

Instructions for Laboratory

- The objective of the laboratory is learning. The experiments are designed to illustrate phenomena in different areas of Workshop and to expose you to uses of instruments. Conduct the job with interest and an attitude of learning.
- You need to come well prepared for the job.
- Work quietly and carefully (the whole purpose of experimentation is to make reliable measurements!) and equally share the work with your partners.
- All presentations of job and diagram should be neatly and carefully done.
- Diagrams should be neatly drawn with pencil. Always display units.
- Come equipped with scales, pencils etc.
- Do not fiddle idly with apparatus. Handle instruments with care. Report any breakage to the Instructor. Return all the equipment you have signed out for the purpose of your experiment.

EXPERIMENT NO:

DATE: / / 20

AIM OF THE EXPERIMENT: To study about different hand tools used in fitting shop.

Theory:

Components may be produced by working on metal either on a machine tool or on the bench. Sometimes it becomes necessary to replace or repair a component which must fit accurately with another component on re-assembly. This involves a certain amount of hand fitting. The assembly of machine tools, jigs, gauges, etc. involves certain amount of bench work. The accuracy of work done depends upon the experience and skill of the fitter. Metal removal at the bench requires the use of a number of simple hand tools and considerable manual effort. Working on components with hand tools and instruments, mostly on workbenches is generally referred to as, 'fitting work'. The hand operations in bench work consist of filing, chipping, scraping, sawing, drilling, tapping, grinding etc.

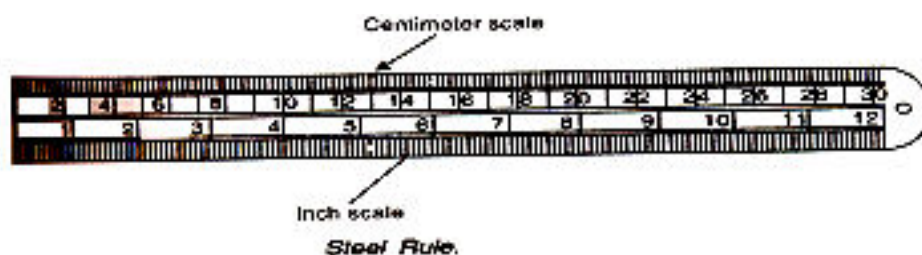
Material Used: Mild steel also known as plain-carbon steel and low-carbon steel, is now the most common form of steel because its price is relatively low while it provides material properties that are acceptable for many applications. It contains a small percentage of carbon approximately 0.05–0.25%. It is strong, tough , malleable and ductile. It has a relatively low tensile strength, but it is cheap and easy to form making it suitable for use in many applications

TOOLS AND EQUIPMENT REQUIRED IN THE FITTING SHOP:

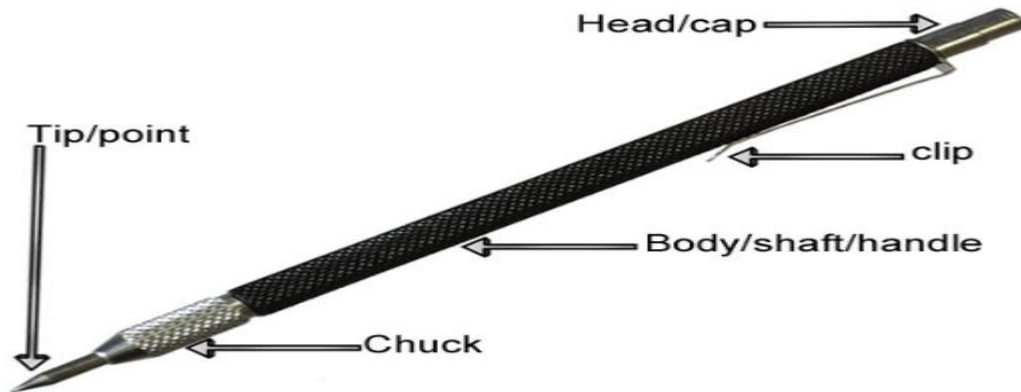
Both the bench work and fitting require the use of a number of simple hand tools.

1. MARKING AND MEASURING TOOLS

- i) **Steel rule-** It is used for measurement of length. It is usually graduated in millimeter and inches. Its least count is 0.5 mm or 1/64 of an inch. For accurate reading it is necessary to read vertically to avoid errors arising out of parallax.



(ii) **Scriber**- A scriber is a slender steel tool used to scribe or mark lines. It is made up of high carbon steel which is hardened.

