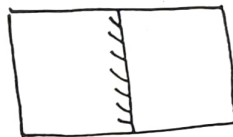
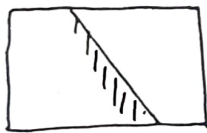


4 Metal Operations :-

(9)

Shearing → The term shearing means cutting of sheet metal by two parallel cutting edges moving in opposite directions manually. Shearing is done by hand shears or snips or by means of machines. Shearing action has three basic stages: Plastic deformation, fracture and shear. When the metal is placed between the upper and lower blades of the shear and pressure is applied, first plastic deformation takes place. Then there is fracture and finally shearing takes place when further pressure is applied.

The selection of particular method and means of cutting depends upon several factors like thickness of sheet metal, sizes of blanks to be cut, amount of cutting required, type of production etc.



Shearing

The some of the basic shearing operations are -

- | | |
|-----------------|-----------------|
| (i) Cutting off | (v) Notching |
| (ii) Parting | (vi) Slitting |
| (iii) Blanking | (vii) Lancing |
| (iv) Punching | (viii) Nibbling |
| | (ix) Trimming |

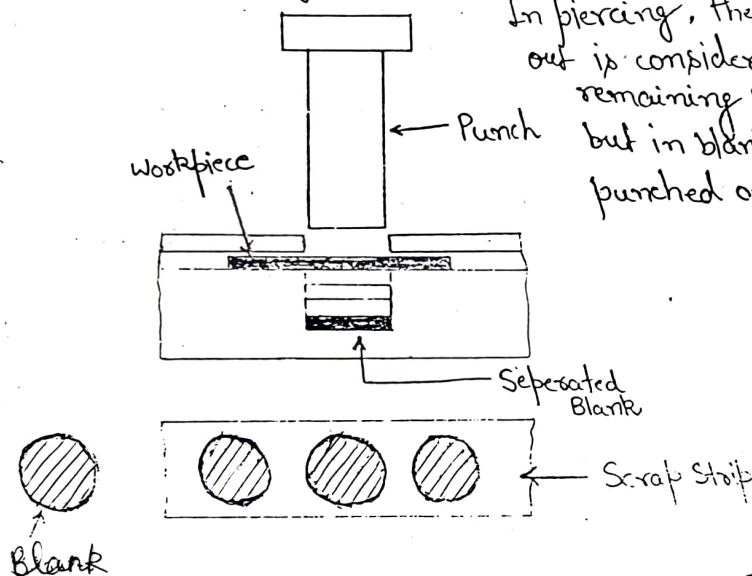
(10)

2) Blanking → Blanking is an operation in which the objective is to obtain a blank from the sheet. In this the required size of sheet metal is removed or sheared from blank sheet. The hole removed in this process is the product and the sheet (blank) is waste.

Blanking consists of cutting the outside contour of stampings on the press. Depending upon the size of the blank, thickness of the material and rate of production, different types of presses are used for blanking operations. This cutting of the outside contours is blanking.

Blanking differs from piercing in the end result part.

In piercing, the piece being punched out is considered waste and the remaining part is the workpiece, but in blanking the piece being punched out becomes the workpiece.



Blanking

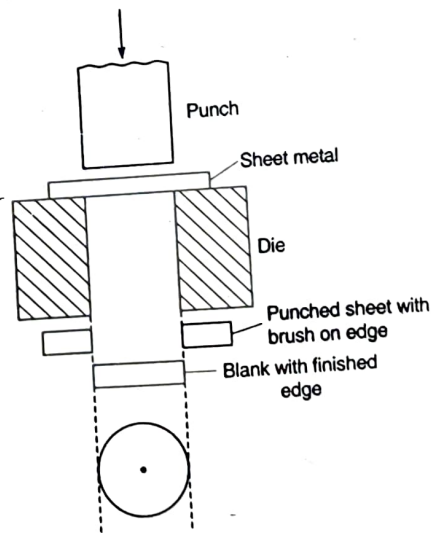
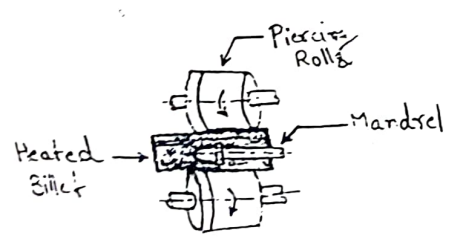


Fig. 8.12 Blanking

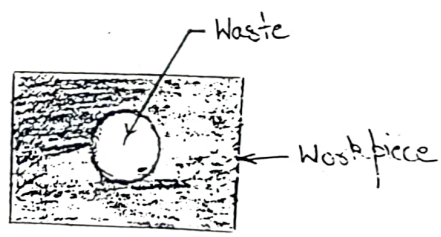
Piercing → It is the process of generating a hole in the sheet metal, thus the hole generated in the blank is a product. In this obtaining a hole in a blank is a objective. It can be obtained by die and a punch mechanism.

