UNIT-6

Differenes between hot working and cold working :-

Hot working	Cold working
1. it is carried out above the recrystalisation temp but below the melting point. Hence deformation of metal and recovery takes place simultaneuously	1. it is carried out below the recrystalisation temp. there is no applicable recovery during deformation.
2. no internal or residual stresses developped in the metal.	2. internal and residual stresses are developped.
3.due to recrystalisation and recovery very negligible hardening of metal takes place.	3. since this process is done below the recrystalisation temp. the work is hard.
4. due to high deformation temp is used the stresses required for effecting deformation is less.	4. the stresses required to deformation much higher.
5. hot working retines metal grains resultins is improve the mechanical properties.	5. most of the sold working processes less to distortion of grains.
6. surface finish is poor.	6. surface finish is better.
7. closer dimensional tolerances cannot be maintained.	7. dimensional tolerances can be maintained.
8. promates diffusion of crystalisation alloys.	8. uniformly of materials is lost and the properties are effected.
9.impurities are squeezed into fibers and distributed throughout the mass.	9. there is no such problem.
10. cranks and blow holes are welded.	10. possibility of crank formation and its propagation is great.
11. no need of intermediate annealing.	11. required intermediate annealing.
12.experiment measurements are difficult to make.	12. experiment measurements can be carried out easily in cold rolling.

Cold working:-

1. different effect on the structure properties of the metals.

2. does not produce an applicable ruduction in size and distorli the grain structure.

3.higher pressure is required.

4. recrystalisation does not takes place.

5. its strength and hardness are decreased. This hardness is called strain harding.

6.its extent of cold working depends on ductility.

7.residual stresses are developped which are undesired hence heat treatment is required to restre the metal to original strecture.

Advantages and limitations:-

1. better dimensional control than hot working because reduction size is not much.

2. surface finish of the metal is better because no oxidation takes place during the process.

3. strength and hardness are decreased.

4. it is an ideal method to increase hardness of those metals which donot respond to heat treatment.

5. only ductale metals can be shaped through cold working.

6. over working of metals results in brittleness and it has to be anneal to the same.

7. heat treatment is essential to remove the residual stresses.

Cold working processes :-

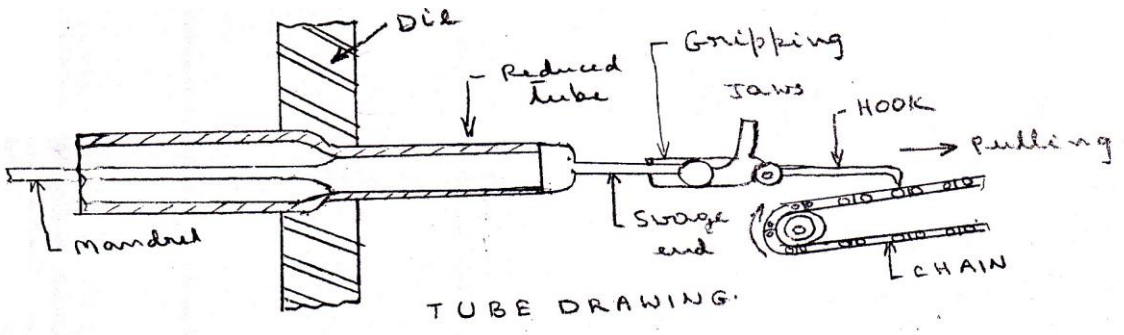
1. cold rolling 2. Cold drawing 3. Cold bending 4. Cold spinning 5. Cold extrusion 6. Cold squezing.

1.cold rolling:-

Cold rolling is done to get a smooth and bright surface finish to the previously hot rolled steel. It is also used to get good surface finish to the rolled components and to improve toughness and hardness. Bars, rods, sheets, plates and wire are cold rolled.

The hot rolled anticles are first in mersed in a wease solution of H_2So_4 to removes coles and woshed in woter and then dried. This procedure of cleaning the articles is known as pickling. The cleaned articles are passed through rolling mills which are similar to that used in hot rolles mills.

2. cold drawing :-

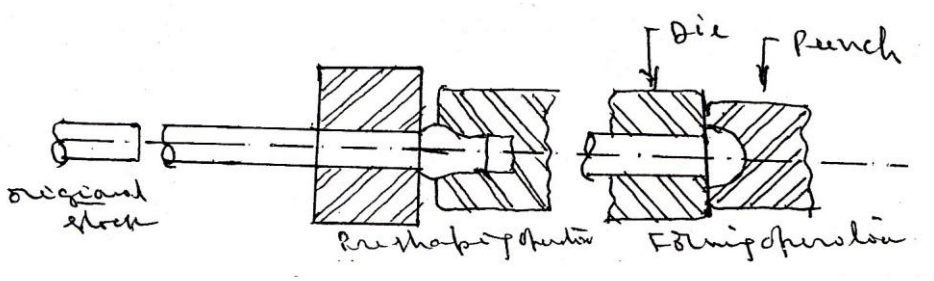


Seamless welded tubes produced by hot working are further cold drawn to attain good surface finish, better dimensional accuracy and inprove mechanical properties. Cold drawn tubes are much bore than hot drawn tubes. The hot drawn tubes are pickled and washed before being put to cold drawing to clean thin surfaces from scoles.