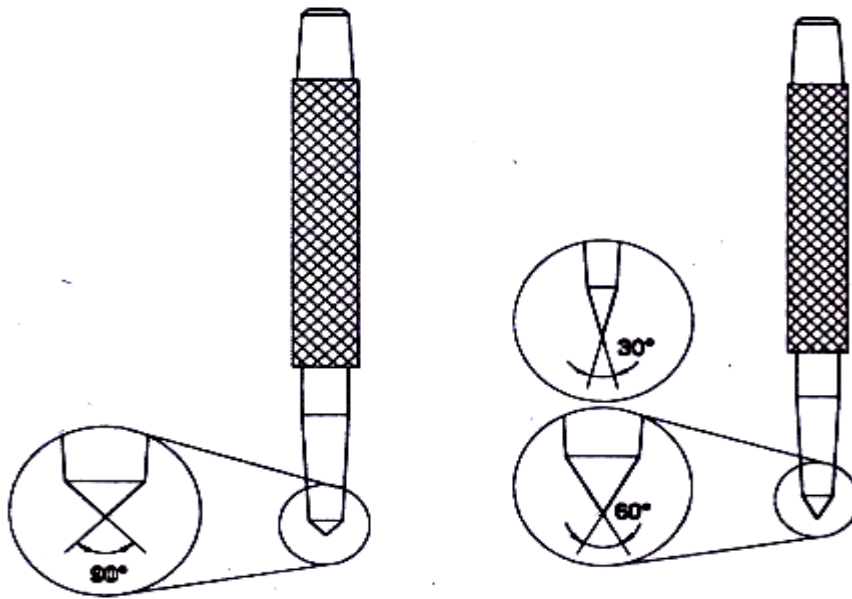


(iii) **Punch**- It is a marking tool used for marking 'by dots'.

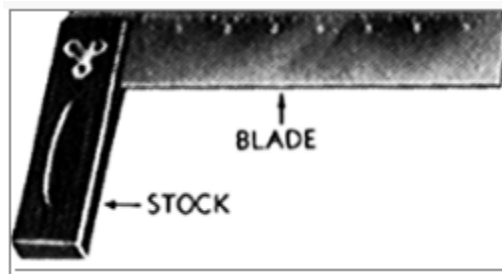
These are of three types:

1. Centre Punch (90°) - It is used for locating centre of holes.
2. Dot Punch (60°) - It is used for weakness marking.
3. Prick Punch (30°) - It is used for light punch marks

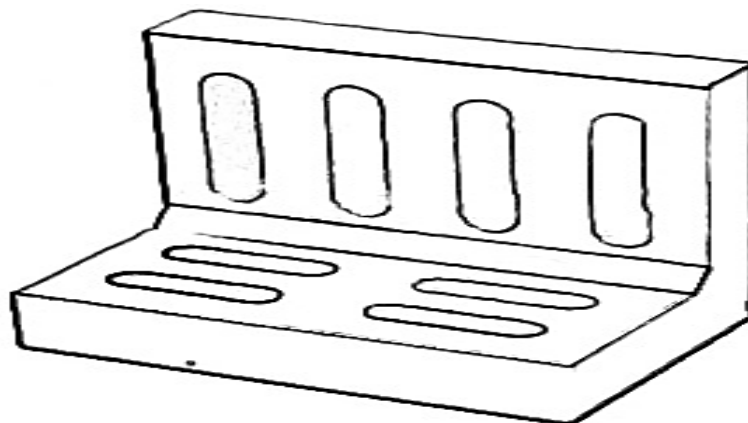




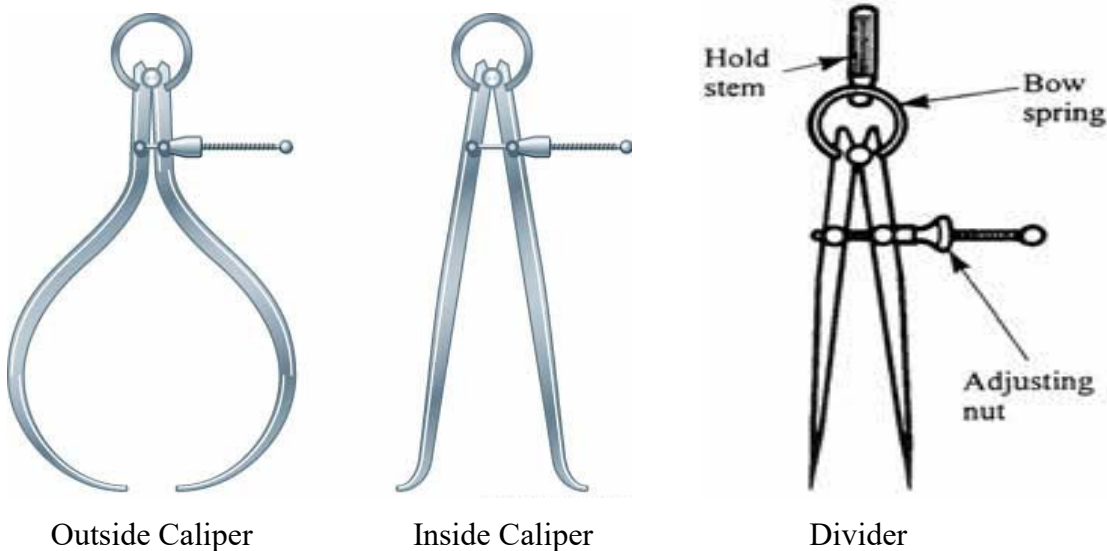
(iv) **Try square**- It is used for measuring right angle of a job and for checking squareness of many types of small works. The blade is made of hard steel and the beam of steel.



