CLASS-01 23-07-2020 TIME- 10:15 - 11:00

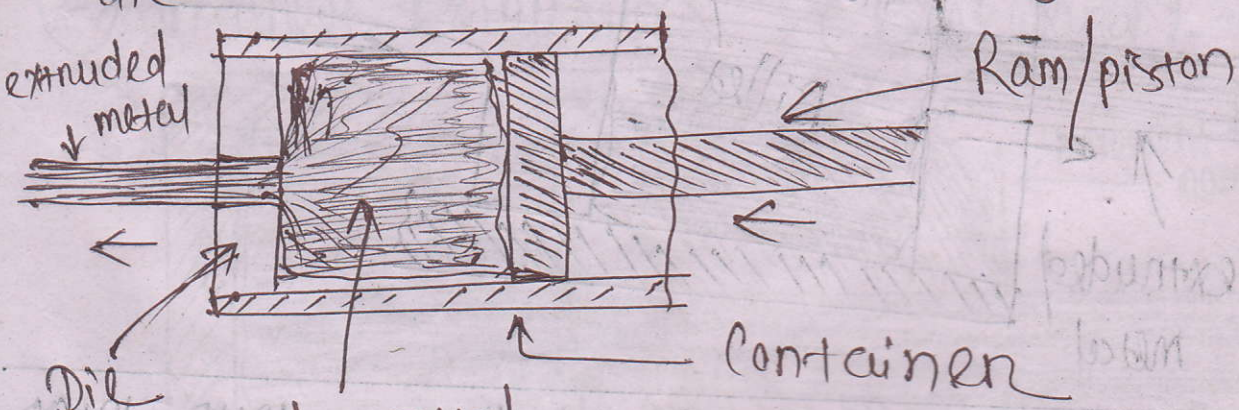
TH-01 Production Technology

CH-01 Metal Forming Process

- Metal forming means forming the metal into desired shapes.

Extrusion :-

- It is a process in which a block of (hot/cold) metal is placed in a container and forced through the opening of a die.



- According to temp. of the metal extrusion is 2 types —
  1- Hot Extrusion (hot metal)
  2- Cold Extrusion (material is not hot)

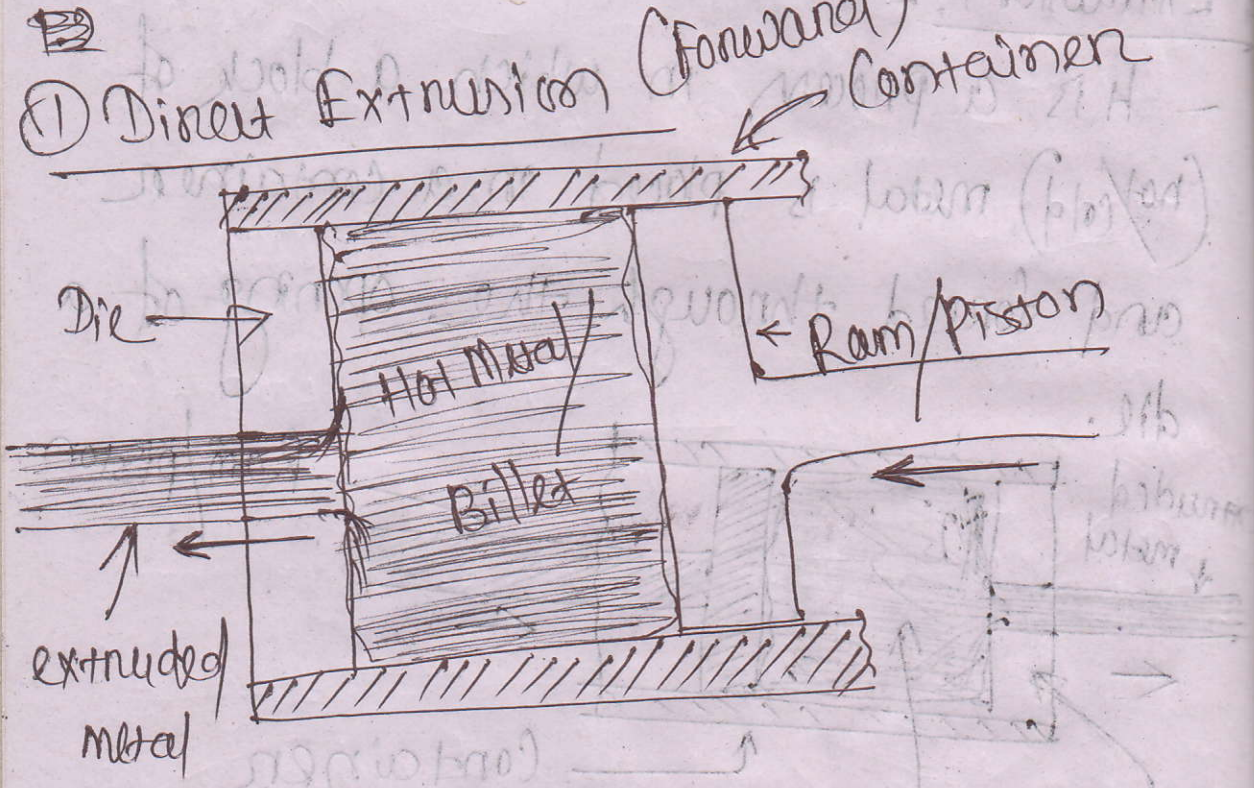
Classification

According to Procen

hot { ① Direct or Forward Extrusion
② Indirect or Backward Extrusion

cold & ③ Impact Extrusion.

① Direct Extrusion (Forward)



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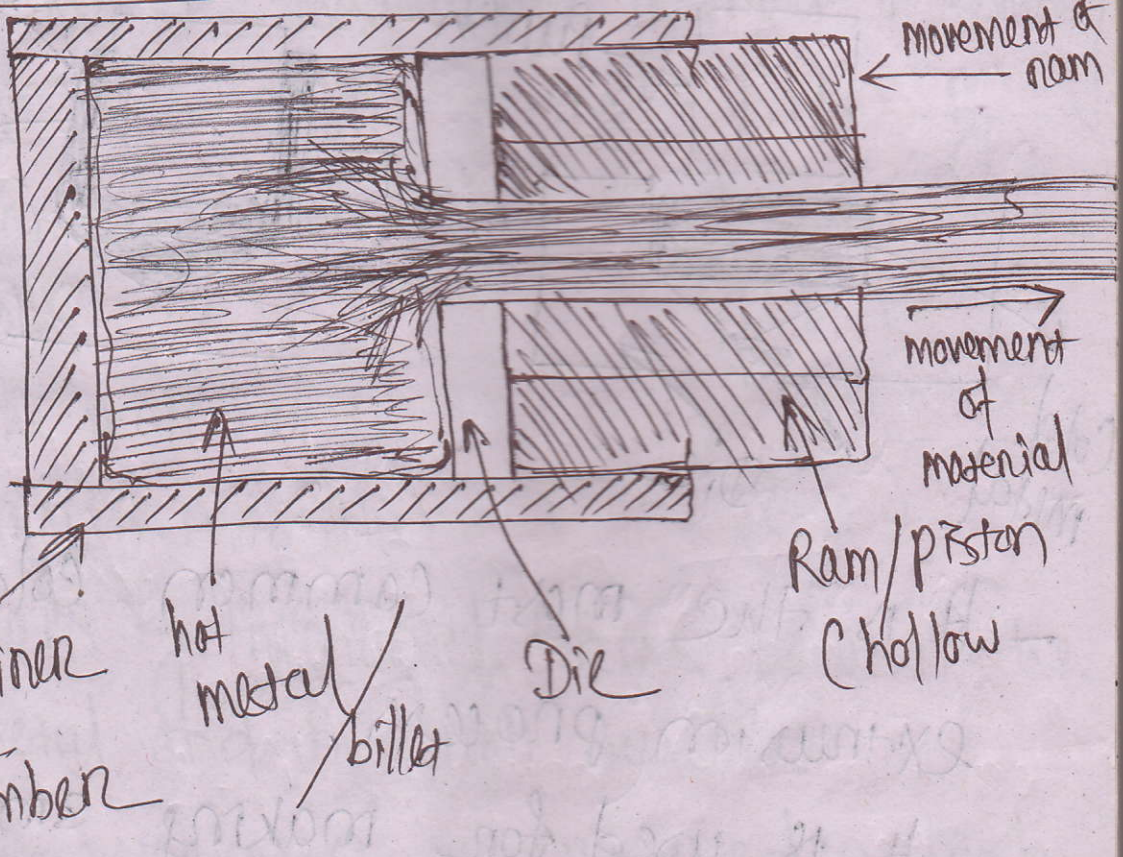
- Direct Extrusion is also known as forward extrusion.
- The metal comes out from the die hole in the same direction as the movement of the ram.

- The hot metal is placed inside the container and pressure is applied by a ram towards the die.

- The material undergoes plastic deformation and is forced to come out through the die opening.

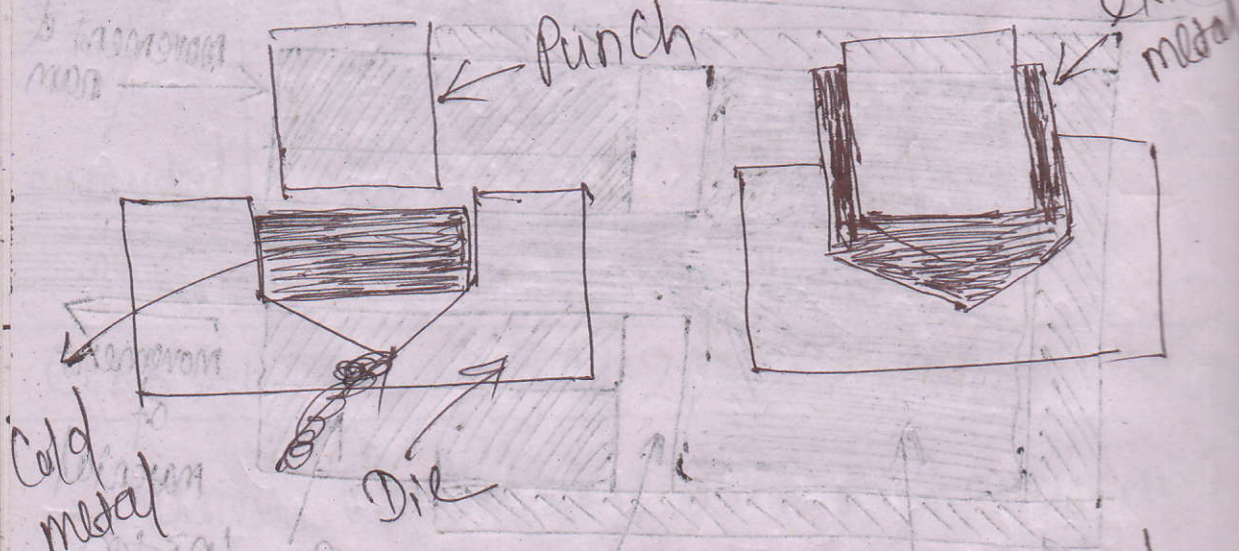
- The length of the extruded part depend upon the size of the billet and cross-section of the die.

