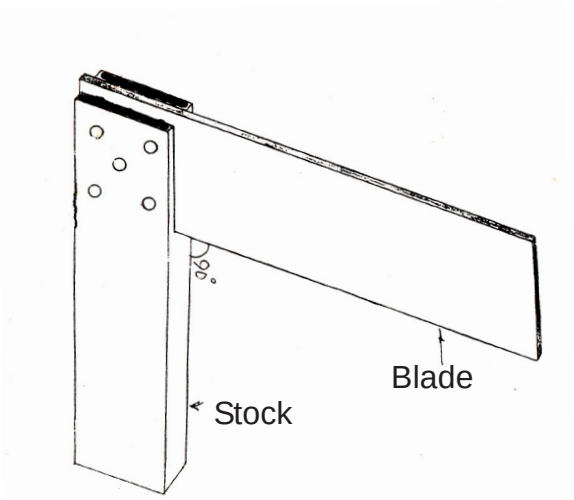
FITTING

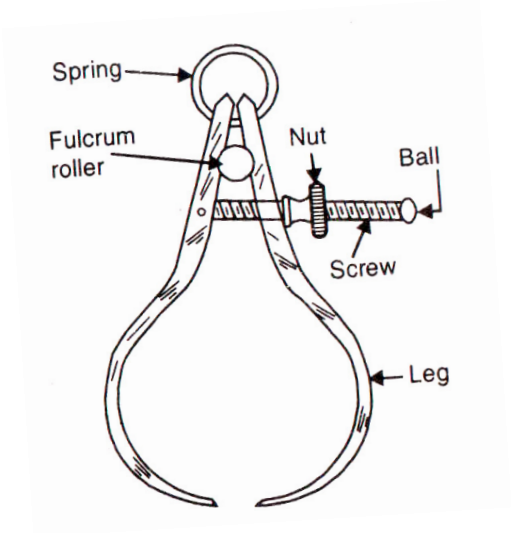
INTRODUCTION

Fitting consists of a handwork involved in fitting together components usually performed at a bench equipped with a vice and hand tools. The matting components have a close relation with each other, and when the function together is termed Fitting. We have to use hand tools, precision tools and various operations, as well as the details of the tool such as identification, material, parts, types, various uses, manipulation, specification, care and maintenance etc.

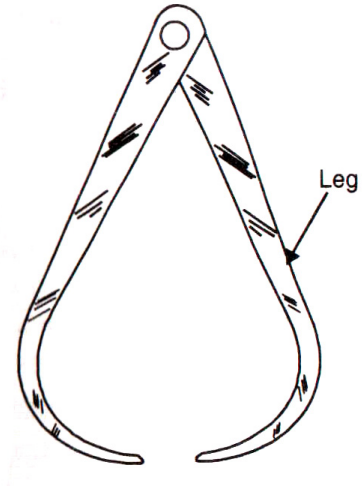
STEEL RULE



TRY SQUARE



SPRING TYPE OUTSIDE CALIPER



FIRM JOINT OUTSIDE CALIPER

SAFETY PRECAUTIONS IN FITTING SHOP

1. Shop floor should be kept clean, free from debris, scrap, oil and grease.
2. Do not touch the chip as it comes out of the job.
3. When using grinding machine protect your eyes with goggles.
4. Always work under sufficient light.
5. Do not wear loose dress.
6. Never use hammers with loose heads.
7. Provide guards between opposite vices.
8. Files must have well fitted handles.
9. See that the job is properly fitted to the vice.
10. Do not blow filing when hacksawing.
11. Ease up the pressure when hacksawing is nearly through.
12. Use the right tool for the right job.

MEASURING TOOLS AND MARKING TOOLS

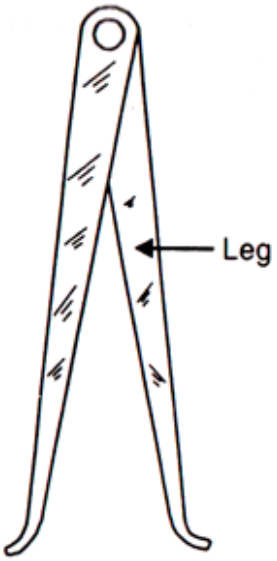
1. Steel Rule : A steel rule is a direct reading measuring instrument used to read an accuracy of 0.5mm. Available in various lengths, widths and thickness with several graduations. They are made from high carbon steel, spring steel, stainless steel and various alloy steel.

2. Caliper : It is a simple tool gauging legs. It is made of high carbon steel and the measuring points are hardened and tempered. Calipers are mainly classified into Spring type and Firm joint caliper.

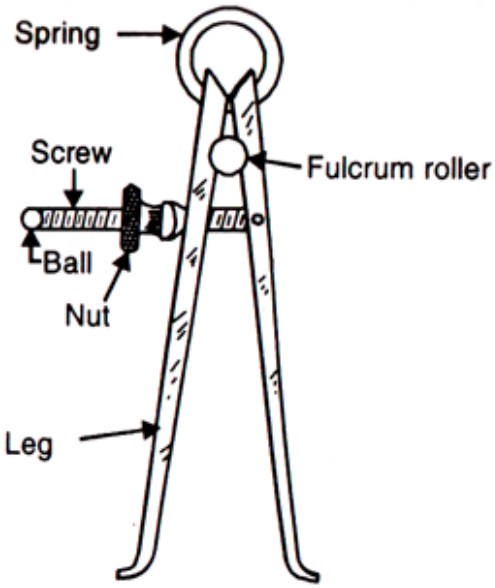
Types : ***Outside Caliper*** - They are used to measure the outer dimensions of the shafts, pulleys and square bars etc.