(v) **Angle plate**- It is placed over the surface plate for supporting jobs at the time of marking. It is made of cast iron.



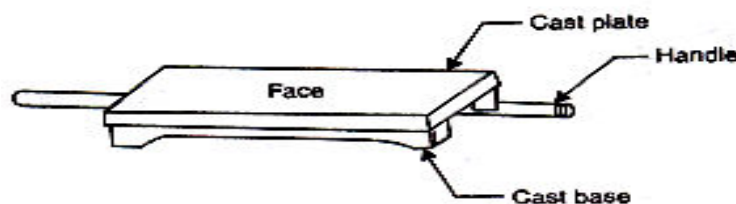
- (vi) **Outside caliper-** It is a device used for measuring and transferring the outside dimensions of components.
- (vii) **Inside caliper-** It is used for measuring inside dimension of components.
- (viii) **Dividers-** It is used for marking, drawing arcs, circles, laying out perpendicular lines, bisecting lines etc.



- (ix) **Steel tape-** It is used for measuring length.
- (x) **Spirit level-** It is used for testing the levels of flat surface.

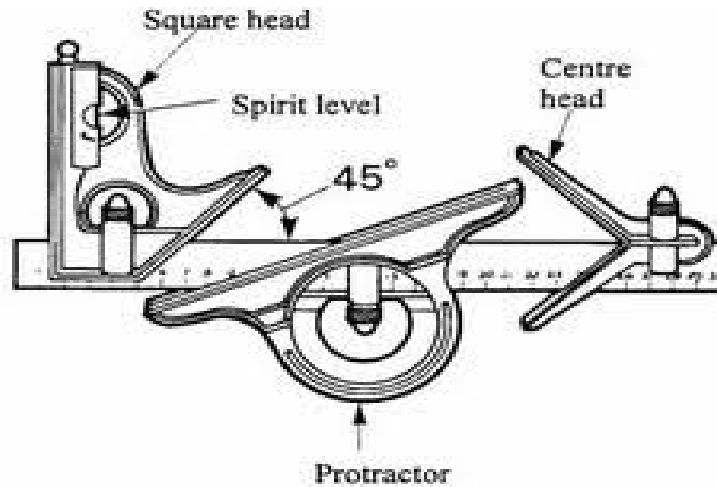


- (xi) **Straight edge-** This tool is used for testing the straightness and flatness of plane surfaces.
- (xii) **Surface plate-** It is used for marking purpose. The job is placed over the surface plate and marked with the help of Bevel protractor. It is made of cast iron. It is usually rectangular in shape.

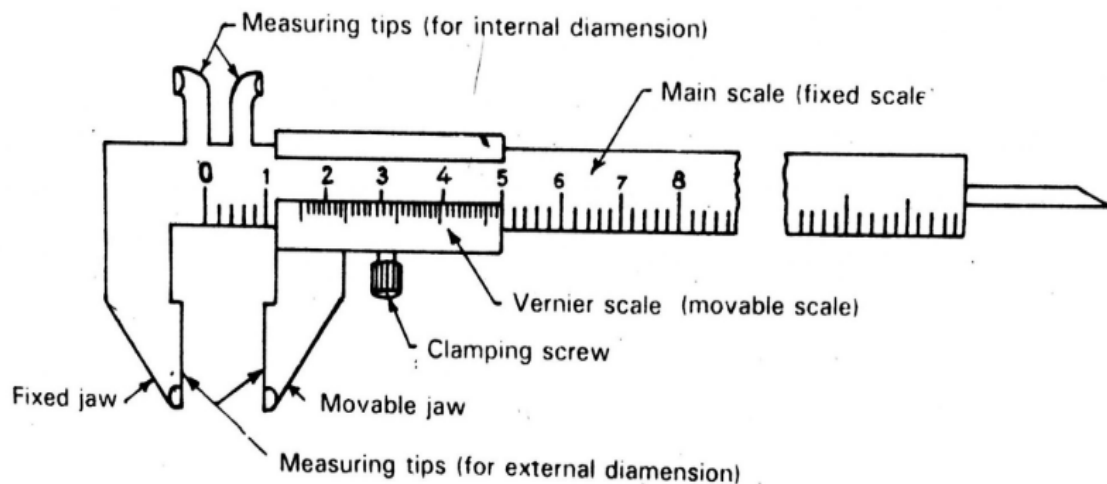


Surface Plate.

