Title: Fitting Work

Objective:

In the fitting operation one can practice cutting, filling, measuring, marking on Mild Steel (MS) material with the help of various hand tool.

Introduction:

Working on components with hand tools and instruments, mostly on work benches is generally referred to as 'Fitting work'. The hand operations in fitting shop include marking, filing, sawing, scraping, drilling, tapping, grinding, etc., using hand tools or power operated portable tools. Measuring and inspection of components and maintenance of equipment is also considered as important work of fitting shop technicians.

Types of fit:

a. Running fit
b. Press fit
c. Push Fit
d. Force Fit

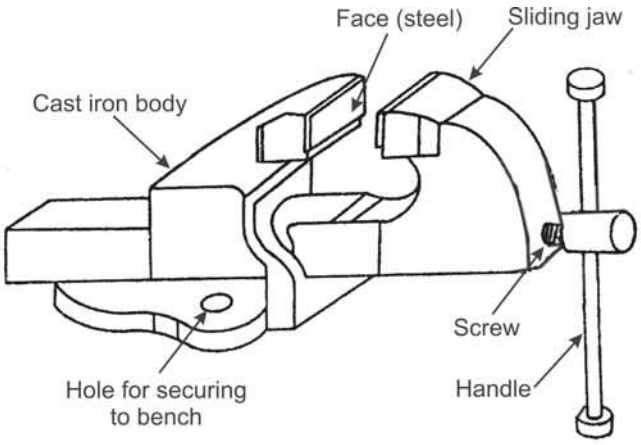
Raw Materials:

Mild Steel (MS) plate of dimension ____x____x_____ mm^3 .

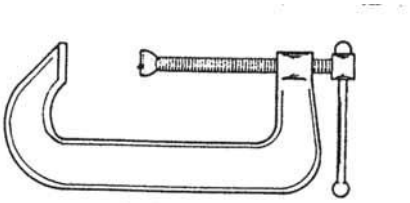
Different Types of Tool:

1. **Work Holding Tools**
   1.1 **Bench Vice**

The bench vice is a device commonly used for holding the work pieces.



Bench Vice

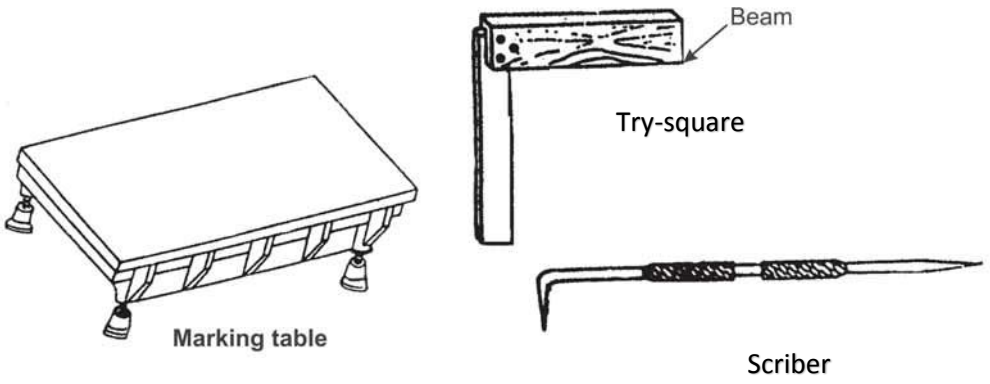

C.clamp

1.2 **C-Clamp**

This is used to hold work against an angle plate or V-block or any other surface, when gripping is required. It is also known as G-clamp.

2. **Marking Tools**
   2.1 **Marking table**

A marking table is a heavily build cast iron table used for layout work on all sizes of jobs.



2.2 **Try-square**

Try-square is used for checking the squareness of small works, when extreme accuracy as not required.

2.3 **Scriber**

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

2.4 **Odd-leg calliper**

This is used for marking parallel lines from a finished edge and also for locating the centre of round bars.

2.5 **Dot Punches**

This is used to locate centre of holes and to provide a small centre mark for divider point etc. For this purpose, the punch is ground to a conical point having 60^{o} included angle.