The drawing equipment consists of a draw bench and a die. The end of the tube reduced in dia. By suraging operotion, by passing through the die, is grippped by the jaws of the carriage to the chain of the drawn bench.

The other side of the tube is gripped in tongs. The tube is pulled through the die over a fixed mandrel. The out side die meter of tube is contrelled by opening of dies ans the inside is contrued by mandrel.

Cold squeezing:-



It is a quich forming process. Squeezing, cold heading, thread rolling and shot peaning will come under cold squeezing.

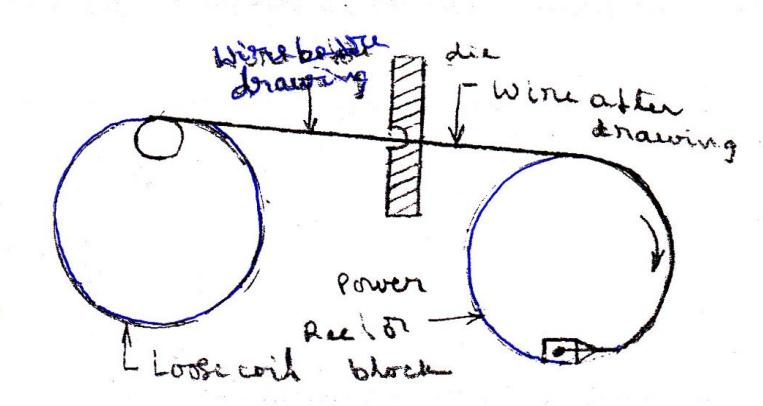
Cold heading:-

It is extensively used for making bolts, rivets and other similar parts. Thus is done on a cold header m/c. dies are used to get the required shape by forming. The rod is fed in to the m/c upto stops through straightening rolls, cut to size and pushed into the header die. The rod is gripped in the die and punch twice or thice by appling pressure and forme the heoel. It is repositioed in angther die, for final shaped and sizing . thread rolling is done to cut threads.

Thread rolling :-

Thread rolling is a mass production process to produce external threads by squezing action without machinis. The die consists of plane threads rolls on their faces straight projections flutes having the profile are pitch of the thread are the desined helix angle of the screw. The blance where threads are to be formed held between the dies. Resulting the displacement of metal from the regian be pitch circle are thus the threads are formed as sume blansh.

Wire drawing :-

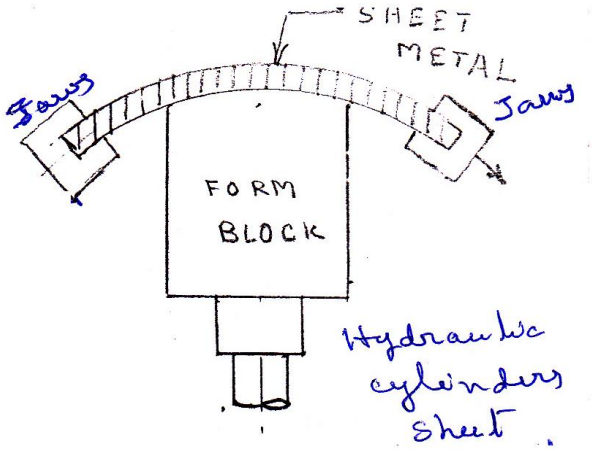


The cross section of a conical drawing die is shown in figure. The entrace of the die is shaped so that the wire entering the die will draw lubricant with it. The shaped of the die causes the hydrostatic pressure to increase and promotes the flow of lubricant into the die.

The approach angle is the section of the die where the actual reduction in diameter occures. The half die angle is an improtant process parameter. The bearing region does not cause reduction, but it does produce a frictional drag on the wire. The chief funtion of the bearing region is to permit the conical approach surface to be refinished without changing the dimensions of the die exit.

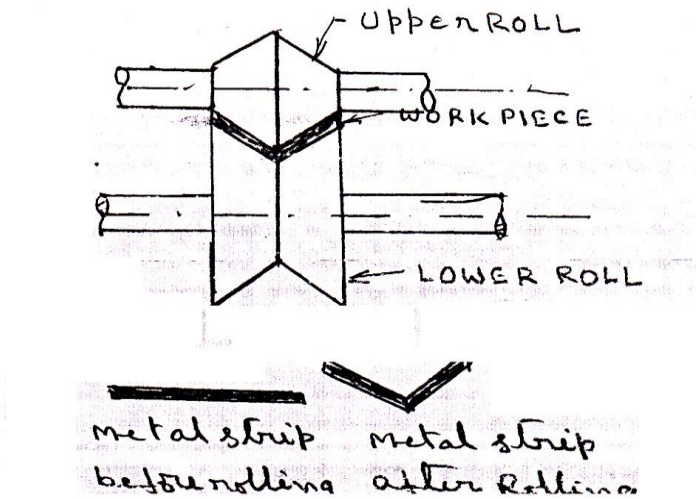
The back relief allows the metal to expand slightly as the wire leaves the die. It also minimizes the possibility of abrasion taking place. If the drawing stops or the die is misaligned. Most drawing dies are cemented carbide or industrial diamond. The die nib is encased for protection in a thick steel casting.

