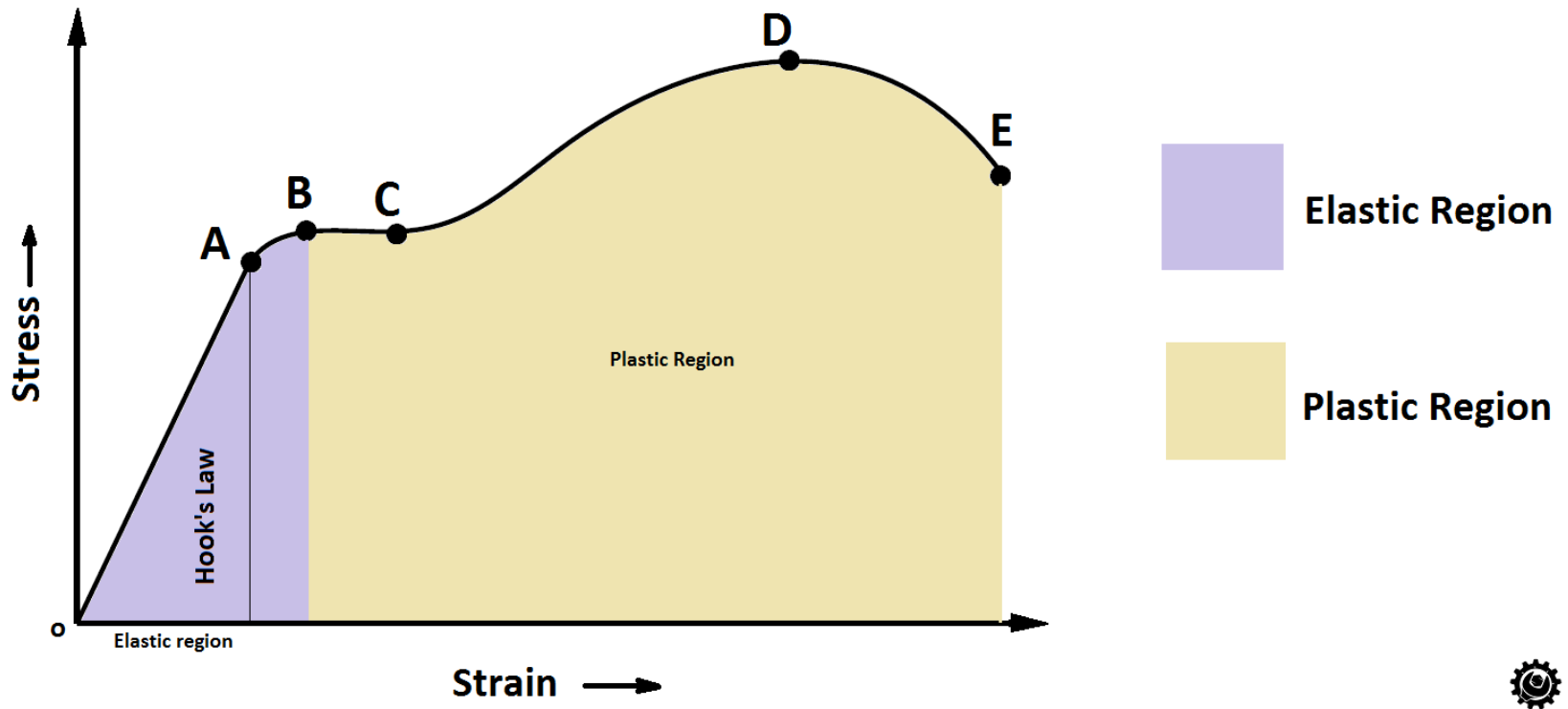
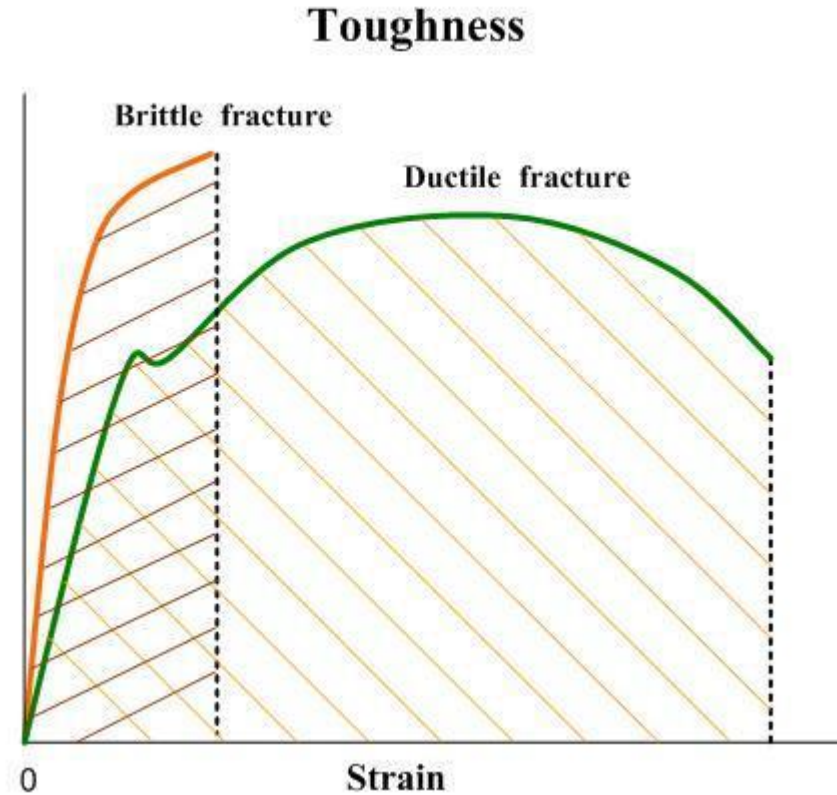
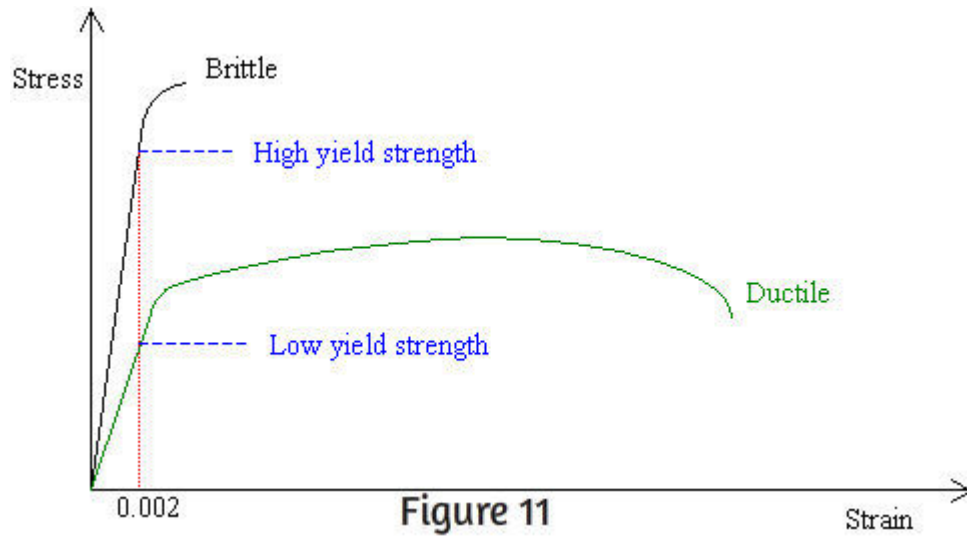