Inside Caliper - They are used to measure the inner dimensions of holes, bores, slots etc.

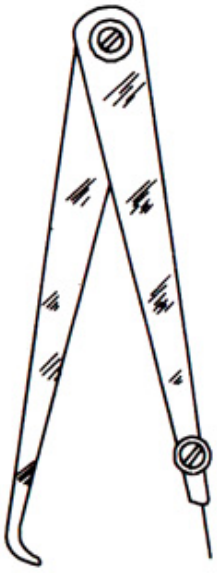
Jenny Caliper - They are used in layout work for locating and testing centre on cylindrical and other sections laying of distance from an edge and to scribe parallel lines.



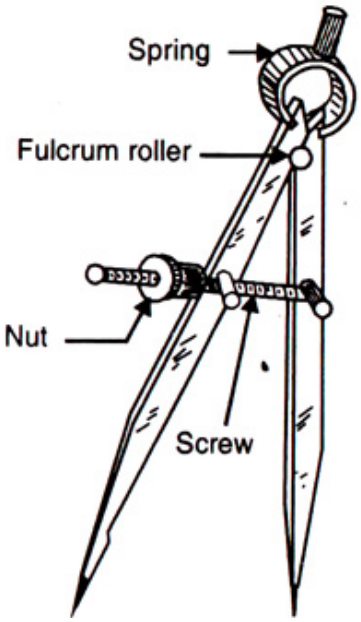
FIRM JOINT INSIDE CALIPER



SPRING TYPE INSIDE CALIPER



ODD LEG CALIPER OR JENNY CALIPER



DIVIDER

3. Try square : It is a marking and checking instrument right angles. It is made of two parts, the stock or beam made of cast iron and the blade made of highcarbon steel. It is classified by the length of the blade from the edge of the stock. It is used to check up the right angles and also for checking the flatness of the object.

4. Scriber : A scriber is a pointed tool used for marking lines on metals. Scribers are made from highcarbon steel and the points are hardent and tempered.

Types : *Straight Scriber, Bent type scriber, Offset scriber, Adjustable Scriber etc.*

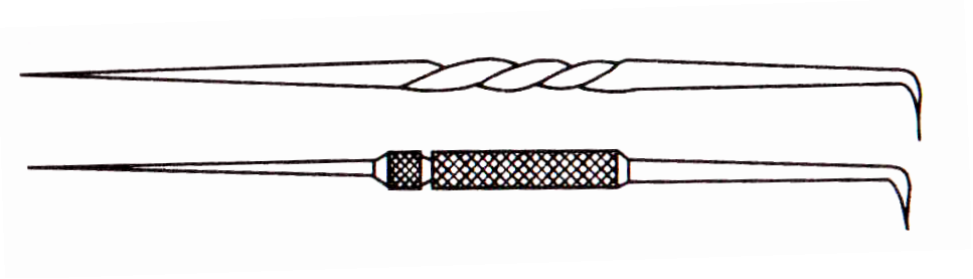
5. Divider : This tool consists of two pointed legs having a joint at the top end. There are spring type and firm joint dividers. It is made from highcarbon steel and the points are hardent and tempered. It is used to scribe circles, arcs, parallel lines and laying of distance. To divide straight or curved lines into number of equal spaces. To find the centre of a round bars. To transfer the dimension from a rule to job.

6. Universal Surface Gauge : It is often needed in connection with a surface plate, to scribe lines at a given vertical height from the base of the work or test the parallelism of the work. It consists of 6 parts. The major difference between the ordinary and universal scribing block are (1) a clamping nut which will adjust the movement of the spindle and (2) a fine adjusting screw which helps the fine adjustment of the scriber point.

7. Angle Plate: If the shape is such that it does not have a base, it has to be clamped to an angle plate. The faces of this plates are provided with slots to fasten the work to the plate by bolt and nut. Solid angular plates and adjustable angle plates are available.

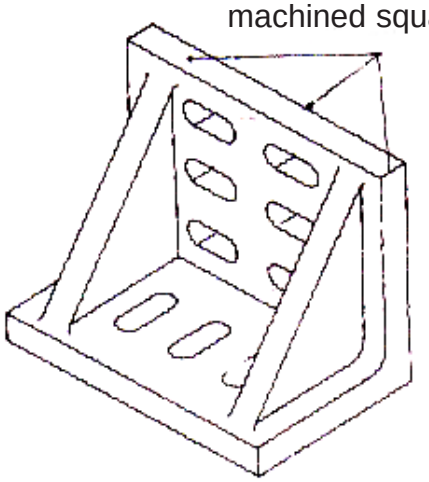
8. Punches : Punches are important tools used for marking outward, locating centre for holes. The punch marks are made along the marked out lines to make them clear till the operation is over.