Strech forming:-



The process is used for curved cantour parts having double curvature on the same surface. The two ends of the metal sheets are firmly gripped by the two jaws which are openoted by hydraulic cylinders. The two edges are stretched by the jaws, by placing the metal over a fixed form blach.

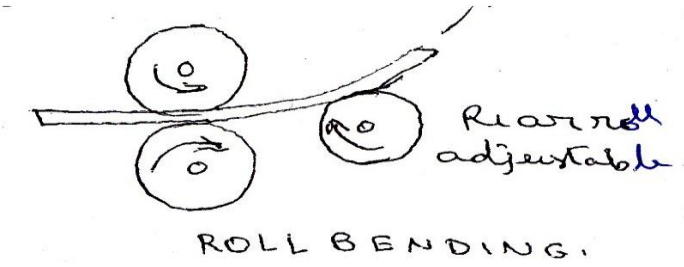
Cold bending :-



In this process straight length is transformed into a curved length by this process the sheets may be transformed into curved channels, bars, rods, wires, tubes and sheets metal are bent to many shapes in cold condition thriugh dies.

Flat metal strip is fed length wire between one or more pairs or mating forming rolls. The sepairs of rolls are mounted on stauls in a straight line lisea a cantinuous rolling mill. The pairs of forming rolls straight section in to cold rolling forming.

Cold bending:-



ROLL BENDING.

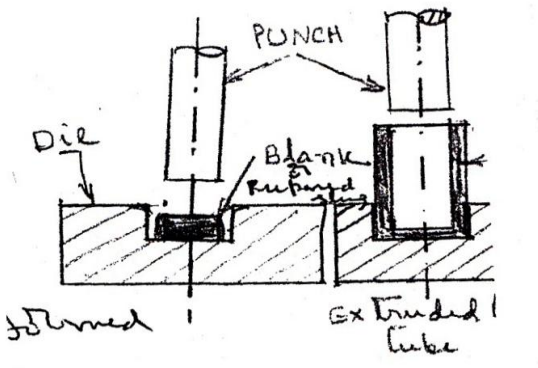
By this methods metal plates and strips are bend to cylindrical shapes. This m/c is made up of three rolls of the same dies two of them being held in a fixed position and one being adjustable. As the metal plate enters and goes through the rolls, the final diameters is deter mined by the position of the adjustable roll. The adjustable rolles closer the smaller will be the diameter.

Cold spinning:-

It is operation of shaping very thin metal by pressing it against a form while it is rotating. The process cold spinning is similar to hot spinning except the metal is worked at room temp.

Aluminium and other soft metals are best suited for cold spinning. The commanly used spun articles made of minimum are colling utusils, liquid container, light retlcetory etc. non- ferrous metals are spun in to tyhicol shapes.

Cold extrusion :-



It is similar to hot extrusion. Impact cold extrusion is commanly used. This operation is performed with the help of a punch and a die. The raw material cold extrusion used in slug form having been turned from a bar or punched out of strip. The prepared slug is placed in die. The punch is struck from top by a punch operating at high pressure and speed.

This process is limited to soft metals like lead, tin, aluminium, zine, and some other soft alloys. The etrems produced by other items which can be made by impact extrusion.

Types of presses :-

Presses may be classified as :

(a) manually operated (fly press)

(b) power operated presses.

Power presses may further be classified as follows

1. on the basis of source of power using

(i) electric motor (ii) pneumatic system (iii) hydraulicsystem

2. on the basis of design of press frame.

(i) inclined (ii) inclin able (iii) gap (iv) arch (v) straight side (vi) horm.

3.on the basis of drive mechanism:

(i) crank (ii) eccentric (iii) rack and gear (iv) hydroulic (v) knecckle joint (vi) toggle drive (vii) screw.

