

## UNIT-III

### FORMINGPROCESS

#### Cold working

The process is usually performed at room temperature, but mildly elevated temperatures may be used to provide increased ductility and reduced strength.

For example: Deforming lead at room temperature is a hot working process because the recrystallization temperature of lead is about room temperature.

#### Effects of Cold Working

Deformation using cold working results in

- Higher stiffness, and strength, but
- Reduced malleability and ductility of the metal.
- Anisotropy

#### Advantages

- No heating is required
- Strength, fatigue and wear properties are improved through strain hardening
- Superior dimensional control is achieved, so little, if any, secondary machining is required
- Better surface finish is obtained
- Products possess better reproducibility and interchangeability
- Directional properties can be imparted
- Contamination problems are minimized

#### Disadvantages

- Higher forces are required to initiate and complete the deformation
- Less ductility is available
- Intermediate anneals may be required to compensate for the loss of ductility that accompanies strain hardening
- Heavier and more powerful equipment is required
- Metal surfaces must be clean and scale-free
- Imparted directional properties may be detrimental
- Undesirable residual stresses may be produced

#### Hot working

Hot working is the deformation that is carried out above the recrystallization temperature.

#### Effects of hot working

• At high temperature, scaling and oxidation exist. Scaling and oxidation produce undesirable surface finish. Most ferrous metals need to be cold worked after hot working in order to improve the surface finish.

- The amount of force needed to perform hot working is less than that for cold work.
- The mechanical properties of the material remain unchanged during hot working.

· The metal usually experiences a decrease in yield strength when hot worked. Therefore, it is possible to hot work the metal without causing any fracture.

Quenching is the sudden immersion of a heated metal into cold water or oil. It is used to make the metal very hard. To reverse the effects of quenching, tempering is used (reheated of the metal for a period of time)

To reverse the process of quenching, tempering is used, which is the reheat of the metal.

### Cold-working Processes

- Squeezing
- Bending
- Shearing
- Drawing
- Presses

### Classifications of Squeezing Processes

- Rolling
- Cold Forging
- Sizing
- Staking
- Staking
- Coining
- Burnishing
- Extrusion
- Peening
- Hubbing
- Riveting
- Thread Rolling

### ROLLING

Process used in sheets, strips, bars, and rods to obtain products that have smooth surfaces and accurate dimensions; most cold-rolling is performed on four-high or cluster-type rolling mills



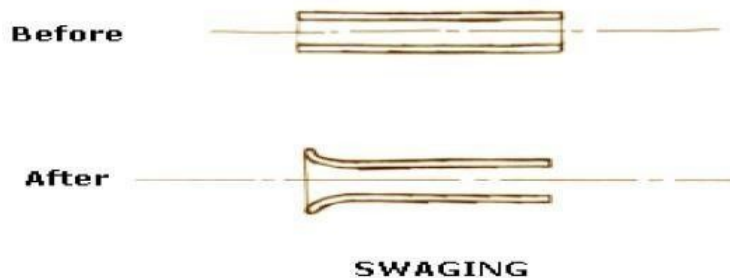
ROLLING PROCESS

### Flat Rolling

A sheet or block or strip stock is introduced between rollers and then compressed and squeezed. Thickness is reduced. The amount of strain (deformation) introduced determines the hardness, strength and other material properties of the finished product. Used to produce sheet metals predominantly

### Swaging

Process that reduces/increases the diameter, tapers, rods or points round bars or tubes by external hammering



### Cold Forging

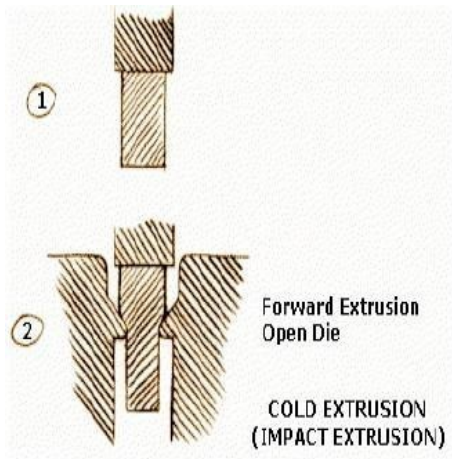
Process in which slugs of material are squeezed into shaped die cavities to produce finished parts of precise shape and size.



### COLD HEADING/COLD FORGING

### Extrusion

Process which is commonly used to make collapsible tubes such as toothpaste tubes, cans usually using soft materials such as aluminum, lead, tin. Usually a small shot of solid material is placed in the die and is impacted by a ram, which causes cold flow in the material.



### Sizing

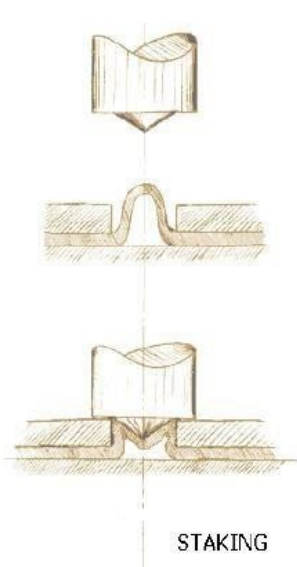
Process of squeezing all or selected areas of forgings, ductile castings, or powder metallurgy products to achieve a desired thickness or precision

### Riveting

Process where a head is formed on the shank end of a fastener to permanently join sheets or plates of material;

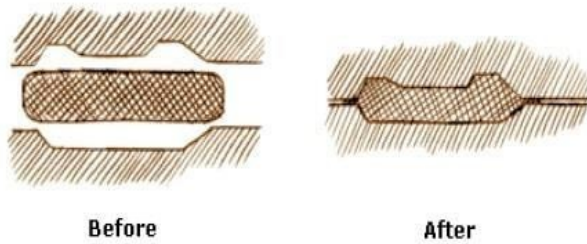
### Staking

Process of permanently joining parts together when one part protrudes through a hole in the other; a shaped punch is driven into the end of the protruding piece where a deformation is formed causing a radial expansion, mechanically locking the two pieces together



### Coining

Process where metal while it is confined in a closed set of dies; used to produce coins, medals, and other products where exact size and fine details are required, and thickness varies about a well-defined average



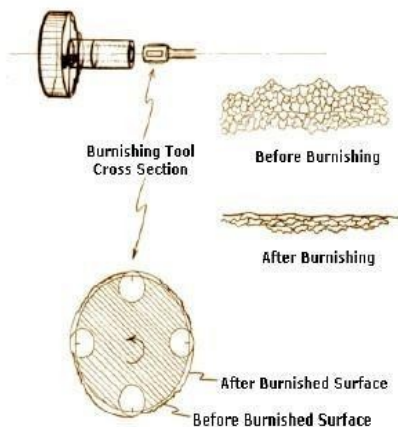
COINING

### Peening

Process where the surface of the metal is blasted by shot pellets; the mechanical working of surfaces by repeated blows of impelled shot or a round-nose tool

### Burnishing

Process by which a smooth hard tool is rubbed on the metal surface and flattens the high spots by applying compressive force and plastically flowing the material



BURNISHING

### Hubbing

Process is used to form recessed cavities in various types of female tooling dies. This is often used to make plastic extrusion dies in an economical manner

### Thread Rolling

Process is used for making external threads; in this process, a die, which is a hardened tool with the thread profile, is pressed on to a rotating workpiece

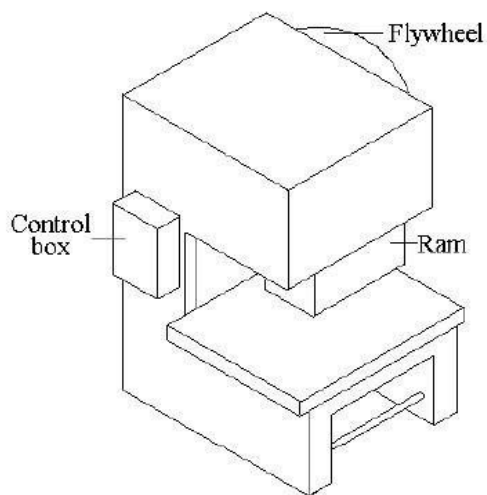


THREAD ROLLING

### The Presses

There are many kinds of machines

- Hydraulic presses
- Mechanical presses
  - C frame
  - Straight sided
- Others



C-frame mechanical press

## Production Technology (25ME304)