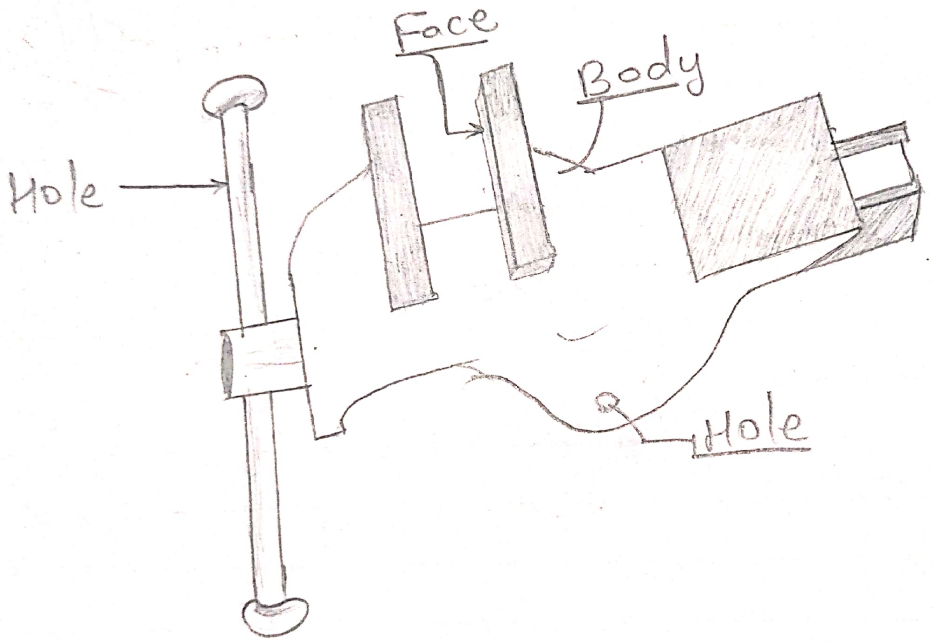


Bench Vice

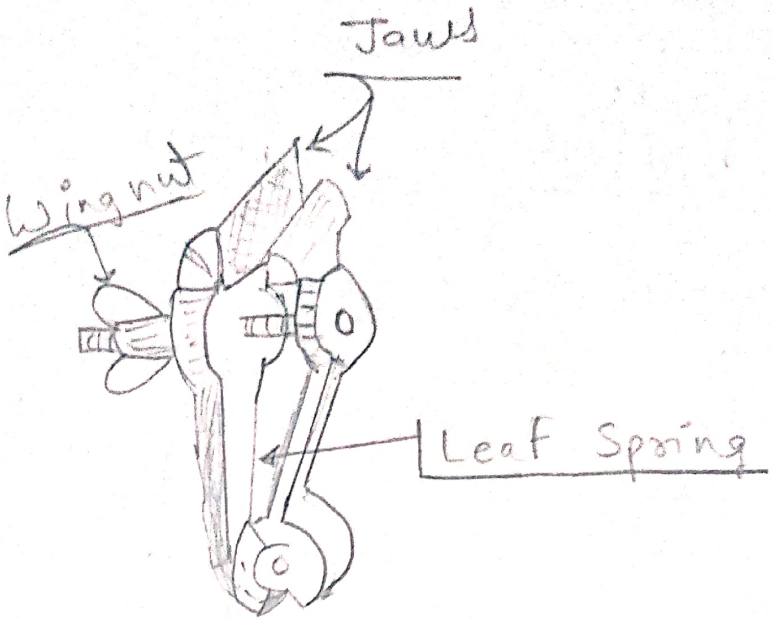
Fitting Shop

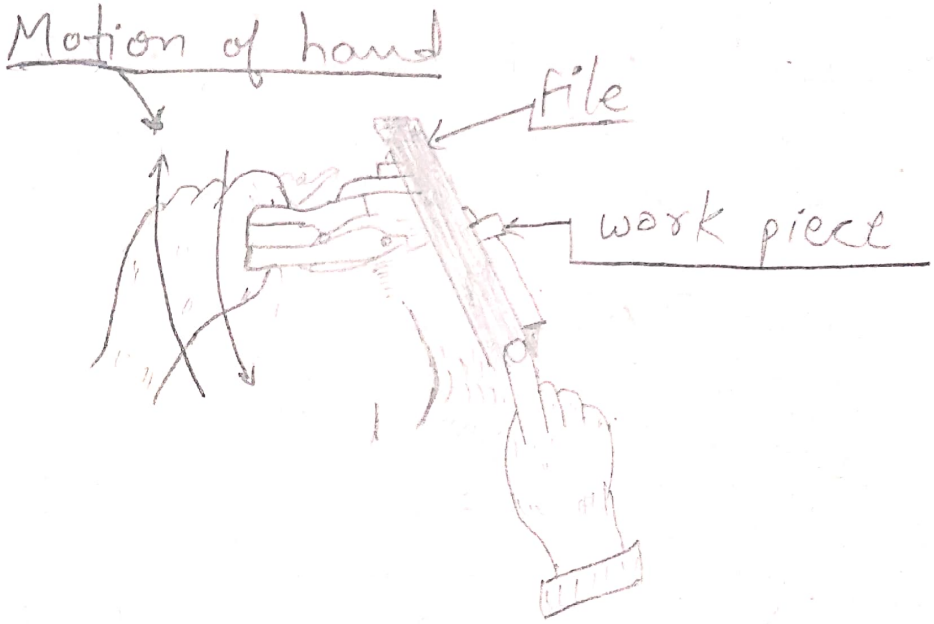
Introduction :- working on component with hand tools and instruments on benches is generally referred as fitting work. Fitting is a very important work in all sorts of engineering works. The person working in fitting shop is known as fitter. A fitter should have complete knowledge of the tools and instruments uses in the shop.

Tools used in fitting Shop :- The tools and instruments used in fitting shop may be classified into the following groups:

① Clamping Tools: The clamping tools are required to hold the job firmly. The different types of clamping tools are as follows:

ⓘ Bench Vice: Bench vice or parallel jaw vice is a common tool used for holding jobs as shown in Fig. This vice is firmly fixed on the work bench by nuts and bolts. It consists of a cast iron body, and cast iron jaws one movable and one fixed.



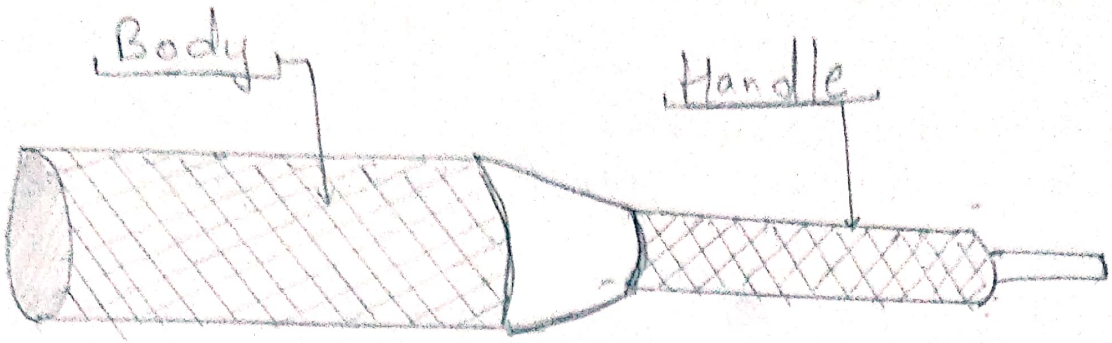


Hand Vice

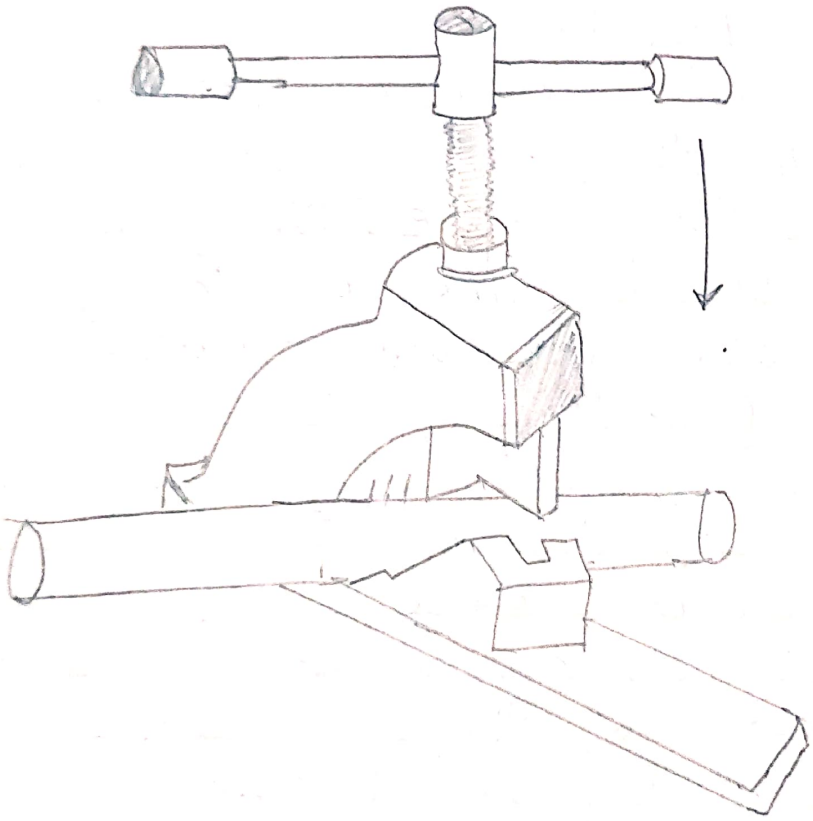
Two jaws plates are fitted on both the jaws. Jaw plates are made up of high carbon steel and are wear resistance.
The jaw plate are replaceable and are made of soft metal so that it does not spoil the surface finish.

A square threaded screw, a handle and a fixed guide call made of mild steel. One jaw is fixed to the body and the second jaw slides on a square threaded screw with the help of handle. The jaws are opened up to required length, job is placed in the two jaws, and is tightened with handle. The size of vice of given by the width of the jaws and the maximum opening between the jaws.

(ii) Hand Vice: Hand Vice is used for griping very small objects like keys, rivets, small drills, screws, sheet metal etc. It consists of the two steel legs hinged together at the bottom as shown in fig. A spring attached to one of the legs, always keeps the jaws open. The



Pin Vice

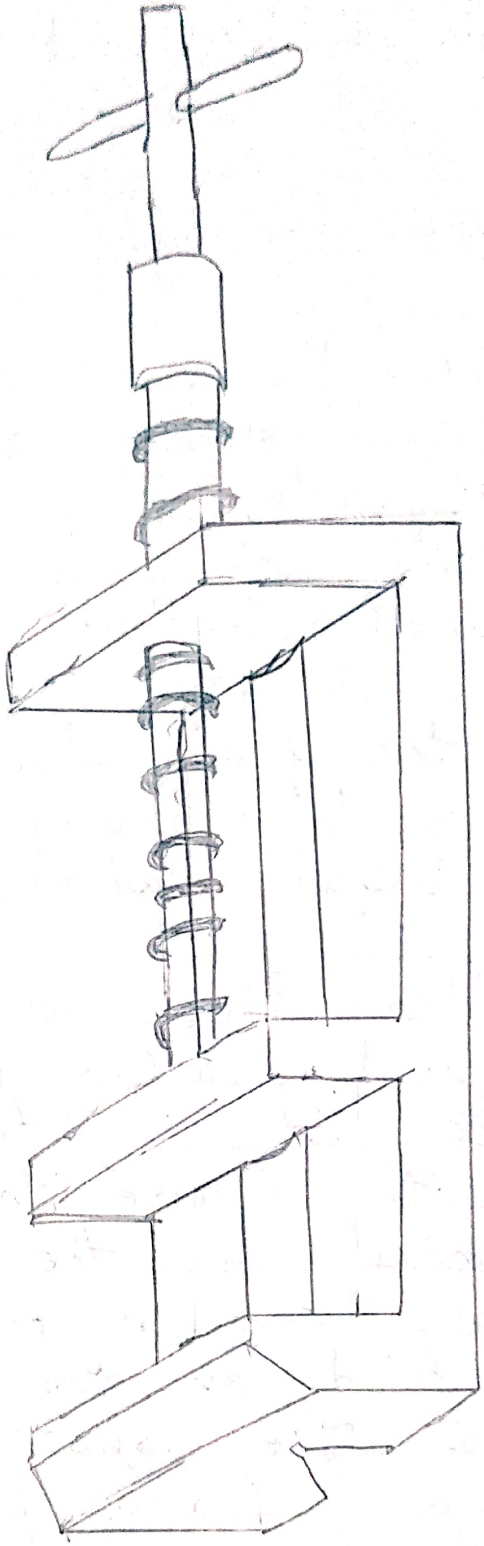


Pipe Vice

jaws can be opened and closed by a wing nut which moves through a screw that is fastened to one leg and passes through the other.

