BASIC WORKSHOP TOOLS

Faculty: SOORAJ V R

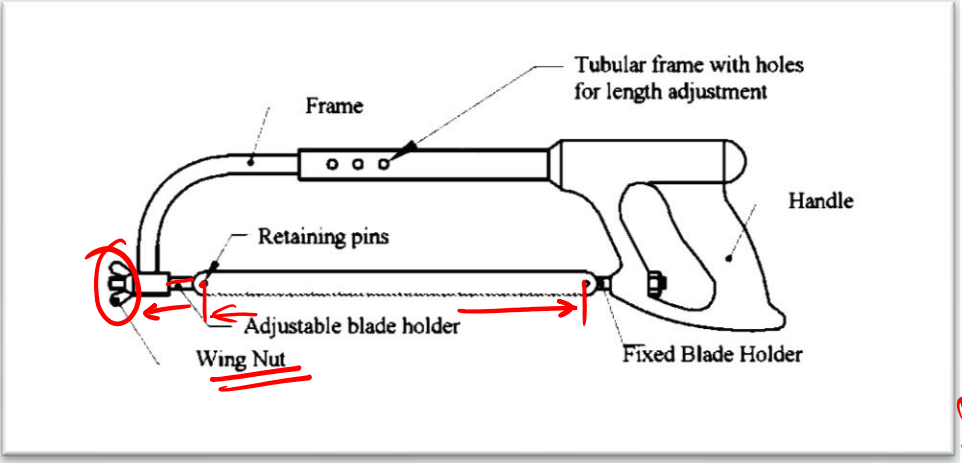
EARNEST ACADEMY

In a Glance

- Elementary ideas about various basic workshop practices of **Carpentry, foundry, sheet metal, welding, smithy and Fitting and various tools using in each sections**

EARNEST
ACADEMY

HACKSAW



- Hacksaw is a cutting tool used to cut sheets, pipes, and various types of metals.
- The process of cutting metal using a hacksaw is known as hacksawing.
- Cutting action takes place only in the forward stroke.
- To **prevent the breakage of the blade** hacksaw is moved slowly at the finishing of the cut.

EARNEST
ACADEMY

PARTS OF HACKSAW

Hacksaw frames are of three types

(i) Solid Hacksaw Frame

(ii) Adjustable Hacksaw Frame

(iii) Deep Cutting Hacksaw Frame

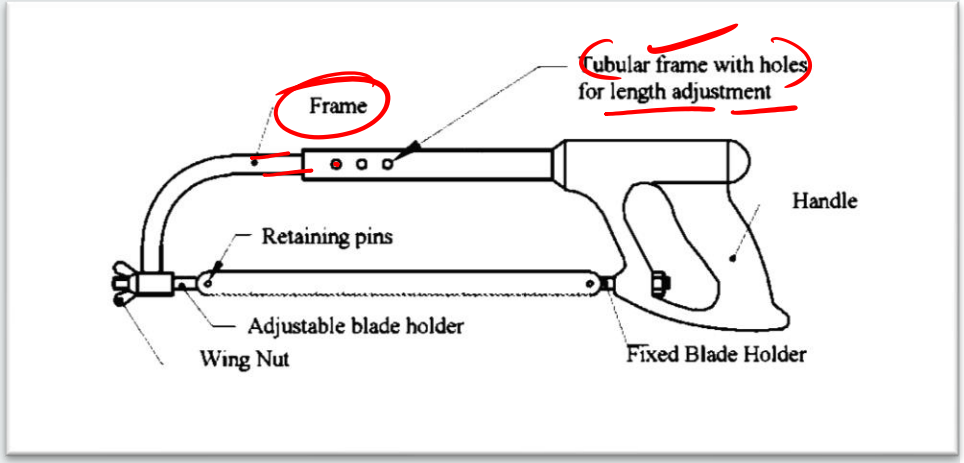
EARNEST ACADEMY

- The main parts of the hacksaw are - **Frame and Blade**.

HACKSAW FRAME

- Hacksaw frame is made of **mild steel strip** and **conduit pipe**.
- It is a **U-shaped** metallic solid or tubular frame.
- There is a **wing nut** for tightening the blade.

HACKSAW FRAME



Solid Hacksaw Frame –

- It is made by bending a mild steel strip at a right angle.
- Only a blade of a particular standard length can be fitted to this frame.

Adjustable Hacksaw Frame –

- This frame has **two parts**. The pins placed on them are used to increase or decrease the length of the frame.
- Different sized blades like **250 mm or 300** mm are fitted in it.

EARNEST ACADEMY

hacksaw frame

- Types of adjustable hacksaw frame

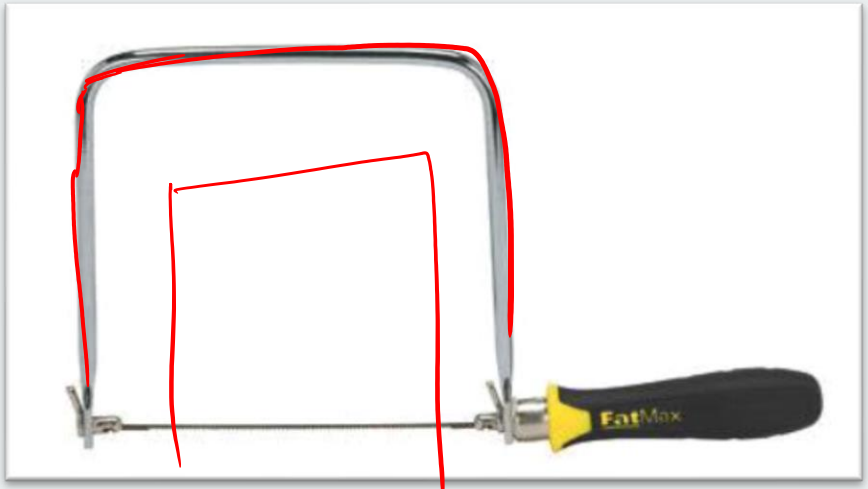
  Flat type: -Only a blade of a different standard length can be fitted to this frame

  Tubular type:

  - It is the most commonly used type.
  - It gives **better grip and control while sawing.**

EARNEST ACADEMY

hacksaw frame

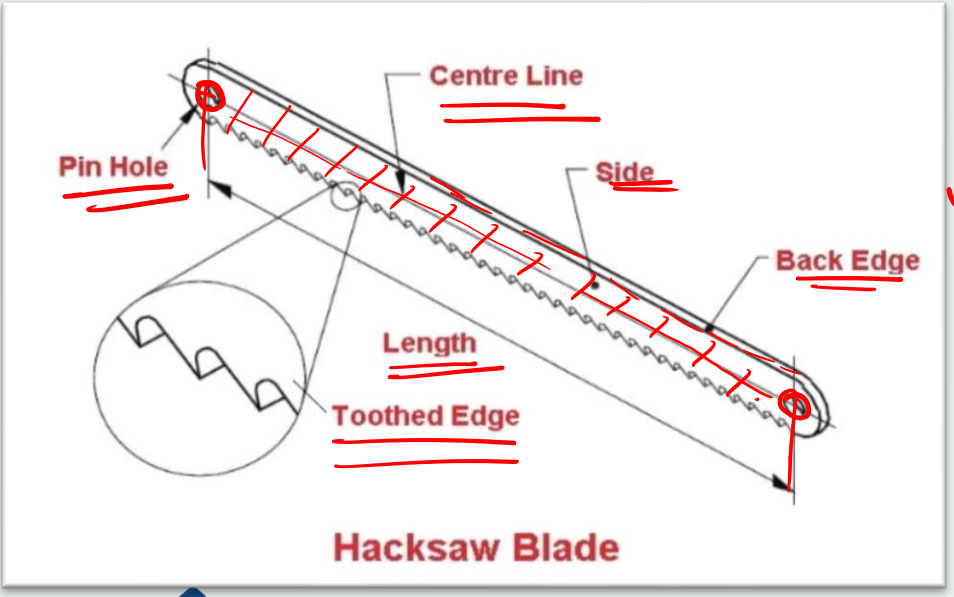


Deep Cutting Hacksaw Frame - This frame is shaped like a 'U' alphabet.

- it is used for deep cutting of the jobs.

