Basic Manufacturing Systems [ME1083]

School Of Mechanical Engineering

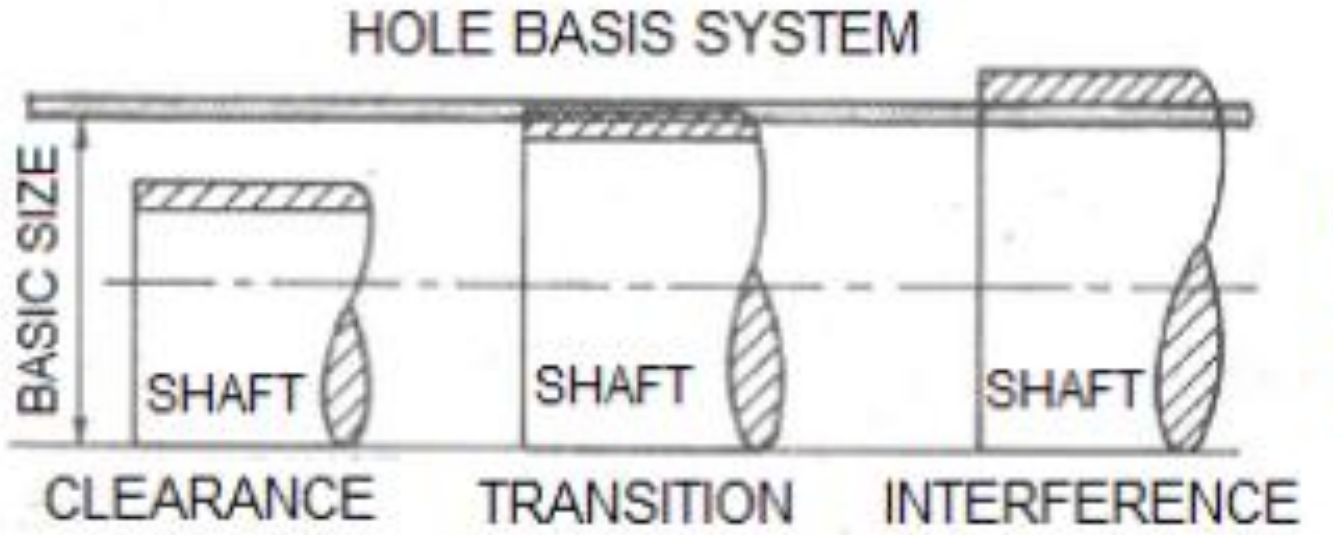
KIIT Deemed to be University

Introduction

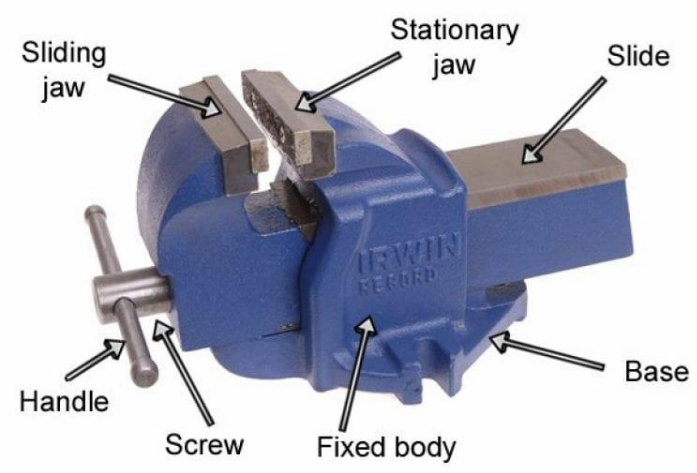
- **What is Fitting?**
  - Fitting is the process of assembling various parts manufactured in the machine shop
  - Working on components with hand tools and instruments, mostly on work benches is generally referred to as *'Fitting work*'.
  - The hand operations in fitting shop include marking, filing, sawing, scraping, drilling, tapping, grinding, etc., using hand tools or power operated portable tools

Types of Fitting:

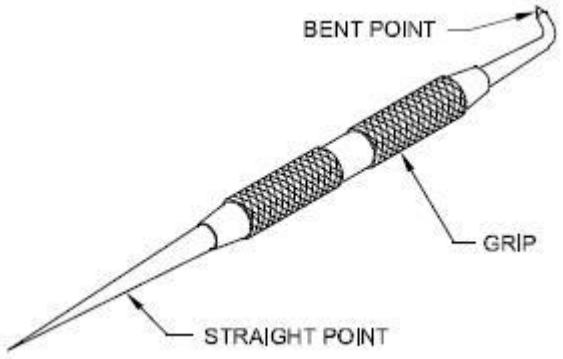
- Running fit / Clearance Fit – Hole diameter > Shaft diameter
- Push Fit / Transition Fit - Hole diameter = Shaft diameter
- Force fit / Interference fit - Hole diameter < Shaft diameter



