



ME 333

Manufacturing Processes II



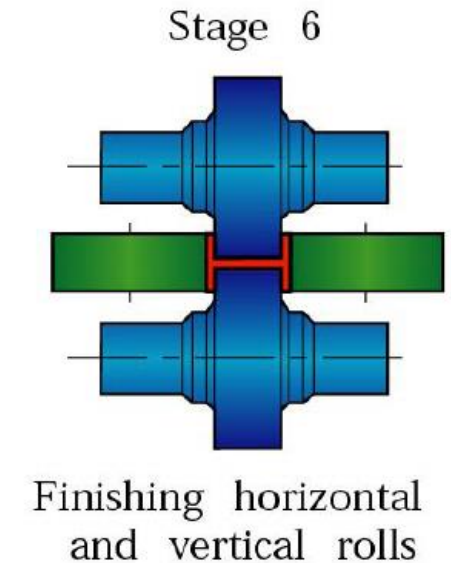
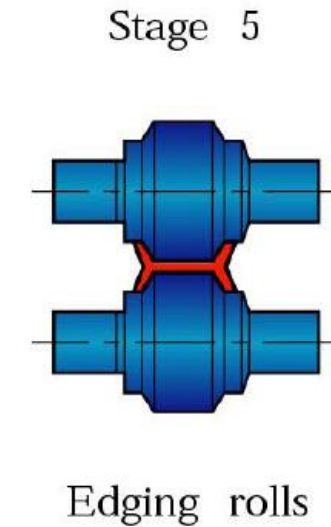
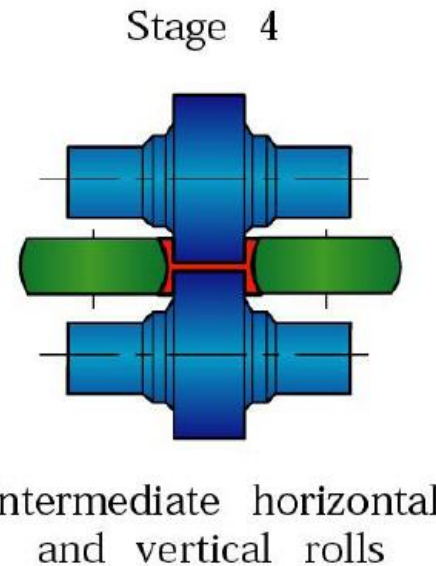
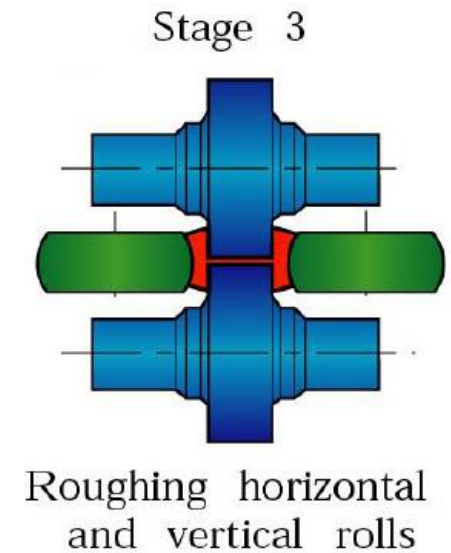
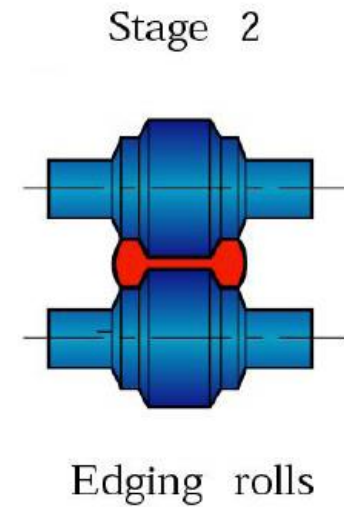
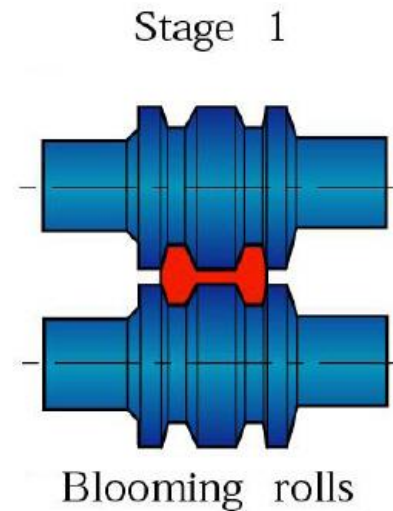
Chapter 6

Special Forming Applications

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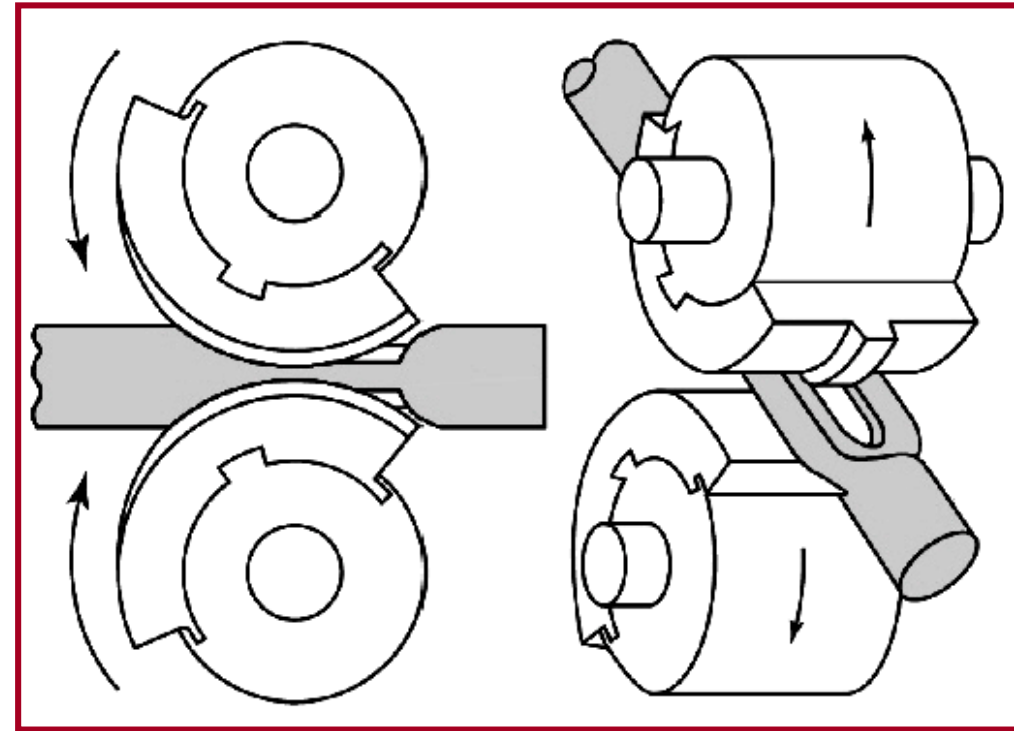
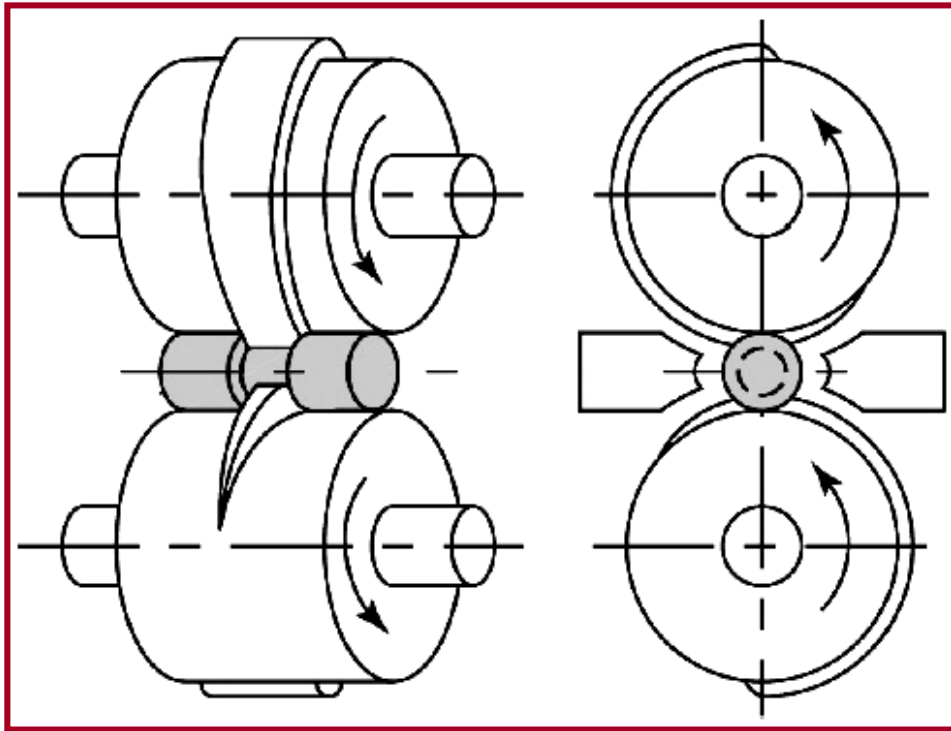


- Figure shows stages in **shape rolling of I-beam**.
- Various other structural sections (e.g. **channels and rails**) are also rolled by this kind of process.





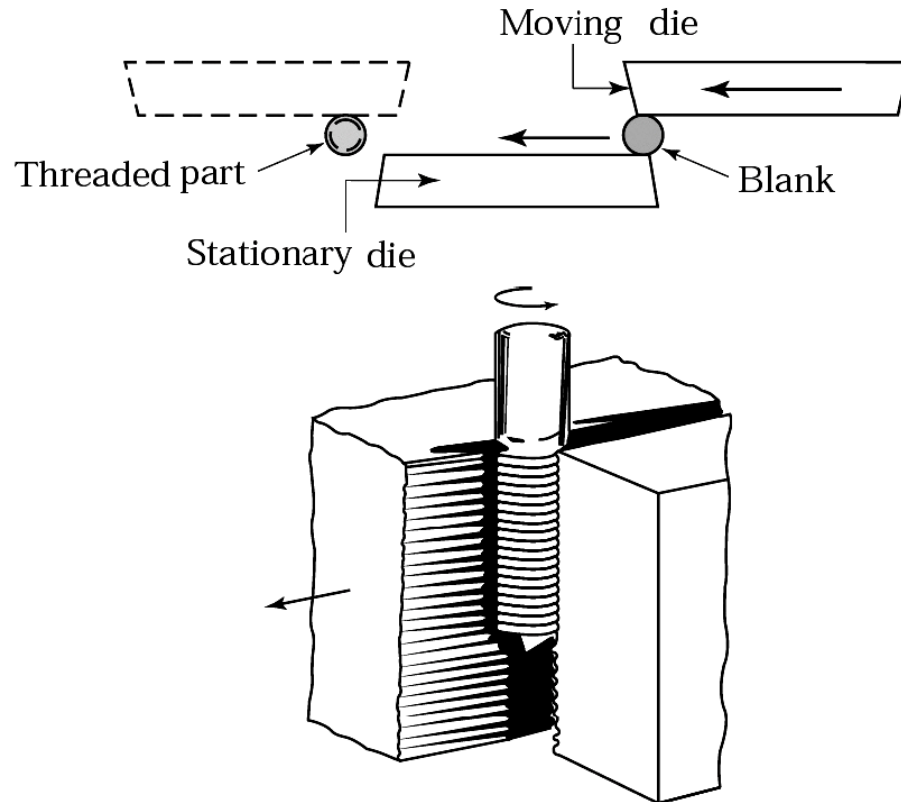
- It is a deformation process used to reduce the cross-section of a cylindrical (or rectangular) workpiece by passing it **through a set of opposing rolls with grooves** matching the desired shape of the final part.
- **Tapered leaf springs and knives** can be made by this process.



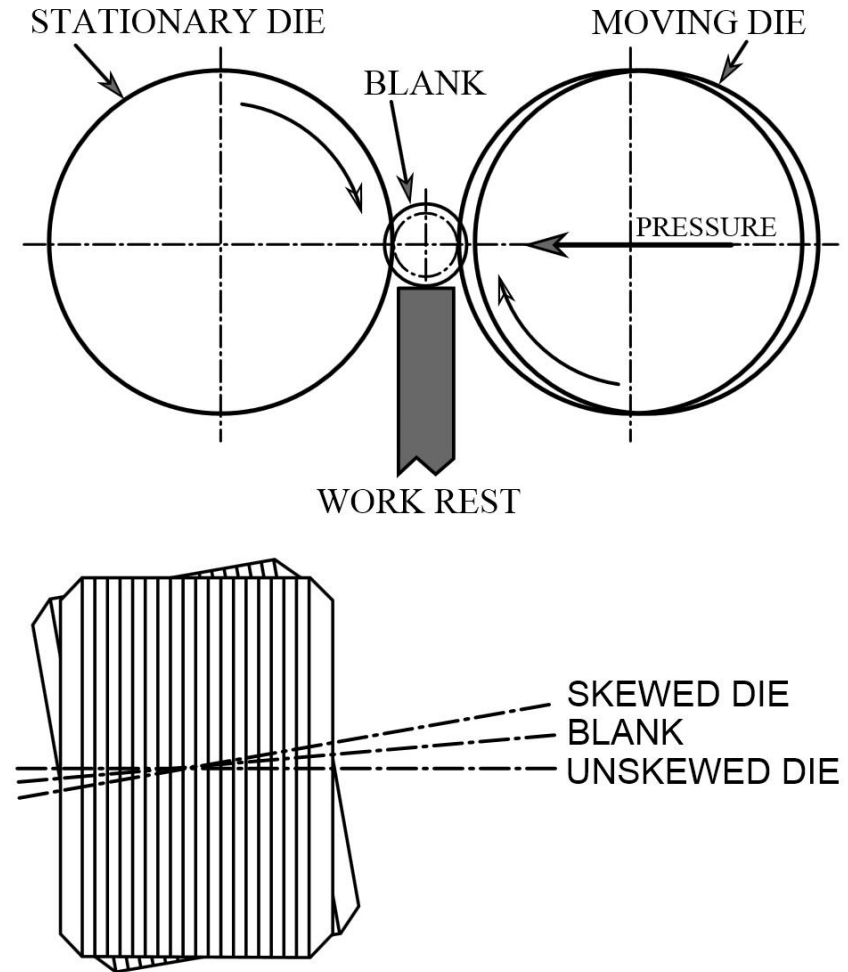


➤ **Threaded fasteners** are made economically by thread rolling at high rates of production.

➤ Thread rolling with **reciprocating flat dies**:

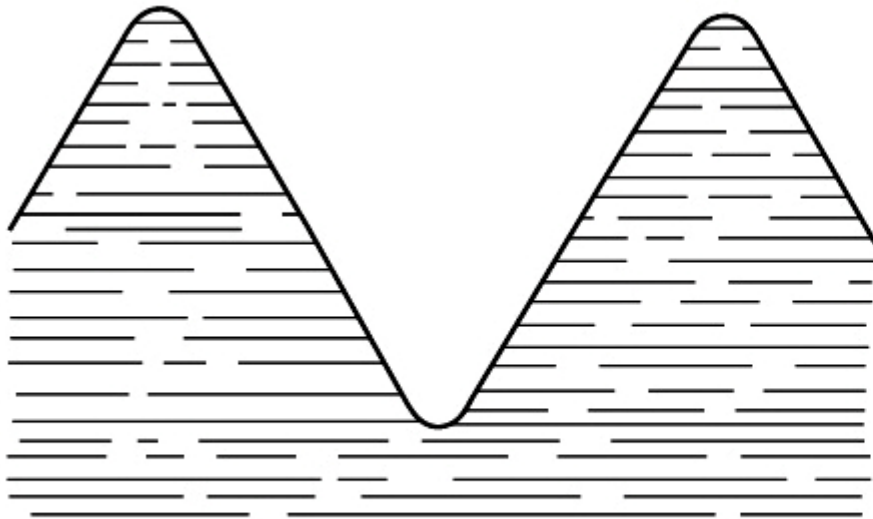
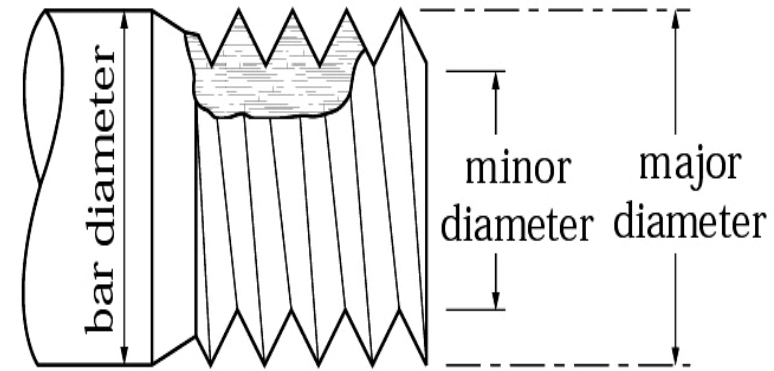


➤ Thread rolling with **two rotary dies**:

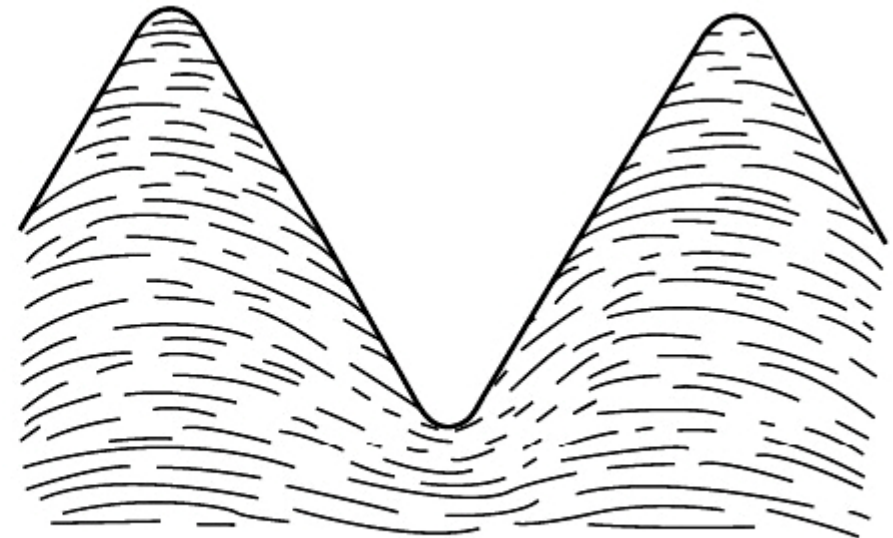




- Unlike machining (*cuts through the grains of metal*), rolling of threads gives **improved strength** due to **cold working and favorable grain flow**.
- Rolled thread has **good surface finish** without loss of material (**scrap**).
- Thread rolling induces **compressive residual stresses** on the work surface, which improves **the fatigue life**.



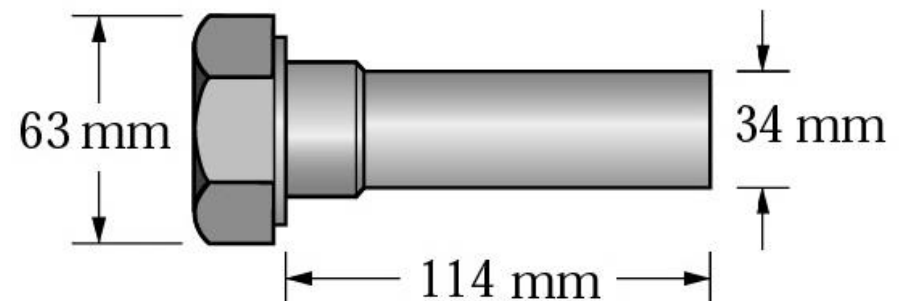
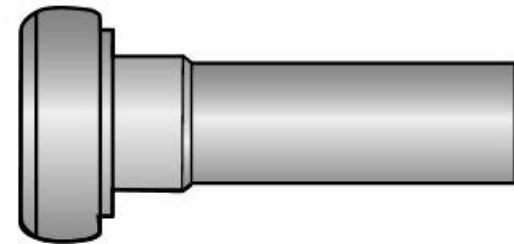
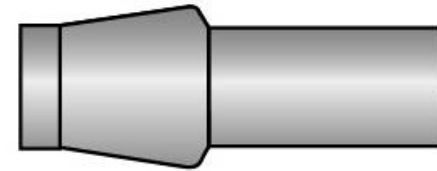
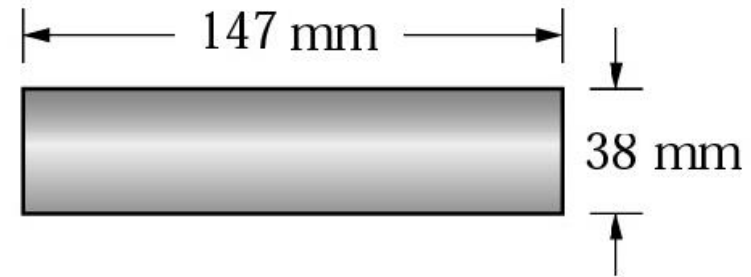
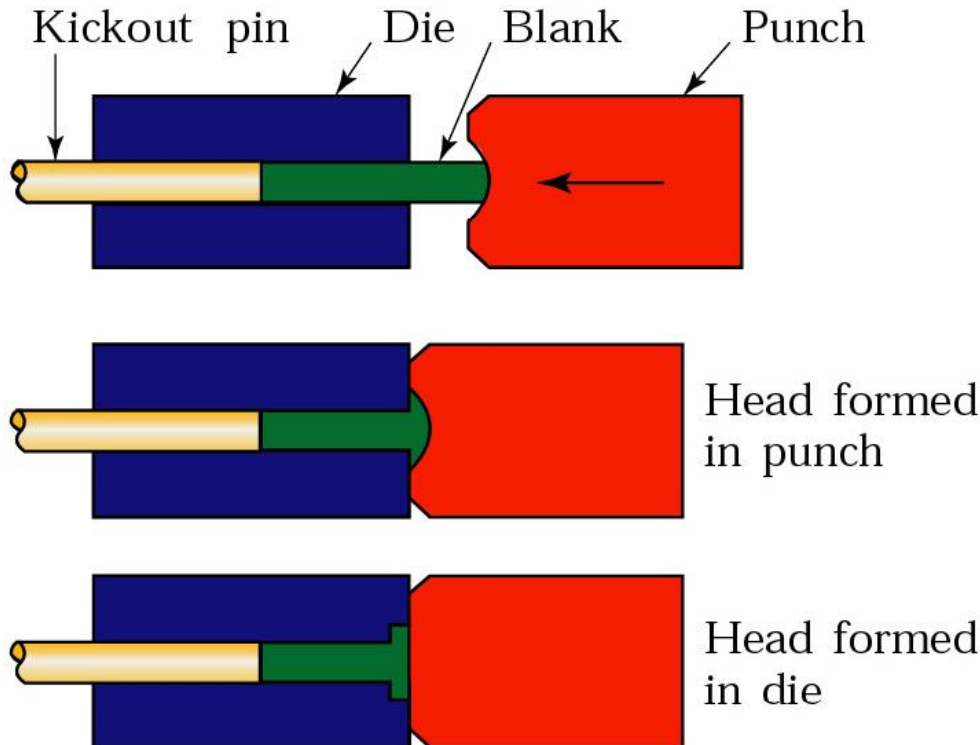
Machined thread



Rolled thread



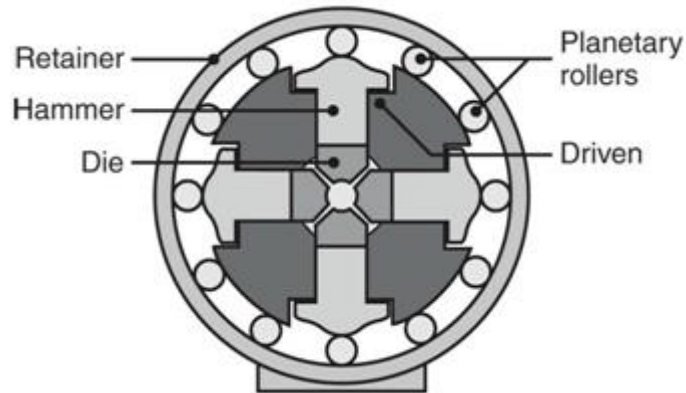
- It is used for **forming the heads on fasteners** (e.g. *bolts, screws, nails, rivets*).
- **Highly automated, high production rates, noisy.**
- Tendency of the bar to **buckle** if its *unsupported length to diameter ratio is more than 3:1*.



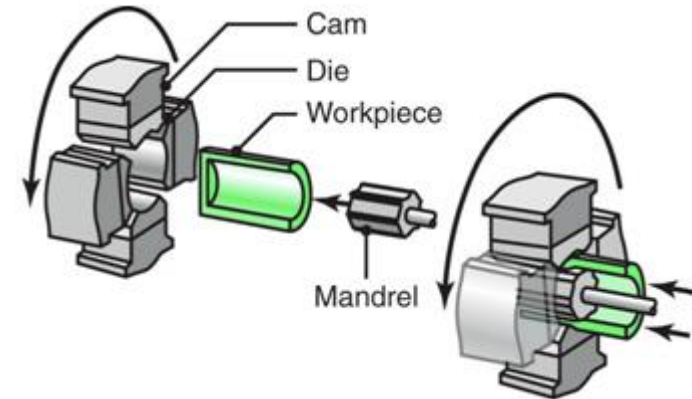
Rotary Swaging (Rotary Forging)



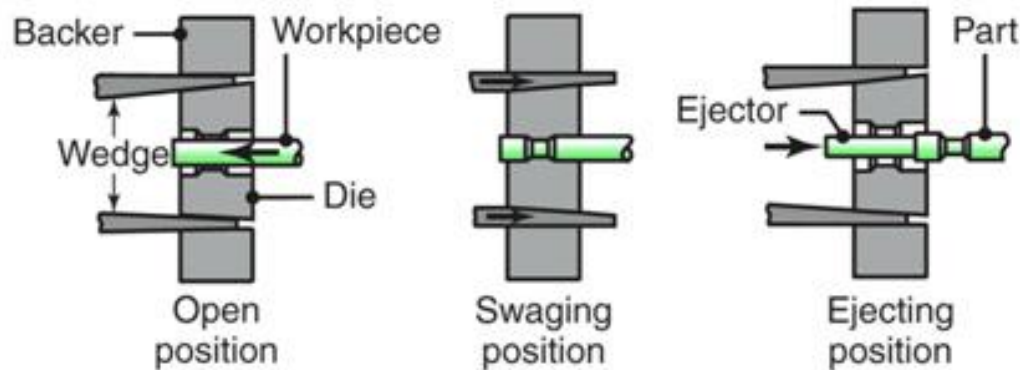
- A solid rod or tube is subjected to **radial impact forces by a set of reciprocating dies**.



Schematic illustration of rotary swaging process



Forming internal profiles on a tubular workpiece



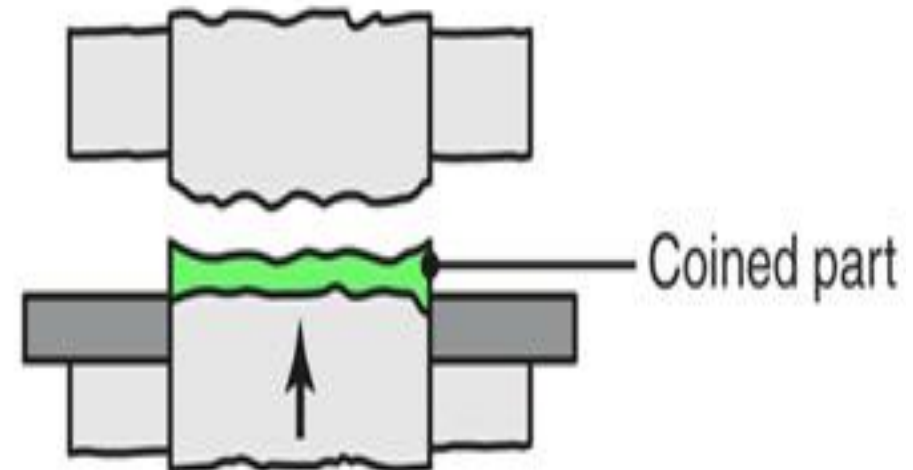
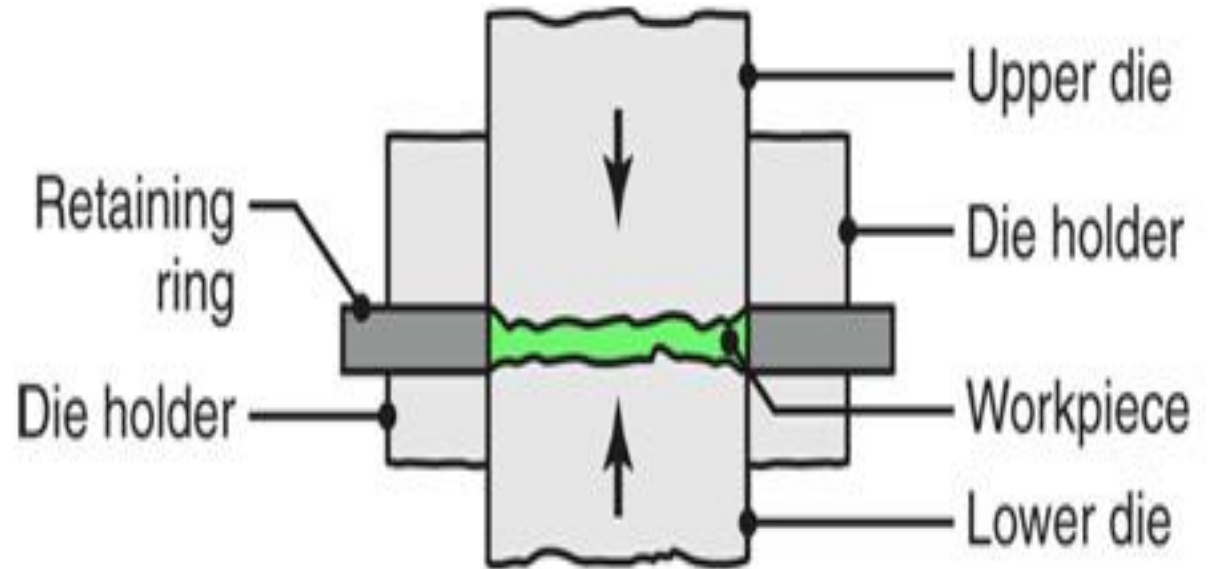
Forming of a stepped shaft using a die-closing swaging machine



Typical parts

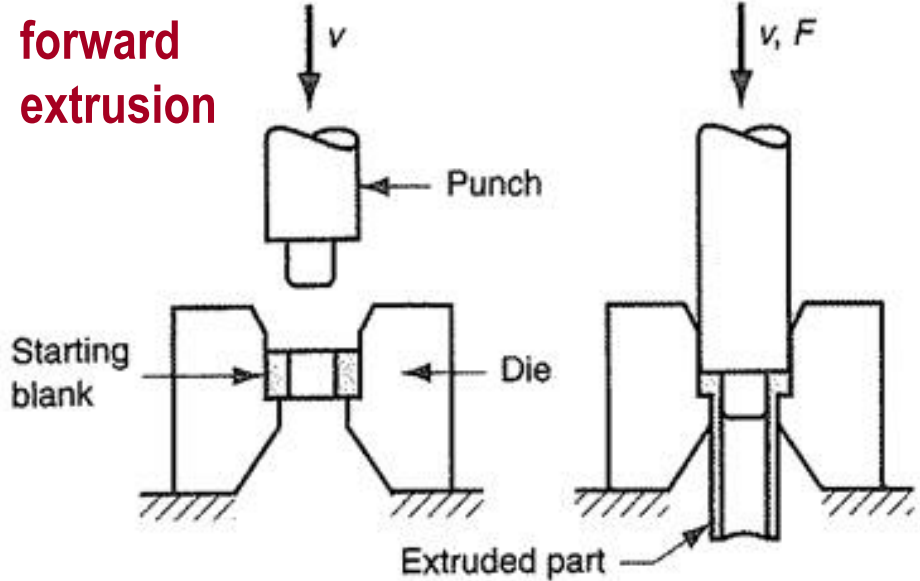


- Coining is used for **minting coins and jewelry**.
- **Completely closed dies** and **high pressures** (5-6 times the workpiece strength) are used to obtain fine details.
- **Lubricants cannot be used** as they are incompressible.

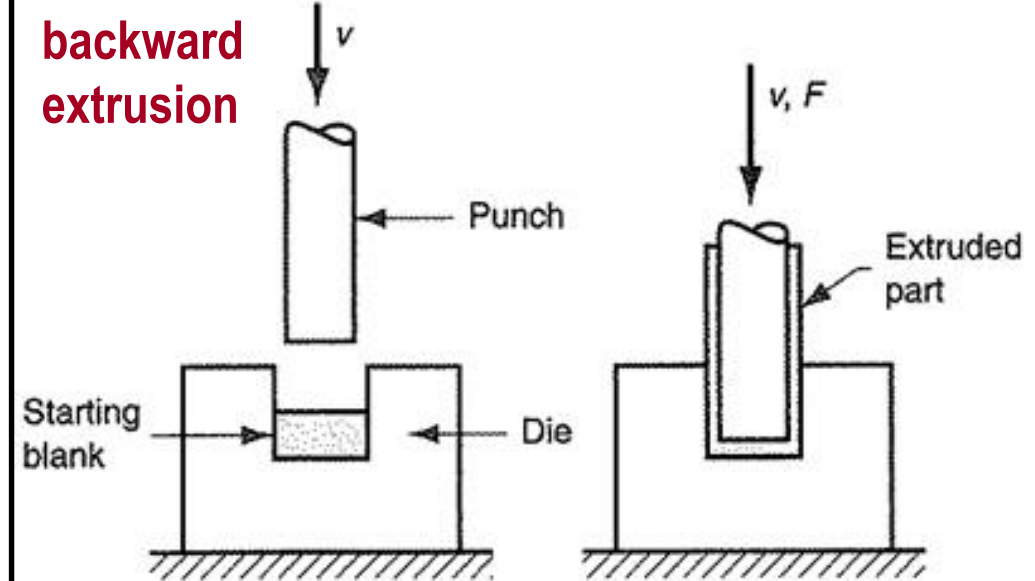




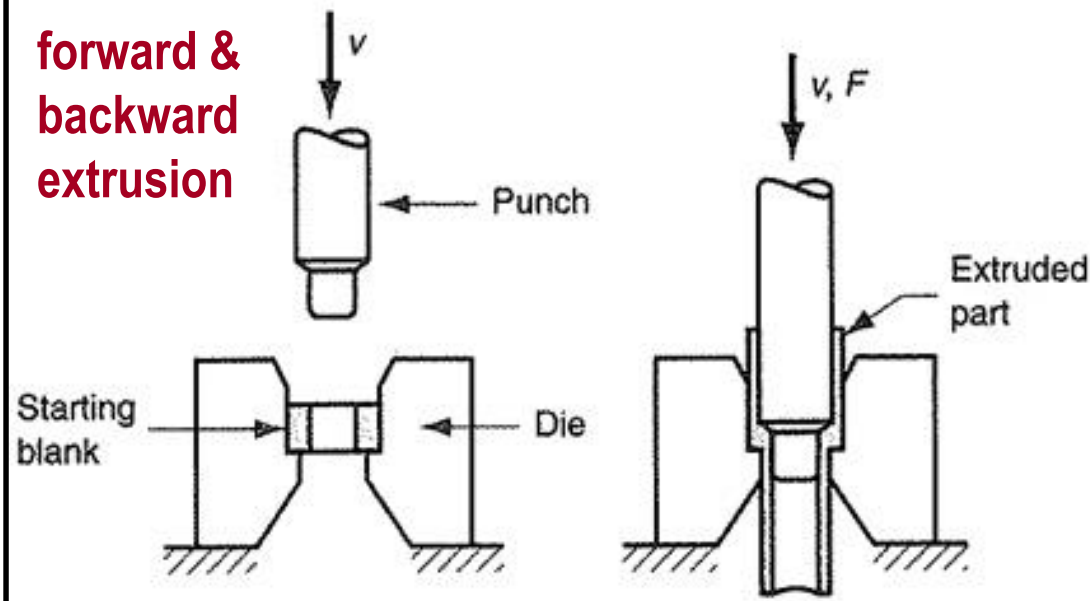
forward extrusion



backward extrusion

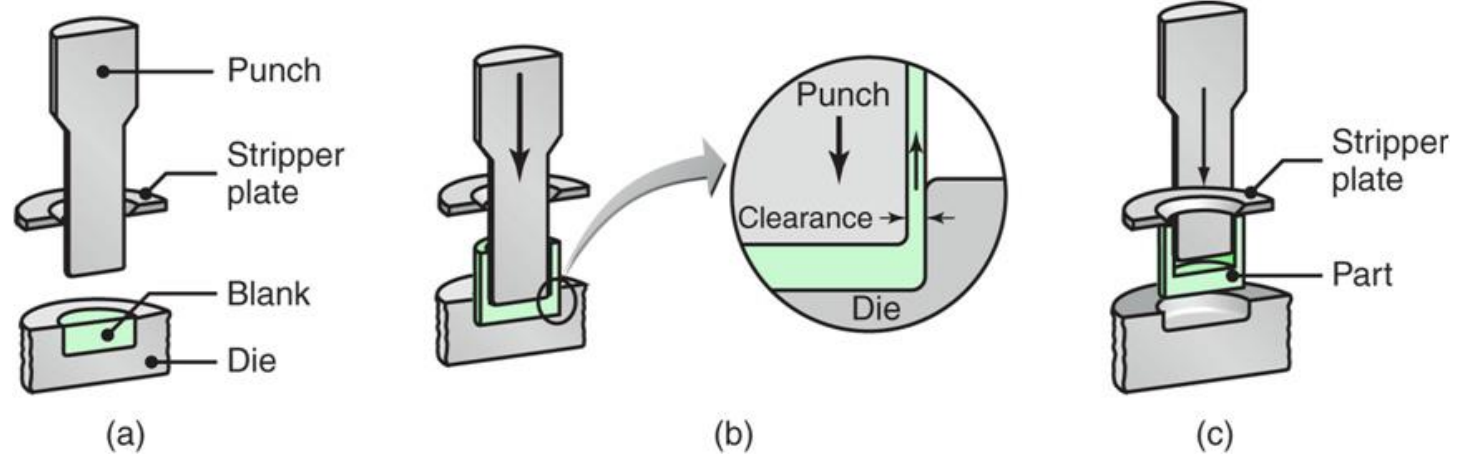


forward & backward extrusion



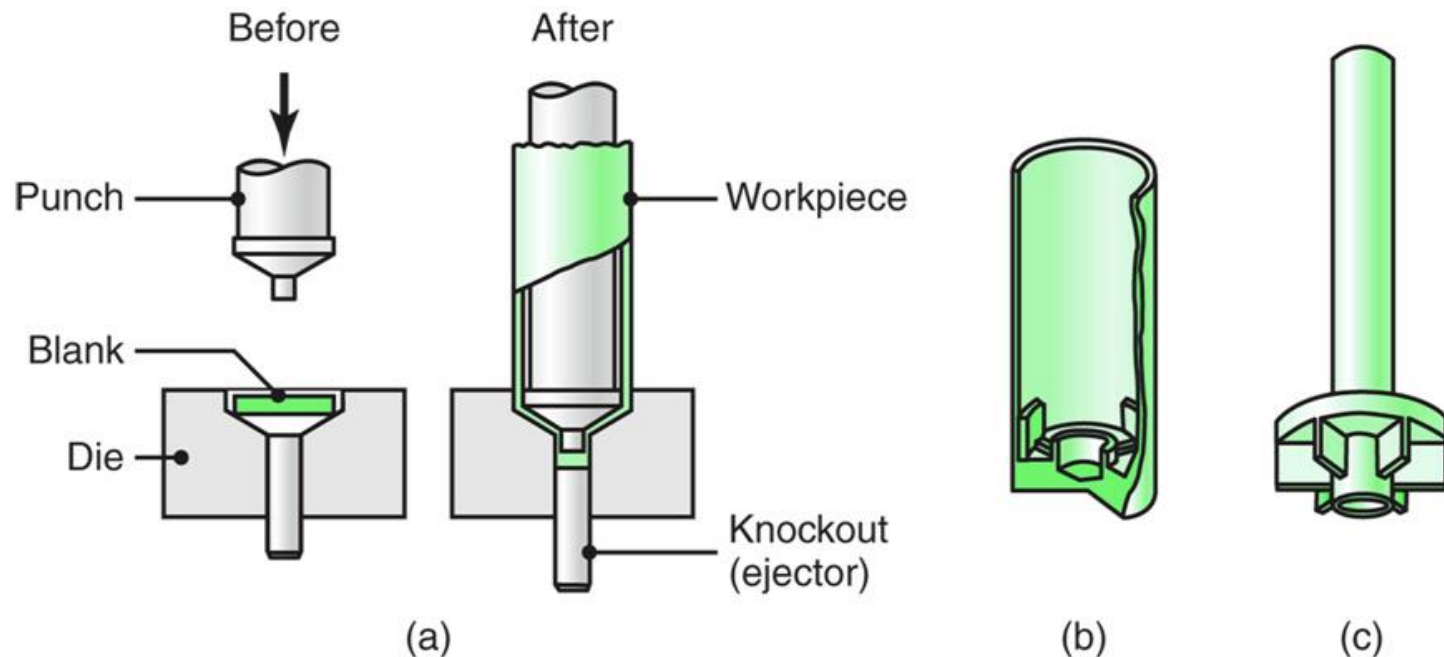


- Schematic illustration of impact extrusion.
- Extruded parts are **stripped** with stripper plate as they tend to stick to the punch.



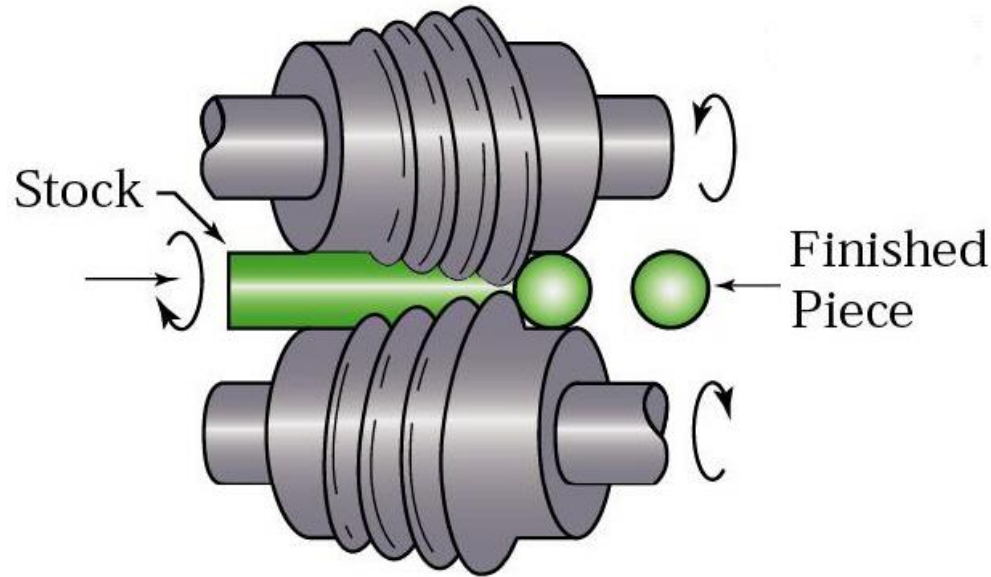
- Typical products shown below: **a)** collapsible tube (**Hooker process**) **b & c)** other examples

- These parts may also be made by casting, forging, or machining.
- The choice of process depends on material, part dimensions, wall thickness, and desired properties.



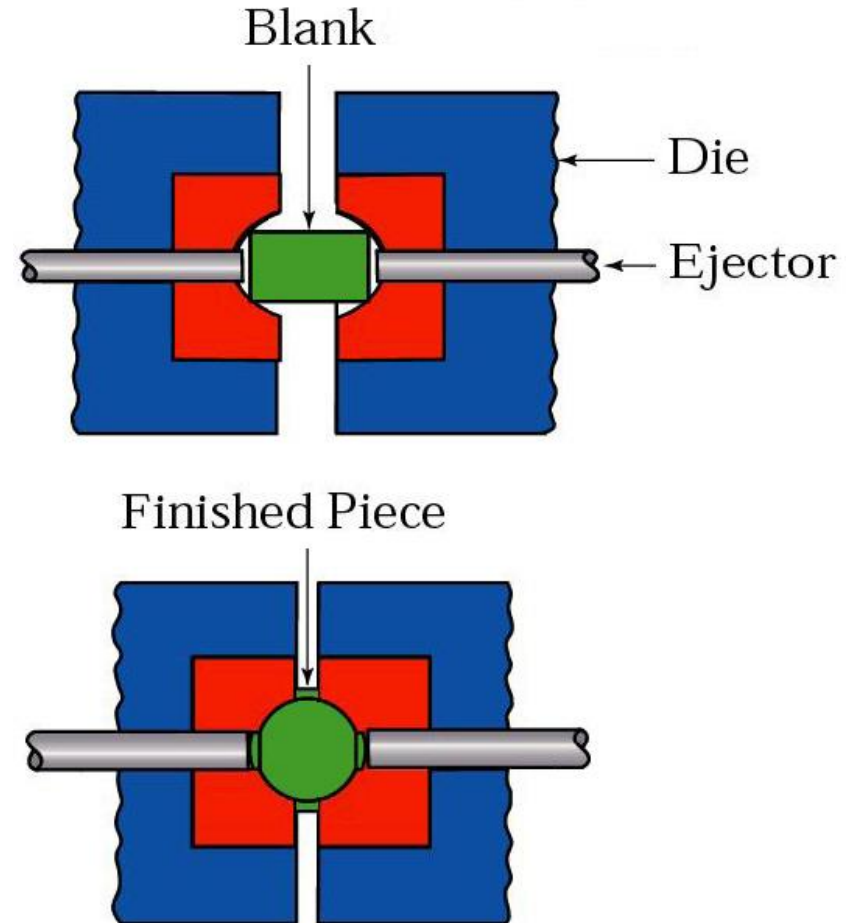


- Production of steel balls by **skew rolling**:



- Note **the formation of flash**.
- The balls made by these processes are subsequently ground and polished for **use in ball bearings**.

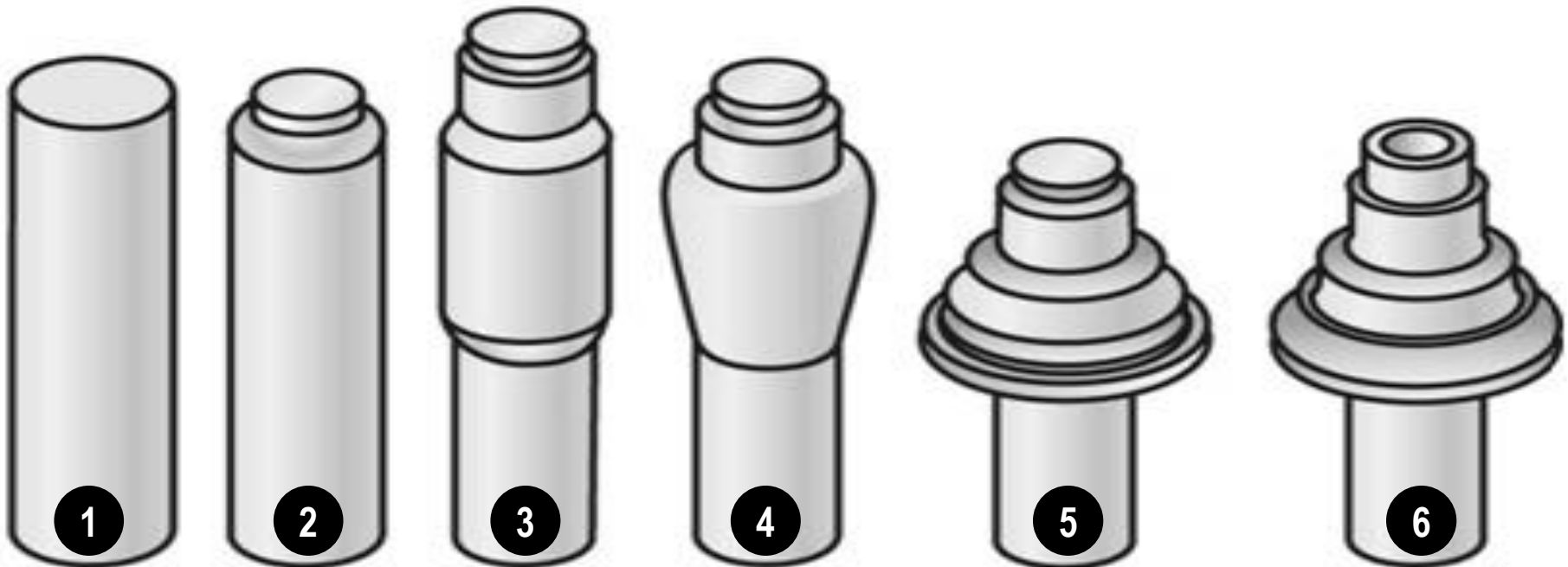
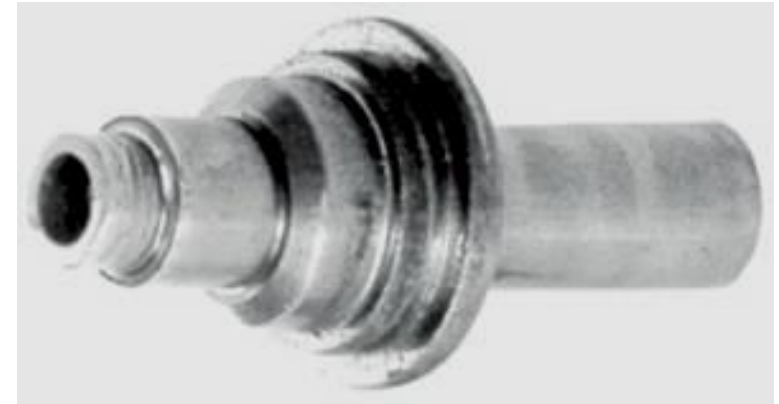
- Production of steel balls by **upsetting**:





► Manufacturing steps for a **stepped pin**:

1. A solid cylindrical blank
2. Extrusion (stage I)
3. Extrusion (stage II)
4. Upsetting (conical section)
5. Impression-die forming
6. Piercing (for boring)





- The figure below shows the production steps for a **cold-extruded spark plug**:

