

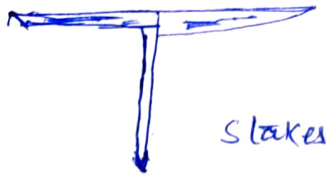
Unit 4

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Sheet Metal work :

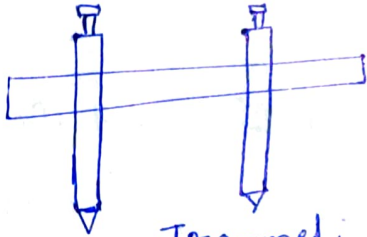
Sheet Metal tools:-

- (1) Punch (2) stakes (3) Mallets (4) wire gauge
(5) Trammel points (6) straight edge (7) set Rules
(8) Hammers, (9) chisel



Stakes

→ These are used for bending or forming sheet metal articles.



Trammel:

→ It is used for scribing arc and circles on sheet metals.



chisel

→ It is used for cutting sheet metals.

Sheet metal machines

1) Shearing machine:- It is used for cutting the metal sheet.

2) Folding machine:- used for bending and folding the edge of the sheet metal.

3) Wiring machine:- It is used to complete the metal edge around the wire after the seat to receive the wire.

4) Turning machine:- It is used to make the round edge for wiring operation.

5) Double Seaming machine:- It is used for double seaming flat bottom on straight cylindrical pieces.

~~Sheet Metals used for sheet~~

Metals used in sheet metal works

1) Black Iron sheet :- It is cheapest, and it has bluish black colour. and it is used to made stove pipes and tanks etc.

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2) Galvanised Iron (GI) sheet :- It is soft steel coated with motted zinc.

The coating resist rust & improve apprea appearance of sheet. It is used to make buckets, furnaces, Cabinets etc.

3) stainless steel :- It is an alloy of steel with coating of nickel, chromium. It has good corrosion resistance property. It is used for kitchen ware, food handling equipments etc.

4) Copper sheet :- Use -> automobiles, domestic, heating appliances.

5) Aluminium -> uses: Airplanes, electrical equipment etc.

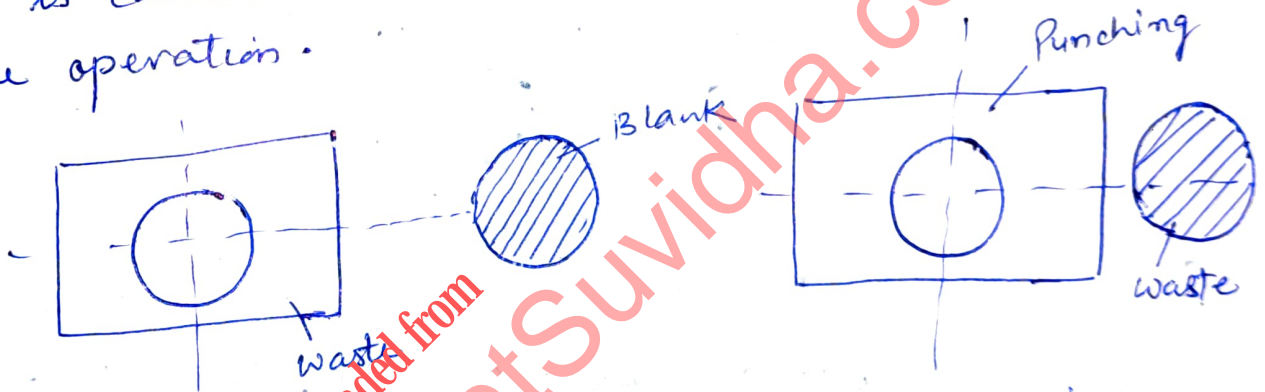
6) Tin plates :- contains, cans, pans etc.

Press working may be defined as a chipless manufacturing process by which various components are made from sheet metals.

Press operation or shearing operation or sheet metal operation

In Press work operation, the workpiece is stressed beyond its ultimate or max. strength.

(a) Blanking :- Blanking is the operation of cutting a flat surface shape from sheet metal. The cut out part is called blank and it is required product of the operation.



(b) Punching :- It is a cutting operation by which various shaped holes are made in sheet metal. The hole is desired product, the material punched out to form the hole is being waste. Hole ^{produce} other than the round shape is known as piercing.

(c) Perforating. This is a process by which multiple holes are which are very small and close together are cut in flat work material.

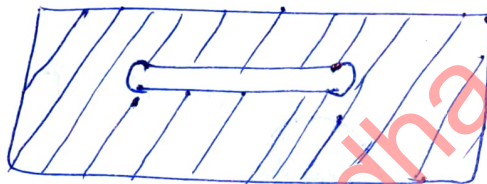
(d) Notching :- This is cutting operation by which metal piece are cut from the edge of a sheet, strip or blank



- * (e) Nibbling: - It is a cutting operation in which simple to complex cutting perform without any special tool. The part is usually moved and guided by hand as the continuously operating punch cut away at the edge of the desired contour.



- (f) Slitting: - It refers to the operation of making incomplete holes in a workpiece.



- (g) Lancing: - This is a cutting in which a hole is partially cut and then one side is bent down to form a sort of tab. Since no metal is actually removed, there will be no scrap.



- (h) Bending: - In this operation, the material in the form of a flat sheet, is uniformly strained around a linear axis which lies in the neutral plane and perpendicular to the lengthwise direction of the sheet of metal.

(i) Drawing :- This is a process of forming a flat workpiece into a hollow shape by means ~~means~~ of punch which cause the blank to flow into a die cavity. (4)

(ii) Trimming :- This operation consist of cutting unwanted excess material from the periphery of a formed component.

(iii) Shaving :- This operation perform to obtain finish and accurate dimension of sheet metal.

(iv) Stamping :- The workpiece obtained after one or more press operation is called metal stamping.

Advantage of stamping :- Small weight of fabricated parts.

- High volume, low cost production.
- Uniformity of parts.
- Less labour consuming.

Method of operation :

1) Simple die :- Simple dies or single action dies perform single operation for each stroke of the press slide.

2) Compound die :- In these dies two or more operations may be performed at ~~same~~ one station.

3) Combination die

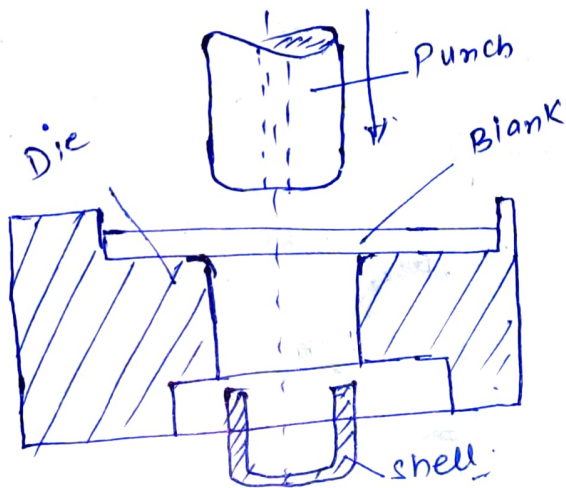
3) Progressive die :- Part requiring multiple operations such as blanking, punching and notching, can be made at high production rate in progressive die. Different operations performed at same station with each stroke of a series of punches.

4) Combination die :- A combination die is same as that of a compound die with difference that there are also included as part of the operation non cutting operations such as bending and forming.

Some other sheet metal operation

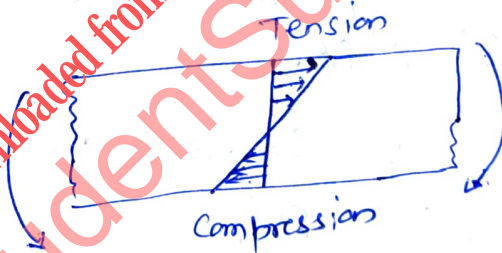
(5)

Drawing :- Drawing is the process of making cup, shells, and similar articles from metal blank.