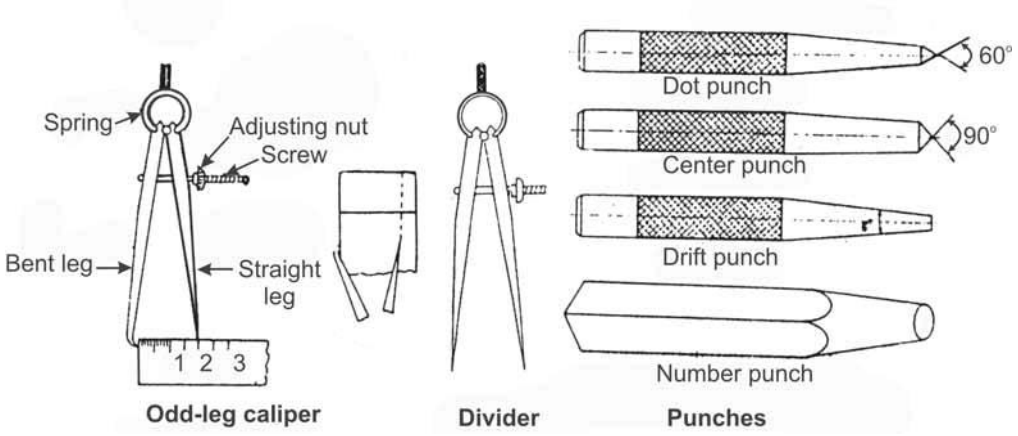
3. **Measuring Tools**

3.1 **Callipers**

These are used with the help of steel rule to check outside and inside measurements.

3.2 **Steel rule**

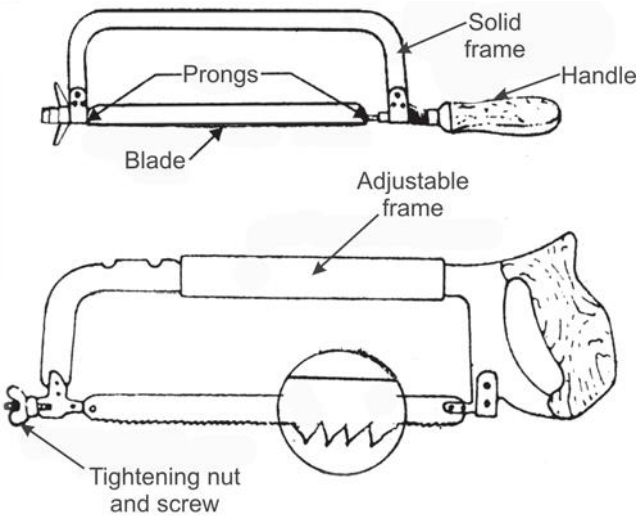
Steel rule is a surprisingly accurate measuring device. A rule is used to measure actual sizes of job or work piece.



4. Cutting Tools

4.1 **Hacksaw**

The hacksaw is used for cutting metal by hand. It consists of a frame which holds a thin blade, firmly in position. The blade has a number of cutting teeth. The number of teeth per 25 mm of the blade length or teeth per inch (TPI) is selected on the basis of the work material and thickness being cut.



Hacksaw frame with blade

4.2 **Twist drill**

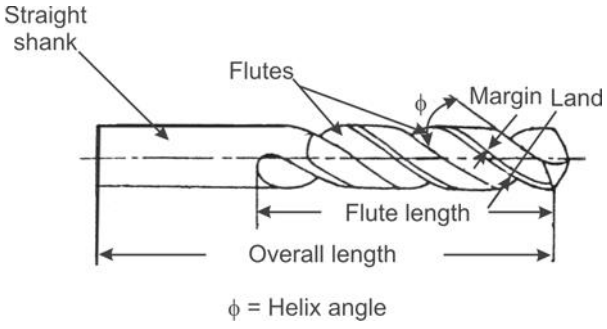
Twist drills are used for making holes. These are made of high-speed steel. Both straight and taper shank twist drills are used with machines. The following are the types, sizes and designations of twist drills:

1. Straight shank.

Millimetres	from 0.4 mm onwards
Inches	from l/64" onwards
Letter drills	A to Z
Number drills	60 to 20