Piercing is employed to produce seamless tubing, which is popular and economical raw stock for machining because it saves drilling and boring of parts. In this process, a heated cylindrical billet (heated to about 1100°C) is passed between two conical-shaped piercing rolls which impart axial as well as rolling movement to the billet. The size and shape is controlled by the piercing mandrel. The first pass makes a rather thick-walled tube which is reduced to required dimensions after further operations. The tube is then passed through a rolling machine which helps in straightening and sizing to the final dimensions.

Piercing differs from blanking in the end result part. In blanking, the piece being punched out becomes the workpiece and the remaining part is treated as waste. But, in piercing the punched out part is considered waste and the remaining part is the workpiece.



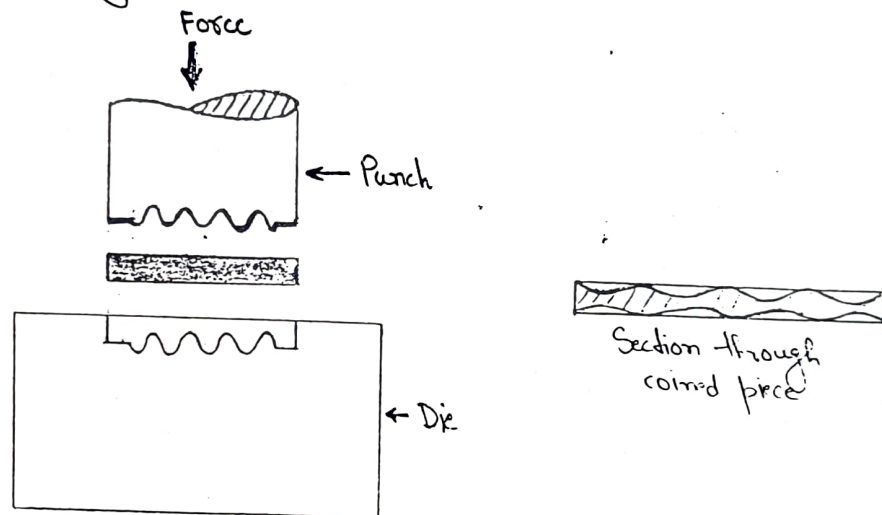
Piercing operation



Piercing

4) Coining → Coining is a closed-die forging operation performed by die and punch at room temperature. The metal is confined in the die and its lateral flow is prevented. The process is used in minting coins, medals, jewellery and other products where exact size and fine details are required. A single impact on the punch produces the desired design on each side of the piece.

In this process metal slug is placed in the die and a heavy pressure is applied by the punch. The metal flows plastically and is squeezed to the shape between punch and die. The process on account of the very high pressure required, can be employed only for soft metals with high plasticity.



Coining operation

5) Drawing → Drawing is a plastic deformation process and is used mainly for reducing the diameter of bars, wires or tubes by pulling them through a die. It can be used both hot and cold forms.

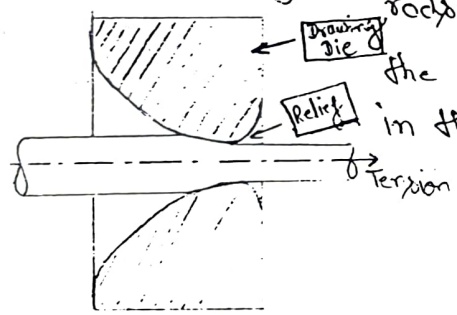
The process involves the forcing of metal through a die by means of a tensile force applied to the exit side of the die. Most of the plastic flow is caused by the compressive force which arises from the reaction of the metal with the die.

Usually the metal has a circular symmetry, but this is not always required.

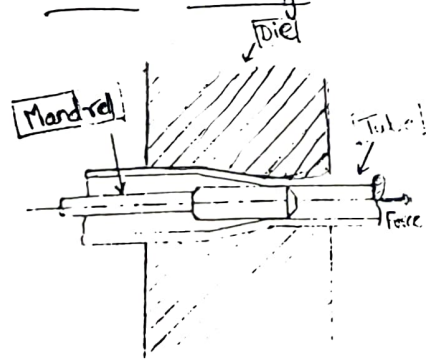
Rods, tubes and extrusions are often given a cold-finishing operation to reduce the size, increase the strength, improve the finish, and provide better accuracy.

Drawing can be categorised into different forms i.e. wire drawing, tube drawing and deep drawing.

• Wire Drawing :- The process of wire drawing is to obtain wires from rods of bigger diameter through a die. It involves reducing the cross-section and increasing the length of the metal in the shape of a bar or a wire.



