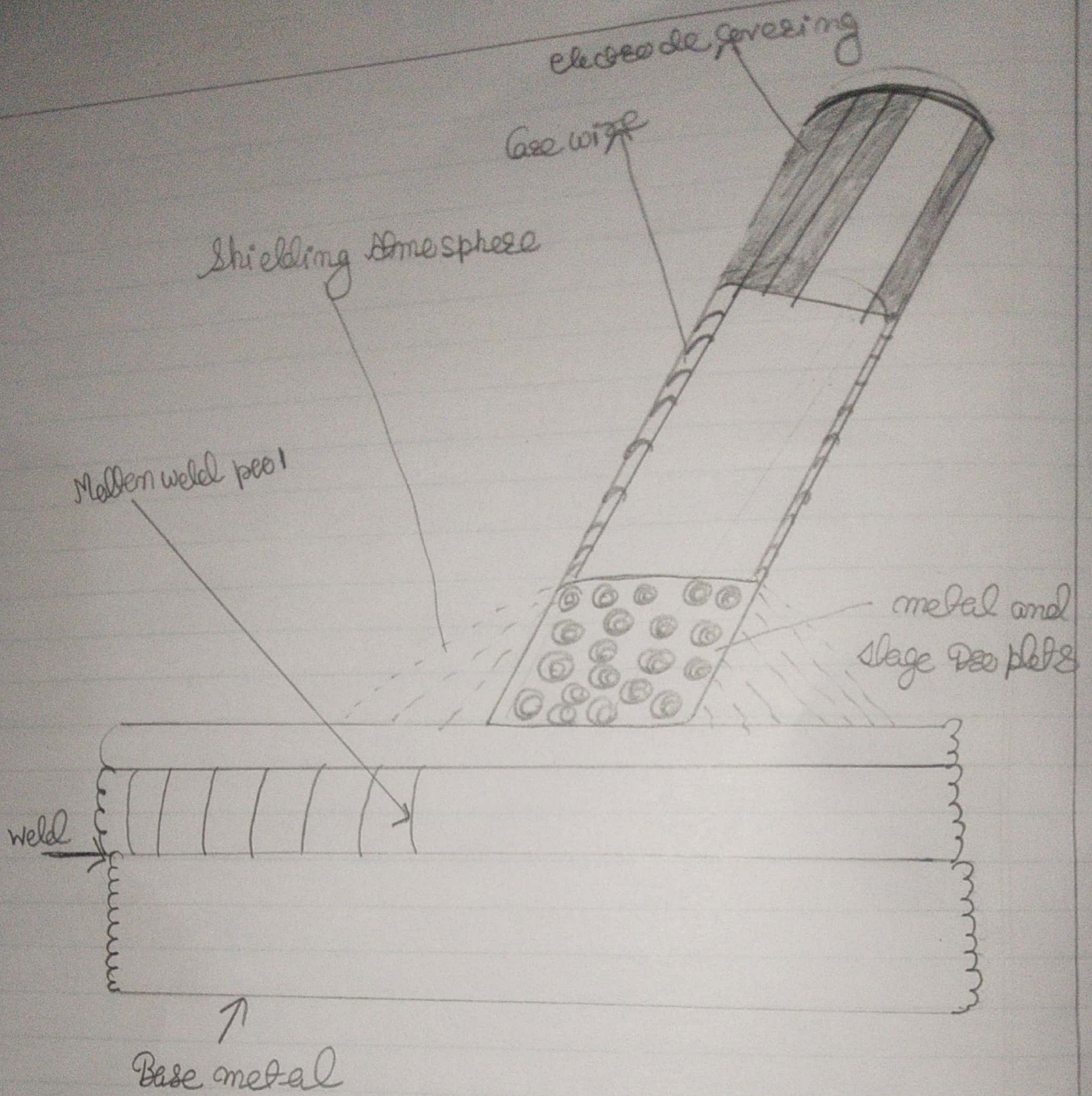




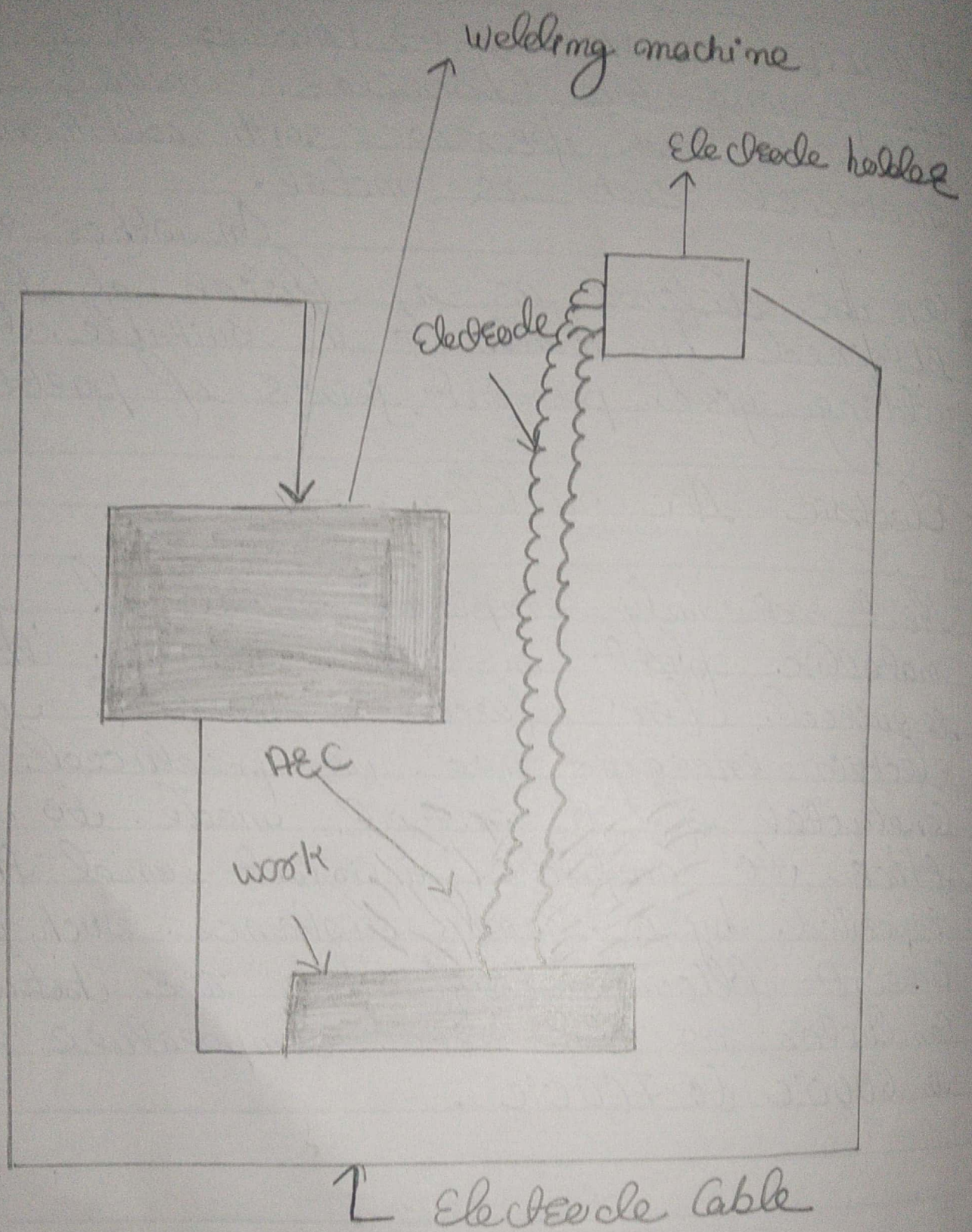
WELDING SHOP

* Principal of welding :-> Welding is a process of joining two similar metal application of heat and pressure with addition of filler material such as metal.

In other words welding can be defined as a fusion of two metal obtained by heat to a suitable temperature welding given permanent joints of parts.

* Electric Arc welding :->

Most extremely employed metal of joining metallic part in arc welding. The heat required for fusion is obtained from the electric energy arc is produced when conductor of a metal made to touch each other to complete a circuit and then separated by a small distance such that the current flows through the arc between the conductor as the arc temperature reached is 6000°C to 7000°C .



* The main type of arc welding are :-

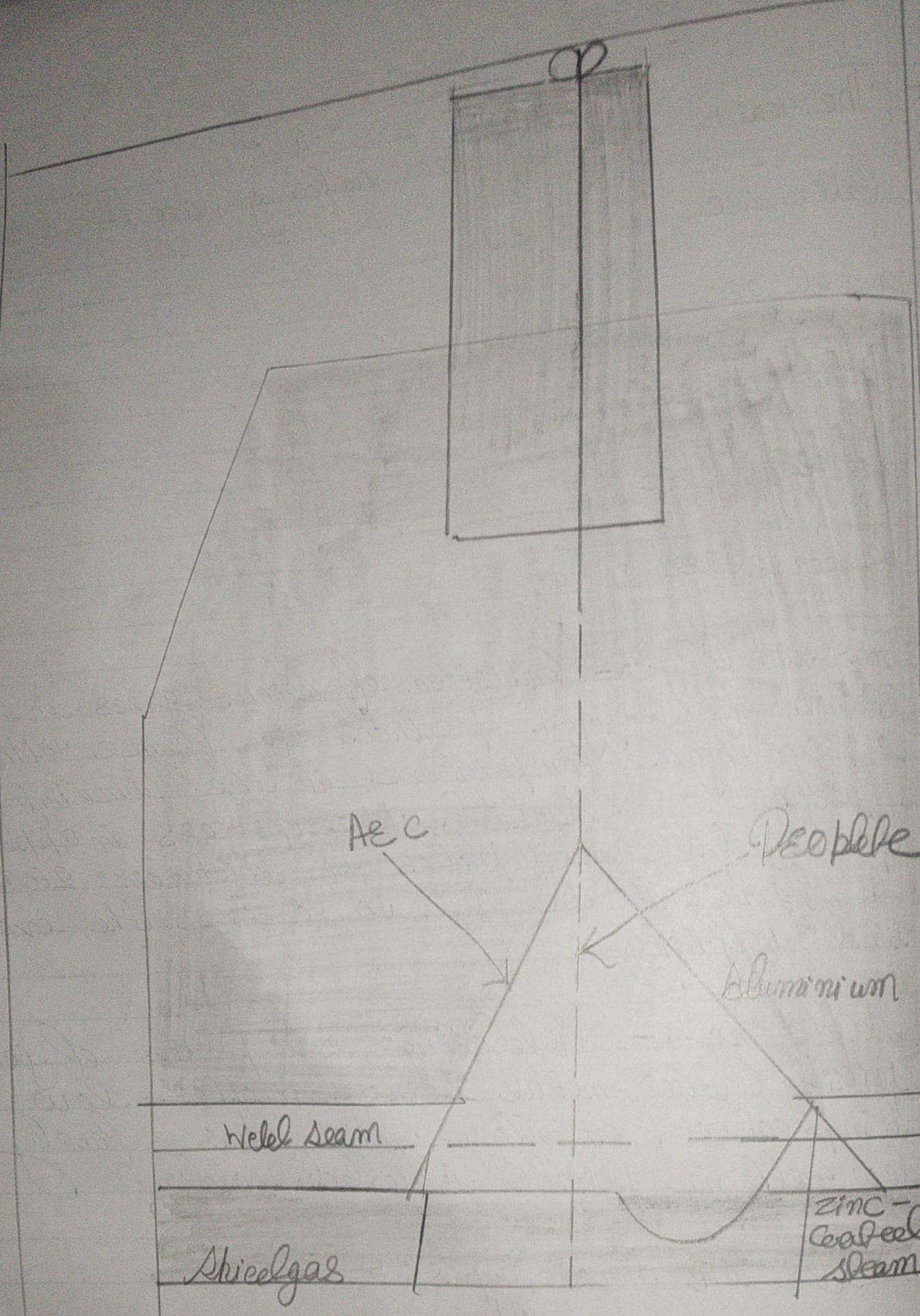
1. Carbon arc
2. metal arc
3. Inert gas arc
4. Sumergal arc
5. Sumergal arc

* Gas welding :- Combustion of various gases in a stream of oxygen produces a flame with a very high temperature at the amount of fusion and metal the process is applied for sheets and plates of thickness 2 to 50 cm. A flame is used to remove the oxides and impurity.

* Soldering :- Soldering is a process of joints joining two metal using another low temperature or alloy which has fairly low melting point is called solder.

* Solder are two types :-

- 1) Hard solder :- Alloys of copper and zinc.



