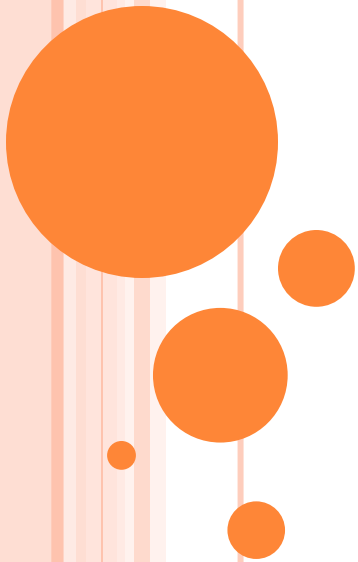


Classification of Casting Processes



Classification of casting Processes

Casting processes can be classified into following FOUR categories:

1. Conventional moulding Processes

- Green Sand moulding
- Dry Sand moulding
- Flask less moulding

2. Chemical Sand moulding Processes

- Shell moulding
- Sodium Silicate moulding
- No-Bake moulding



Classification of casting Processes

Casting processes can be classified into following FOUR categories:

1. Permanent mould Processes

- Gravity Die casting
- Low and High Pressure Die Casting

2. Special Casting Processes

- Lost Wax or Investment mold casting
- Ceramics Shell moulding
- Evaporative Pattern Casting
- Vacuum Sealed moulding
- Centrifugal Casting



1. Permanent Mould casting

- In all the above processes, a mould need to be prepared for each of the casting produced.
- For large-scale production making a mould for every casting may be difficult and expensive.
- Therefore, a permanent mould, called the **die** may be made from which a large number of castings can be produced
- The moulds are usually made of cast iron or steel, graphite, copper and aluminium.
- The process which uses a die to make the castings is called **permanent mould casting or gravity die casting**, since the metal enters the mould under gravity.
- Some time in die-casting we inject the molten metal (***Injection Moulding***) with a high pressure. When we apply pressure in injecting the metal it is called **pressure die casting process**.

Advantages

- Permanent Moulding produces a *sound dense casting* with superior mechanical properties.
- The castings produced are quite *uniform in shape* have a *higher degree of dimensional accuracy* than castings produced in sand
- The permanent mould process is also capable of producing a *consistent quality of finish* on castings

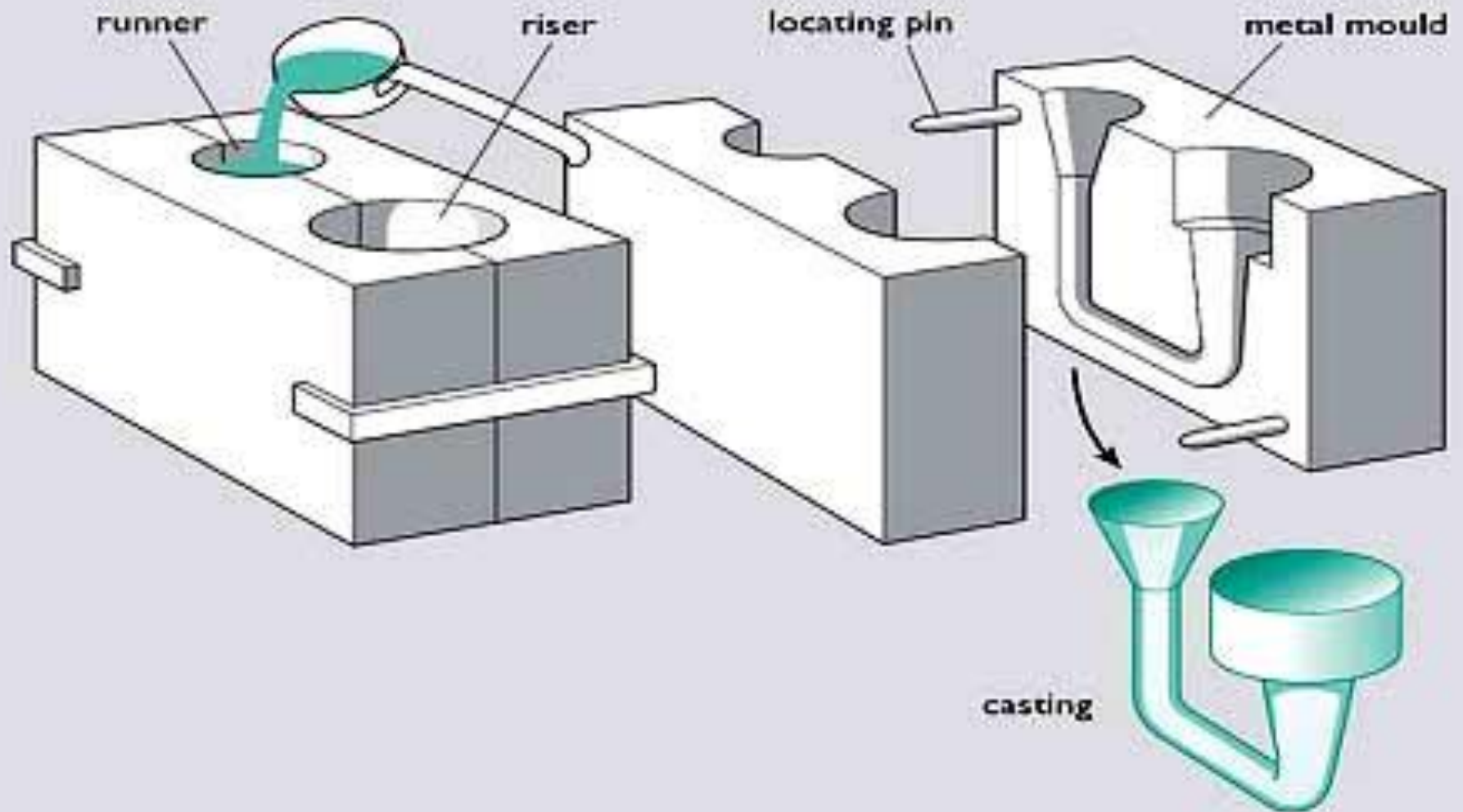
Disadvantages

- The *cost of tooling* is usually higher than for sand castings
- The process is generally limited to the production of small castings of simple exterior design, although complex castings such as aluminium engine blocks and heads are now commonplace.