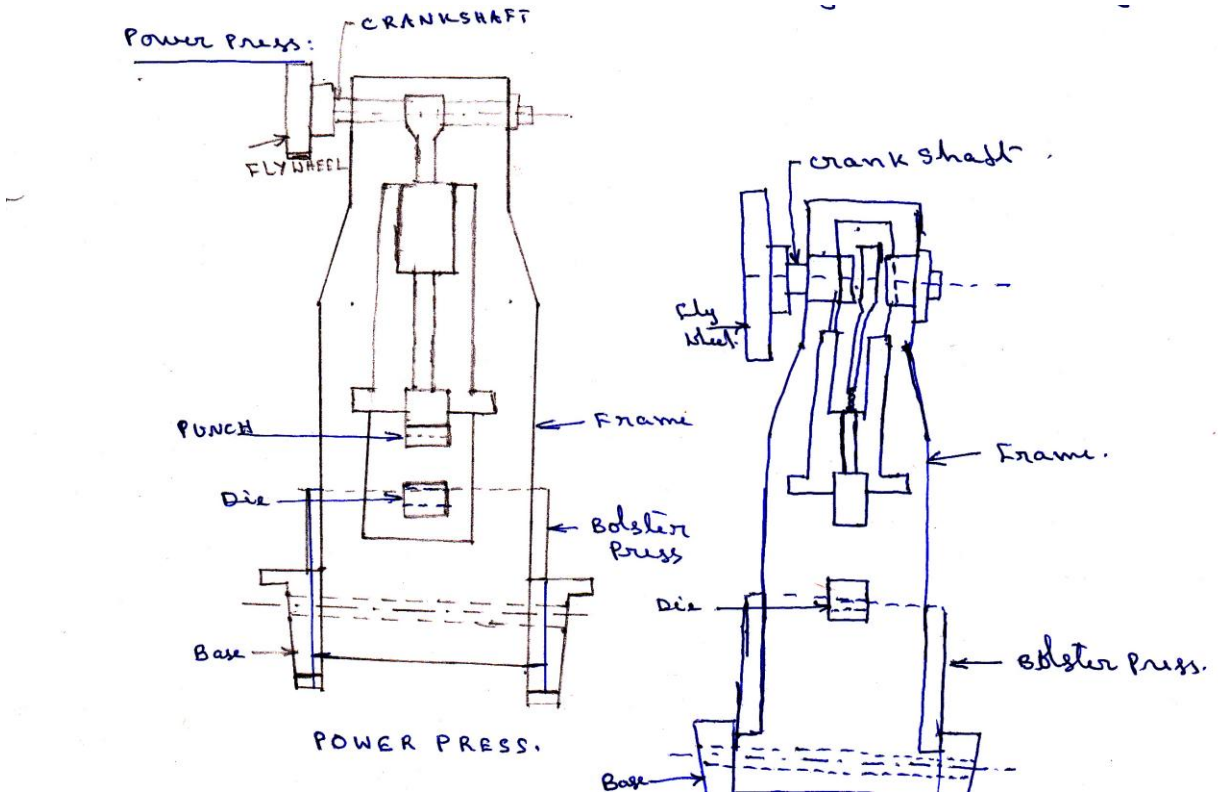
4. on the basis of no of slides :

(i) single acting press (using gone slide only) (ii) double action presses (iii) trible action presses.

5. on the basis of the intended use of the press :

(i) shearing press (ii) brake press (iii) punching (iv) straightening (v) coining (vi) transter (vii) stretching (viii) extruding.

Power press:-



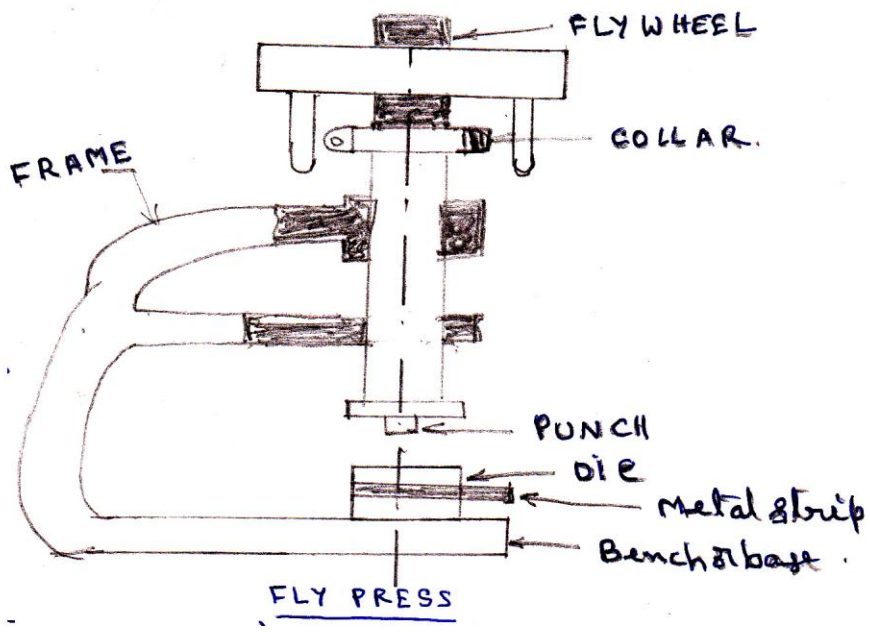
Different types of presses used is sheet metal are

(1)fly press (2)power press (3)gap press (4)horn press (5)pillar press (6)adjustable press

The working of power press is similar to fly press,but the hand. Apuding the type of working mechanism, power press are classified as mechanical pressed and hydraulic press. The mechanical press operated by crank and connecting rod mechanism . To the end of ram, a punch is fixed and die is attached to the bolster plate. The crank shaft is drives the fly wheel which stores the energy and supplies a constant speed to ram where the steel metal is pressed between die and punch.

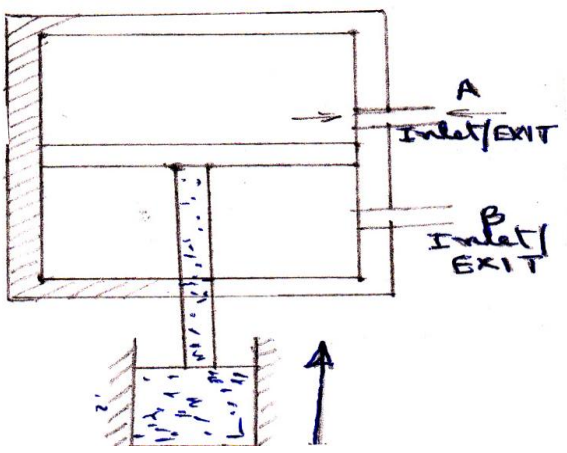
FLY PRESS:-

HYDRALLIC PRESS:-



It consists of a piston of a cylinder assembly in to which compressed liquid is passed which helps in sliding action.