2. Soft solder :- Alloy of Sn and Cu.

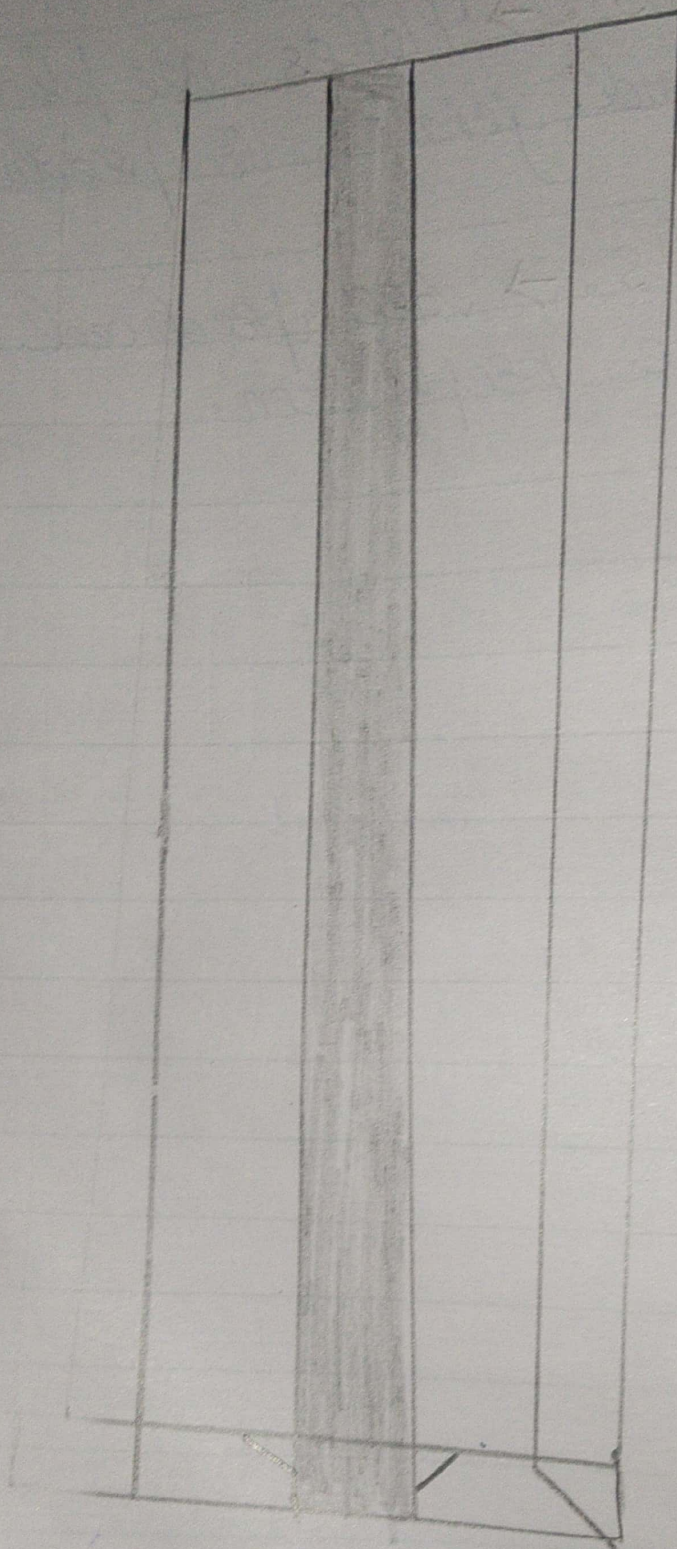
* Principal of Brazing :-> The process of joining two metal surface by heating and adding a fusible alloy melting point above 400°C is known as brazing. It is similar to soldering except that a harder filler material is used at element temperature than the solder joint.

* List of Equipments :->

1. Well insulated electrode holder
2. Wire table and cable connects
3. Welding helmet
4. Safety goggles
5. Earthing clamps
6. Cable cage
7. Apron
8. Wire bacs

* Types of joints in welding shop :-

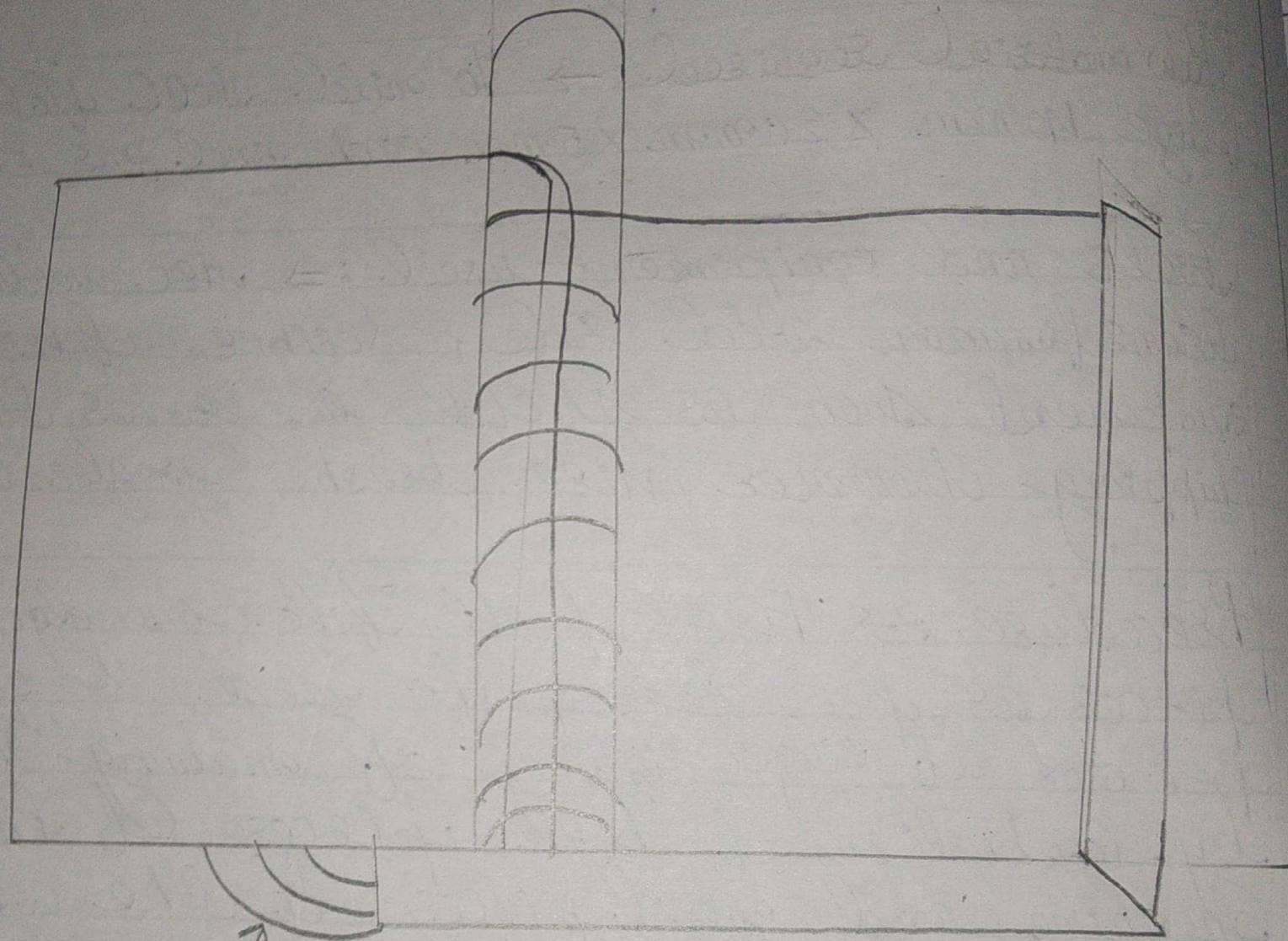
1. Butt Joints :- $\rightarrow$ It is formed by welding the edges of the part for joining metals up to 3mm thick. Joints are made on the edge before welding of 4 joints are used.
2. Lap joints :- $\rightarrow$ Plates are placed one over the other and joints is produced by fillet welds.
3. Tee Joints :- $\rightarrow$ Arc produced with or without edge preparation.



Butt Joint

JOB NO. 1

- * **Object :** $\rightarrow$ To prepare a butt joint through electric arc welding in flat position.
- * **Raw material required :** $\rightarrow$ To mild steel flat pieces of size 140mm x 90mm x 5mm each and one electrodes.
- * **Tools and equipment used :** $\rightarrow$ Arc welding transformer, steel rule, scribe, files, safety equipment such as shield or gloves, tangs, chipping hammer, wire brush, goggles etc.
- * **Procedure :** $\rightarrow$ First of all file one edge of both pieces as per drawing to make a groove. This process of edge filing of making V-groove by combustion of both pieces of the welding machine and weld pieces of the welding cast remove slag by chipping with the help of chipping hammer.
- * **Precautions :** $\rightarrow$ The work piece and place of work must be perfect dry use suitable current voltage value for safety welding.

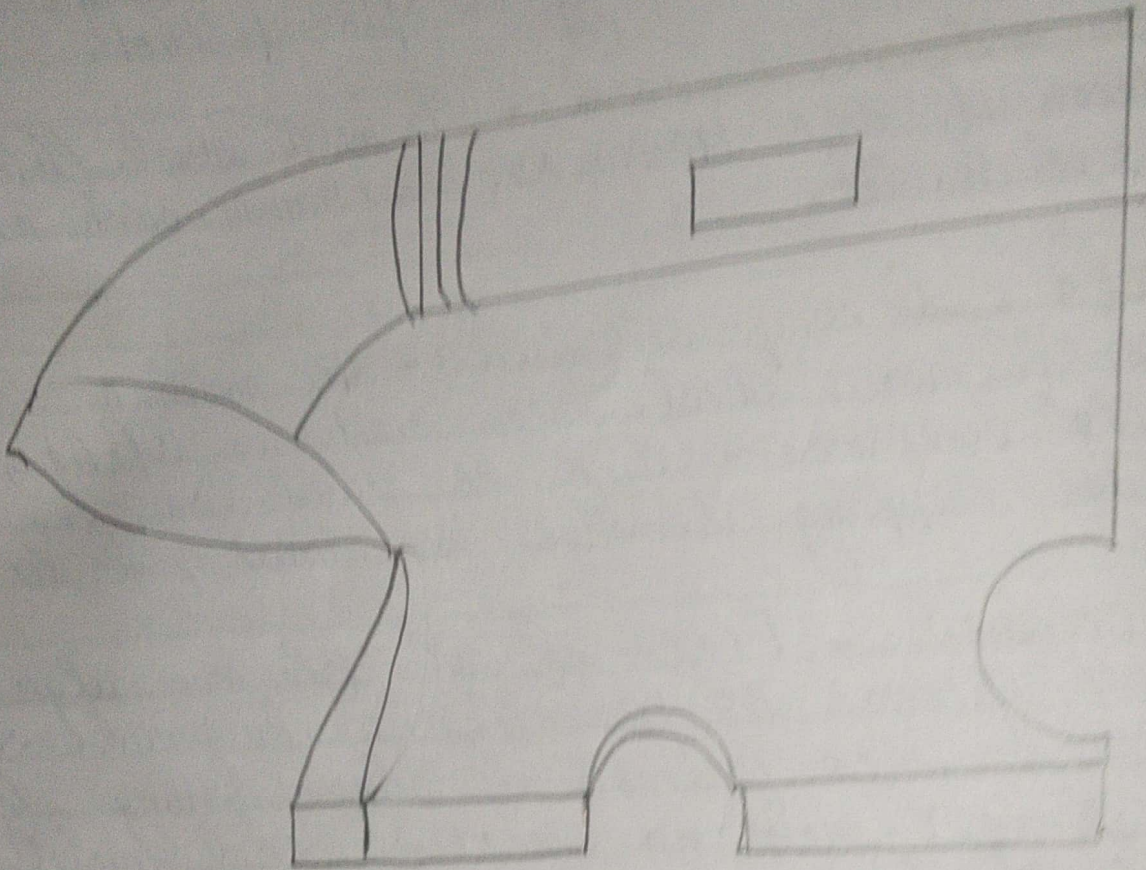


Joint

Lap joint

JOB NO - 2

- * **Object:** - To prepare a lap joint through electric arc welding in flat position.
- * **Raw material required:** - To mild steel flat pieces of size $140\text{mm} \times 20\text{mm} \times 5\text{mm}$ each and ms electrodes.
- * **Tools and equipment used:** - Arc welding transformer, steel rule, scriber, files, safety equipment such as shield, arc gloves, long chipping hammer, wire brush, goggles etc.
- * **Procedure:** - First of all file one edge of both pieces as per drawing to make V groove. This process of edge filing of making V-welding machine and weld the job in this last remove slag by chipping with the help of chipping hammer.
- * **Precautions:** - The work piece and place of work not by perfect, they result current voltage value for safety welding.