Mechanical properties

Stress-strain curve

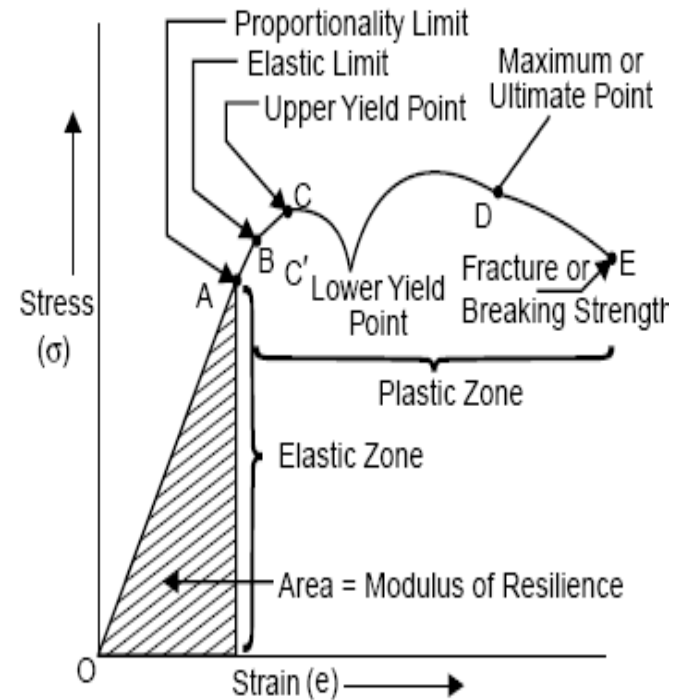


Stress-strain curve

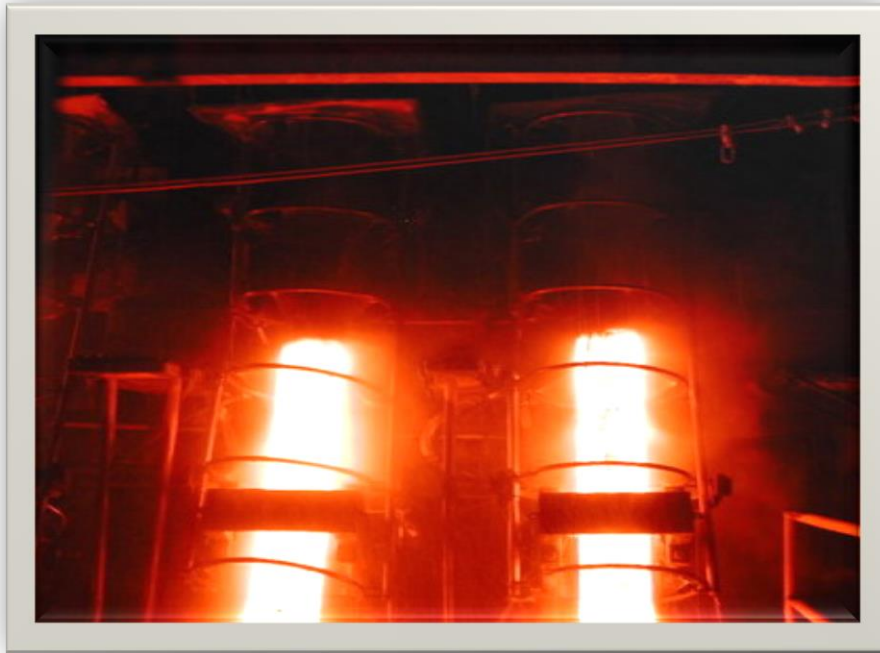


HOT WORKING OF METALS

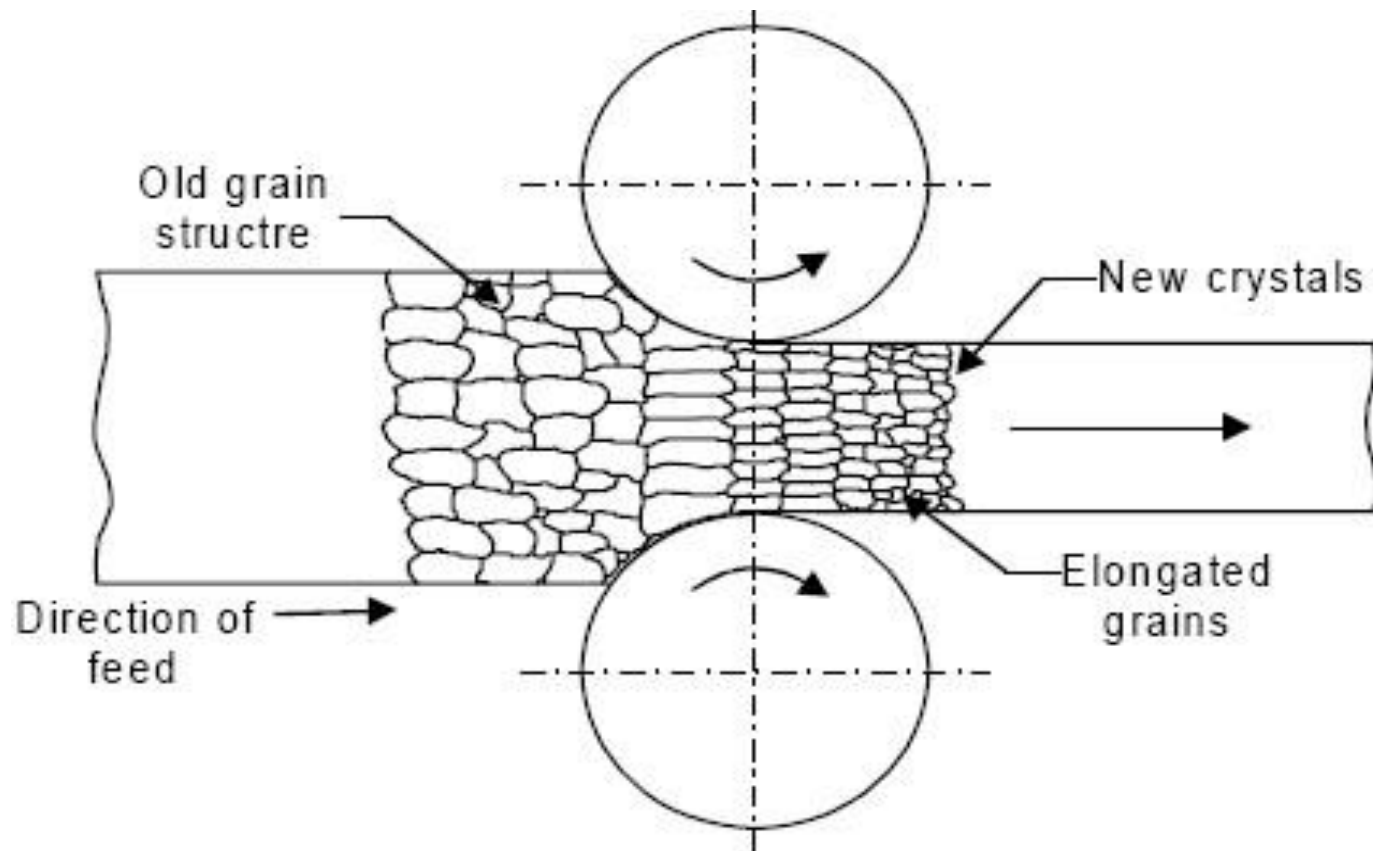
1) Metal forming



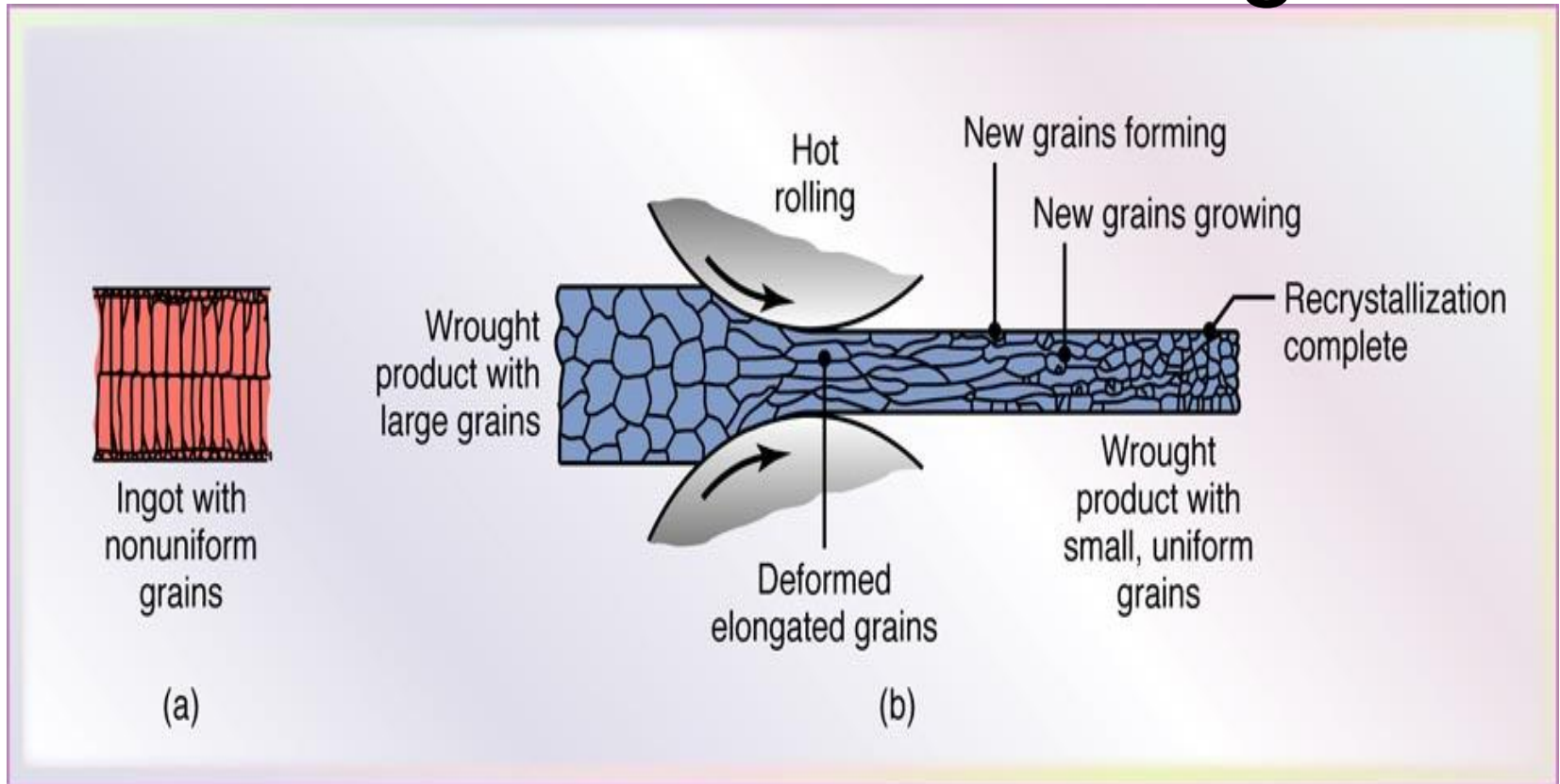
HOT WORKING



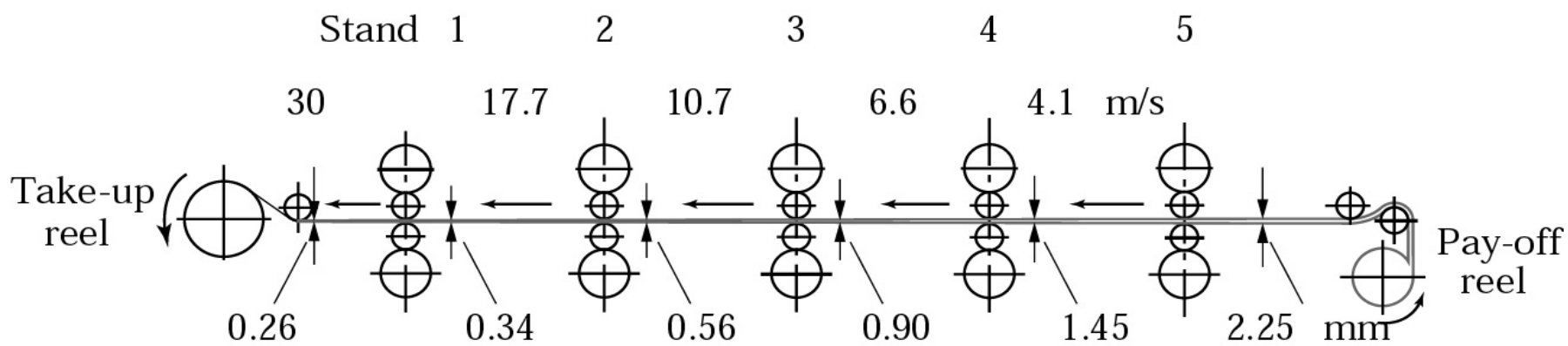
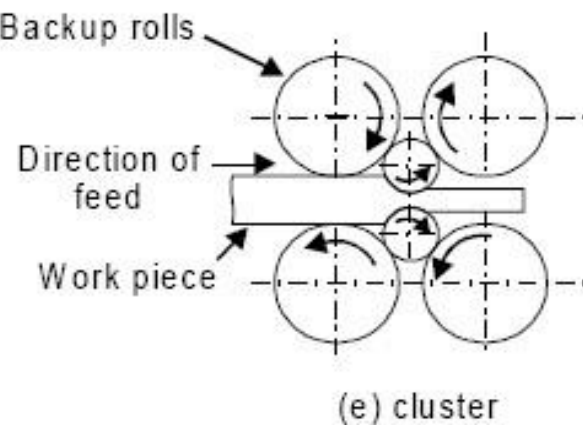
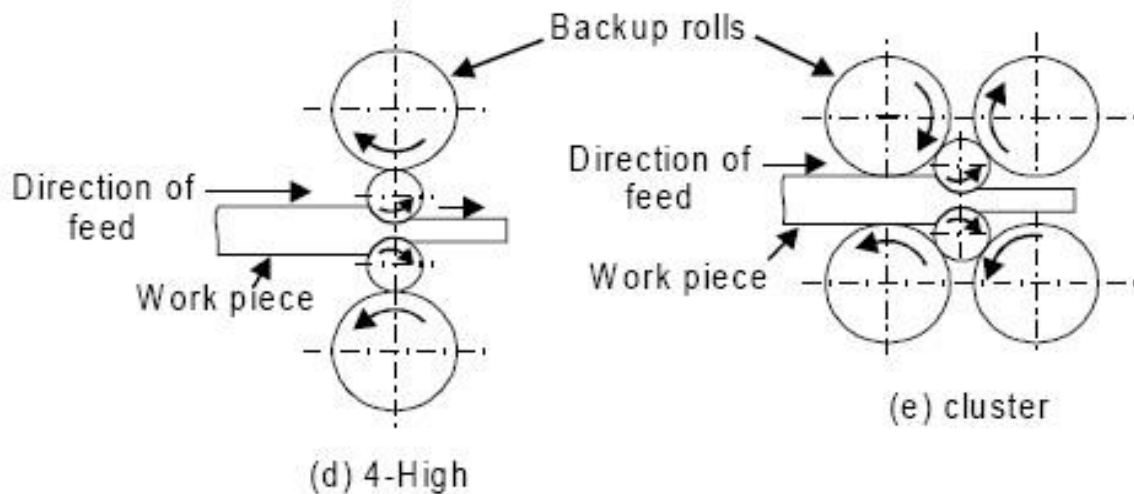
