

SHEARING AND FORMING PROCESS

Shearing Process

1. **Punching:** shearing process using a die and punch where the **interior** portion of the sheared sheet is to be **discarded**.
2. **Blanking:** shearing process using a die and punch where the **exterior** portion of the shearing operation is to be **discarded**.
3. **Perforating:** punching a number of holes in a sheet
4. **Parting:** shearing the sheet into two or more pieces
5. **Notching:** removing pieces from the edges
6. **Lancing:** leaving a tab without removing any material

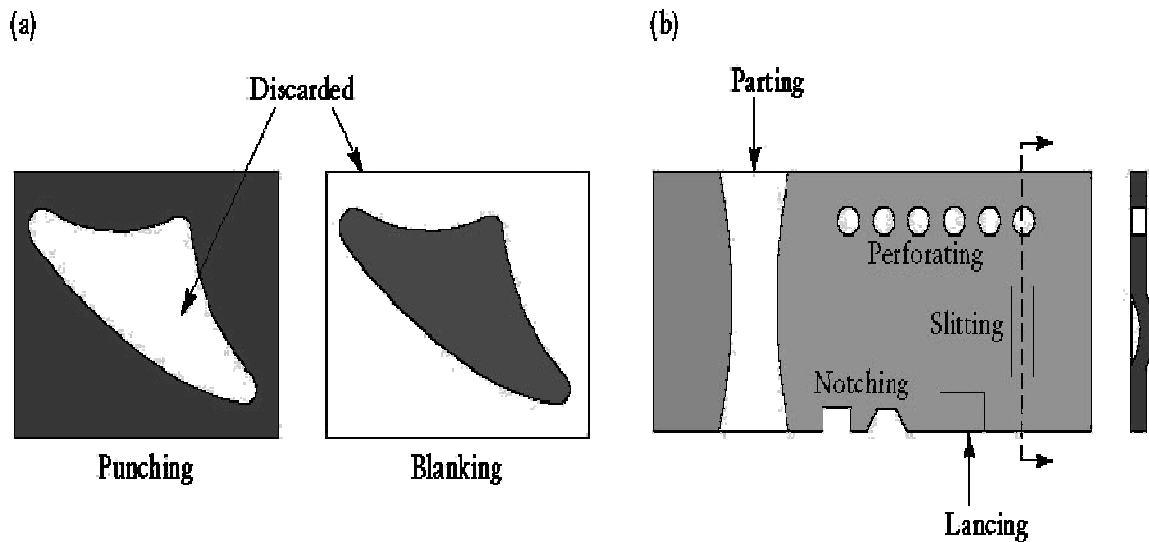
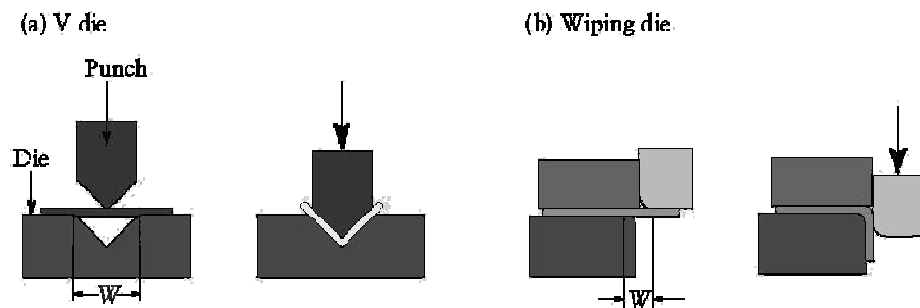


Fig. Shearing Operations: Punching, Blanking and Perforating

Forming Processes

- **Bending:** forming process causes the sheet metal to undergo the desired shape change by bending without failure. Ref fig.1



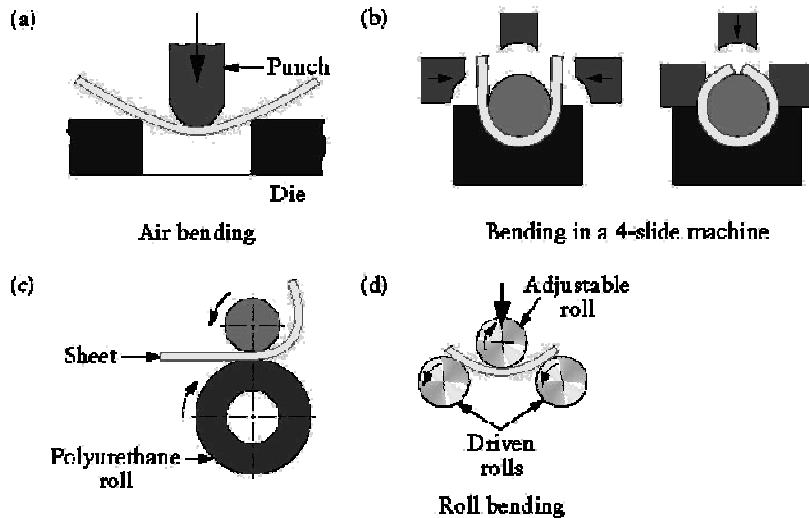


Fig.1

Various

Bending Operations

- **Stretching:** forming process causes the sheet metal to undergo the desired shape change by stretching without failure. Ref fig.2