(2) Indirect Extrusion (Backward)



- In this process the die is mounted in a hollow ram and enters the chamber.
- As the ram travels, the die applies pressure on the billet, and the deformed metal flows through the die opening in ram.
- The direction of flow of the metal is opposite to the ram movement.

③ Impact Extrusion



- It is the most common cold extrusion process.
- It is used for making small workpieces.

- It is mostly used for ductile materials.
- The material is placed inside the die.
- A punch is forced which results in the deformation of material and it takes the shape of the die.
- A clearance is there in between the die and punch.

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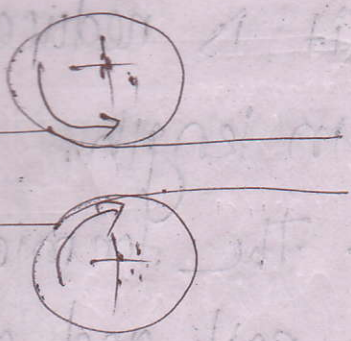
Rolling :-

- It is the most rapid method of forming the metal into desired shapes by plastic deformation in between the rolls.
- The material is drawn into the rolls by frictional forces between the metal and the roll surface.



- The workpiece is subjected to high

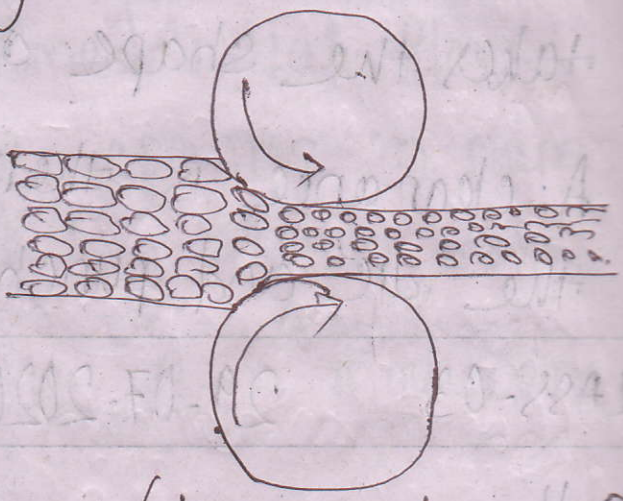
Types of Rolling Process

Basically, it is 2 types —

- Hot Rolling
- Cold Rolling

Hot Rolling

- In hot rolling process, the metal in a hot plastic state, is passed between the two rollers revolving at the same speed, but in opposite direction.

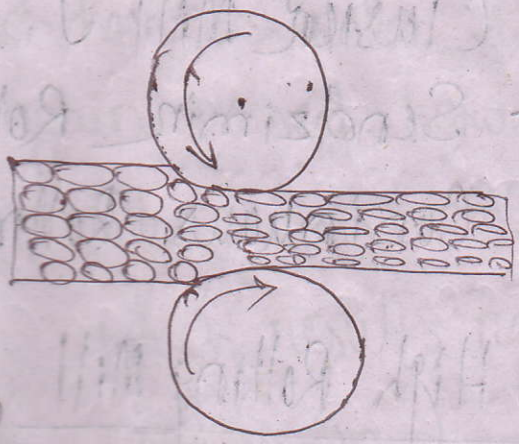


(Largen reduction in the cross section)

- As the metal passes through the rolls it is reduced in thickness and increased in length.
- The forming of bar, plate, sheet, rails and other structural sections are made by this process.

Cold Rolling

- Cold rolling is usually a finishing process in which the products made by hot rolling process are given a good surface finish and dimensional accuracy with increased mechanical strength of the material.



Rolling Mill

- A rolling mill is a complex of machines for deforming the material in the rotary mills (on rollers) and performing auxiliary operations.
- A set of rolls (rollers) in their massive housing is called a Stand.

Classification of Rolling Mills

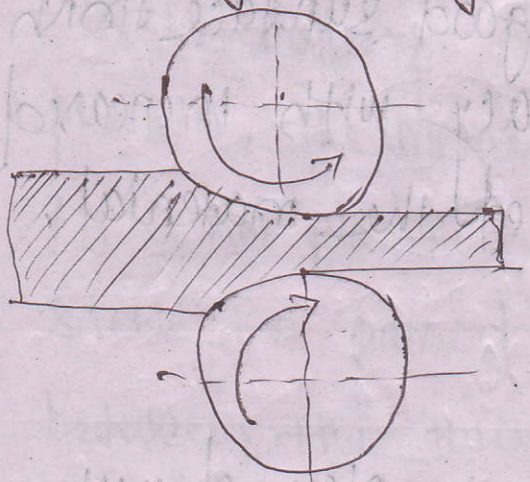
According to no. of rolls —

1- Two High Rolling Mill

2- Three High Rolling Mill

3- Four High Rolling Mill
4 - Clusted Mill
5 - Sendzimir Rolling Mills
6 - Coninuous Rolling Mill

Two High Rolling Mill



- When two rollers are used in the rolling mill, it is known as Two-High Rolling mill.
- Greater reduction in thickness is not possible due to less force.

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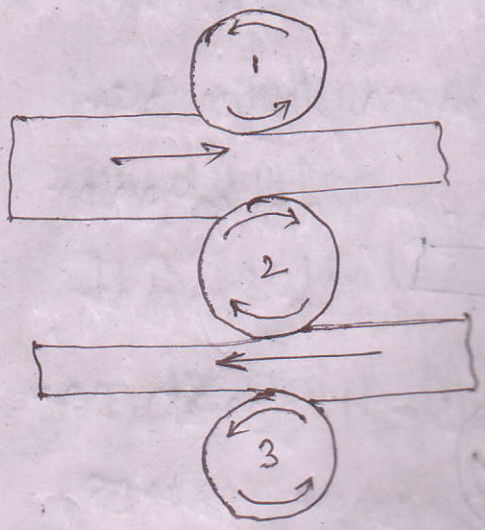
- The bottom roll is usually fixed, the upper one is moved to adjust the gap between the rollers.

Three High Rolling Mill

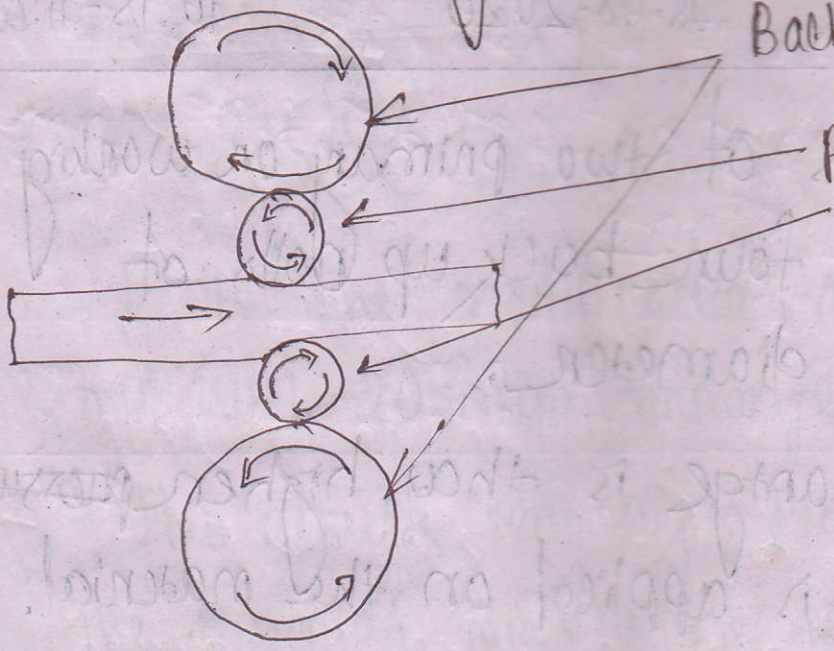
- It consists of 3 rollers, the upper and lower roll rotate in same direction,

the middle one rotates in opposite direction.

- The metal is passed between roller 1 & 2 and then it is again passed between roller 2 and roller 3, which results rapid production.



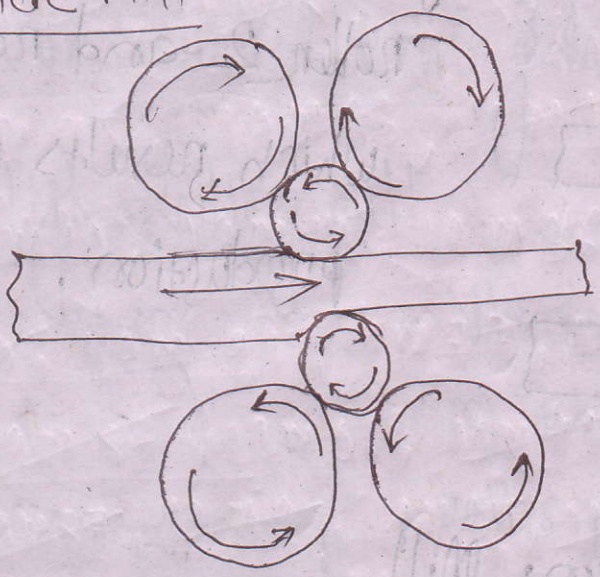
Four High Rolling Mill



- The four high Rolling mill consists of 2 primary rolls and 2 bigger back up rolls.
- These back up rolls provides extra pressure on the primary roll, which results in

- greater reduction in thickness due to high pressure on the material

Clusion Mill



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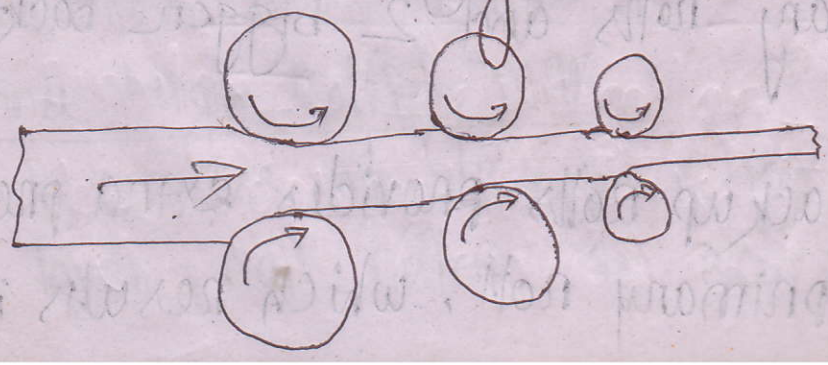
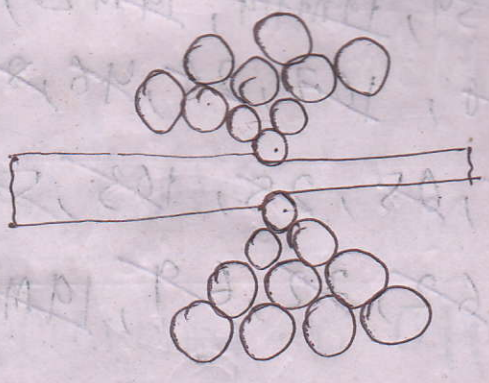
- It consists of two primary or working rolls and four back up rolls of Langer diameter.
- The advantage is that higher pressure is applied on the material.