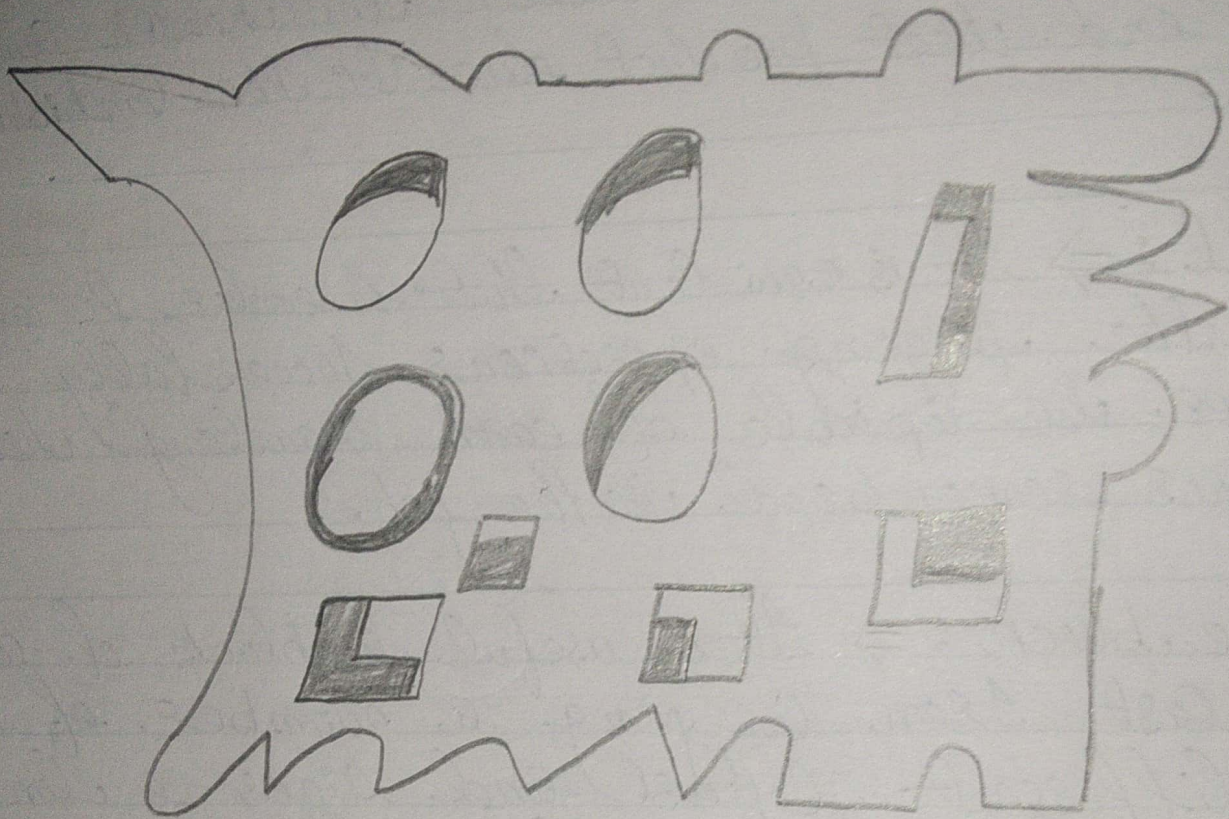


Anvil

BLACK SMITH SHOP

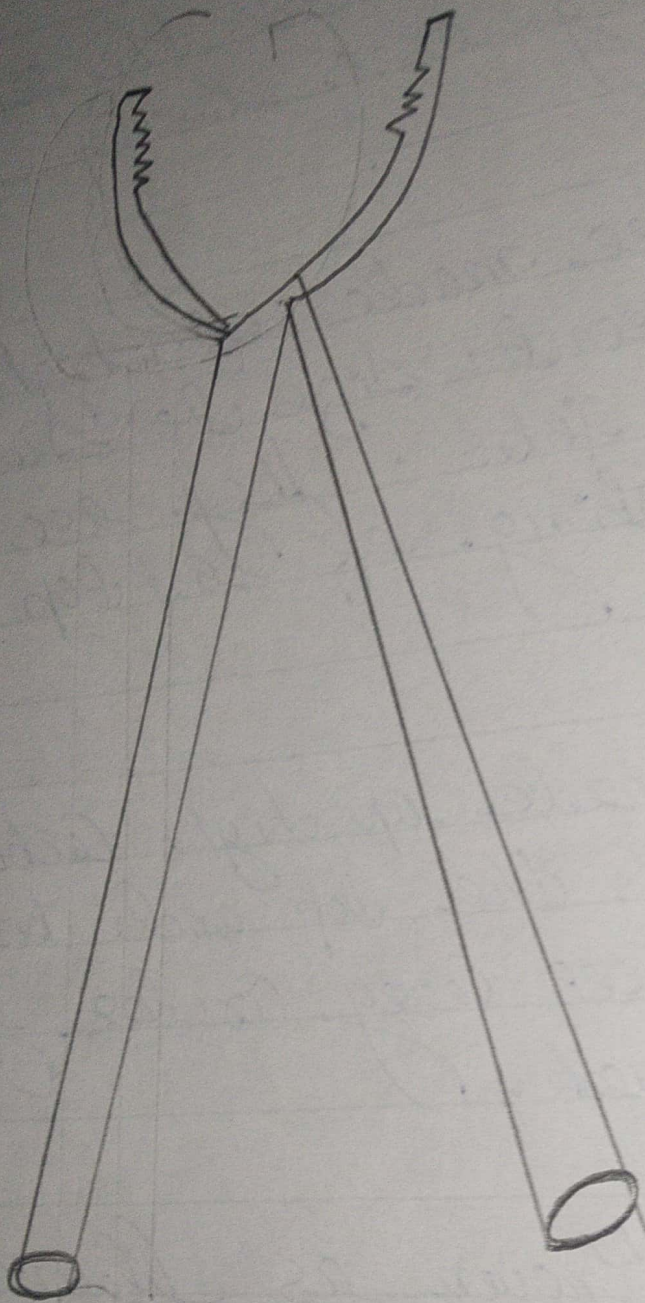
* Tools used in hand forging.

- i) Smith's used in hand forging :- It has robust cast iron or steel structure consisting of support on iron known as cheeks. The cheeks come & cool and heat product due to the combination of coal.
- ii) Anvil : $\Rightarrow$ It is evident that in order to carry out the forging operations successfully a person is capable of each standing heavy blows remembered to the job.
- iii) Slag block : $\Rightarrow$ It is useful a block of cast steel or cast iron carrying a number of slabs of different slopes and sizes a long with for side face and although holes from its top face to bottom face. This is used as support in punching holes forming different shapes.
- iv) Hammer : $\Rightarrow$ All the hammers are mainly divided in to 4 parts namely head, eye, cheek and face. The head is the top part made and lightly tapered iron the cheeks and rounded at the top.



Stage black

- V Tongs :→ These are used to hold the jobs in position and damping over during forging and other work too.
- VI Fullers :→ These tools are made of high carbon steel in different size to suit the various types of jobs. They are usually used in pairs consisting of a top and bottom fullers.
- Vii. Slages :→ They are also made up high carbon steel in two parts called the top and bottom slages these working forces carry circular grooves the suit the size of the work.
- viii. Flatbers :→ They are also known as flammers or smoothers they are made of high carbon steel consist of square body fitted with a handle and flat square.
- ix. Beick Anvil :→ It can be said to be small facimade of anvil. It is made of tool steels and hardened.
- x. Blowers :→ Efficient and adequate supply of air at pressure is always a vital necessity for proper combustion of the fuel. In fact, however, they are only seldom viable because blowing air supply are at high

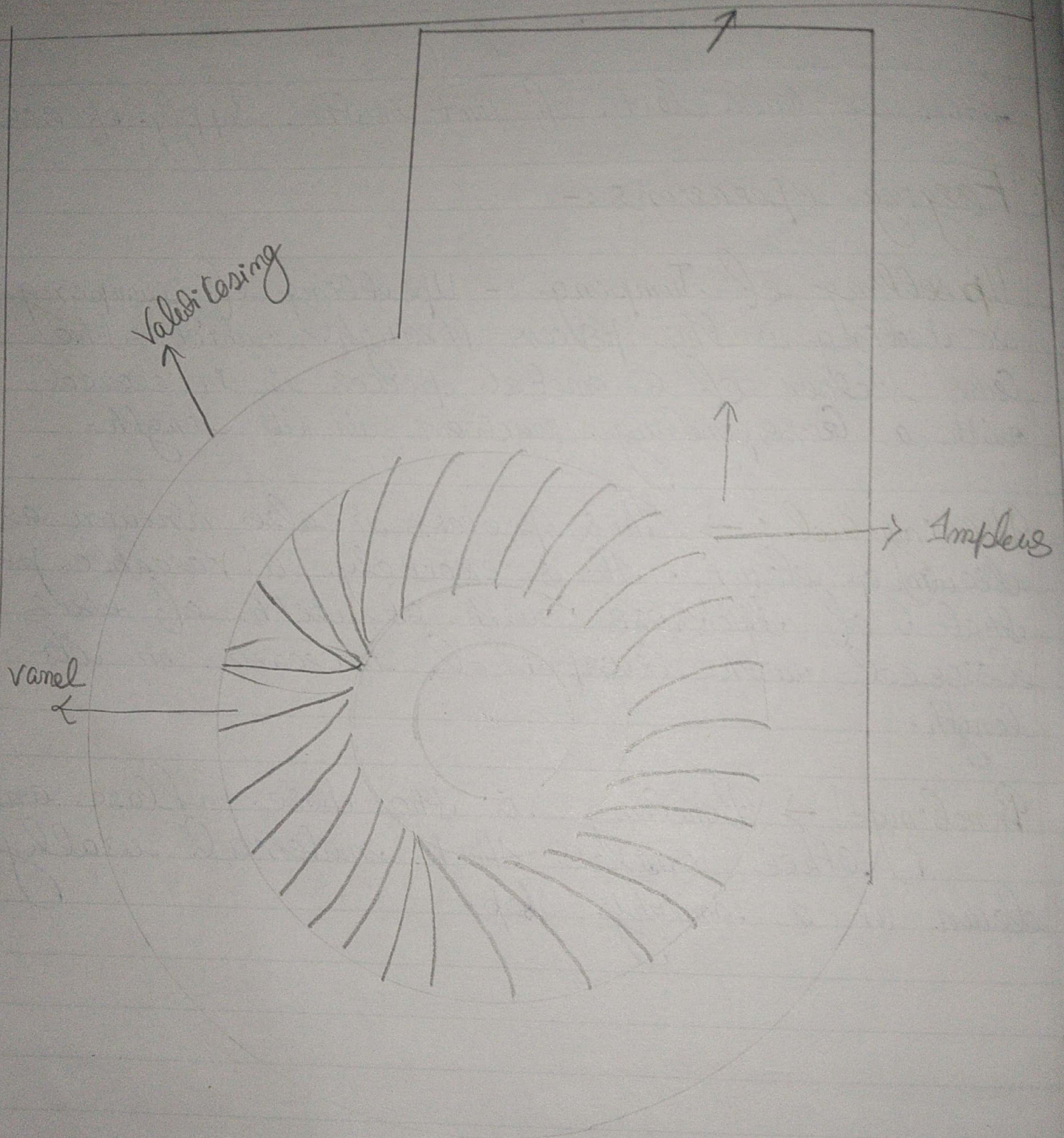


TONG

pressure and lack of amt in the supply of air.

* Forging operations:-

- i) Upsetting or Jumping :- Upsetting or jumping or heading is the process through which the cross section of a metal piece is increased with a corresponding section in its length.
- ii) Drawing out :- $\rightarrow$ This process is also known as drawing down. It is exactly a variable process that of thickness with or both of ends desired with corresponding increase in its length.
- iii) Bending :- $\rightarrow$ Bending is the case flare and other similar stock material usually down in a smithy shop.



JOB NO-1

* Aim : - To make a cold chisel

* Material required : → M.S Round Rod

Tools required : - Flat peen Hammer Tang
Anvil Furnace.

Theory : - The cold chisel is a tool made of tempered steel used for cutting cold metals meaning that they are not used in conjunction with heating process, forgas etc. Cold chisels are used to finish is not required or when the work not be done easily with other tools such as a half saw file bench shears or power tools the name cold chisel comes from its use by black smithy to cut metal while its was cold as compared the other tools they used to cut hot metal.

* Precautions :-

1. Don't operate any machinery without permission in result damage.
2. Don't keep any tool in the pocket.
3. Keep eye mind on the job.
4. Don't make noise in class room.

INTRODUCTION

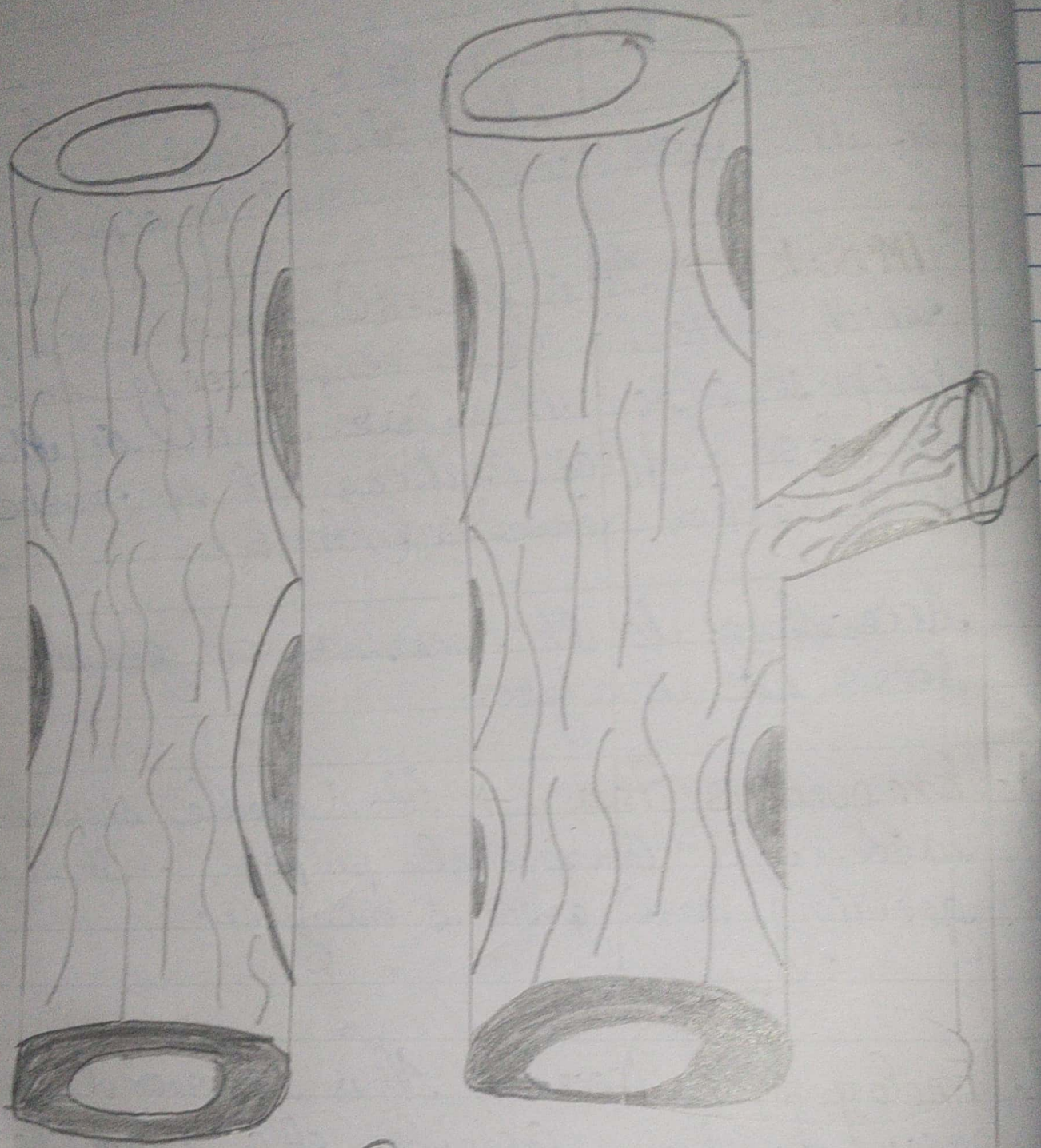
- * **WOOD** :→ It is available in nature in the form of trees, trunk is the most useful part of the tree and is used in carpentry.
- * **TIMBER** :→ It is general name for wood which suitable for engineering and building purpose after the tree it is in the form of logs. After making it to market size it is called commercial timber.