Fitting Tools

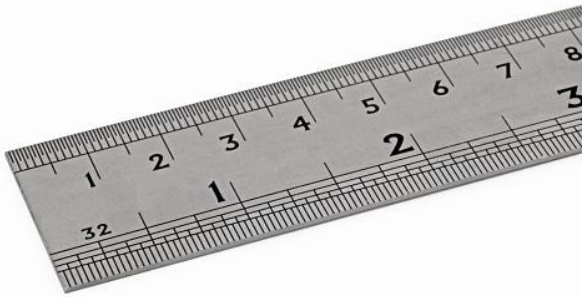


Bench vice

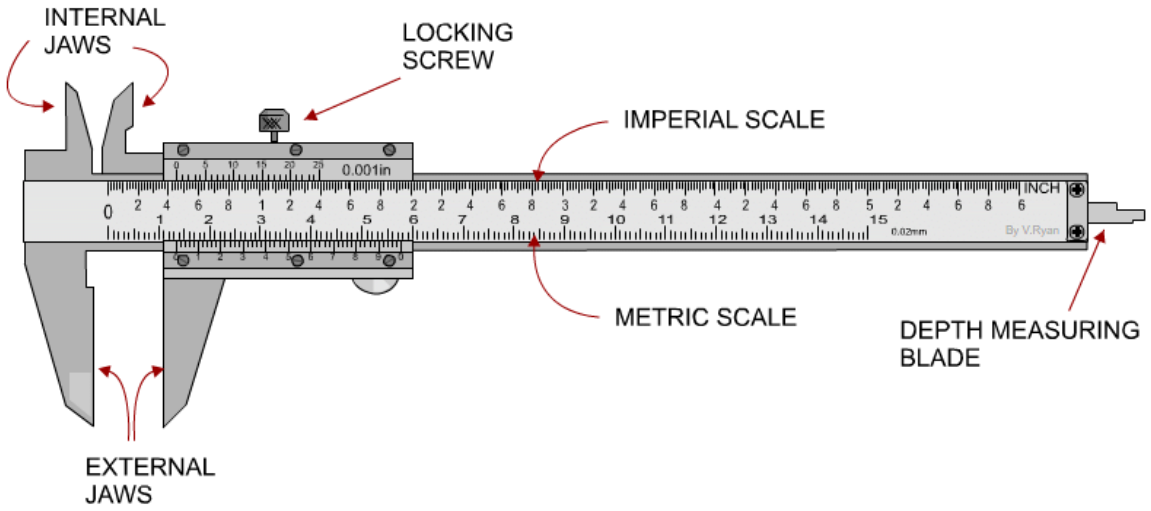


Scriber

Dot punch

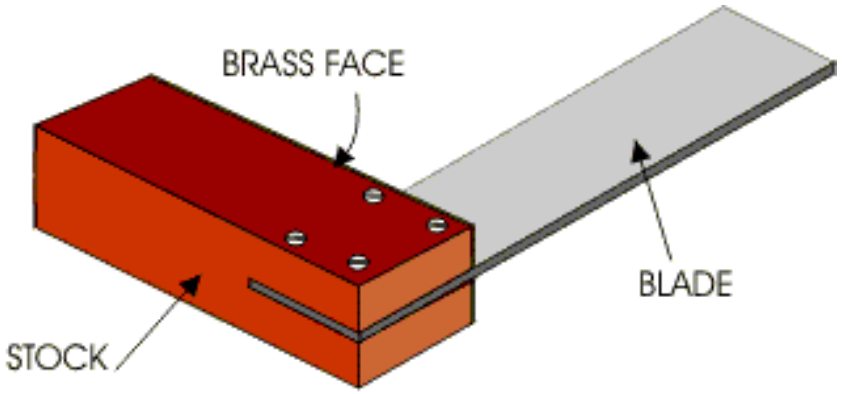


Steel Rule

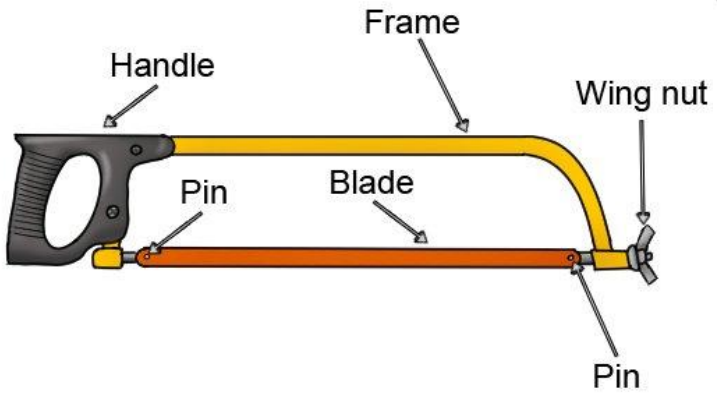


Vernier Caliper

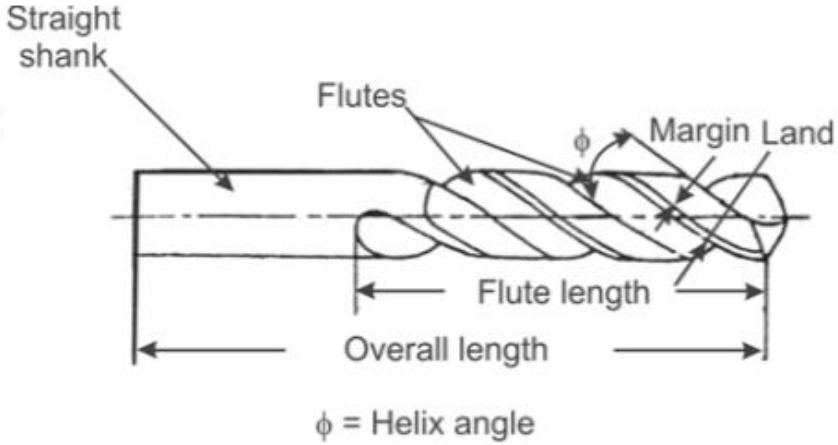
Fitting Tools



