

FABRICATION PROCESS (23ME715)

DEPARTMENT OF CIVIL ENGINEERING

LECTURENOTES

ON

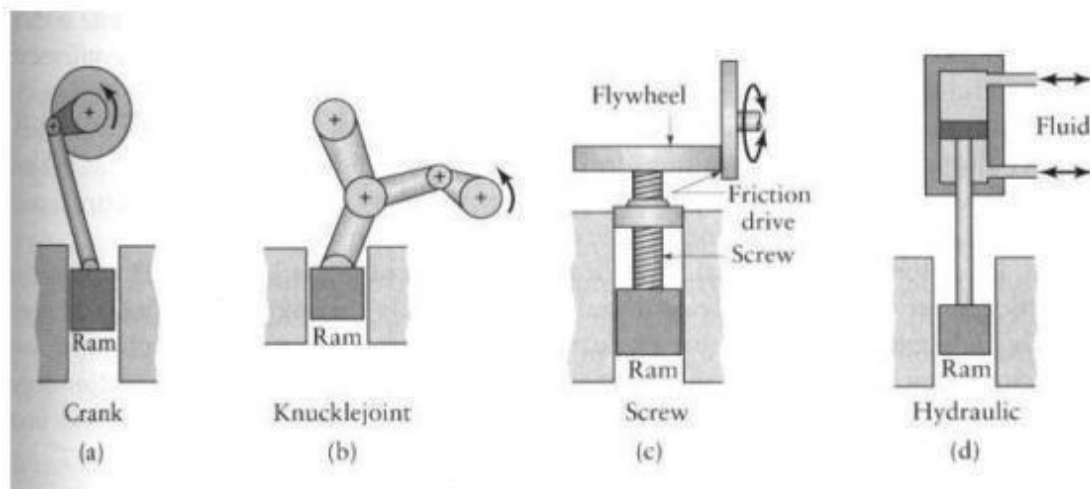
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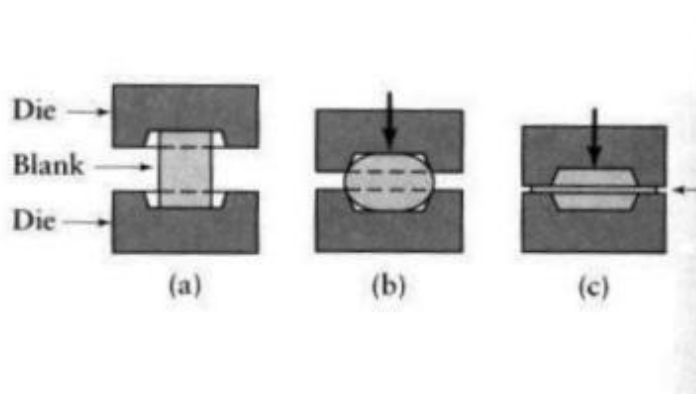
UNIT-V

FORGING PROCESS

Types of Forging Presses



Impression Die Forging



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Forging operations

Forging is a process in which the workpiece is shaped by compressive forces applied through various dies and tools. It is one of the oldest metalworking operations. Most forgings require a set of dies and a press or a forging hammer.

A Forged metal can result in the following: -

- Decrease in height, increase in section - open die forging
- Increase length, decrease cross-section, called drawing out.
- Decrease length, increase in cross-section on a portion of the length - upsetting
- Change length, change cross-section, by squeezing in closed impression dies - closed die forging. This results in favorable grain flow for strong parts

Types of forging

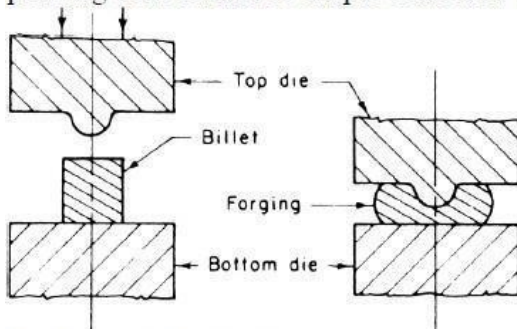
- Closed/impression die forging
- Electro-upsetting
- Forward extrusion
- Backward extrusion
- Radial forging
- Hobbing
- Isothermal forging
- Open-die forgig
- Upsetting
- Nosing
- Coining

Commonly used materials include

- Ferrous materials: low carbon steels
- Nonferrous materials: copper, aluminum and their alloys

Open-Die Forging

Open-die forging is a hot forging process in which metal is shaped by hammering or pressing between flat or simple contoured dies.



Equipment. Hydraulic presses, hammers.

Materials. Carbon and alloy steels, aluminum alloys, copper alloys, titanium alloys, all forgeable materials.

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Process Variations. Slab forging, shaft forging, mandrel forging, ring forging, upsetting between flat or curved dies, drawing out.

Application. Forging ingots, large and bulky forgings, preforms for finished forgings.

Closed Die Forging

In this process, a billet is formed (hot) in dies (usually with two halves) such that the flow of metal from the die cavity is restricted. The excess material is extruded through a restrictive narrow gap and appears as flash around the forging at the die parting line.

Equipment. Anvil and counterblow hammers, hydraulic, mechanical, and screw presses.

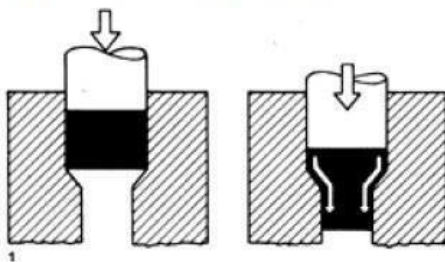
Materials. Carbon and alloy steels, aluminum alloys, copper alloys, magnesium alloys, beryllium, stainless steels, nickel alloys, titanium and titanium alloys, iron and nickel and cobalt super alloys.

Process Variations. Closed-die forging with lateral flash, closed-die forging with longitudinal flash, closed-die forging without flash.

Application. Production of forgings for automobiles, trucks, tractors, off-highway equipment, aircraft, railroad and mining equipment, general mechanical industry, and energy-related engineering production.

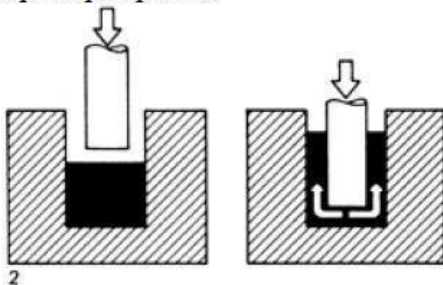
Forward extrusion

Forward extrusion reduces slug diameter and increases its length to produce parts such as stepped shafts and cylinders.



backward extrusion

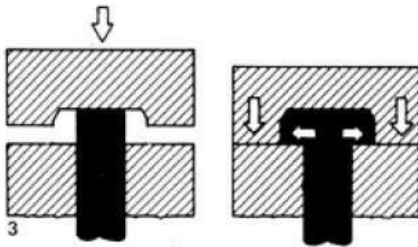
In backward extrusion, the steel flows back and around the descending punch to form cup-shaped pieces.



Upsetting, or heading

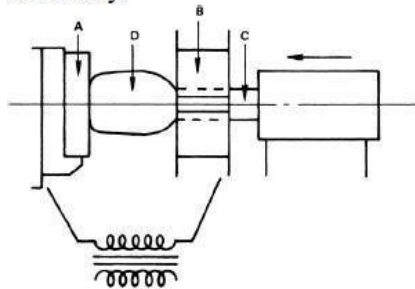
Upsetting, or heading, a common technique for making fasteners, gathers steel in the head and other sections along the length of the part.

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Electro-Upsetting (Fig. 2.4)

Electro-upsetting is the hot forging process of gathering a large amount of material at one end of a round bar by heating the bar end electrically and pushing it against a flat anvil or shaped die cavity.



A, anvil electrode; B, gripping electrode; C, workpiece; D, upset end of workpiece

Equipment. Electric upsetters.

Materials. Carbon and alloy steels, titanium.

Application. Preforms for finished forgings.

Hobbing

Hobbing is the process of indenting or coining an impression into a cold or hot die block by pressing with a punch.

Equipment. Hydraulic presses, hammers.

Materials. Carbon and alloy steels.

Process Variations. Die hobbing, die typing.

Application. Manufacture of dies and molds with relatively shallow impressions.

Nosing

Nosing is a hot or cold forging process in which the open end of a shell or tubular component is closed by axial pressing with a shaped die.

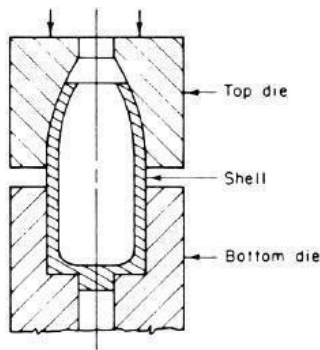
Equipment. Mechanical and hydraulic presses, hammers.

Materials. Carbon and alloy steels, aluminum alloys, titanium alloys.

Process Variations. Tube sinking, tube expanding.

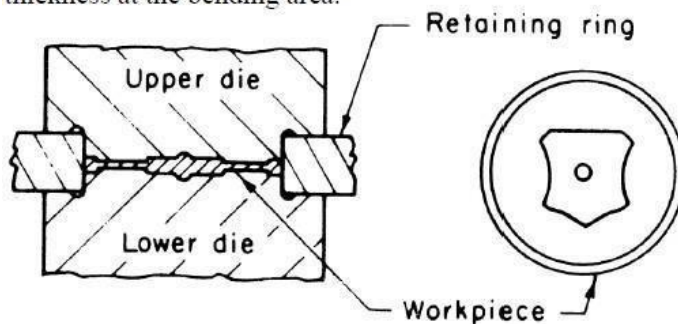
Applications. Forging of open ends of ammunition shells; forging of gas pressure containers.

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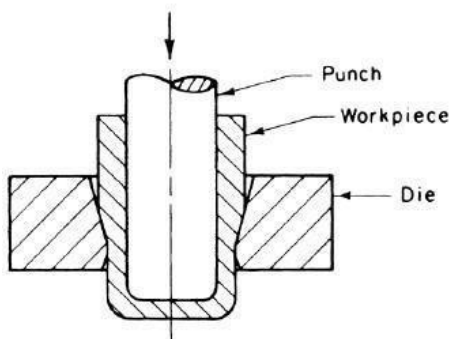
Coining

In sheet metal working, coining is used to form indentations and raised sections in the part. During the process, metal is intentionally thinned or thickened to achieve the required indentations or raised sections. It is widely used for lettering on sheet metal or components such as coins. Bottoming is a type of coining process where bottoming pressure causes reduction in thickness at the bending area.



Ironing

Ironing is the process of smoothing and thinning the wall of a shell or cup (cold or hot) by forcing the shell through a die with a punch.



Equipment. Mechanical presses and hydraulic presses.

Materials. Carbon and alloy steels, aluminum and aluminum alloys, titanium alloys.

Applications. Shells and cups for various

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Swaging

Uses hammering dies to decrease the diameter of the part

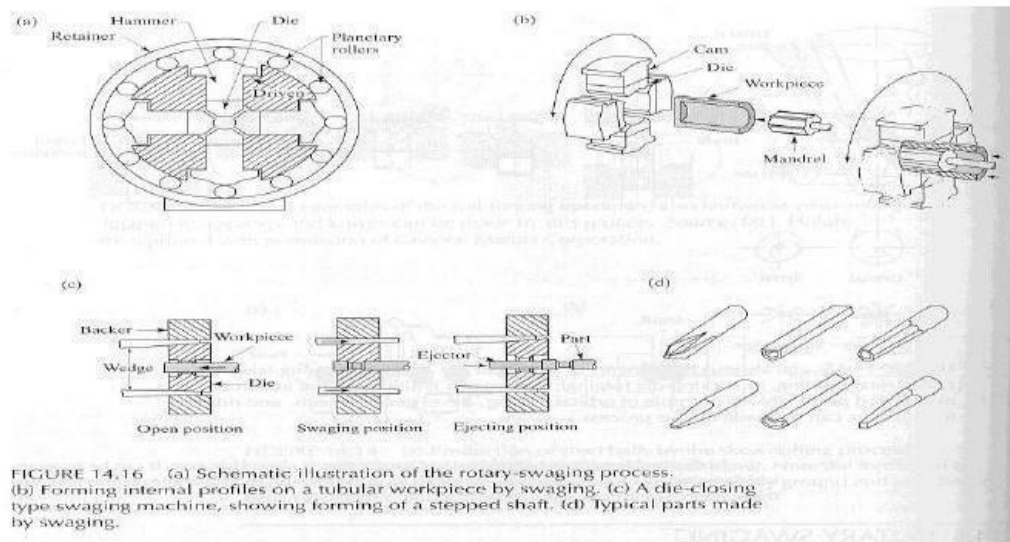


FIGURE 14.16 (a) Schematic illustration of the rotary-swaging process. (b) Forming internal profiles on a tubular workpiece by swaging. (c) A die-closing type swaging machine, showing forming of a stepped shaft. (d) Typical parts made by swaging.

Defects in Forging