EARNEST
ACADEMY

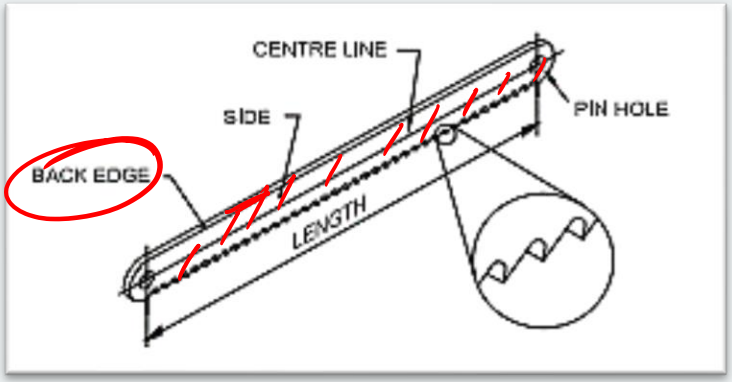
HACKSAW BLADE



- Hacksaw blade is generally made of **high carbon steel (HCS), high-speed steel (HSS), or low alloy steel**. It is hardened and tampered with.
- HCS used for **general cutting** and HSS for **tough resistant material**
- The selection of the blade depends on the **shape** and **hardness of the material** to be cut.

EARNEST
ACADEMY

PARTS OF A HACKSAW BLADE

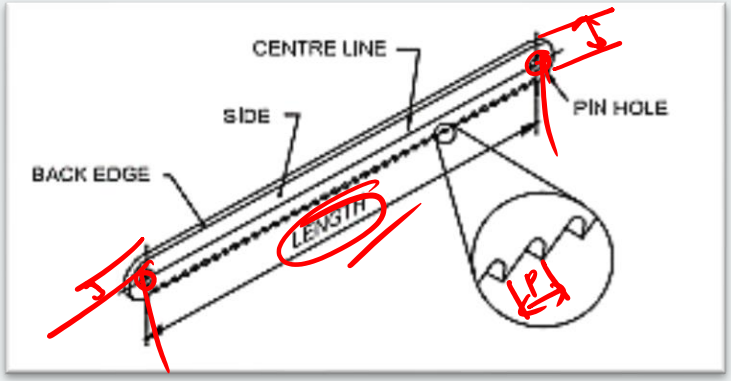


EARNEST
ACADEMY

Parts of a hacksaw blade

- Back edge
- Side
- Center line
- Pin holes

Specifications of Hacksaw Blade



EARNEST
ACADEMY

Specifications of Hacksaw Blade

- Type- Hard or Flexible
- Standard Length – 250 or 300 mm
- Width – 13 to 16 mm
- Thickness – 0.60 to 0.80 mm
- Pitch (Gap of teeth) - 0.8 to 1.8 mm

The size of the blade is considered from the **center of one hole to another.**

TYPES OF HACKSAW BLADES

All hard blade

- Entire length between the pinhole is hardened
- It is used for harder materials such as HCS, dies steel, and tool steel

EARNEST
ACADEMY

TYPES OF HACKSAW BLADES

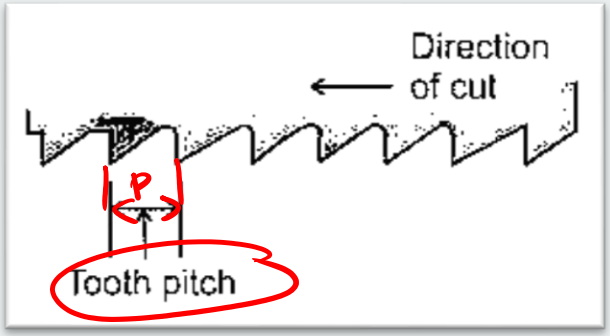
Flexible blade

- Only the teeth portion is hardened.
- Because of flexibility these blades are useful for cutting along **curved lines.**
- Flexible blade should be thinner than the harder blade.

EARNEST
ACADEMY

PITCH OF HACKSAW BLADE

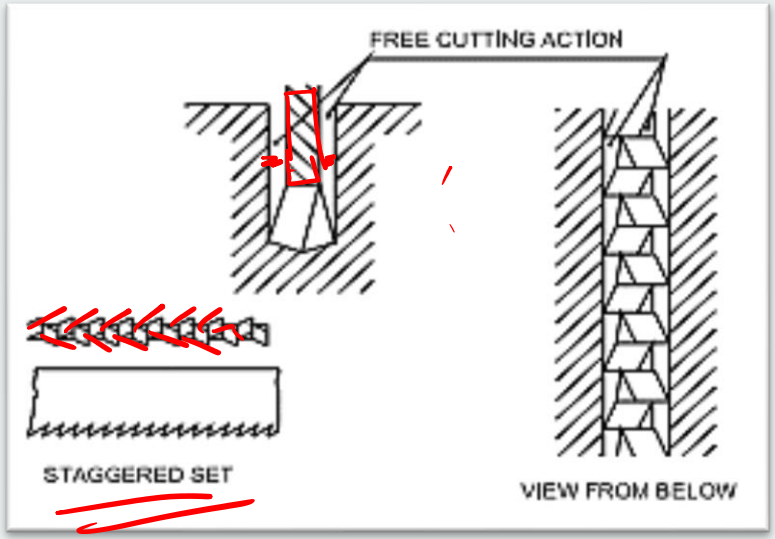
0.8 to 1.8 mm



Classification	Pitch	Use
Fine	0.8 mm	Thin tubes Sheet metal Conduit tubes
Medium	1 mm	Angle iron Brass tubes Copper, Iron pipe
	1.4 mm	Tool steel High carbon steel High-speed steel
Coarse	1.8 mm	Bronze Brass Soft steel Cast iron,Heavy angle iron

EARNEST ACADEMY

SETTING OF HACKSAW TEETH



- Free movement of the blade is achieved by the setting of the hacksaw teeth.
- It prevents the binding of the blade when penetrating the material.

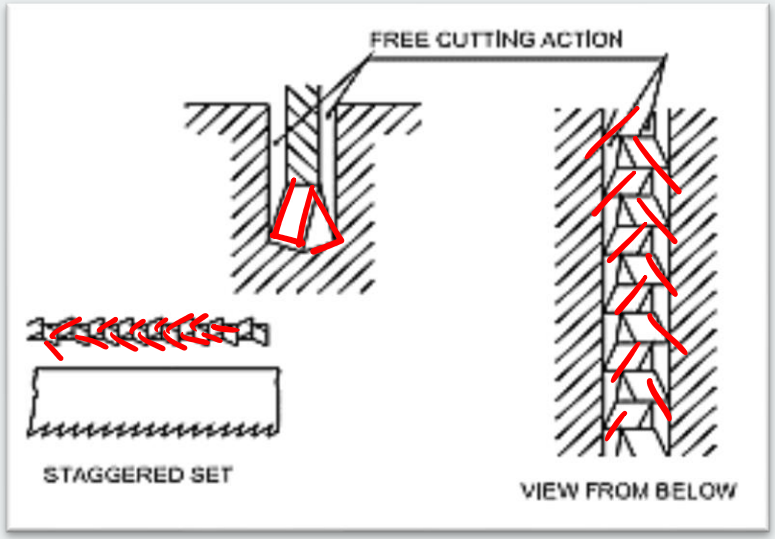
There are two types of hacksaw teeth settings,

I. **STAGGERED SET**

II. **WAVE SET**

EARNEST ACADEMY

SETTING OF HACKSAW TEETH

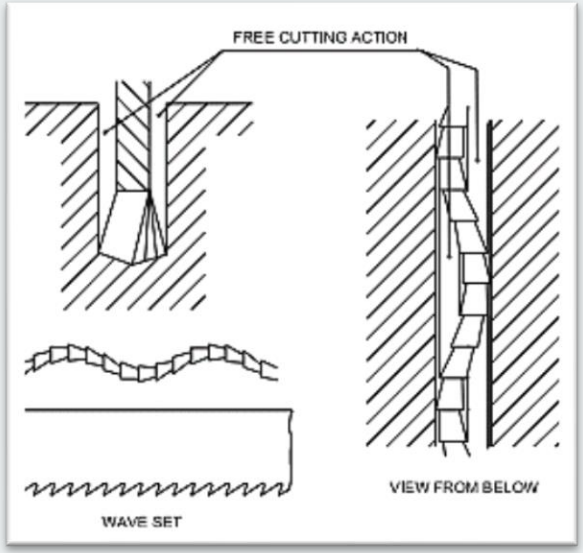


EARNEST ACADEMY

STAGGERED SET

- Alternate teeth or groups of teeth are staggered
- This arrangement helps in free cutting & provides good chip clearance.