2. Taper shank

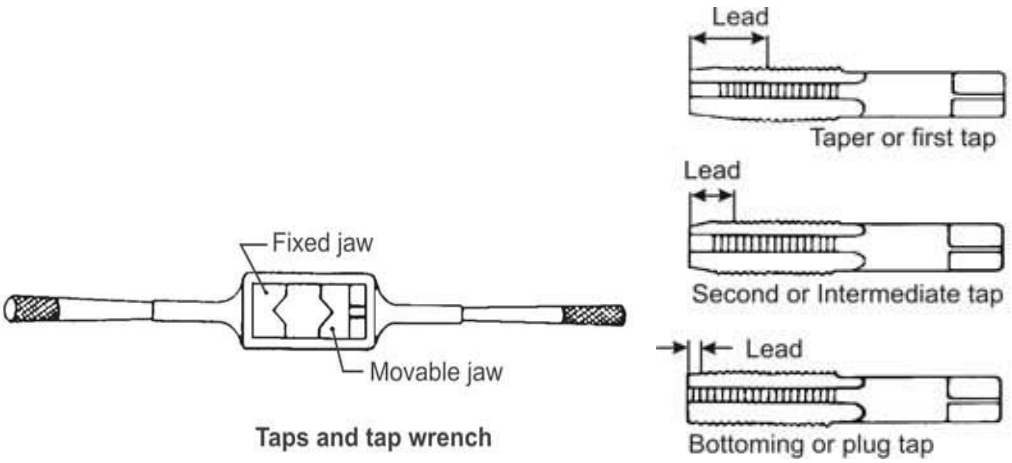
Millimetres	3 to 100 mm
Inches	1/8" to 4"



ϕ = Helix angle

4.3 **Taps and Tap Wrenches**

A tap is a hardened steel tool, used for cutting internal threads after drilling a hole. Hand taps are usually supplied in sets of three for each diameter and thread pitch. Each set consists of a taper tap, intermediate tap and plug or bottom tap. The following are the stages involved in tapping operation:



Taps and tap wrench

1. Select the correct size tap, with the desired pitch. A thread is specified by its shape, size and pitch. Ex: M20 × 2.5 (nominal dia 20 mm, pitch 2.5 mm Metric thread).

2. Select the correct size tap drill, usually indicated on the tap.

3. Drill the hole.

4. Secure the tap in the tap wrench.

5. Insert the first or taper tap in the drilled hole and start turning clockwise, by applying downward pressure.

6. Check the alignment of the tap with the hole axis (verticality) with a try-square and correct it if necessary, by applying sidewise pressure while turning the tap.

7. Apply lubricant while tapping.

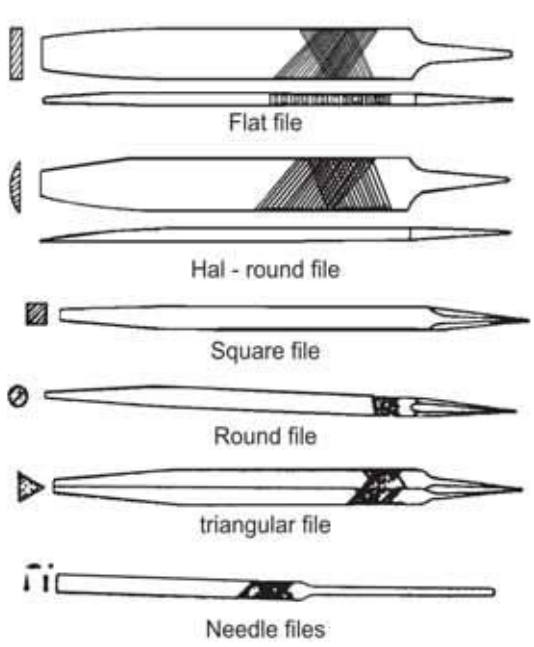
8. Turn the tap forward about half a turn and then back until chips break loose. Repeat the process until threading is completed with intermediate and bottom taps.