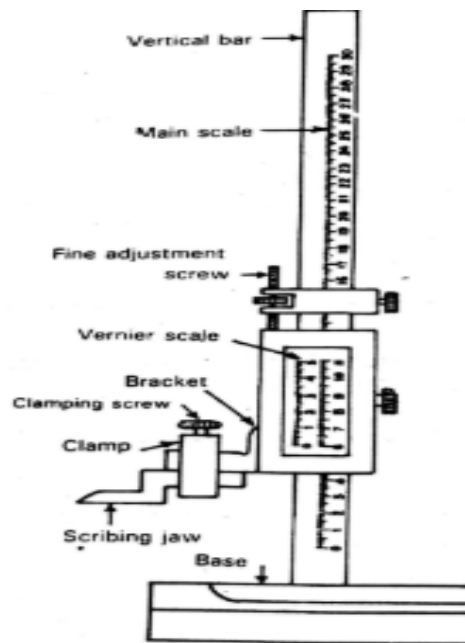
- (xiii) **Combination set-** It is a very useful instrument having a combination of five different instruments in one. A combination set consists of a rule, square head, centre head and a protractor. This may be used as a rule, a square, a depth gauge for marking degrees (45°) and for locating the measuring and marking angles.



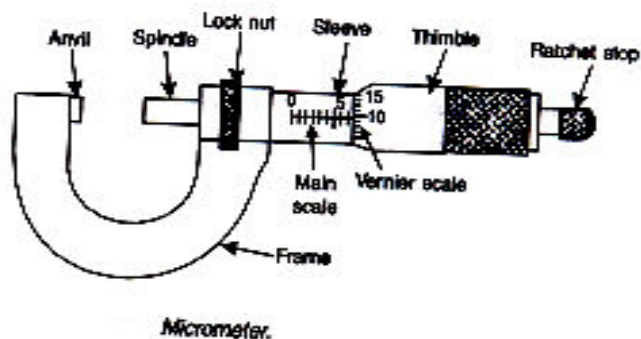
- (xiv) **Vernier caliper-** Vernier caliper is a precision measuring instrument of outside diameter, inside diameter and depth. The least count of vernier scale may be 0.001 inch system, 0.02mm metric system.



- (xv) **Vernier Height Gauge-** It is similar to vernier calipers and used for marking purpose. It consists of scriber by which lines are scribed on the job.

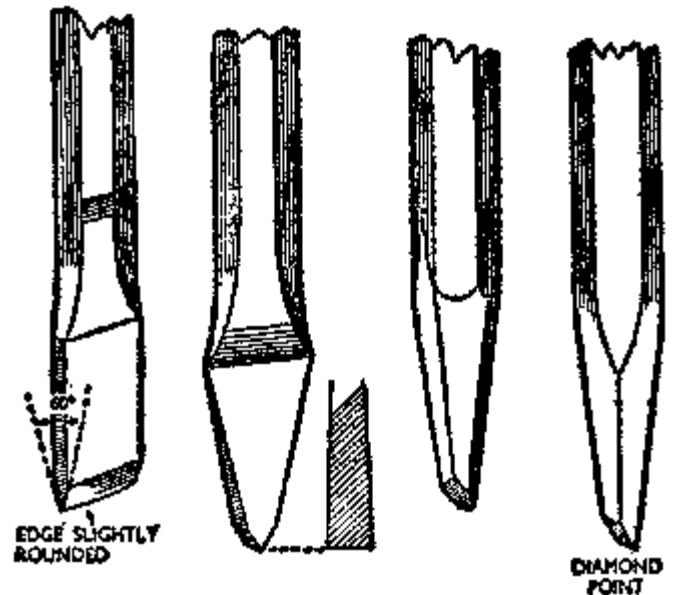


- (xvi) **Universal scribing block-** It is also for scribing lines for layout work and checking parallel surfaces.
- (xvii) **Outside micrometer-** It is a measuring instrument used for measuring external dimensions accurately. They are available in different ranges outside micrometer list count of 0.001mm.

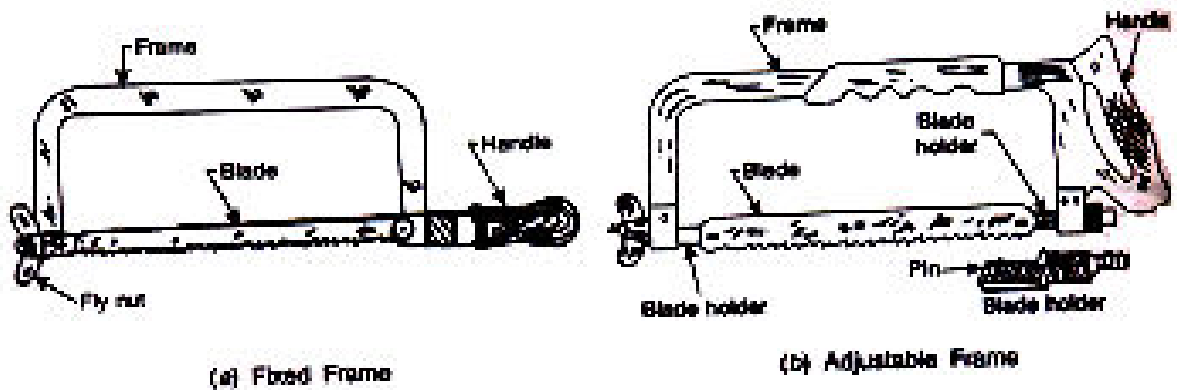


b. **CUTTING AND FINISHING TOOLS:**

- (i) **Chisels-** Chisel is a single point cutting tool. It is used for removing surplus metal or for cutting sheets. The tools are made from 0.9% to 1.0% carbon steel of octagonal or hexagonal section.

