

## FITTING

### INTRODUCTION:

Machine tools are capable of producing work at a faster rate, but there are occasions when components are processed at 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.

The term bench work refers to the production of components by hand on the bench, whereas fitting deals with the assembly of mating parts, through removal of metal, to obtain the required fit.

### IMPORTANCE:

In engineering, particularly in heavy and medium engineering, even to-day, with the use of automatic machines, bench work and fitting have important roles to play to complete and finish a job to the desired accuracy.

### APPLICATIONS:

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.

### METALS USED:

Mild steel, Copper, Brass, Aluminium.

### MILD STEEL:

It is an alloy of iron and carbon .It is coming under low carbon steel. Carbon content is varying from 0.15% to 0.45%.

### FITTING TOOLS:

All types of work require the use of large number of tools involving a number of operations such as filing, chipping, scraping, sawing, tapping, etc. to finish the work to the desired shape and size.

Different types of tools used in Fitting are:

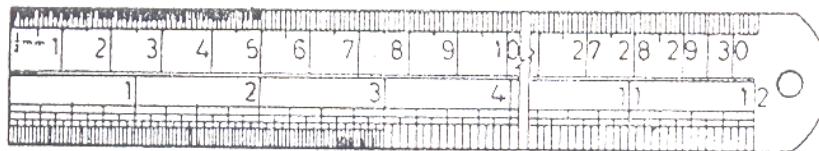
1. Marking and measuring tools
  - a) Steel rule
  - b) Try square
  - c) Scriber
  - d) Dot punch
  - e) Centre punch

- f) Divider
  - g) Inside caliper
  - h) Out side caliper
  - i) Odd leg caliper
2. Cutting tools
    - a) Hack saw
    - b) Chisel
    - c) Drill
    - d) Tap
  3. Finishing tools
    - a.) Files
      - i. Hand file
      - ii. Flat file
      - iii. Square file
      - iv. Triangular file
      - v. Half round file
      - vi. Round file
  4. Striking tools
    - a) Ball peen hammer
    - b) Straight peen hammer
    - c) Cross peen hammer
  5. Holding tools
    - a) Bench vice
  6. Supporting tools
    - a) Anvil
  7. Miscellaneous tools
    - a) Number punch
    - b) Letter punch

## **1. MARKING AND MEASURING TOOLS:**

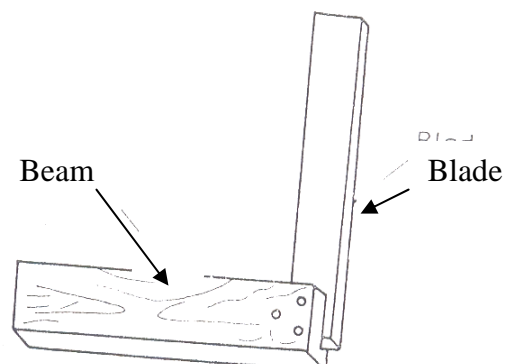
### **STEEL RULE:**

It is stiff, straight steel strip having all the faces machined true. On one of the flat faces, graduations are marked in inches and centimeters. The least count is 1mm. It is used to set out dimensions.



### **TRY SQUARE:**

Try square is used for making and testing angles of 90 degree. It consists of a steel blade, riveted into a hard wood stock which has a protective brass plate on the working surface. Another type is the all-metal square,

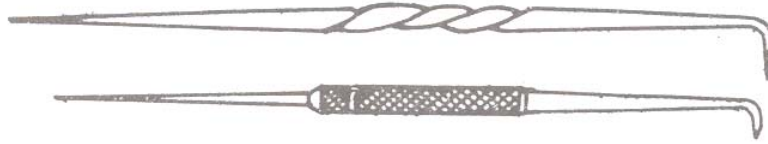


with steel blade and cast iron stock. Sizes vary from 150 to 300mm, according to the length of the blade.

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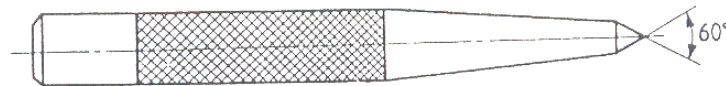
## SCRIBER:

A scribe is a slender steel tool, used to scribe or mark lines on metal work pieces.



