

# FORGING – OPERATIONS AND CLASSIFICATIONS

## Definition:

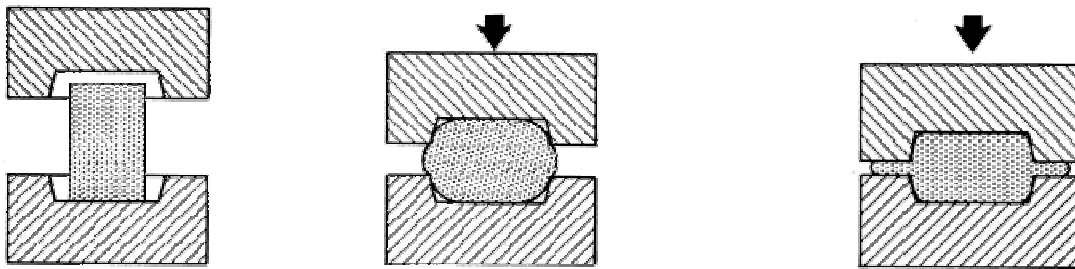
Forging is a metal working process in which useful shape is obtained in solid state by hammering or pressing metal.

It is one of the oldest metalworking arts with its origin about some thousands of years back. Some examples of shapes obtained by forging process: Crane hook, connecting rod of IC engine, spanner, gear blanks ..etc.

## Different Forging Operations

### 1. Upsetting

The thickness of the work reduces and length increases



Steps: (i)

(ii)

(iii) Final

Fig1. Upsetting

### 2. Edging

The ends of the bar are shaped to requirement using edging dies.

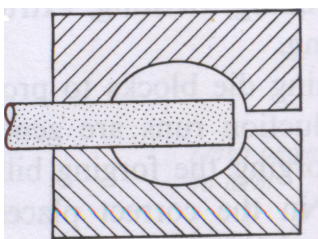


Fig 2. Edging

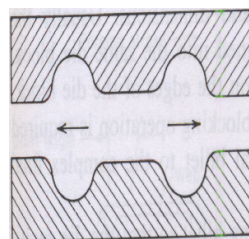


Fig 3. Fullering

### 3. Fullering

The cross sectional area of the work reduces as metal flows outward, away from centre.

#### 4. Drawing

The cross sectional area of the work is reduced with corresponding increase in length using convex dies.

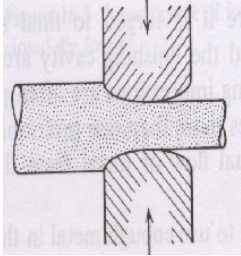


Fig 4. Drawing

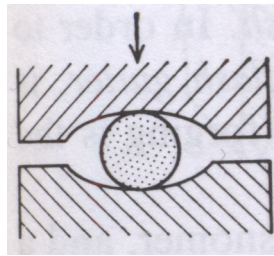


Fig 5. Swaging

**5. Swaging:** The cross sectional area of the bar is reduced using concave dies.

**6. Piercing:** The metal flows around the die cavity as a moving die pierces the metal.

**7. Punching:** It is a cutting operation in which a required hole is produced using a punching die.

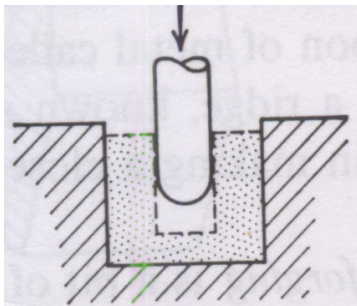


Fig 6. Piercing

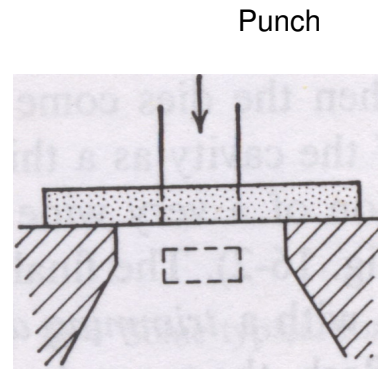


Fig 7. Punching

**8. Bending:** The metal is bent around a die/anvil.

### Classification of Forging Processes

#### Based on Temperature of the work piece:

**1. Hot Forging:** (most widely used)

Forging is carried out at a temperature above the recrystallization temperature of the metal.

**Advantages:**

- High strain rates and hence easy flow of the metal
- Recrystallization and recovery are possible
- Forces required are less

**Disadvantages of Hot Working:**

- Lubrication is difficult at high temperatures
- Oxidation and scaling occur on the work
- Poor surface finish
- Dies must withstand high working temperature

**2. Cold Forging:**

Forging is carried out at a temperature below the recrystallization temperature of the metal.

**Advantages:**

- Less friction between die surface and work piece
- Lubrication is easy
- No oxidation or scaling on the work
- Good surface finish

**Disadvantages of Cold Working:**

- Low strain rates, hence less reduction per pass.
- Recrystallization and recovery do not occur.
- Hence, annealing is required for further deformation in subsequent cycles.
- Forces required are high.

Source : [http://elearningatria.files.wordpress.com/2013/10/mp3\\_unit3\\_forging\\_final.pdf](http://elearningatria.files.wordpress.com/2013/10/mp3_unit3_forging_final.pdf)