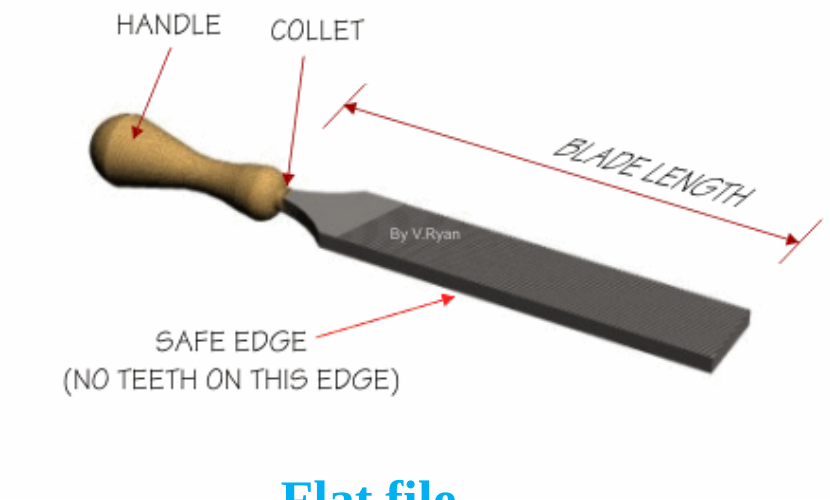
Try square



Hacksaw



Twist Drill



Flat file

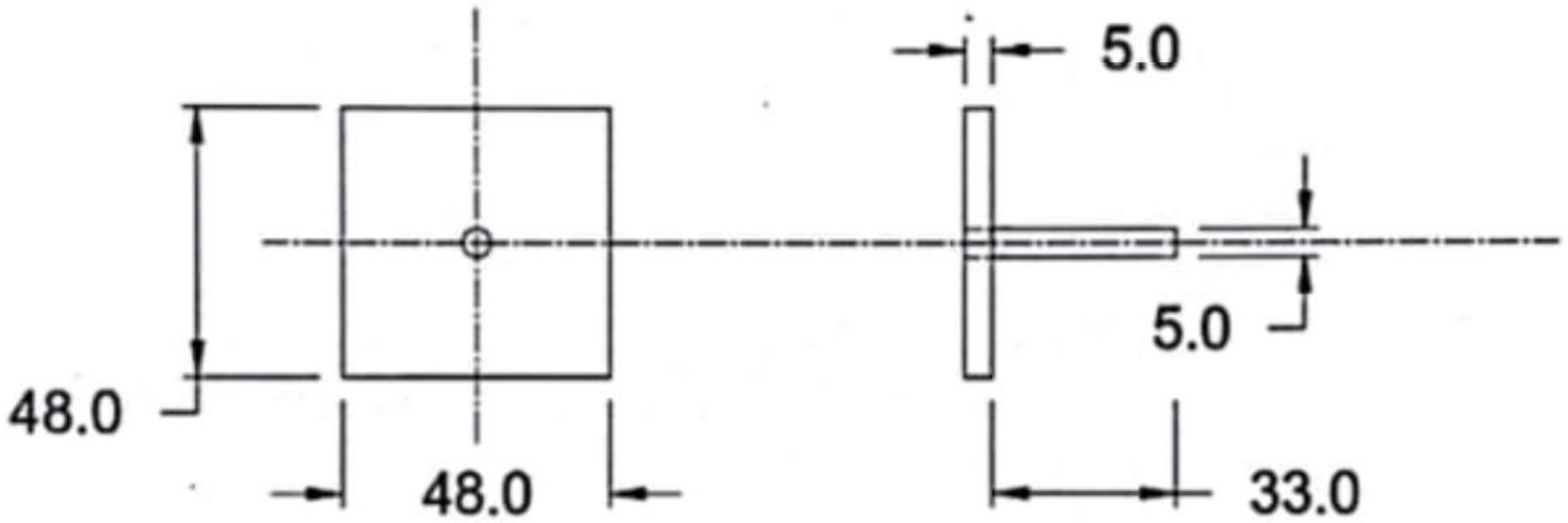
Round file

Ball-peen hammer

Operations in Fitting Section

- **Operations involved are -**
  - Measuring and marking
  - Holding and Cutting
  - Filing
  - Center marking
  - Drilling
  - Striking