(iii) Pin Vice : the pin Vice is used for holding round objects of small diameter like pins, nails, and wires during working. It consists of a handle and a small nose shaped collar chuck at its end as shown in fig. The collet chuck carries the jaws which are operated by turning the handle. It also forms a very useful handle for small files.

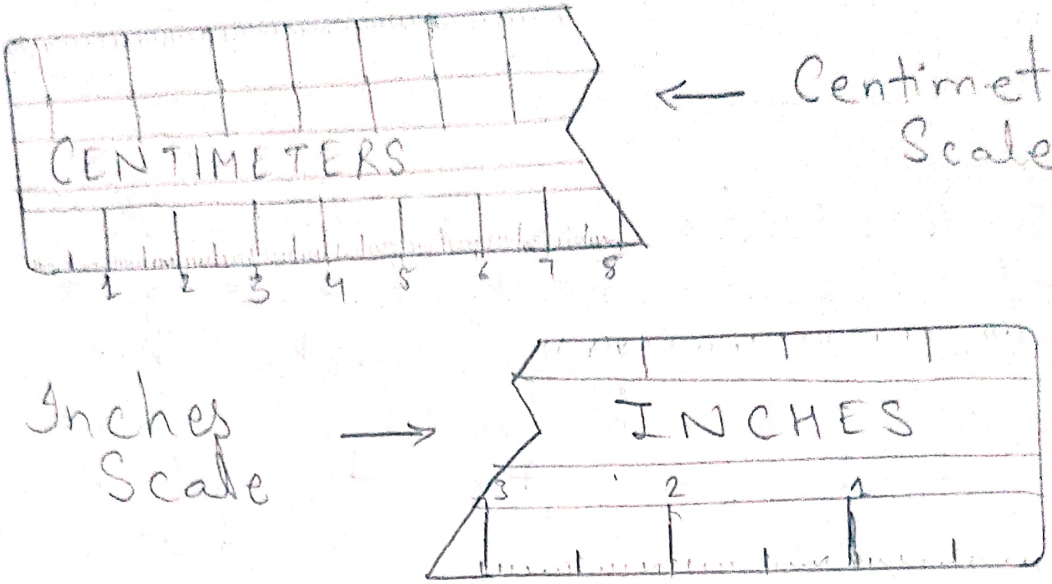
(iv) Pipe Vice : Pipe vice is used to hold round section metal, tubes, pipes etc. It consists of a vertical screw with square threads. A handle is attached on the top of the screw as shown in fig. A movable jaw is fixed on the lower end of the screw. The shape of the jaws is like a "V" and it grips the work at four points.



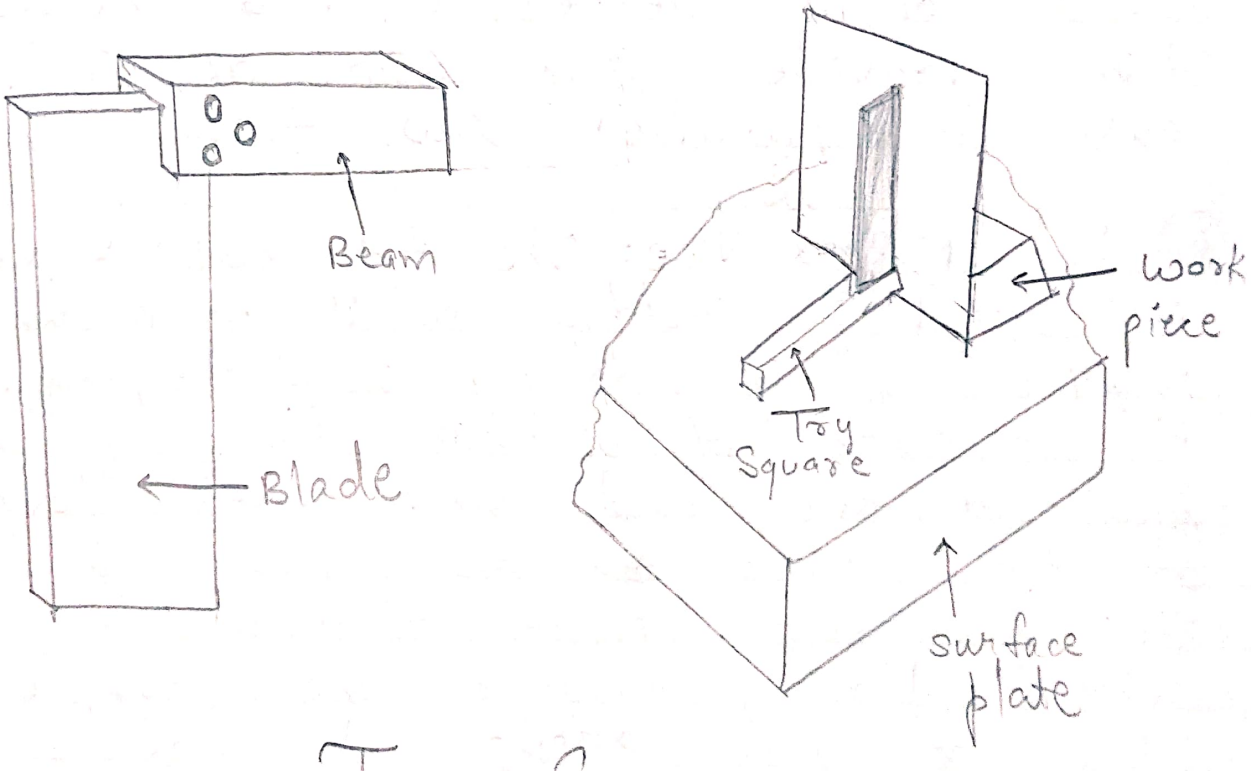
Tool Makers Vice

(v) Leg Vice: leg vice is the best suited for chipping, heavy hammering and cutting in fitters work. This vice is used by blacksmith. The leg vice is fitted on the top of bench by a strap which is fastened to a plate bolted to the bench top. The leg of the vice is fastened to the bench leg with staples and its ends fits into a hole in the floor. The robust construction of the vice makes it useful for heavy work. The disadvantage of this type is that the jaws come together like the arms of a letter "V", and therefore does provide firm grip as in the case of parallel jaw type.

(vi) Tool Makers Vice: The tool makers vice is useful for holding small work which requires filling, drilling and tapping. it consists of a base having fixed jaws at one end and screw block at the other as shown in fig. The jaw screw passes through the screw block, carrying the movable jaw at one end and handle at the other. The jaw screw and



Engineer's Steel Rule



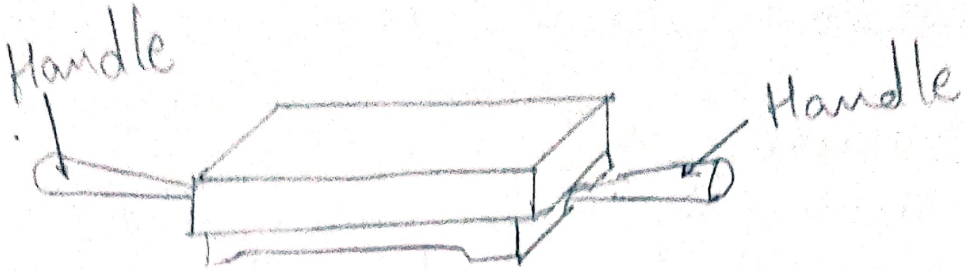
Try Square

the screws block have square threads.

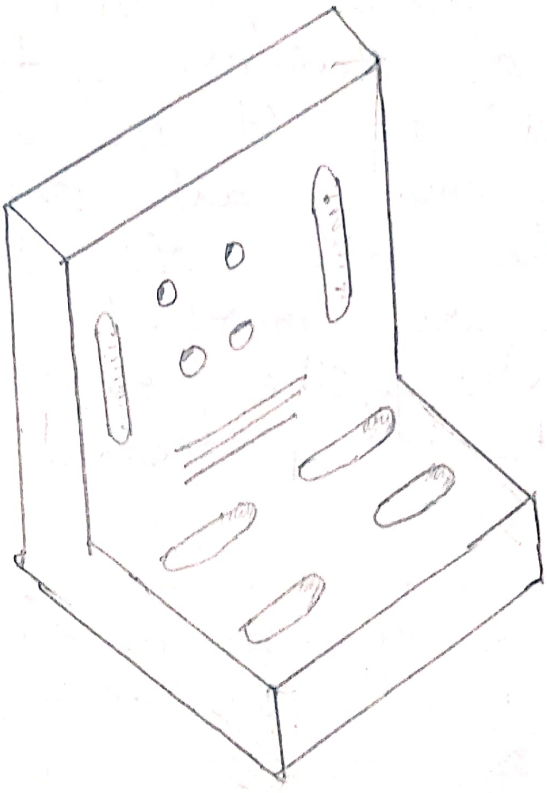
② Measuring tools :
The measuring tools are required to measure job accurately. The different types of clamping tools are as follows :

(i) Engineer's Steel Rule : It is the most common measuring device and are made device and are make up of stainless ~~stell~~ steel as shown in fig. It is a stiff, straight steel strip having all the faces machined. On one of the flat faces graduations are marked in inches and centimeters. The edges of steel rules, should be protected from rough handling.

(ii) Try Square : Try square or engineer's square is used for testing the squareness of surfaces as shown in fig. It consists of a steel blade fixed at right angles to the edge of machined beam of cast iron. Try square is also used for marking right angles.



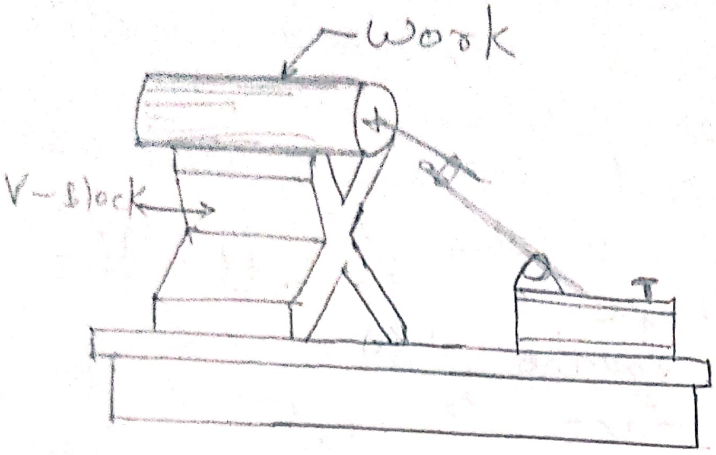
Surface Plate



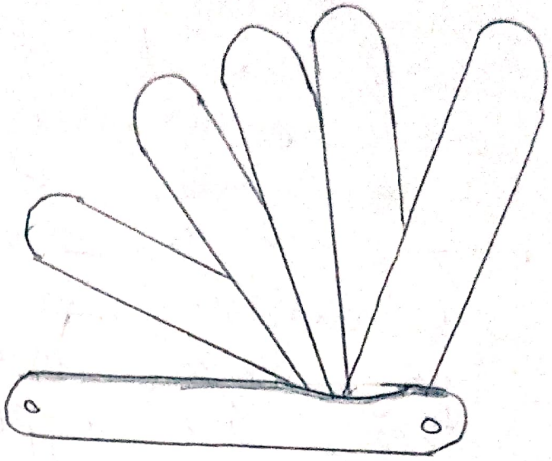
Angle Plate

(iii) Surface Plate: Surface plate is used for testing the flatness of work itself and forms a reference surface for measurement as shown in fig. It is made of cast iron in various sizes. It is usually square or rectangular in shape and all the four sides are square to each other. Its upper face is planned to form a very smooth surface. When not in use, the surface with a fine film of oil to prevent rusting. Handles are provided on two opposite sides to carry it while shifting from one place to another.