Punches are made from carbon tool steel of length 90 to 150mm. The head is hardened and tempered. The point is ground to the proper angle according to the purpose of the punch;

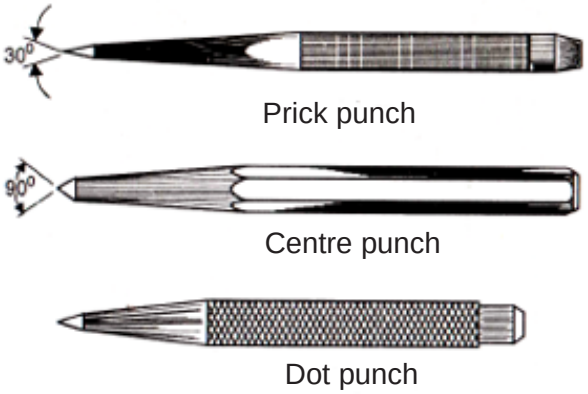


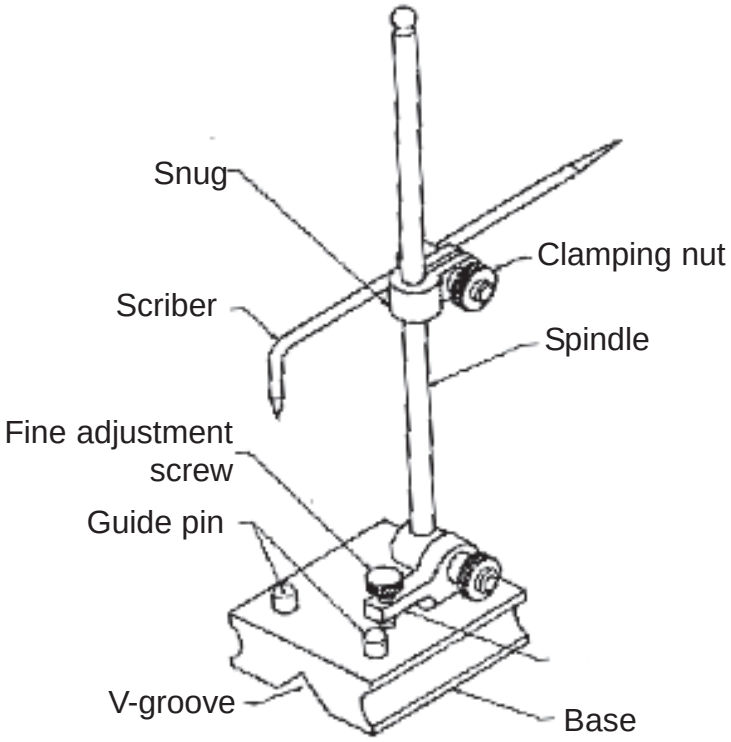
SCRIBER

Edges and ends
machined square



ANGLE PLATE





UNIVERSAL SCRIBING BLOCK

(a) ***Dot punch :*** are used to make dots or points along the scribed line.

(b) ***Centre Punch :*** are used for locating the centre of holes to be drilled to keep the drilling correct position.

(c) ***Prick punch:*** Punches are using for the above said purposes. Its point angle are 30^0 or 40^0 so that their points are more sharp.

VERNIER HEIGHT GAUGE

The vernier Height gauge is used to measure the height of parts to an accuracy of 0.02mm (0.001 inches).

The vernier Height gauge are available for the following lower and upper limits of measurements 0-200, 20 to 250, 30 to 400, 40 to 500, 60 to 800 and 60 to 1000.

For making out the scriber is set for the specified height and the lines are scribed by moving the scriber along the workpiece.

COMBINATION SET

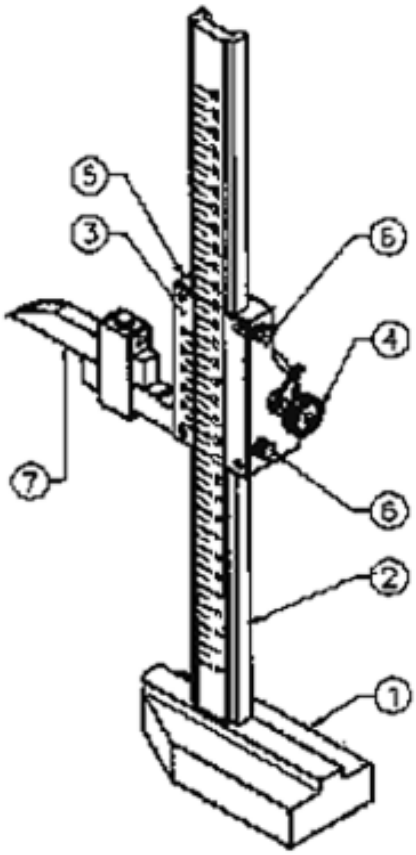
It is a precision checking instrument as well as a measuring instrument. It combines in one instrument a square head, a centre head and a Protractor head. The three heads are used separately being held in at any desired position by nuts which engage in a slot machined on the whole length of the beam at its back.

The beam which acts as a rule is marked in inches and centimetre for measuring length or height as and when required.

Square Head : It has one edge square to the rule giving a right angle while the other edge from a meter. It is also provided with a spirit level both 90^0 and 45^0 can be tested by this head in conjuction with the rule.