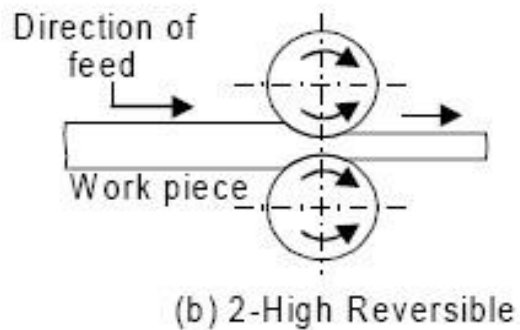
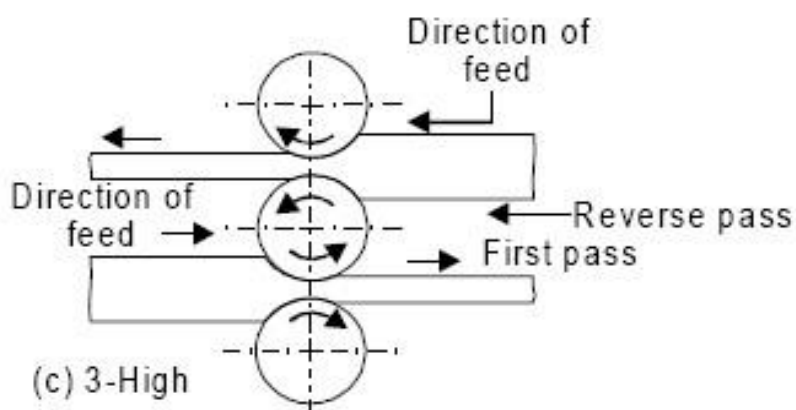
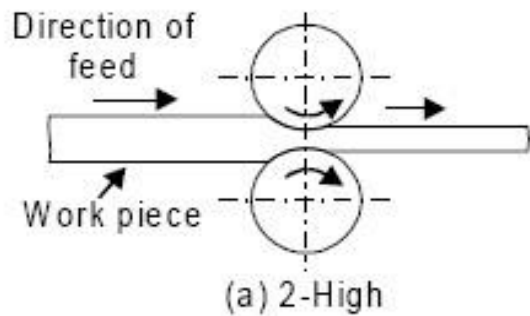
Hot ingots



Effects of Hot Rolling

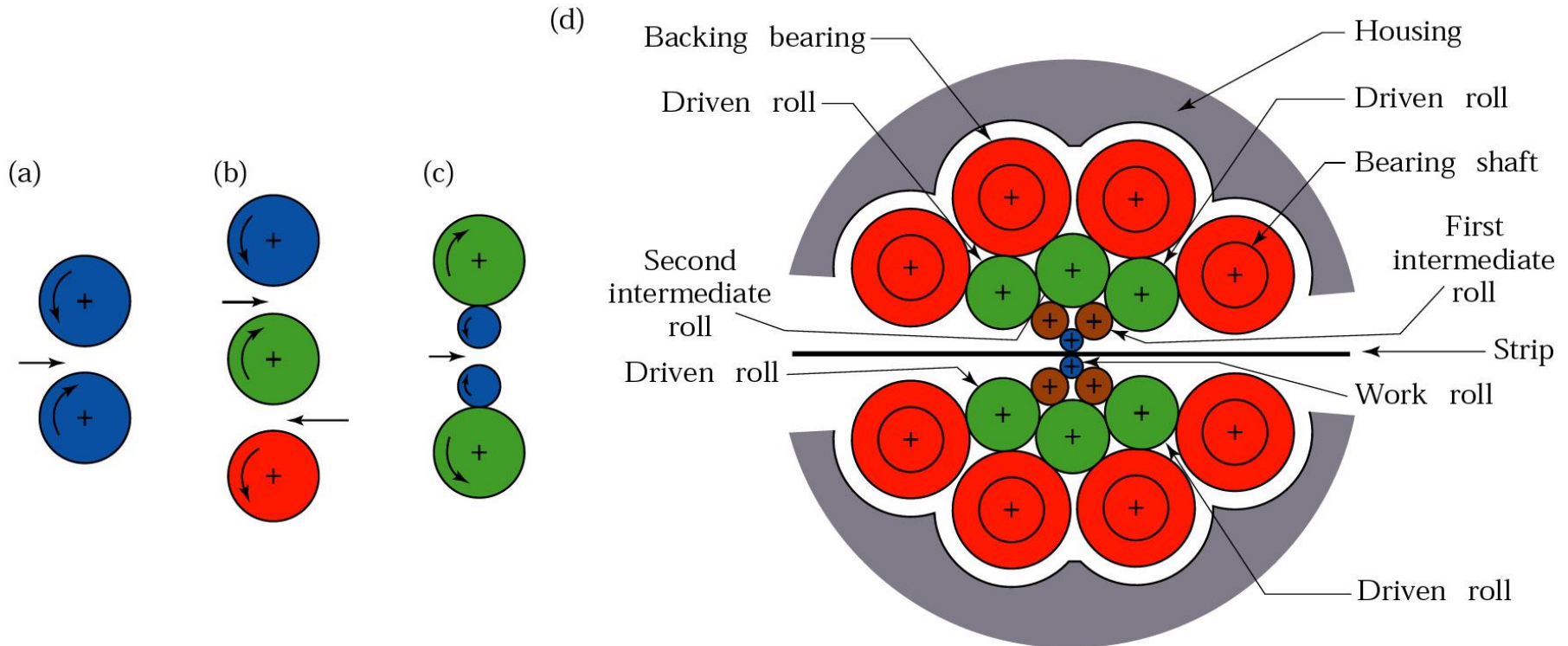


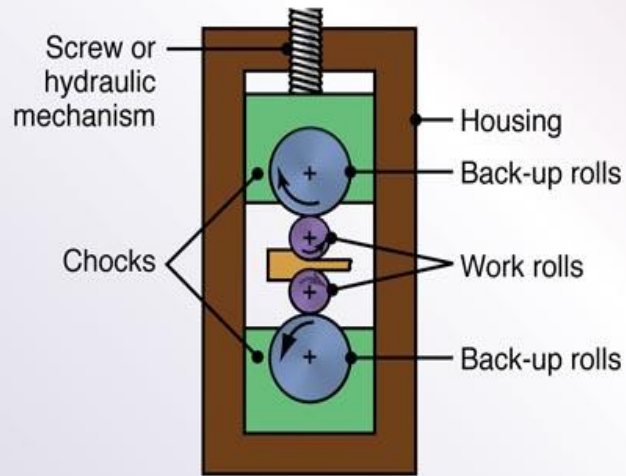
Changes in the grain structure of cast or of large-grain wrought metals during hot rolling. Hot rolling is an effective way to reduce grain size in metals for improved strength and ductility.