(iv) Angle Plate: An angle plate is simply a cast iron plate with two plates at right angles to each other and having slots in various positions for the clamping bolts as shown in figure. It is always used with the face plate for holding such parts which can not be clamped against the vertical surface of the face plate.



Use of V-Block



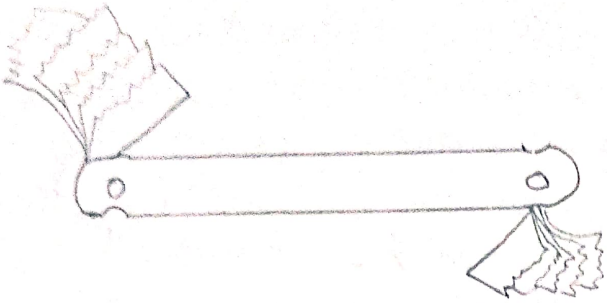
Feeler Gauge

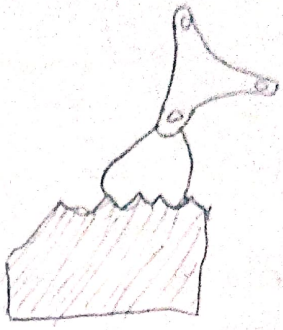
Wire Gauge

(v) V-Block:
V-Block is made up of cast iron or steel. It is used for supporting as well as marking purpose as shown in fig. Round jobs are generally placed on it to mark centre time. For long cylindrical work, several blocks of the same size are used as set.

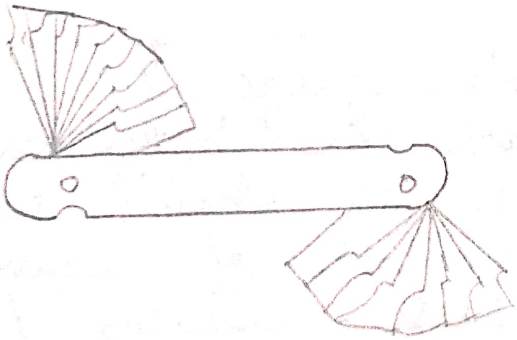
(vi) Wire Gauge: Wire-Gauge is made up of a steel sheet disc as shown in fig. It is used to check the diameter of wire or thickness of sheet metal. The commonly used wire gauge is SWG (Imperial Standard Wire-Gauge).

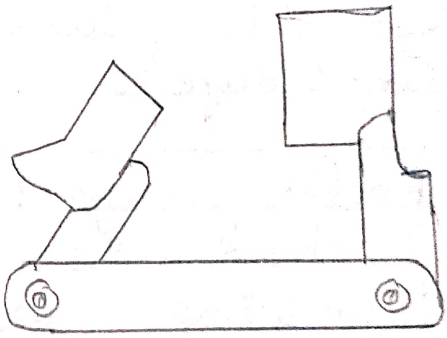
(vii) Feeler Gauge: Feeler gauge is used to check the clearances between two mating surfaces as shown in fig. It consists of a number of leaves having different thickness ranging from 0.05 mm to 1mm. The leaves are pivoted in holder of knife shape.





Thread Gauge

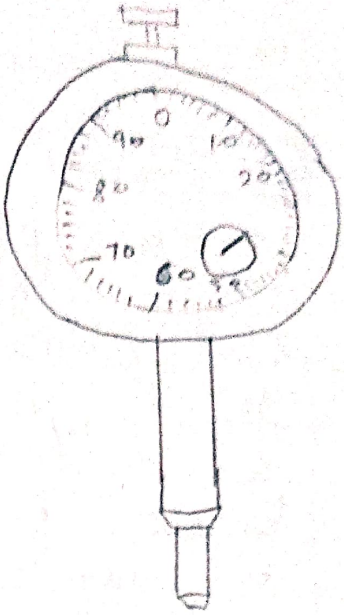




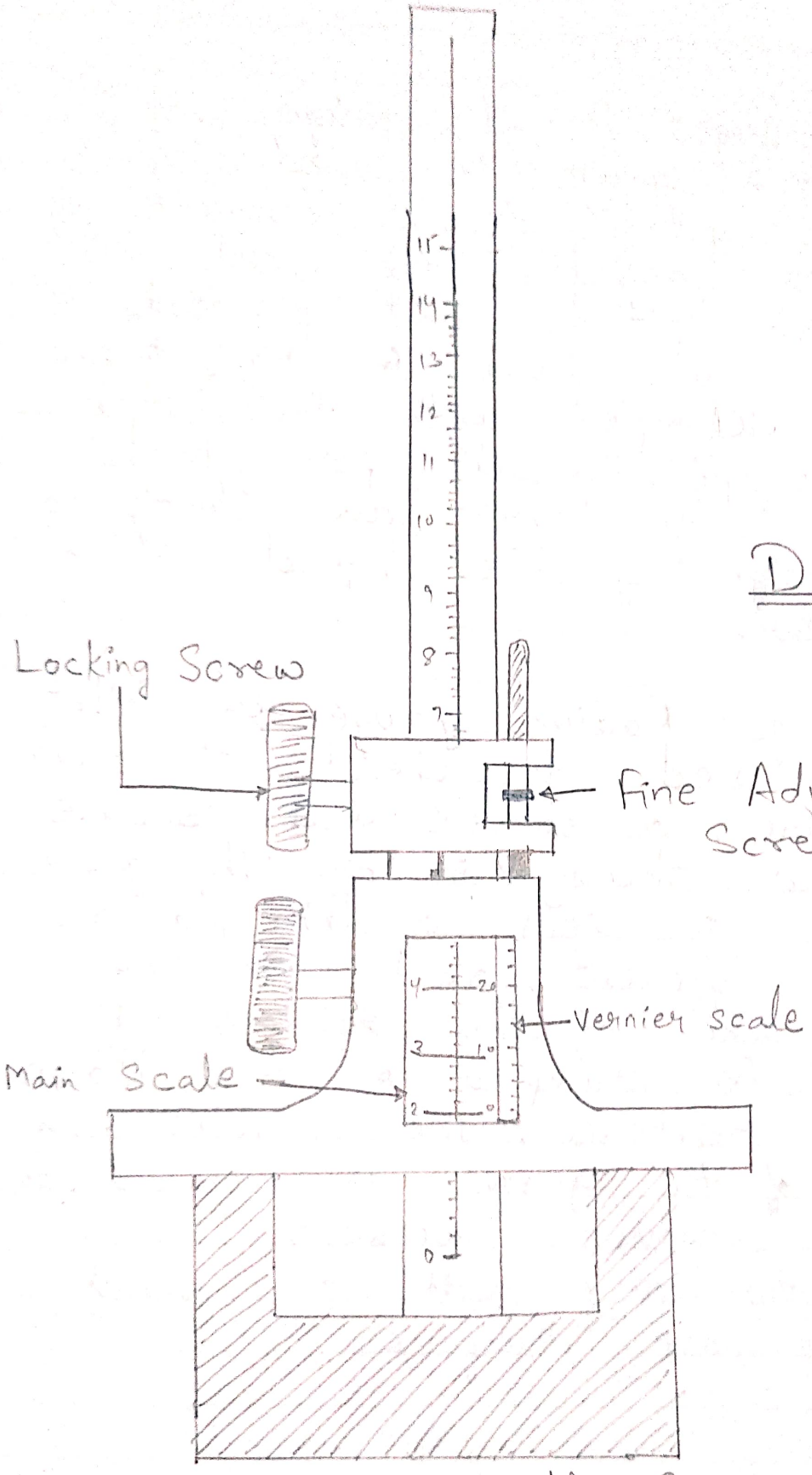
Radius Gauge

(viii) Thread Gauge: Thread gauge or screw pitch gauge is used to check the pitch of a number of flat blades which are cut out to a given pitch and pivoted in a holder as shown in fig. Each blade is stamped with the pitch or number of threads per inch and the holder bears an identifying number designating the thread it is intended for.

(ix) Radius Gauge: Radius gauge or fillet gauge is used to check the radii of curvature of convex and concave surfaces as shown in fig. The gauges are made in sets of thin plates curved to different radii at the ends. The size of the radius of the curve is stamped on the blade for ready reference. The blades on one end of the gauge are used to check the convex surfaces and those on the other ends are used for the concave surfaces.