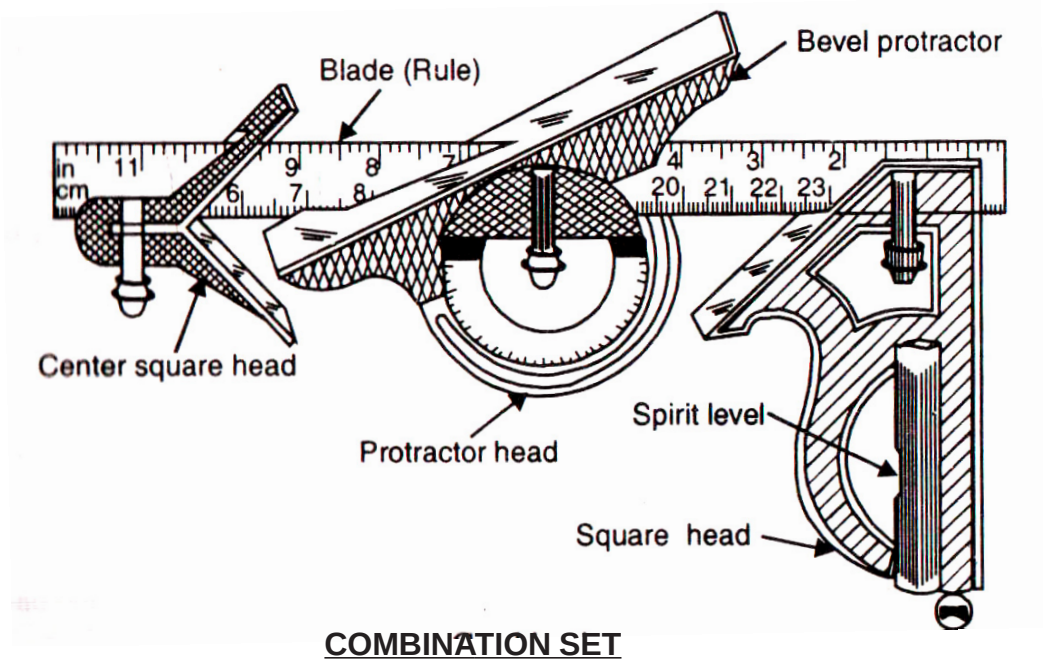
Centre Head : With the rule fastened to it is called a centre head. It has two arms at right angles to one another and is so set as the rule that this angle is exactly divided centre of a round bar or shafts. This is placed usually at the end opposite to the square head on the rule.

Protractor Head. : It is fitted at the centre of the rule is used to check, mark and measure angles from 00 to 1800. It consists of a metal frame and graduated disc. The disc is graduated from 00 to 1800 in both directions.



1. Base
2. Beam scale
3. Vernier Attachment
4. Locking screw
5. Fine adjustment
6. Vernier scale locking screw
7.Scriber

VERNIER HEIGHT GAUGE



COMBINATION SET

The adjustment is made by a screw, the head is provided with a spirit level to help in levelling the work or setting it as an angle.

SURFACE PLATE

Surface plate is the basic tools used for marking. It is a plane table of fine grained cast iron. Even though surface plates are made indifferent sizes and shapes, the most common shapes are rectangular and square. The surface plate is specified in it's sizes.

V-BLOCK

This is a block of steel or cast Iron, which provide with V-shaped groove on it's top or bottom or both surfaces. All it's faces are truly machined. It is used to hold round bars during marking and drilling. The round bars clamped firmly on the V-block by a U -clamp the slots cut at the 2 sides of the V-block.

CUTTING TOOLS

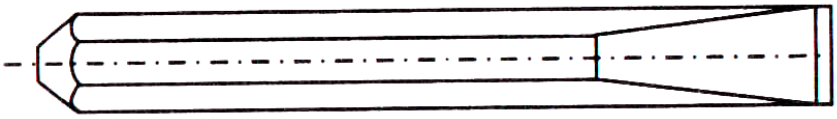
CHISELS

Chisels arae used for cutting and chipping away pieces of metal and are made of carbon steel usually of rectangular, hexagonal cross section. They are forged to shape roughly ground and then hardent and tempered. The edge is correct to the cutting angle. Care being taken not to over heat the steel and draw the temper. The cutting angles given to the chisel is determined mainly by the nature of the metal to be chip. It varies between 35^0 and 70^0.

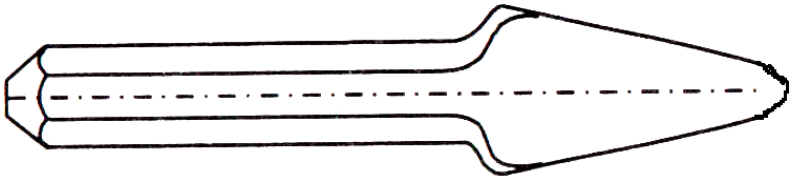
It is generally specified by the length and width of the cutting edge.

Types :

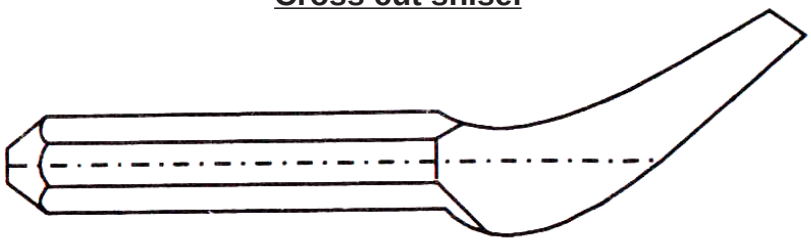
1. Flat Chisel : The flat chisel is the most common of all the chisels used in engineering. It is the chisel which is used for most of the general chipping operation. It may be used for removing surplus metal from surface of jobs.