The punch and die are provided with necessary rounding at the corners to allow for the flow of metal during drawing.

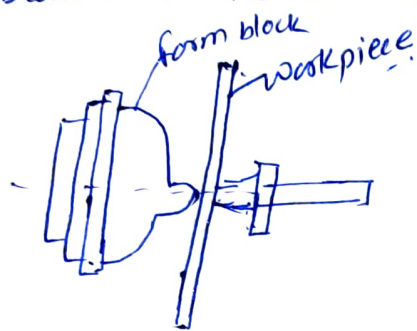
2) Bending :-



Bending refers to the operation of deforming a flat sheet around a straight axis where the neutral plane lies.

Here due to applied forces, the top layer are in tension and bottom layer are in compression. The plane with no stresses is called neutral plane.

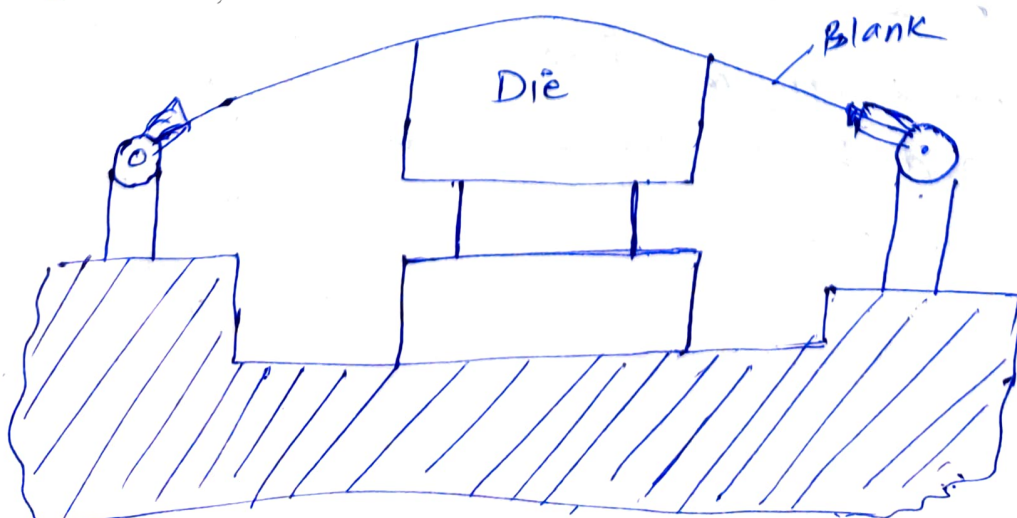
3) Spinning:- Spinning the process used for making cup-shaped articles which are axis-symmetrical. The process of spinning consist of rotating the blank fixed against the form block and then applying a ~~grad~~ gradually moving force on the blank so that the blank takes the shape of the form block.



4) Stretch forming:- In the process, the sheet is held in jaws of hydraulic cylinders and stretched beyond elastic limit.

In stretch forming complete deformation is carried out in plastic state only.

After stretch sheet brought in contact with die so as to give it the shape of the die.



5) Embossing :- Embossing is the operation ⁽⁶⁾ used in making raised figures on sheet with its corresponding relief on the other side.

Coining :- It is closed die forming operation used in minting coins, medal and jewelry. The flow of metal occurs only at the top layers and not the entire volume.

** Clearance in punch & die :-

- In Blanking operation clearance is given to the punch where as die opening size equal to the blank size.
- In punching operation, the clearance is given to the die and punch size equal to the size of the hole.

** Spring back :- Generally all material have some finite elasticity, when these material undergoes plastic deformation, after removing the extra applied load some elastic recovery occurs. Such elastic recovery in press work known as ~~in bending~~

Spring back.