Construction: press consists of a cylinder and piston ram is attached to a piston with the help of piston rod. Cylinder has two opening through which liquid is supplied and also made to come out as shown.



Working:-

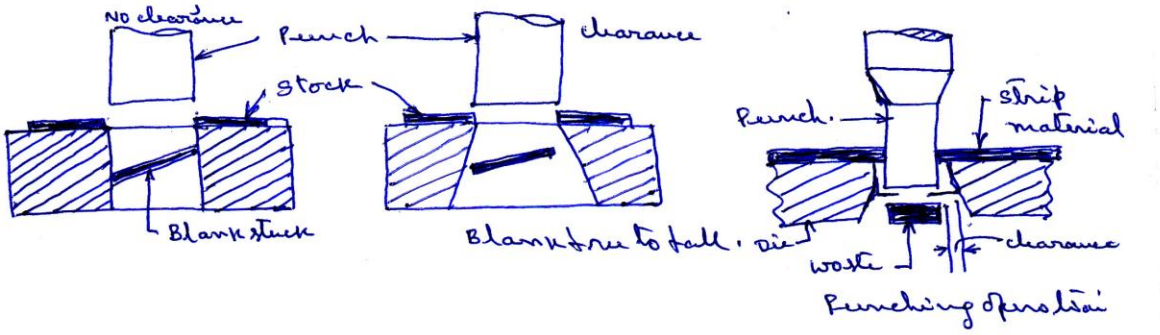
let the piston be at BDC initially now

1. Liquid is compressed and forced through the inlet B.
2. As the liquid below the piston in croses the piston reaches TDC.
3. A long with the piston ram is also made to raise as the piston and ram are inter connected.
4. Liquid is now forced through inlet 'A' which forces the piston down at the same time ram moves down and liquid below the piston goes out through outlet 'B'.

Advantages of hydraulic press:-

1. Smooth working and noise less.
2. No vibrations to m/c.
3. Wear and tear mechanical parts are nill.
4. Possible to give high pressure to ram.
5. No.of strocks per minute are high.

BLANKING:-



Blanking is the operations of cutting a shape ram a metal strip. The piece detached ram strip is know as blank and is used for further operations the remaing metal is scrop. Work beaing per formed at one stroke of the press.

A blanking die must have clearance other wise the blank may stroke.

Punching:-

BLANKING AND PUNCHING IS ALSO BASIC DIE CUTTING OPERATION.
PUNCHING IS THE CUTTING OF A SLAG from the metal to produce a hole. The metal with the hole is the required product and the slag is waste.
In blanking blank is the useful product where as in punching the left out strip is waste.

PIERCING:-

PIERCING is a punching operation .piercing is a pointed hole making process characterized by the scrop from the hole. In piercing process pointed bullet shaped punch is forced through the sheet metal to produce a hole with a rough flange around the hole.

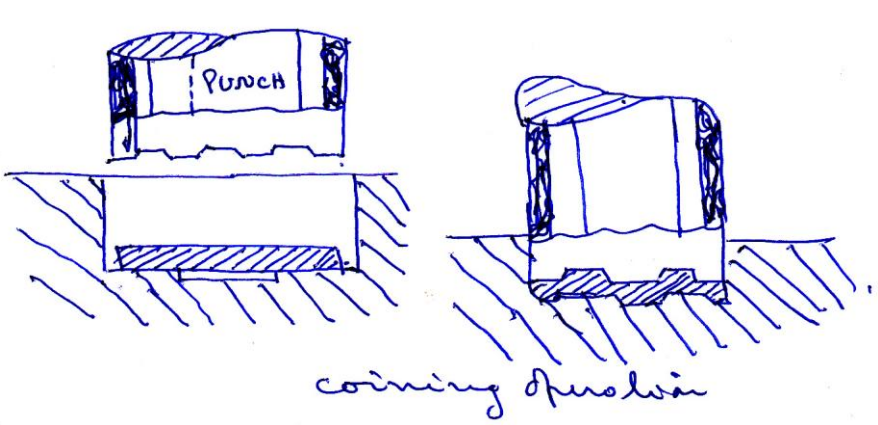
FORMING:-

It is a metal working process in which the shape of the die is directly reproduced in the metalwith little orno metal flow.

The purpose of forming:-

(1).to strengthen the edges of the part and add rigidity.
(2).to remove shape edges produced during the cutting operation.
(3).to incrose sale appeal or apperance.

Couning:-



It is a closed die squerzing (cold forging)operation is which all surface of the work are continued or restrained.