Dial Indicator

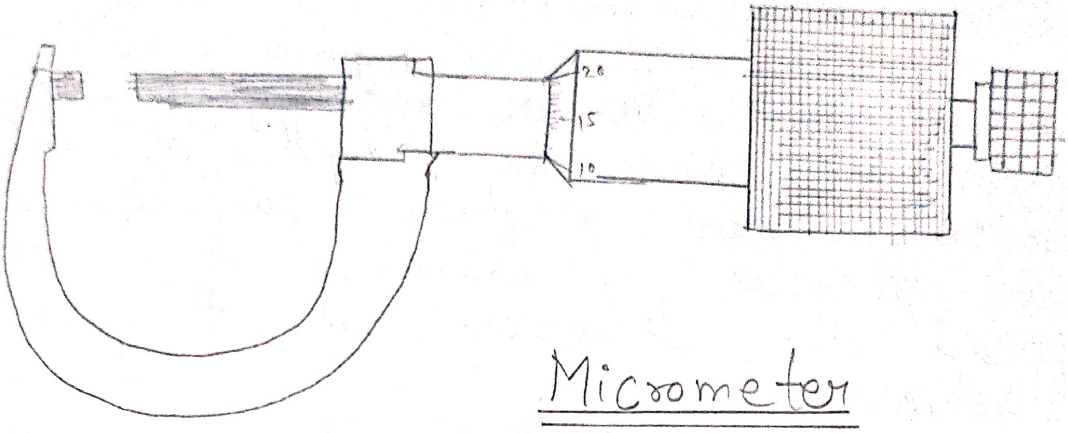


Depth Gauge

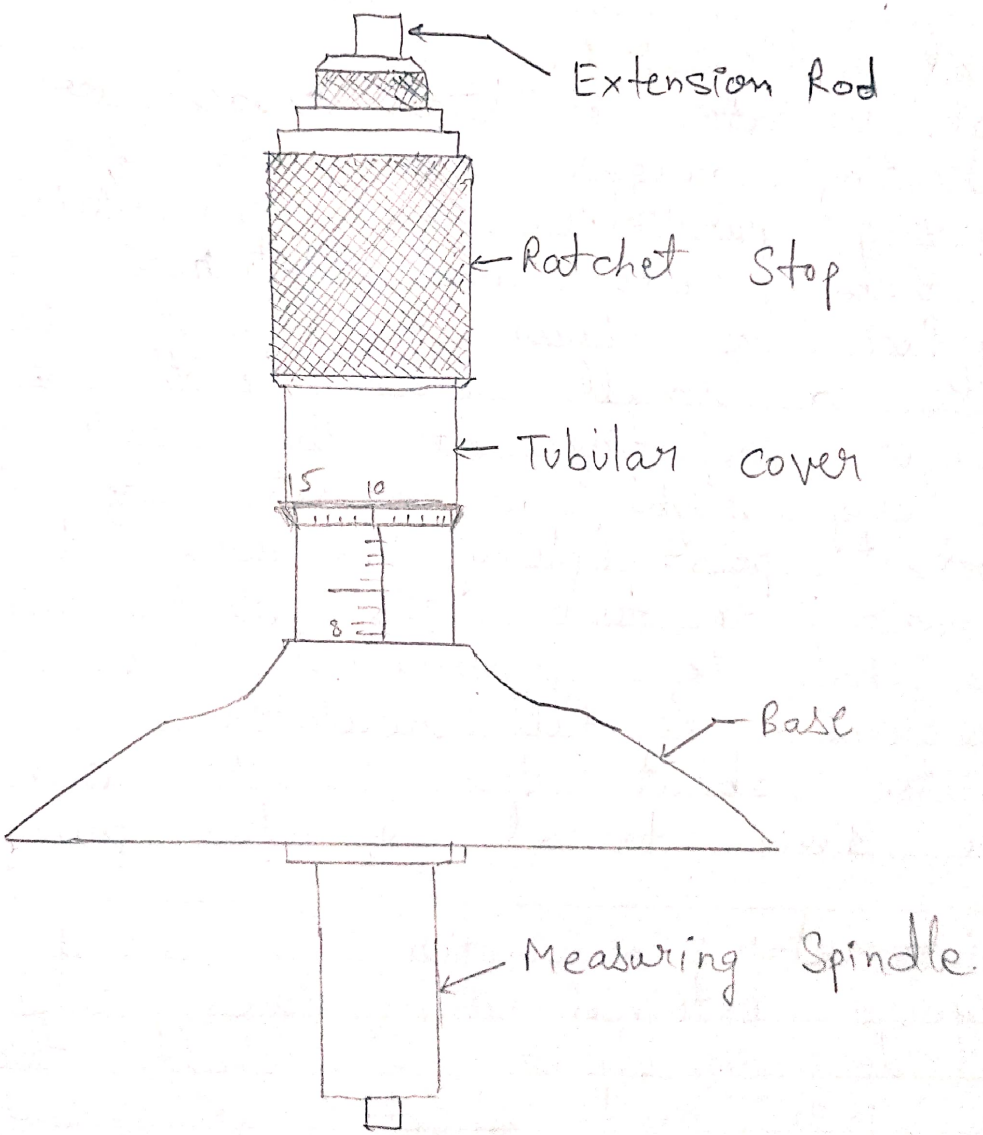
(X) Depth gauge: Vernier depth gauge is used to measure the depth of holds, distance from a plane surface to a recesses as shown in fig. It read the dimension as the vernier calliper.

Dial Indicator:
Dial indicator or dial gauge or indicating gauges are used for checking parallelism and concentricity of holes, rods and flatterers of surfaces as shown in fig. It is like a small clock with a plunger projecting at the bottom. A very slight movement of the contact point (plunger) causes the plunger to turn the dial pointer. The dial is graduated into 100 divisions. A full revolution of the pointer about this scale corresponds to 1 mm travel of the plunger.

Micrometer: micrometer is used to measure external dimensions like outside diameters of shafts, thickness of wires and sheets as shown in fig.



Micrometer

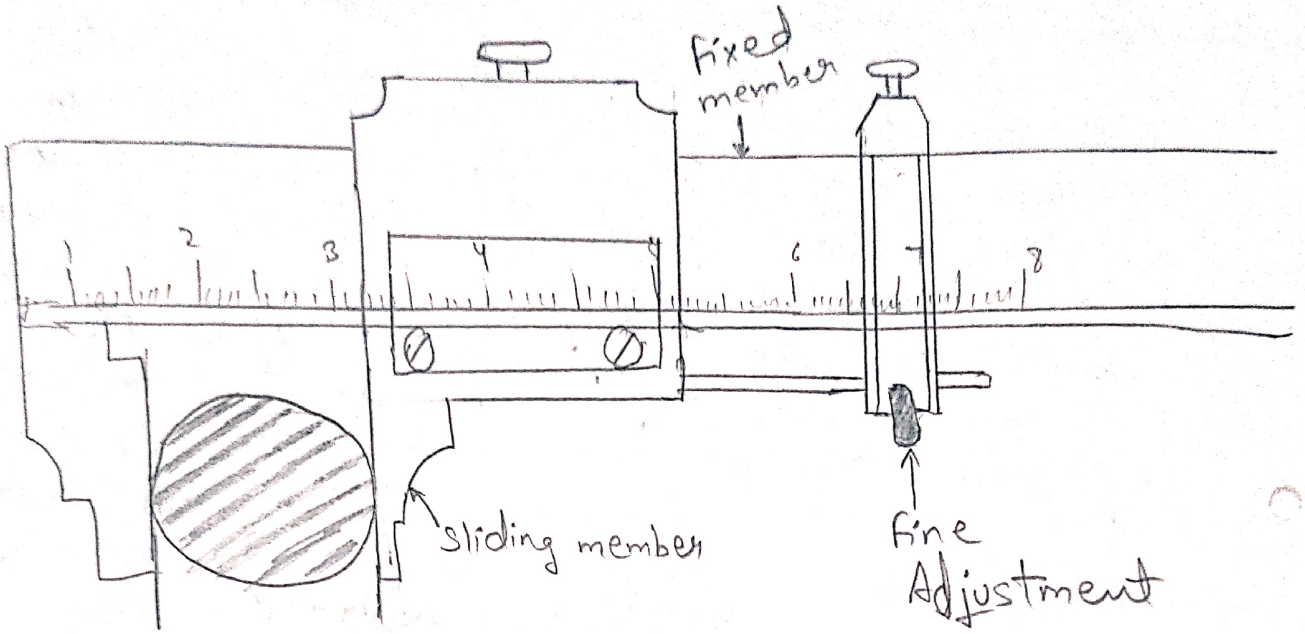


Depth Gauge Micrometer

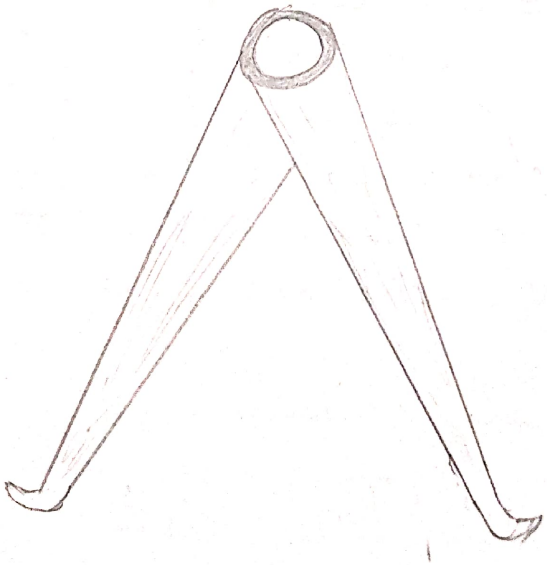
It can measure the dimension to an accuracy of 0.01 mm (accuracy of vernier caliper is generally 0.02mm). It consists of C-shaped frame made of steel, Anvil on the left hand side of the frame made of high grade tool steel, spindle clamp or lock nut to lock the spindle, Barrel fixed graductions which are clearly engraved on it and are blackened for reading, thimble is a tubular cover fastened with the spindle, ratchet or friction stop controls the pressure applied on the work piece for accurate measurement.

Depth Gauge Micrometer:

Depth gauge micrometer or depth micrometer is used to measure the depth of holes, distance from a plane surface to a recesses to an accuracy of 0.01 mm as shown in fig.



Vernier Calliper

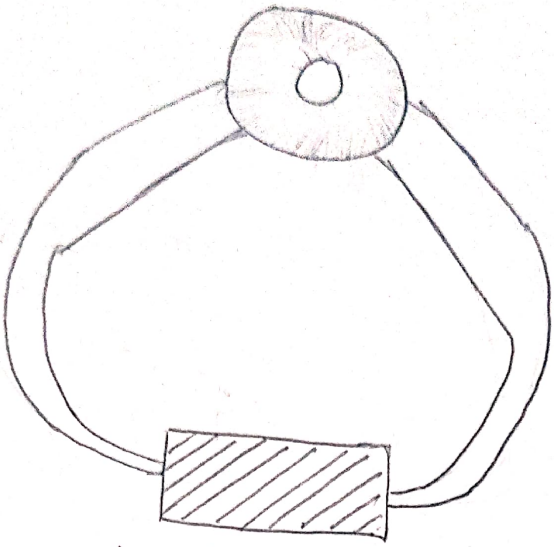


Inside Calliper

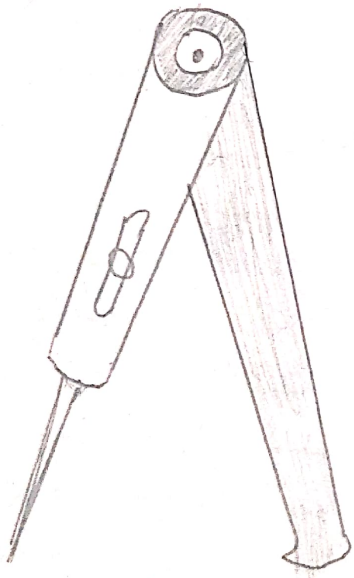
Vernier Calliper :-

Vernier Calliper is a precision instrument which is used for measuring external as well as internal dimensions as shown in fig. It consists of two scales, main scale engraved on stide solid L-shaped frame and a vernier head, having a vernier scale with a movable jaw which slides on a frame. The movable jaw can be locked by locking screw at any desired position. Minimum dimension that can be expressed on vernier calliper is known as least count. The material of the vernier calliper is stainless steel.

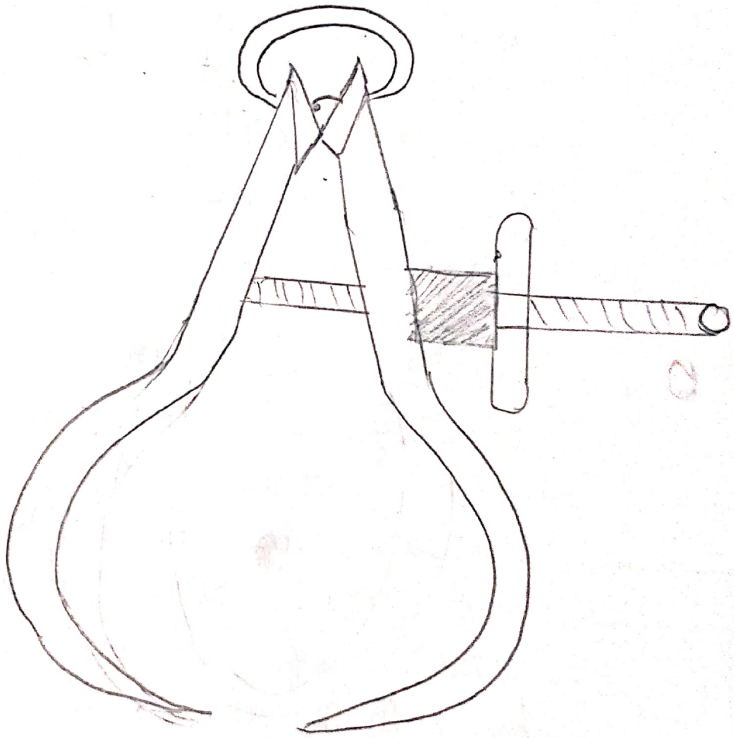
Inside Calliper : An inside calliper is exactly similar to an outside calliper, with it's legs bend outside as shown in fig. These are used to measure the diameter of holes. The size of the callipers is specified by the maximum dimensions which can be measured by it.



Outside Callipers



Hermaphrodite Callipers



Spring Callipers

Outside Calliper:-

When it is not possible to measure the dimension of the work directly with the scale, we need used callipers as shown in fig. An outside calliper is a two legged steel instrument with it's legs bent inwards. It in used for measuring or comparing diameters, thickness and other outside dimensions.

Hermaphrodite Callipers:

Hermaphrodite or odd leg or Jenny calliper has one leg pointed like a divider and the other bent like a calliper as shown in fig. It is used for drawing parallel lines to the working edge and is also used to find the centre of a cylindrical work.