Spring back occurs not only in flat sheets and plate, but also in rod, wire and bar with any cross-section.

PM Product

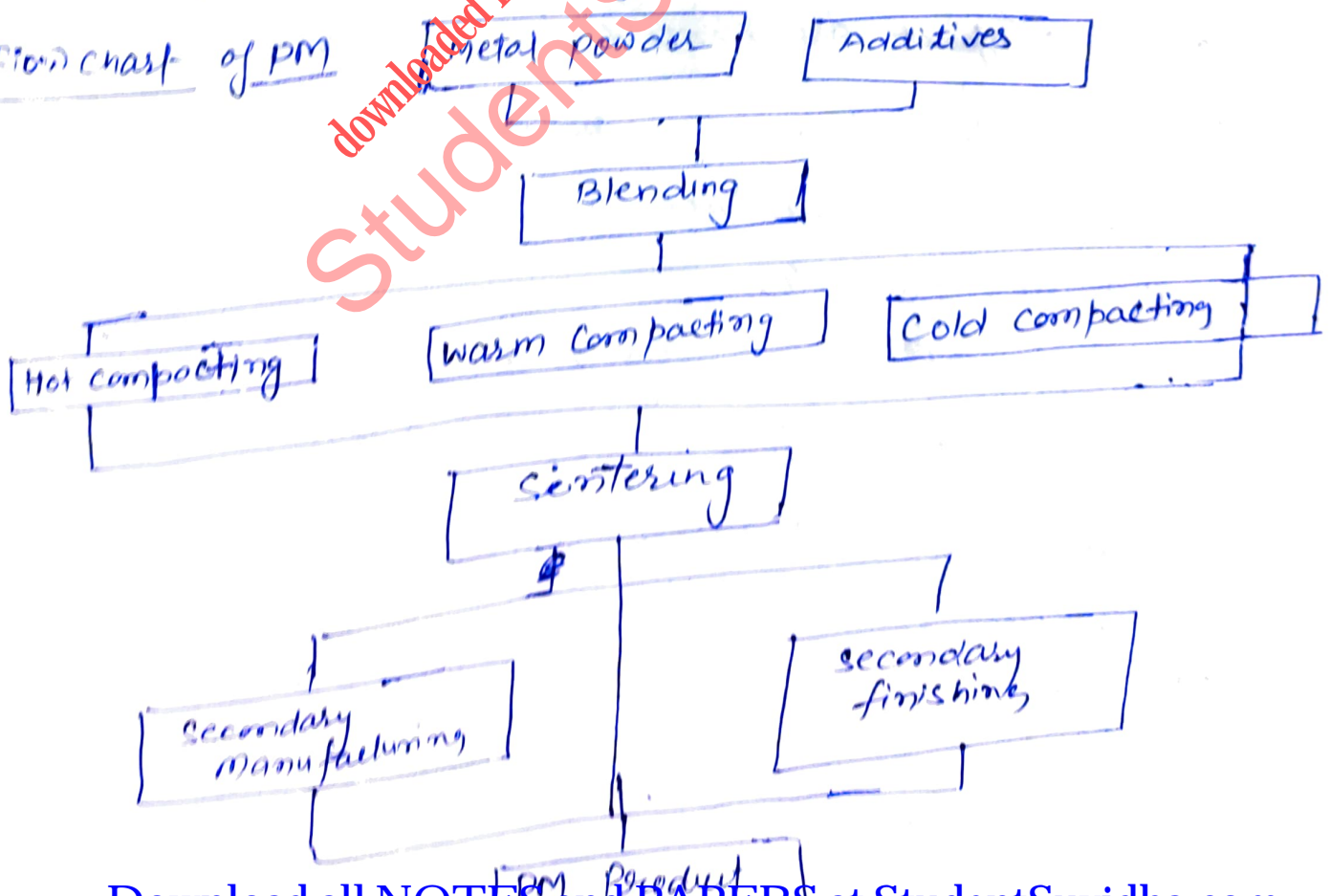
Powder Metallurgy:

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The powder metallurgy (PM) process involves metal or alloy powder to be compacted into desired shape after blending, and then to be heated in a controlled atmosphere at a temperature below their melting point in order to achieve bonding of the particles to get the desired property.