Continuous Rolling Mills:-



- It consists of a no. of non-reversing rollers arranged one after another.
- The material passes through all of these rollers resulting very rapid production.
- It is suitable for only mass production.

Sendzimir Mill :-



- It is the modification of cluster mill with 20 rollers arranged.
- This results very high pressure on the material for rolling thin sheets from stainless steel, high carbon steel, or alloy steels.
- The outer rolls are only driven. The remaining rolls rotate due to friction.

Online attendance

19M16, 19M31, 19M75, 19M106, 19M116, 19M18, 19M50, 19M23, 19M78, 19M95, 19M83, 19M119, 19M125, 19M10, 19M14, 19M36, 19M01, 19M100, 19M91, 19M73, 19M16, 19M14, 19M57, 19M06, 19M49, 19M21, 19M87, 19M91, 19M34, 19M119, 19M28, 54, 114, 82, 19, 60, 107, 86, 46, 89, 71, 09, 00, 17, 24, 05, 25, 103, 50, 81, 111, 123, 60, 62, 72, 69, 19M03 44, 87, 28, 112,

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CH-02

WELDING :-

- Welding is a procen of joining similar or dusimilar metals by application of heat, with/without

application of pressure and with/without the use of fillen metal.

Weldability

- It is the capacity of being welded into inseparable joints.

Joints
- Temporary (Thread, Nut & bolt etc.)
- Permanent (welding, riveting etc.)

Classification

According to application of Pressure:-

1- Pressure Welding

2- Non-Pressure / Fusion Welding

According to Process:-

1. Gas Welding (Oxy-Acetylene, Air-Acetylene, Oxy-Hydrogen)
2. Arc Welding (Carbon Arc, Metal Arc, MIG, TIG etc.)
3. Resistance Welding
4. Thermit Welding
5. Solid State Welding
6. Newer Welding (Advanced)

CH-02

WELDING :-

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- Temporary (Thread, Nut & bolt) etc.
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According to application of Pressure:-

1- Pressure Welding

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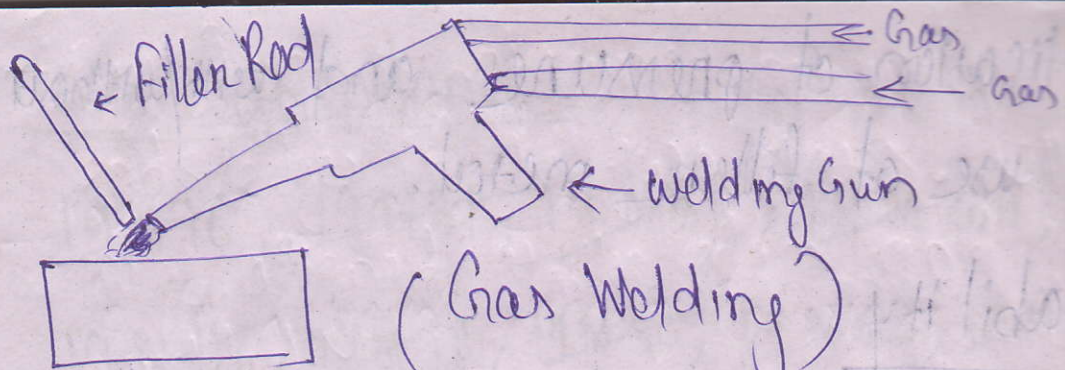
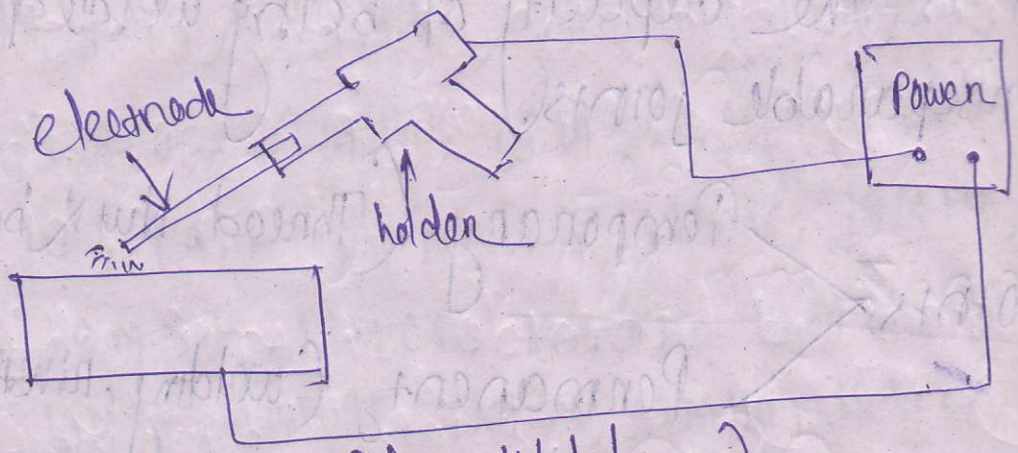
3. Resistance Welding
4. Thermit Welding
5. Solid State Welding
6. Newer Welding (Advanced)



(Gas Welding)



(Arc Welding)

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FLUX :-

- When metals are heated, the oxygen from the air combines with them and form metal oxides. These oxides produce poor quality and low strength welds
- So fluxes are added in order to prevent oxidation and unwanted chemical reactions during welding.

- Fluxes are chemical compounds available in several forms like dry powder, paste on as a coating on the welding rod.
- The commonly used fluxes are :-
  - → Sodium Carbonate
  - → Sodium bicarbonate
  - → Sodium Silicate
  - → Bonic Acid etc.

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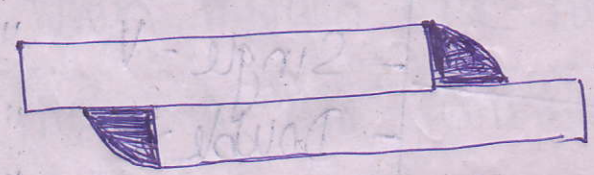
Types of Welded Joints :-

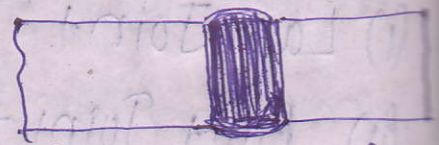
(i) Lap Joint
(ii) Butt Joint
  - Square butt joint
  - Single-V "
  - Double-V "
  - Single-U "
  - Double-U "
(iii) Corner Joint
(iv) Edge Joint
(v) T-Joint

- Lap joint is obtained by overlapping the plates and then welding the edges of the plates.

- Butt Joint is obtained by welding the ends/edges of the two plates. They are alligned at the edges and welded.
- Corner Joint is obtained by joining the edges of two plates perpendicular to each other.
- Edge joint is obtained by joining two parallel plates.
- T-joint is obtained by joining two plates whose surfaces are at 90° to each other.

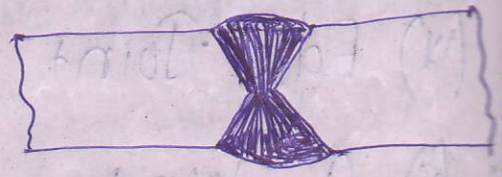


(Lap Joint)

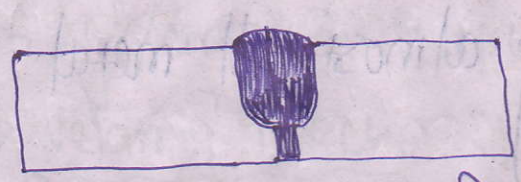


(Square Butt)

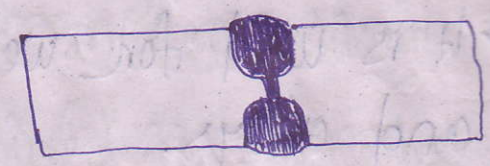
(Single V Butt)



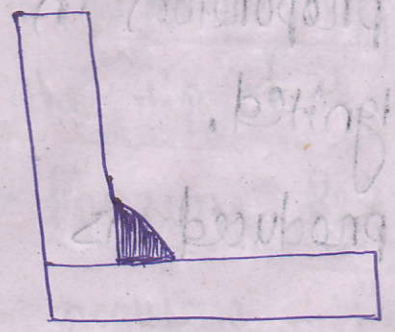
(Double V Butt)



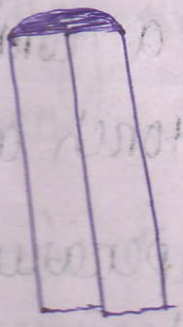
(Single U Butt)



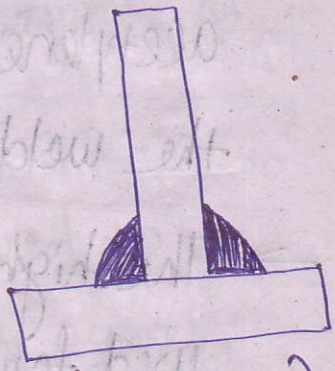
(Double U Butt)



(Conner Joint)



(Edge Joint)



(T-Joint)

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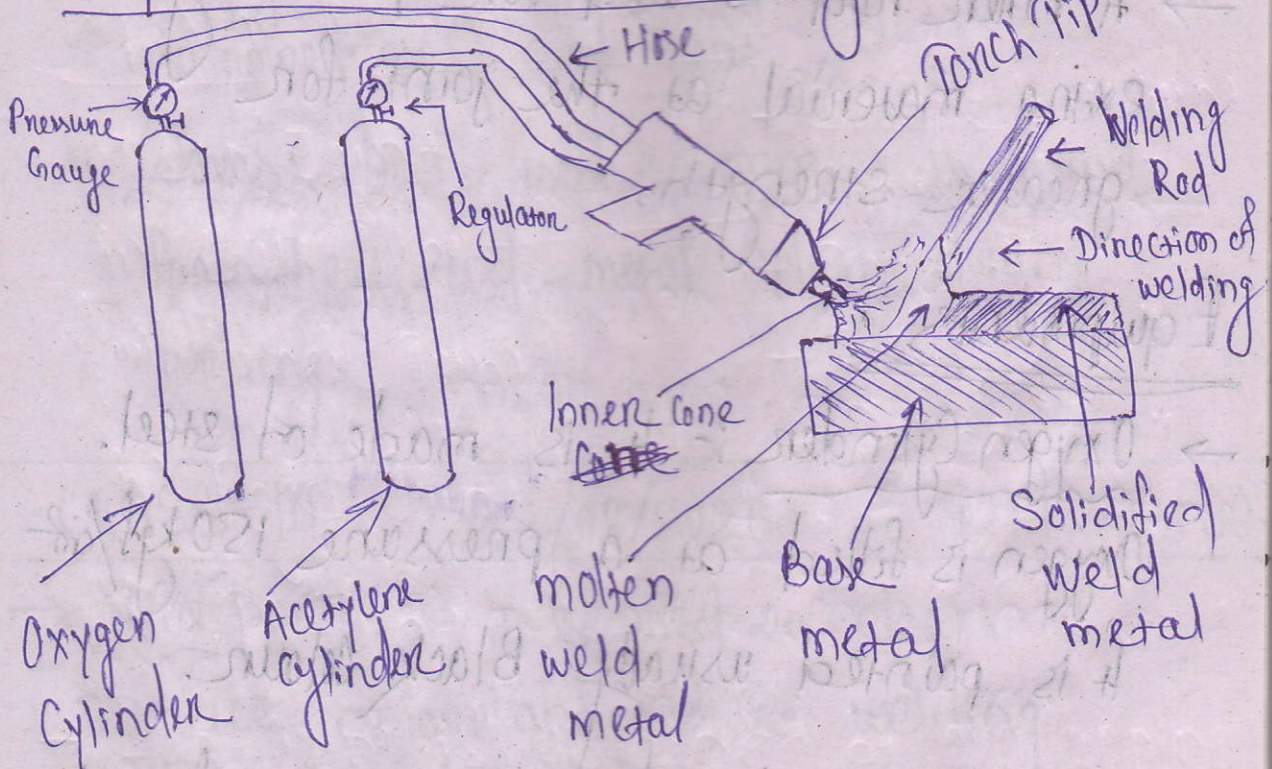
Oxy Acetylene Gas Welding



→ It is used for welding almost all metal and alloys.

