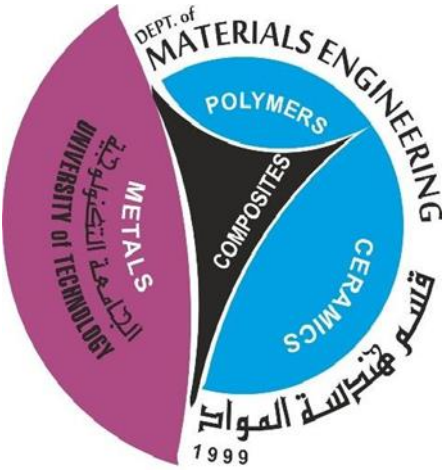


University of Technology
Materials Engineering Department

Fourth Class –General Materials Branch

Casting Technology II

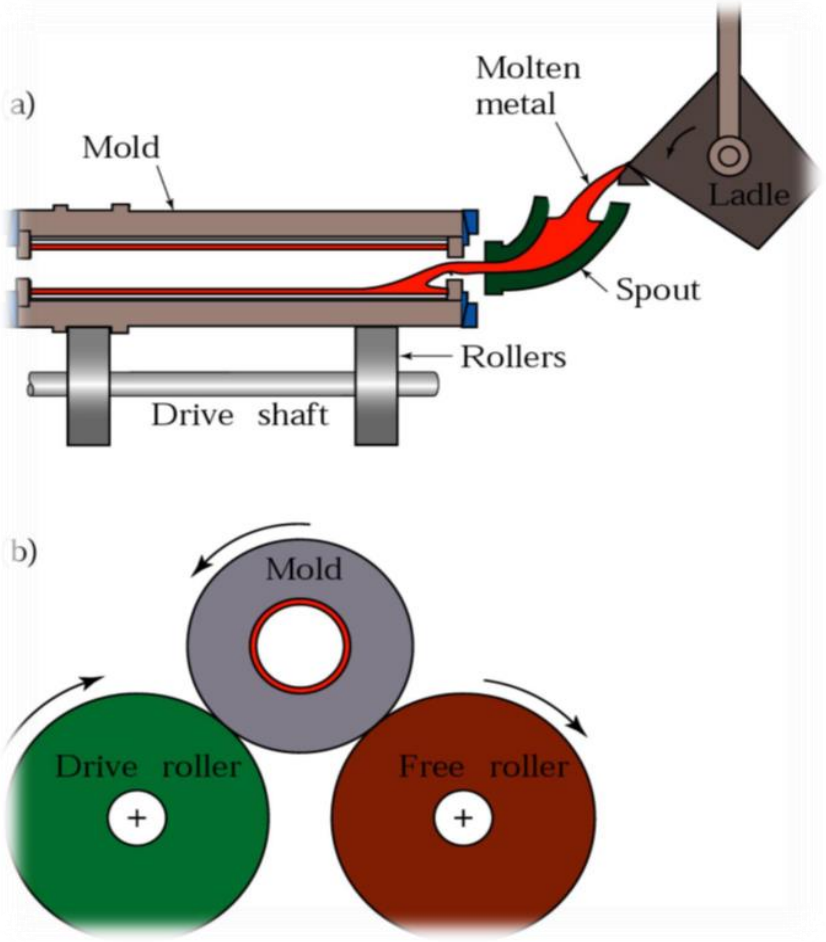
2018-2019

Lecture Five :Centrifugal Casting

Centrifugal casting

- Centrifugal casting refers to several casting methods in which the mold is rotated at high speed so that centrifugal force distributes the molten metal to the outer regions of the die cavity. The group includes

1. True centrifugal casting,
2. Semi-centrifugal casting
3. Centrifuge casting.



True Centrifugal Casting

- $F = \frac{mv^2}{R}$
- Where
- F = force, N .
- m = mass, kg .
- v = velocity, (m/s)
- R = inside radius of the mold (m)

G-Factor

- The so-called G-factor GF is the ratio of Centrifugal force divided by Weight:
- W=mg
- where
- m = mass (Kg)
- g= acceleration of gravity, 9.8 m/s^2
- $GF = \frac{mv^2}{RW} = \frac{mv^2}{Rmg} = \frac{v^2}{Rg}$

True Centrifugal Casting

- Velocity v can be expressed
- $v = \frac{2\pi N}{60}$
- $v = \frac{\pi N}{30}$
- where
- N=rotational speed, rev/min. R=Inside Radius of Mold
- So the G-Factor is
- $GF = \frac{R(\frac{\pi n}{30})^2}{g}$

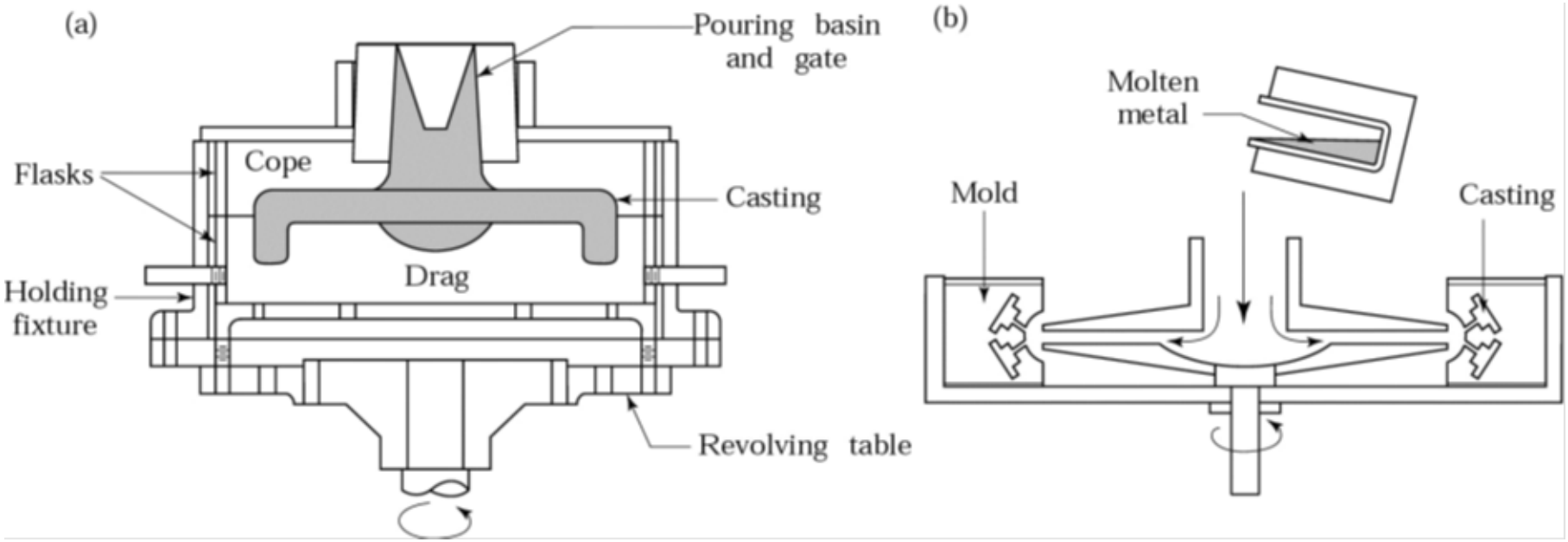
True Centrifugal Casting

- Rearranging this to solve for rotational speed N, and using diameter D rather than radius in the resulting equation, We Have

$$N = \frac{30}{\pi} \sqrt[2]{\frac{2gGF}{d}}$$

- D =inside diameter of the mold (m) .

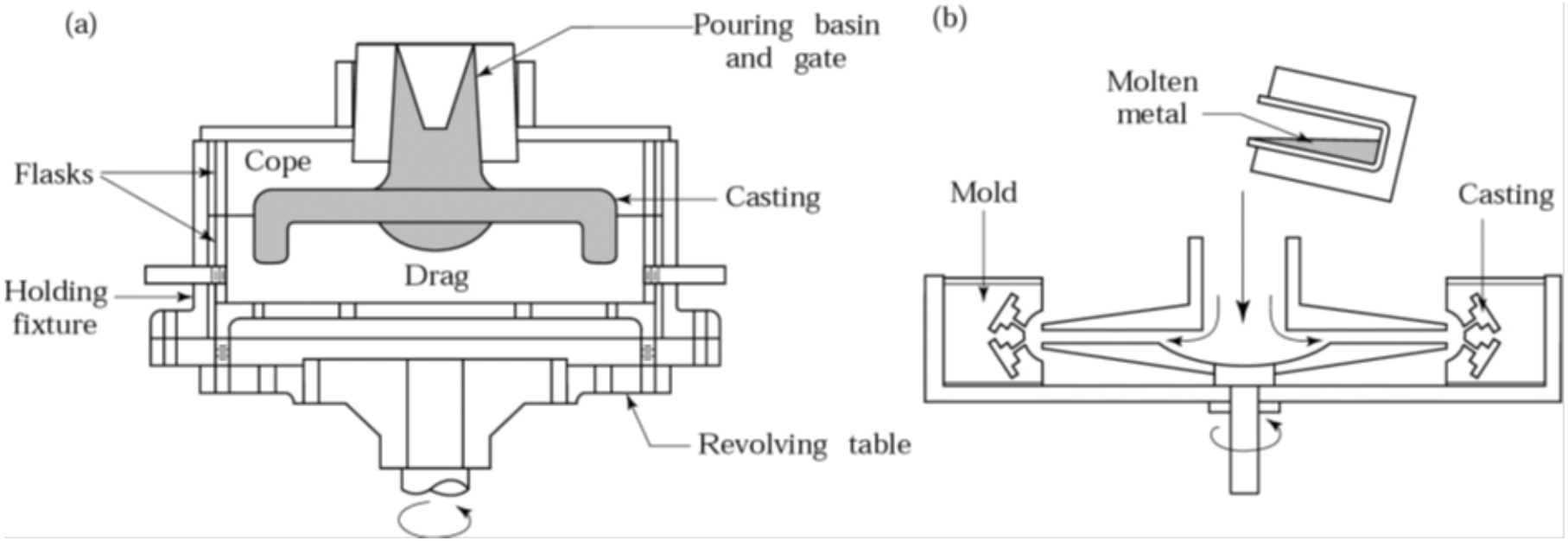
Semi -Centrifugal Casting



(a) Schematic illustration of the semi centrifugal casting process. Wheels with spokes can be cast by this process.

(b) (b) Schematic illustration of casting by centrifuging. The molds are placed at the periphery of the machine, and the molten metal is forced into the molds by centrifugal force

Centrifuge Casting



(a) Schematic illustration of the semi centrifugal casting process. Wheels with spokes can be cast by this process. (b) Schematic illustration of casting by centrifuging. The molds are placed at the periphery of the machine, and the molten metal is forced into the molds by centrifugal force.

Vertical Centrifugal Casting

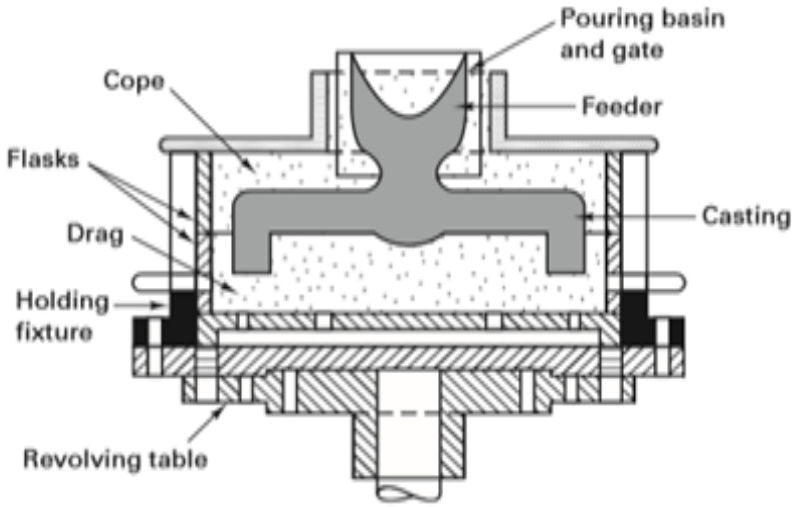


FIGURE 13-11 Schematic of a semicentrifugal casting process.

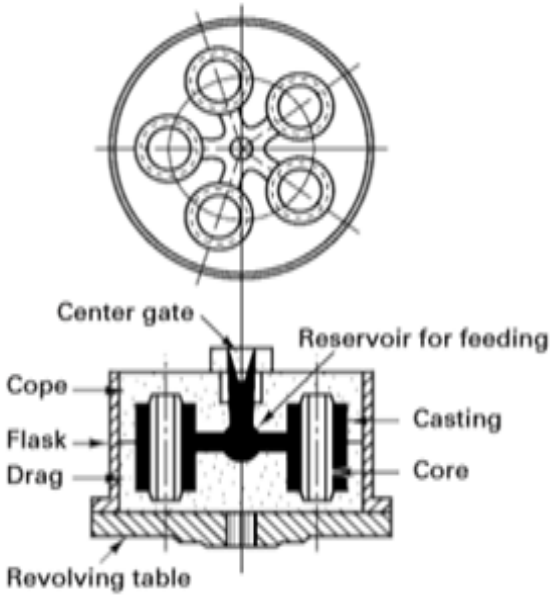


FIGURE 13-12 Schematic of a centrifuging process. Metal is poured into the central pouring sprue and spun into the various mold cavities. *(Courtesy of American Cast Iron Pipe Company, Birmingham, AL.)*

Vertical Centrifugal Casting

Equation can be used to determine the required rotational speed for vertical centrifugal casting

$$N = \frac{30}{\pi}^{2} \sqrt{\frac{2gL}{R^2{}_i - R^2{}_b}}$$

- where
- L= vertical length of the casting(m).
- R_i= inside radius at the top of the casting (m).
- R_b =inside radius at the bottom of the casting(m).

Centrifugal Casting

- **Process**: Molten metal is introduced into a rotating sand, metal, or graphite mold and held against the mold wall by centrifugal force until it is solidified.
- **Advantages:** Can produce a wide range of cylindrical parts, including ones of large size; good dimensional accuracy ,soundness, and cleanliness.
- **Limitations:** Shape is limited; spinning equipment can be expensive. Common metals: Iron; steel; stainless steel; and alloys of aluminum, copper, and nickel.
- **Size limits**: Up to 3 m in diameter and 15 m in length. Thickness limits: Wall thickness 2.5 to 125 mm
- **Typical tolerances**: O.D.to within 2.5 mm ;I.D.to about 4 mm
- **Draft allowance:** 10 mm/m
- **Surface finish**: (2.5–12.5 µm) rms.