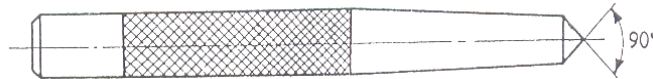
## DOT PUNCH:

This is used to lightly indent along the layout lines, to locate center of holes and to provide a small center mark for divider point, etc. For this purpose, the punch is ground to a conical point having 60 degrees included angle.



## CENTRE PUNCH:

This is similar to the dot punch, except that it is ground to a conical point having 90 degrees included angle. It is used to mark the location of the holes to be drilled.



## PRICK PUNCH:

It is sharply pointed tool. The tapered point of punch has an angle of usually 40°. It is used to make small punch marks on layout lines.

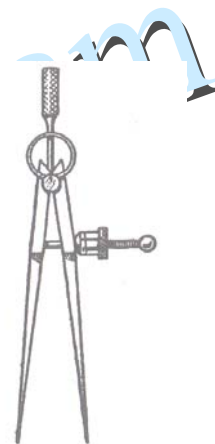


## DIVIDER:

It has two straight legs sharpened at one end, hinged at other end. This is used for marking circles, arcs, laying out perpendicular lines, bisecting lines, etc.

## CALIPER:

A caliper is used to transfer and compare dimensions from one object to another or from a part to a scale

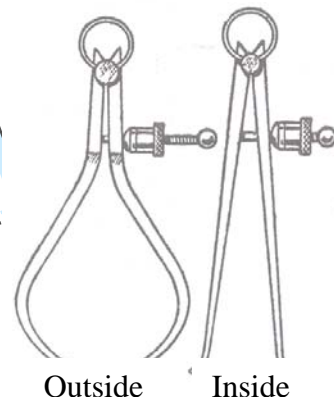


### INSIDE CALIPER:

These are also of two types ordinary, spring type. It has two steel legs, which are bent outward. These are used to set internal dimensions, to transfer them to work.

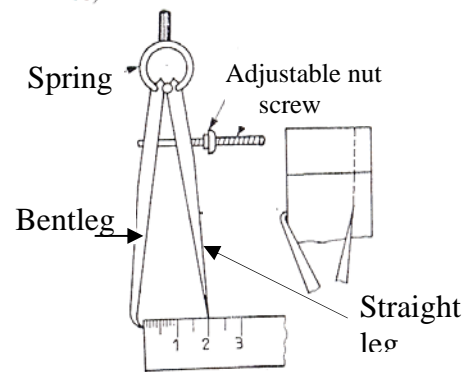
### OUT SIDE CALIPER:

These are also of two types ordinary, spring type. It has two steel legs that are bent inward. These are used to measure the out side dimensions of round objects.



### ODD LEG CALIPER (Hermaphrodite):

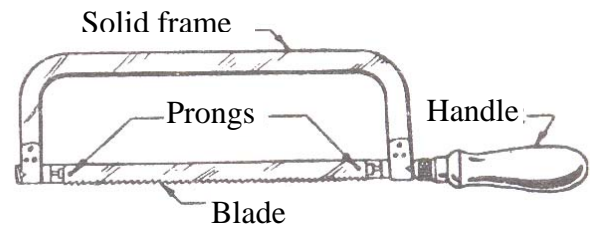
It is made of steel tapered strip, which is hinged between washers at one end, one leg is bent at the tip inwardly and the other has a straight pointed end. It is used to find the center of a bar. It is extremely used for scribing lines parallel to edge of work.



## 2. CUTTING TOOLS:

### HACK SAW:

The hack saw is used for cutting metal by hand. It consists of a frame which holds a thin blade, firmly in position. Hacksaw blades have a number of teeth ranging from 5 to 15 per centimeter. Blades having lesser number of teeth per cm are used for cutting soft materials like aluminium, brass and bronze.



Blades having larger number of teeth per cm are used for cutting hard materials like steel and cast iron. Hacksaw blades are classified as, (i) all hard and (ii) flexible types. The all hard blades are made of H.S.S, hardened and tempered throughout to retain their cutting edges longer. These are used to cut hard metals. These blades are hard and brittle and can break easily by twisting and forcing them into the work while sawing. Flexible blades are made of H.S.S or low alloy steel but only the teeth are hardened and the rest of the blade is soft and flexible. These are suitable for use by un-skilled persons.