According to the manner of growth. the trees are two types.

1. **Exogenous Trees** :→ It is needle shaped and used for commercial purpose. It is outward growing and grow in one year.
2. **Endogenous Trees** :→ It is in wood growing are bamboo, coconut, etc, examples of such trees.

WOOD :-

- 1 Soft wood (Deodar, Kail, chie, etc)
- 2 Hard wood (Teak, shisam, sal, mango etc)
- 3 Ply. wood (Teak, bak, sheesham)



PLYWOOD

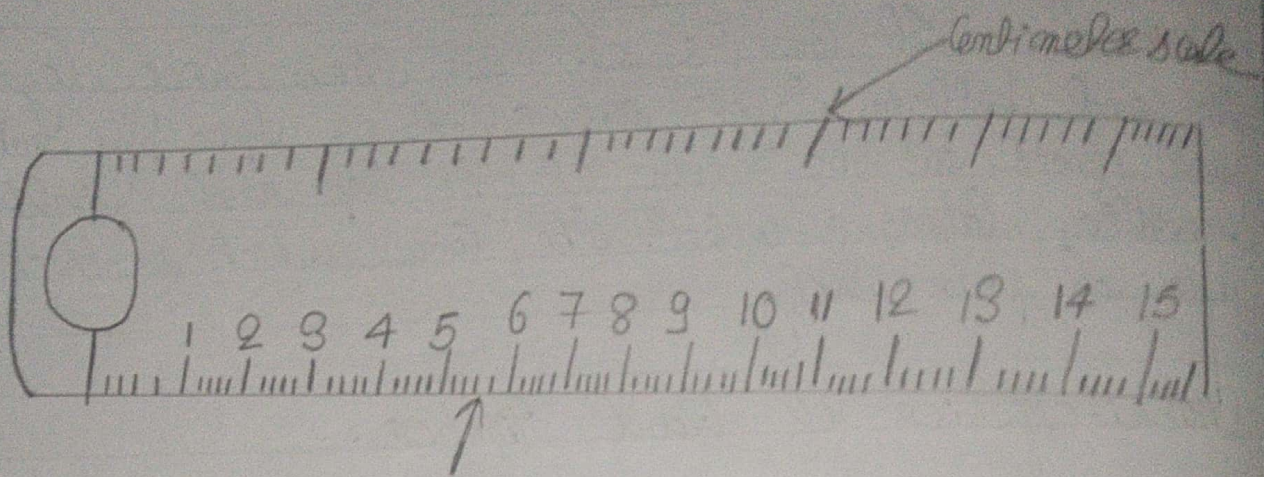
* Plywood :- It consists of more than three layers. Top and bottom layers are called as face ply which are glued on the core at the top and bottom. Middle layers is called the core which is thick but of poor quality.

* Characteristics of Good Timber :-

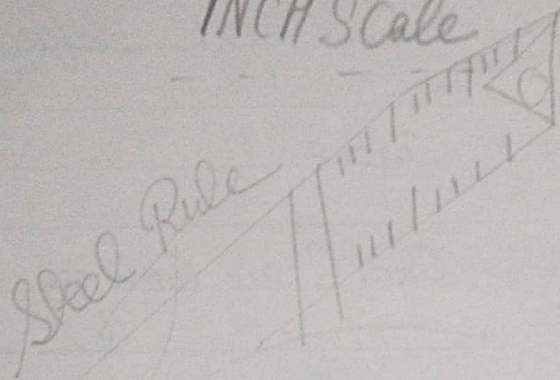
1. It should be free from natural defects like
2. It must be of uniform colour
3. It should have pleasing smell on cutting.
4. It should not bend or warp after seasoning.
5. It should not decay easily.

1. Filling :- The cracks, hole and uneven surface is filled with a paste known as putty which is made by mixing powdered chalk with linseed oil. Sometimes the space between parts of joints is filled before applying putty.

* Carpenter's Tools :- In the carpentry shop the tools are classified as uncut.



INCH Scale



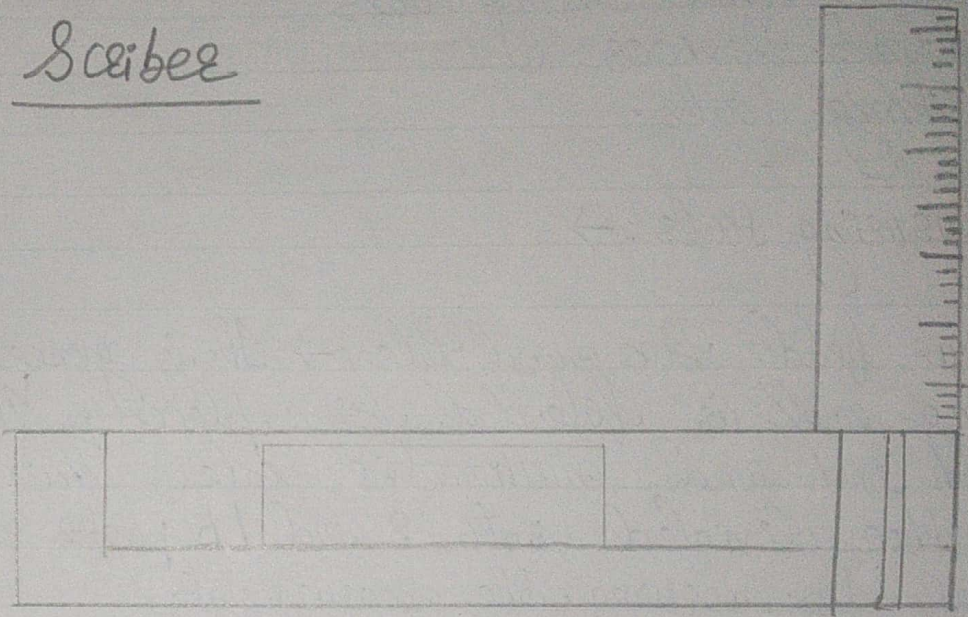
- a. Measuring Tools
- b. Marking Tools
- c. Cutting Tools
- d. Drilling and Boring Tools
- e. Holding Devices
- f. Striking Tools.

a. Measuring Tools : →

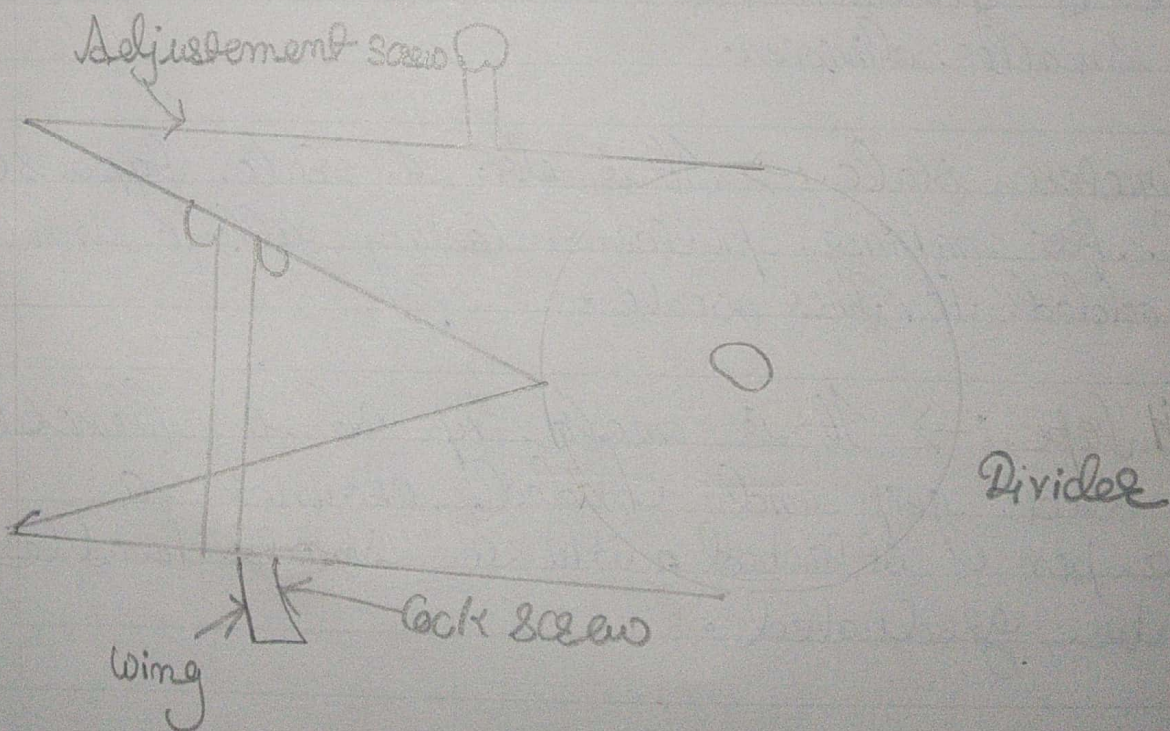
1. Engine fold. Box wood Rule : → It is generally 2 feet long and is folded from pieces. It is marked with inch and millimeter scale. The inches are further divided into 8 and 16 parts whereas the used for marking the measurement.
2. Steel Rule : → It is made up of stainless steel and is marked with scales in the scale also there is graduation in both inches and centimeters into smaller division.
3. Centimeter scale : → It is also a rule type scale used for making patterns using allow scales are added to this scale.
4. INCH Tape : → It is made up of a flexible thin steel strip and folded around a center pin attached with a small handle and be graduated.



Scribe



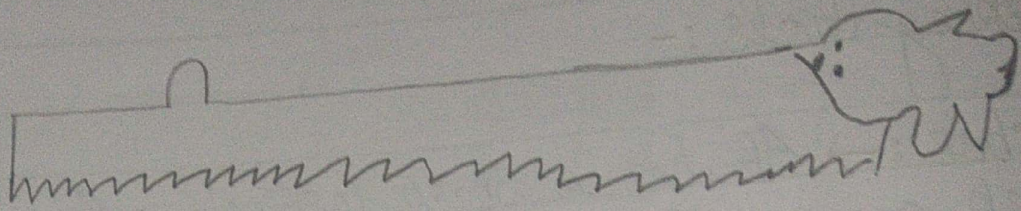
Try Square



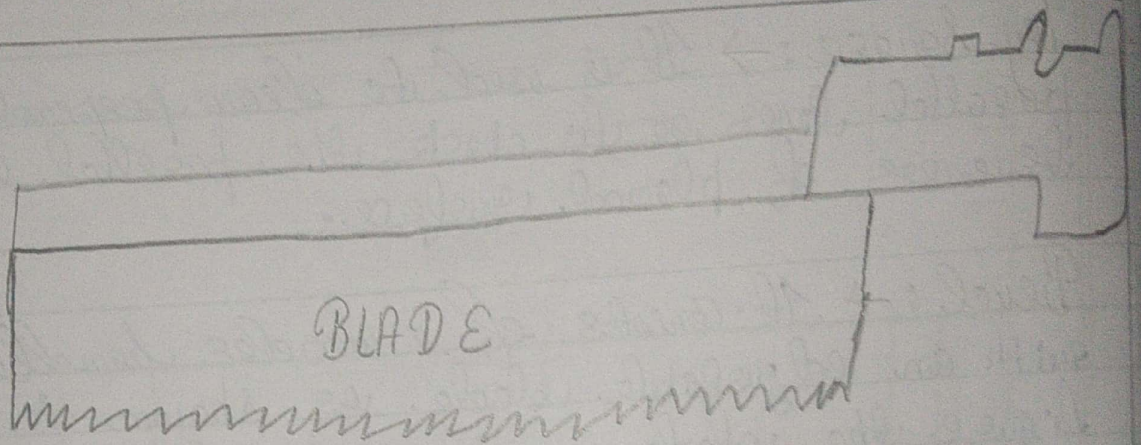
* Marking Tools :-

1. Scribe :- $\rightarrow$ It has a sharp lateral edge used to mark on even hard surface. The stem edge is hardened so as to resist wear and tear.
2. Try Square :- $\rightarrow$ It is used to draw perpendiculars or parallel lines or to check the parallel or true-ness of planar surface.
3. Bevel :- $\rightarrow$ It consists of a wooden handle fitted with an adjustable blade as shown in the figure. The blade can be rotated by 180° with respect to handle. It is used for marking various angles.
4. Compass / Dividers :- $\rightarrow$ These are used for dividing equal number of parts and for drawing arcs and circles. It consists of two legs with a spring on the top of the legs. A screw is also attached at the end of legs for adjustment.

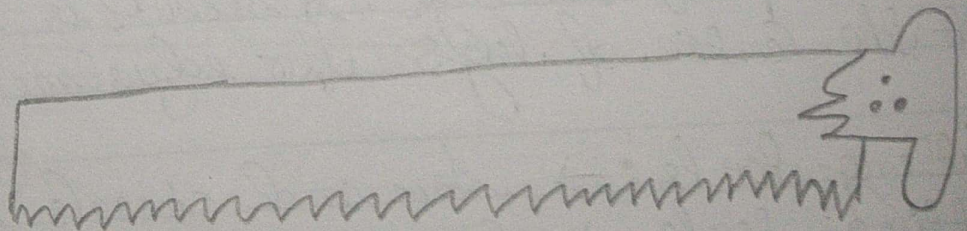
* Cutting Tools :- $\rightarrow$ Saw and chisels are used as cutting tools in carpentry. Shop saw works in backward and forward direction in which backward direction feed cuts more material than forward direction because there is more pressure exerted in backward direction.