→ In this process oxygen is mixed with acetylene in a correct proportion in the welding torch and ignited.

→ The high temperature produced, is used for welding.

→ The mixture of gases is burned at the tip, it reaches a temperature about 3000°C.

→ A filler rod is used for providing extra material at the joint for greater strength.

Equipments :-

→ Oxygen Cylinder :- It is made of steel. Oxygen is filled at a pressure 150 kgf/cm². It is painted usually Black Colour.

→ Acetylene Cylinder :- It is made of steel. The acetylene gas is filled at a pressure

16 kgf/cm^2. It is painted maroon colour.

→ Welding Torch :- It is used to mix the gases in correct proportion & the flame is produced by igniting the mixture at the tip of the torch.

→ Pressure Regulator :- It is used to regulate the pressure of the gases.

→ Hoses :- Hose is a rubber tube used for the flow of gases.

→ Goggles :- Goggles are used for protection of eyes from harmful rays (ultra violet, infrared etc.) and heat.

→ Gloves :- It is used to protect the hand from heat and metal splash during welding.

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→ Wire Brush :- It is used to clean the surface before and after welding.

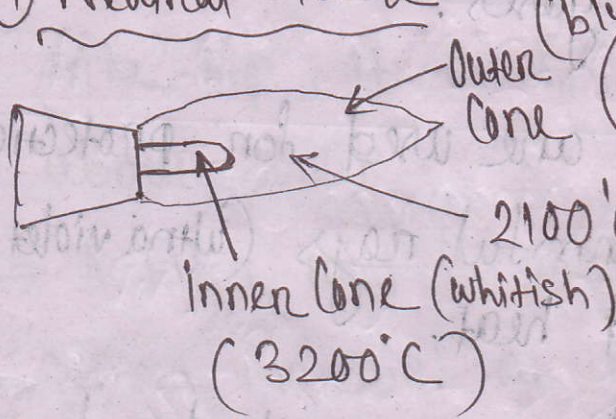
→ Welding Rod / Filler Rod :- It is used to provide extra metal to the weld.

→ Chipping Hammer :- It is used to remove metal oxides and splashes from the welding bed.

Various Types of Flames in Oxy-Acetylene Gas Welding :-

→ Various types of flames are obtained by changing the proportions of gases.

① Neutral Flame



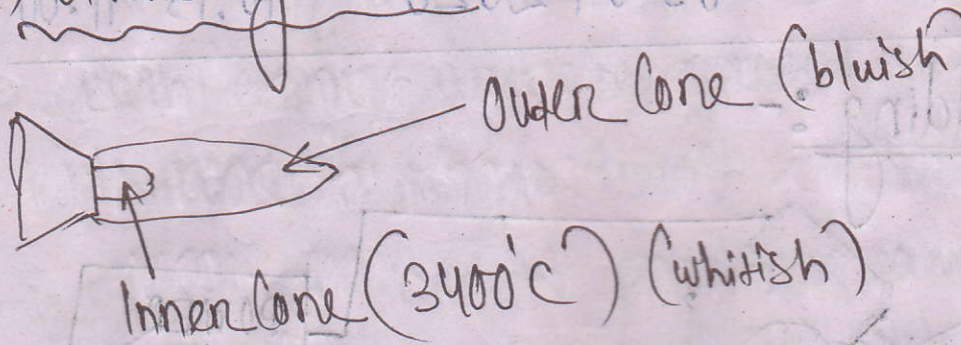
→ This type of flame is obtained when oxygen and acetylene are supplied in equal volume.

→ ratio = 1

→ Inner Cone is whitish colour. Outer cone is blwish colour.

→ Uses :- Steel, Cast iron, Copper, Aluminium etc.

(ii) Oxidising Flame :-

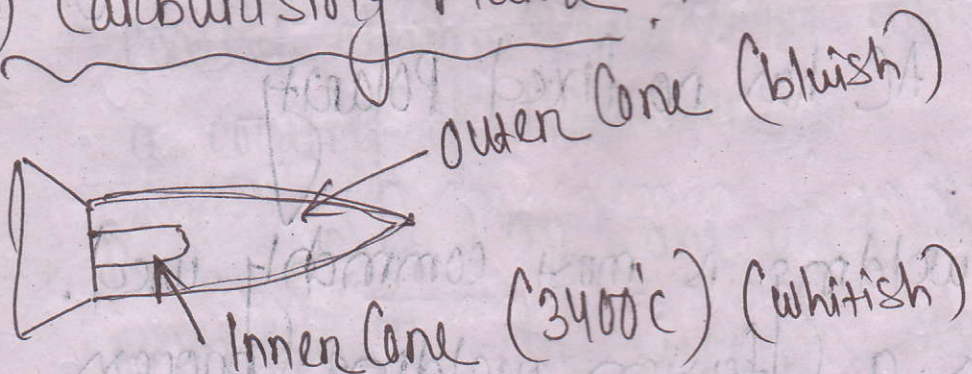


→ This type of flame is obtained when there is an excess of oxygen.

→ Ratio of oxygen to Acetylene is 1.15 to 1.5.

→ uses :- Brass, Bronze

(iii) Carburising Flame :-



→ This type of flame is obtained when there is an excess of Acetylene.

→ Ratio of Oxygen to Acetylene is 0.85 to 0.95.

→ uses :- Steel, Aluminium

→ It provides a hard and brittle weld.

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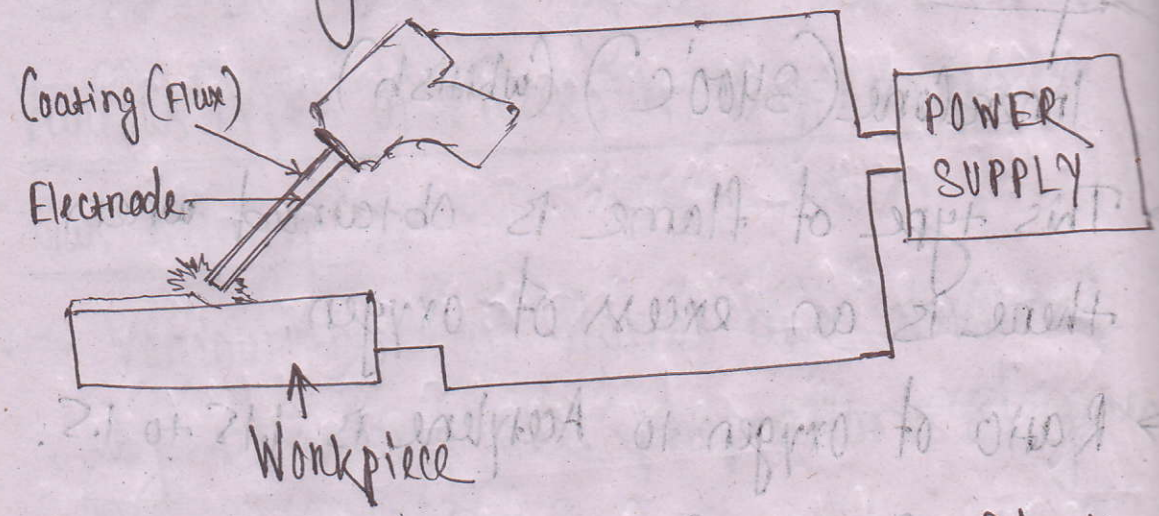
Arc Welding :-



For DC: Electrode Negative → Straight Polarity
Electrode Positive → Reverse Polarity

For AC:
AC has no fixed Polarity

→ Arc welding is most commonly used.
→ It is a fusion welding process in which the welding heat is obtained from an electric arc between the workpiece and electrode.
→ The Electrode and the workpiece are connected to the two terminals of a power supply. (AC or DC)

→ Then they are made in contact with each other and separated by a small distance (2 mm to 4 mm).

→ Thus an arc is produced which provides the heat for welding.

→ The temperature of heat produced by the electric arc is 6000°C to 7000°C.

→ Commonly a metal electrode is used which supplies the filler metal. Coated electrode is used which has a coating of flux over it.

→ Both AC and DC are used for welding. The DC supply is obtained from a generator.

→ The voltage required in case of DC is 60V to 80V for striking the arc and 15V - 25V for maintaining the arc.

→ The AC supply is obtained from a step down transformer. It receives the supply of 200V-440V and transforms it to 80V—100V for striking the arc and 30V-40V for maintaining the Arc.

Arc Welding Electrodes

→ Electrodes for Arc welding are 2 types —

(i) Non-Coated or Bare Electrode
(ii) Coated Electrode

→ Standard dimensions of Electrode —

Diameter = 1.6mm — 9mm
Length = 250mm — 450mm

→ Bare Electrodes or Non-coated electrodes do not have a coating of flux over them. These are cheaper. Welding produced by using bare electrode are poor quality.

→ Coated Electrodes are those which have a coating of flux over the metalic wire electrode. The Flux materials reduces oxidation, stabilises the Arc, and provides necessary alloying elements to the weld.

→ Consumable Electrodes are those which is consumed itself during welding. It means it is used for producing the Arc and also supplies filler metal.

→ Non consumable Electrodes are those which are not consumed during the welding. It is used only for producing the Arc. Filler metal is supplied additionally.