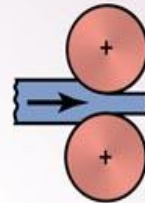
Rolling Mills

Figure 13.11 Schematic illustration of various roll arrangements: (a) two-high; (b) three-high; (c) four-high; (d) cluster (Sendzimir) mill.

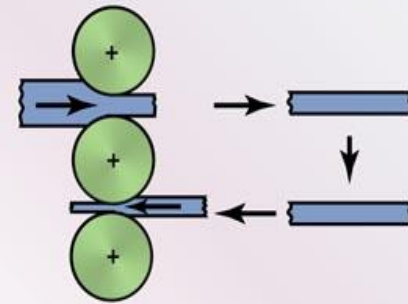




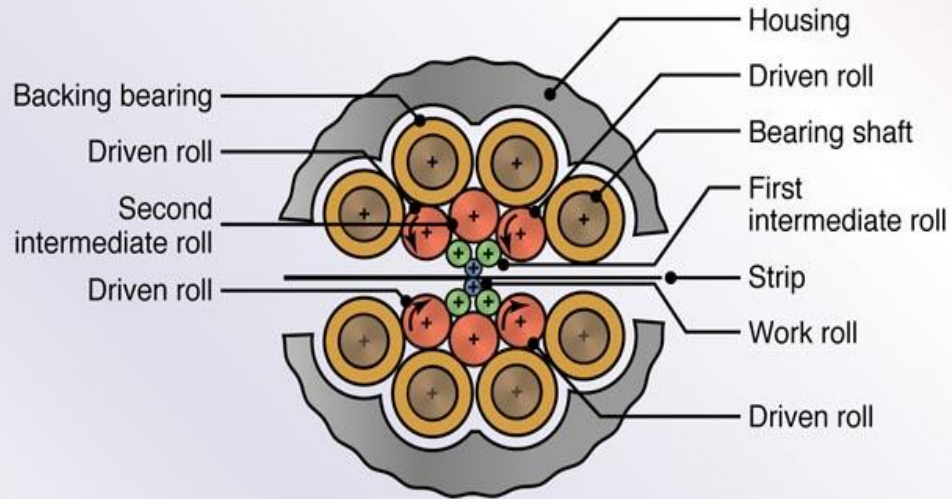
(a)



(b)

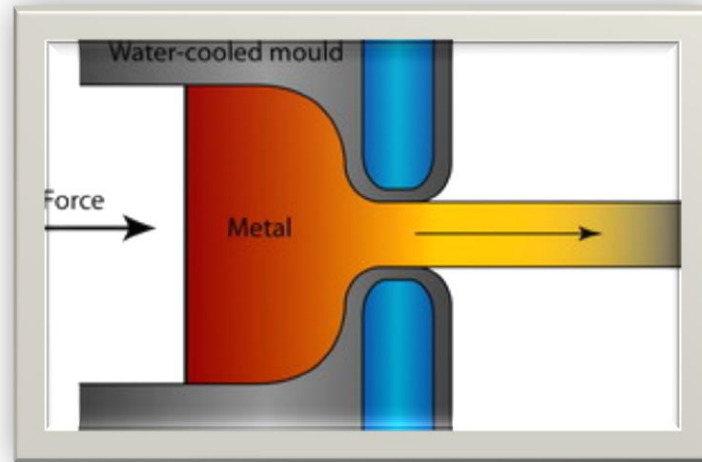


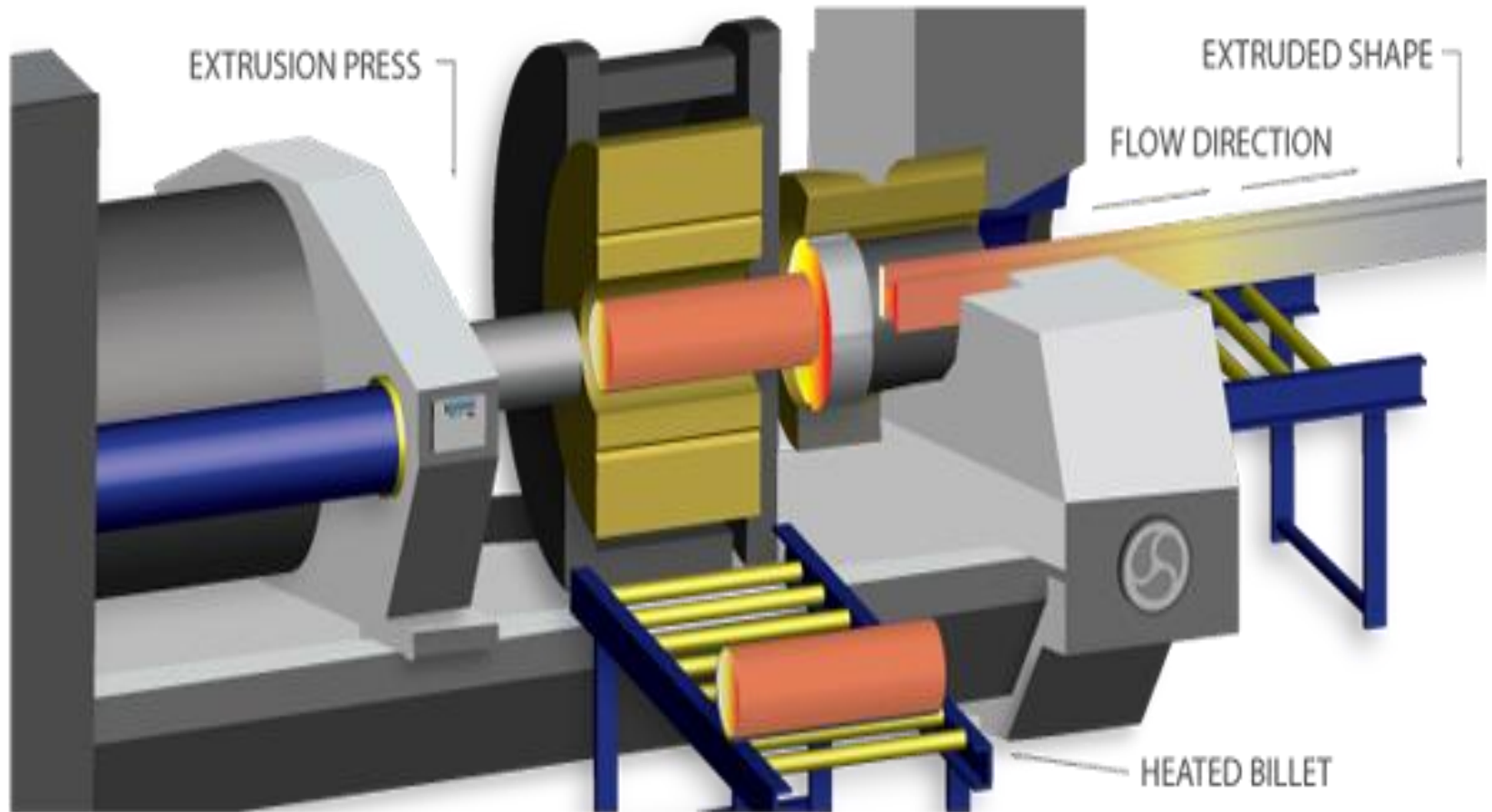
(c)



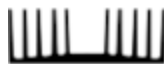
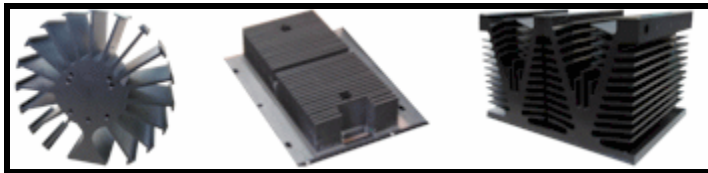
(d)