Spring Calliper:

Spring callipers are used for accurate measurement as shown in fig. The callipers are adjusted to set dimensions by means of a adjusting screw and nut. Spring

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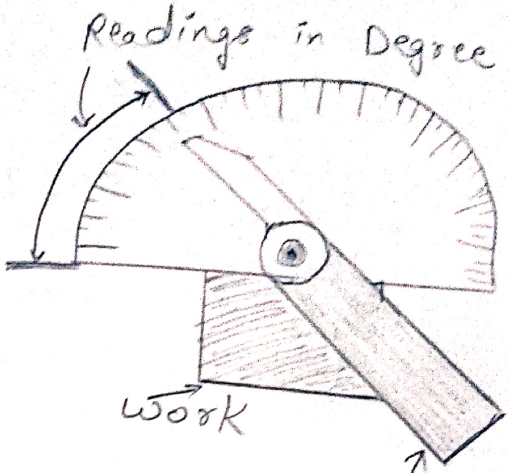
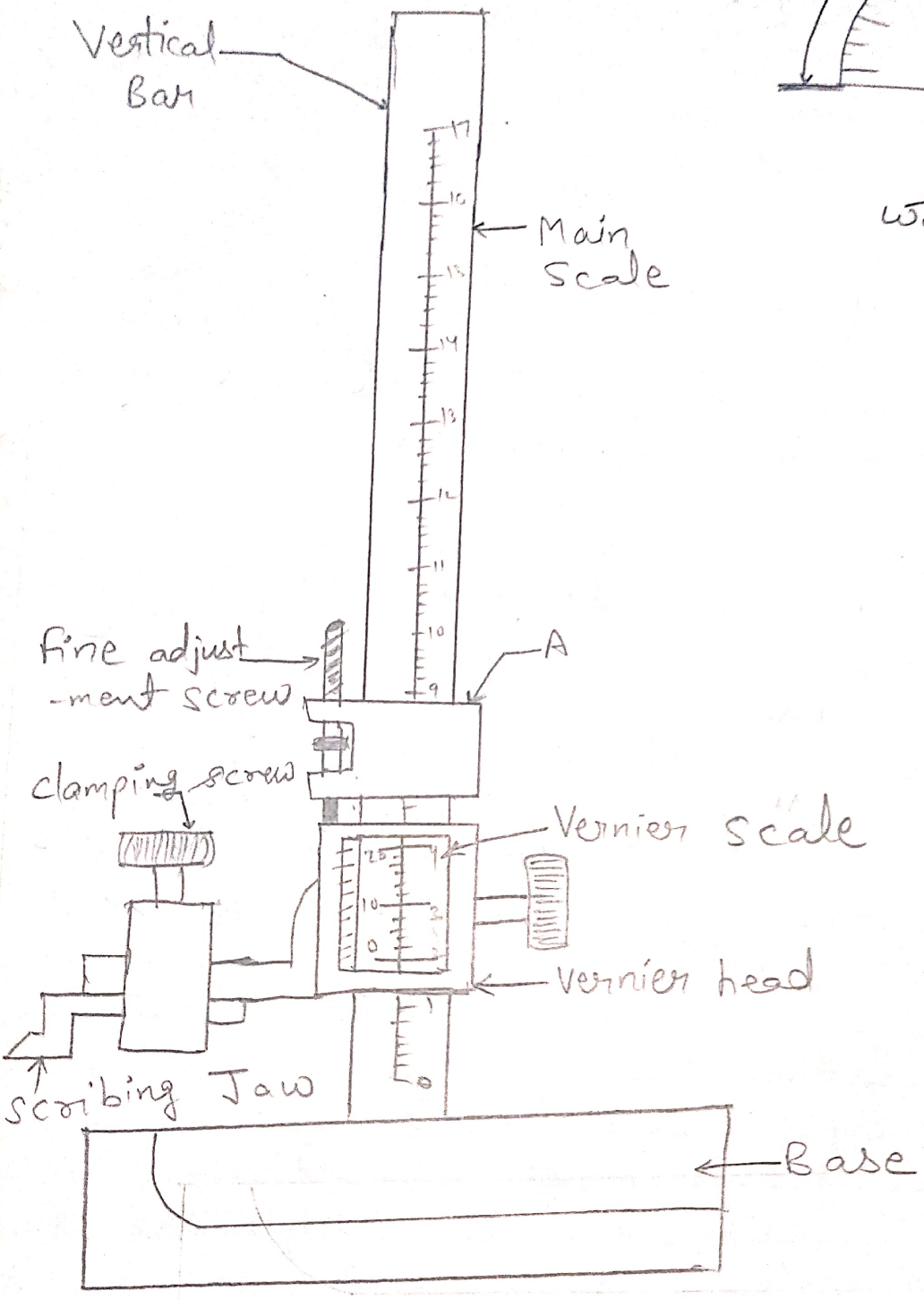




Vernier Height Gauge

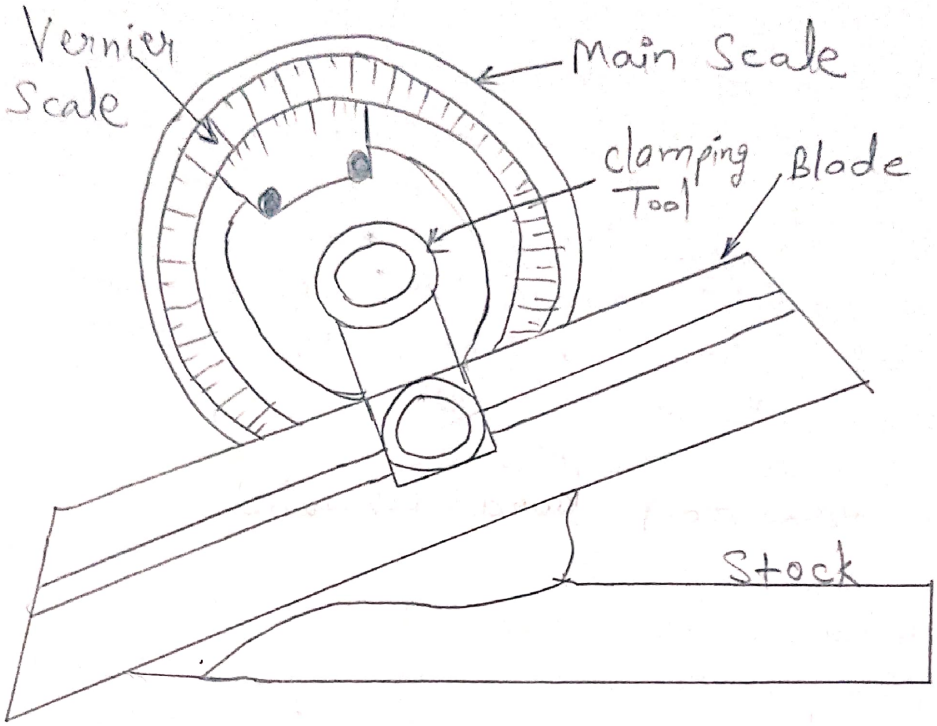
callipers are available as inside and outside callipers.

Vernier Height Gauge:

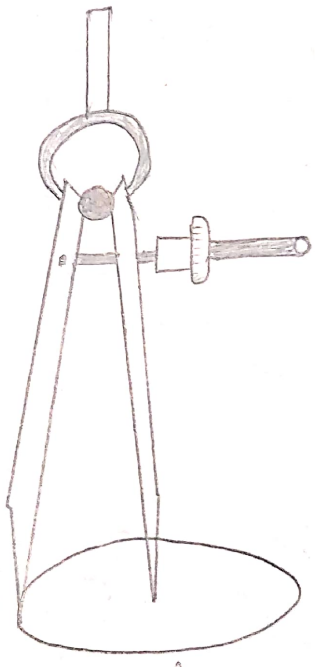
Vernier height gauge is used to measure the height of work pieces to an accuracy of 0.02 mm as shown in fig.
It consists of a vertical bar mounted on a base. A sliding vernier head carrying the vernier scale and clamping screw. An auxiliary head having the fine adjustment and clamping screw. A scribing jaw before using vernier height gauge it should be checked for zero error. The measurement is read in the similar way as in the vernier calliper. The base of the vernier height gauge is made up of cost iron and the beam is made up of stainless steel.

Protractors:

Protractor is the most simple device to measure angle directly blade and an angle measuring device in the form of "D" as shown in fig. the "D"



Universal Bevel Protractor



Divider

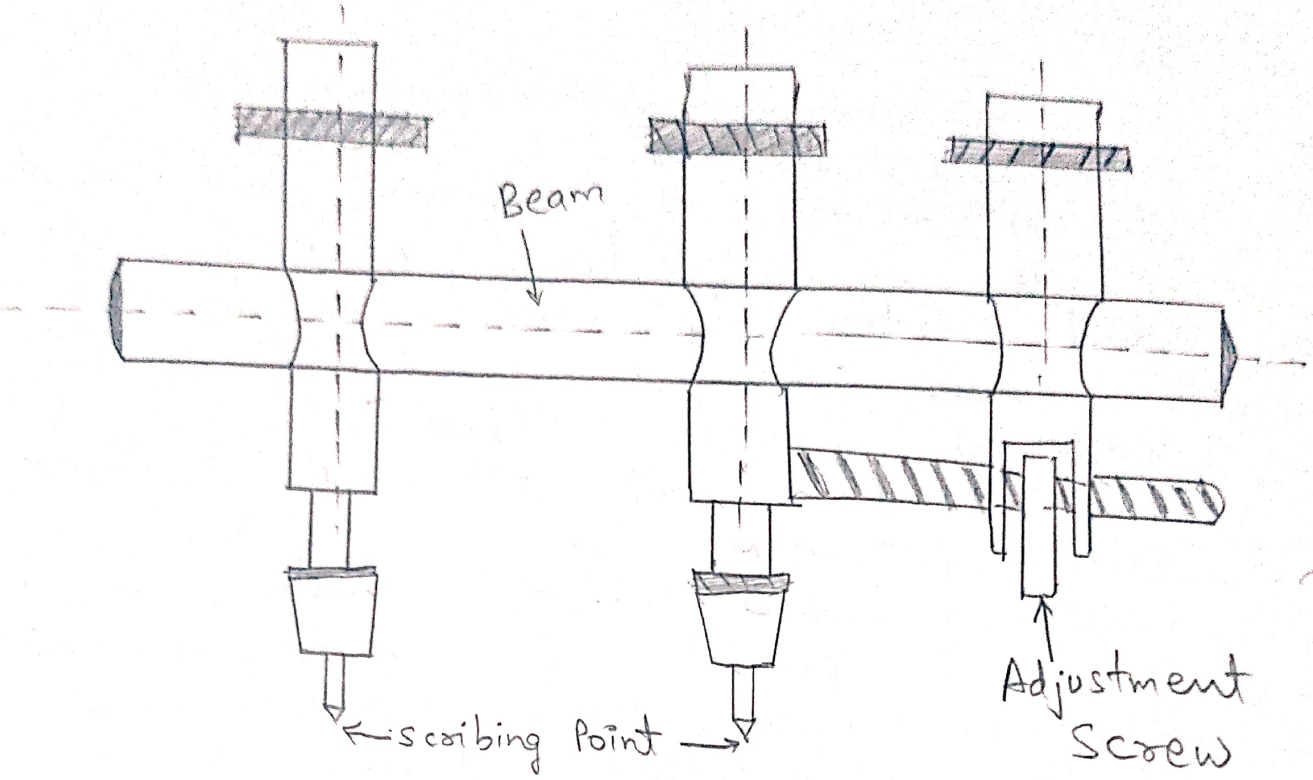
is graduated in degrees and minutes. It is a standard workshop tool and extensively used in workshops.