• Tube Drawing :- The process of tube drawing is to produce tubes having smaller diameters or thinner walls that can be obtained by hot rolling. This is used to get dimensional accuracy, smooth surface and improved physical properties of tubes already made by hot rolling process.



(14)

6) Deep Drawing → Many parts made of sheet metal are cylindrical or box-shaped, for example, pots and pans, containers for food and beverages, kitchen sinks and automotive fuel tanks. Such parts are usually made by a process in which a punch forces a flat sheet-metal blank into a die cavity, the process is called deep drawing. On account of its capability of producing deep parts, it is also used to make parts that are shallow or have moderate depth, and the depth produced is usually more than the diameter. Deep drawing is also known as cup or radial drawing because of its ability to produce cup shaped products.

In this process, a flat sheet metal blank is kept under a blankholder is forced into a die cavity by means of a punch. The force on blankholder should be such that it allows material to slide into die cavity, but must be great enough to prevent wrinkling of the sheet as it is drawn in.

Wrinkling can be reduced or eliminated if a blankholder is kept under the effect of a certain force. The force on the blank is given through the punch. The punch transmits the force through the walls of the cup as the flange being drawn into the die cavity. As the punch forms the cup, the amount of material in the flange decreases. In order to improve performance the magnitude of this force can be controlled as a function of punch travel.

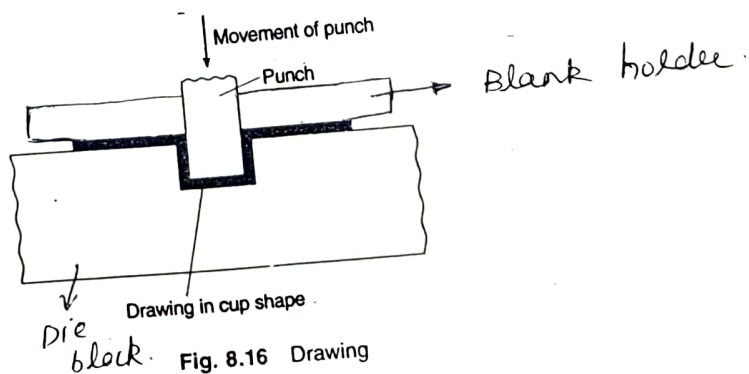
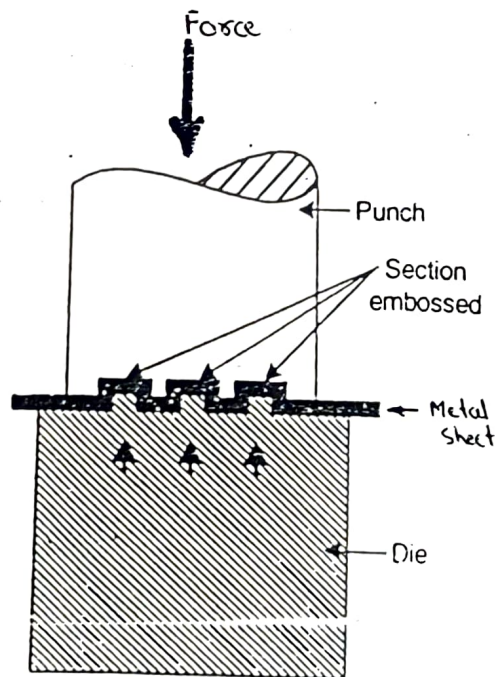


Fig. 8.16 Drawing

(159)

Embossing → It is a press working process in which raised lettering or other designs are impressed in sheet material. It is done with the help of two mating dies. A sheet of the required size is placed on the die and the punch is allowed to strike the surface with the help of a press. In this manner, the metal is squeezed and words and figures are printed on the surface of the sheets.

It is a very shallow drawing operation where the depth of the draw is limited to one to three times the thickness of the metal and the material thickness remains largely unchanged. It is generally used for providing dimples on sheets to increase their rigidity and for decorative sheet work used for houses and religious places.



Embossing.

SPINNING:-

Spinning is metal forming operation used to make products that are axially symmetrical in shape. In this operation the products are shaped by gradual plastic deformation of metal blank. This operation is widely used to manufacture cones, hemispherical bowls, and jugs etc.

In this operation metal blank is held against a rotating chuck or mandrel and fixed by a clamp. The shape of the mandrel should be same as that is expected to have by final product. A spinning tool is used to deform the metal against rotating mandrel. The spinning tool may be controlled manually or mechanically. The spinning mandrel does not experience much more stress so it can be made of any soft material like wood. The tools used for spinning are relatively cheaper than that are used for drawing operation.

If the product is of complicated shape the spinning is done in multi stages using the mandrel of different shape in each stage according to the requirement.