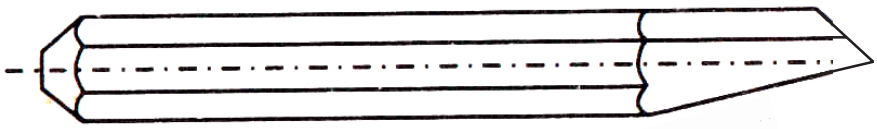
Flat Chisel



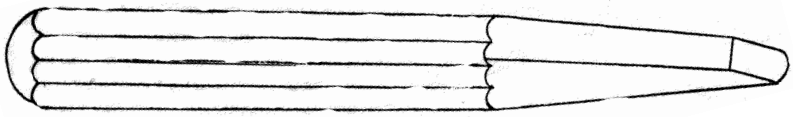
Cross cut shisel



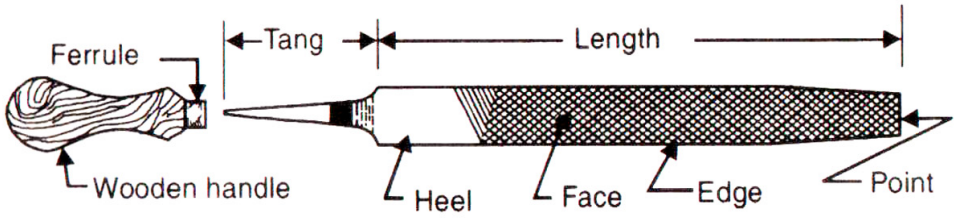
Half round shisel



Diamond point chisel



Round nose Chisel



Parts of File

2. ***Cross cut chisel :*** The cross cut chisel or cape chisel as it is sometimes called, is used cutting grooves in large surfaces. The cutting edge is slightly wider than the supporting metal to provide clearance length of this chisel various from 100 to 400 mm, and width of the edge varies from about 4 to 12 mm.

3. ***Half round chisel :*** A half round chisel is particularly useful for cutting oil ways or grooves in bearing, pulleys, and bushes. They are also used for setting over pilot holes.

4. ***Diamond point chisel :*** It is made square at the point and then bevelled to make a cutting edge. It is used to make a cutting edge. It is used for cutting grooves and square corners.

5. ***Side Chisel :*** It is ground and bevelled on one side only. It is used for cutting sides where flat chisels cannot enter.

FILES

The most widely used hand tool in an engineering shop is the file. A file is a hardened piece of high grade steel with standing row of teeth.

The cuts all metals except hardened steel. The file consists of the following parts, tang, heel, face, edge, and point.

Files are classified according to four principal factors, *sizes, shape, grade and types of cut of teeth.*

(1) **Size :** The size of the file is its length. This is the distance from the point to the heel.

(2) **Shape :** The shape of a file is its general out line and cross section, commonly used shapes are as follows

a) Flat file : This is tapered in width and thickness and one of the most commonly used file to general work. They are always double cut on faces and single cut on edges.

b) Hand file : This is parallel in its width and tapered in thickness. It is used for finishing flat surfaces. It has one safe edge.

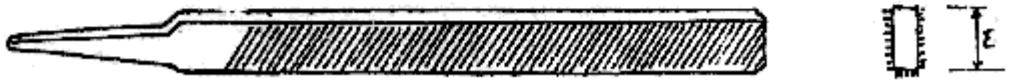
c) Square file : This square in cross section, double cut and tapered towards the point used for filing square corners, enlarging square or rectangular openings.

Round File

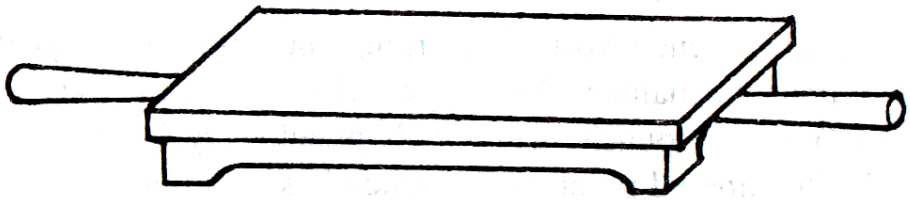
Half round File

Square File

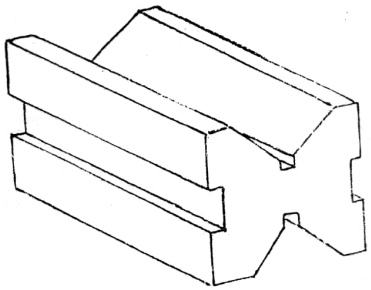
Triangular File



Safe Edge File



SURFACE PLATE



V- BLOCK

d) Round file : They are round in cross section and usually tapered towards the point.

e) Halfround file : Its tapered, double cut, and its cross section is not a half circle but only about 1/3 of a circle. This file is used for round cuts and filing curved surfaces.

f) Triangular file : It is triangular in shape and it is used for filing sharp corners and angles.

g) Knife edge file : It is shaped like knife edge, tapered in width and thickness and double cut. They are used for filing narrow slots, notches and grooves.

h) Needle file : It is made in sizes from 100mm to 200mm of various shapes and cuts, are extremely delicate and are used for fine work.

(3) Grade : It is the coarseness is spacing between the rows of teeth, they are
Rough, Bastard, Second cut, smooth, dead smooth and super smooth.