Job Layout



All Dimensions are in mm

Procedure

- Cut the raw material of appropriate size *i.e.* 50 x 50 x 6 mm sand using a flat file and try square, make all the adjacent sides perpendicular to each other
- Using flat file, file the both side surfaces to make them flat and smooth
- Apply a thin coat of chalk powder on one surface of the workpiece and let it dry
- Join two opposite vertex to draw two diagonals by using steel rule and scriber
- Punch the intersection point of two diagonals using a dot punch and ball peen hammer; this point will be the center point for making the hole by drilling operation

Procedure

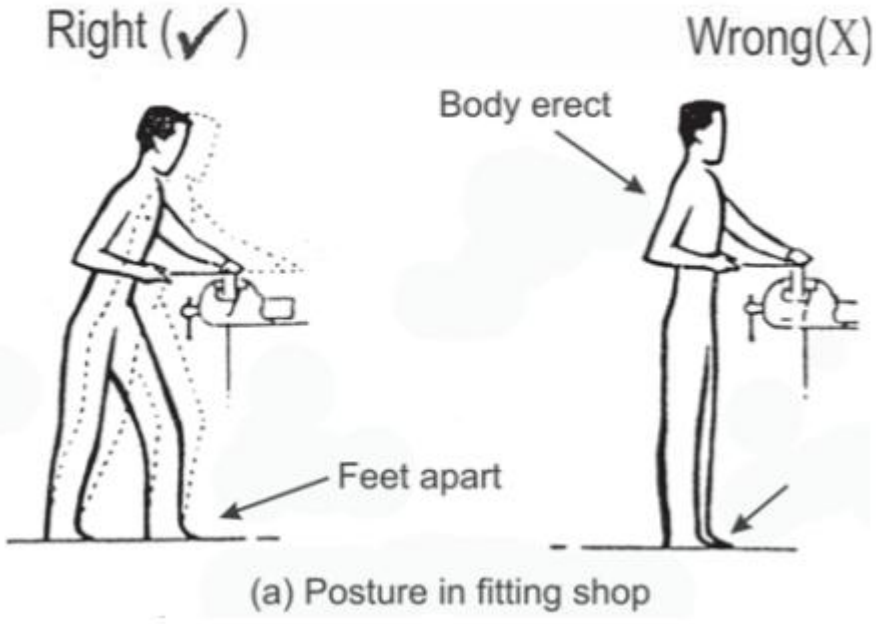
- Drill a hole of 5 mm diameter using the drilling machine and the drill bit
- Then prepare the round bar by filing operation; remove any sharp edges and smooth the surface using a file
- One end of this round bar should be made slightly taper for facilitating the striking operation
- Strike the round bar into the base part using the ball peen hammer
- Check all the dimensions using a Vernier caliper to ensure the correct dimensions of the square base paper weight
- Submit the part to the class teacher

Safety Precautions

- **Safety precautions to be followed in fitting section**
  - Always wear an apron and a safety glass to be safe from any dust particles
  - Wearing a hard-sole shoe is must for the safe movement inside the lab
  - Right posture should be maintained during filing or cutting operation to avoid any injuries to your hand
  - Position the work piece area such that the cut to be made is close to the vice. This practice prevents springing, saw breakage and personal injury.
  - Apply force only on the forward (cutting) stroke, relieve the force on the return stroke
  - You need to be more attentive during drilling operation to avoid any accident
  - Enough care must be taken while handling the workpiece and tools; the sharp edges may injure your hand

Safety Precautions

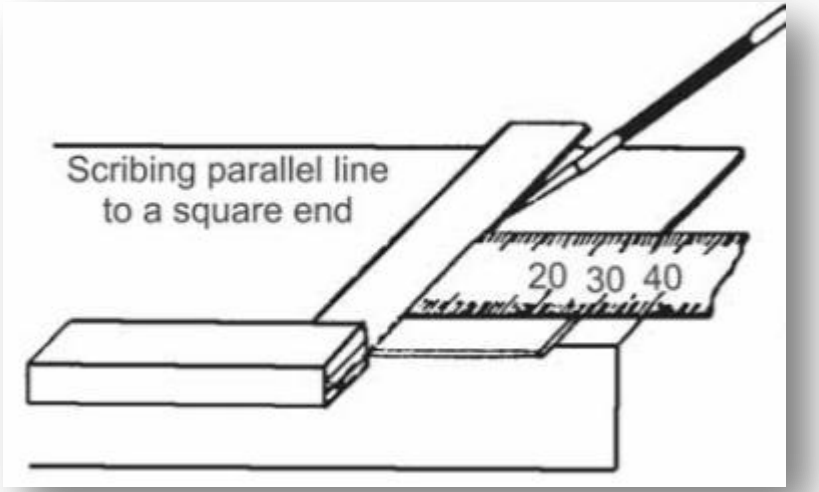
- **Right and Wrong working in Fitting shop**
- With left foot set forward the whole of the body is in action and the filing or cutting stroke with pressure is done without much strain to hands or legs.
- In the second case with body movement the arm would tire soon