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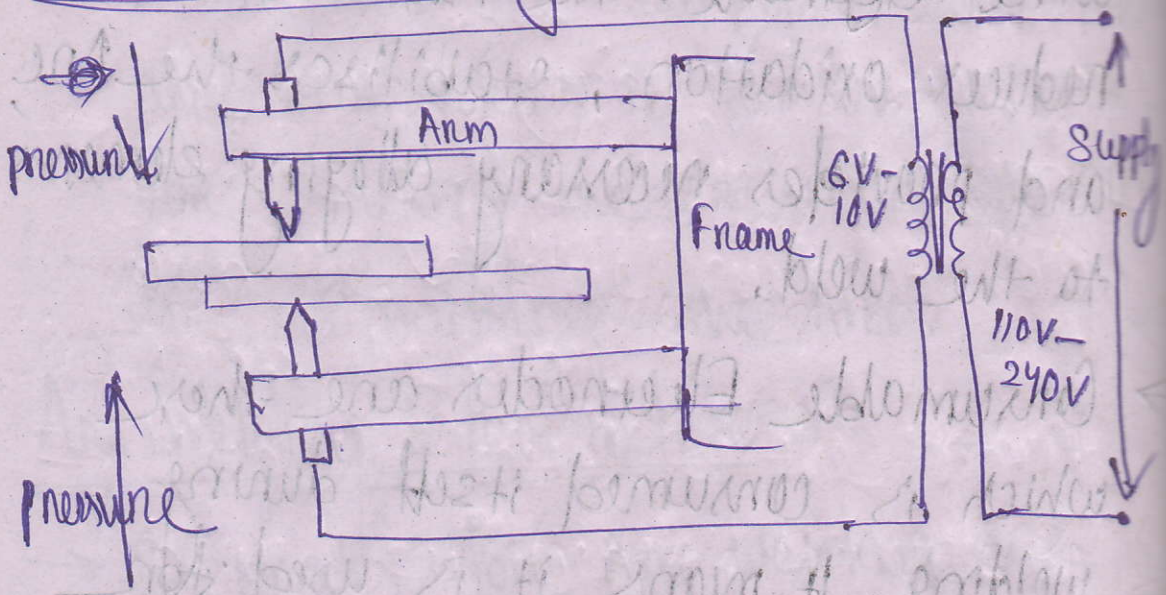
Resistance Welding :-



→ It is a type of Pressure Welding.

→ It is the process of joining metal pieces together by raising the temperature of the pieces to fusion point and applying mechanical pressure to join them.

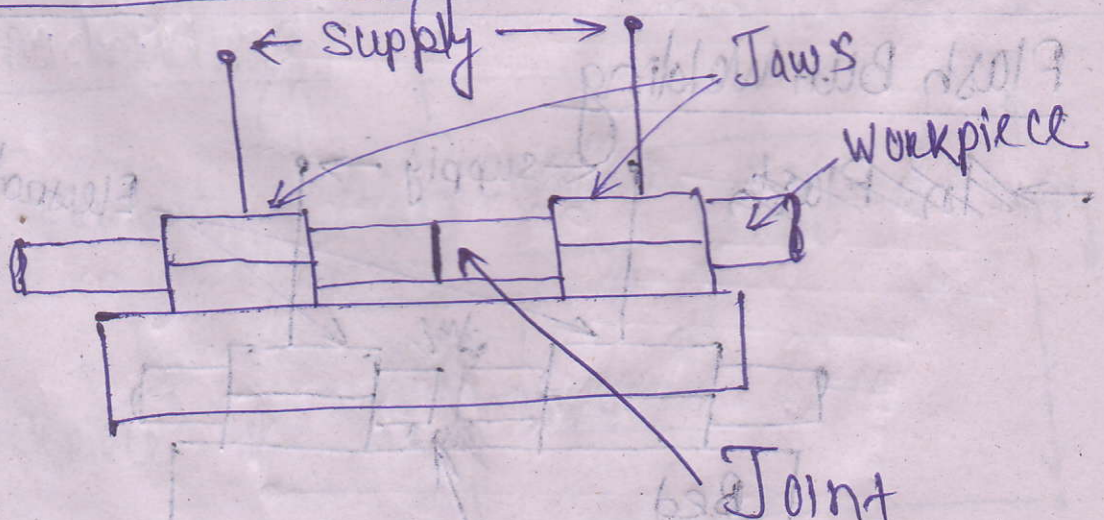
→ In this process two electrodes are placed in a circuit and the metals to be welded are pressed between two electrodes.

→ The welding heat is obtained at the desired location by the electrical resistance through the metals.

→ Voltage 6V — 10V
Current 60A — 4000A
Pressure 25 — 55 MPa

→ Resistance welding is following types:-
(i) Butt Welding — [Upset butt welding, Flash butt welding]
(ii) Spot Welding
(iii) Seam Welding
(iv) Projection Welding

Upset-Butt Welding



→ In upset butt welding the two metal parts are clamped in the jaws and forced together.

→ The heat is generated in the contact surface by the electric resistance when the electric current flows across the joint.

→ When the metal at the joint is heated sufficiently, pressure is applied by the two jaws to join the parts.

→ This process is generally used for welding of bars, rods, wires etc.

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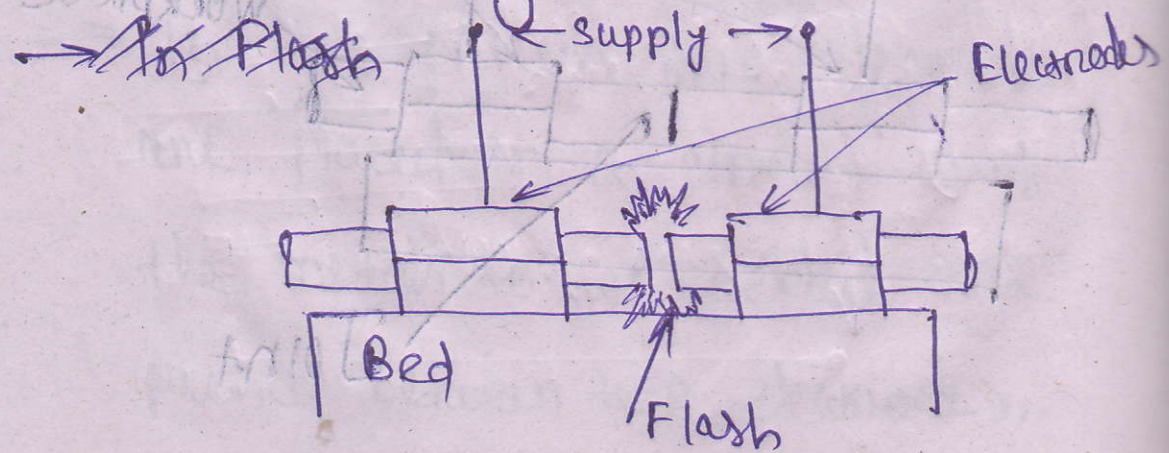
Flash Butt Welding



→ In Flash Butt welding the heat required is obtained from the arc that occured between the parts to be joined.

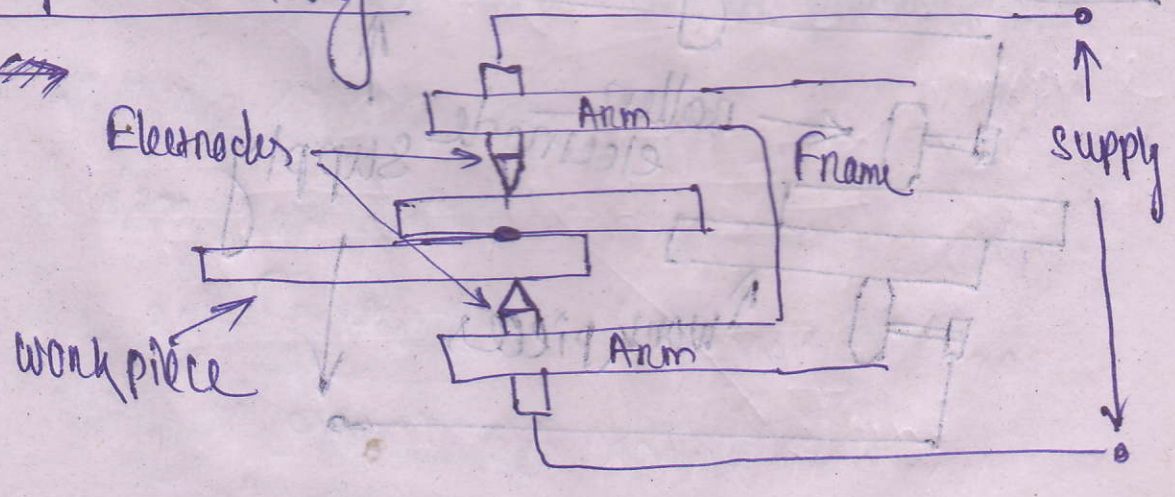
→ The two metals are first made in contact and separated by a small distance.

→ In separating, an arc is formed which heats the end of the parts to fusion temperature.

→ Then the current supply is cut off and the pieces are forced together.

→ This process is used mostly in automobile constructions like body, axle, wheel, frame etc.

Spot Welding



→ Spot welding is used for welding lap joints, where the total thickness is up to 12mm.

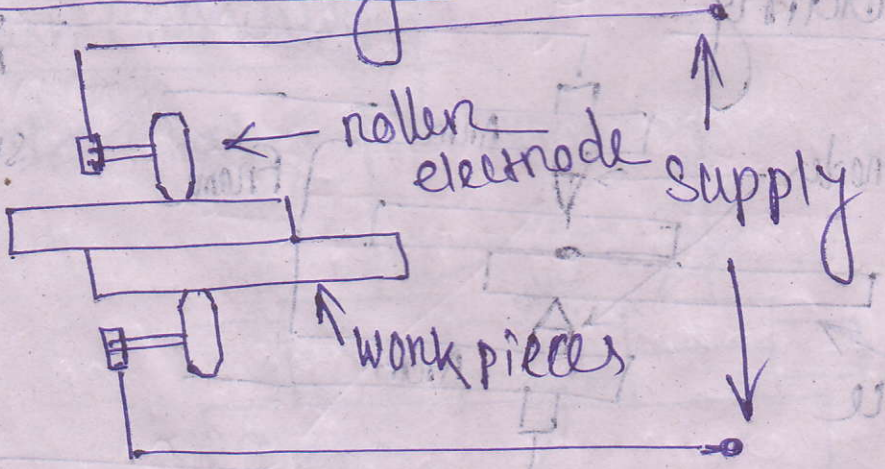
→ The plates to be joined together are placed between the two electrode tips.

→ A low voltage and high ampere current is passed between the electrodes causing the metal temperature to rise to the fusion temp.

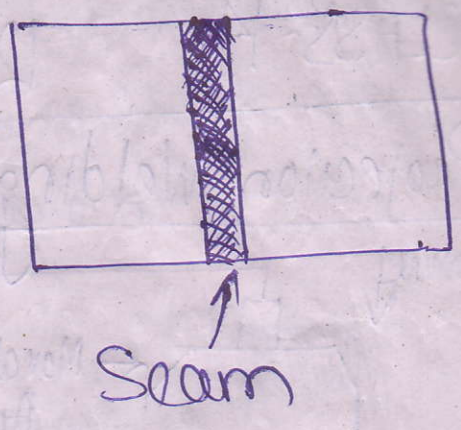
→ Then pressure is applied which completes the weld.

→ It is widely used in automobiles, refrigerators, metal stamping etc.

Seam Welding



→ It is a method of making a continuous joint between the two overlaping pieces of sheet metal.



→ The workpieces to be welded are passed between the rollers which serve as electrodes. The electrodes maintain a continuous pressure on the workpiece.

→ The current passing from roller to roller through the workpiece, heats up the parts to be joined and the pressure on the roller electrodes forms the weld.

→ uses pressure tight and leak proof tanks and other products.