WAVE SET

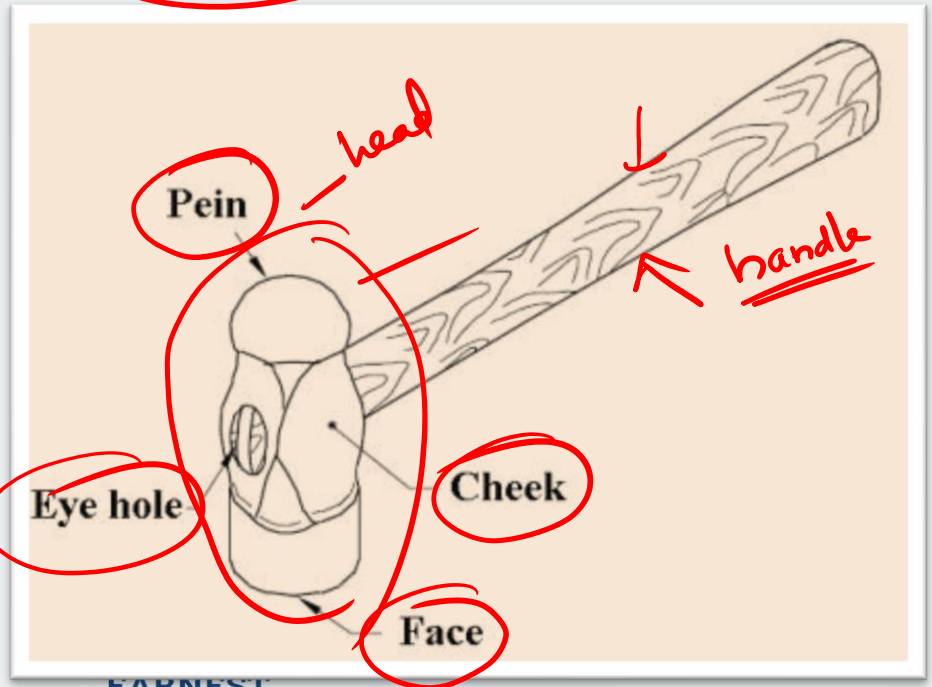


- Blades are arranged in the waveform.

Type of set	Pitch
Wave set	0.8 mm
Wave or staggered	1 mm
Staggered	Over 1 mm

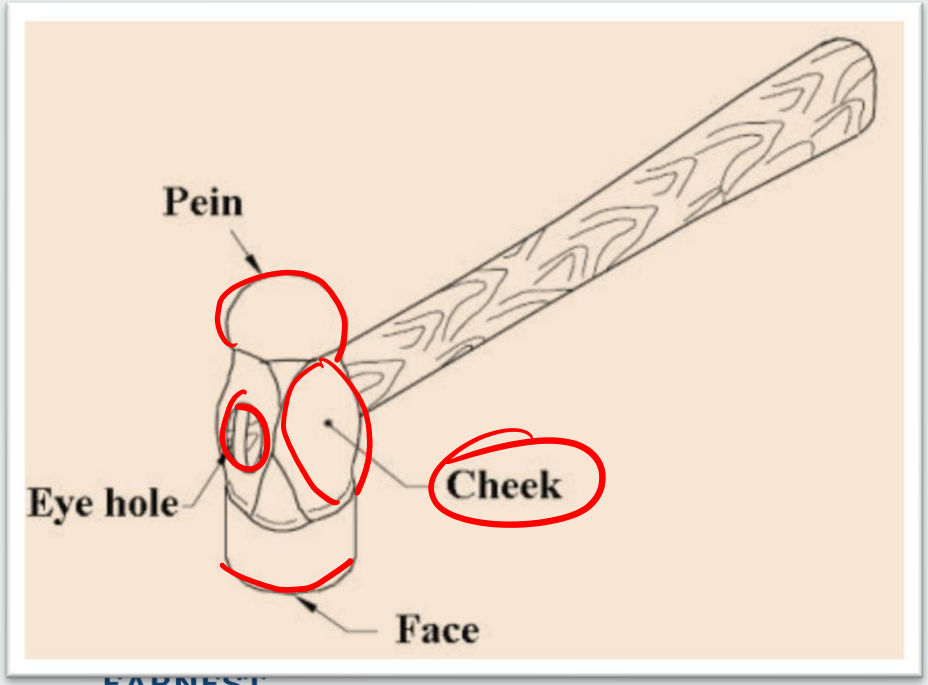
EARNEST ACADEMY

HAMMER



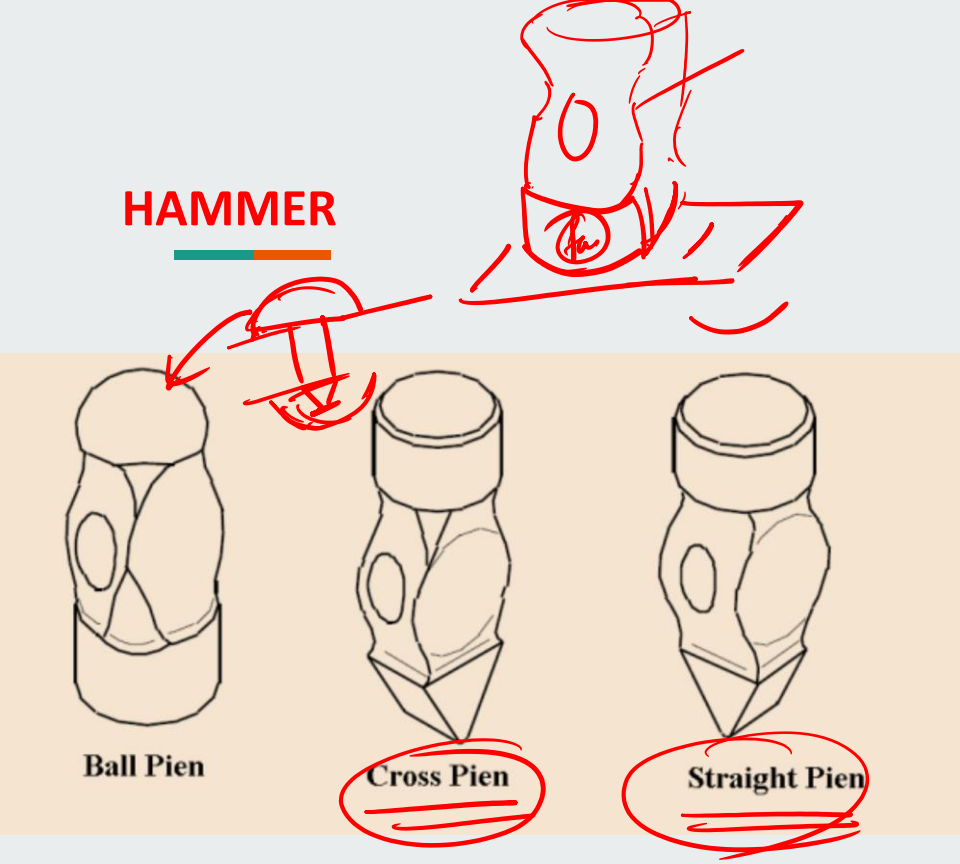
- An engineer's hammer is a hand tool used for striking purpose.
- The major parts of a hammer are, **Head & Handle**.
- The hammer head is made of, **Drop forged carbon steel**
- The hammer handle is made of, **Wood** capable for absorbing shock.

HAMMER



- The parts of the hammer head are:
  - Face
  - Pein
  - Cheek
  - Eye hole

HAMMER



FACE :

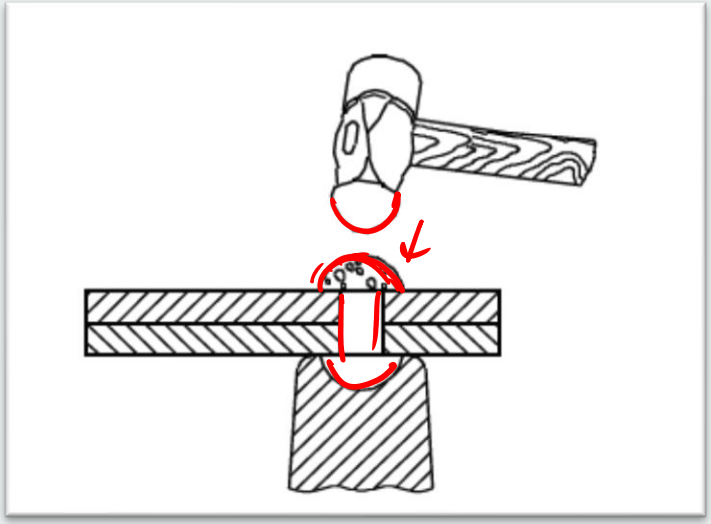
- It is the striking portion of the hammer-head.
- A slight convexity is given in the face to avoid digging of the edge.