Ripe Saw



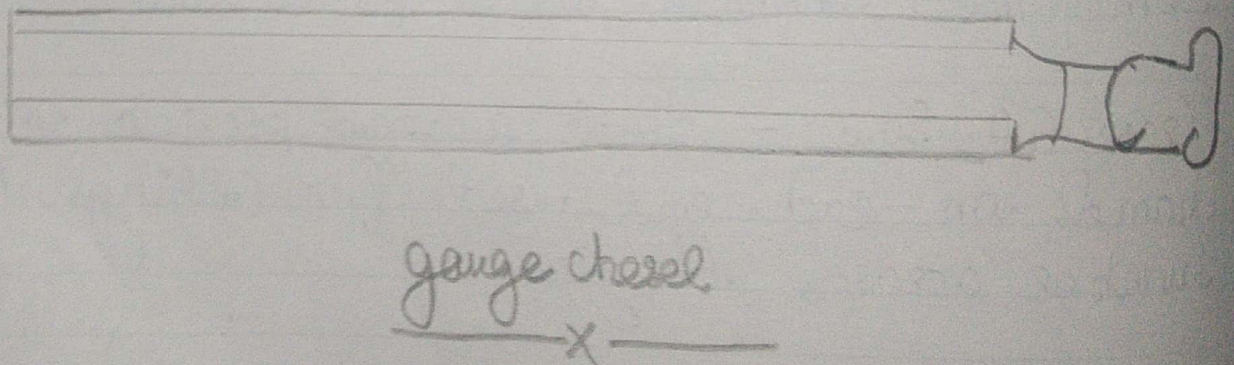
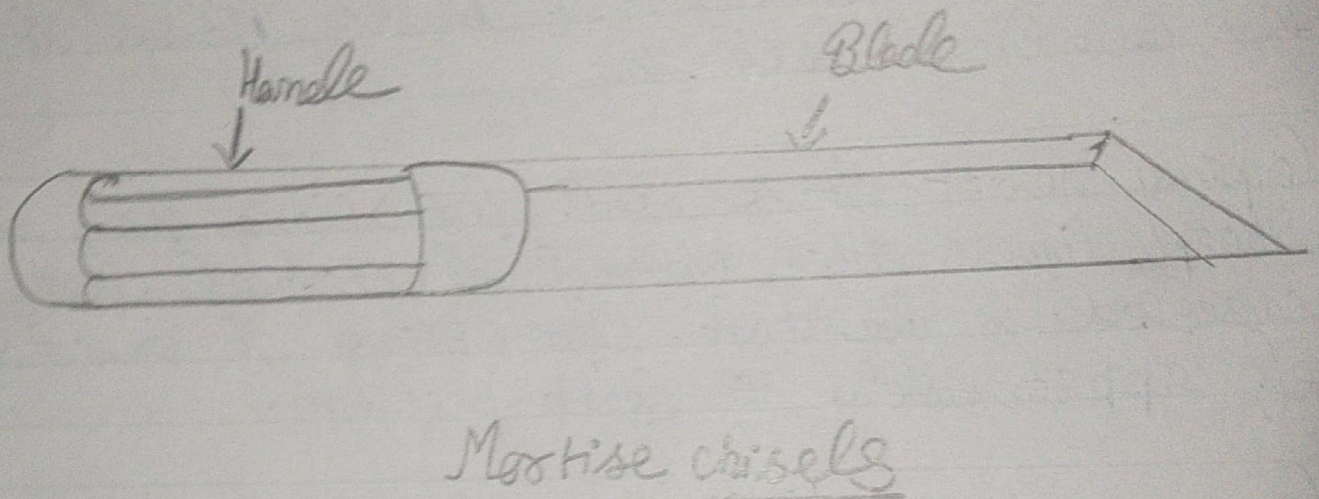
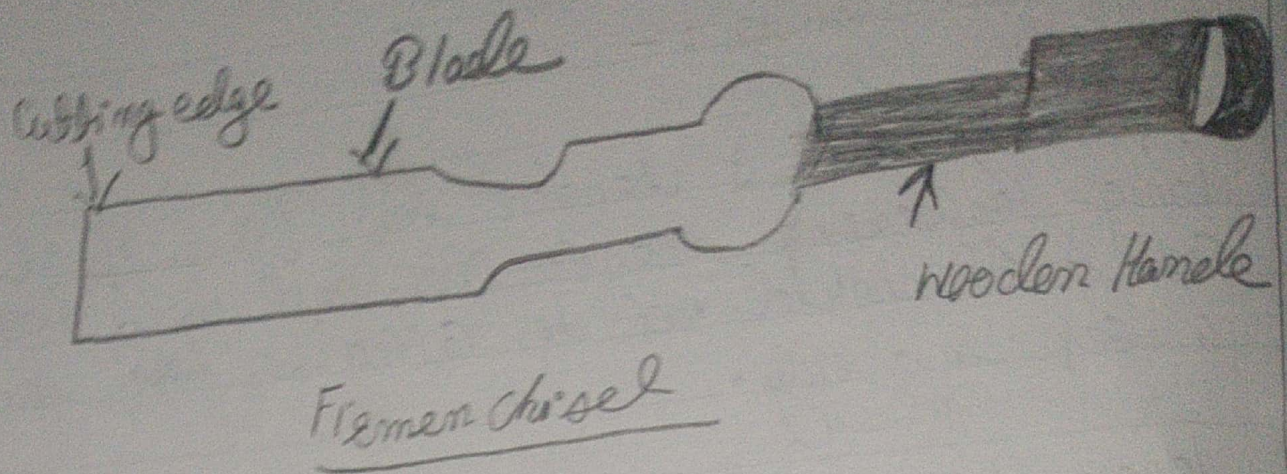
Temem Saw



Caping Saw

* Different Saws :-

1. Rip Saw :- It is hand saw from 30cm to 7cm long containing one to one and half teeth per cm. It should not be called a hand saw but a rip saw only.
2. Tenon Saw :- It drew its name from the tenon form of joint. It is a thin saw ranging from 20cm to 40cm in length and is supported by block of wrought iron or brass; hence it is also called a back saw.
3. Coping saw :- It is used for cutting quick of sharp curves either internal or external for inserted in the hole for cutting. It consists of approximately 10 teeth per cm.
4. Compass saw :- It is a short narrow saw tapering towards the point used for cutting sweeps and large interior circles by hand sometimes termed as a fable saw.
5. Cross Cut Saw :- It is a saw parallel with two hand on each end used for cutting heavy lumber across the grain.



* Chisels : → These are three type of chisels commonly used in carpentry shop.

1. Fiemore chisel : → It is general purpose chisel used to finish inside. grooves it has various sizes of cutting edge depending upon the work to be done. width varies from 5mm to 25mm. The cross section of the blade, rectangular in shape. the wider portion of the rectangle shows the width and the smaller side the thickness.

2. Mortise chisels : → It is used to make mortises chisel is used for heavy cuts. The blade thickness varies from 5mm to 12mm. Because of wider thickness this blade is stronger. is comparison the other chisels of same size stronger in comparison capable of taking the heavy work.

3. Gauge chisels : → : It is used to finish around holes. Gauge chisels are of two type i.e. inside and outside.

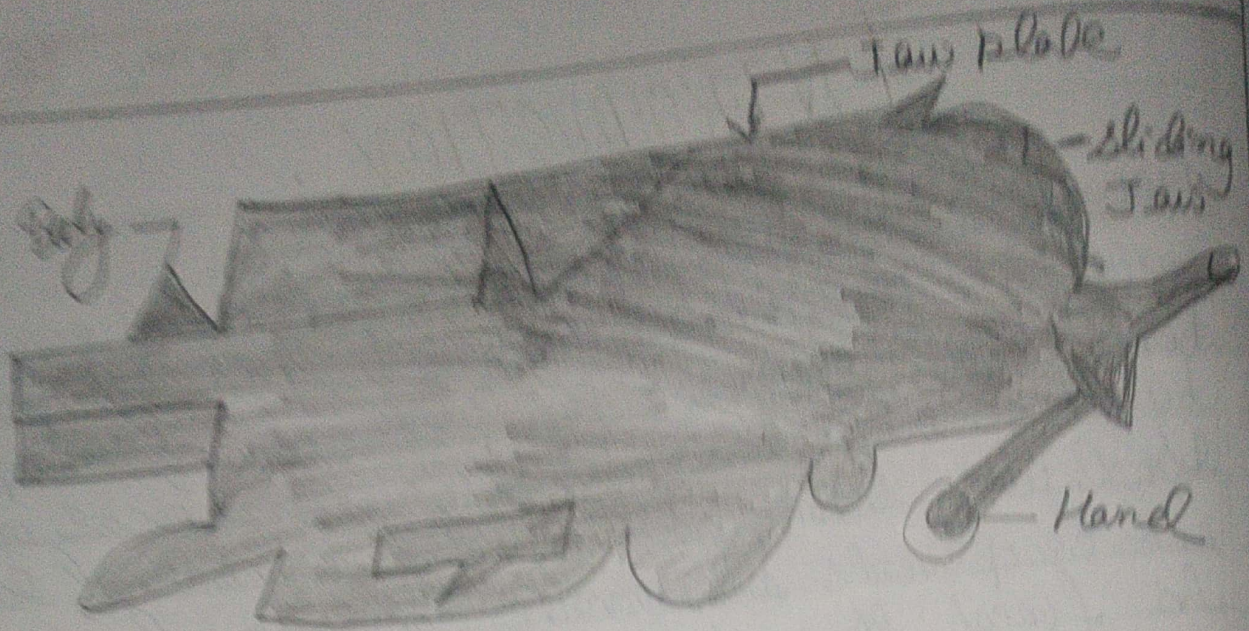
INTRODUCTION

Fitting is assembly together of parts and removing metal to secured the necessary fit. The term "bench work" denotes the production of a component by hand on a bench production chamber and bench work require use of large number of tools and equipments and involve number of operation to finish the work to desired shape and size.

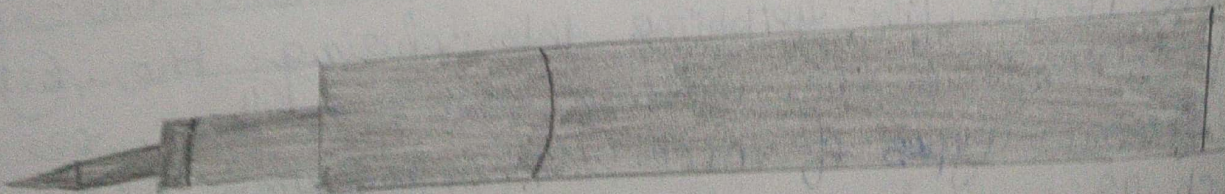
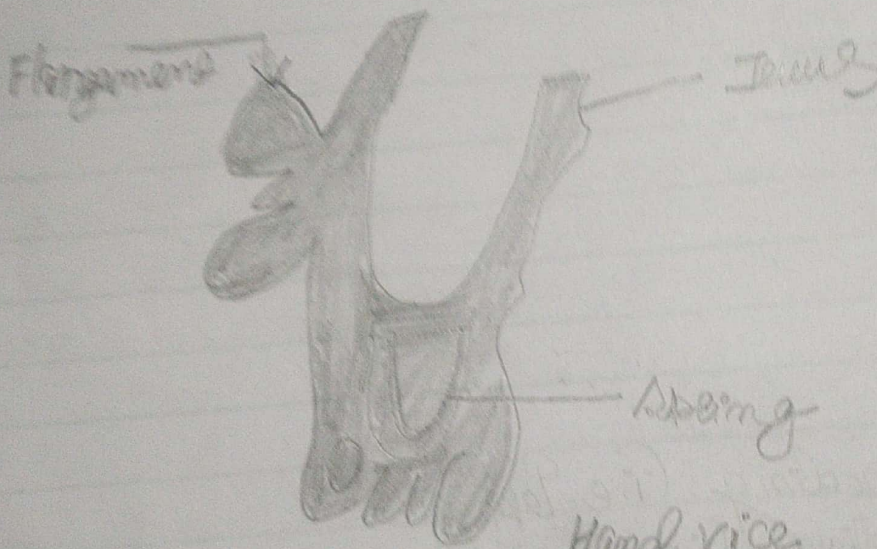
The operation commonly used in bench and fitting work may be classified.