(4) Cut : Cut of files are classified into two groups :

(a) Single-cut, and ***(2) Double-cut***

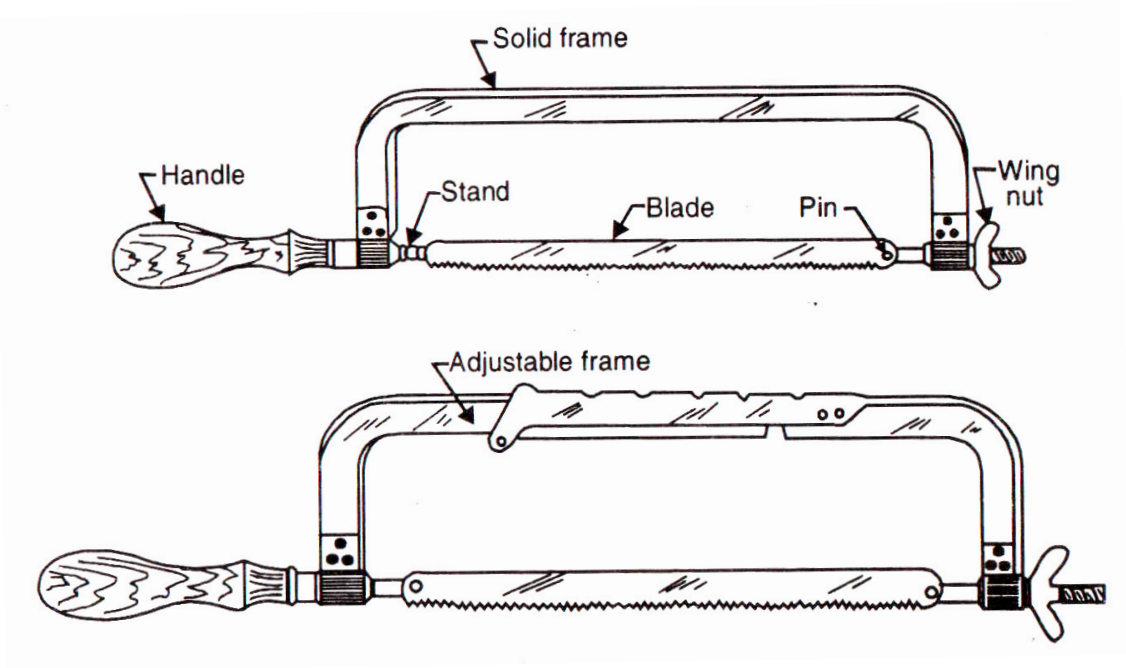
On single cut files, the teeth are cut parallel across the file at an angle of about 60^0 to the centre of the file. Double-cut file at an angle of teeth, the over-cut teeth being cut at about 60^0, and the up-cut at 75^0 to 80^0 to the centre line.

HACKSAW

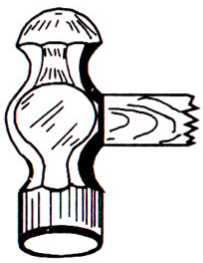
The hacksaw is used for sawing metals. A hand hacksaw consists of a frame, handle, prongs, tightening screw and nut and blade.

The frame is made to hold the blade tightly. It is of two types :-
The *solid frame*, in which the length cannot be changed, and the *adjustable frame*, which has a back that can be lengthened or shortened to hold blades of different length.

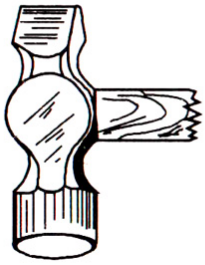
Hack saw blades are made of either low alloy steel and a standard lengths 225, 250 & 300mm. Push type blades - those which cut in forward stroke only are generally used. Two types of hacksaw blades are available, all hard and flexible. The all hard blade is hardened through out and being more rigid - it is aid to an accurate sawing in hard metals. It requires skill to use, as it is easily broken. The flexible blade is hardened on the cutting edge only. They are suitable for general work for cutting.



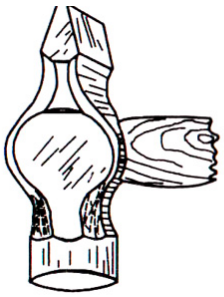
HACKSAW FRAME WITH BLADE



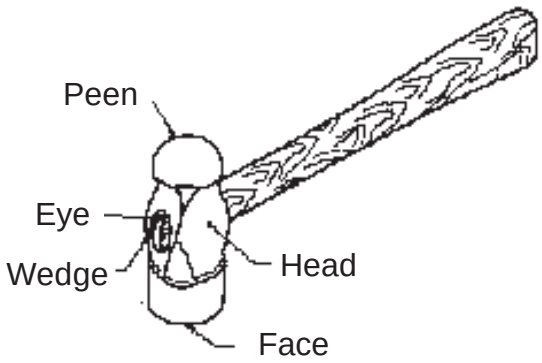
Ball peen hammer



Straight peen hammer



Cross peen hammer



PARTS OF HAMMER

STRIKING TOOLS

Hammers are used to strike a job or a tool. They are made of forged steel of various sizes and shapes to suit various purposes. A hammer consists of 4 parts namely, peen, head, eye and face. The eye is made oval or elliptical inside in shape and accommodate the handle.

Hammers are classified according to the shape and peen.

1. Ball peen hammer : This is the most common hammer. The peen has a shape of a ball which is hardened and polished, size varies from 0.11 to 0.91 Kgs.

2. Cross peen hammer : This is similar to ball peen hammer in shape and size except the peen which is across the shaft or eye.

3. Straight peen hammer : This hammer has a peen straight with the shaft or parallel to the axis of the shaft.

4. Soft hammer : When it is necessary to strike metal a blow with minimum damage to the surface as off hammer called mallet is used. They are made of hard rubber, copper, brass or commonly wood.