Universal Bevel Protractor:

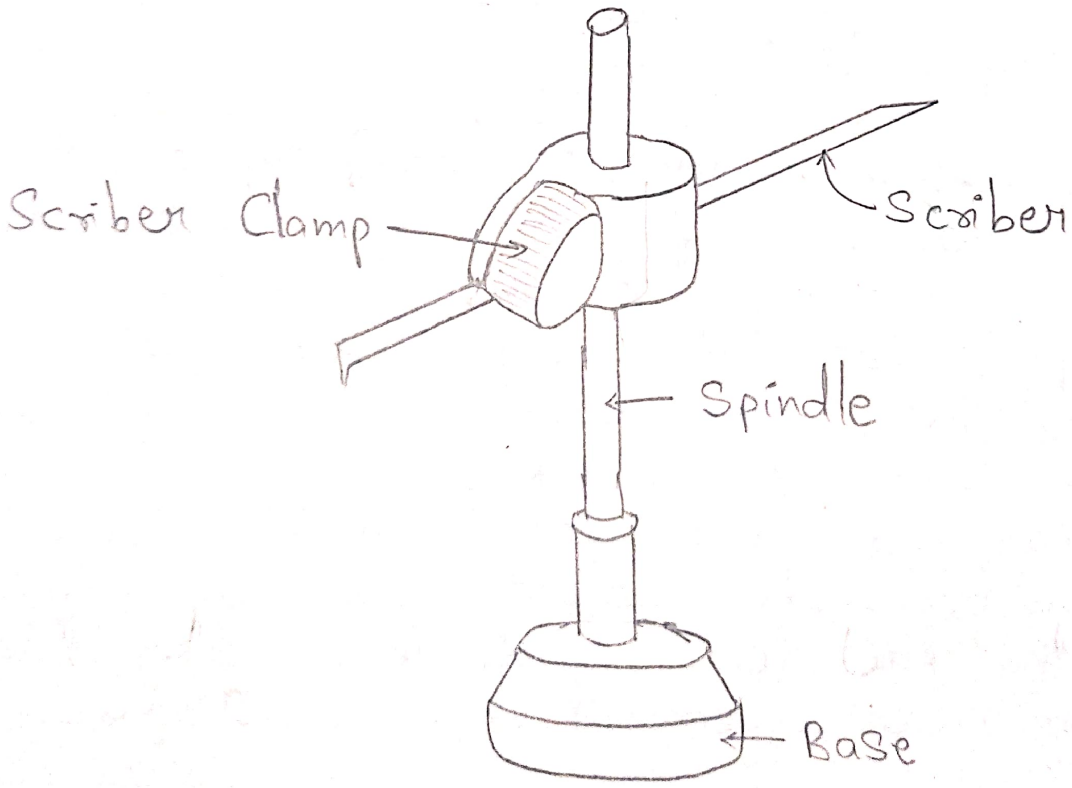
Universal bevel protractor or vernier bevel protractor is used for measuring and testing angles as shown in fig. It consists of a base, graduated disc (main scale), sliding blade and vernier scale. The sliding blade can be locked against the dial by tightening the blade clamp nut.

Marking Tools:

(i) Divider: A divider is an important instrument used for marking work as shown in fig. It is similar to callipers but it's legs have sharp points. These are made up of steel. It is used for marking arcs, dividing a line or transferring the dimensions. The most common type of the divider used in fitting have spring arrangement.



Trammel



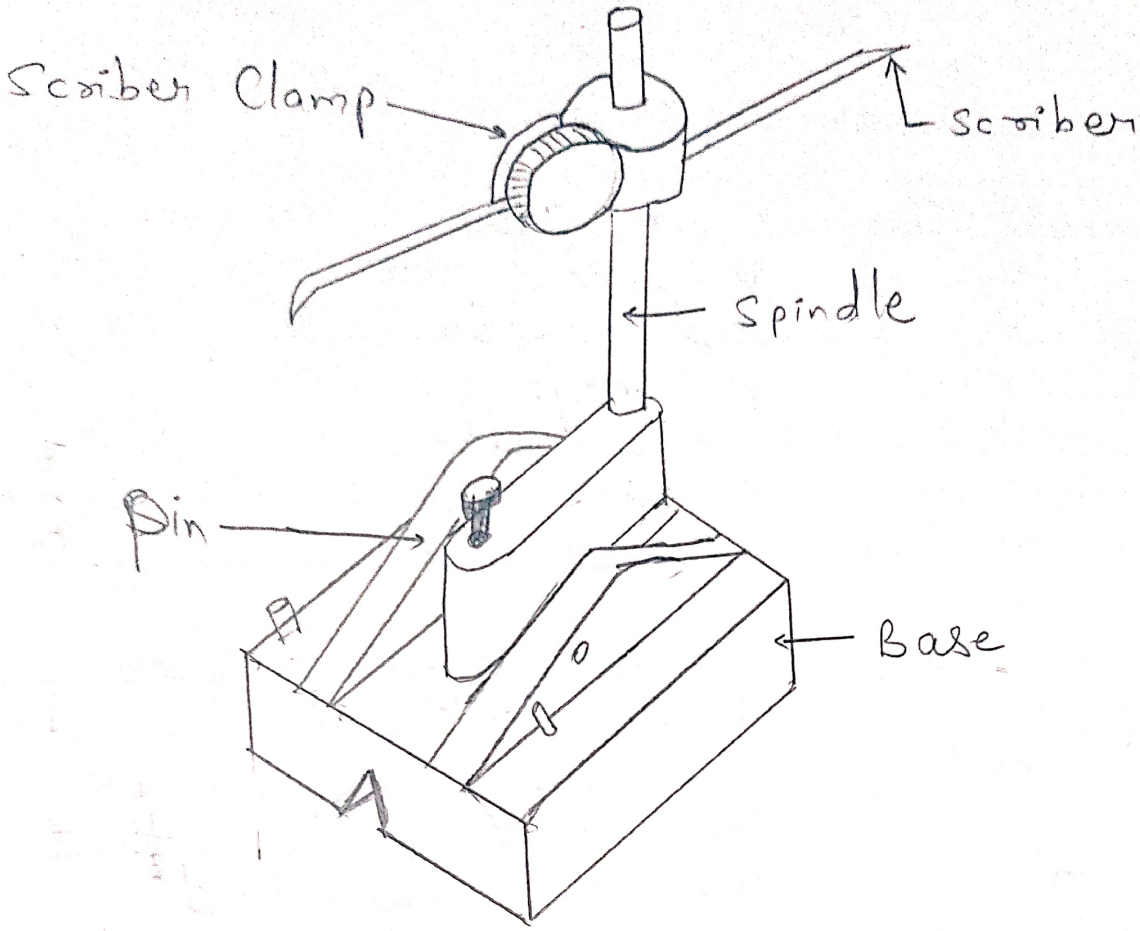
Fixed Surface Gauge

(ii) Trammel: Trammel or beam compass or beam trammel is an alternative to divider. It is used where a large circle having a large radius is to be marked. It may also be used to measure distance in the same way as a divider is used.

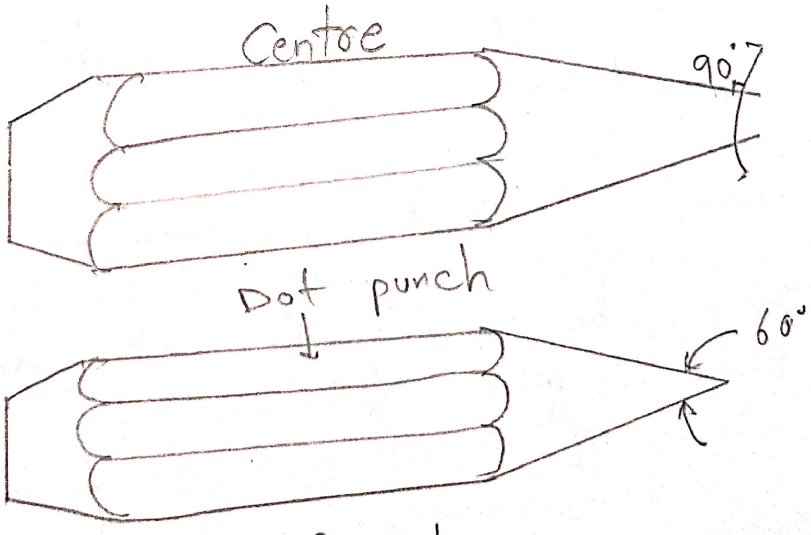
(iii) Fixed Surface Gauge: Fixed surface gauge or scribing block is used for checking parallelism of work and for marking out parts that have to be fitted or machined (centering of a job on lathe). It consists of a solid base. Precision machined at the bottom, with a fixed pillar carrying a scriber which can be ~~clamping~~ clamped on it so as to set it at any height or angular position.

(iv) Universal surface Gauge: The universal surface gauge has a pillar which can be moved at any position with the help of screw and nut. it consists of a heavy base, scriber, bar.

Teacher's Signature.....



Universal Surface Gauge



Punches

...ght Gauge

Scribers :

Scribers are used to scratch lines on metal surfaces. It is made from hardened and tempered steel having a long narrow sharp point. Some Scribbers are held in hand like a pencil while others are held in marking tools like a universal surface gauge, the bent end is used to scratch line in place where the straight end cannot reach. The point of scriber is always kept in good condition by sharpening on an oilstone.

Punches : Punches is used for marking out work, locating centres for drilling etc. Three types of punches are shown in fig.

(a) Centre Punch
(b) Dot Punch
(c) Automatic Punch

Centre punch is used for marking centre of the hole before drilling. It is made up of high carbon steel or high speed steel and tempered at the point. One end of

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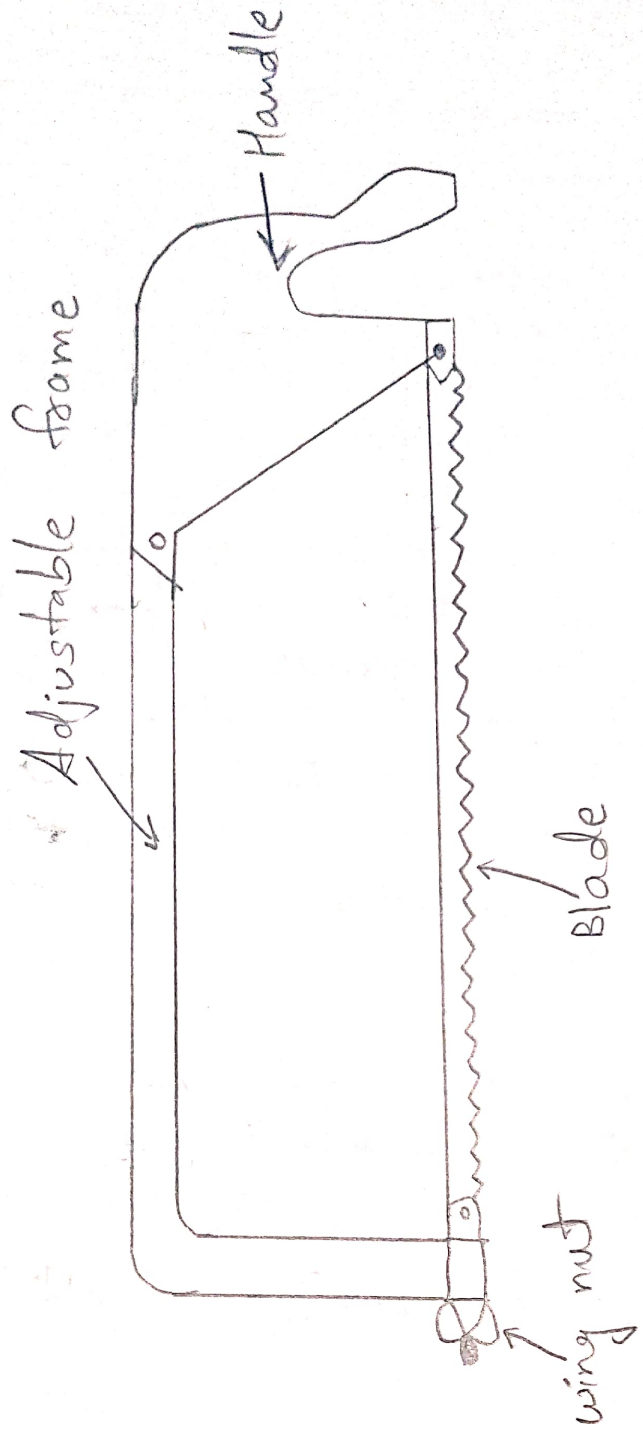

Hack - Saw

the punch carries a point ground to an included angle of 90°, while the other end (Head) is slightly chamfered to prevent it from burning.