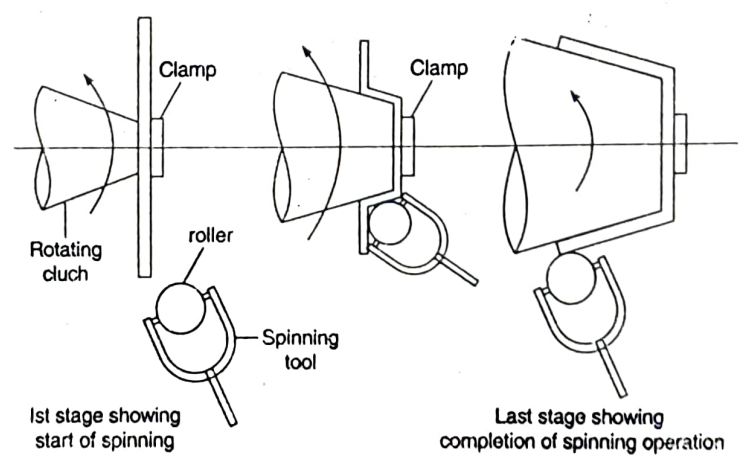


Fig. 8.23 Spinning

Bending → Bending is defined as the plastic deformation of metal about its neutral axis where compression is on one side and tension is on other side. Both tensile and compressive stresses are below the ultimate strength of the material. During the process, position of the neutral axis changes, it shifts more towards compression side.

In bending metal flows and there is permanent change in shape. It is a cold working process and used for bending bars, rods, wires, tubing and structural shapes as well as sheet metal to many shapes in cold conditions through dies. It is based on the theory of simple supported beam or cantilever. After bending a hollow section or tube, the outer layer of the workpiece reduces in cross-sectional area whereas increase in cross-sectional area takes place in the inner portion. The neutral axis also gets displaced. In sheet metal work, bending is sometimes called forming. Forming dies of various shapes are also used for various forming process.

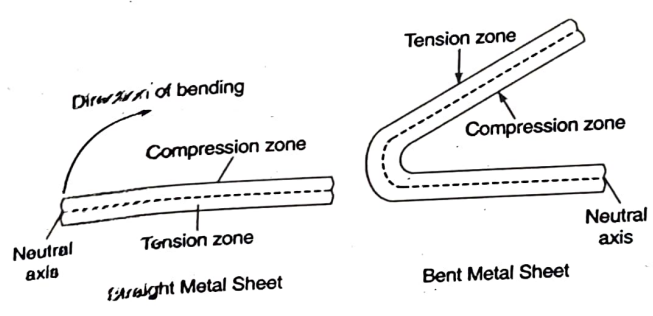


Fig. 8.17 Stresses in Bent Strip -

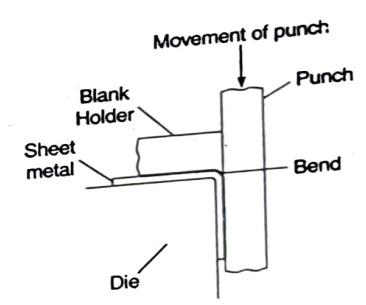


Fig. 8.20 Edge Bending

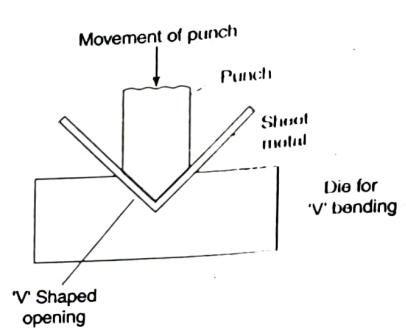


Fig. 8.18 'V' Bending

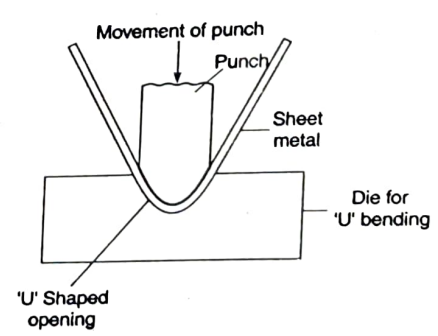


Fig. 8.19 'U' Bending

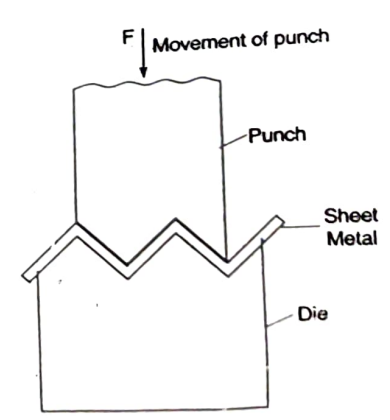


Fig. 8.21 Multiple Bending