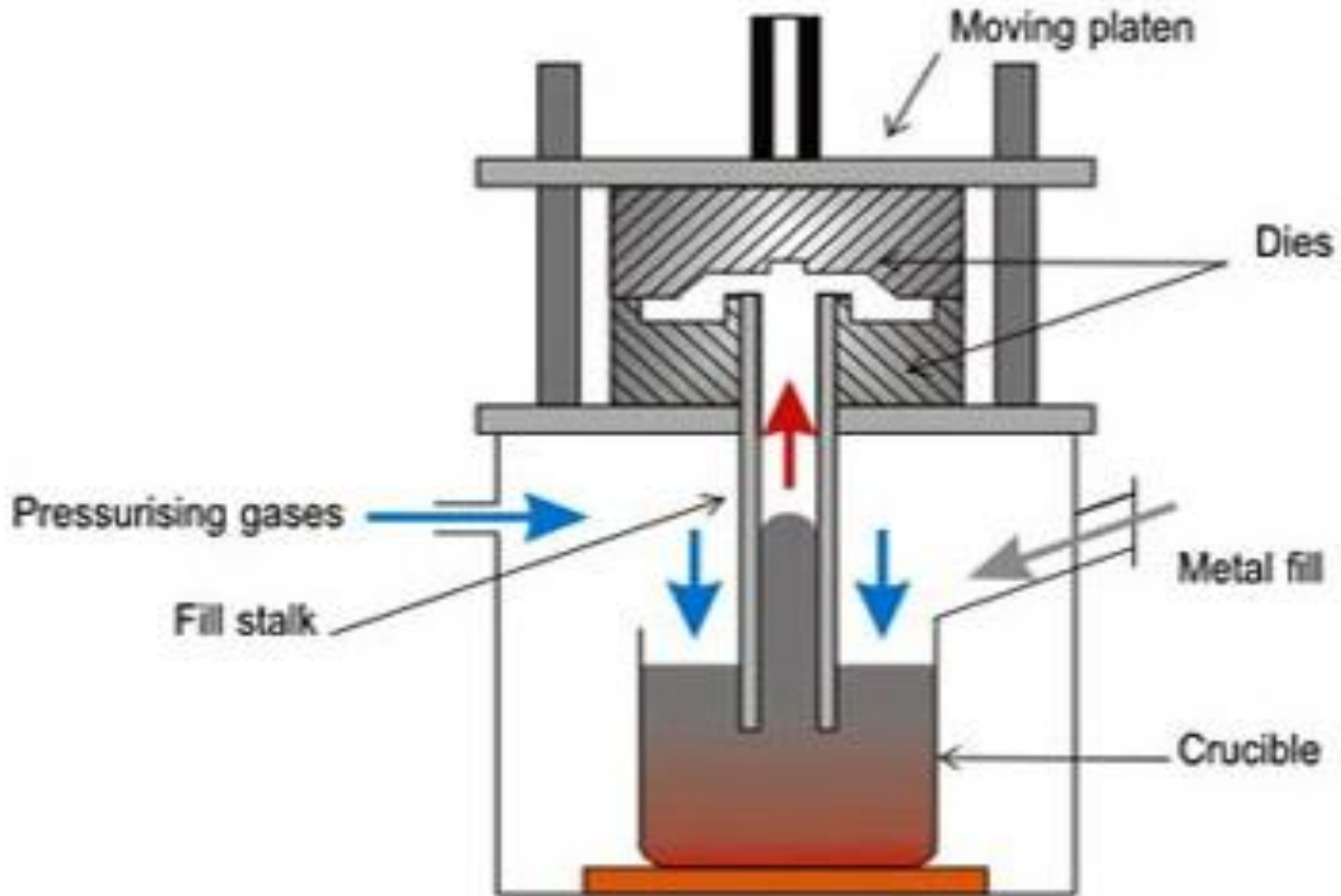


Permanent mould casting

- Gravity casting



- Die Casting



High Pressure Die Casting : There are two main High Pressure Die casting Methods:-