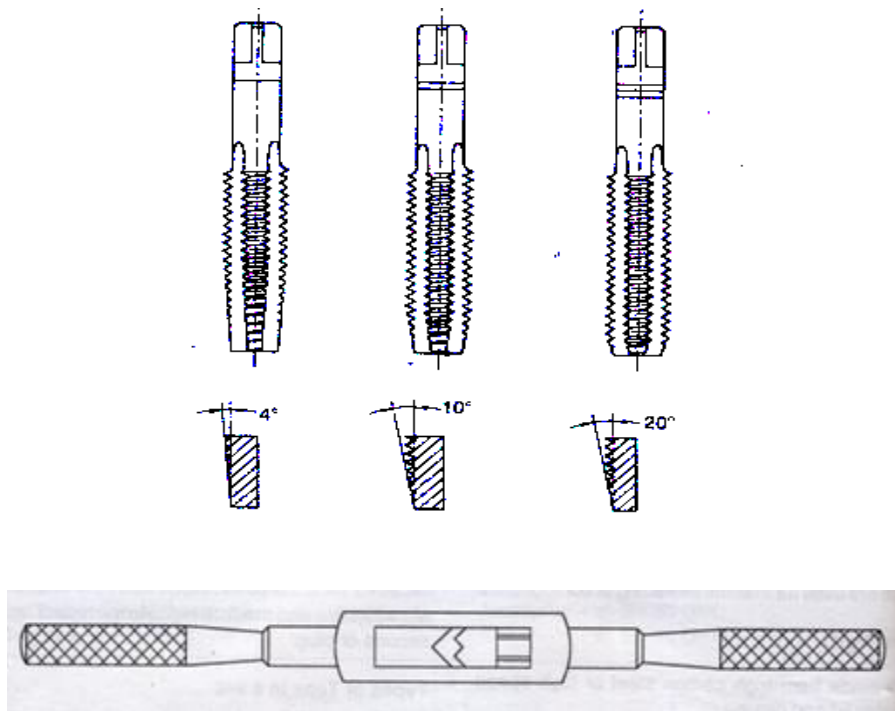


- (ii) **Hacksaw-** Hacksaw is a multi-point cutting tool. It is used for cutting metal by hand with a frame which holds a thin blade, finally in position. The blade has a number of cutting teeth. The number of teeth per inch is selected on the bit of types of job.



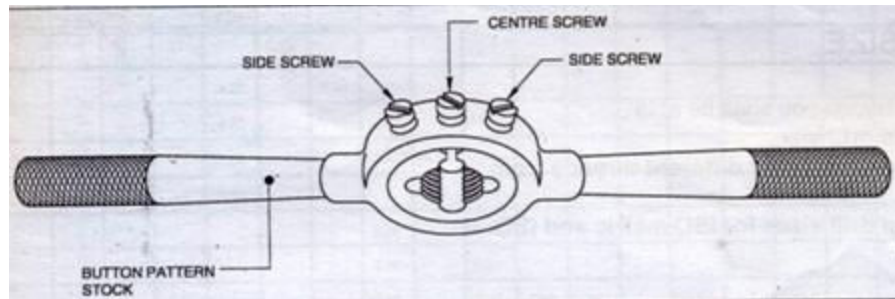
Hand Hacksaws.

- (iii) **Scraper-** It is a single point cutting tool. It is used for obtaining a fine surface finish on the work by removing convex spots from machined surfaces. Scrapers may be flat, triangular and half-round. The material is good quality forged steel and cutting edge is usually left very hard. Scrapers are made in a variety of lengths from 100mm onwards and in many shapes.
- (iv) **Taps and Tap Wrenches-** A tap is a hardened steel tool, used for cutting internal threads in a drilled hole. Hand taps are usually supplied in sets of three for each diameter and thread size. Each set consists of a taper tap, intermediate tap and plug or bottoming tap.