(a) Posture in fitting shop

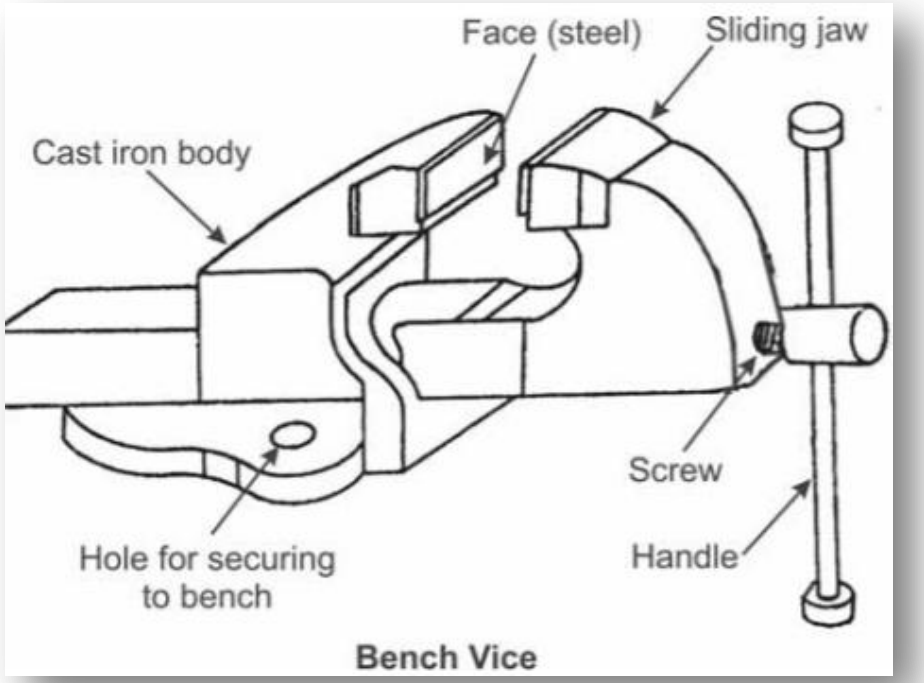
Measuring and Marking Operations

- Accurate marking is the first step; and the methods and instruments used are common in all fitting works.
- Measurements are taken either from a finished edge or from a center line.
- Measuring and testing are continuous processes throughout the manufacturing, whether working with hand tools or machines
- Tools used are:
  - Steel rule
  - Scriber
  - Try square



Holding and Cutting Operations

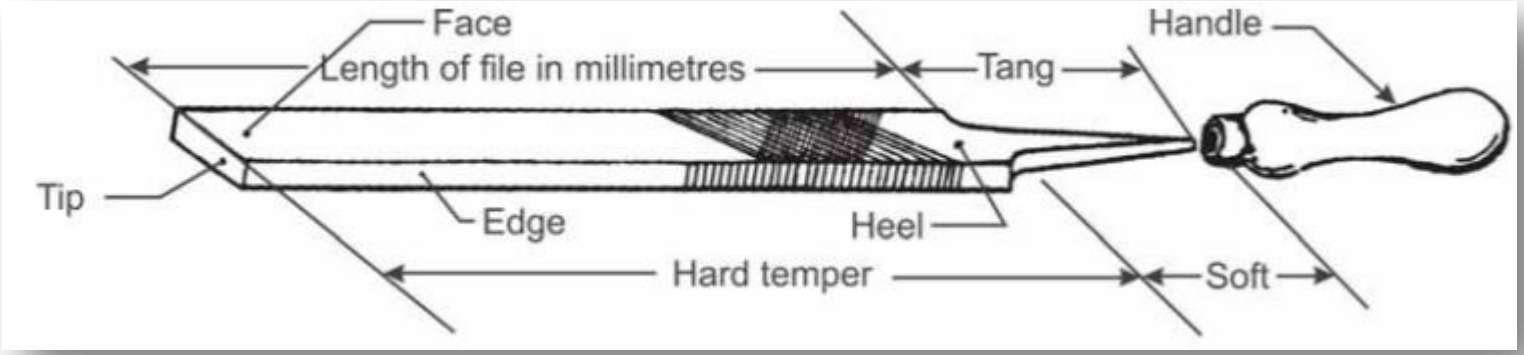
- After the marking operation, the workpiece will be fixed in a bench vice and cut to the required size by a hacksaw
- Tools used
  - Bench Vice:
  - Hacksaw
- The bench vice is a device commonly used for holding the work pieces.
- When the vice handle is turned in a clockwise direction the moving jaw forces the work against the fixed jaw