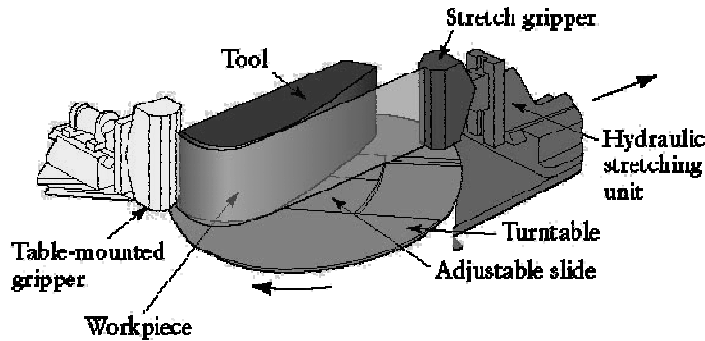


Fig.2 Schematic illustration of a stretch-forming process.

- **Deep Drawing:** forming process causes the sheet metal to undergo the desired shape change by drawing without failure. Ref fig.3

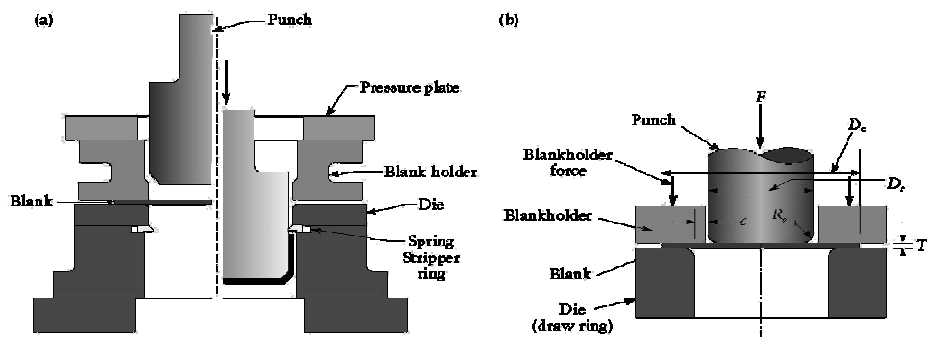


Fig. 3 Schematic of the Drawing process.

- **Roll forming:** Roll forming is a process by which a metal strip is progressively bent as it passes through a series of forming rolls. Ref fig.4

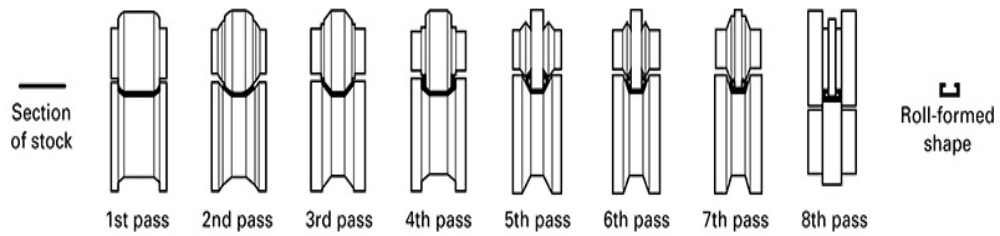
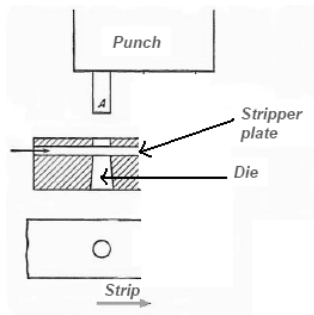
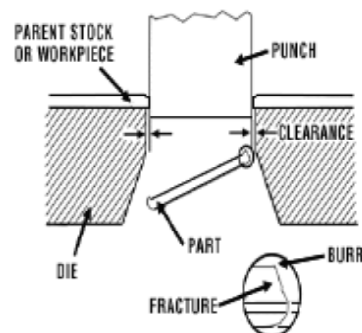