- * PM product does not need any additional machining
- * Raw material not wasted during the processing
- * It is possible to get ^{part with} unique properties.
- * But large parts are very expensive tooling

Flowchart of PM



After the metallic powder production, following steps are:-

- 1) Mixing and Blending :- Blending refers to the mixing of the same metal or alloy powders of different size to reduce the porosity in PM product. The powder are also mixed with other additive to help with the alloying process as well as lubrication. The main function of lubrication is to reduce the friction between the powder and the die walls.
- 2) Compacting :- It is a step in which the blended powder are pressed into shape in die. The pressed powder is known as green compact. It is carried out at room temperature.
- 3) Sintering :- Sintering is the process where by green compact are heated in a controlled atmosphere furnace to a temperature ~~below~~ below the melting point, but sufficient high to allow bonding of the individual particles. Sintering temp^e is generally 70 to 90% of melting temp^r of the melting pt. of metal and alloys.
- 4) Secondary and finishing operation :- It is after sintering to improve property of PM products.

(vi) coining and sizing:- It is done to achieve accuracy and improve mechanical properties

(2)

(ii) forging → To get desired shape.

** (iii) ~~Impa~~ Impregnating - It is done usually by immersing the part in heated oil.

(iv) Infiltration:- The PM component is dipped into a low melting temp^r alloy liquid, such that the liquid would flow into the void simply by capillary action, thus by decreasing the porosity and improving the strength of the component.

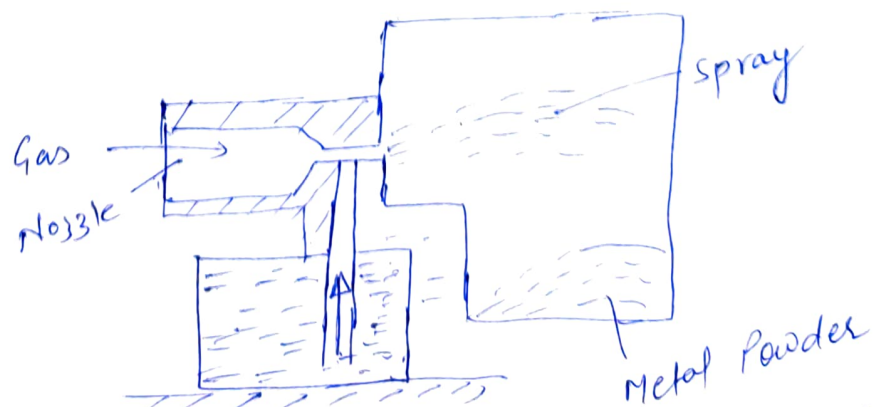
Production of Metallic Powder:-

The properties of PM product depends upon the properties of metal, or alloy powders that were used in its production.

These are the methods used for production of powders.

(1) Solid state Reduction:- In this process, the selected metal/ alloy is crushed, mixed with carbon and passed through a continuous furnace where a reaction takes place.

(2) Atomization:-



Atomization produces a liquid-metal stream by injecting molten metal through a small opening. The stream broken up by jet of inert gas, air or water vapour.

Metal powder ^{are} collected in a box.

③ Electrolysis:— The ^{desired} metal is made as anode in an electrolytic cell, such that it is dissolved by the electrolyte in the cell and then deposited on the cathode in the form of powder. The deposit is removed, to get the metal powder.

Applications of PM:— tiny ball for ball point pen
gear, Cam, bushing, cutting tool
piston ring, hydraulic piston.