Cutting tools :

① Hack Saw : Hack saw is used for cutting metal by hand. It consists of a metal frame which holds a thin blade, firmly in position. The wing nut at the front end of the frame is for tentioning the blade. The blades are made of high speed steel and frames are made of steel. The soft-backend blades are toughter and less liable to break than the all hard blades. The hacksaw blade is fitted into a hacksaw frame with teeth pointing away from the handle. The length of the blade is the distance between the outside edges of the holes which hits over the pins. Blades are classified as follows :

(i) Depending upon the direction of cut :

(a) Forward (b) Backward.

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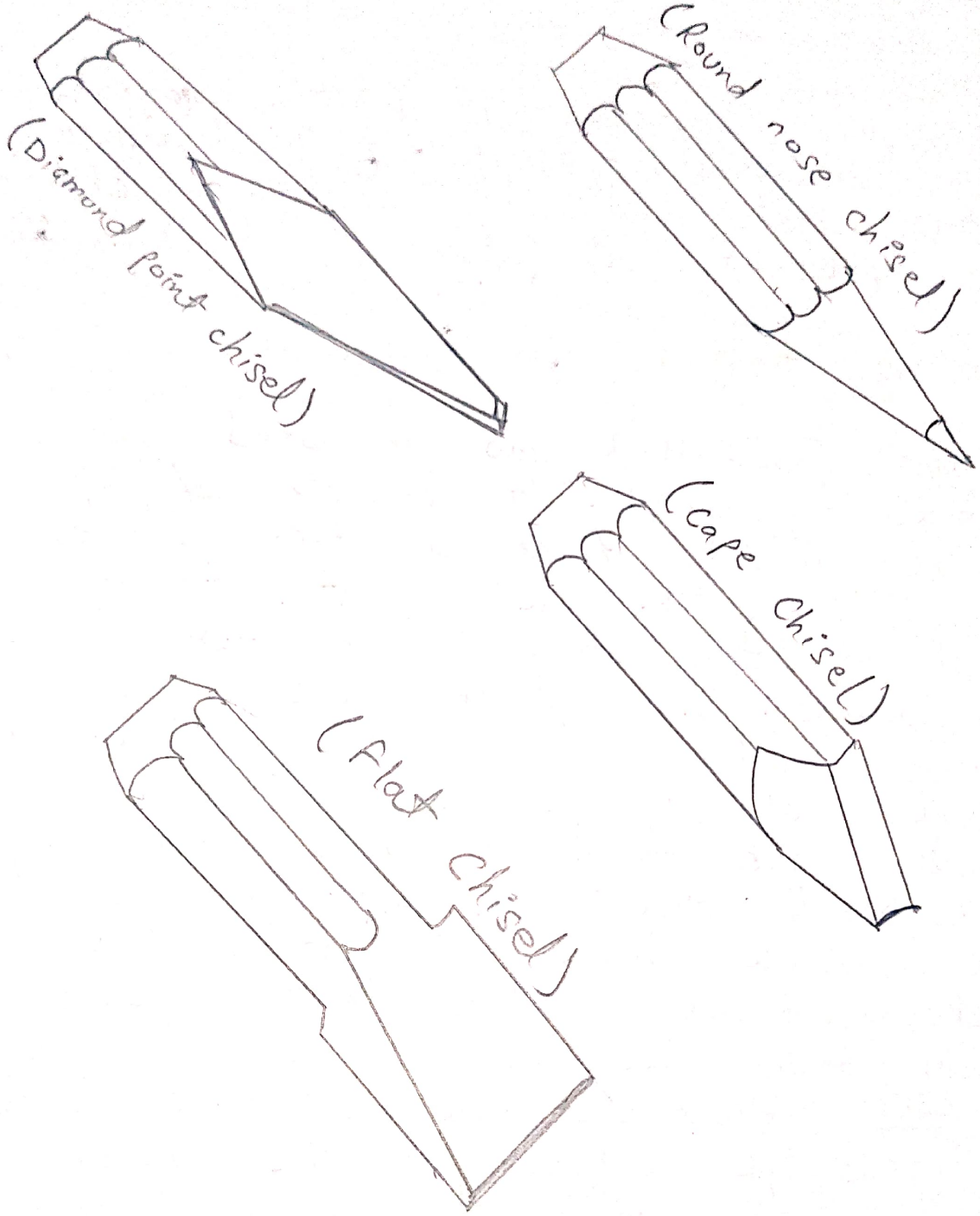
A


(Diamond point chisel)
(Round nose chisel)
(Cape chisel)
(Flat chisel)

Chisels

(ii) Depending upon the pitch of the teeth

(a) Coarse (9-14 TPI) (b) Medium (16-20 IPI)
(c) Fine (24-32 IPI)

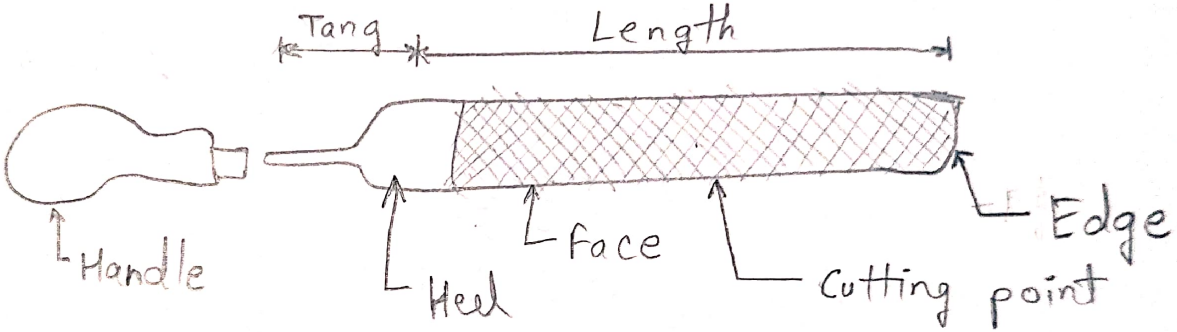
② Chisels : Chiesels are used for chipping and cutting pieces of metal and are made of carbon steel. It is forget to shape, roughly ground and then hardened and tempered. The cutting angle of 60° is most commonly used for chisel but this may vary, depending upon the material to be cut.

The chisel are classified according to their shape and width. They are:

(a) Flat Chisel (b) Cross cut Chisel
(c) Diamond point Chisel (d) Round nose chisel.

Flat Chisel are used for chipping flat surfaces, cutting off sheet metal, cutting bars, rivets, etc. It has a wise cutting edge about 20 mm to 25 mm.

File



Cross Cut or Cape Chisel is used for cutting keyways. It has a cutting edge about 6 mm to 10 mm wide. From the edge the metal thickness tapers off slightly. This is to permit the body of the chisel to clear when a groove is being cut.

Round nose chisel are used to cut grooves and oil channels in bearings. The cutting edge of such chisels is semi-circular

Diamond point chisels are used to cut V-shaped grooves and to chip square corners. It has a cutting edge shaped like a diamond.

③ Files: files are classified and named according to their shape, cutting teeth grade of cut and sectional form.

(a) According to size is the distance from tip of the file to the heel, without the tang. The length of files ranges form 100mm to 450 mm.

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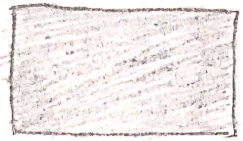
Table : Classification of Files

Type	Form	No. of teeth/10mm	Uses
Rough (R)		8	for soft metal
Bastard (B)		12	for general shaping work.
Second cut (SC)		18 / 6	for Harder metals and good finish
Smooth (S)		20 - 24	for High degree of accuracy and very High finish.
Dead Smooth (DS)		40	for high degree of accuracy and very High finish.

(b) According to cut of a file cuts of files are divide into two groups.
(i) Single-cut
(ii) Double-Cut

The single-cut files have teeth which are cut parallel to each other across the file. They are inclined at an angle of 60° to the centre line of the file. Such files are frequently termed as "flats" and are mainly used on very hard metal.
The double-cut files have two sets of teeth. The over cut teeth are cut at 60° and the up cut teeth at 75° to 80° to the centre line.

(c) According to grade of cut grade of cut is obtained from the number of teeth on a length of 10mm. Shorter the file, greater is the number of teeth per 10mm for any given grade the different grades are as follows:

Table : classification of files
(on white page)

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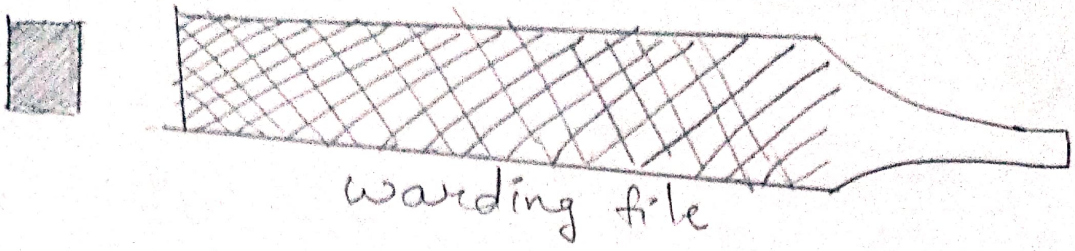
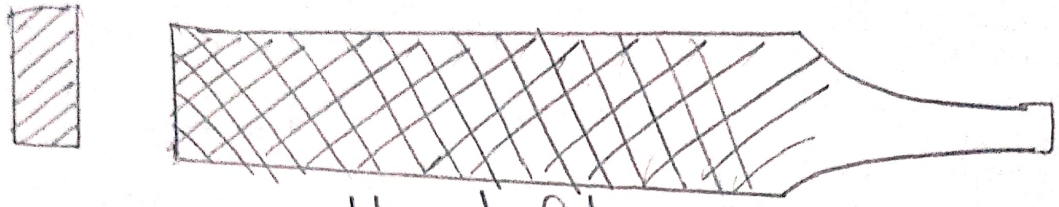
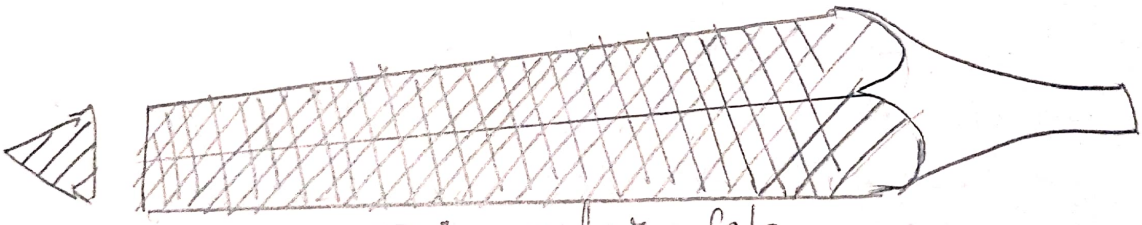


warding file

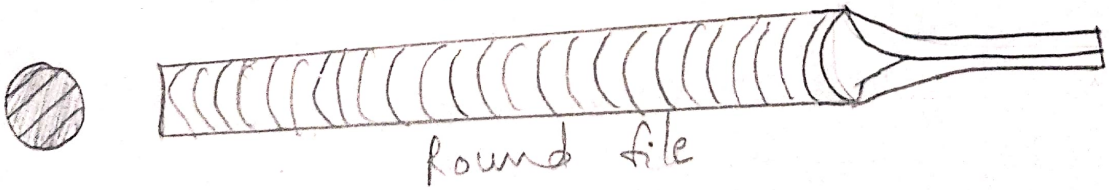


Hand file

flat file



Triangular file



Round file

Types of Files

(d) According to shape of file. The shape of a file is its general outline and cross-section. Most commonly used files are as follows:

(i) Flat file (ii) Hand file
(iii) Square file (iv) Pillar file
(v) Round file (vi) Triangular file
(vii) Half-Round file (viii) Knife edge file or needle files
(ix) Needle file (x) Riffler file
(xi) Warding file

Triangle file is also known as three square file. It has a cross-section tapering the point. It is used for filling square shoulders or corners and for sharpening wood working jaws. Half round file is tapered double-cut and its cross section is not a half circle but only about one third of a circle. It is used for filing curved surfaces.