Bench Vice

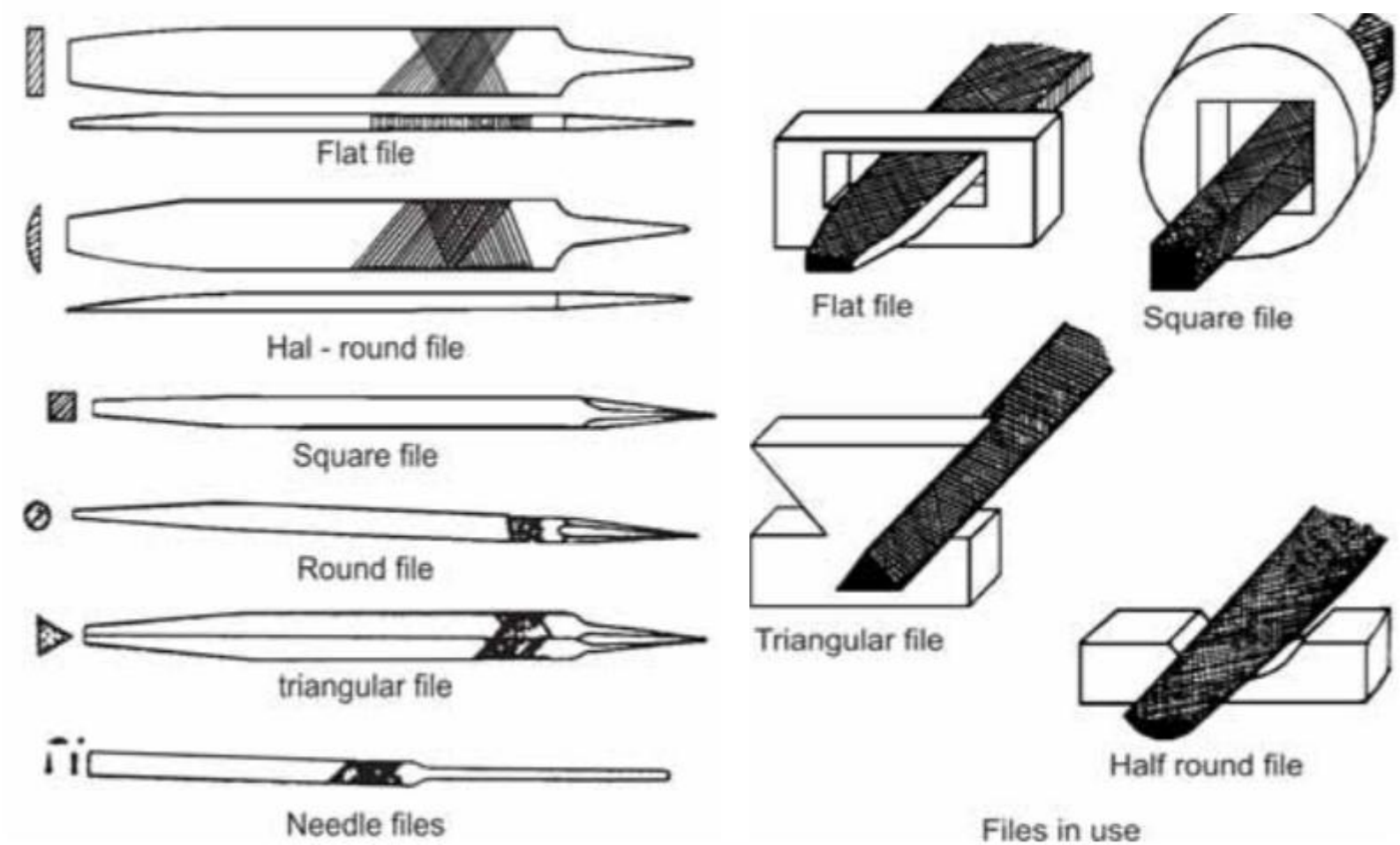
Filing Operation

- **Filing Operation:** 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.
- Tools sed:
  - Flat File
  - Bench Vice
  - Try Square



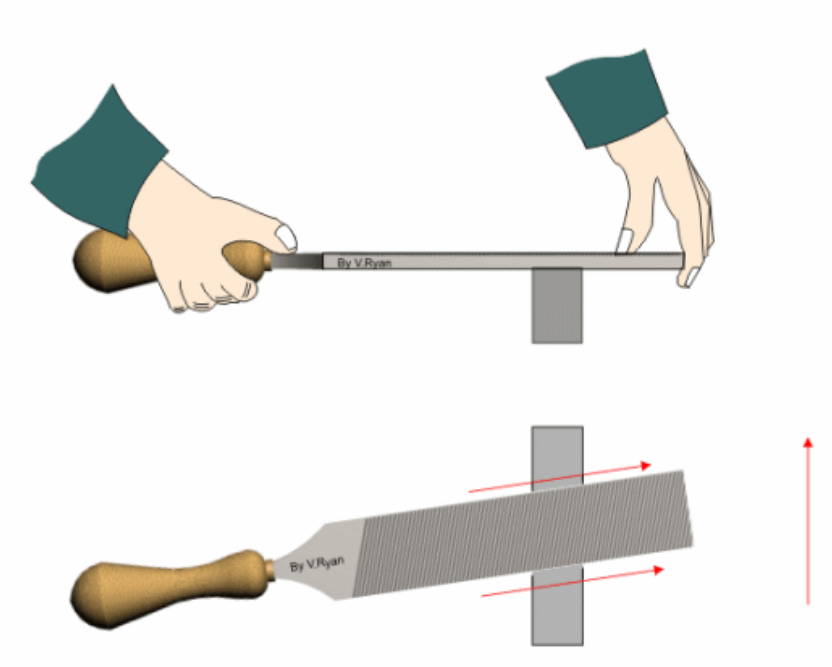
Filing Operation

- **Types of File:**
- Hand file
- Flat file
- Square file
- Triangular file
- Round file
- Half-round file
- Swiss or needle file