- * Chipping
- * Filing
- * Marking
- * Drilling
- * Shaping
- * Grinding
- * Reaming
- * Internal Threading (i.e. Tapping)
- * External Threading (i.e. Drawing)

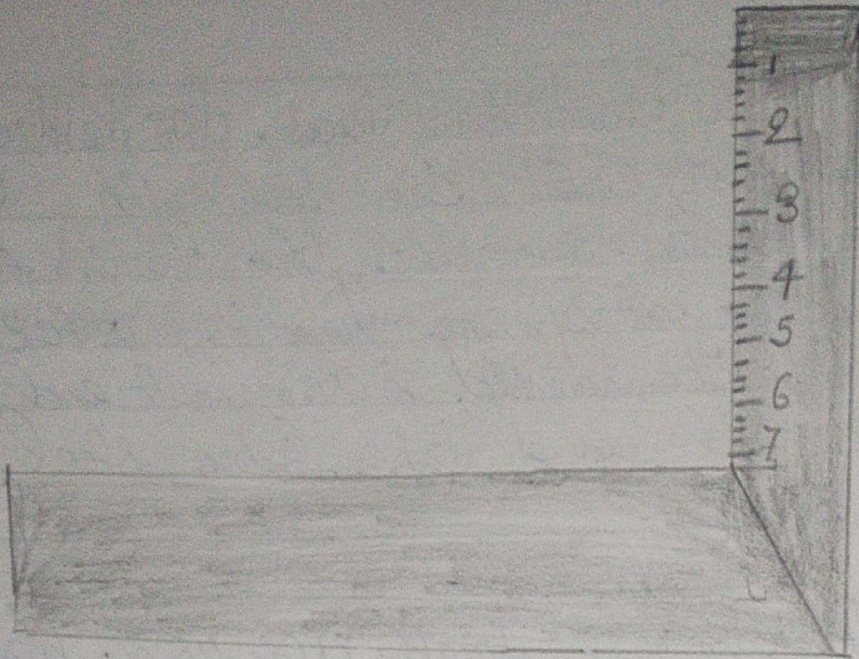
Vice : → These are the most suitable and widely used tools for gripping jobs during the various operations in the fitting shop. These are different types of vice in engineering use such as



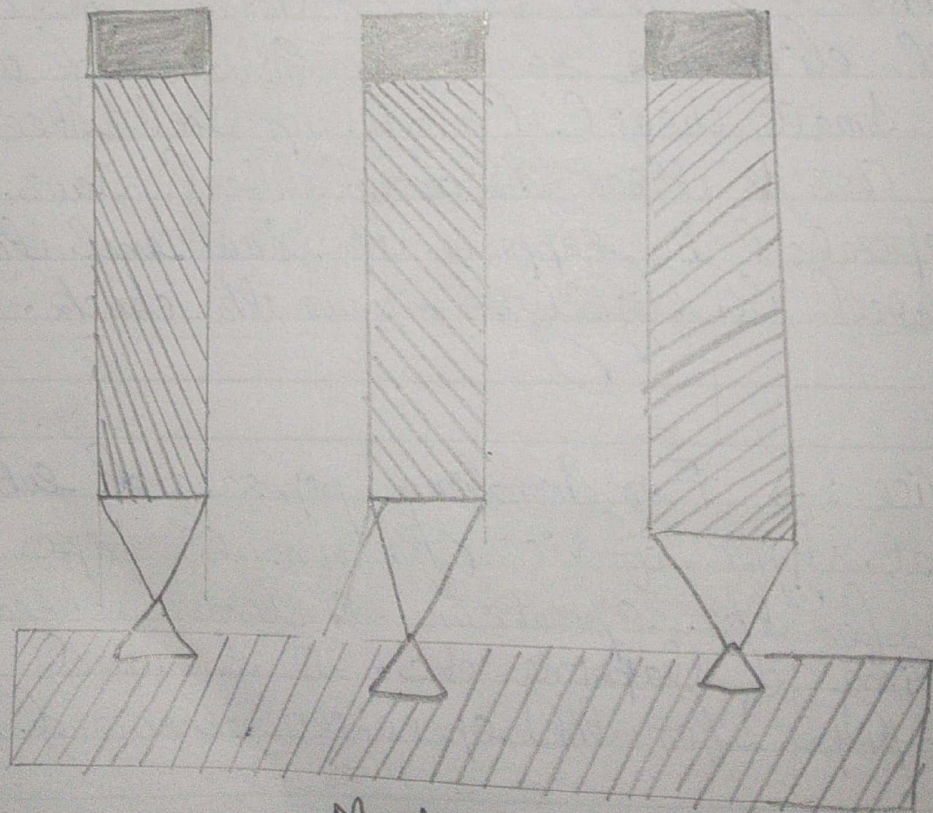
Bench vice.



- 1) Bench vice : $\rightarrow$ It is a common tool used for holding the job. It consists of a cast iron body with one fixed jaw and one moveable. This known as sliding jaw. Screw nut, spring, handle, after pin end, washer. The handle, screw nut and end body are made up of high carbon steel and is wear resistant.
- 2) Hand vice : $\rightarrow$ It is a very small vice used for gripping small job and is hard, special. These vices are often used to repair the key of lock. It consists of a fangle / wing nut & a spring, provided between two long ends. Jaws which are adjusted by wing nuts.
- 3) Pin vice : $\rightarrow$ It is used to hold the wire or small diameter rods. It consists of a handle and small chuck (made up tool steel) which carries three hardened steel jaws which are operated by tapping the jaw and the handle is rotated to tightly grip in the chuck.
- 4) Pipe vice : $\rightarrow$ For handling pipes and tubes a special type of vice known as pipe vice is used for the operation like, threading, turning, bending of tapering etc. it is used to hold pipes for the operation discussed above.



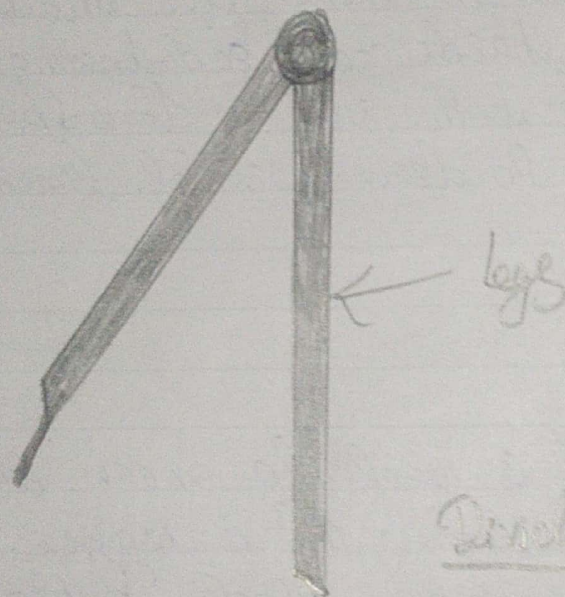
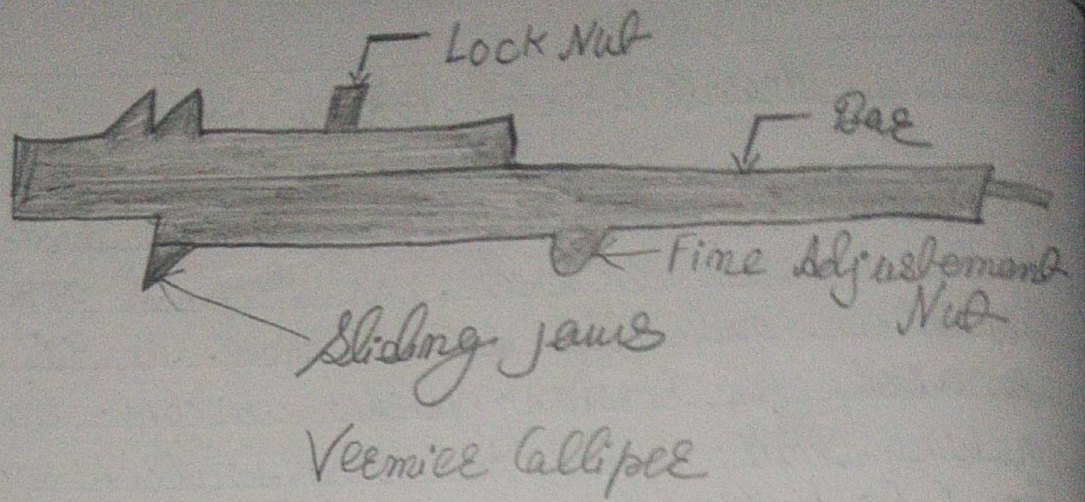
Try Square



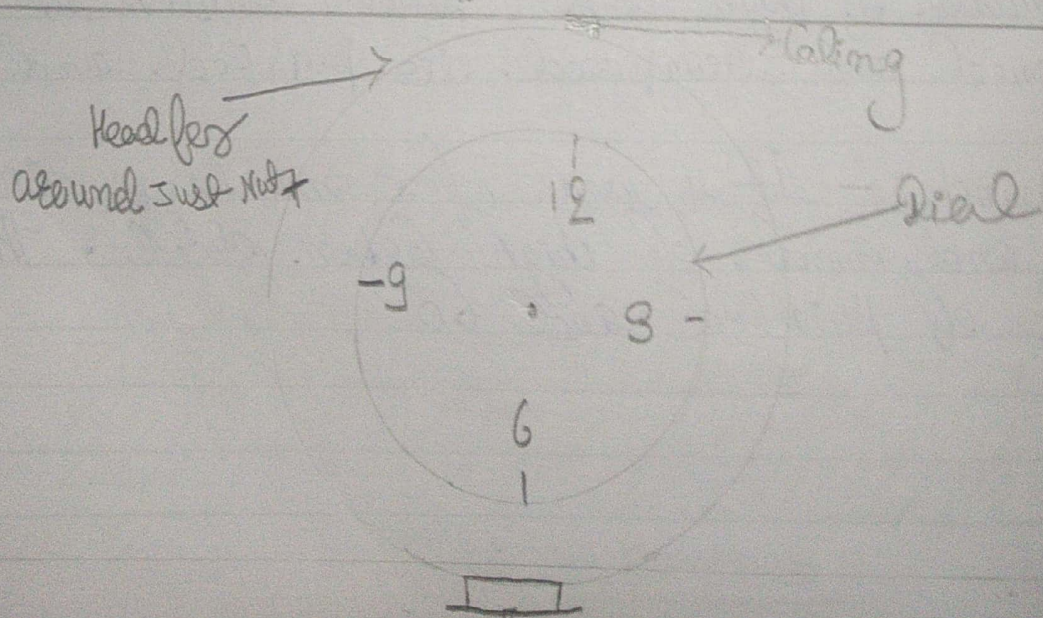
Marking punches

Measuring and Making Tools

1. Try Square: $\rightarrow$ It consists of blade and stock. Blade is made of steel and stock is made of cast iron and both are attached at 90° . These are used for scribing clean straight lines and making right angles and also to check the true squareness and flatness of the surface.
2. Scribe and surface gauge: - It is made up of high carbon steel and used for marking lines. It is a piece of hardened steel having a pointed needle on one of both sides. It works like a pencil. It is used to draw parallel lines of desired length.
3. Punch
 - a) Center Punch: - It is used to mark the center of holes to be drilled. It is bigger in size and made of high carbon steel which is hardened and tempered. Its point is 90° .
 - b) Dot punch: - It is used for marking dotted lines and made of high carbon steel. The angle of point is 60° .



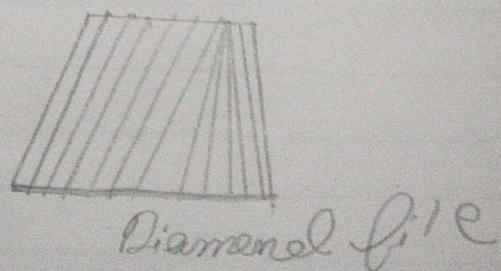
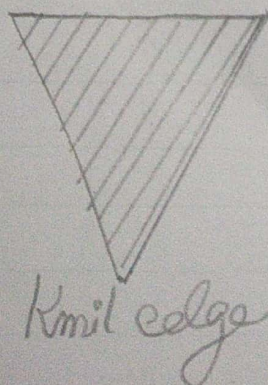
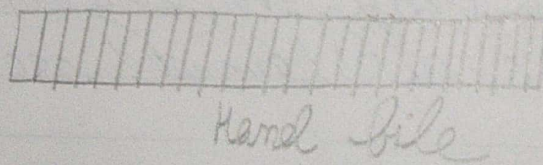
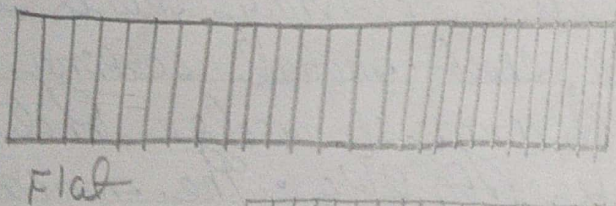
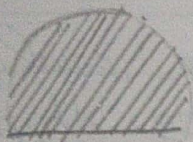
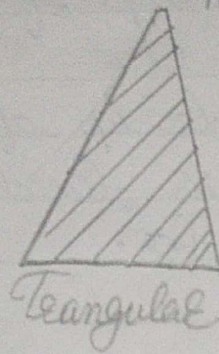
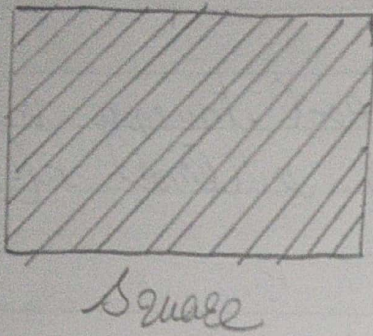
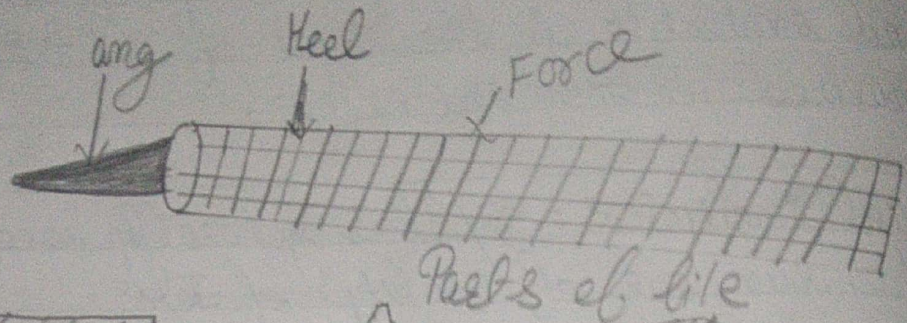
Protractor



4. Steel rules : $\rightarrow$ It is made up of stainless steel and available in the sizes of 6" to 24" it is marked in mm and inches.
5. Dial indicators : $\rightarrow$ It is generally used to check the run out of quality of tools.
6. Divide : $\rightarrow$ It is made up of steel having two legs for marking axis dividing a line of desirable the diameter.