PEIN :

- It is the other end of the hammer-head.
- It is used for shaping and forming work like riveting and bending etc.

EARNEST ACADEMY

BALL PEIN HAMMER

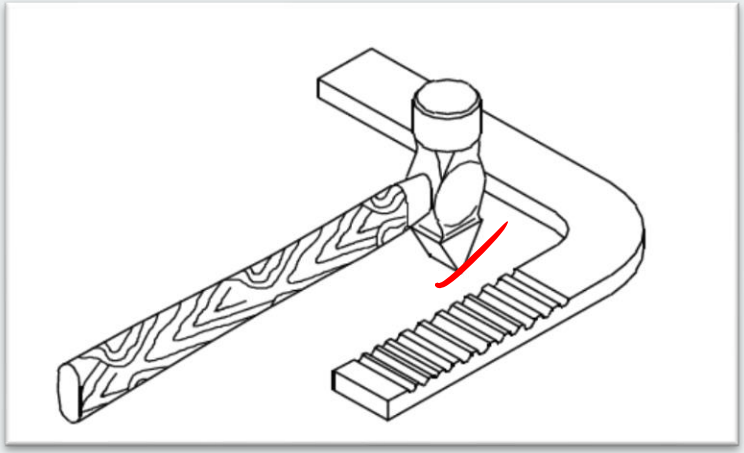


- It is used for **riveting**
- The most commonly used hammer is the **Ball pein hammer**.
- The weight of the ball-peen hammer used for marking purposes is **250 gm**.

Sledge hammer => 1.5kg

EARNEST ACADEMY

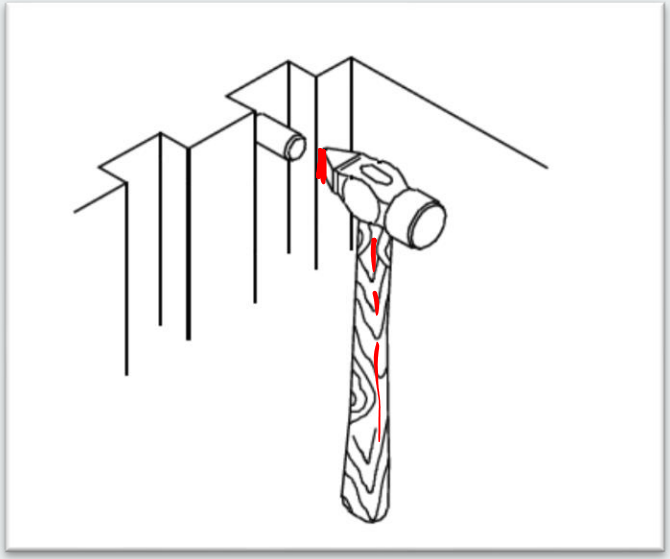
CROSS PEIN



- It is used for Spreading metal in one direction.

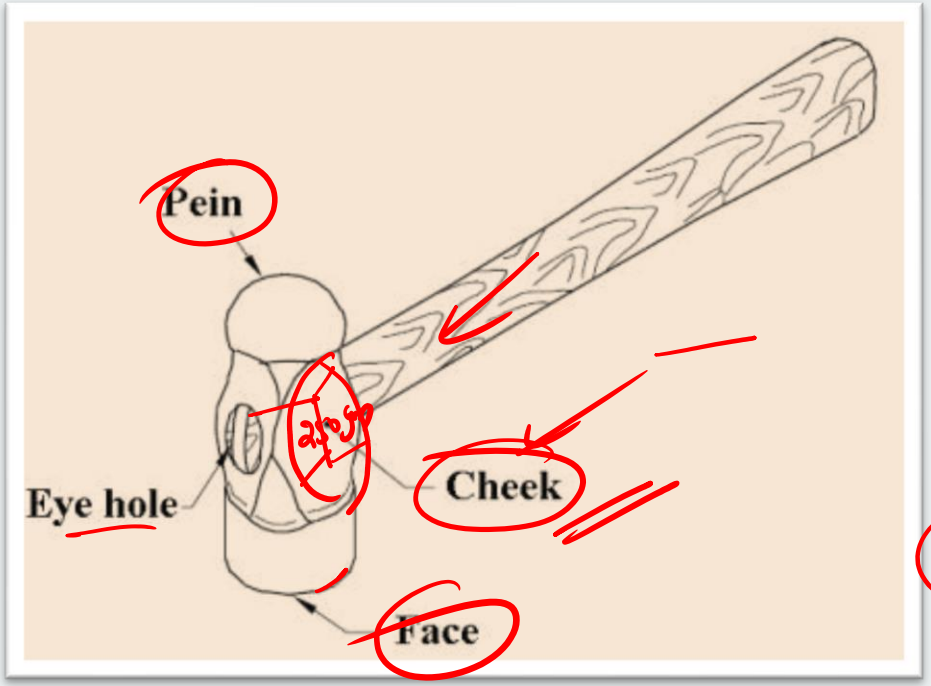
EARNEST
ACADEMY

STRAIGHT PEIN



- It is used for squaring metals at corners.

EARNEST
ACADEMY



EARNEST ACADEMY

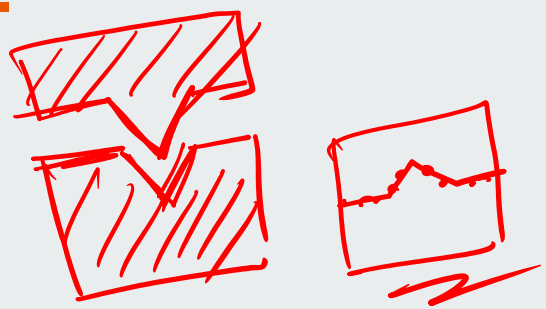
CHEEK :

- It is the middle portion hammer head.
- The weight of the hammer is stamped here.
- This portion of the hammer head is left **soft.**
- Cheek is not hardened.

EYE HOLE

- It is provided for fixing the handle
- It is an oval-shaped tapered hole with an increase in diameter from the center towards its ends.

TYPES OF MARKING MEDIA



WHITE WASH

- White wash is prepared by mixing:
  - **Chalk + water**
  - **Chalk + methylated spirit**
  - **White lead powder + turpentine**
- White wash applied to **rough forgings** and **castings** with oxidized surfaces.
- Whitewash is not recommended for workpieces of high accuracy

EARNEST ACADEMY

TYPES OF MARKING MEDIA

MARKING BLUE

- A Chemical dye, blue-based colour mixed with methylated spirit used for marking on workpieces which are reasonably machined surface

PRUSSIAN BLUE

- It is used on **filed or machine-finished surfaces**.
- This will give very clear lines but takes more time for drying than other marking media.

EARNEST
ACADEMY

TYPES OF MARKING MEDIA

COPPER SULPHATE

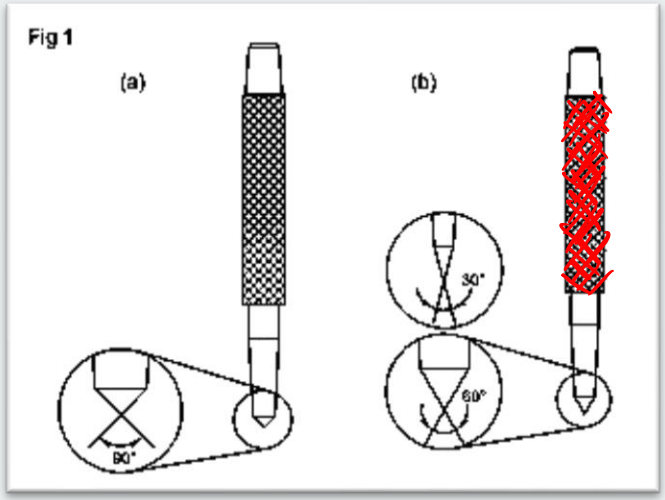
- It is prepared by mixing copper sulphate in water and few drops of nitric acid.
- It is also used filed or machine finished surface and it is **poisonous**.