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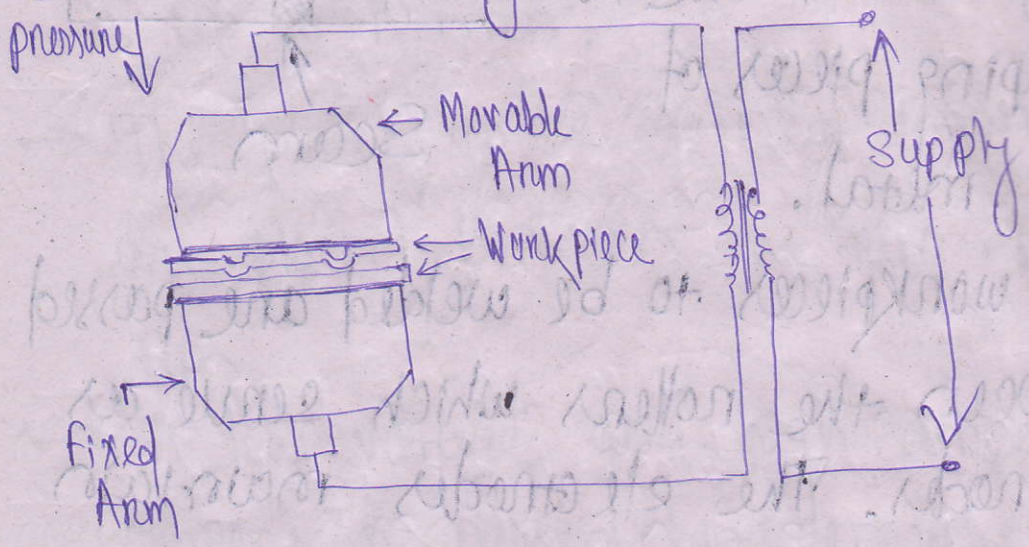
Projection Welding :-



→ It is similar to spot welding except that one of the metal pieces to be welded has projections on its surfaces at the points where welding is to be done.

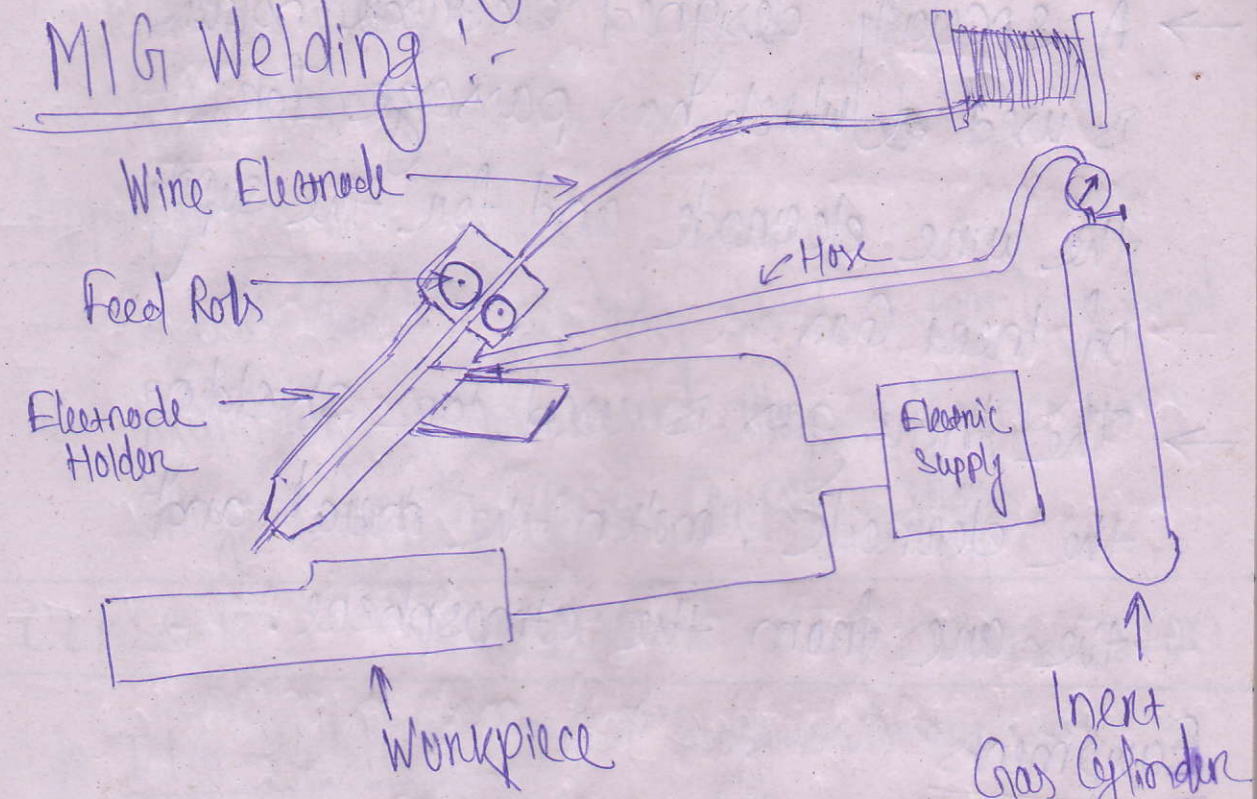
→ The contact between the two metal pieces to be joined is made at the projections.

→ When the current passes through these projections, they are melted and flattened, allowing the two surfaces to come together.

The melted projections become the welds.

→ Projection welding is suitable for large quantity production.

MIG Welding :-



→ It is also known as GMA (Gas Metal Arc) Welding.

→ It involves welding of metals using a consumable metal electrode in an inert gas atmosphere.

→ The arc is produced between the metal electrode and the workpiece.

→ The electrode is in the form of a continuous metal wire, which

is fed into the arc at the same speed at which it is melted and deposited in the weld.

→ A specially designed electrode holder is used which has passage for the wire electrode and for the supply of Inert Gas.

→ The Inert gas is used for shielding the electrode, molten the metal and the arc from the atmosphere.

Equipments

- Inert Gas Cylinder
- Gas Regulator
- Hoses
- Power Source
- MIG Welding Gun
- Electrode wire
- Water Supply

Inert Gases

METAL	INERT GAS
Steel	CO_2
Al, Cu	Ar, Ar-He
Stainless Steel	Ar-O, Ar-He
Titanium	Ar

Advantages

- No Flux Required
- High welding speed
- Better quality welds
- High Economy

Applications

- Carbon Steels, low alloy steel, Stainless Steel.
- Aluminium & Aluminium alloys, Magnesium alloys, Copper and Copper alloys.

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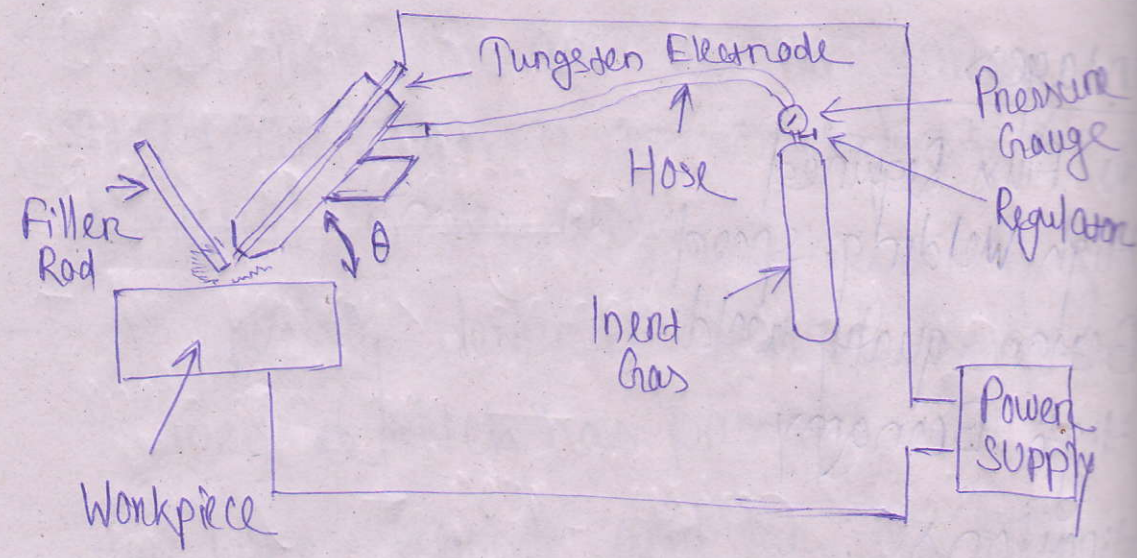
TIG Welding :- (Tungsten Inert Gas)

→ It is also known as Gas Tungsten Arc (GTA) welding.

→ In this process the welding heat is obtained from an arc produced between the non-consumable tungsten electrode and the workpiece.

→ The shield is obtained from an Inert gas such as Argon, Helium or mixture of both.



→ Argon is more widely used than Helium because it is heavier and provides better shielding.

→ The gaseous shield protects the arc, electrode, ~~and~~ molten metal and the weld area from the atmosphere.

→ The tungsten electrode does not provide filler metal due to its non-consumable nature. Additional filler metal is provided to the weld if needed.

Equipments :-

- Welding Gun (electrode holder)
- Tungsten Electrode

- power supply (AC or DC)
- Filler Metal
- Hose pipe
- Inert Gas Cylinder
- pressure regulator
- pressure gauge

Power Supply :-

DCSP → Copper Alloys, Stainless Steel, Ferrous Alloys.

DCRP → Magnesium Alloys

AC → Non-Ferrous Alloys.

Advantages :-

→ No Flux Required
→ High Quality welds
→ Cleaning of weld not necessary

Applications :-

→ Al alloys
→ Cu Alloys
→ Mg Alloys
→ Ni Alloys
→ Stainless Steel
→ Carbon Steel
→ Cast Iron
→ Silicon Bronze
→ Titanium

CLASS-16

Defects in Welding :-

- The various defects found in welding are —
  - → poor fusion
  - → Cracks
  - → Undercut
  - → Porosity or voids
  - → Slag Inclusions
  - → Burning

Poor Fusion :-

→ It is the lack of thorough and complete union between the deposited and the parent metal.

→ It is due to faulty welding conditions and technique.

Cracks :-

→ Cracks occur due to non-uniform heating and cooling of the

metal and presence of gas forming elements like sulphur, phosphorus in the weld metal.

→ Cracks are following types -

(i) Micro cracks - can be seen by microscope.

(ii) Macro Cracks - can be seen by low power magnify

(iii) Fissures - wide cracks on surface

Undercut :-

→ It is a groove formed into the base metal near the toe of weld.

→ It occurs due to -

(i) non-uniform feeding of the welding rod.

(ii) Improper position of the electrode or torch tip

(iii) Excessive heating

Porosity or Voids

→ It is the formation of blow holes, gas pockets or roughness on the surface of weld.

→ It is due to the presence of gases

in the metal, moisture in the flux or rust on the welded edges or fillen metal.

Slag Inclusions :-

→ These are slag entrapped in the weld deposit during welding.

→ These are due to

(i) Contamination of the weld metal by oxides

(ii) non-uniform melting of the electrode coting.

(iii) Insufficient deoxidising of the metal in the weld.

Burning :-

→ It is oxidation of the metal in the weld and the base metal.

→ Its causes may be -

(i) A strong oxidising medium

(ii) An Arc of excessive length

(iii) Excessive high welding current.

CHAPTER-3.