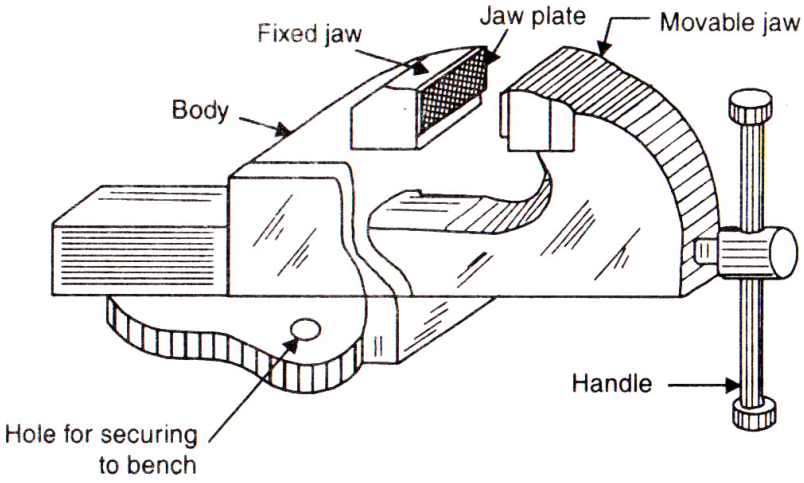
5. Double faced : Both faces are similar in shape and are striking faces. It is used for heavier work and on flat surface in shops.

WORK HOLDING DEVICES

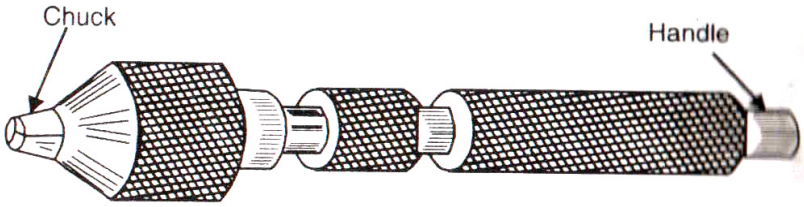
Vice : Vice the most common tool for holding the work various types of vices are used for various purposes.

(a) Bench vice : The most commonly used vice is engineer's parallel jaw bench vice. It must be firmly fixed to a bench with nuts and bolts or screws.

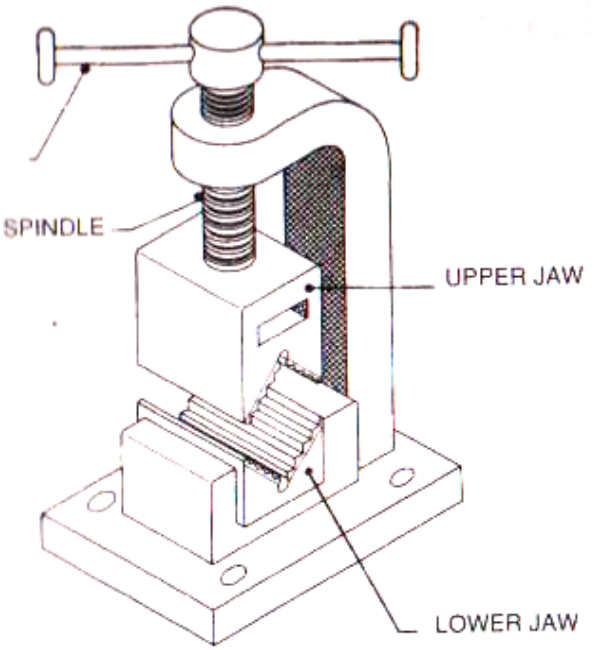
The vice essentially consists of a cast iron body. A fixed jaw, a movable jaw-both made of cast steel, a handle, a square the ended screw and a nut all made of mild steel, separated cast steel plated called jaw plates are fixed to the jaws by means of set screws and they can be replaced when worn. The holding faces of Jaw plate, have teeth to hold the work firmly. The movement of the vice is caused by the movement of the screw through the nut fixed under the movable jaw. The size of the vice is known, by the width of it's jaws.



BENCH VICE



PIN VICE



PIPE VICE

(b) **Leg vice :** The legvice used by black smith is suitable for heavy hammering, chipping and cutting in fitters work.

(c) **Pipe Vice:** Pipe vice is used for holding round metals, tubes, pipes etc. In this case the screw is vertical and the movable jaw works vertically. It grips the work at 4 points on its's surfaces.

(d) **Hand vice :** The hand vice is used for gripping screws rivets, keys, small drills and other similar objects which are too small to be conveniently held, in the bench vice. It consists of two legs mad of mild steel which hold the jaws at the top and hinged together at the bottom a flat spring held between the legs tends to keep the jaws open. The jaws can be open and close by a wing nut which moves through a screw that is fastened to one leg and passes through other.

(e) **Pin Vice :** Pin vice is used for holding round materials of smaller diameter such as wire and pins during working. It also forms handles for small files. It consists of a handle and tapered nose covering a small collect chuck at its end. The chuck carries the jaws which are operated by turning the handle.

(f) **Tool maker's Vice :** The tool maker's vice is useful for holding small work which required filing or drilling. It is made of mild steel. It consists of a fixed jaw and a movable jaw, fixed with jaw plates. The movement is caused by the turn of screw through the nut, fixed under the movable jaw.