### CHISEL:

Chisels are used for removing surplus metal or for cutting thin sheets. These tools are made from 0.9% to 1.0% carbon steel of hexagonal or octagonal section. Chisels are annealed, hardened and tempered to produce a tough shank and a hard cutting edge. The cutting angle of the chisel for general purpose is about 60degrees.



Flat chisels

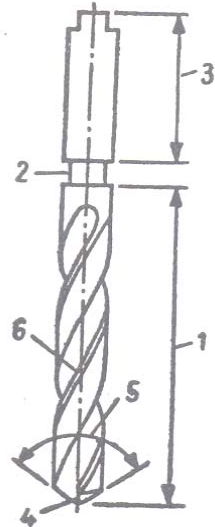
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## DRILL:

A drill is a tool for making holes in a metal. It usually consists of two cutting edges set at an angle with the axis. For rapid and accurate work twist drills are now universally adapted. There are two types of twist drill - (i) parallel shank drill (ii) tapered shank drill. Drilling is the operation of producing circular holes in a metal piece.

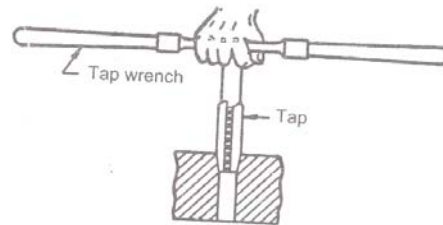
The following are the part of the drill bit:

- 1.Length,
2. Neck,
3. Shank,
4. Lip,
5. Lip angle,
6. Heel



## TAP:

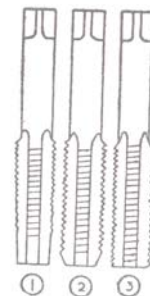
A tap is a screw-like tool, which has threads like bolt, and three or four thread flutes cut across the thread. It is used to cut threads on the inside of a hole, as in a nut. Hand taps are usually made in sets of three (i) Rougher (ii) Intermediate and (iii) Finisher respectively.



The end of the Rougher tap (1) has about six threads tapered. This is used to start the thread so that the threads are formed gradually as the tap is turned into the hole.

The intermediate (2) is tapered back from the edge about three or four threads. This is used after the rougher has been used and to cut thread as far as possible.

The finisher (3) has full threads for whole of its length and used to finish the work by the other two taps.

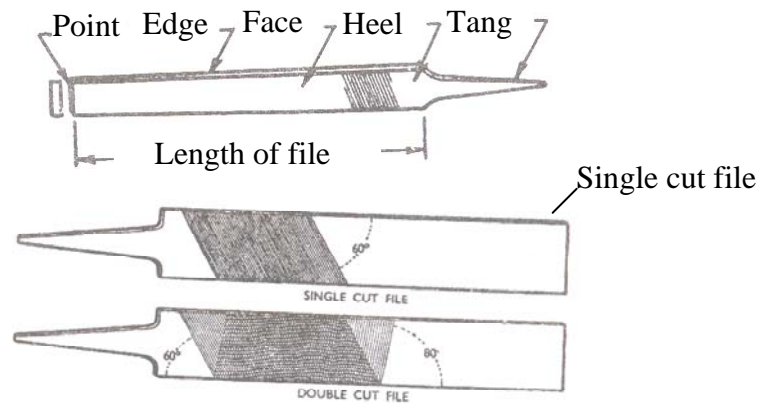


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### 3. FINISHING TOOLS:

#### FILES:

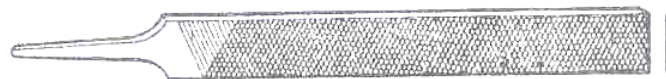
Files are classified according to their shape, cutting and pitch or grade of the teeth. (i) single cut teeth files  
(ii) double cut teeth files.



Single cut files have rows of teeth running in one direction, across their faces and double cut files have a second row of teeth, cut diagonally to the first row.