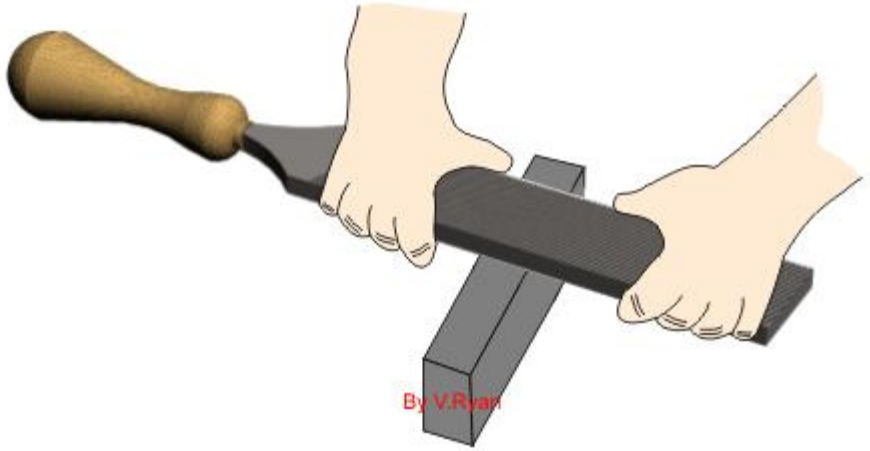
Filing Operation

- **Types of Filing:**
- **Through filing:** The file is held flat against the surface it is to cut / smooth. The file is then pushed forward, and it cuts on the forward stroke. It is then lifted away from the metal and returned to the starting point for the next push forward.



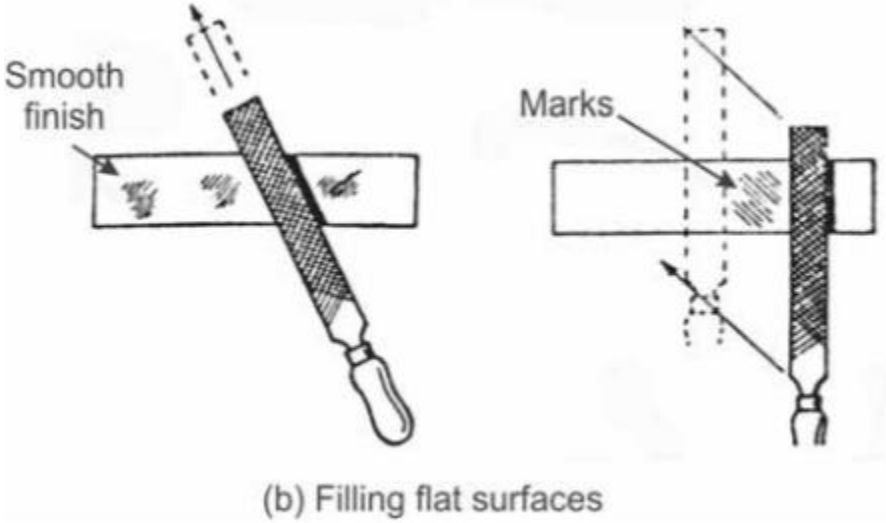
Filing Operation

- **Types of Filing:**
- If the surface produced by through filing is not good enough - the next stage is '**Draw filing**'. The file is held in both hands by the blade and pushed forwards and backwards along the material. This will further smooth the material.

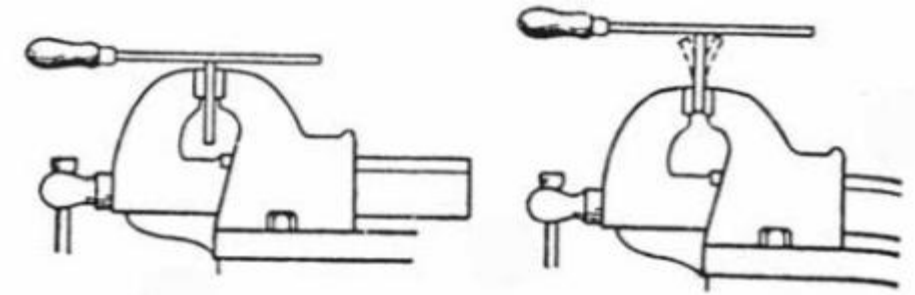


Filing Operation

- With filing diagonally across the work, smooth finish is obtained. Note that the file moves in the direction of the length of the file as shown. In the second case cut of the file teeth are produced on the work.
- Keep the work as low in the vise as possible. Work too high means lack of rigidity and too much vibration



(b) Filling flat surfaces


© Holding work in vice

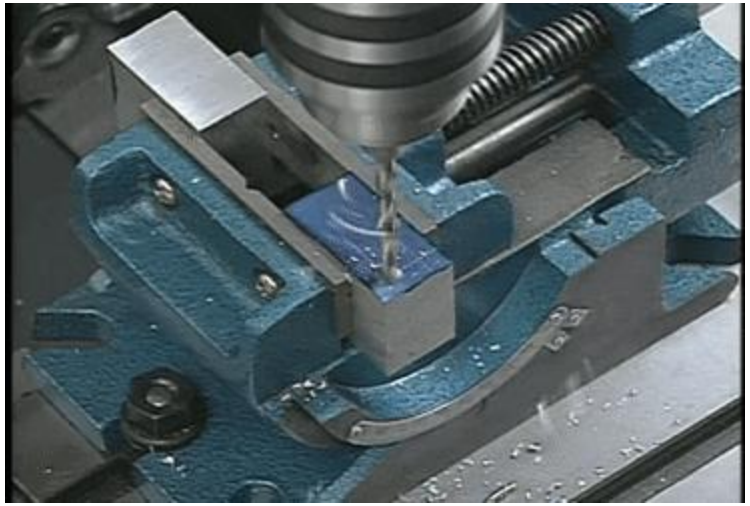
Center Marking

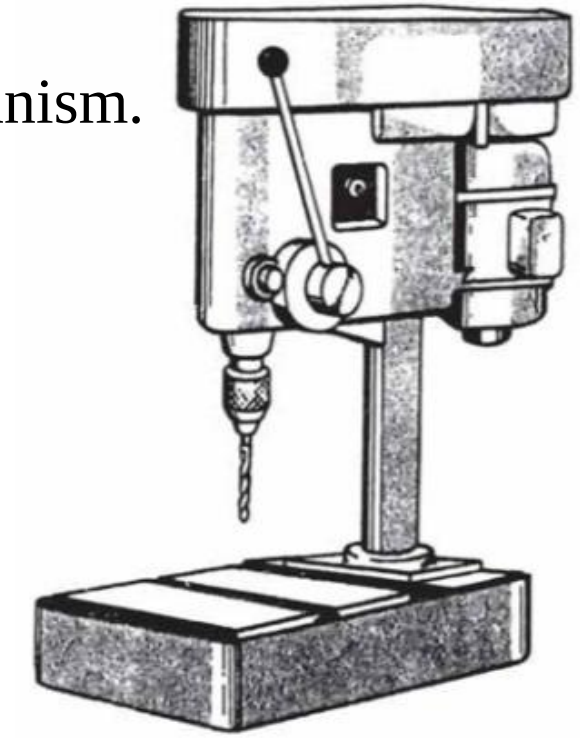
- Why Center Marking?
- It is required for the purpose of drilling operation
- Center mark helps in positioning the drill bit
- What are the tools required?
  - Chalk
  - Steel rule and Scriber
  - Center punch
  - Ball-peen hammer
  - Anvil

Drilling Operation

- **Drilling Operation**
  - Drilling is a cutting process that uses a drill bit to cut a hole of circular cross-section in solid materials.
  - A **bench drilling machine** is generally fixed on the work bench
  - The main parts of this machine are:

  Base, column, portable, spindle, head, and drive mechanism.





Bench drilling machine

Drilling Operation

- **Tool used:**
  - Drill bit
  - The drill bit is usually a rotary cutting tool, often multi-point. The bit is pressed against the work-piece and rotated at rates from hundreds to thousands of revolutions per minute
  - Drill bits are used to remove material to create holes, almost always of circular cross-section. Drill bits come in many sizes and shapes and can create different kinds of holes in many different materials.

Drilling Operation

- **Procedure**
- Layout and mark the centers of each hole, with a center punch.
- Select proper size drill bit and fix it in the chuck properly.
- Clamp the work in a vice or to the bench.
- With the power-off position the drill point at the center punch mark. Make sure that the tool is square with the surface.
- Hold the drill with one hand and steady it with the other. Put-on the power and apply pressure steadily.
- Release the pressure slightly, when the point of the drill pierces the lower surface of the metal.
- Remove the tool from the hole and put it off.

Shaft Preparation

- Round bar [*Shaft*] preparation
  - Cut the round bar of required size by using a hacksaw
  - Filing the round bar to remove rust from the surface to make it shine and smooth
  - Make one side of the round bar slightly taper as it will help to strike the bar easily into the bore of the square base
- Tools used are -
  - Hack saw
  - Steel rule and scriber
  - Flat file

Striking Operation

- The prepared round bar will be inserted to the bore by striking it by the help of a hammer
- The operation will be carried out by placing the square base over an anvil
- Tools used are -
  - Hammer
  - Anvil

Anvil