CASTING:-

- Casting is a process of pouring the molten metal into a mould and allowing it to solidify to get the final product
- Foundary is a place where castings are made.

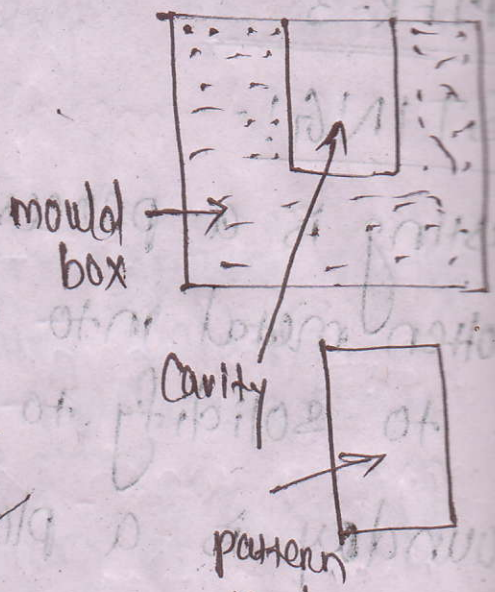
Types of Casting

1- Sand
2- Plaster
3 - Metallic

Sand Casting (Moulding Process)

→ A pattern is made, which is the replica of the object to be made.
- A moulding box is made and filled with sand.
- Close packing of the sand is done.

- The pattern is pressed into the mould to get the impression of the pattern.



- The hollow portion is called cavity.
- The molten metal is poured into the sprue which flows to the cavity through the runner and gate.
- When the cavity is full, the molten metal will overflow through the riser.
- When the cooling process completes the material gets solidified.
- Then the moulding box is opened, the mould is break to get the final product.

- Machining is done on the product to get a finished shape.

Types of Moulding Sand :-

- The sand to be used in moulding is prepared specially by adding some additives to increase the strength of the sand.
- Most common types are ——
  (i) Green Sand
  (ii) Dry Sand
  (iii) Loam Sand
  (iv) Facing Sand
  (v) Parting Sand
  (vi) Baking Sand
  (vii) Core Sand
  (viii) Oil Sand
  (ix) Molasses Sand

Green Sand :-

- It is a mixture of
  - Silica Sand
  - Clay 10% - 15%
  - moisture content 4% - 6%
- Green Sand moulds donot require any baking before pouring molten metal into them.
- It is used for small size castings.

Dry Sand :-

- It has a composition of -
  - old floor Sand 64%
  - coal dust 13%
  - New sand 20%
  - clay 3%
- The moulds are baked / dried before pouring the molten metal.
- The moulds have greater strength, rigidity and are used for large and heavy castings.

Loam Sand :-

- It is a mixture of -
  - moulding sand 50%.
  - clay 50%.
- It is used in loam moulding in very large castings.

Facing Sand :-

- Initial coating around the pattern surface is given by this sand.
- It is a specially prepared sand from silica sand and clay, without addition of used sand.
- It must posses high strength and refractoriness.

Parting Sand :-

- It consists of dried silica sand and burnt sand.
- It is sprinkled on the pattern and parting surfaces of the mould so that the sand of one flask don't

stick to the other.

Baking sand / Floor sand :-

- It is the used sand which is left on the floor after the castings have been removed from the sand.

Core Sand :

- The sand carrying high silica content and used for making cores are known as core sand.

Oil Sand :-

- Silica sand using oil as binder is known as oil sand.

Molasses Sand

- Sand using molasses as binder is called molasses sand.
- It is used for small castings and also used as core sand.

Pattern :-

- It is the replica of the object to be made.
- The pattern can be made by using wood, metal, plastic etc.
- Wood is the most common material in sand moulding.

Types of Pattern :-

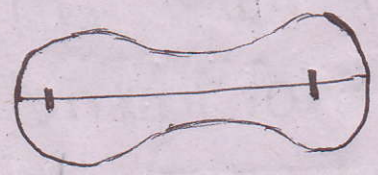
- The various types of pattern used in sand moulding are —
  1. Single Piece Pattern / Solid pattern
  2. Multipiece Pattern / Split pattern
  3. Match plate pattern
  4. Gated Pattern
  5. Loose piece pattern
  6. Sweep pattern
  7. Segmental pattern
  8. Skeleton Pattern

  etc.

1. Single Piece Pattern :-

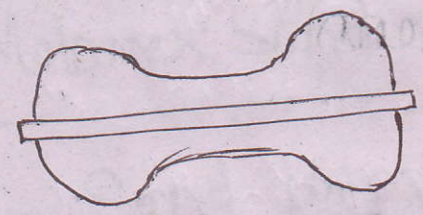
- Single piece patterns are made in one-piece.
- Simple shape objects are made by this pattern.

Multipiece Pattern :-



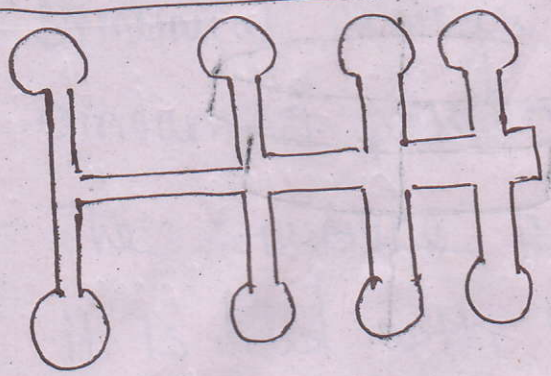
- When a pattern is made in more than one piece, it is called split pattern or multipiece pattern.

Match Plate Pattern :-



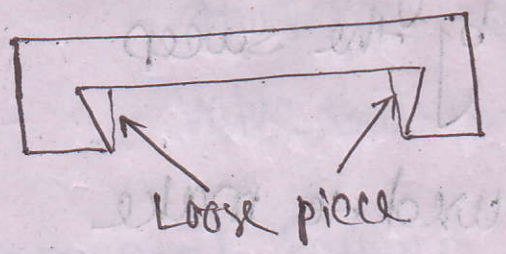
- When a match plate is used in between the two pattern halfs it is called match plate pattern.

Gated Pattern :-



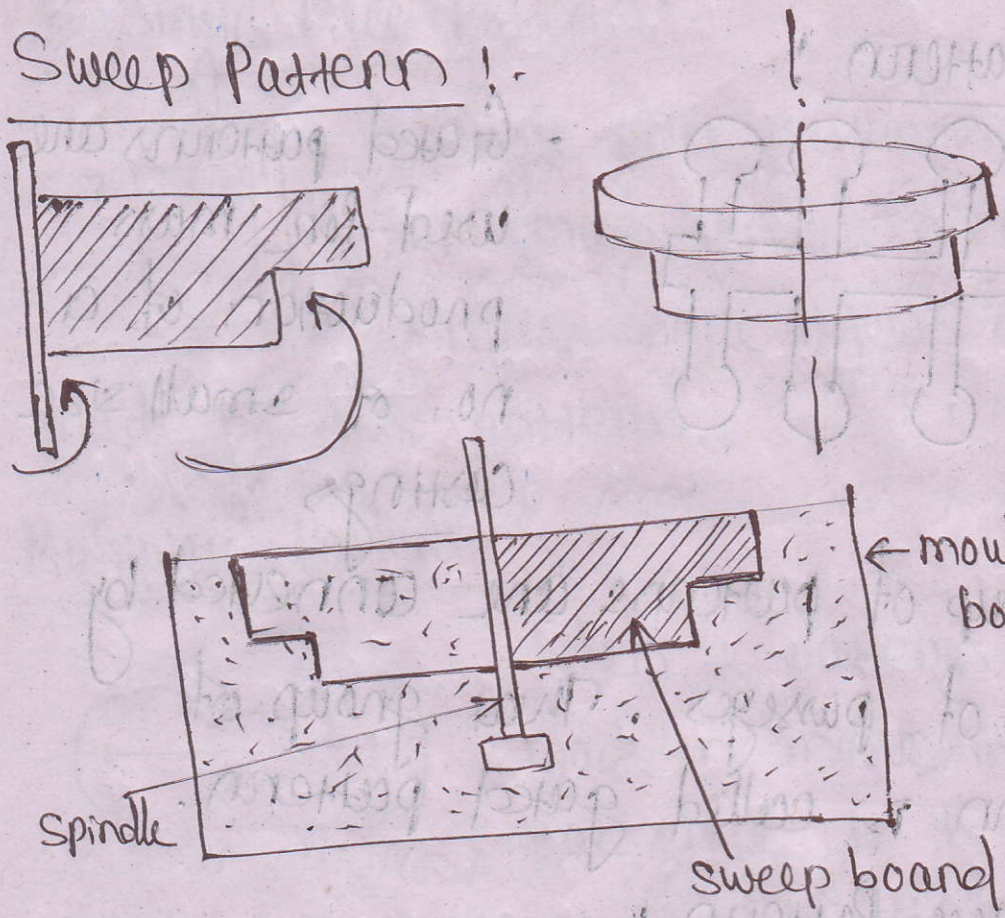
- Gated patterns are used for mass production of a no. of small size castings
- A group of patterns are connected by means of passages. This group of pattern is called gated pattern.

Loose-piece Pattern :-



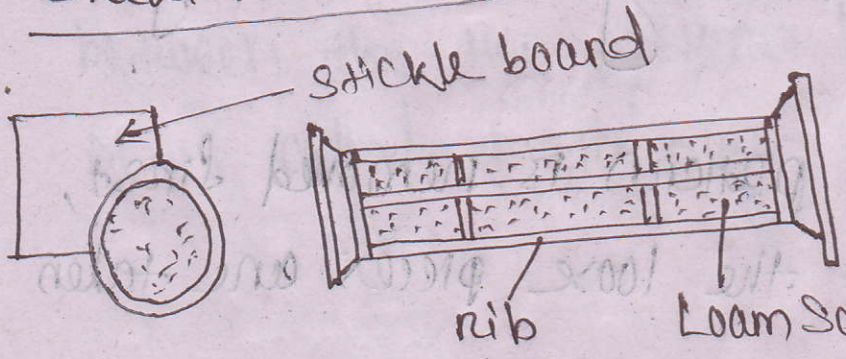
- The loose piece patterns are used, when the total pattern can not be removed from the moulding box as a single piece.
- The main pattern is removed first, after that the loose pieces are taken out.

Sweep Pattern :-



- Large symetrical castings of circular sections are made by the sweep pattern.
- A sweep board is used to make the cavity.
- It eliminates heavy pattern cost.