Knife edge file has a width tapered like a knife blade. It is also tapered towards the tip and thickness. It is used for finishing sharp corners

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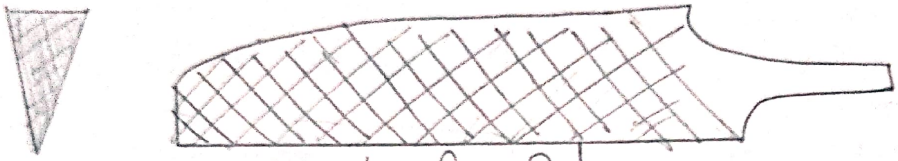
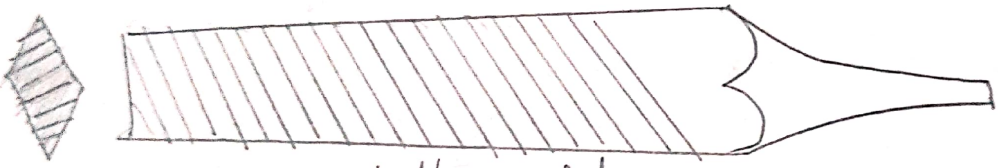
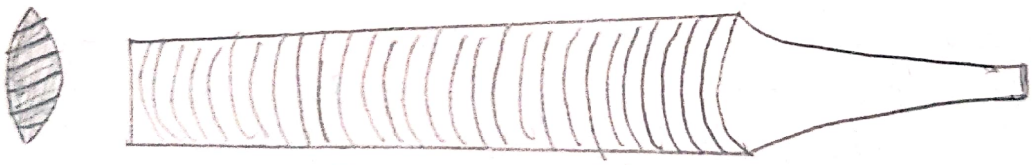
Square file



Knife file



Slitting file



Crossing file

Types of files

of grooves and slots.

Needle file is a small file having a round handle which is an integral part of the file. These files are used for fine work such as pieced deg designer in sheet metal.

Riffler file is small file which is curved upward at the ends into an arc having double cut teeth. These files are used for filing the inside of casting and bottoms of cavities in tool room work. These are also called needle files.

Warding file is thin flat having fine teeth and are about 100mm long.

Striking tools :

(i) Hammers : Hammers are used to strike a job or a tool. It consists of a head, striking face, peen and a handle. The hammers heads are made of plain carbon steel, forged or stamped. The face and peen are hardened and tempered where the head

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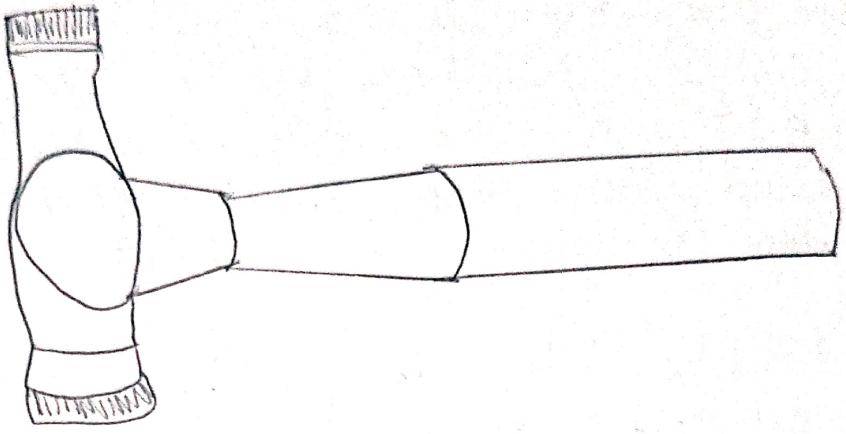

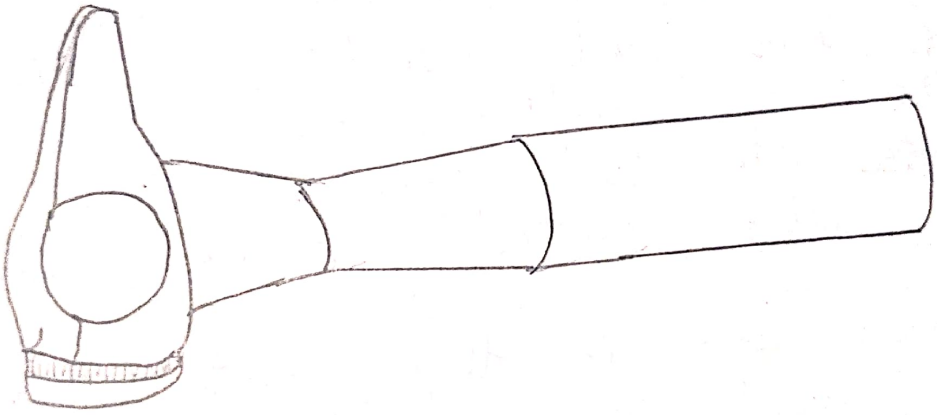

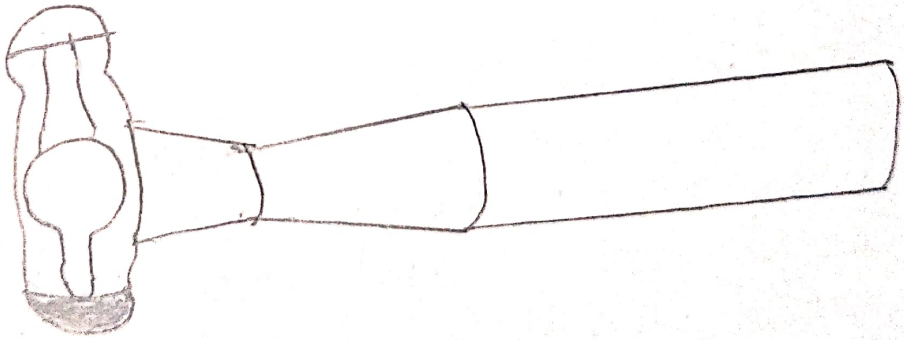

Hammers

along with the eye are left soft. The handle or shaft is made from wood or bamboo, hammers are classified according to the shape of the peen, weight and the material of which they are made. The main types of hammer are as under:

(a) Ball peen hammer: Ball peen hammer or engineers hammer of chipping hammer is the most common type of hammer. It is used for hammering the ends of pins, rivets and chipping. The peen of ball peen hammer is in the shape of a ball.

(b) Cross peen hammer: Cross peen hammer is mainly used for bending, stretching, hammering. This is similar to ball peen hammer except the peen which is across the shaft or eye.

(c) Straight peen hammer: Straight peen hammer has been straight with the handle (parallel to the axis of the shafts).

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(d) Soft hammer : Soft hammer or mallets are used for getting finished surface which would be damaged by the grounded face of a hammer.

Practical

To Cut A Square Notch using backsaw and Drill Three Holes on PCD and Tapping.

OBJECTIVES :→

1. Preparation for the Job.
2. Perform required operation tools, equipment and material.

TOOLS EQUIPMENT AND MATERIALS REQUIRED :→

1. Drill machine
2. Bench-vice
3. Hack-saw
4. Flat file 300mm bastard.
5. Square file smooth 200mm
6. Drill bits 5mm
7. Divider
8. Centre punch
9. Tap set of 6mm
10. Tap handle

PRECAUTIONS :→

1. Mark direction accurately.
2. Cut the notch properly.
3. File as per dimension.
4. Drill after punching drill mask.

PROCEDURE :→

1. Mark the centre of square piece.
2. mark the square notch of 10 at one corner of work-piece.

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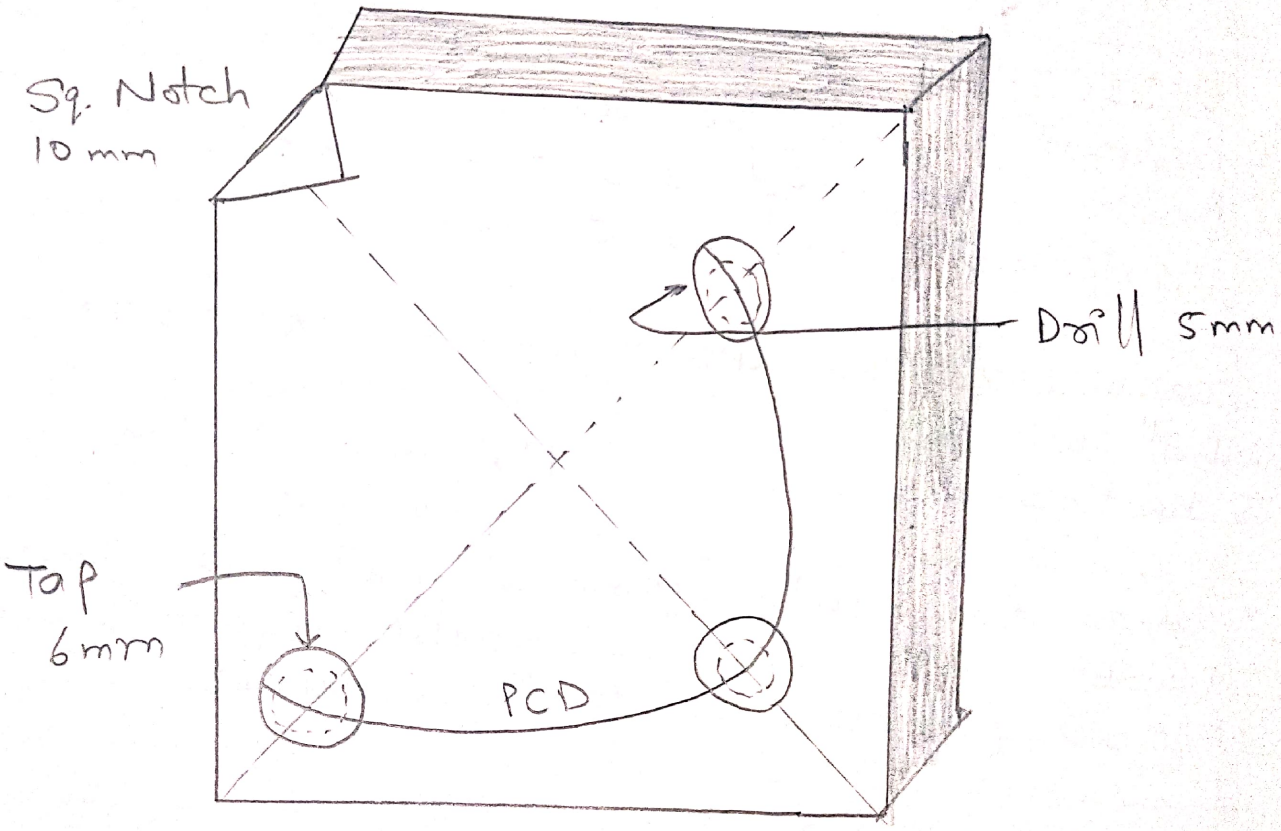

Cutting, Drilling and Tapping operation on MS Flat

3. Cut the square notch by holding job in vice with square file.
4. File and finish the notch.
5. Mark PCV 25mm from centre of Job.
6. Mark centre of on ch.... the centre of PCD circle with divider and centre punch.
7. Hold the Job in vice horizontally. Drill three holes of 5mm size.
8. Tapp holes with 6mm tapes set sequence wise.
9. Finish the Job.

Conclusion :→
Cut Notch, drilled holes on PCD and Tapped.

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