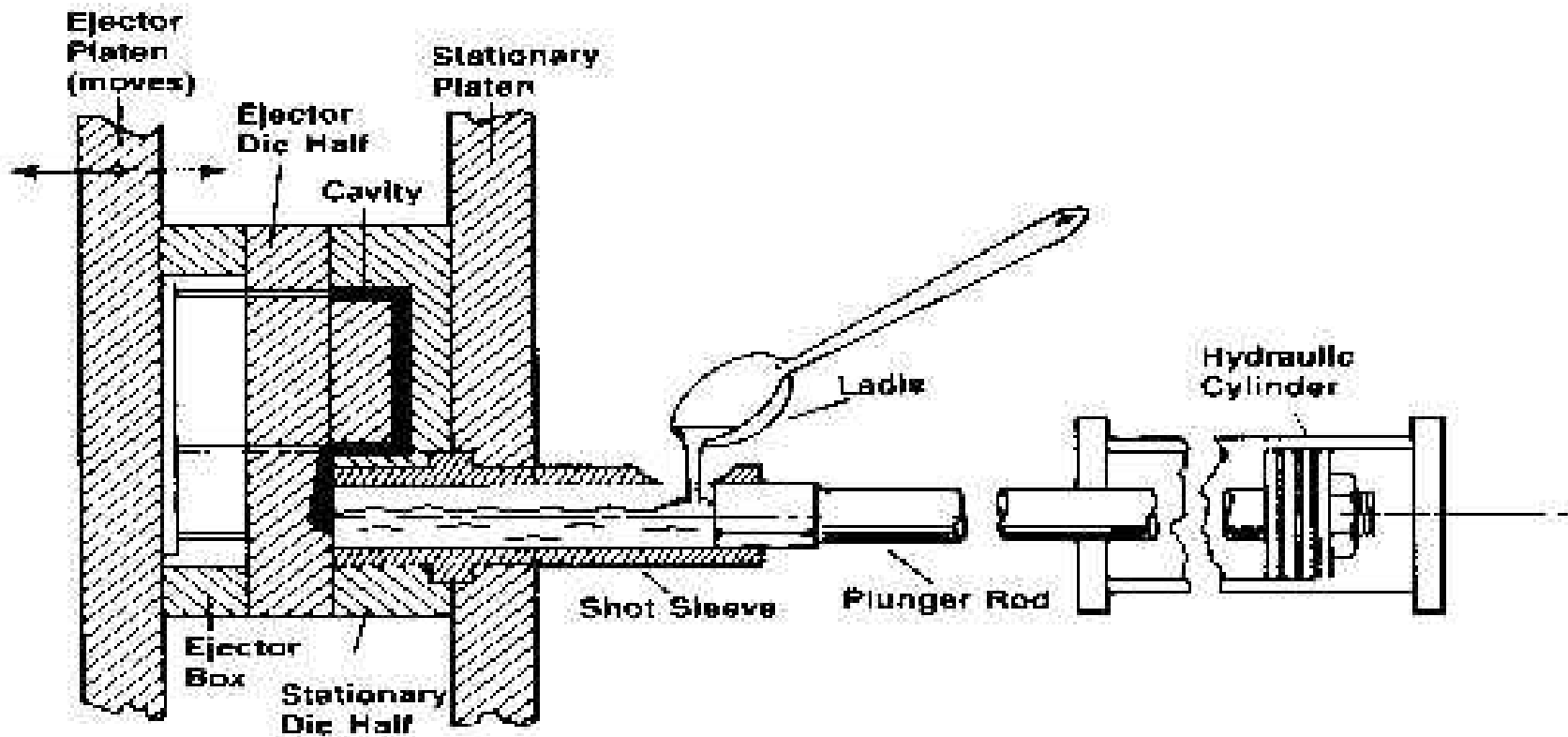
1. Cold Chamber :

- ✓ The term "*Cold Chamber Die Casting*" refers to a separate metal melting furnace.

2. Hot Chamber :

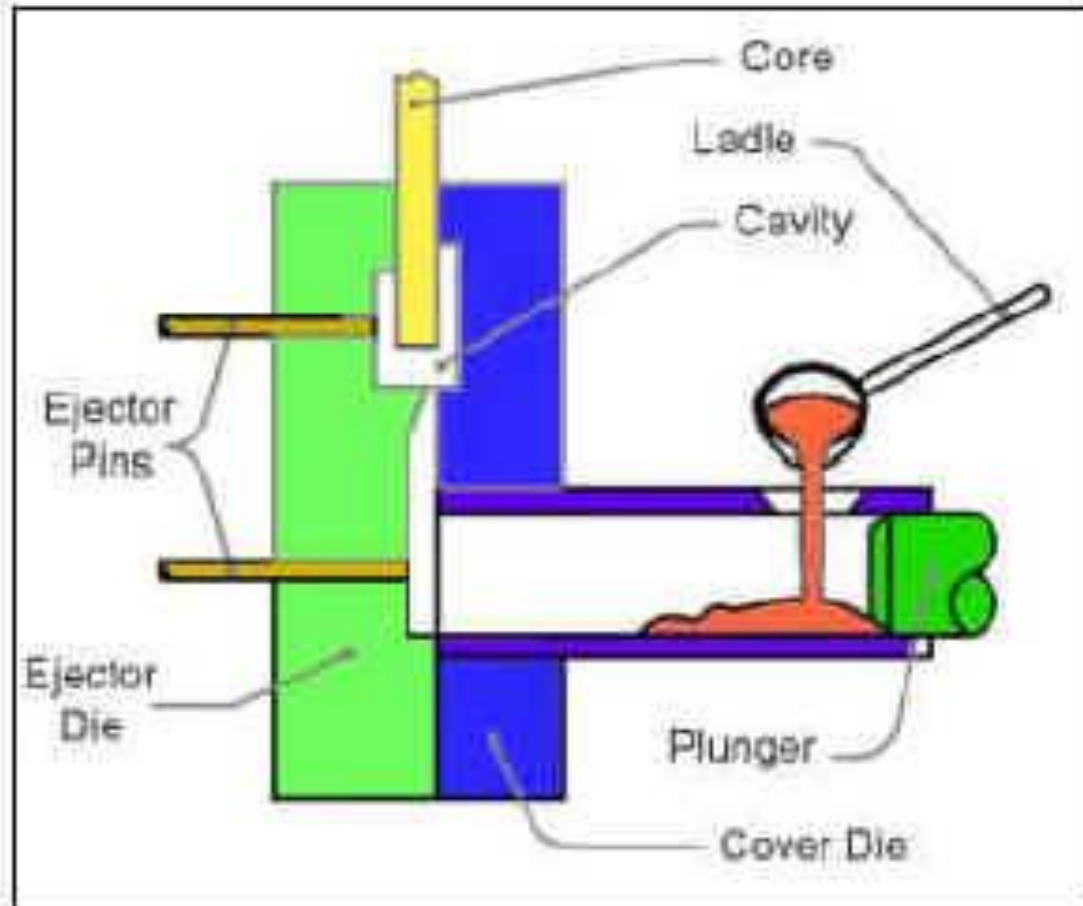
- ✓ The term "*Hot Chamber Die Casting*" refers to a **no** separate metal melting furnace.