Shallo configurations on the surfaces of that objects such as coins ,badges or metals are produced by this method

Since coining requires very robust tools and the use of a powerful press , the processes is limited to fairly soft alloys

In coining method thickness is changed depends on the internal stracture of the work piece . A closed die is used to continue the method. The work piece will be an accuarate reproduction of the die cavity

STRAIN HEADING:-

It is a phenomenon that results is all increase air strength and hardness of a metal subjected to placti deformation (cold worming) at a temp. lower than its

1. Strain hardening reduce ductility and plasticity
2. all cold worked parts get strain hardened during one or two initial operations and is further cold working is continued part may get erased and fail
3. Components require more operations for during processed need be subjected to enabling after every or two cold working operation to restore there destility further cold working

CUTTING FORCES:-

The formulae for calculating the force required to cut sheet metal in a die are as follows

General formulae, $F=S\times P\times T$

For rectangular cuts, $F=S\times 2(L+W)\times T$

For circular cuts, $F=S\times PI\times D\times T$

Where F is the cutting force, KG

S is the shear strength

T is the thickness of the shat metal

P is the perimeter of cut, CM

L is the length of the cut, CM

W is the width of the cut, CM

D is the diameter of cut

EX:-

A 25 MM square hole is to be cut in sheet metal 0.75 MM thick .the shear strength of the material is 2860 KG/ CM2. Calculate the cutting force.

$F=S\times(L+W)\times T$

$=2860\times 2(25+25)\times(0.75/10)$ KGS

$=2145$ KGS.

The cutting force may be reduced to 50% approximately by grinding the force of the punch or die at a small shear angle there by reducing the area in shear at any one time.

NIBBING:-

operation used for only small quantities of components which is designed for cutting out flat parts from shear metal . The flat parts range from simple to complex contours. This operation is substuted for blanking . This part is usually moved and guided by hand as the continuousely operated punch cuts away at the edge of the desired contour.

DISTINGUISH B/W OPEN FRAME AND CLOSED FRAME:-

OPEN FRAME:-

1. Open denoted C shaped process are available in their as rigid or inclinable.
2. Open fronted frames provide adequate working clearance for the tools.
3. Open fronted frames press may be approached from three sides.
4. It is generally consists of a single column at the back of work table.
5. Open frame facilitates ejecting of finished parts by gravity.
6. Open frame press equipped with mechanical feeds for rapid automatic production and frame is in over hang position.
7. Open frame press suited for blanking, piereing and shallow drawing operations.
8. Open frame press is suited for production of small and medium size parts.

CLOSED FRAME:-

1. Closed frame process are available in fabricoatedstrees control form.

2. Closed frame process do not provide much clearance for the tools.

3. Closed frame press not permitted to approach from all sides at a time.
4. It consists of double column at the sides of work table.
5. Closed frame press not familor for gravity ejecting parts.
6. Closed frame press is a rigid gap frame press in which single piece feeding is allowed.
7. Closed frame press suited for bending , stamping operations.
8. Closed frame press suited for production of large size parts.

plastics

Processing of plastics- Types of plastics-properties- Applications & their processing methods & equipment (Blow & injection moulding):-

1. Thermosetting resins
2. Thermo plastic resins

Plastic mouldings are highly economical since machining, fitting, assembling & finishing operations can be minimized or eliminated.

Plastics are strong, light, highly dielectric, workable, corrosive & chemical resistant & durable.

CONCEPT:-

i Plastics are moldable organic resins.
ii Plastics consists of large molecules.
iii Plastics are synthetic resins.
iv Plastics generally are organic high polymers.
v Plastics are very attractive organic engineering materials & find extensive applications in industries such as automotive, electrical appliances, communication & house hold goods.

TYPES OF PLASTICS:

i Thermo setting resins:
   1 Phenol-formaldehyde resins.
   2 Urea-formaldehyde resins.
   3 Melamine-formaldehyde resins.
   4 Polyster resins.
   5 Epoxy resins.
   6 Silicon resins.

ii Thermo plastic, amorphous:
   1 Polystyrene.
   2 A.B.S (acrylonitrite- butadiene- styrene).

3 Methacrylate.
4 P.V.C (poly vinyl chloride).
5 Poly carbonate.
6 Polychloroacetal.
7 Fluorinated polymers.....etc.

iii Thermo plastic, crystalline:

1 Polyethylene.
2 Poly propylene.
3 Polyamides.
4 Polyacetal.....etc.

THERMO SETTING RESINS:-

By the application of heat & pressure required for forming, change into a hard & rigid substance. Once done cannot be softened by the application of heat.

The reason for the above phenomenon is that the thermo setting plastics consists of linear, relatively low molecular weight thermo plastic polymer chains with cross links which bond the chains together with primary valence bonds. Such three dimensional polymers, once cross linked, will not soften when heated (but may decompose – dis ritegrate at high temp.) because this process is an irreversible chemical reaction & the entire structure becomes essentially a single molecule.

Thermo plastic resins can be resoftened & remolded by application of heat & pressure. They are composed of linear or long chain molecules.

Properties of plastics:

1 They are less brittle than glass, yet they can be made equally transparent & smooth.
2 They are light in weight & at the same time posses good strength & rigidity.
3 They possess good toughness.
4 Their high dielectric strength makes them suitable for electric insulation.
5 They resist corrosion & the action of chemicals.
6 Wrappers & bags can be mass produced.
7 Low moisture absorption.
8 Can be easily molded to desired shapes.
9 Ability to resist weather changes.
10 Colorability.

11 Heat resistance.

12 Deformability.

13 Damping characteristics.

Thermo setting resins	Thermo plastic resins
1. Ones hardened & set, they do not soften with the application of heat & pressure.	1 They can be repeatedly softened by heat & hardened by cooling.
2. They are more harder & stronger than thermo plastic resins.	2 Comparatively softer & less strong.
3. Objects made by this process can be used at comparitively higher temp. without damage.	**3** Cannot be used at comparatively higher temps. As they will tend to soften under heat
4. They are usually supplied in monometric or partially polymerized form in which they are either liquids or partially thermo plasic solids.	**4** They are usually supplied as granular material.
5. Applications: Telephone receivers, electric plugs, radio TV cabinets, camera bodies, automobile parts, circuit breaker switch panels.	**5 Applications:** Toys, combs, toilet goods, photographic films, insulating tapes, hoses, electric insulation.....etc

Forming & fabricating:-

1 Thermo setting plastics can be formed by

i Compression or transfer molding.

ii Casting.

2 Thermo plastics can be formed by

i Injection molding

ii Blow molding

iii Extrusion.

iv Calendaring.

v Thermo forming.

vi Casting.

Thermo setting plastics can be joined with the help of

i Mechanical fasteners.

ii Adhesive bonding.

Thermo plastics can be joined with the help of

i Solvents.

ii Welding.

iii Mechanical fasteners.

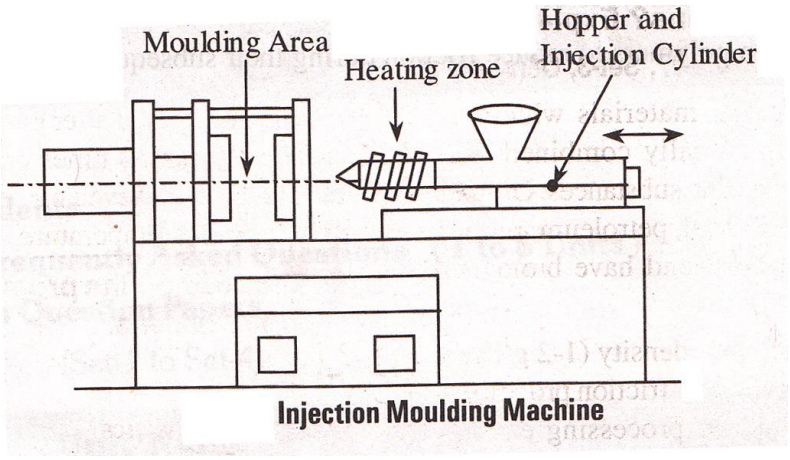
iv Adhesive bonding.

v

Injection moulding:-

It is successful and widely used method for moulding thermo plastics granulated material is fed from a hopper, in measured amounts, to the heating chamber where it attains a fluid consistency. The softened plastic is then injected in to the dies by means of a plunger (or screw). These dies are water cooled to solidify the molten plastic material into final shape. Pressure on the material is maintained until it has solidified.

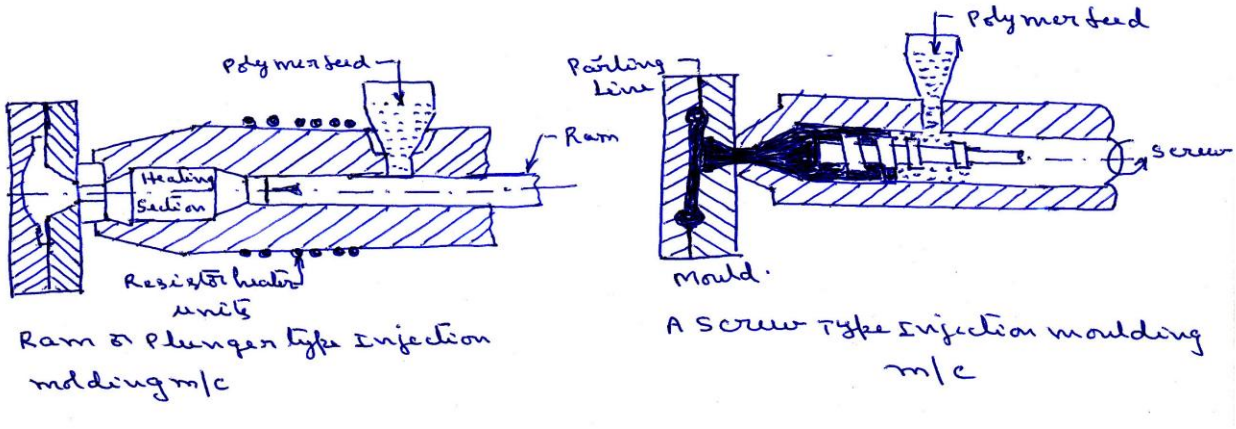
After a short cooling period, the dies open and eject the completed solidified piece.



Injection Moulding Machine

Temp of the heating section – 150-300

Molding pressure 100N/mm2-150N/mm2



Advantages:-

1.less material loss, gates and runners can be reused .

2. high thermal efficiency , the heating chamber and mold remains at constant temperature.