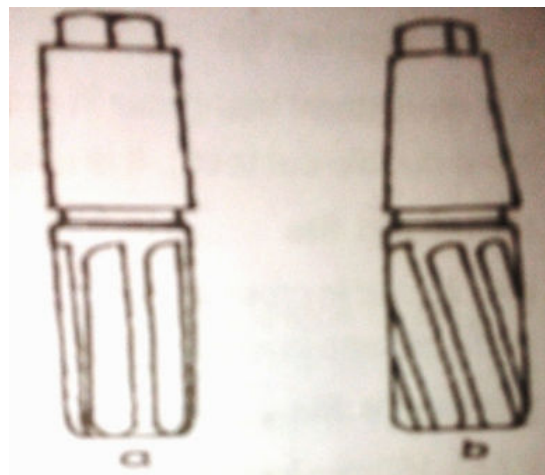


Tap Wrench

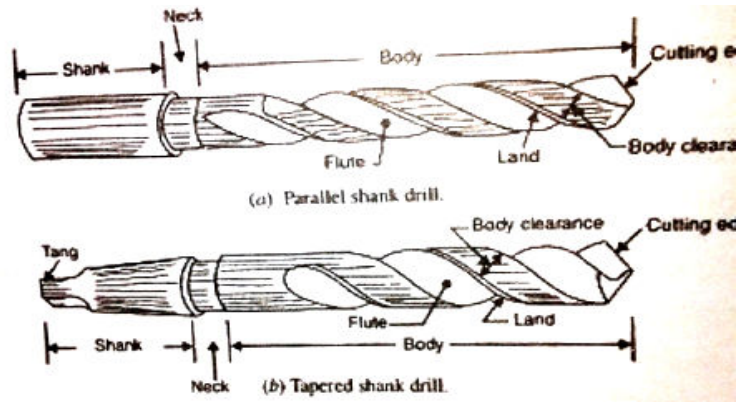
- (v) **Dies and Die-holders-** Dies are the cutting tools used for making external threads. Dies are made either solid or split type. They are fixed in a die-holder for holding and adjusting the die-gap. They are made of tool steel or high carbon steel.



- (vi) **Reamer**- A reamer is a multi-point cutting tool used for enlarging and finishing previously drilled holes to accurate sizes. Reaming produces high quality surface finish and dimensional accuracy to close limits. Also small holes which cannot be finished by other processes can be finished.



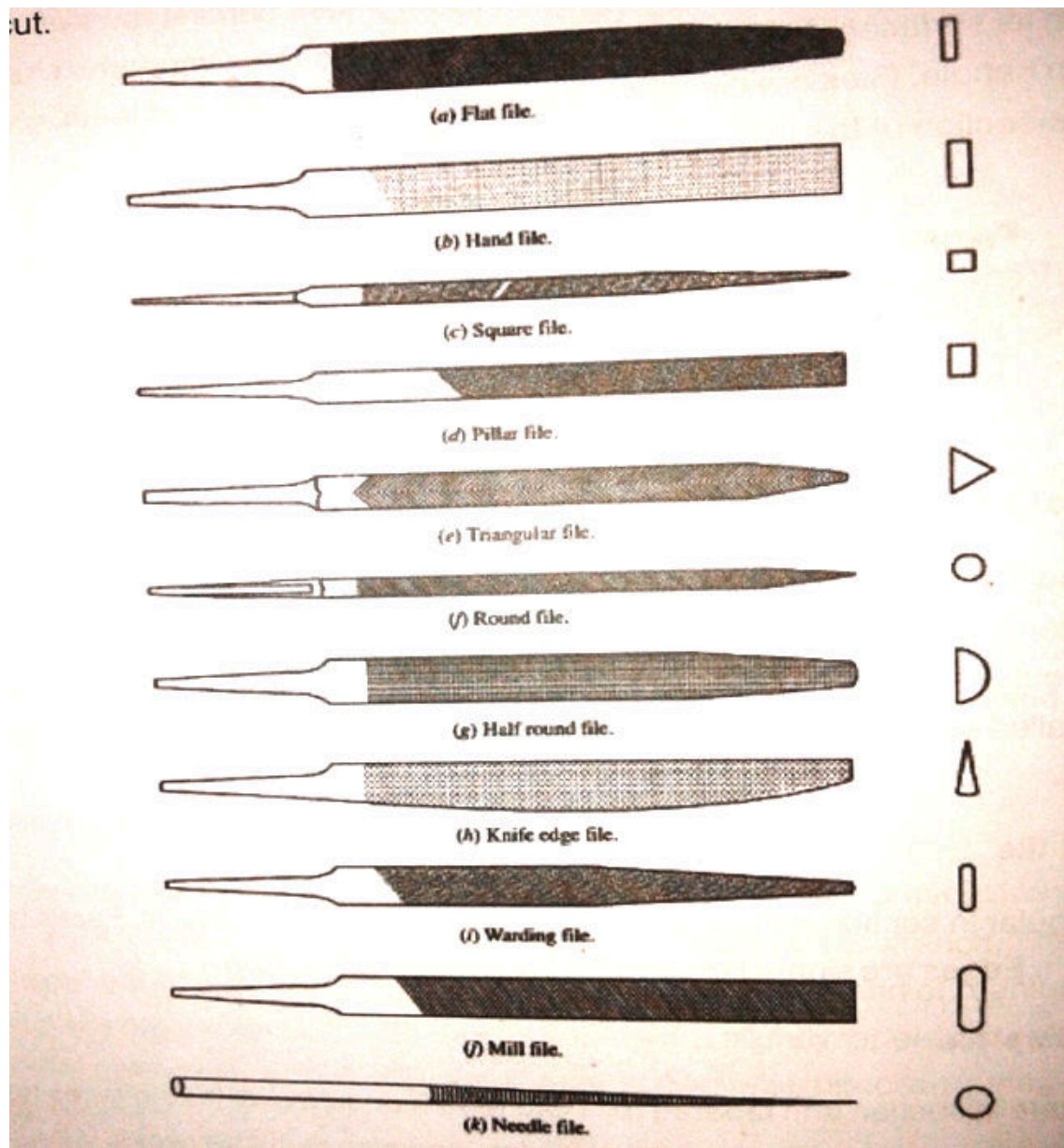
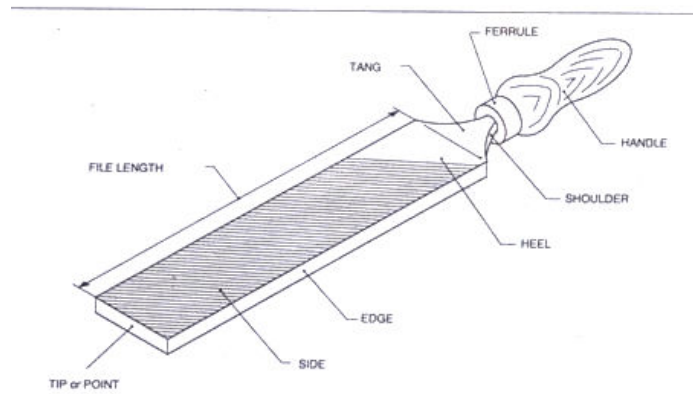
- (vii) **Combination Cutting Pliers** - This is made of tool steel and is used for cutting as well as for gripping the work.
- (viii) **Twist Drill**- Twist Drills are used for making holes. These are made of high speed steel. Both straight and taper shank twist drill are used. The following are the sizes and designations of twist drills.
- Millimeters from 0.4 mm onwards
 - Inches from 1/16" onward
 - Letter Drills A to Z
 - Number drills 60 to 20
 - Taper shank drills 3 to 100mm