Skeleton Pattern

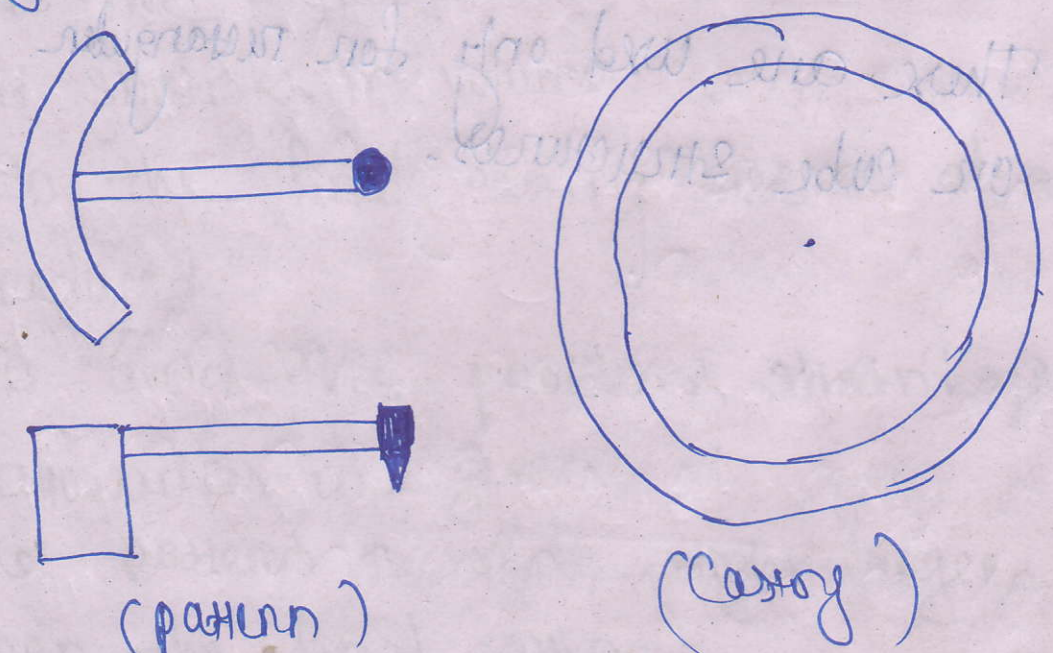


- Skeleton patterns are used for very large symetrical castings which require huge amount of pattern materials.
- The structure is made of wood, then it is filled with loam sand in the rectangular holes.
- A stickle board is used to shape the sand.

Uses :-

- Soil and water pipes
- turbine casings
- valve bodies etc.

Segmental Pattern :-



(pattern) (Casting)

- This pattern is used for large circular sections.

Ex:- wheels, rims, etc.

- First, a segment is made and moved to all positions.
- segmental patterns save time, cost and material for making the complete pattern.

Boxed up Pattern :-

- Boxed up patterns are made of wood, plastic or card board to save pattern material.
- These are used only for rectangular or cube structures.

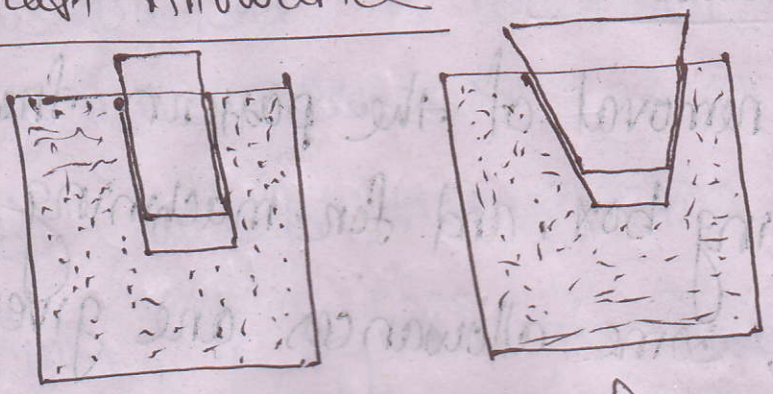
Pattern Allowances

- For easy removal of the pattern from the moulding box, and for machining purposes, some allowances are given to the pattern. This allowances are known as pattern allowances.
- Most common allowances are —
  (i) Shrinkage Allowance
  (ii) Draft allowance
  (iii) Machining Allowance
  (iv) Shake Allowance
  (v) Distortion Allowance

Shrinkage Allowance

- As the material solidifies and cools, it shrinks in volume.
- So the final casting size is also reduced.
- To avoid this problem, shrinkage allowances are given.
- The pattern is made slight larger than the final casting.

Draft Allowance



- All the vertical surfaces are given taper for easy removal of the pattern from the mould without damaging the surfaces.
- This taper is known as draft allowance.
- It is expressed in angular measurement or linear form.

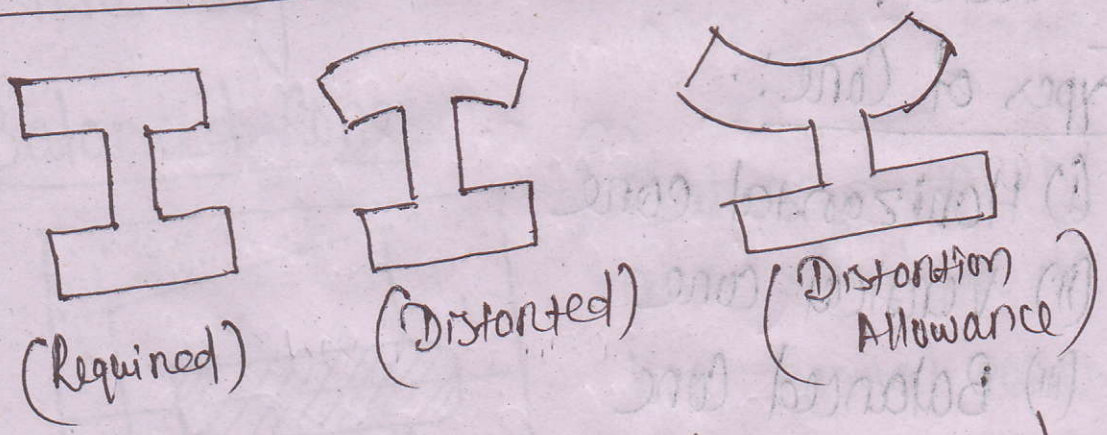
Machining Allowances

- Some portions of a final casting may require machining after solidification.
- For that purpose, some allowance is given to the pattern known as machining allowance.

Shake Allowance

- For easy removal of the pattern from the moulding box, the box is shaken, for which a negative allowance is given to the pattern, to compensate for the enlargement of the cavity.

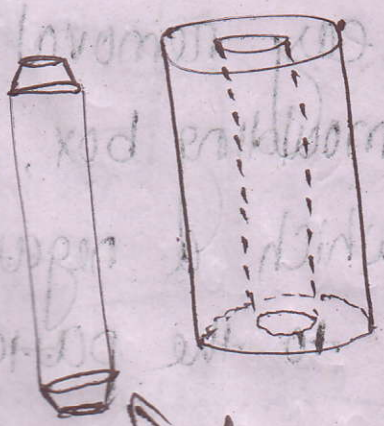
Distortion Allowance :-



- Some castings bend downwards due to the heavy weight of the molten metal.
- To prevent this, the pattern is bent upwards. This allowance is known as distortion allowance.

Cores :-

- Cores are used to make hollow portions in a mould (casting).
- Cores are sand bodies in a mould which are prepared from special sand.

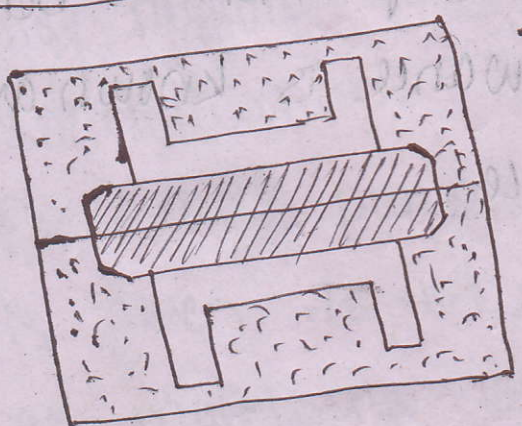


Core

Types of Core :-

(I) Horizontal core
(II) Vertical core
(III) Balanced Core
(IV) Hanging Core
(V) Drop core

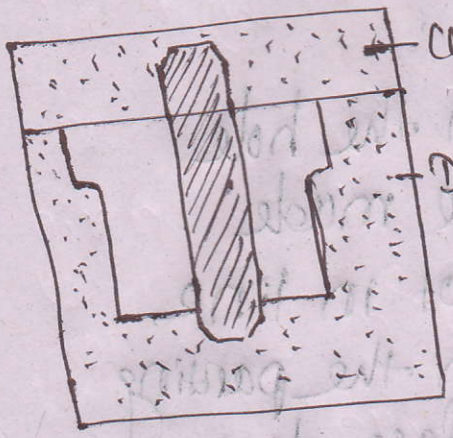
- Horizontal Core :-



- Horizontal cores are used where it is placed horizontally
- It is used for two piece patterns. Half portion remain

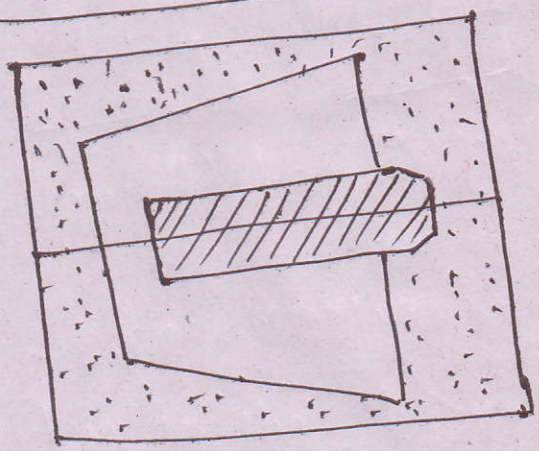
in cope and the other half in drag.

Vertical Core :-



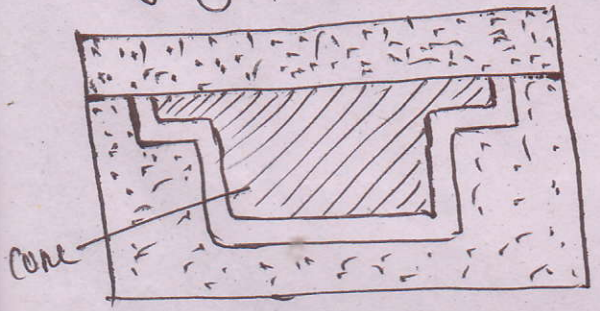
- Vertical cores are used when the hole is required vertically.
- The upper portion is given more taper for easy removal of the cope.

Balanced Core



- Balanced cores are similar to horizontal cores except that they are supported at one end only. These are used for producing blind holes.

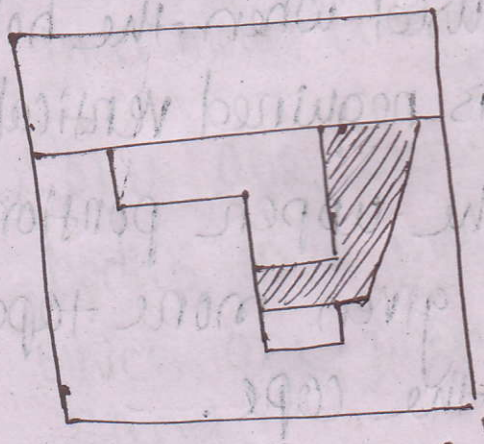
Hanging Core



- Hanging cores are used when the entire core is to be supported from the top.

- It is used where the entire cavity lies in the drag.

Drop Core



- When the hole to be made is not in line with the parting surface, drop cores are used.
- The core lies in either cope or in drag.