3. Fast manufacturing ratio.

4.wide range of shapes and plastic materials can be moulded.

5.large number of accurate parts can be produced automatically or manually.

6. More than one material may be used at the same time when utilizing co-Injection Molding.

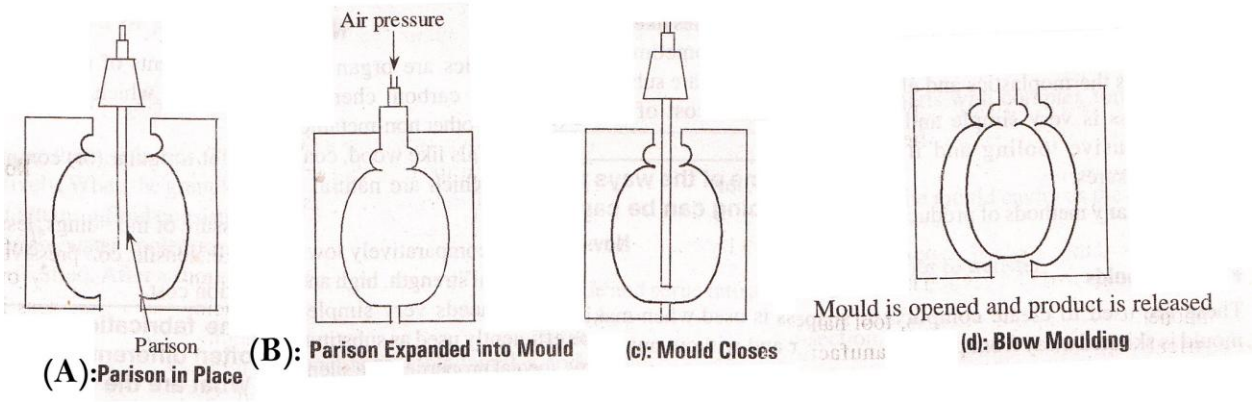
Disadvantages:-

The molding process has several disadvantages to other molding processes. The following is a short list of some of the disadvantages to Injection Molding.

1. This is not a preferred method of manufacturing for short production runs. This is mainly due to the cost of tooling and the cost of operation. However B.J. Molding can handle smaller runs than most shops.

2. Design and development of parts that will work well with Injection Molding often takes a very long time. Many parts are just not suited to the process.

Blow moulding:-



1. it is used for making plastic bottles, toys, doll bodies and so many items.

2. the blow moulding commences with the extrusion of the(heated) tubular piece of plastic, know as parison, which transferred to the two piece mold.

3. the parison is gripped in the two piece mold and its bottom end is sealed.

4. air is injected into the parison to force the plastic against the walls of the water cooled mold. Air pressure ranges from 0.7 to 10 Kg/cm2

5.as the parts thus formed, cools the mould is opened and the part is removed.

Advantages:-

1.parts of re entrant curves (i.e., the walls are designed, which turn inwards and towards the centre).

2. components of complex shapes can be made.

3.due low pressure of mouldings, less internal stresses are formed(i.e., tensile, compressive etc).

4.low production cost.

Processing of plastics:-

The polymers and additives (like stabilizers and plasticizers, colorants, lubricants, fillers which may be solids or liquids of varying viscosity) are mixed in rotating drum with stirring arrangement (for power and low viscosity plastic) are in blenders with heating and cooling provisions and compounded in heated roll mills. In the case of thermosetting plastics, hardness catalyst fillers and reinforces are also added after milling, mixing and compounding the linear polymers and additives.

Fillers :-

Fillers are used to improve mechanical strength, stiffness, electrical resistance and thermal resistance of the final plastic product. It is also used to reduce material cost. A filler which is the increases the mechanical strength is called as a reinforcing filler.

Commonly used fillers are wood flour, cellulose, cotton flock, silica sand, powdered metal, paper, mica.

Wood flour is a general purpose filler which lowers the cost and also improve the strength of the plastics. Mica also imparts electrical properties to plastics and results in low moisture adsorption. Some other materials link fabric, chipped-wool, moulding compound wood vanear, textile or glass fibres are used as filler materials.

Stabilizers:-

These are used to improve the thermal stability during processing that is to prevent the deterioration of plastics due to the action of the light and heat. For example, zinc soap is used to vinyls and phenyls to the styrenes.

Plasticizers:-

Plasticizers are liquids of high boiling point and low molecular weight which are added to improve the plastic behaviour of the polymers. The plasticizers are added to plastics to make them soft, to improve toughness and flexibility of final product. These added plasticizers separate the macromolecules and descreses the intermolecular forces and there by providing relative movements between the molecules of the polymer. These plasticizers are generally oily in nature. The commonly used plasticizers are camphor, paraffins, napthalene, phosphates, organic solvents, resin and water.

Catalysts:-

The catalyst in each compound serves as the reaction controller with the type and quantity of catalyst acting to either accelerate or inhibit the curing rate in both the production and the moulding phase.

Solvents:-

Solvents are used for dissolving plasticizers or fillers and to improve the flowability of the plastic in the mould during manufacturing. For example, alcohol is added in cellulose nitrate plastics to dissolve camphor.