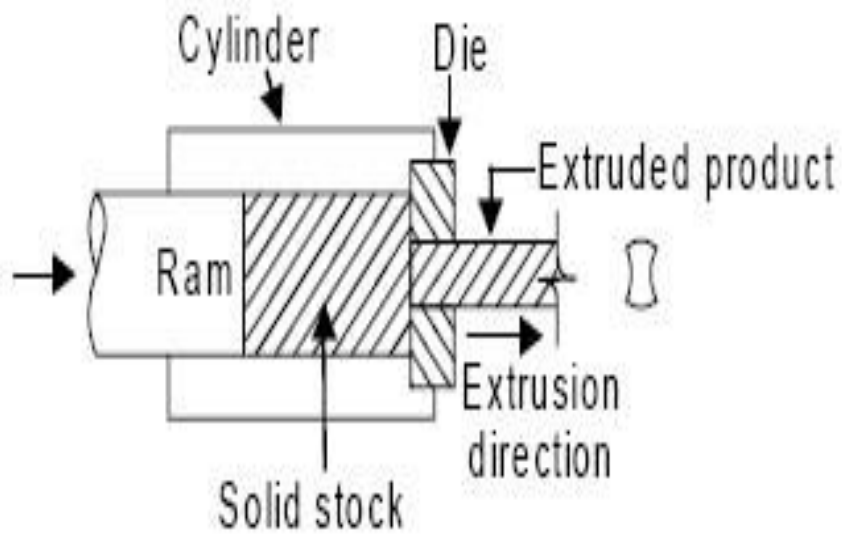
Hot Extrusion



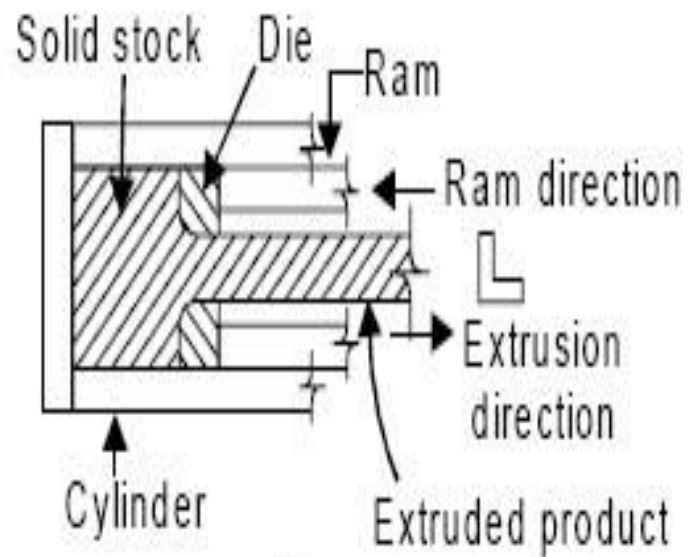


Examples of parts made by extrusion

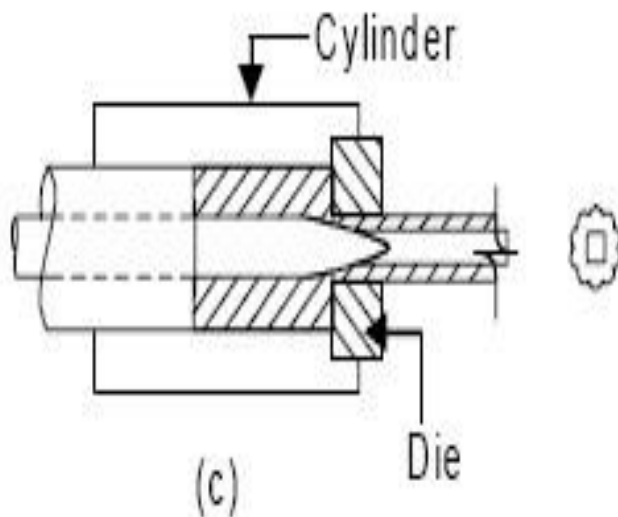




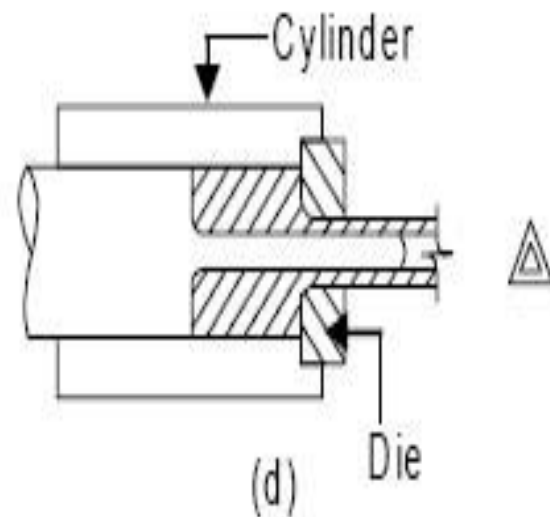
(a)



(b)



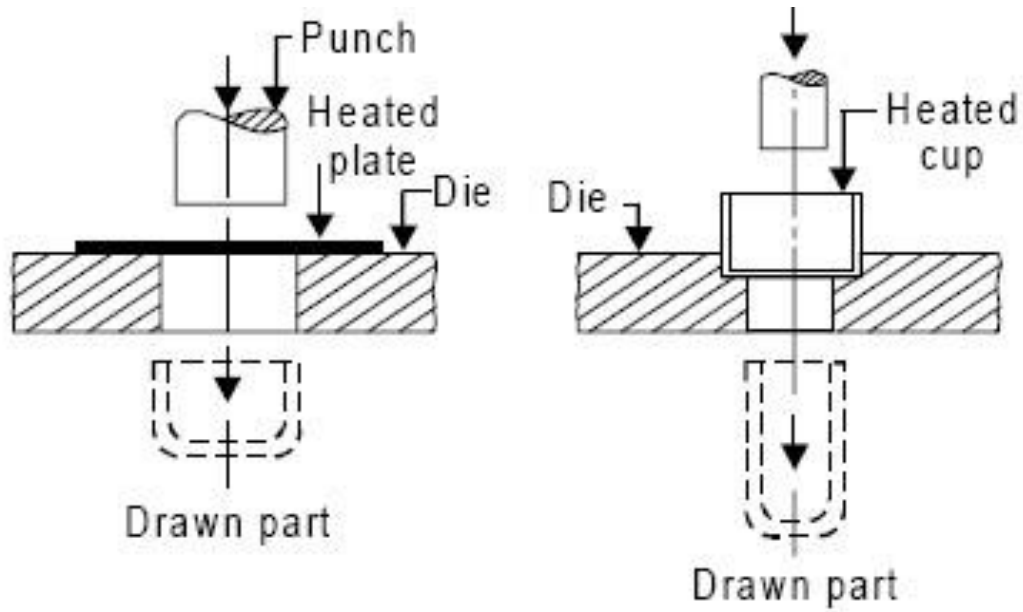
(c)



(d)