CELLULOSE LACQUER

- It is **commercially available** marking medium
- It is made in different colours It dries very quickly

EARNEST ACADEMY

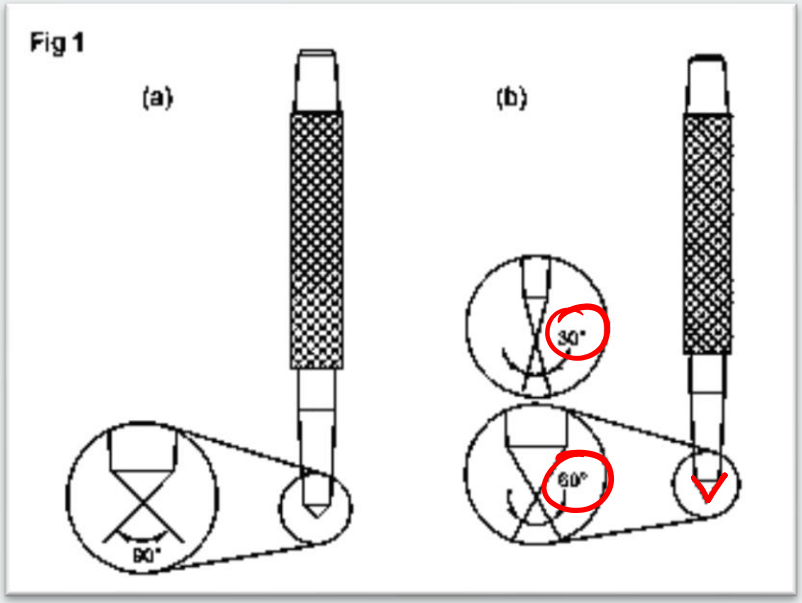
MARKING PUNCHES



- It is used for **layout work.**
- Made of **High Carbon Steel**
- The body of the punch is **octagonal** or it is knurled by making it cylindrical
- The commercial sizes of punches is represented by its length and diameter: **50 x 12.50 mm**

EARNEST
ACADEMY

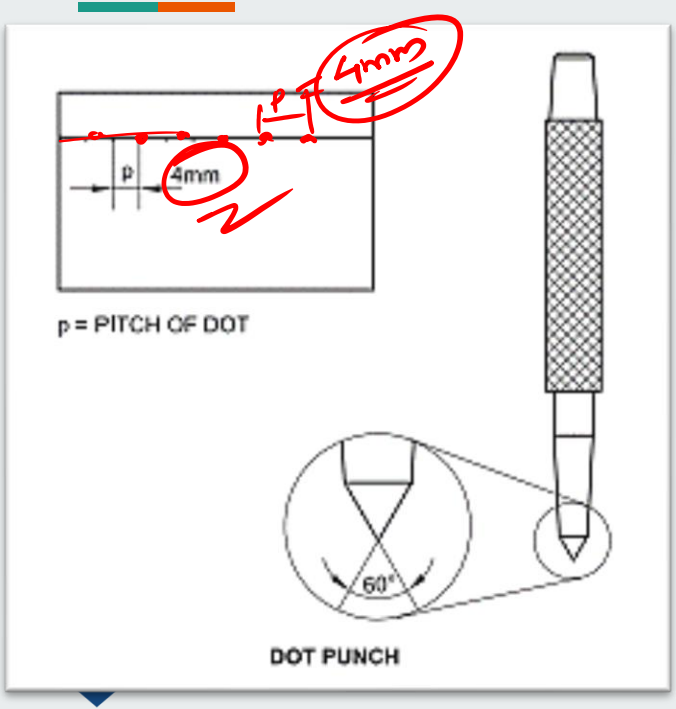
TYPES OF PUNCHES



PRICK PUNCH

- The point angle is 30^0 or 60^0
- It is used for light punch marks
- Used for **positioning of divider legs**

EARNEST ACADEMY

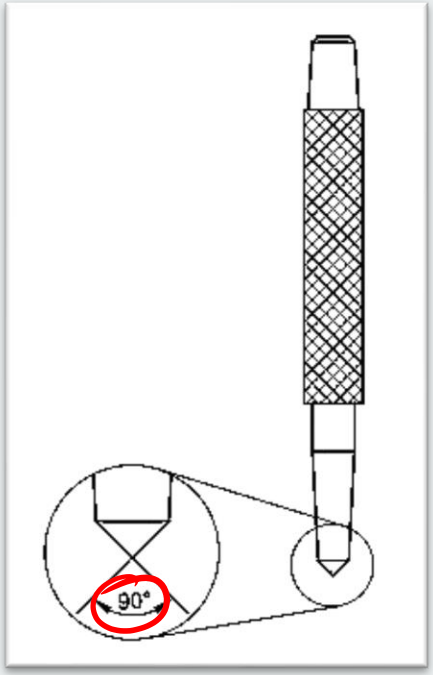


EARNEST
ACADEMY

DOT PUNCH

- The point angle is 60^0
- The **60^0 prick punch** is called **DOT PUNCH**
- It is used for **witness marking** and pitch of dot should be minimum **4 mm**

CENTRE PUNCH

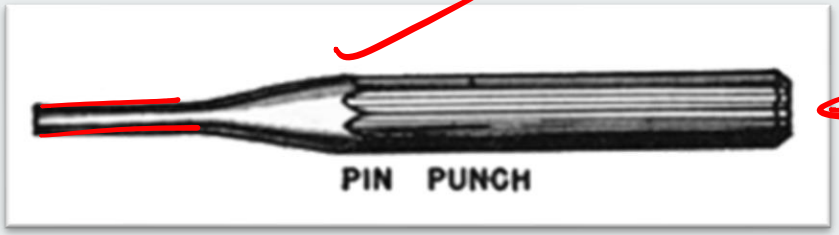


CENTRE PUNCH

- The point angle is 90^0
- The punch mark made this very wide but not very deep.
- This punch is used to **locate holes.**
- The wide punch mark gives a good seating for **starting the drill**.

EARNEST
ACADEMY

PIN PUNCH



Pin Punch

- It is longer than the other punches
- Used to remove taper and cotter pins from holes

EARNEST
ACADEMY

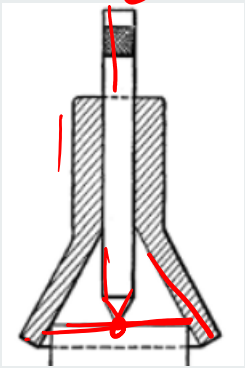
Hollow Punch

Hollow Punch

- Used to drill holes in soft thin iron sheets, leather, soft nonferrous metals etc.
- Hollow from inside and available in different size

EARNEST
ACADEMY

Bell Punch

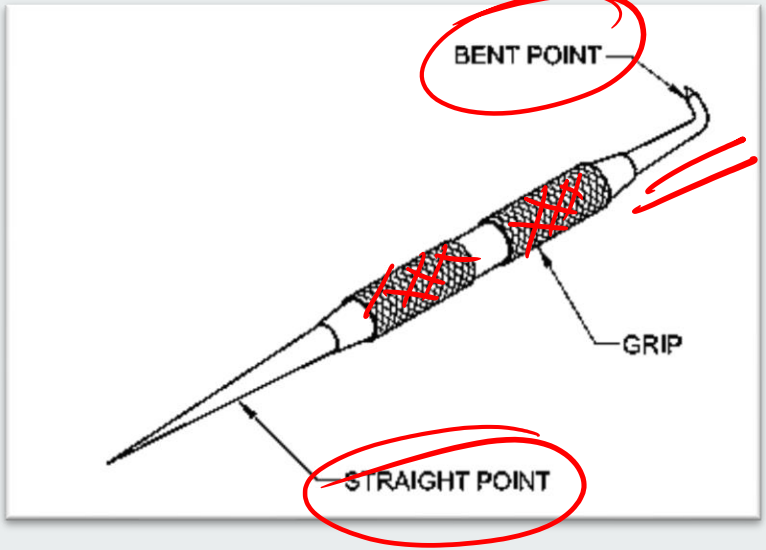


Bell Punch

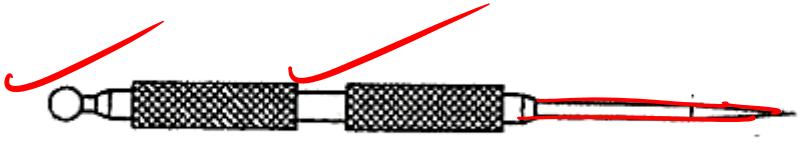
- Used to locate or mark the center of cylindrical rod.
- It is bell shaped in front and its size depends on the circumference of the bell.