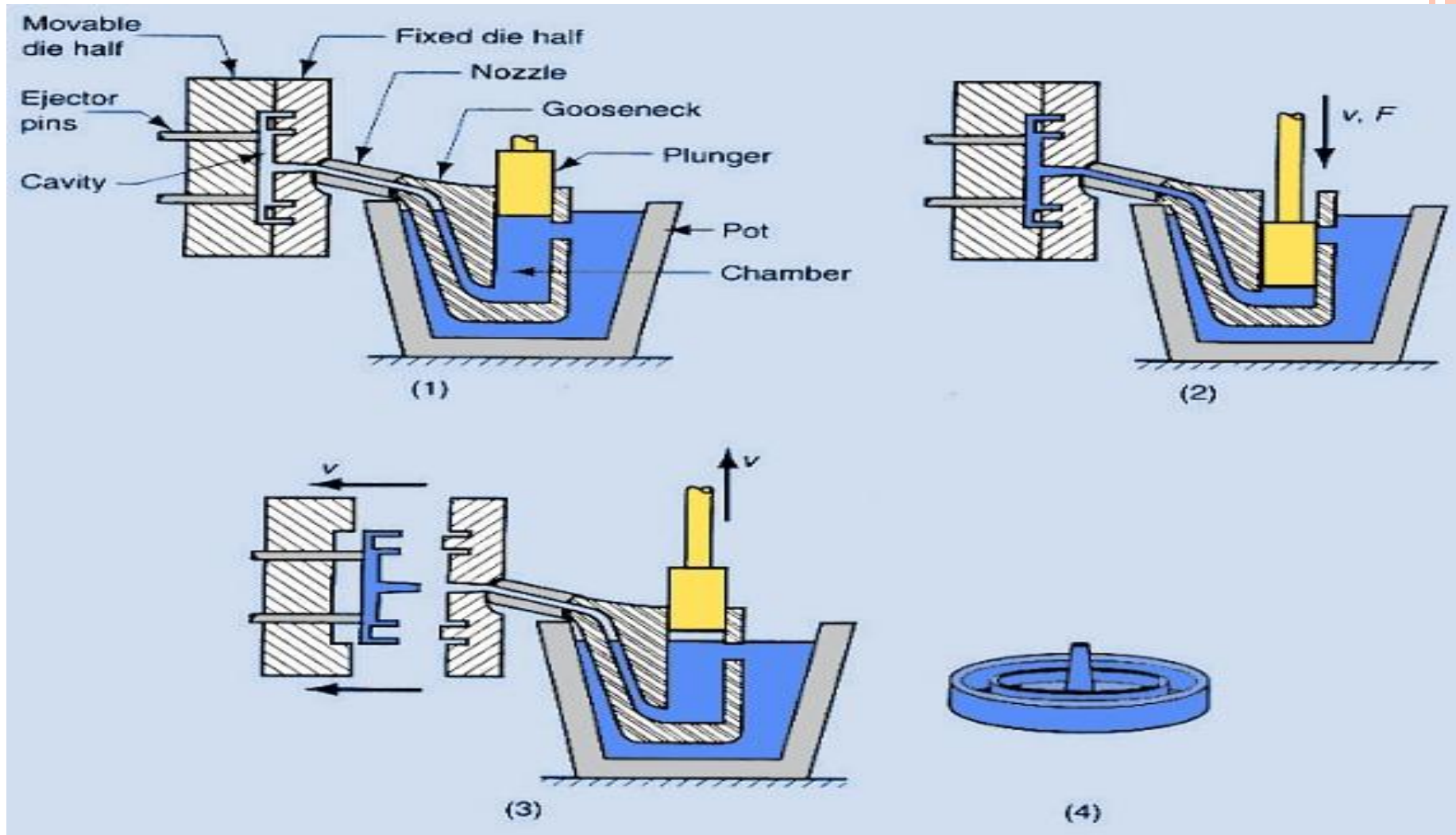


Cold Chamber Die Casting



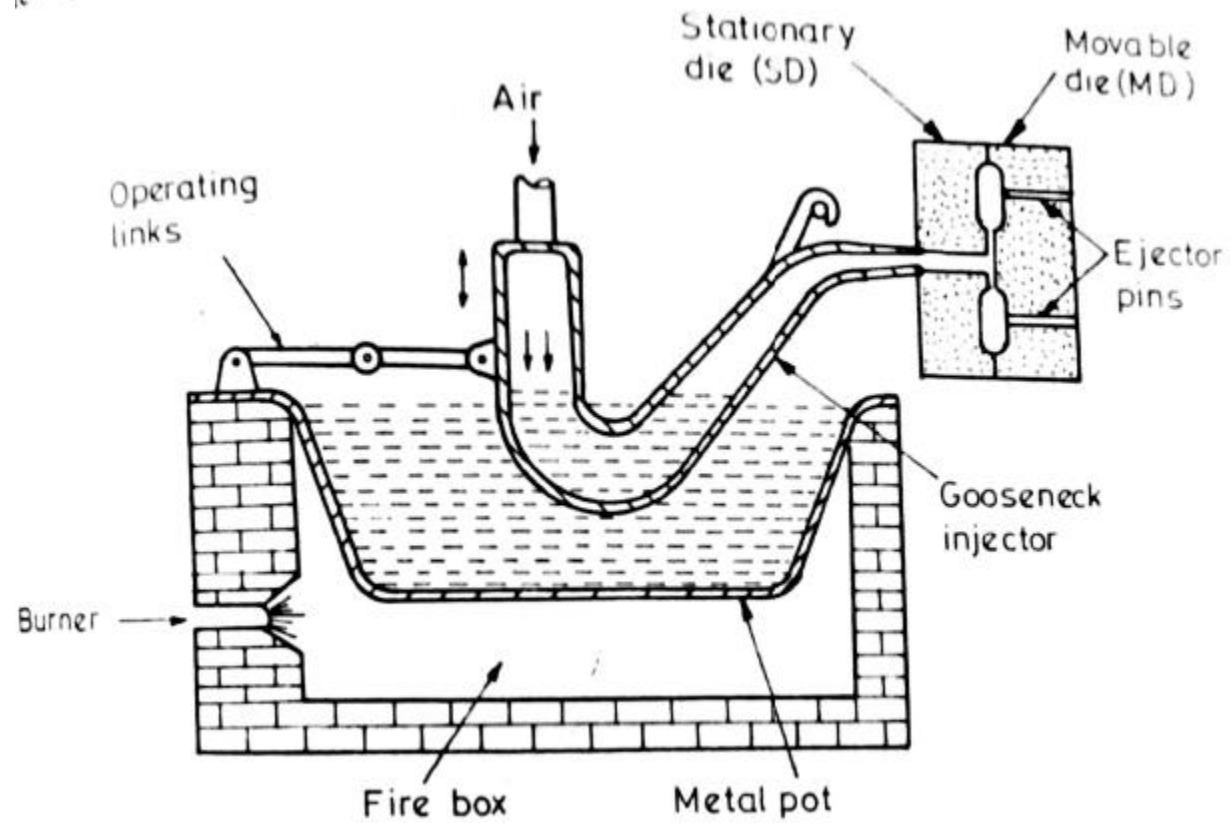


Hot chamber die casting



Submerged plunger type

IC 151



Gooseneck/ air –injection type



- **High Pressure Die Casting**

1. The mould is closed and sealed. The plunger is in the upper position.
2. The plunger injects liquid metal through the gooseneck and along to the mould preserving static pressure with the movement, until the material solidifies.
3. After casting the plunger returns to it's original position, whilst the product remains in the mould.
4. The product is removed from the mould by moving side ejectors.



Advantages and Disadvantages of Pressure Die Castings

Advantages:

- i. *High speed production* can be achieved as the whole process is completely automated
- ii. Possible to obtain *fairly complex castings* than that of gravity die casting
- iii. *Very small thicknesses* can be easily filled as the liquid metal is injected under high pressure
- iv. *Very good surface finish* can be obtained
- v. *Closer dimensional tolerances* & better *mechanical properties* can be obtained compared to sand casting
- vi. *Very economical* *for large scale production



Advantages and Disadvantages of Pressure Die Castings

Disadvantages:

- i. *Large capital investment* is required to set up a pressure die casting process as the die casting machines & tooling costs are very expensive
- ii. Cannot be used for large size castings as the *casting machine capacity is limited*
- iii. *Not suitable for all materials* because of the limitations of the die materials & the alloys used must have a low melting point



SPECIAL CASTING PROCESSES

- Lost Wax or Investment mold casting
- Ceramics Shell moulding
- Evaporative Pattern Casting
- Vacuum Sealed moulding
- Centrifugal Casting



Special Casting Processes

Advantages of Special Casting Processes

- i. Greater dimensional accuracy
- ii. Higher metallurgical quality
- iii. Lower production costs (in certain cases)
- iv. Ability to cast extremely thin sections
- v. Higher production rates
- vi. Better surface finish in the castings, therefore low labor and finishing costs.
- vii. Minimum need for further machining of castings
- viii. Castings may possess a denser and finer grain structure.
- ix. Castings are slightly stronger and more ductile than sand mold made castings

Casting Processes

Lost Wax or Investment mold casting

- The root of the investment casting process or “lost wax” method dates back to at least the fourth millennium B.C.
- The artists of ancient Egyptians are used the investment casting process to create intricately detailed jewellery and idols.
- The investment casting process begins with the production of wax replicas or patterns of the desired shape of the castings.
- A pattern is needed for every casting to be produced.
- The patterns are prepared by injecting wax or polystyrene in a metal dies.



4. Special Casting Processes

Lost Wax or Investment mold casting

- The mould is prepared by surrounding the pattern with refractory slurry that can set at room temperature.
- The mould is then heated so that pattern melts and flows out, leaving a clean cavity behind.
- The mould is further hardened by heating and the molten metal is poured while it is still hot.
- When the casting is solidified, the mould is broken and the casting taken out.