- (ix) **Files** - Filing is one of the methods of removing small amount of material from the surface of a metal part. A file is a hardened steel tool, having slant parallel row of cutting edges or teeth on its surfaces. On the faces, the teeth are usually diagonal to the edge. One end of the file is shaped to fit into a wooden handle. The hand file is of parallel width and tapering slightly in thickness, towards the teeth. It is provided with double cut teeth on the faces, single cut on one edge and no teeth on the other edge, which is known as the safe edge. Files are classified according to their shape, cutting teeth and pitch or grade of the teeth based on the coarseness or the pitch of the teeth.

Flat file: Flat files are of rectangular cross-section. The edges along the width of these files are parallel up to the $\frac{2}{3}$ rd of the length, and then they taper towards the point. The faces are double cut and the edges single cut. They are useful for filing and finishing external and internal surfaces.

Hand file: these files are similar to the flat files in their cross section. The edges along the width are parallel throughout the length. The faces are double cut. One edge is a single cut whereas the other is a safe edge. These are useful for filing surfaces which are at right angles to surfaces already finished.

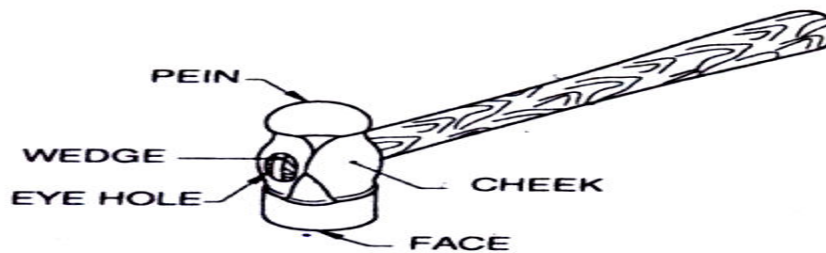


2) Striking Tools:

An Engineers hammer is a hand tool for striking purpose while Punching, Bending, Straightening, Chipping, And Forging, Riveting can be done.

Main Parts of a Hammer:

1. Face
2. Peen
3. Cheek
4. Eyehole



3



BALL PEEN



CROSS PEEN



STRAIGHT PEEN

SQUARE CUTTING

EXPERIMENT NO:

DATE: / / 20

AIM OF THE EXPERIMENT: To make a Square fit from the given mild steel pieces with specified dimensions

MATERIALS REQUIRED: Mild steel flat (48 X 48 X 5mm).

TOOLS AND EQUIPMENT REQUIRED:

1. 6" try square
2. 6" scribe
3. Odd leg caliper
3. 12" hack saw Frame
- 4 Blades (12 TPI)
5. 10" rough file
6. 10" smooth file
7. 10" Square file
8. Dot punch
9. Ball peen hammer.
10. Steel Rule

Sequence of OPERATIONS:

1. Measuring
2. Marking
3. Filing
4. Punching
5. Sawing
6. Finishing
7. Inspecting

PROCEDURE:

1. The given mild steel flat piece is checked for given dimensions.

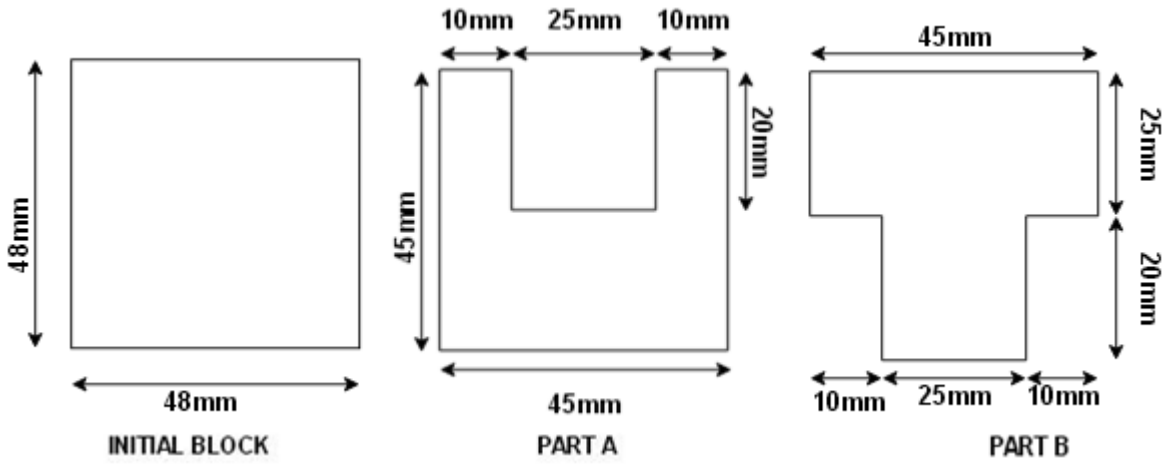
2. One edge of given is filed to straightness with rough and smooth files and checked with try Square.
3. An adjacent is also filed such that is square to first edge and checked with try square.
4. Wet chalk is applied on one side of the flat and dried for making.
5. Lines are marked according to given figure, using odd leg caliper and steel rule.
6. Using the dot punch indentations are made along the marked lines.
7. The excess materials removed from the remaining two edges with try square level up to half of the marked dots.
8. Finally burrs are removed by the filing on the surface of the fitted job.

PRECAUTIONS:

- (1) Keep hands free from dirt oil and grease to avoid slip during work
- (2) Do not carry sharp tool in pocket.
- (3) Wear leather shoes all the time during work.
- (4) Apply force only in forward stroke and relieve the force in backward stroke while sawing and filing.
- (5) While cutting hacksaw blade should remain straight to avoid any damage
- (6) Do not hold work piece in hand during cutting
- (7) Use file and hacksaw with properly fitted handle.
- (8) After filing remove the burr from the edges of the work with brush, to prevent cuts to the finger.
- (9) Filing should be done with proper pressure of hand
- (10) The perpendicularity of face ends edges is checked perfectly by using try square.
- (11) Finishing is given by using only with smooth files.
- (12) Marking is done without parallax error.
- (13) Burrs on the edges should not be removed with hand to avoid cuts.

RESULT: The Square Fit is done successfully as per given specifications.

JOB DIAGRAM



V-FITTING

EXPERIMENT NO:

DATE: / / **20**

AIM OF THE EXPERIMENT: To make a V-Fit from the given mild steel pieces with specified dimensions.

MATERIALS REQUIRED: Mild steel flat (48 X 48 X 5mm).

TOOLS AND EQUIPMENT REQUIRED:

1. 6" try square
2. 6" scriber
3. Odd leg caliper
3. 12" hack saw Frame
- 4 Blades (12 TPI)
5. 10" rough file
6. 10" smooth file
7. 10" triangle file
8. Knife Edge file
9. Dot punch
10. Ball peen hammer
11. Steel Rule

Sequence of Operations:

1. Measuring
2. Marking
3. Filing
4. Punching
5. Sawing
6. Finishing
7. Inspecting

PROCEDURE:

1. The given mild steel flat piece is checked for given dimensions.
2. One edge of given is filed with rough and smooth files and checked with try square for straightness.
3. An adjacent edge is also filed such that it is square to first edge and checked with try square.
4. Wet chalk is applied on one side of the flat and dried for marking.
5. Lines are marked according to given figure, using odd leg caliper and steel rule.
6. Using the dot punch, indentations are made along the marked lines.
7. The excess materials removed from the remaining two edges with try square level up to half of the marked dots.
8. Finally burrs are removed by the filing on the surface of the fitted job.

PRECAUTIONS:

- (1) Keep hands free from dirt oil and grease to avoid slip during work
- (2) Do not carry sharp tool in pocket.
- (3) Wear leather shoes all the time during work.
- (4) Apply force only in forward stroke and relieve the force in backward stroke while sawing and filing.
- (5) While cutting hacksaw blade should remain straight to avoid any damage
- (6) Do not hold work piece in hand during cutting
- (7) Use file and hacksaw with properly fitted handle.
- (8) After filing remove the burr from the edges of the work with brush, to prevent cuts to the finger.
- (9) Filing should be done with proper pressure of hand
- (10) The perpendicularity of face ends edges is checked perfectly by using try square.
- (11) Finishing is given by using only with smooth files.
- (12) Marking is done without parallax error.
- (13) Burrs on the edges should not be removed with hand to avoid cuts.

RESULT: The V-fit is done successfully as per given specifications.

JOB DIAGRAM