EARNEST
ACADEMY

SCRIBERS



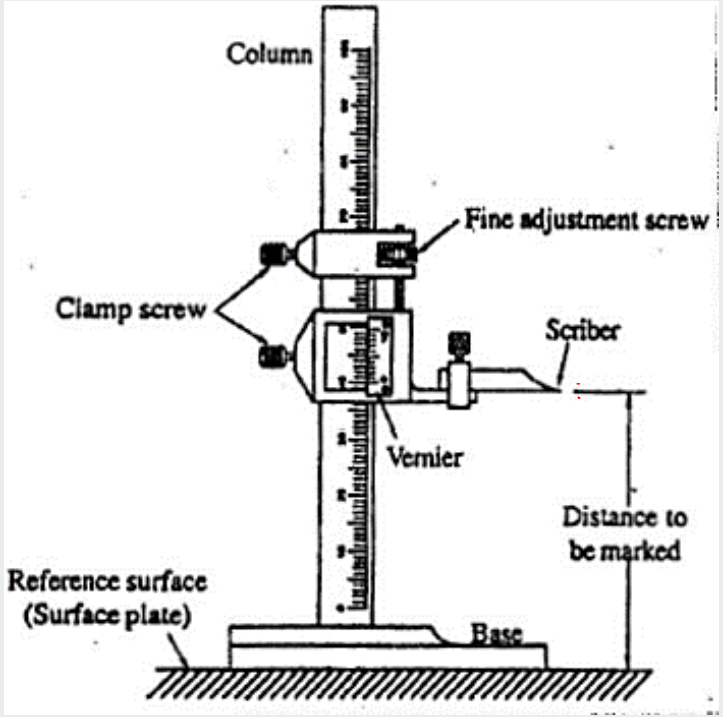
- It is used for drawing clear and sharp lines on filed or machined metal surfaces.
- Made up of **High Carbon Steel**
- Three types **Bent type scriber, Plain Scriber** and **offset scriber**



Plain scriber

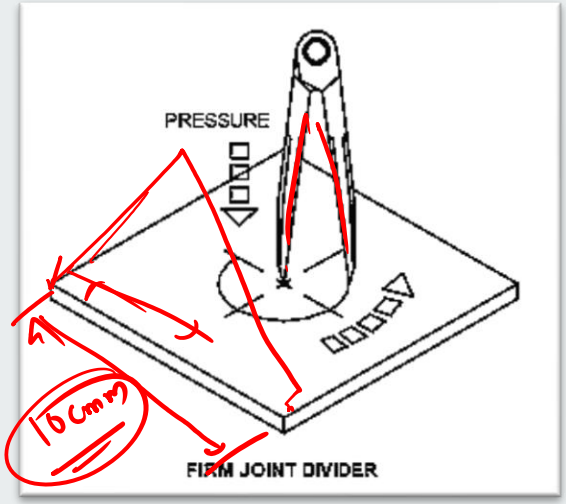
EARNEST ACADEMY

OFFSET SCRIBER



- Offset scriber is used along with vernier height gauge for measuring height.
- The most commonly used scriber is **Plain scriber**.
- The point angle of scriber is **12^0 to 15^0**
- Scriber point is always sharp, so used to prevent accidents the point inserted in **cork**.

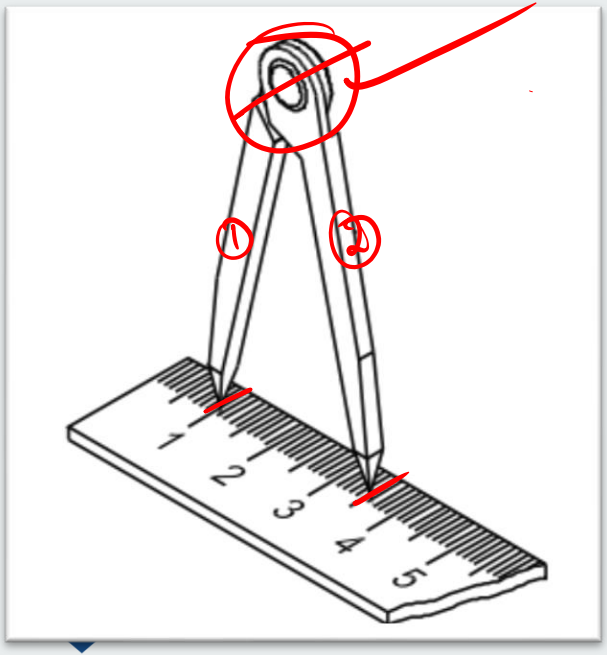
DIVIDERS



- It is an instrument for **measuring, transferring** or **marking off distances**
- Also used for **scribing arcs, circles**
- **Indirect measuring tool** that is measurements set on the divider with a steel rule.
- For the correct location and seating of the divider point **prick punch** marks of 30° are used.
- The two legs of the divider should always be of **equal length**.

EARNEST
ACADEMY

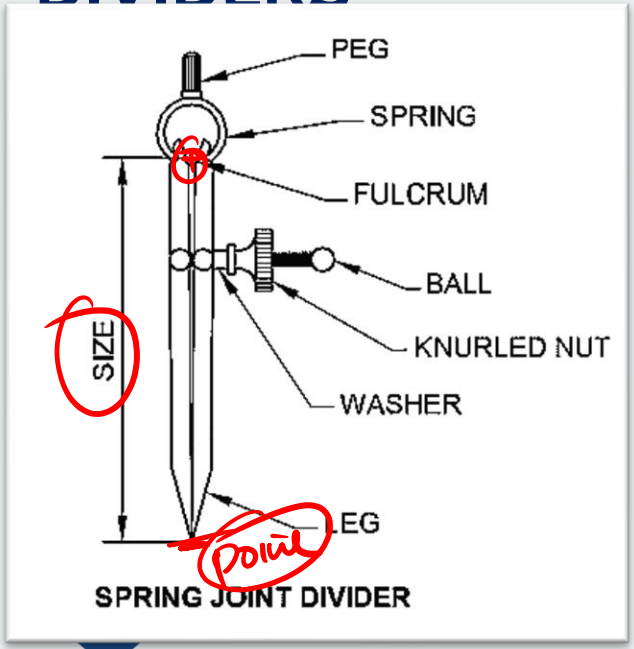
TYPES OF DIVIDERS



EARNEST
ACADEMY

I. **FIRM JOINT**: whose legs are jointed together at the top with a nut and which must be opened and closed by hand pressure.

TYPES OF DIVIDERS

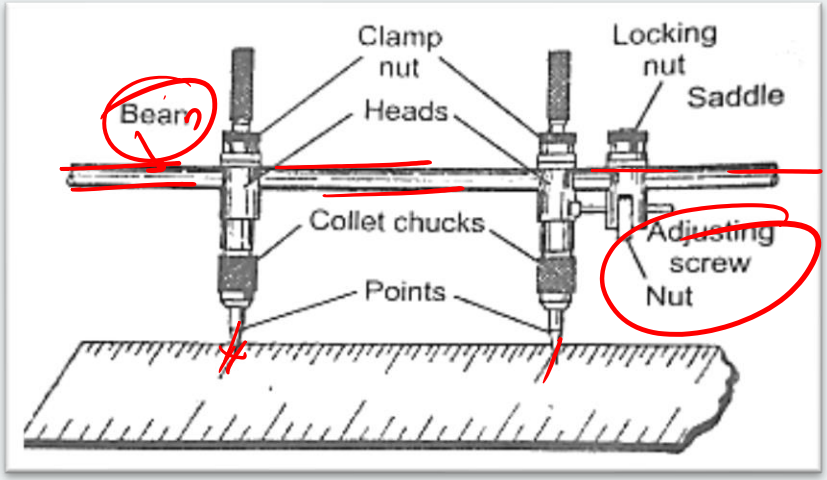


EARNEST ACADEMY

SPRING JOINT

- Quick setting with the help of an adjustable nut
- The sizes of divider ranges from **50 mm to 200 mm**
- **The size of divider**: The distance from the **point to the center of the fulcrum (pivot).**
- Specification of divider: **The joints and length**

BEAM COMPASS /TRAMMEL

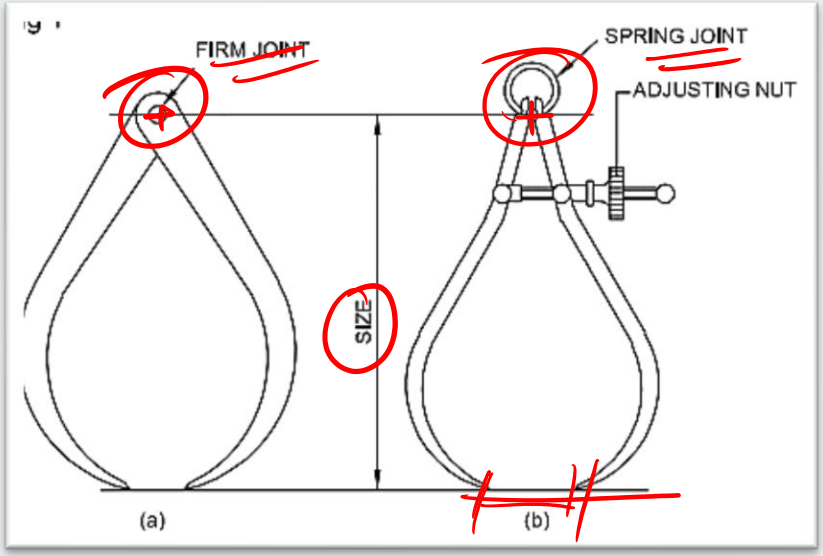


EARNEST ACADEMY

BEAM COMPASS /TRAMMEL

- Trammel is a bigger form of divider
- Used to draw **big arc and circles**
- It has a circular or flat rod which is called **beam** or trammel bar
- This beam is fitted with two sliding heads
- Used for taking an internal and external measurement or for drawing a circle on a job.