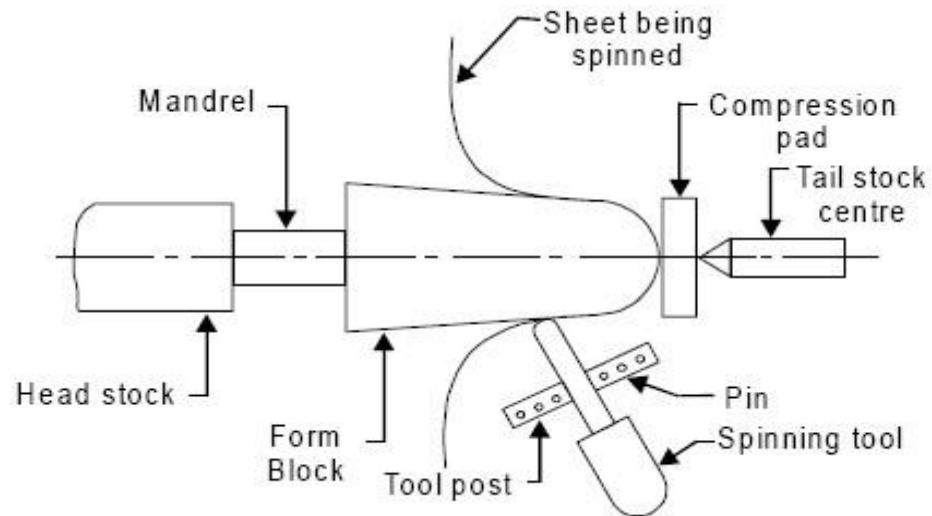
Extrusion

3. Deep Drawing



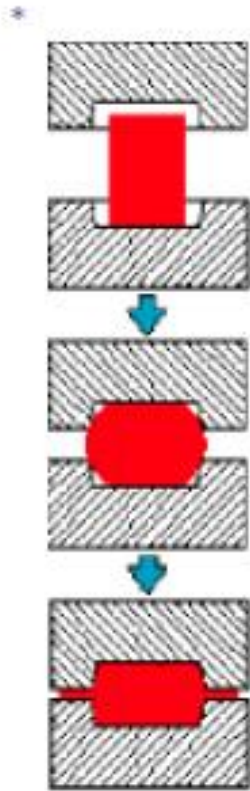
Deep drawing

4. Hot Spinning

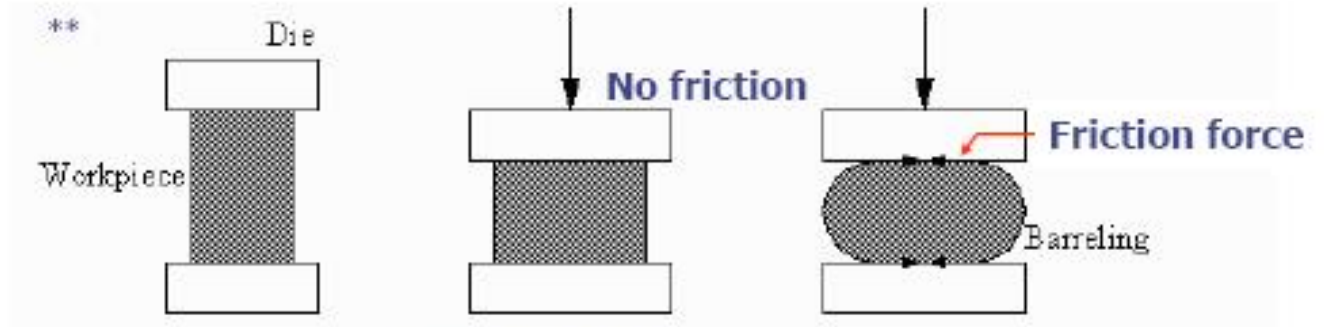


Hot spinning

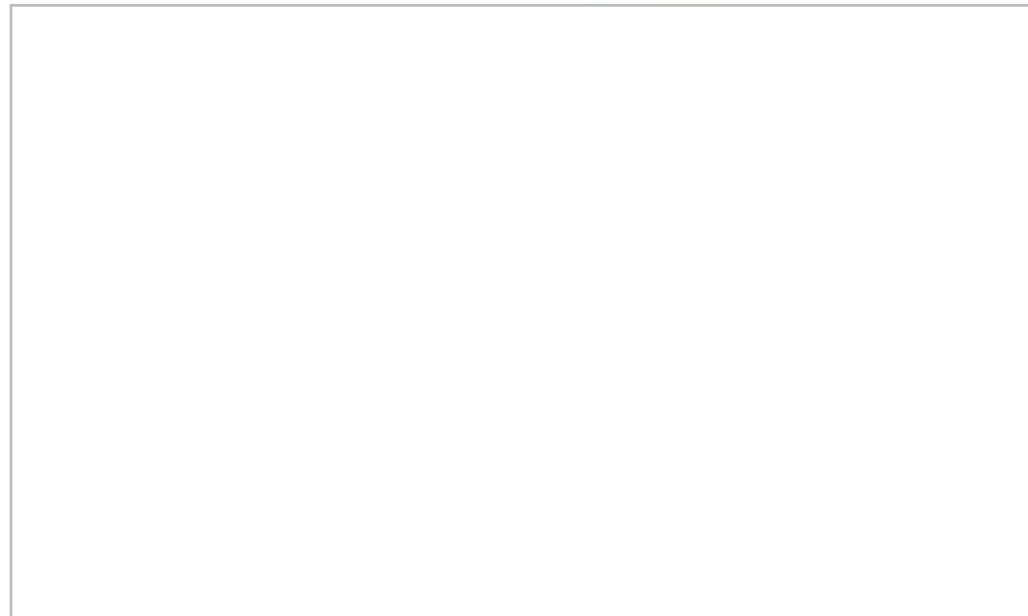
Forging



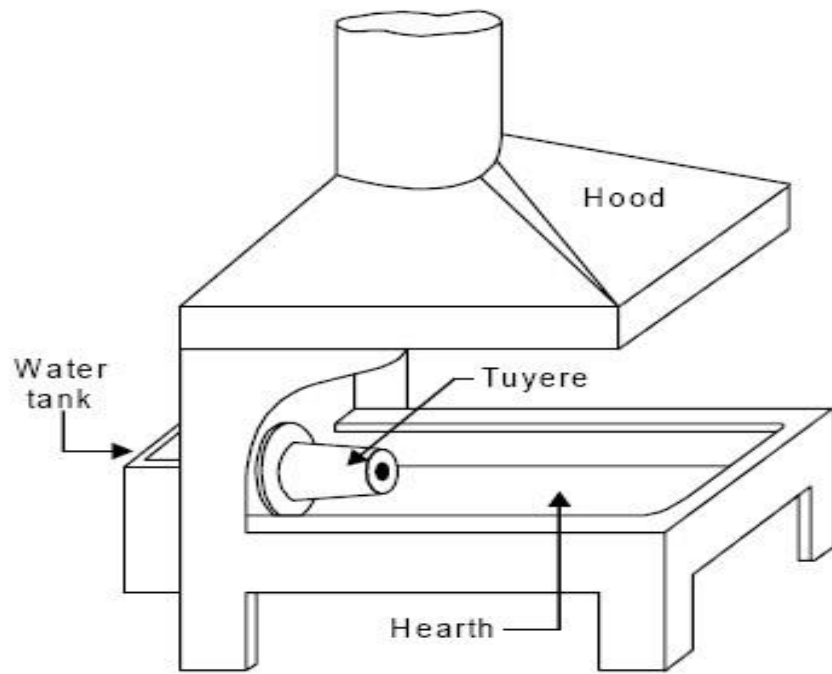
Closed Die Forging



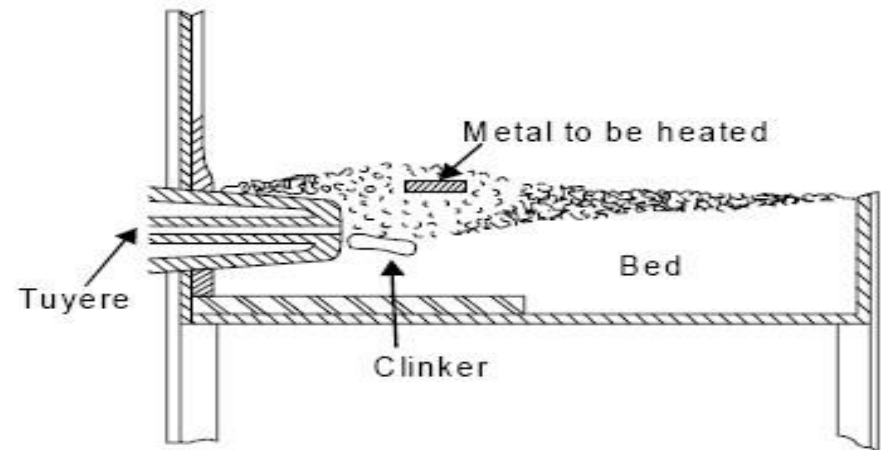
Open Die Forging



Heating Devices



Typical hearth



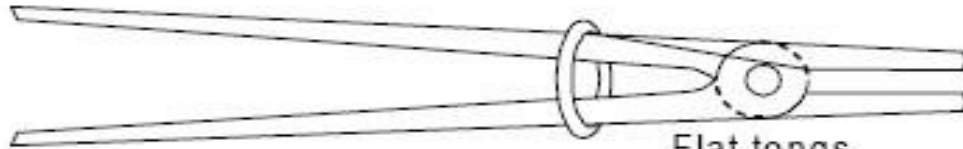
Black smith furnace



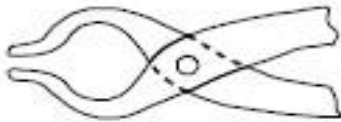
Straight-lip fluted tongs



Rivet or ring tongs



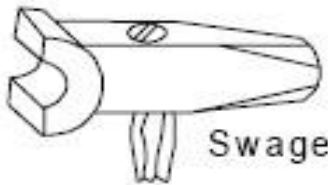
Flat tongs



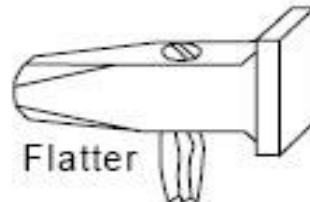
Gad tongs



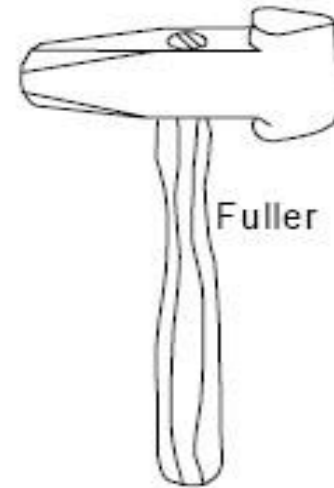
Flat tongs



Swage

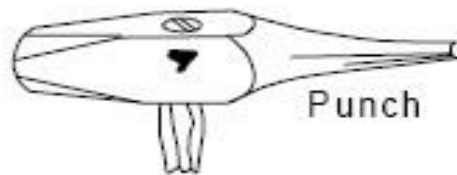
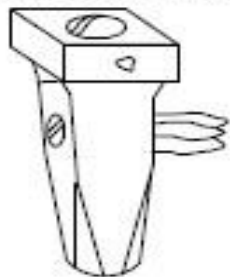


Flatter

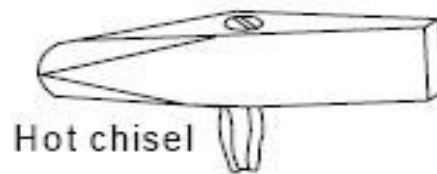


Fuller

Rivet header

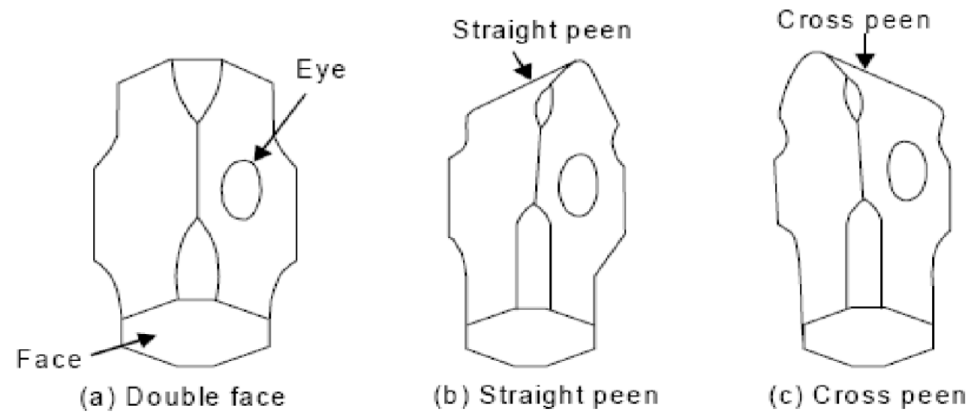
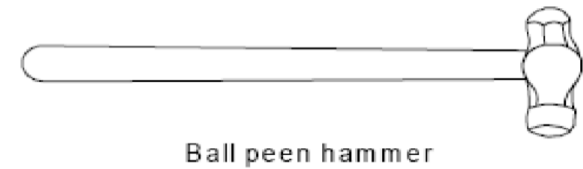
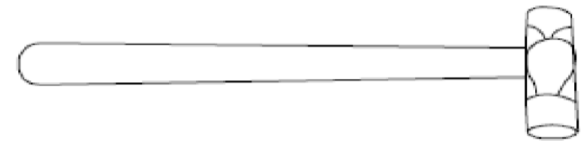
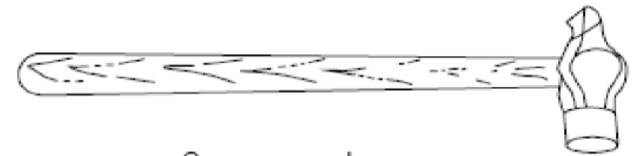
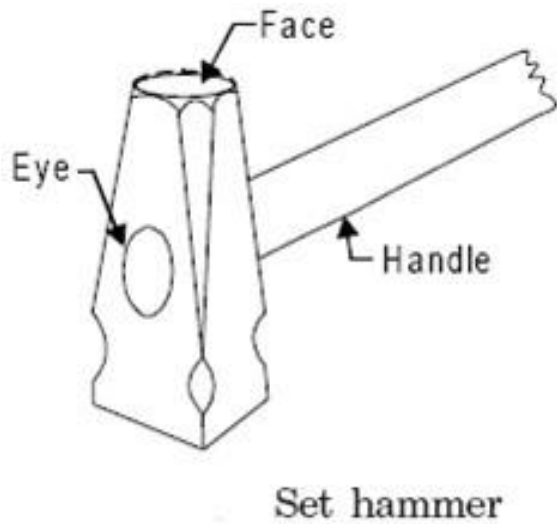
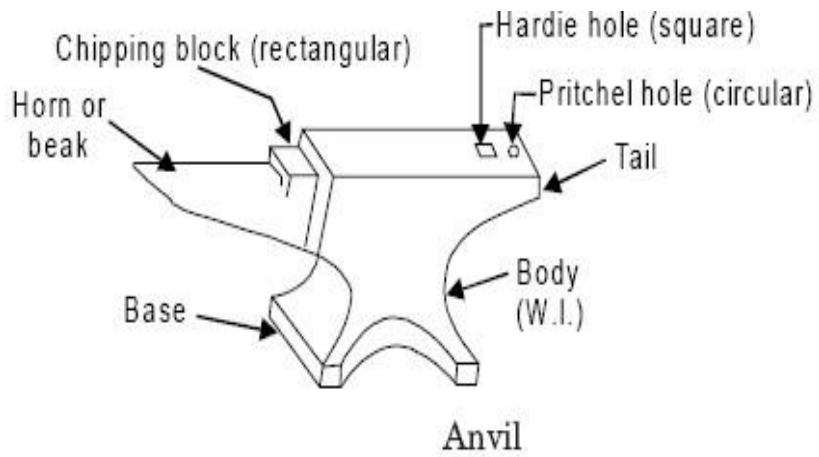


Punch

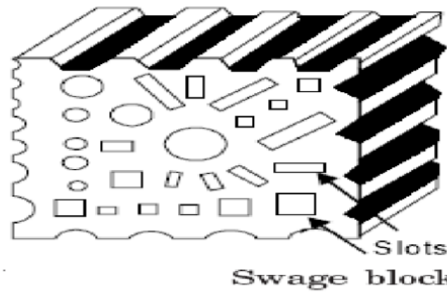


Hot chisel

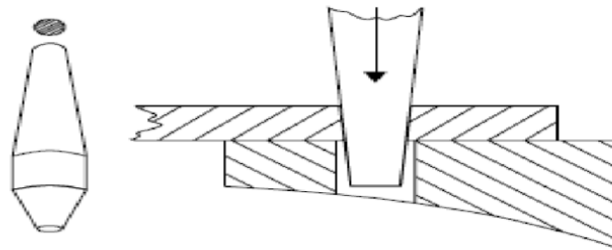
Hand forging tools



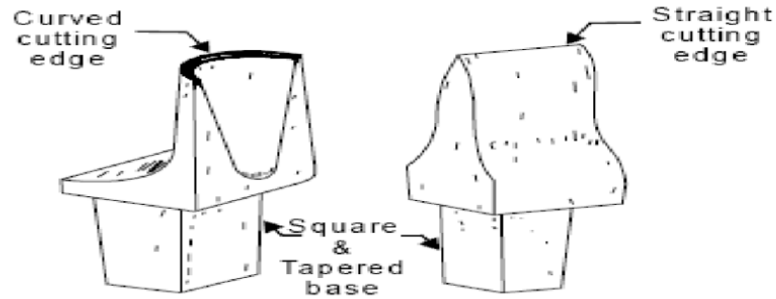
Types of hammers



Swage block



Drift



Hardie Shovel



Poker



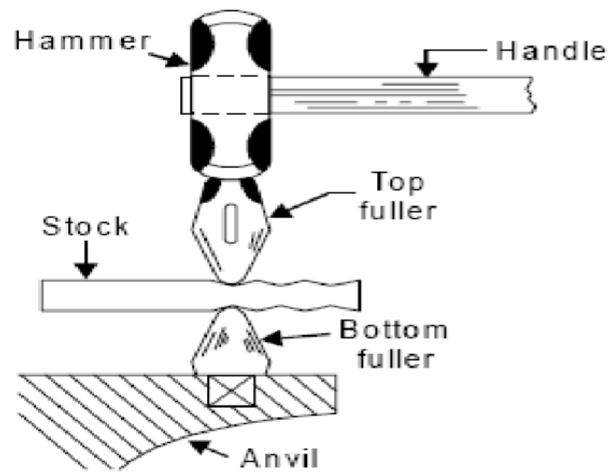
Rake



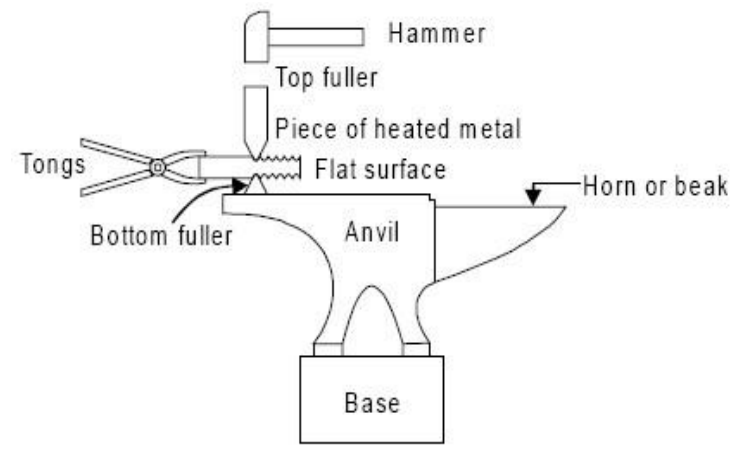
Shovel, Poker and Rake



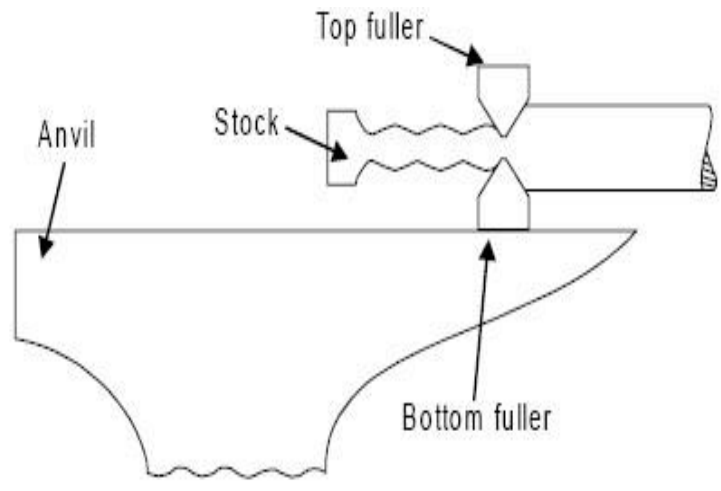
40,000 Ton Forging Press



Drawing out



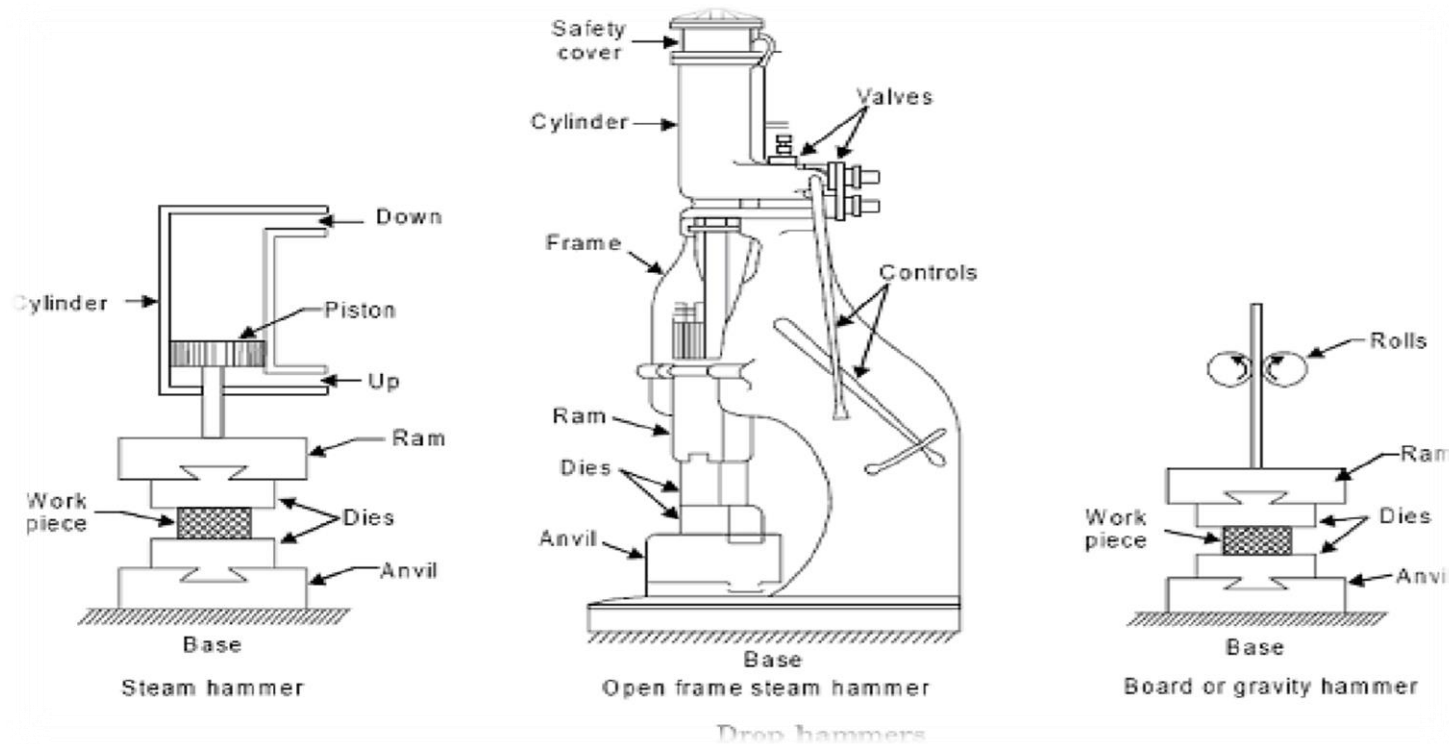
Hand forging

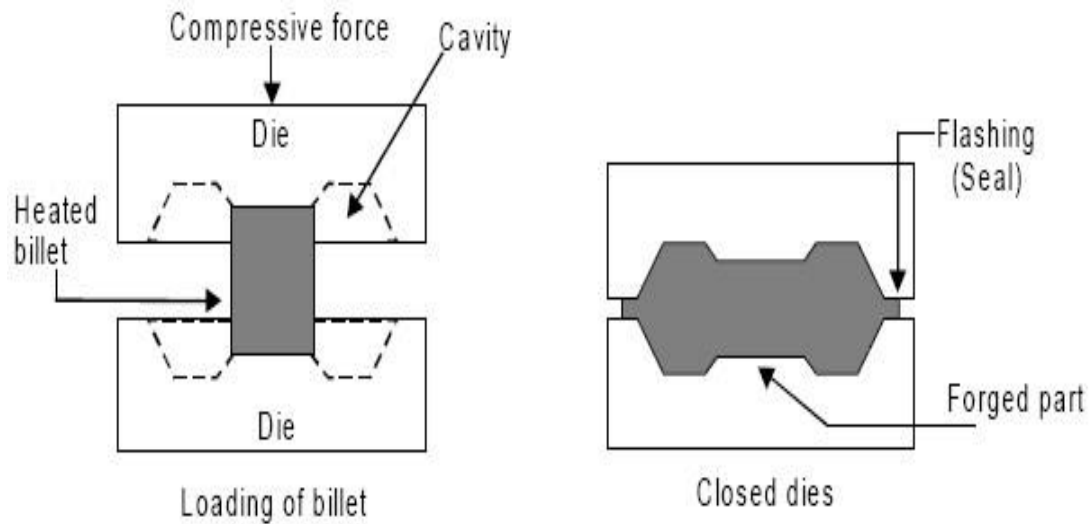


Fullering

Power Forging

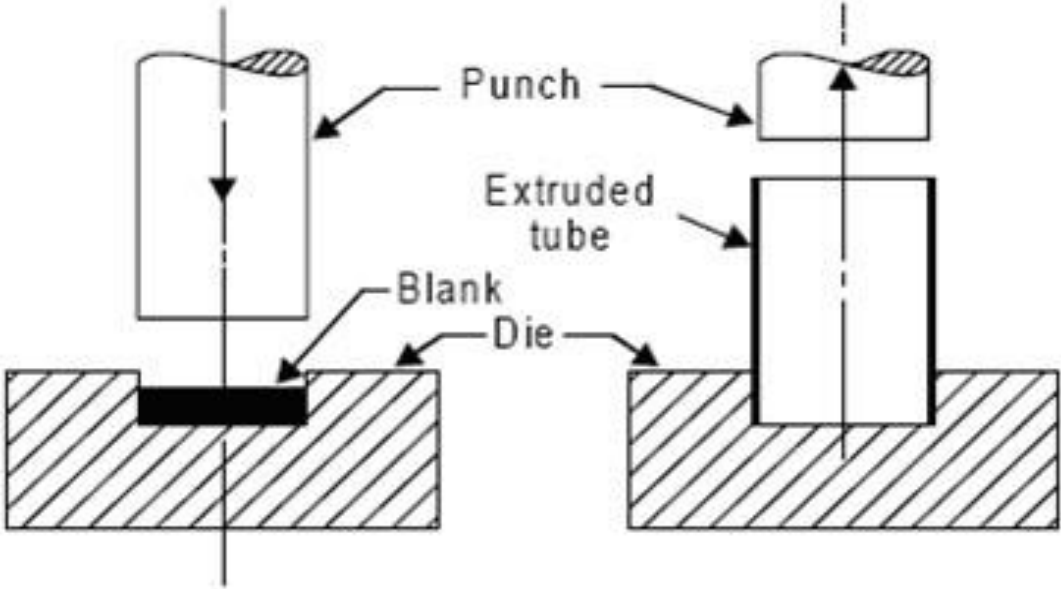
Drop Hammers





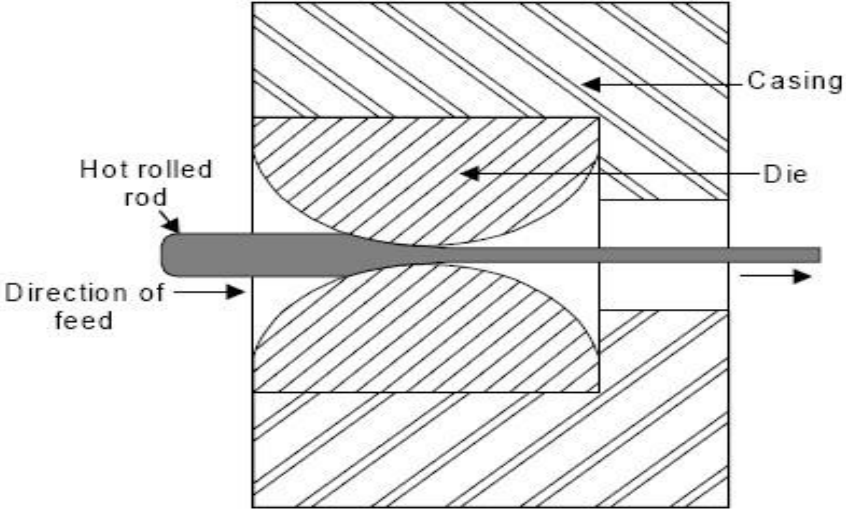
Close die forging

Impact extrusion

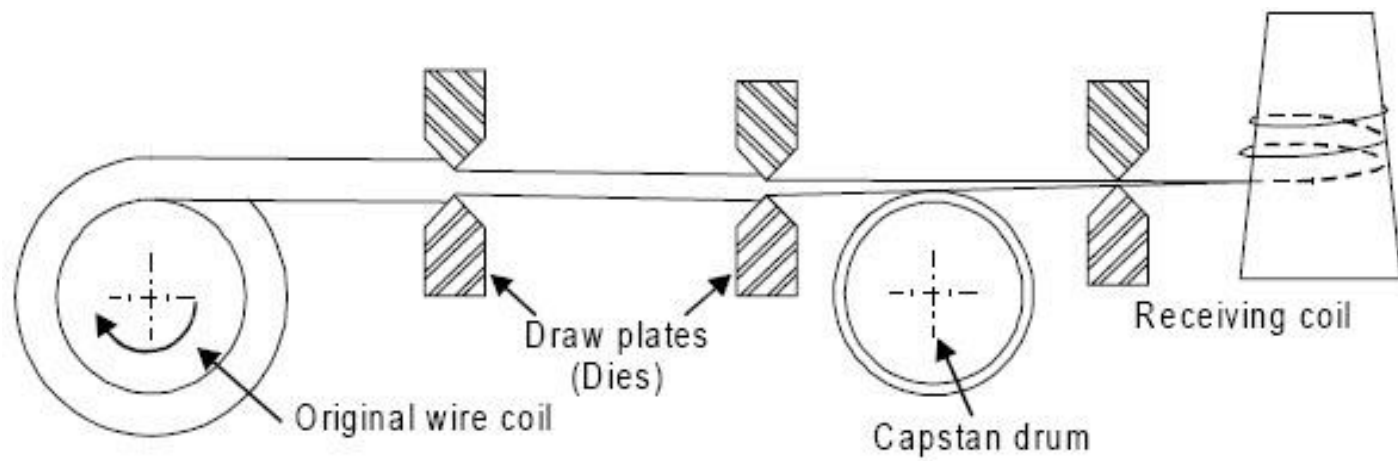


Impact extrusion

Wire drawing



Wire drawing

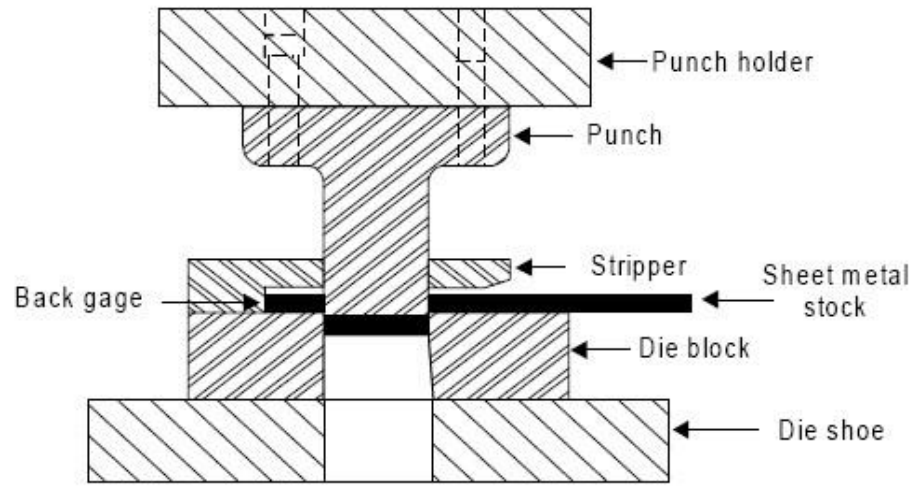


Wire drawing

General Sheet Metal Operations

First Shearing :

•Blanking & Piercing



Typical simple press tool