4. Special Casting Processes

Lost Wax or Investment mold casting

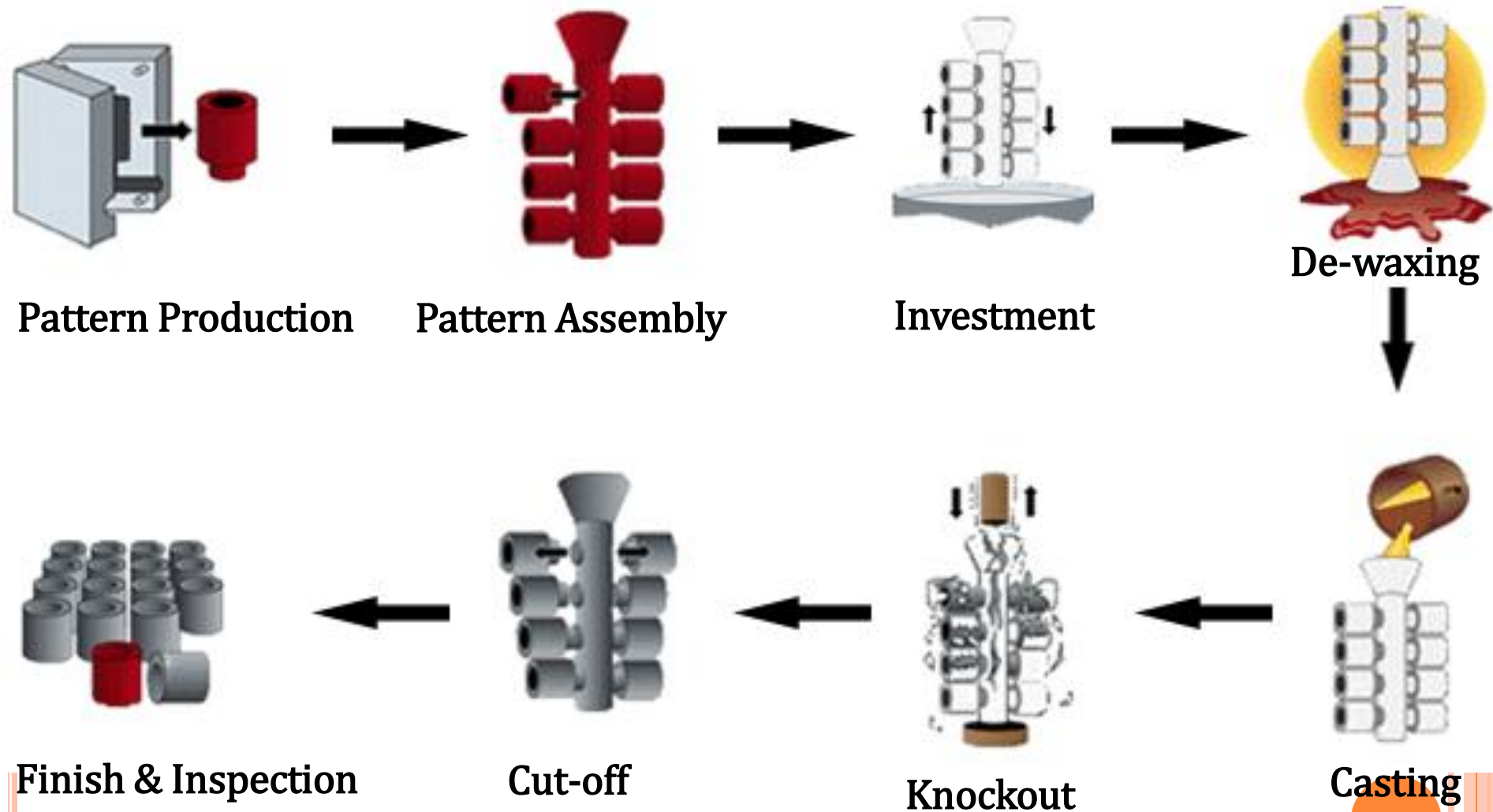
The basic steps of the investment casting process are

- Production of heat-disposable wax, plastic, or polystyrene patterns
- Assembly of these patterns onto a gating system
- Investing or covering the pattern assembly with refractory slurry
- Melting the pattern assembly to remove the pattern material
- Firing the mould to remove the last traces of the pattern material
- Pouring
- Knockout, cut-off and finishing.



4. Special Casting Processes

Lost Wax or Investment mold casting



[Lost Wax or Investment mold casting Video](#)
[\(Click Here\)](#)

4. Special Casting Processes

Lost Wax or Investment mold casting

Advantages

- *Formation of hollow interiors* in cylinders *without cores*
- *Less material* required for gate
- *Fine grained structure* at the outer surface of the casting
- *Free from gases and shrinkage cavities and porosity*

Disadvantages

- *Contamination of internal surface* of castings with non-metallic inclusions
- *Inaccurate internal diameter*



4. Special Casting Processes

Ceramics Shell moulding

- The basic difference in investment casting is that in the investment casting the wax pattern is immersed in a refractory slurry before dewaxing
- Whereas, in ceramic shell investment casting a ceramic shell is built around a tree assembly by repeatedly dipping a pattern into a slurry (refractory material such as zircon with binder).
- After each dipping, the assembly is allowed to thoroughly dry before the next coating is applied.
- Thus, a shell is built up around the assembly.
- The thickness of this shell is dependent on the size of the castings and temperature of the metal to be poured.




4. Special Casting Processes

Ceramics Shell moulding

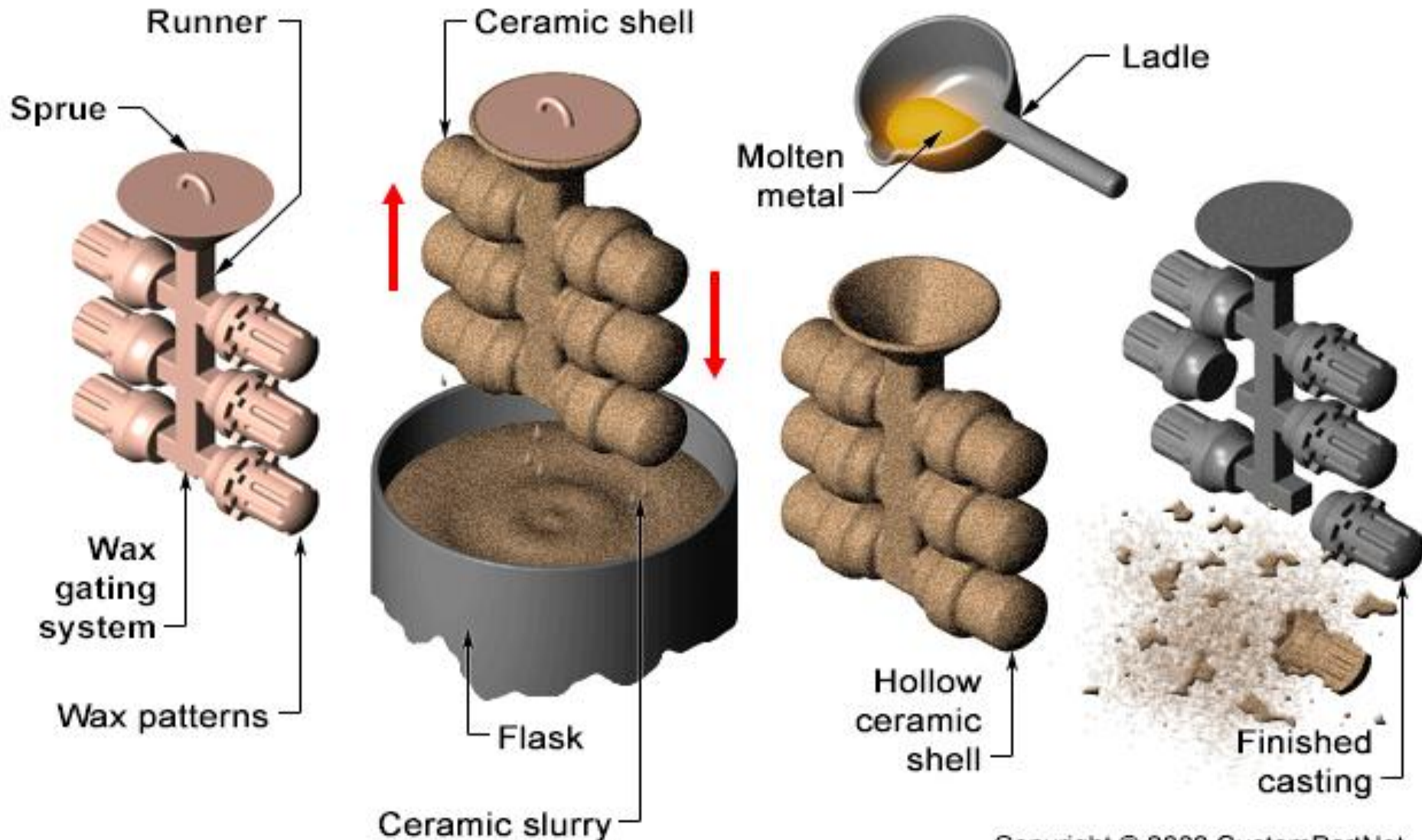
- After the ceramic shell is completed, the entire assembly is placed into an autoclave or flash fire furnace at a high temperature.
- The shell is heated to about 982 °C to burn out any residual wax and to develop a high-temperature bond in the shell.
- The shell moulds can then be stored for future use or molten metal can be poured into them immediately.
- If the shell moulds are stored, they have to be preheated before molten metal is poured into them.

