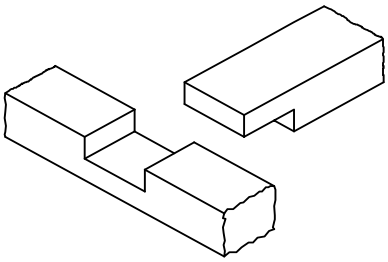


HALF LAP JOINT

ELN1215G1

Middle-lap joint (Fig 2)**:** This joint is used where one part of a job meets another part at some distance from the ends.

Fig 2

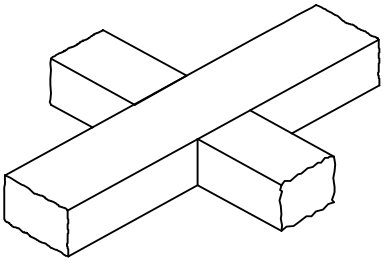


MIDDLE-LAP JOINT

ELN1215G2

Cross-lap joint (Fig 3)**:** This joint is used where two parts of a frame cross each other at a distance from the ends.

Fig 3



CROSS-LAP JOINT

ELN1215G3

Curve-cutting saws - types - uses

Objectives: At the end of this lesson you shall be able to
- **state the necessity of curve-cutting saws**
- **state the types of curve-cutting saws and their application.**

Curve-cutting saws have narrow blades which enable them to turn along the curve with ease while sawing along the curves. Stiff and wider blades are provided with handles, while very fine blades are held in frames to keep them under

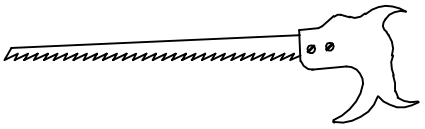
tension. Very narrow, fine blades are dispensed with and replaced as soon as they become blunt. The other blades are re-sharpened.

There are various types of curve-cutting saws. The saws, with slightly wider blades are used for cutting larger curves, and the saws with finer blades are used for cutting sharp curves.

Types of curve-cutting saws

- **Compass saw** (Fig 1)**:** Used for larger curve cutting.

Fig 1

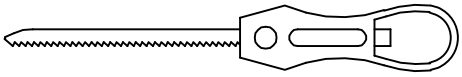


COMPASS SAW

ELN'215H1

- **Keyhole saw or pad saw** (Fig 2): It is used for internal cutting.

Fig 2



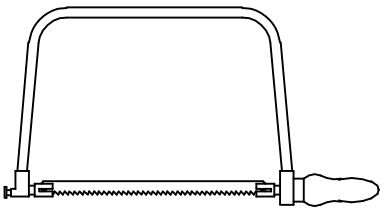
KEYHOLE SAW

ELN'215H2

- **Coping saw:** It is used for cutting sharp corners. (Fig 3)

– **Fretsaw:** It has a very fine blade. (Fig 4) It is used for cutting sharp and fine curves.

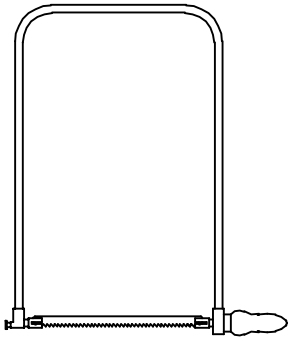
Fig 3



COPING SAW

ELN'215H3

Fig 4



FRET SAW

ELN'215H4

Blades with larger teeth will cut faster, but the surface will be rough and the blades with smaller teeth will cut slower, but the surface will have a fine finish.

Wood working files - parts - uses

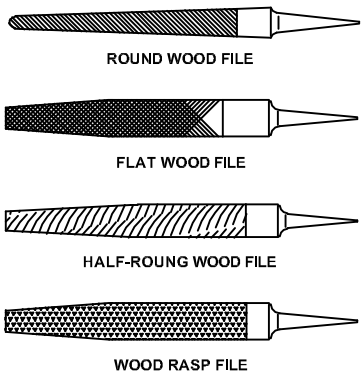
Objectives : At the end of this lesson you shall be able to

- **state the use of wood working files**
- **state the types of wood working files and their application.**

Wood working files are used to shape various profiles for smooth finish in wood or laminates.

Types and uses of wood working files : Various types of the available wood working files are named according to the shape of their cross-section. (Fig 1)

Fig 1



TYPES OF WOOD WORKING FILES

ELN'2151

Round files: Used for finishing concave corners, and for finishing and enlarging.

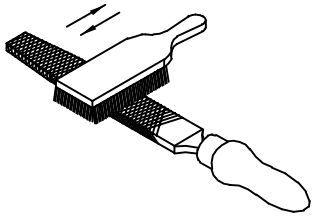
Flat files: Used for finishing end grains and corner edges.

Half-round files: Used for finishing both corner and convex edges.

Wood rasp files: Used for preliminary rough work for rapid removal of waste part of the wood.

All files should be cleaned frequently. (Fig 2)

Fig 2



CLEANING OF FILE

ELN'2152