CALIPERS



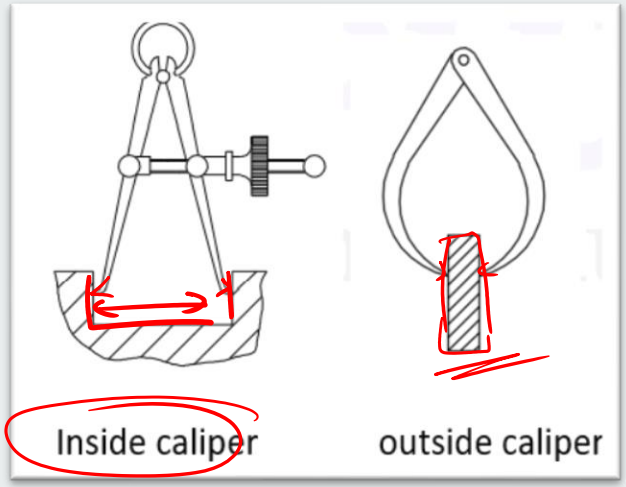
- Calipers are **indirect measuring instruments**
- Used for **transferring measurements from a steel rule to a job and vice versa**.
- The Calipers are made of **Carbon steel**
- Calipers are used along with **steel rules**, and the accuracy is limited to **0.5 mm**
- Calipers are classified according to their **joints** and their **legs**.

EARNEST ACADEMY

Classification according to Joint

a. **Firm joint caliper**

b. **Spring joint caliper**



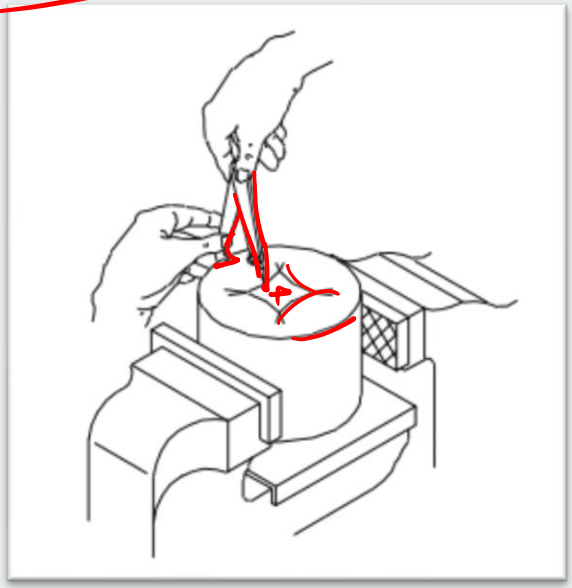
Classification according to their legs

i. **Inside caliper** for internal measurement.

- The ends of its two legs are bent at an angle of 45^0

i. **Outside caliper** for external measurement

Jenny Calipers



- Jenny calipers have one leg with an adjustable divider point, while the other is a bent leg.
- Also known as
  - **hermaphrodite calipers**
  - **leg and point calipers**
  - **odd leg caliper**

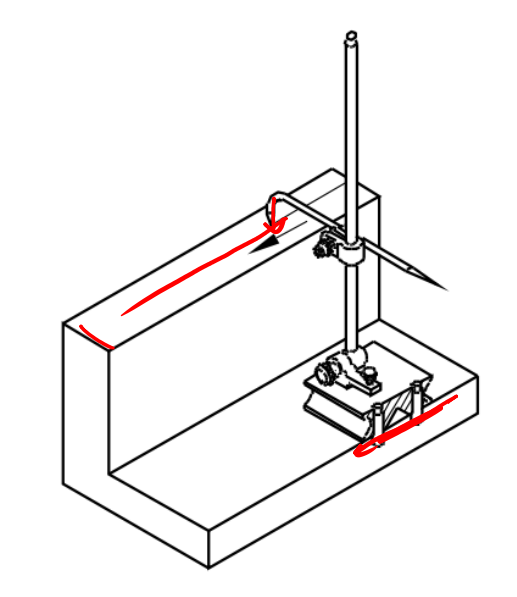
EARNEST ACADEMY

Jenny Calipers

- **Used for:**
  - finding the Centre of round bars
  - marking lines parallel to the inside and outside edges

EARNEST
ACADEMY

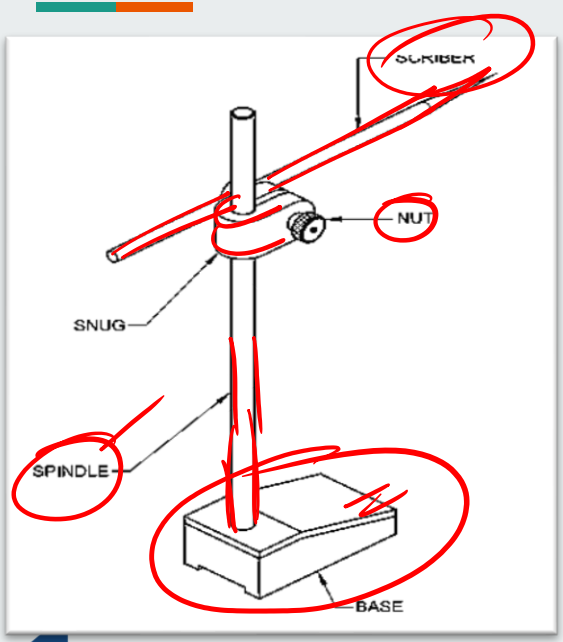
SURFACE GAUGE/ MARKING BLOCK



- It is the most common marking tool used for:
  - **Drawing lines parallel to datum surface.**
  - **Checking the height and parallelism of jobs.**
  - **Setting jobs concentric to the machine spindle.**