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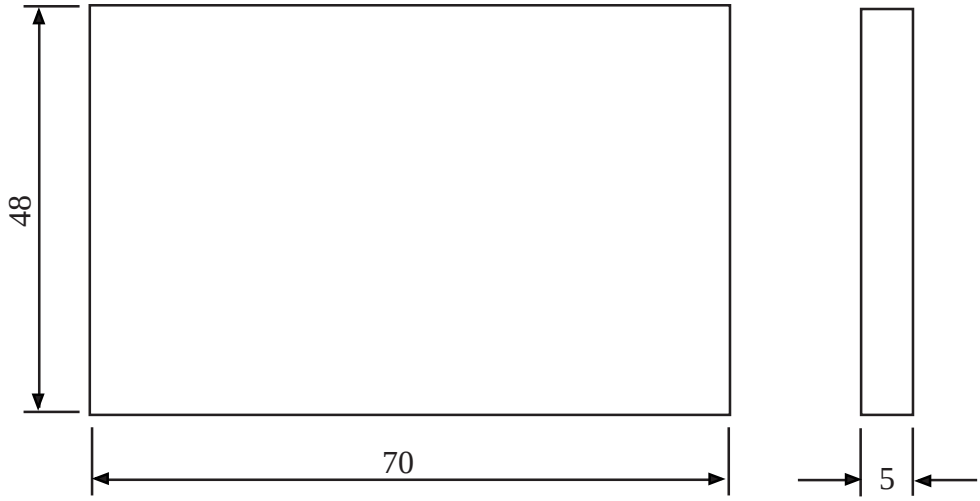
Exercise No. 1

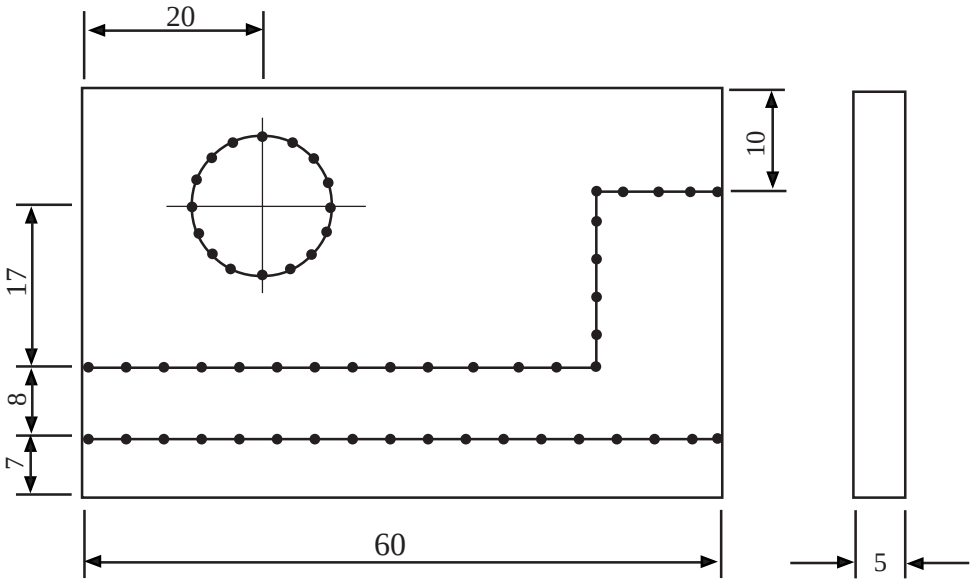
FILING PRACTICE



All dimensions are in ‘mm’.

Exercise No. 2

MARKING AND PUNCHING



All dimensions are in ‘mm’

MODELS FOR PRACTICE

Ex.No. 1
Date :

FILING PRACTICE

Aim :-

Material Required :-

Tools Required :-

Operations to be carried out :-

PROCEDURE

Ex.No. 2
Date :

MARKING AND PUNCHING

Aim :-

Material Required :-

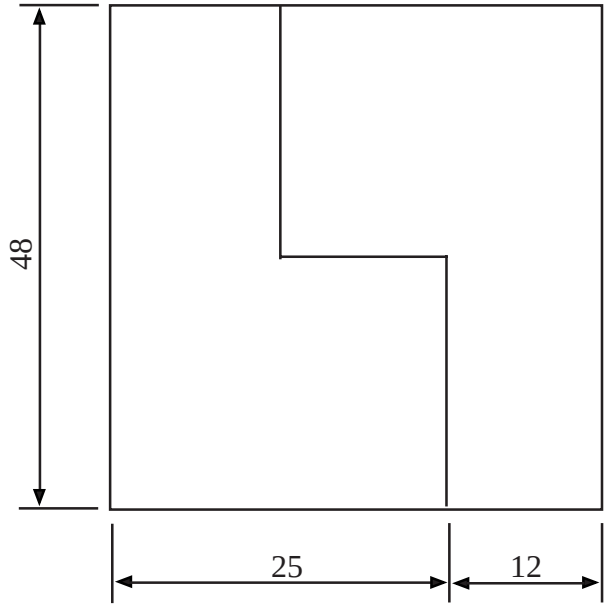
Tools Required :-

Operations to be carried out :-

PROCEDURE

Exercise No. 3

L - JOINT



All dimensions are in ‘mm’

Ex.No. 3
Date :

L - JOINT

Aim :-

Material Required :-

Tools Required :-

Operations to be carried out :-

PROCEDURE