Fig. 4 Eight-roll sequence for the roll forming of a box channel

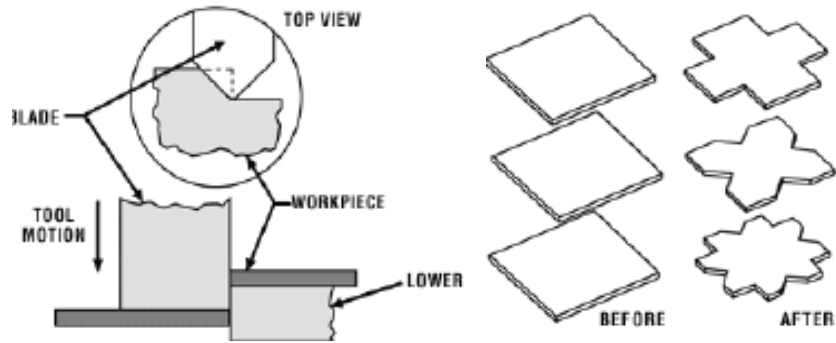
- **Punching or piercing :** The shearing of the material when the metal inside the contour is discarded. The punch A is piercing the hole for the washer.



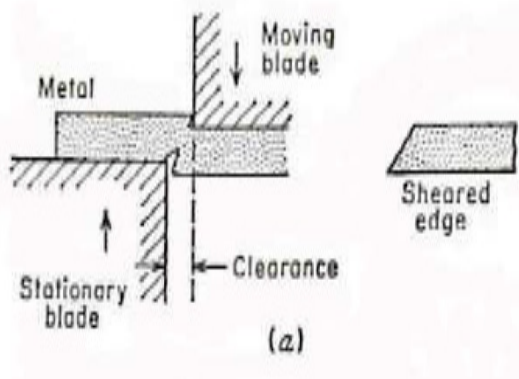
- **Blanking:** The shearing of close contours, when the metal inside the contour is the desired part



- **Notching:** The punch removes material from the edge or corner of a strip or blank or part.

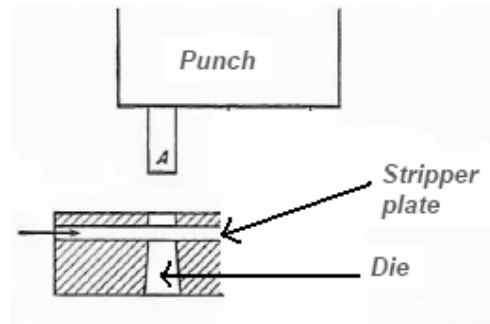


- **Shearing:** The separation of metal by the movement of two blades operated based on shearing forces.

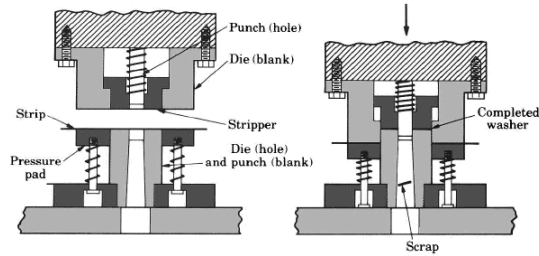


Dies and Punches

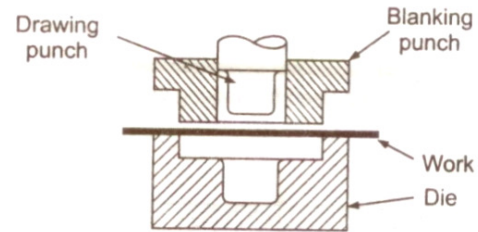
Simple- single operation with a single stroke



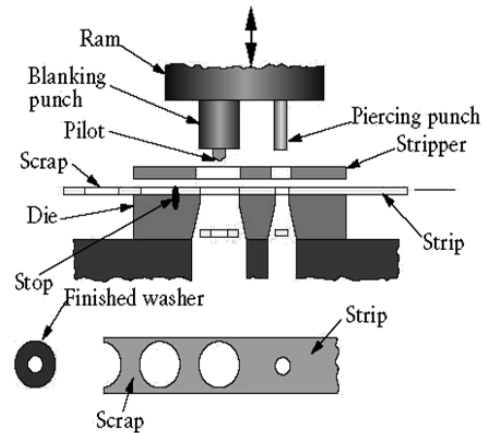
Compound- two operations with a single stroke



Combination- two operations at same station.



Progressive- two or more operations at two or more stations with each press stroke, creates what is called a strip development. Punches and dies are designed so that successive stages in the forming of the part are carried out in the same die on each stroke of the press. Progressive dies are also known as multi-stage dies.



Limiting draw ratio (LDR)

Drawability is a ratio of the initial blank diameter (D_o) to the diameter of the cup drawn from the blank to punch diameter (D_p)

$$LDR \approx \left(\frac{D_o}{D_p} \right)_{\max} \approx e^{\eta}$$

Where η , is an efficiency term accounting for frictional losses. Normally the average maximum reduction in deep drawing is $\sim 50\%$.