EARNEST ACADEMY

Types of surface gauges

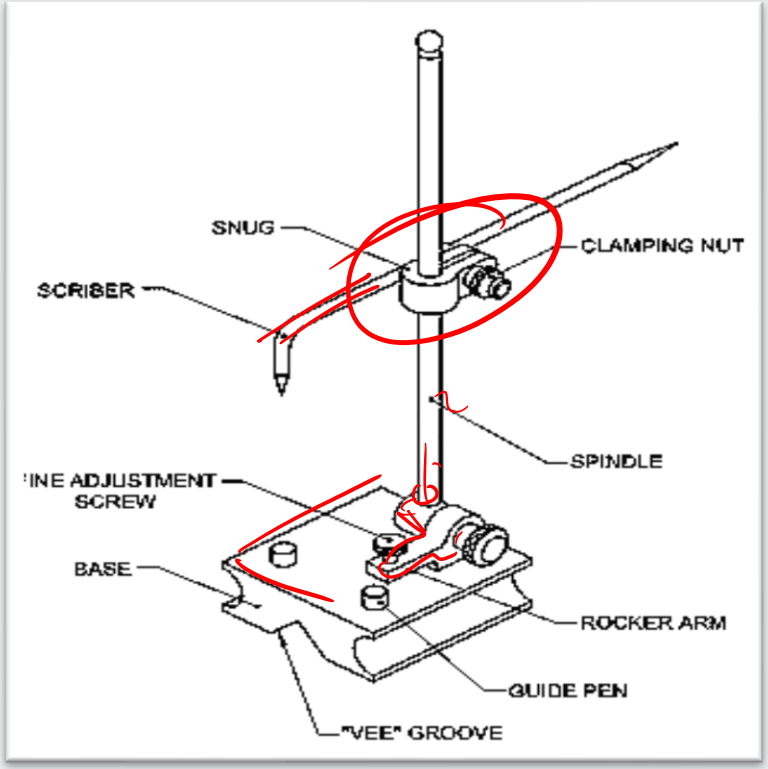


EARNEST
ACADEMY

FIXED TYPE SURFACE GAUGE

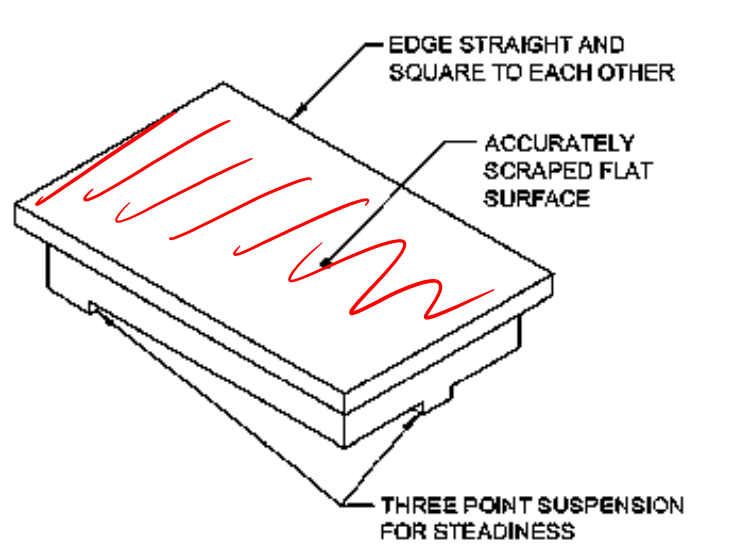
- It consists of a heavy flat base and a spindle.
- It consists of a plain scriber attached with a snug and a clamp nut.

Universal Surface Gauge



- The spindle can be set to any position.
- The **guide pin** helps to draw parallel line along the datum edge.
- Can also be used on cylindrical surfaces.
- **The rocker arm** in the base attached with a spring and a fine adjustment screw.
- **The spindle** is attached to the **Rocker arm**.
- The scriber can be clamped in any position on the spindle with the help of a **snug and a clamping nut**.

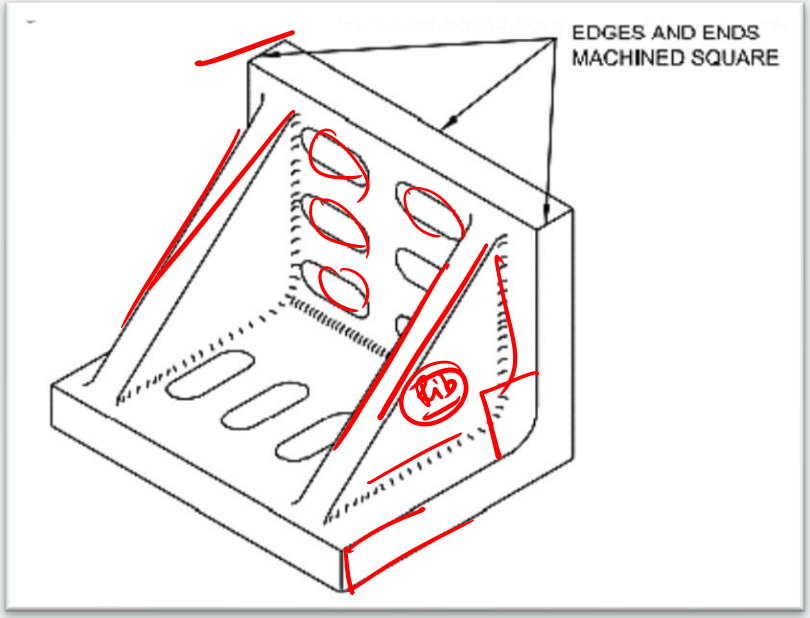
SURFACE PLATE



EARNEST ACADEMY

- It is a datum plane with a perfectly flat surface.
- Used to test flatness of other surfaces and provide truly flat datum surface in marking off work in machining.
- The most widely used datum surfaces in machine shop work are the **surface plates** and **marking tables.**
- Surface plates are generally made of good quality **cast iron** and **Granite**.

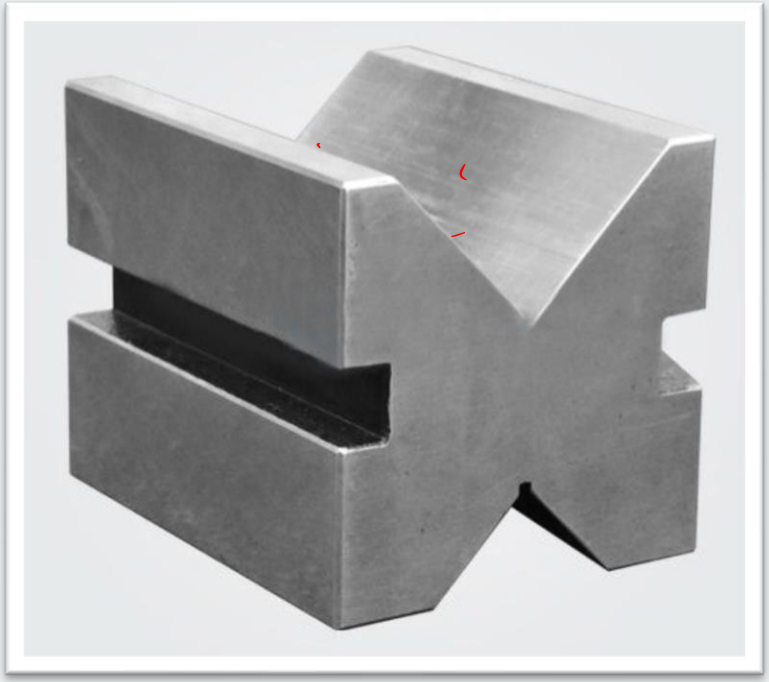
ANGLE PLATES



EARNEST
ACADEMY

- Angle plate is a work holding device used as fixture in metal working.
- These are made of **closely grained cast iron** or **steel**.
- Angle plates have two plane surfaces, machined perfectly flat and at right angles. (90°)
- The edges and ends are also machined square.
- They have ribs on the unmachined part for good rigidity and to prevent distortion

VEE BLOCK



- V' Blocks are devices used for marking and setting Upwork on machines.
- The included angle of the VEE is **90°** in all cases.
- 'V' Blocks are finished to high accuracy in respect of dimension, flatness and squareness.

VEE BLOCK

GRADES AND MATERIALS

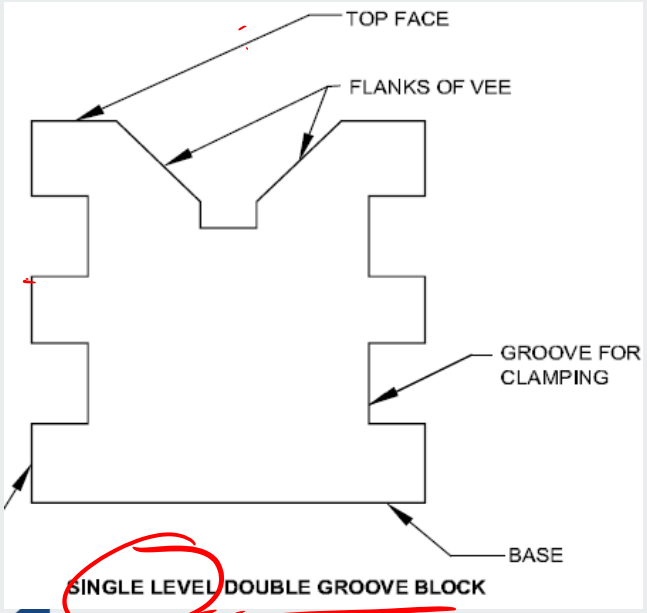
- 'V'Blocks are available in **Grade A and Grade B.**

Grade A 'V' Blocks

- These are more accurate, and are available only **up to 100 mm in length**.
- They are made of **high-quality steel**.

EARNEST
ACADEMY

VEE BLOCK

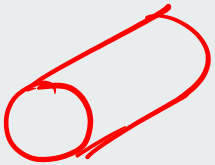


EARNEST ACADEMY

Grade B 'V' Blocks

- These blocks are not as accurate as the ones in Grade A.
- These blocks are used for **general machine shop work.**
- These blocks are available up to **300 mm length**.
- These ‘V' Blocks are made of **closely grained cast iron.**

DESIGNATION



1 A 50 mm long (nominal size) 'V' block capable of clamping workpieces between 5 to 40 mm in diameter and Grade A will be designated as - 'V' block 50 /5-40 A - B.I.S. 2949.

2 In the case of a matched pair, it will be designated as 'V' block M50/5-40 A B.I.S. 2949.

3 For'V' blocks supplied with clamps, the designation will be 'V' block with clamp 50/5-40 A B.I.S.2949.

EARNEST
ACADEMY

Thank you learners

EARNEST ACADEMY