Advantages

- Excellent surface finish
 - Tight dimensional tolerances
 - Machining can be reduced or completely eliminated
- 

4. Special Casting Processes

Ceramics Shell moulding



Centrifugal Casting

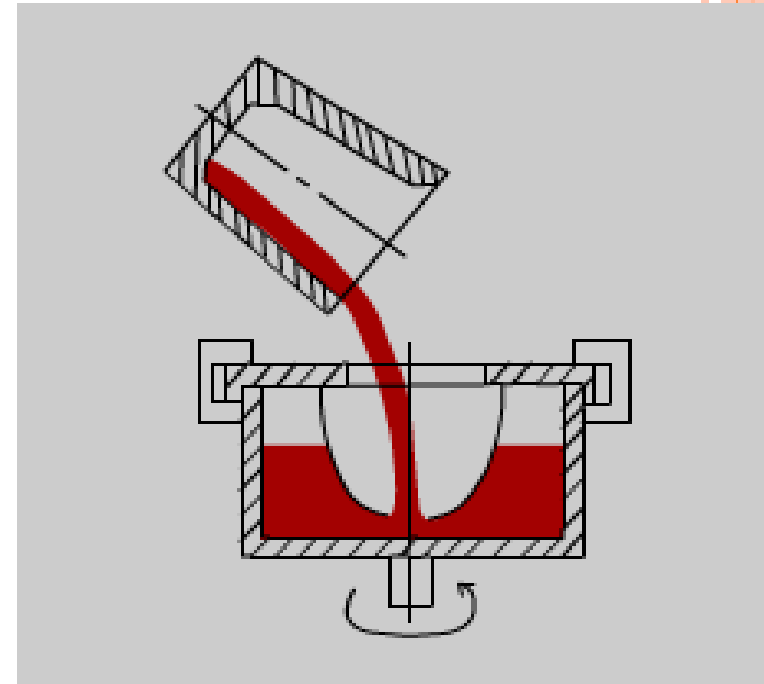
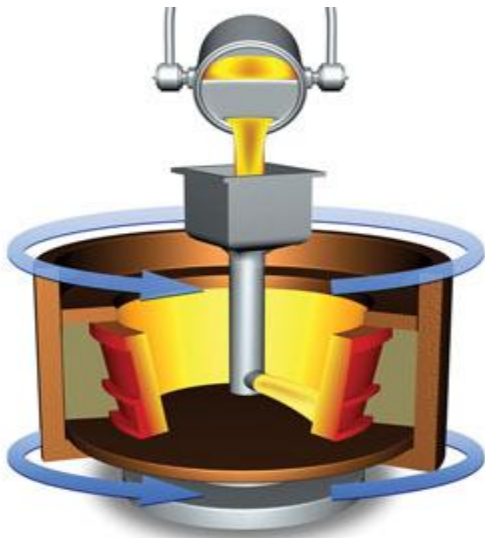
1. True centrifugal
2. Semi centrifugal
3. Centrifuge casting

- In this process, the *mould is rotated rapidly* about its central axis as the metal is poured into it.
- Because of the *centrifugal force, a continuous pressure will be acting* on the metal as it solidifies.
- This process is normally used for the making of hollow pipes, tubes, hollow bushes, etc., which are axisymmetric with a concentric hole.
- Since the metal is always pushed outward because of the centrifugal force, no core needs to be used for making the concentric hole.