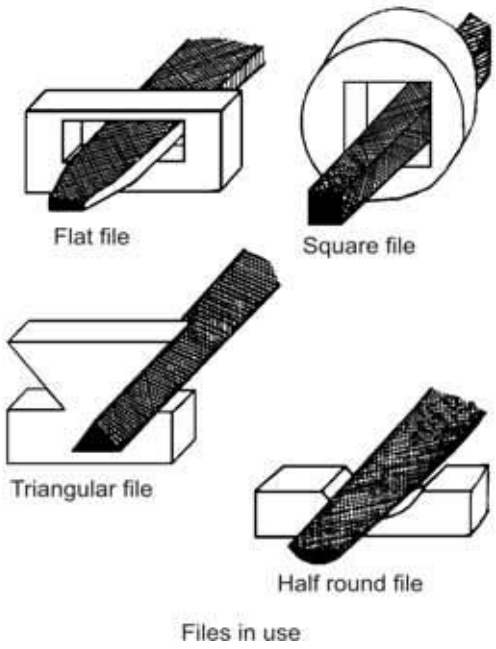
9. Remove them carefully. If it gets stuck, work it back and forth gently to loosen.

5. Finishing Tools

5.1 **Files**

Filing is one of the methods of removing small amounts of material from the surface of a metal part. A file is a hardened steel tool, having slant parallel rows 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. Figure shows the parts of a hand file.





5.1.1 **Types of files**

Hand file

Rectangular in section and tapered in thickness but parallel in width. The faces carry double cut teeth and one of the edges single cut. The other edge, known as safe edge, does not have any teeth and hence this file is also known as safe edge file. It is useful in filing a surface which is at right angles to an already finished surface.

Flat file

It is rectangular in section and tapered for 1/3 length in width and thickness towards the tip. The faces carry double cut teeth and the edges carry single cut teeth. It is a general-purpose file.

Square file

It is square in section and carry double cut teeth on all the four faces. It is tapered for 1/3 of its length towards the point. Square files are used for filing corners and slots. It is also used to cut keyways.

Triangular square file

It is of equilateral triangular in section and tapers towards the tip. The faces are double cut and the edges sharp. These files are used to file angular hole, and recesses. Used for sharpening wood saws.

Round file

It is tapered for 1/3 length with double cut on large coarse grades. Used for filing out round, elliptical and curved openings.

6. Miscellaneous Tools

6.1 Striking tool (Hammer)

Hammers are named depending on their shape and material and specified by their weight. A ball peen hammer has a flat face which is used for general work and the ball end particularly used for riveting. They weigh from 200 gm to 1.5 kg

The hammer consists of a hardened and tempered steel head varying in mass from 0.1 kg to about 1 kg, firmly fixed on a tough wooden handle.

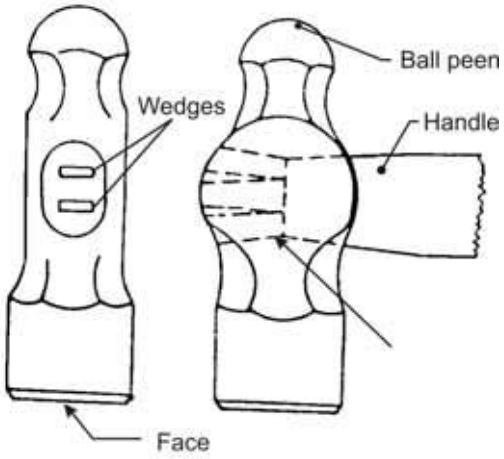
The flat striking surface is known as the face, and the opposite end is called the peen. The most commonly used is the ball-peen, which has a hemispherical end and is used for riveting over the ends of pins and rivets.

For use with soft metals such as aluminium or with finished components where the workpiece could be damaged if struck by a hammer, a range of hammers is available with soft faces, usually hide, copper, or tough plastics such as nylon. The soft faces are usually in the form of replaceable inserts screwed into the end or forced into a recess in the face.

Always use a hammer which is heavy enough to deliver the required force but not too heavy to be tiring in use. The small masses, 0.1 kg to 0.2, are used for centre punching, while the 1 kg ones are used with large chisels or when driving large keys or collars on shafts. The length of handle is designed for the appropriate head mass, and the hammer should be gripped near the end of the handle to deliver the required blow. To be effective, a solid sharp blow should be delivered and this cannot be done if the handle is held too near the hammer head.

6.1.1 **Types of Hammer:**

a. Ball peen hammer
b. Cross peen hammer
c. Straight peen hammer



Ball peen hammer

7. Procedure of Experiment:

8. Conclusion: