

# Manufacturing processes

## Unit-1

# MANUFACTURING PROCESSES

## Unit 01

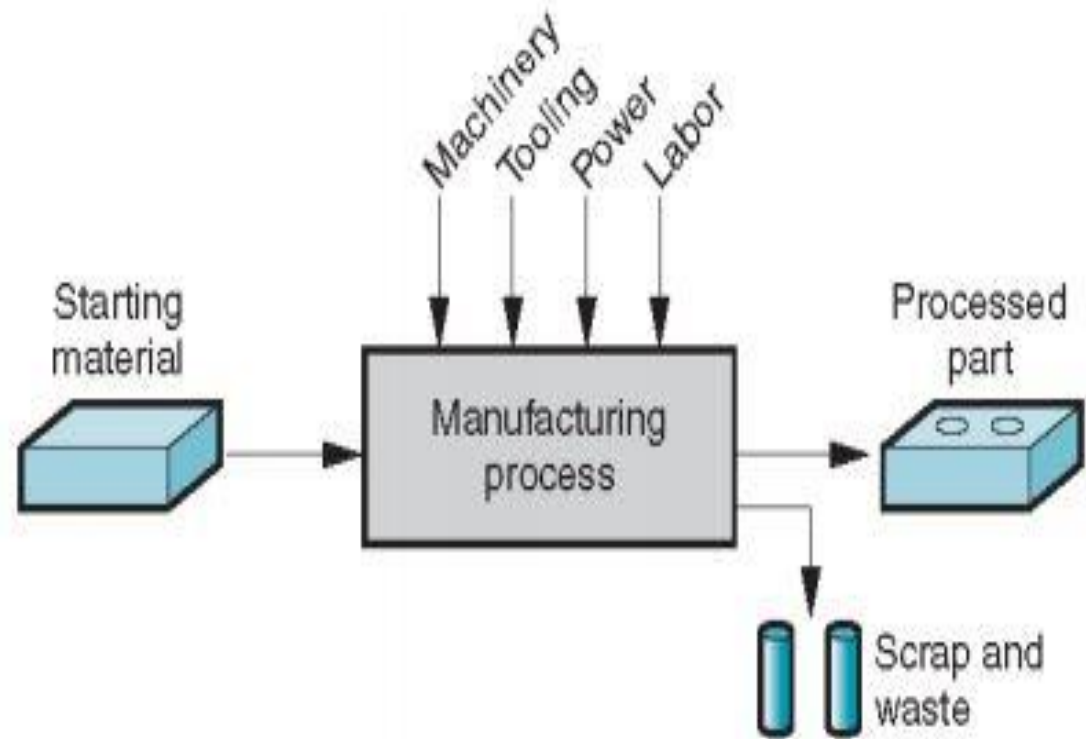
- Importance and selection of Manufacturing Processes.
- **Casting Processes:**
- Introduction to casting process, process steps
- Pattern -types, materials and allowance
- Cores -Types of cores, core prints, principles and design of gating system
- Solidification of casting: Concept, solidification of pure metal and alloy
- Special casting processes: Shell casting, investment casting, die casting, centrifugal casting, casting defects and remedies.

**Manufacturing** can be simply defined as value addition processes by which raw materials of low utility and value due to its inadequate material properties and poor or irregular size, shape and finish are converted into high utility and valued products with definite dimensions, forms and finish imparting some functional ability.

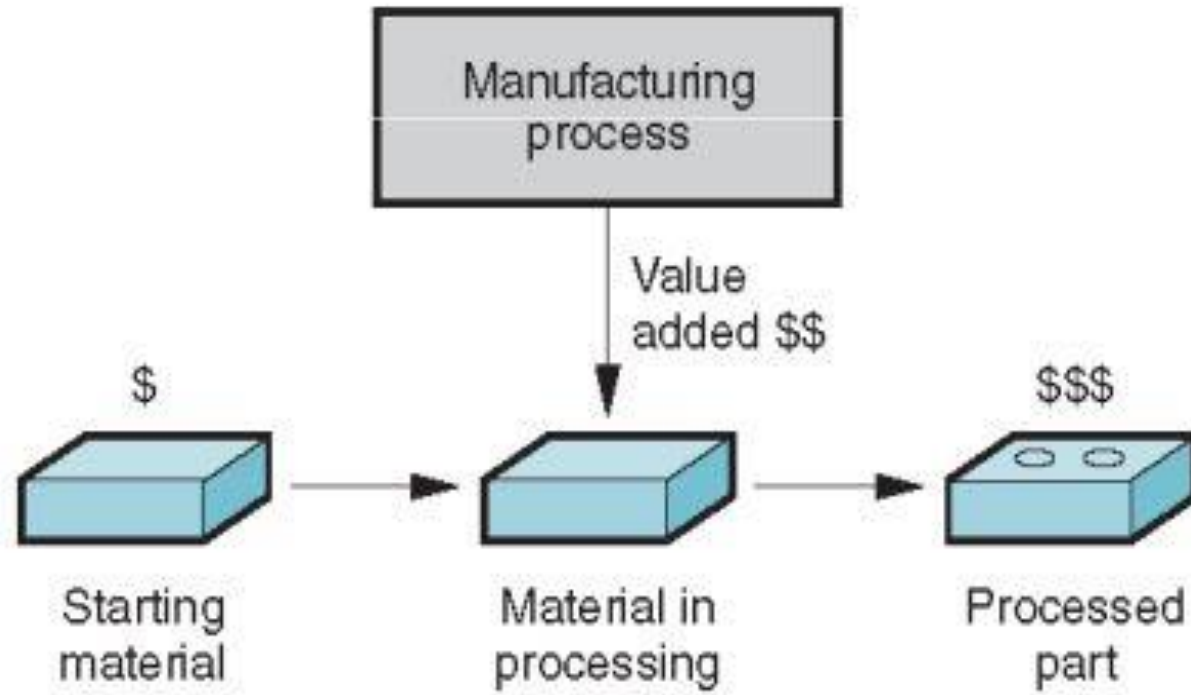
**Manufacturing Process** refers to science and technology of manufacturing products effectively, efficiently, economically and environment-friendly through proper selection of input materials, tools, machines and environments.

# Classification of Manufacturing Processes

- 1. Shaping or forming** -Manufacturing a solid product of definite size and shape from a given material. Eg. Rolling
- 2. Joining process** -Welding, brazing, soldering etc.
- 3. Removal process** -Machining (Traditional or Non-traditional), Grinding etc
- 4. Regenerative manufacturing**  
Production of solid products in layer by layer from raw materials in different form.



**Fig: Manufacturing Process**



**Fig: Manufacturing Process**

Two basic types:

1. **Processing operations** - transform a work material from one state of completion to a more advanced state
  - Operations that change the geometry, properties, or appearance of the starting material
2. **Assembly operations** - join two or more components to create a new entity

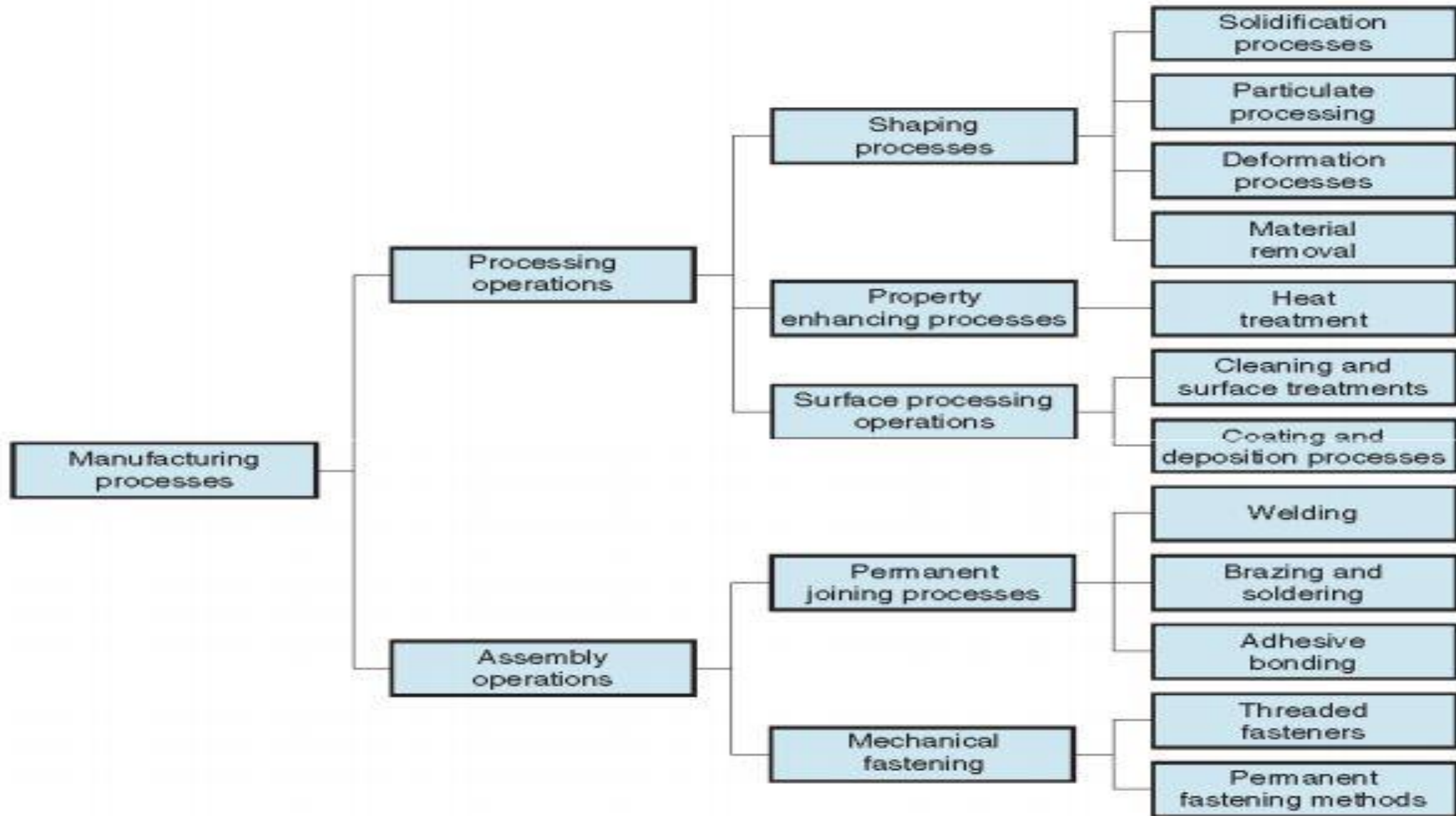


Fig: Classification of Manufacturing Processes



## Casting

- Casting is the process of producing metal parts by pouring molten metal into the mould cavity of the required shape and allowing the metal to solidify.
- The solidified metal piece is called as "casting".
- The solidified object is taken out from the mould either by breaking or taking the mould apart.
- The solidified object is called casting and the technique followed in method is known as casting process.

## Properties of sand

1. **Porosity:** It is the ability of the moulding sand to allow gasses to pass through.
2. **Cohesiveness:** Cohesiveness is the property of sand to hold its particles together
3. **Adhesiveness:** Adhesiveness is the property of sand due to which the sand particles sticks to the sides of the moulding box
4. **Plasticity:** Plasticity is the property of the moulding sand by virtue of which it flows to all corners around the mould when rammed, thus not providing any possibility of left out spaces, and acquires a predetermined shape under ramming pressure.
5. **Flow ability:** Flow-ability is the ability of moulding sand to free flow and fill the recesses and the fine details in the pattern. It varies with moisture content.
6. **Collapsibility** is the property of sand due to which the sand mould collapse automatically after the solidification of the casting

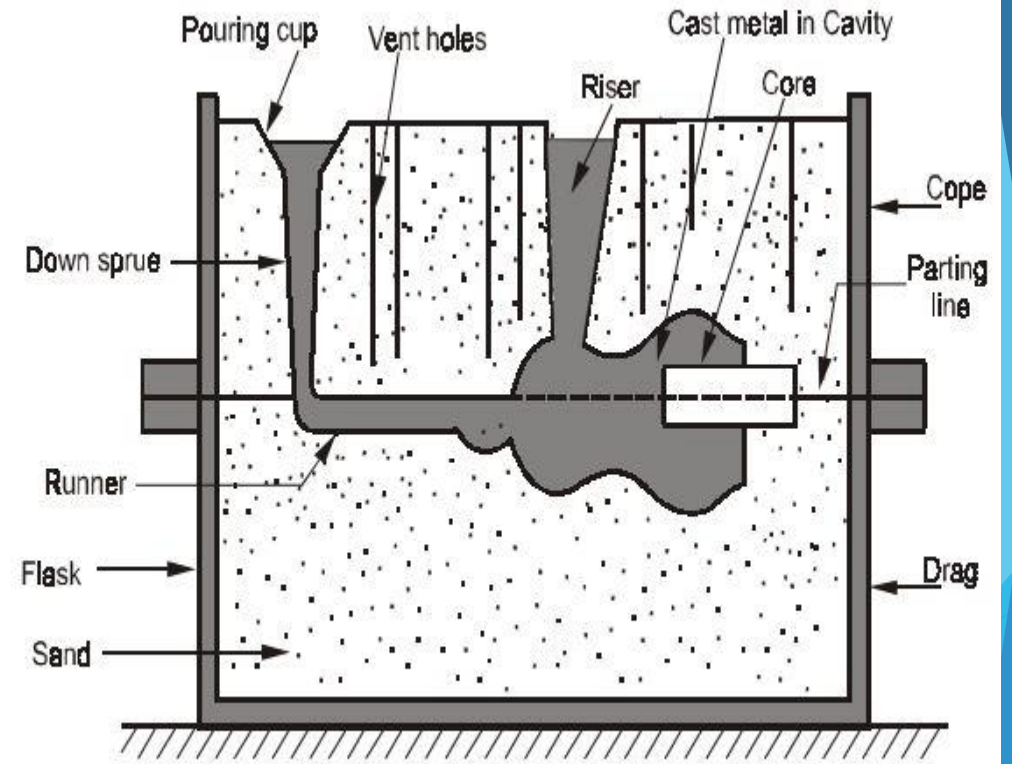
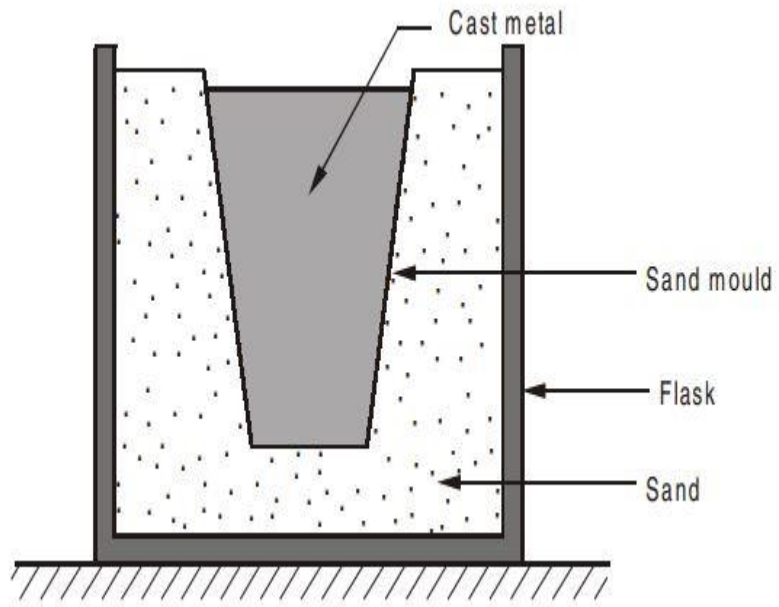
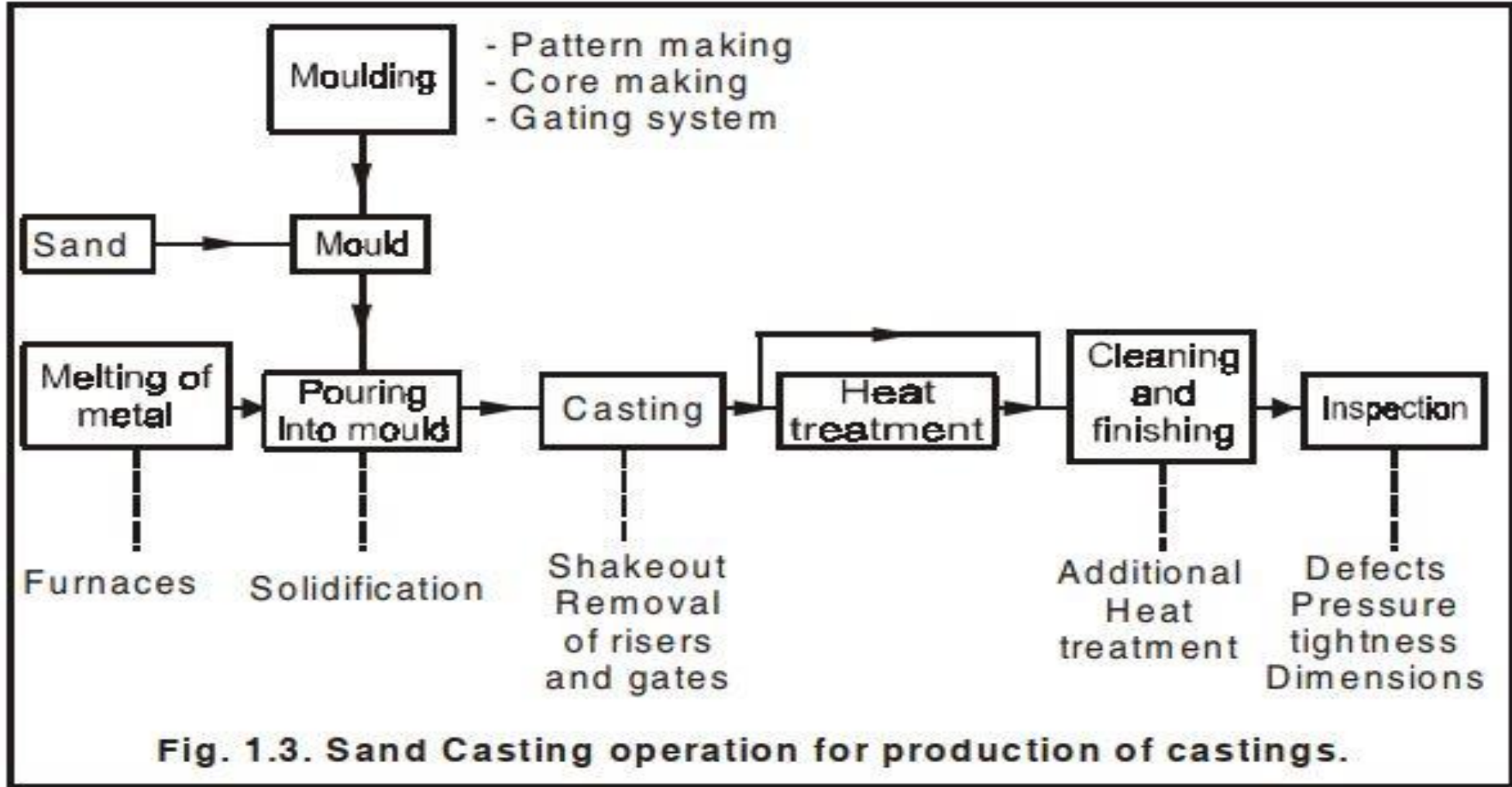
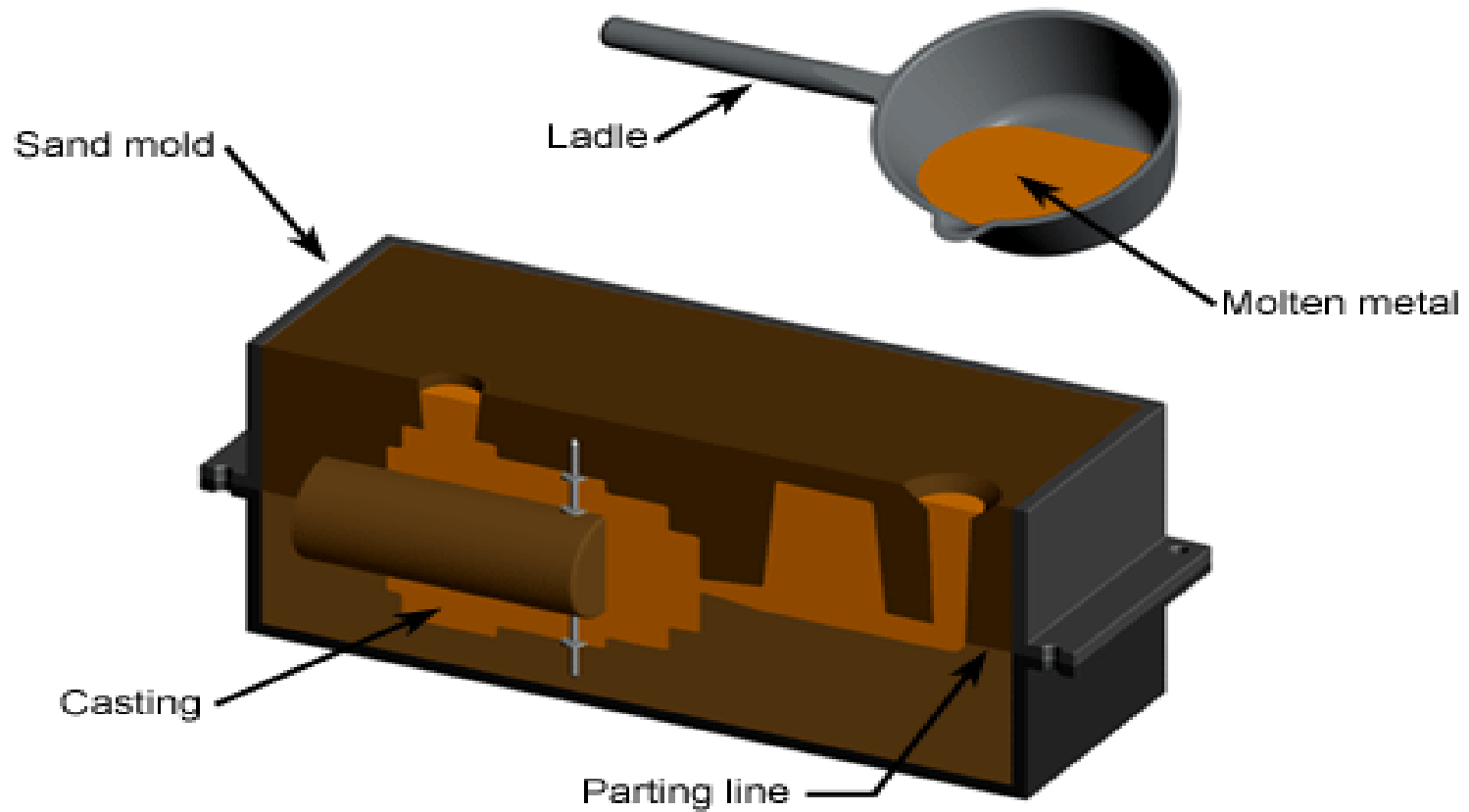


Fig. 1.2 (b) Closed mould



## Steps in sand Casting Process

1. Preparation of mould cavity and molten metal.
2. Pour molten metal into sand mould
3. Allow metal to solidify
4. Break up the mould to remove casting
5. Clean and inspect casting
6. Heat treatment of casting is sometimes required to improve metallurgical properties.



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## Terms used in sand Casting:

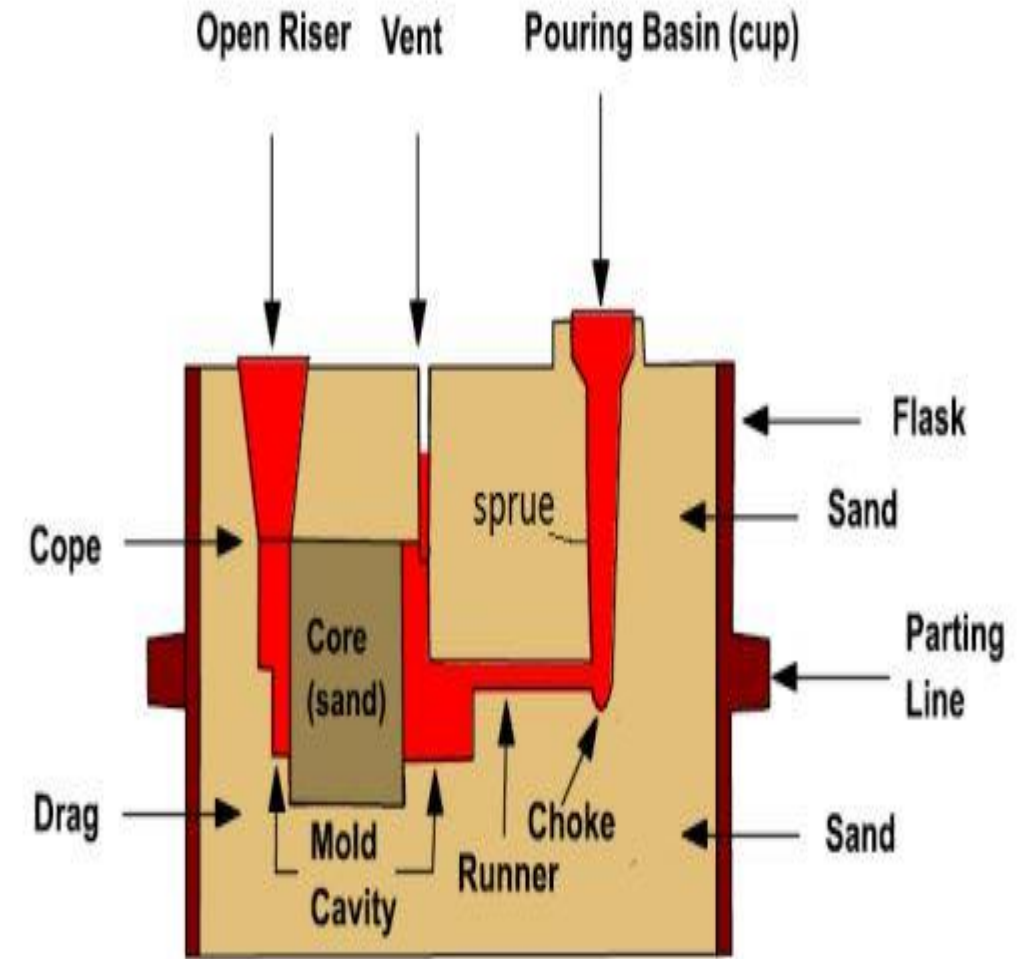
1. **Moulding Flask:** A metal or wood frame, without fixed top or bottom, in which the mould is formed.

drag – lower moulding flask

cope – upper moulding flask

2. **Pattern:** It is the replica of the final object to be made. The mould cavity is made with the help of pattern.

3. **Parting line:** This is the dividing line between the two moulding flasks that makes up the mould.



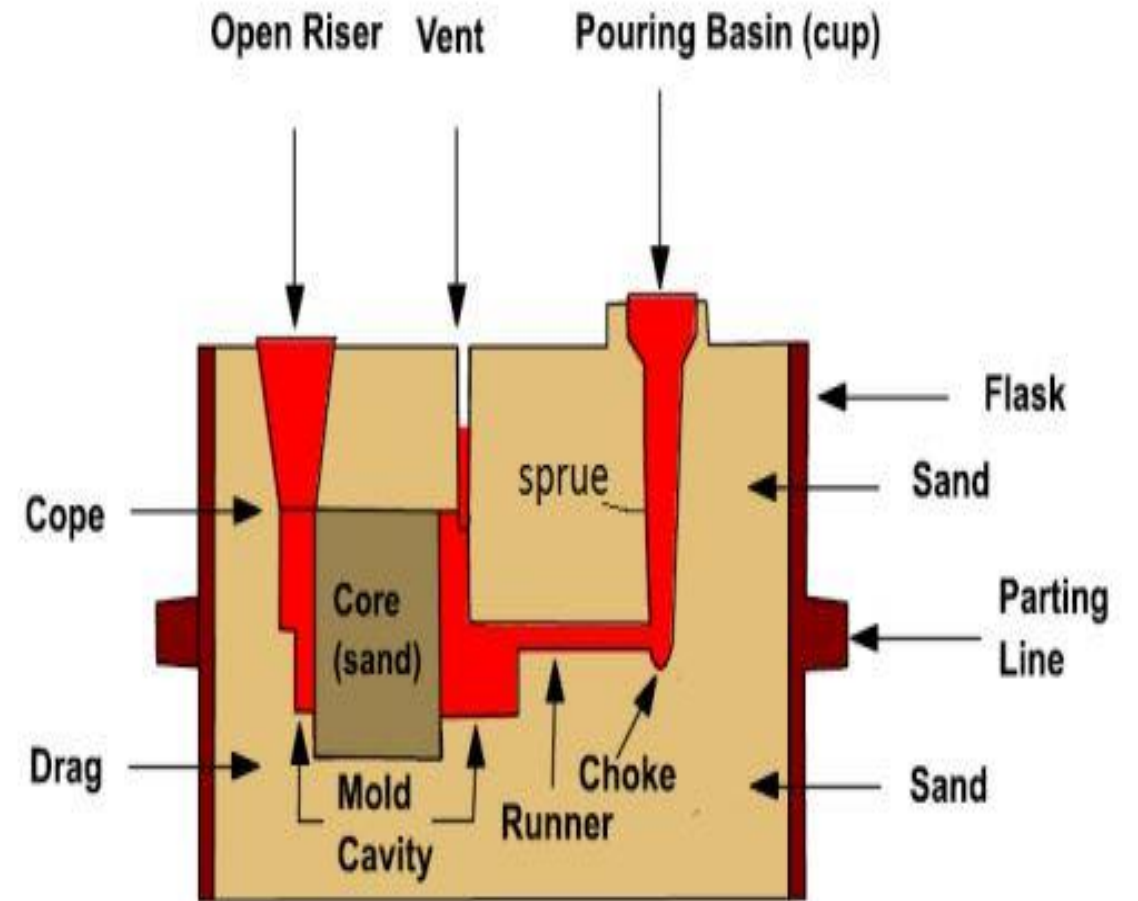
Mould Section and casting nomenclature

4. **Moulding sand:** Sand, which binds strongly without losing its permeability to air or gases. It is a mixture of silica sand, clay, and moisture in appropriate proportions.

5. **Facing sand:** The small amount of carbonaceous material sprinkled on the inner surface of the mould cavity to give a better surface finish to the castings.

6. **Core:** A separate part of the mould, made of sand and generally baked, which is used to create openings and various shaped cavities in the castings.

7. **Pouring basin:** A small funnel shaped cavity at the top of the mould into which the molten metal is poured.



Mould Section and casting nomenclature .

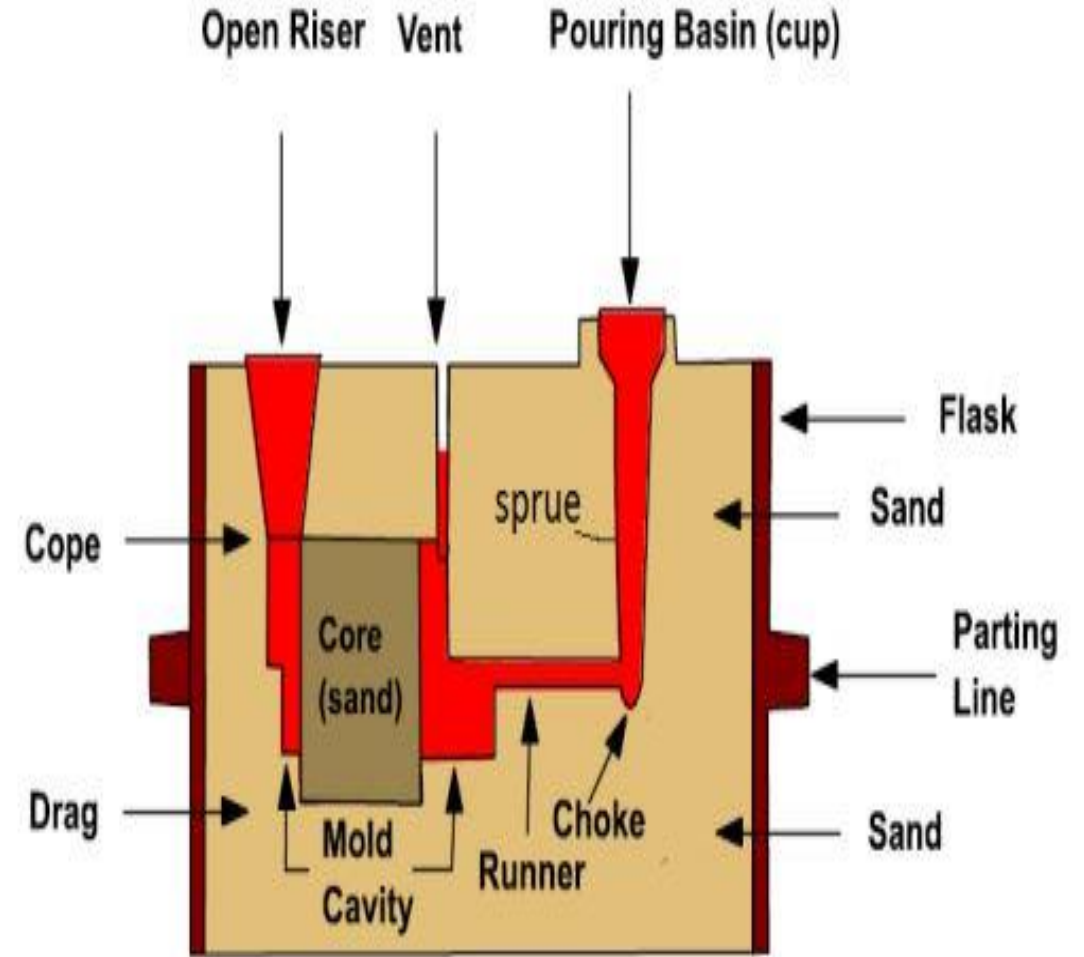


8. **Sprue:** The passage through which the molten metal, from the pouring basin, reaches the mould cavity. In many cases it controls the flow of metal into the mould.

9. **Runner:** The channel through which the molten metal is carried from the sprue to the gate.

10. **Gate:** A channel through which the molten metal enters the mould cavity.

11. **Riser:** A column of molten metal placed in the mould to feed the castings as it shrinks and solidifies



Mould Section and casting nomenclature .

# Steps in Sand Casting Process:

## 1. Pattern making:

- Pattern: Replica of the part to be cast and is used to prepare the mould cavity.
- It is the physical model of the casting used to make the mould.
- It is made of either wood or metal.
- When the pattern is withdrawn, its imprint provides the mould cavity.
- This cavity is filled with metal to become the casting.

## 2. Core making:

- Cores are placed into a mould cavity to form the interior surfaces of castings.
- Thus the void space is filled with molten metal and eventually becomes the casting.

### **3. Moulding:**

- Moulding is the mould preparation activities for receiving molten metal.
- The mould cavity contains the liquid metal and it acts as a negative of the desired product.
- The mould also contains secondary cavities for pouring and channeling the liquid material in to the primary cavity and will act a reservoir, if required.

### **4. Melting and Pouring**

- The preparation of molten metal for casting is referred to simply as melting.
- The molten metal is transferred to the pouring area where the moulds are filled.

### **5. Cleaning**

- Cleaning involves removal of sand, scale, and excess metal from the casting.
- Burned-on sand and scale are removed to improve the surface appearance of the casting.
- Excess metal, in the form of fins, wires, parting line fins, and gates, is removed.
- Inspection of the casting for defects and general quality is performed.