Striking tool

1. Hammer :- A hammer is a most common and generally used striking tool in fitting shop for the work of chisel. It is also used for other purpose like driving nails in the punching holes in sheet metal setting and fitting of joint driving of wedge and the weight range is 0.25 kg to 2 kg. The main types and parts of hammer are shown in fig.



Types of hand hammer

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

Miscellaneous tools

1. Scrapers
2. Files
3. Reamer
4. Taps
5. Die etc.

Scraper:- Scraper is the operation of scraping flat and curved surface with a very sharp tool like scraper. It is used to remove tools making from the surfaces machined, scraped, planed, or milled machine for fine finishing. Scraping is done to obtain an effect as the surface of machine tool to develop shallow impression at micro level.

Scrapers are usually made from the steel or file by heating them and bending it to the required shape. Then it is ground to have a sharp edge and hardened and tempered many types of scrapers.

INTRODUCTION

Sheet metal work involves the development of surface or layout of sheet for many important engineering under for application in houses. Agriculture machine, decorative articles etc.

Metal used for sheet metal.

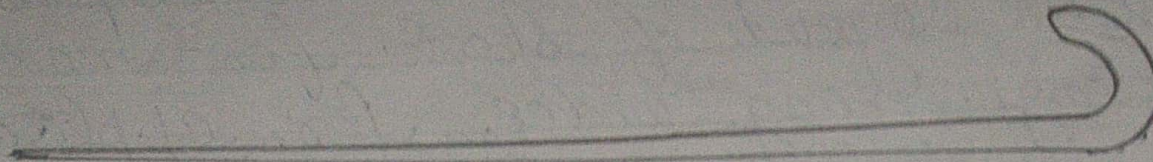
Large variety of metal in the form of sheets and plates used in sheet metal working includes black iron, galvanized, non-copper, brass, tin, aluminum, lead and zinc. The metal sheets are designed in terms of gauge. If thickness is 0.94 mm for gauge 10, the thickness is 3.51 mm for gauge 3, it is 19.101 mm if it is 19.101 mm. Cold rolled sheets are available in thickness of 0.8 to 3.25 mm width 1000 mm and length 2000 mm.

1. Black Iron Sheets :-

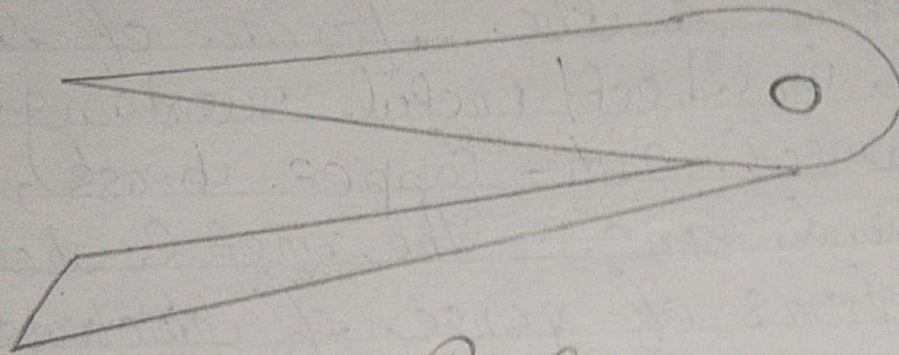
These are the cheapest material used for sheet metal work. These sheets carry no protective coating on metal work. Coming in them surface likely to corrode quickly.

2. Copper sheets :-

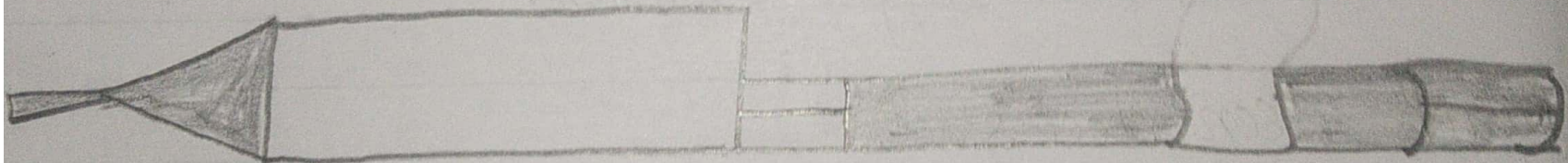
Such sheets are used for making radiators of automobile engine heating application for chemical plant etc. These sheets are costly and better resistance for corrosion and can be easily worked upon plastic and soil material.



Scriber



Divider



Center punch

Tools used in sheet metal

1. Scribe: $\rightarrow$ It is steel wire of 200mm length with one end sharp hardened. To mark lines on metallic sheet.
2. Dividder: $\rightarrow$ It is used to scribe arc and circles on metallic sheets.
3. Teacup points: $\rightarrow$ It is used for drawing large circle and arcs. It has two straight removable legs depend to needle point and mounted on separate holder.
4. Punches: $\rightarrow$ The following punches of tool steel are used in sheet shop.
 - a. Centre punch: $\rightarrow$ Used for marking the location of point and the centre of holes to be drilled. Its tapered point is ground to 90° included angle.

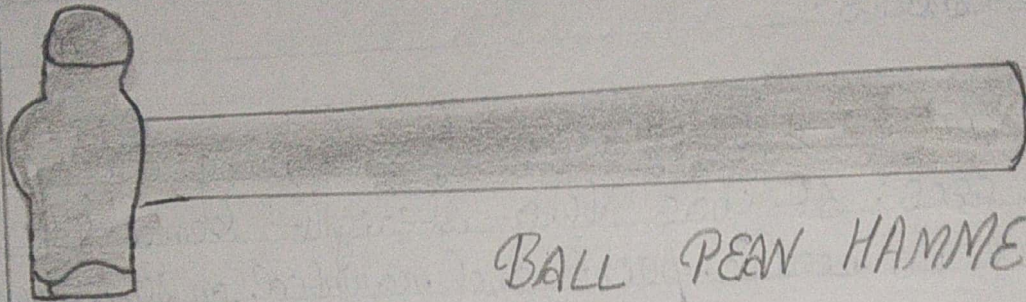
Cutting Tools

Cutting tools used in the shops are.

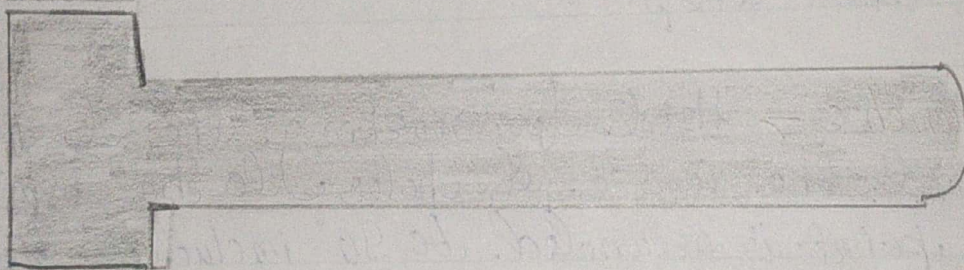
1. Straight Snips: $\rightarrow$ For cutting along straight lines straight snip is used. These blades are straight it is used to cut 22 W.B or lighter. To cut sheets of greater thickness level shearing machine is used.



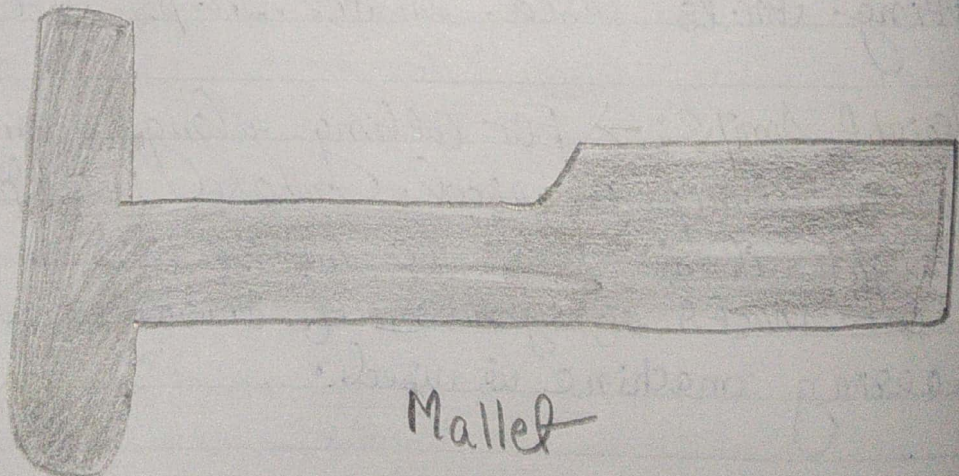
HOLLOW PUNCH



BALL PEEN HAMMER



SQUARE FACE HAMMER

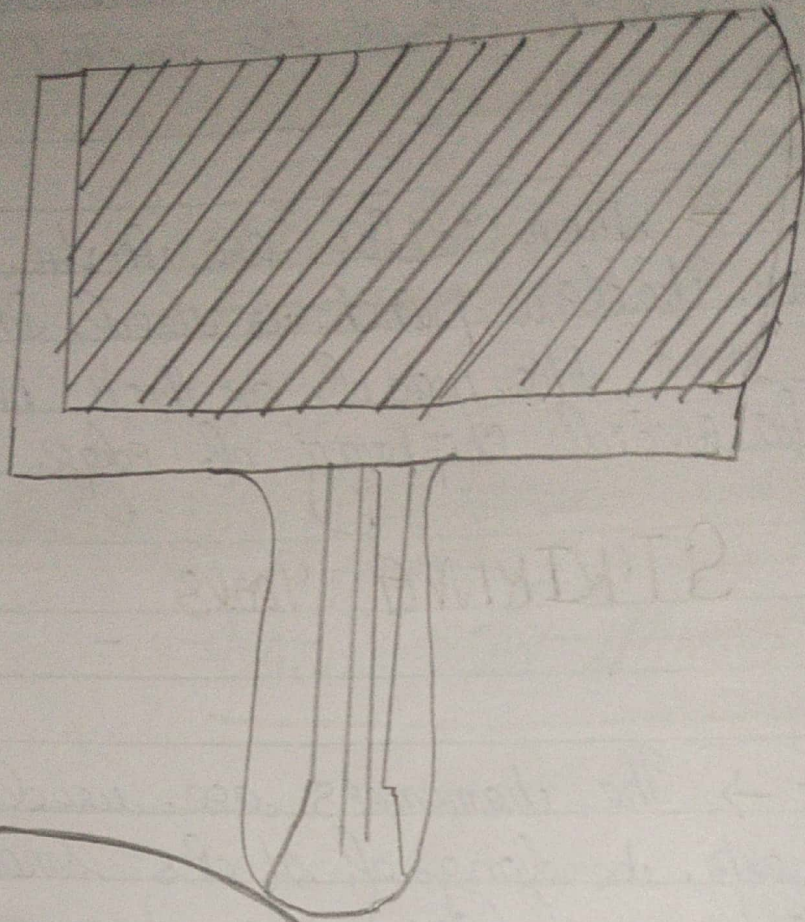


Mallet

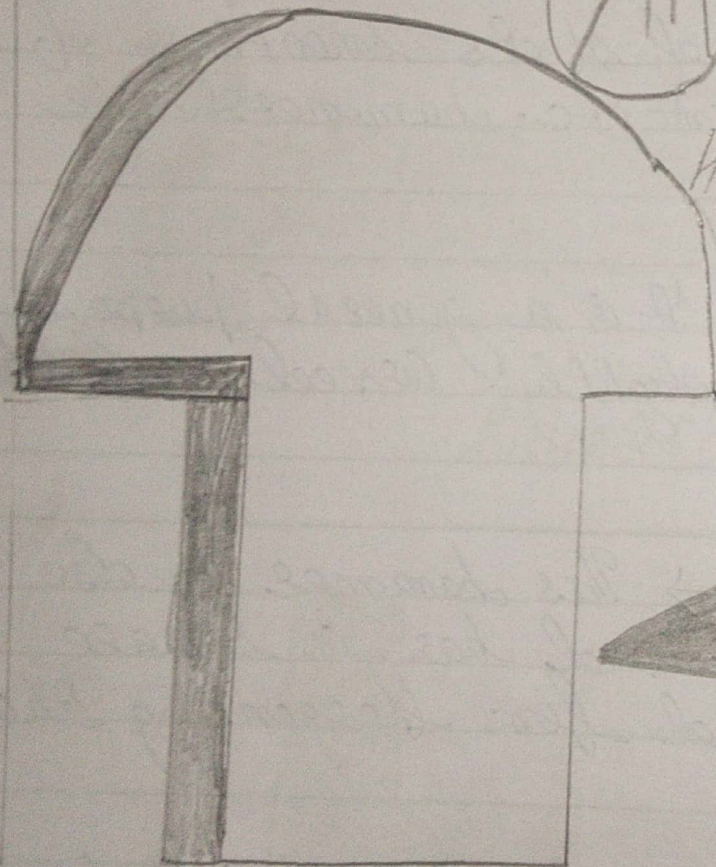
2. Bent Slip: → Blades are curved back from the cutting edge which allows the metal to slide over lap blades.
3. Hollow punch: → When circles are to be cut in thin sheets then hollow punch is used. The sheet should be placed over the wood or thick block of lead to lead to avoid chipping of edge of the punch.

STRIKING TOOLS

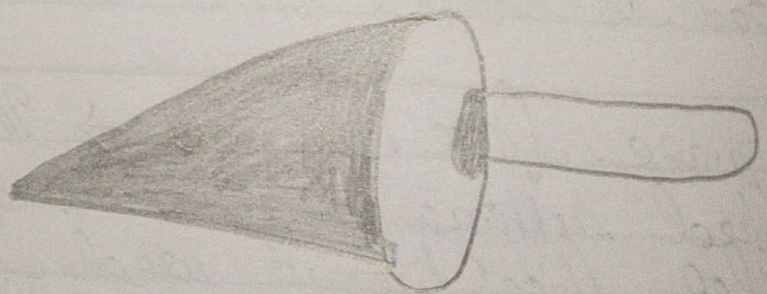
1. Hammers: → The hammers are used for riveting work, bending of sheets, smoothing of sheets, locking of joint etc. hammers are generally used.
 - a. Ball pean Hammer: → It is a general purpose hammer its face is slightly curved and the head is round.
 - b. Square face Hammer: → This hammer is also called setting hammer and has a square flat face it is used for flattening the seams.
 - c. Peening Hammer: → It is used to form flat surface of sheet into curved surface. it is used with raising block.



HAND STAKE



ROUND STAKE



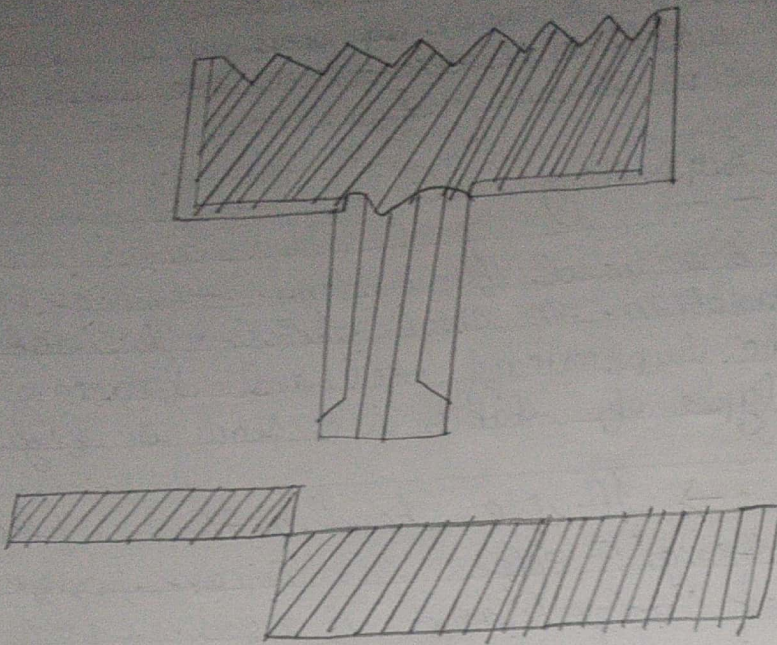
TAPER STAKE

2. Mallet :- Mallet is made up of good quality of wood or plastic. These are used whenever light force is required.

Supporting tools :-

Stakes :- It is a tool used for bending, seaming, or forming operation on sheet metal. The stakes work as both the supporting tool and forming tool. Different types of stakes are shown in figures.

1. Hand stake :- $\rightarrow$ It is a hand tool with a flat face and two straight edges one concave edge and other convex edge and is used for pressing the inner sides of straight zone.
2. Half Round stake :- $\rightarrow$ It is used for pressing round seam joint on inner side.
3. Taper stake :- $\rightarrow$ It is used for rounding of tapering jobs such as conical jobs.
4. Grooving stake :- $\rightarrow$ It is made up of forged steel and is used to make grooves of different SF/CS. Grooves are made to impart strength.



Date :

Operation

A variety of
of various
them used

be selected
of material

should be u

Sho

Following
sheet

lap joint

Gas welded

Riveted

Flash joint

Edge joint

Double

Operation in sheet metal working.

A variety of shapes can be made with the help of various operations of sheet metal, which is them used below.

Appropriate cutting tool should be selected for cutting based on the thickness of material to be cut.

A sharp cutting tool should be used for precise working.

Sheet metal Joints :-

Following are the common types of joints in sheet metal work.

- a. lap joint
- b. Grooved joint
- c. Rivetted joint
- d. Flush joint
- e. Edge joint
- f. Double groove joint
- g.

INTRODUCTION

Casting is a very important and oldest known manufacturing process used to produce in a single unit. It is widely used in manufacturing.

In casting molten metal is poured in a cavity similar to the size of the object being made. The molten metal is allowed to solidify in this cavity is ejected so that out the solid object from it this solid object is called casting if this solid is called casting process involves following basic steps:-

- i) Making metal to be cast in furnace.
- ii) Making the mould cavity conforming to the shape of casting.
- iii) Pouring the molten to cool and solidify.
- iv) Removal of solidification casting from the mould.
- v) Cleaning removal of unused portion and inspecting of casting.

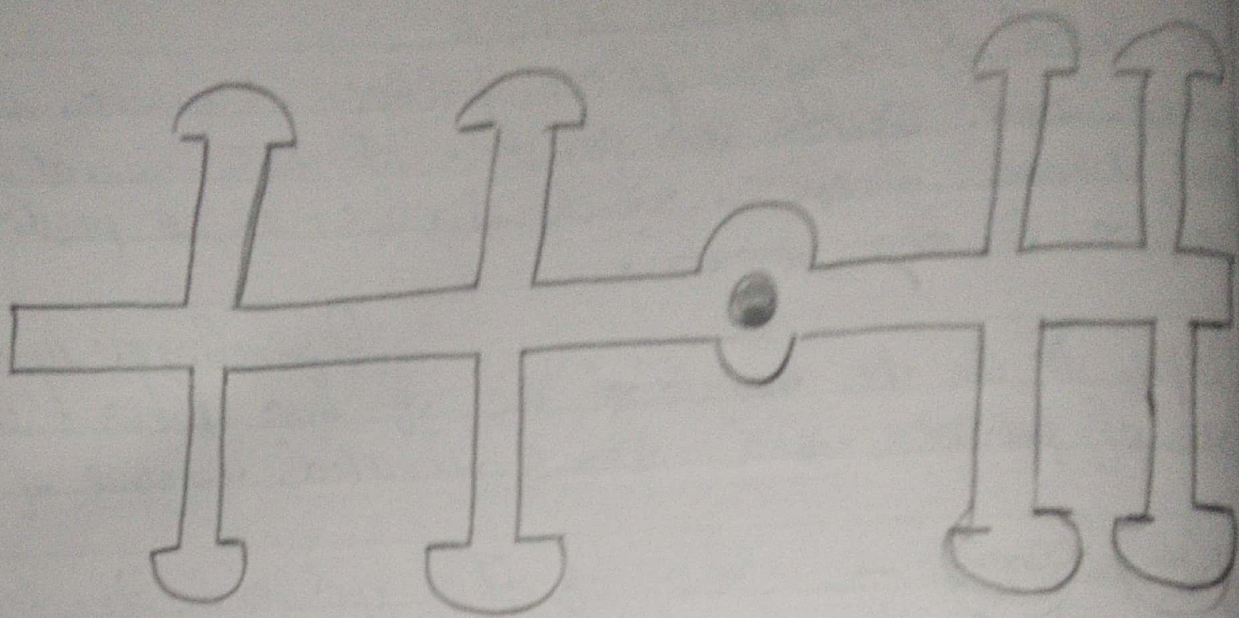
pattern can be of different types depending on the shape and size of the part to be manufactured. Given below are some of the commonly used pattern types.

i) Solid or single piece pattern.

The solid or single piece pattern is made in one piece and carries no joint. It has usually one broad surface which serves as a parting surface in the mould.

Depending upon the shape it can be moulded one of two boxes. This type of pattern is used for a limited number of castings.

ii) Split pattern : → Most of the patterns are not made in a single piece because many times the design of casting effects difficulties in mould and withdrawal of pattern. In order to eliminate this difficulty some patterns are made in two or more pieces. They are made in two parts which are joined at the parting line by means of dowels one half of the pattern rests in lower part of the moulding box and other half zone.



Javed Rabbani

1) Gated pattern :-

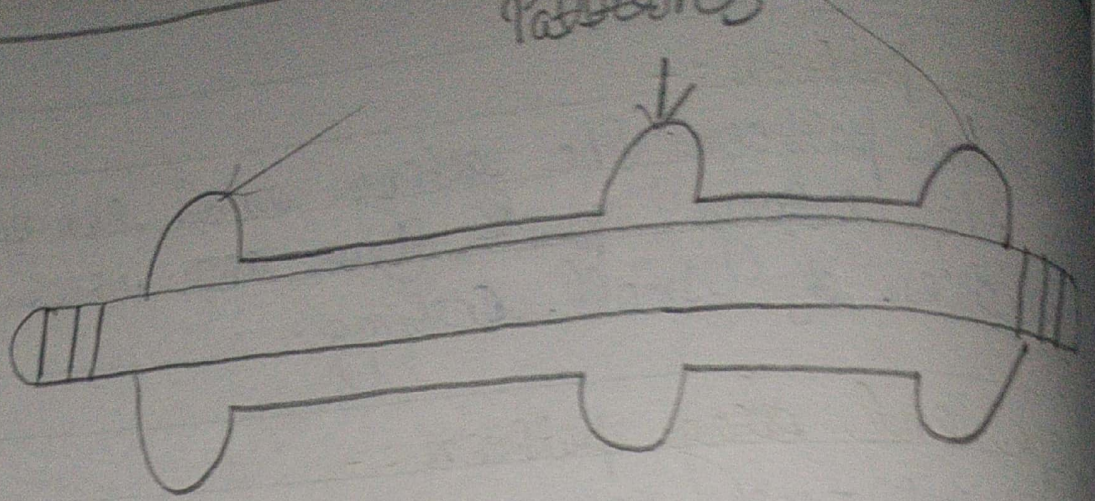
In this pattern the gating and runner system are the integral part there are used in mass production of small casting.

2) Lope and drag pattern :-

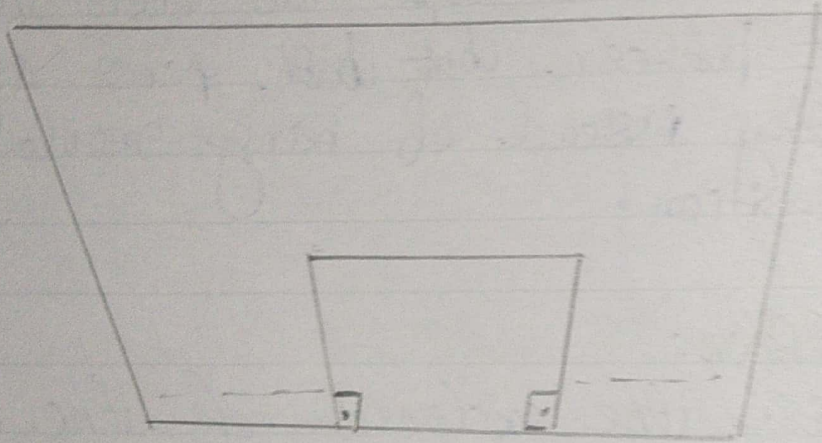
These patterns are made in two parts which are separately moulded in different moulding boxes. After completion of the moulds the two boxes are assembled to form the complete two cavity of which one part is obtained by the drag and the other in lope. These two are similar to split pattern, but both parts are moulded separately instead of being moulded in the assembled position.

3) Match plate pattern :-

These pattern are the extension of the lope and drag pattern. Here the lope and drag pattern along with the gating and risering are moulded on a single matching metal on either side. On the one of match plate is removed a complete mould with gating is obtained by joining the lope and the drag together.



Match Plate Pattern



loose piece pattern

vi) loose piece pattern:-

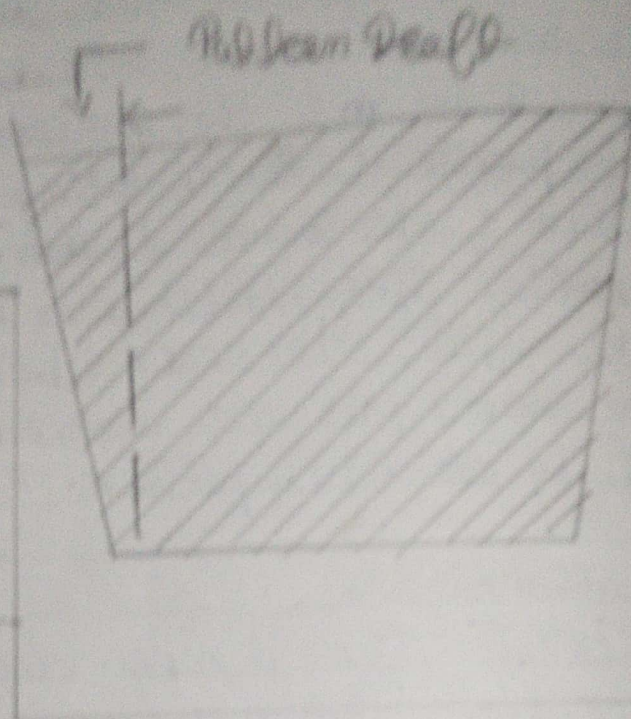
Some pattern are made to have loose piece. These pattern are used when contour of the part is such that with drawing the pattern from the mould is not possible. Hence during moulding the obstructing part of the contour is held as a light piece by a wire. After moulding is over loose piece by the first the main pattern is removed and then the loose pieces are removed through the gap generated by the main pattern.

Skeleton pattern:-

When the casting size is very large and only few number of casting are to be made then it will not be economical to make a large solid pattern of that size. In such cases, a pattern consisting of wooden frame and ship is made so that it will form a partially enclosed outline of the casting and provided the general contour and size of the desired casting.

Pattern allowances:-

The dimension of the pattern are different from the final dimension of the casting required this is due to the various reason mentioned below.



Draft allowance

i) Draft allowance :-

The draft allowance is a layer which is given to all the vertical walls of the pattern. As shown at the time of withdrawing the pattern from the sand mould the vertical faces of the pattern are in continual contact with the sand which may damage the mould cavity. So to avoid this and clean without damaging the mould cavity the draft allowance is provided on all vertical walls of the pattern. The draft allowance may be expressed in millimeters per meter on a side or in degrees.