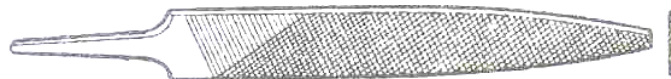
#### HAND FILE:

Rectangular in section, tapered in thickness but parallel in width. The faces have double cut teeth and one of the edges, single cut. It is used for filing a surface, at right angles to an already finished surface.



#### FLAT FILE:

Rectangular in section and tapered for 1/3<sup>rd</sup> length in width and thickness. The faces have double cut teeth and edges single cut. Used for general purpose filing.



#### SQUARE FILE:

Square in section and tapered for 1/3<sup>rd</sup> length in all faces. All the faces have double cut teeth. Used for filing corners and slots and also to cut keyways.



#### TRIANGULAR FILE:

Equilateral triangular in section and tapered for 1/3<sup>rd</sup> length on all faces. All the faces have double cut teeth. Used for filing internal corners.



#### HALF ROUND FILE:

It has one flat face, connected by curved face and tapered for 1/3<sup>rd</sup> length. The curved face is not exactly semi-circular but only a part of circle. The flat face has double cut

teeth and the curved face, single cut. Used for filing concave surfaces and internal corners.



#### ROUND FILE:

Circular cross section and tapered for 1/3<sup>rd</sup> length. It has double cut teeth. Used for filing concave surfaces and circular openings.



#### 4. STRIKING TOOLS:

##### BALL PEEN HAMMER:

It has the peen of the shape of a ball. It is the most common type of the hammer and is mostly used for riveting.



Ball peen

##### STRAIGHT PEEN HAMMER:

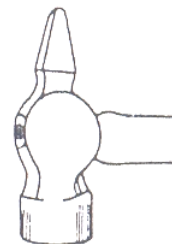
It has a flat and tapered peen. The width is usually equal to the diameter of the face. It is used for stretching the metal by hammering.



Straight peen

##### CROSS PEEN HAMMER:

It is used for hammering into shoulders, inside curves for bending.



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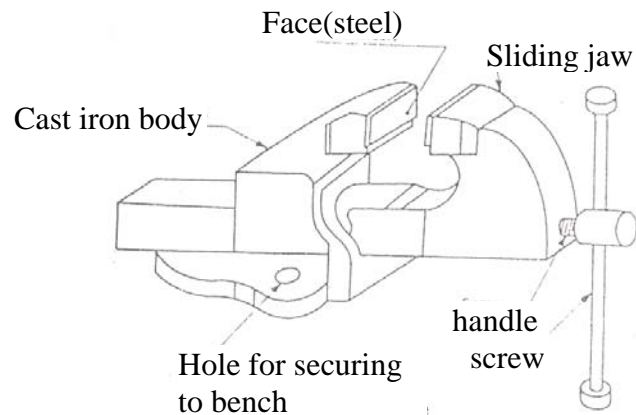
#### 5. HOLDING TOOLS:

##### BENCH VICE:

The bench vice is a work-holding device. When the vice handle is turned in a clockwise direction, the sliding jaw forces the work against the fixed jaw. The greater the pressure applied to the handle, the tighter is the work held. Jaws are made of hardened steel. Serrations on the jaws ensure a good grip. Jaw caps made of soft material are used to protect finished surfaces, gripped in the vice.

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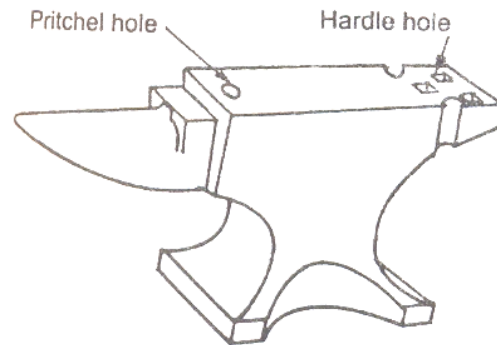
The vice is made of cast iron which is strong in compression but fractures under shocks and therefore should never be hammered.



## **6. SUPPORTING TOOL:**

### **ANVIL:**

The anvil forms a support for blacksmiths work when hammering and it is also used in work shop to support the work pieces when they are made to chiseling and punching operations



## **7. MISCELLANEOUS TOOLS:**

Number punch & Letter punches are used to mark the numbers and names on the work piece for identification purpose. Generally it is made up of hard steel.

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