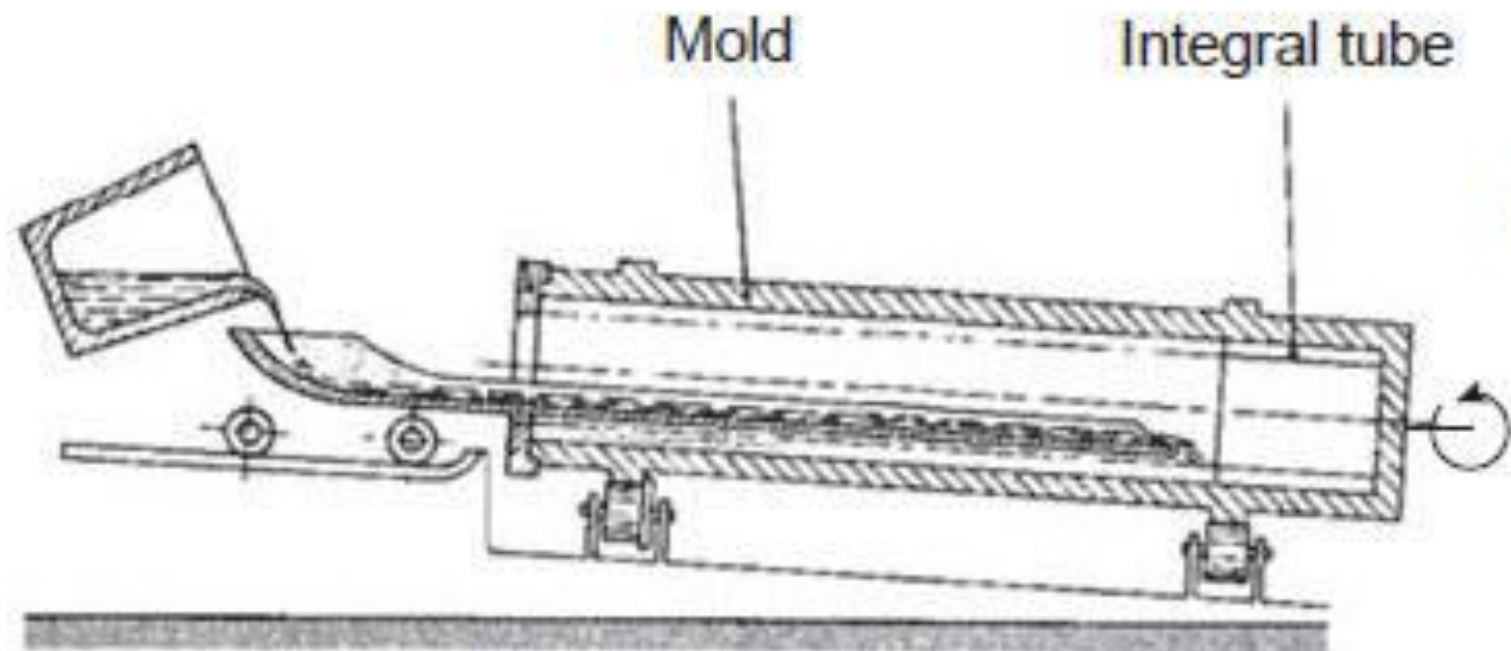
4. Special Casting Processes

Centrifugal Casting

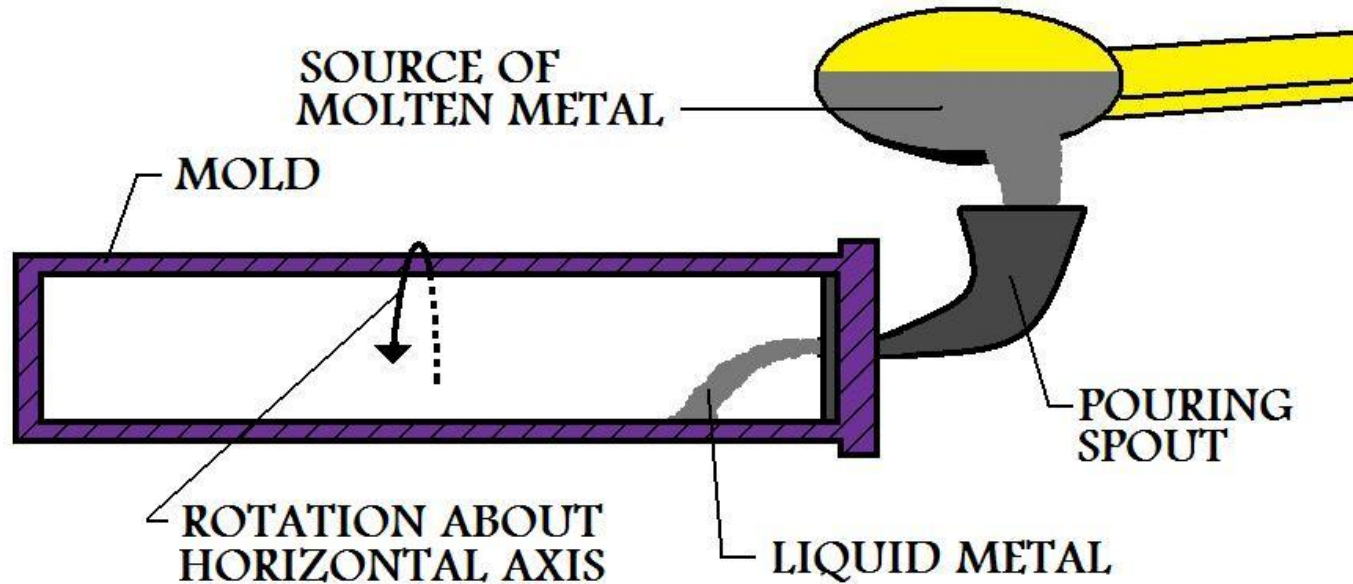
- The mould can be rotated about a vertical, horizontal or an inclined axis or about its horizontal and vertical axes simultaneously.
- The length and outside diameter are fixed by the mould cavity dimensions while the inside diameter is determined by the amount of molten metal poured into the mould.
- Fig: Vertical Centrifugal Casting



Inclined true centrifugal casting



POURING IN TRUE CENTRIFUGAL CASTING



4. Special Casting Processes

Centrifugal Casting

Advantages

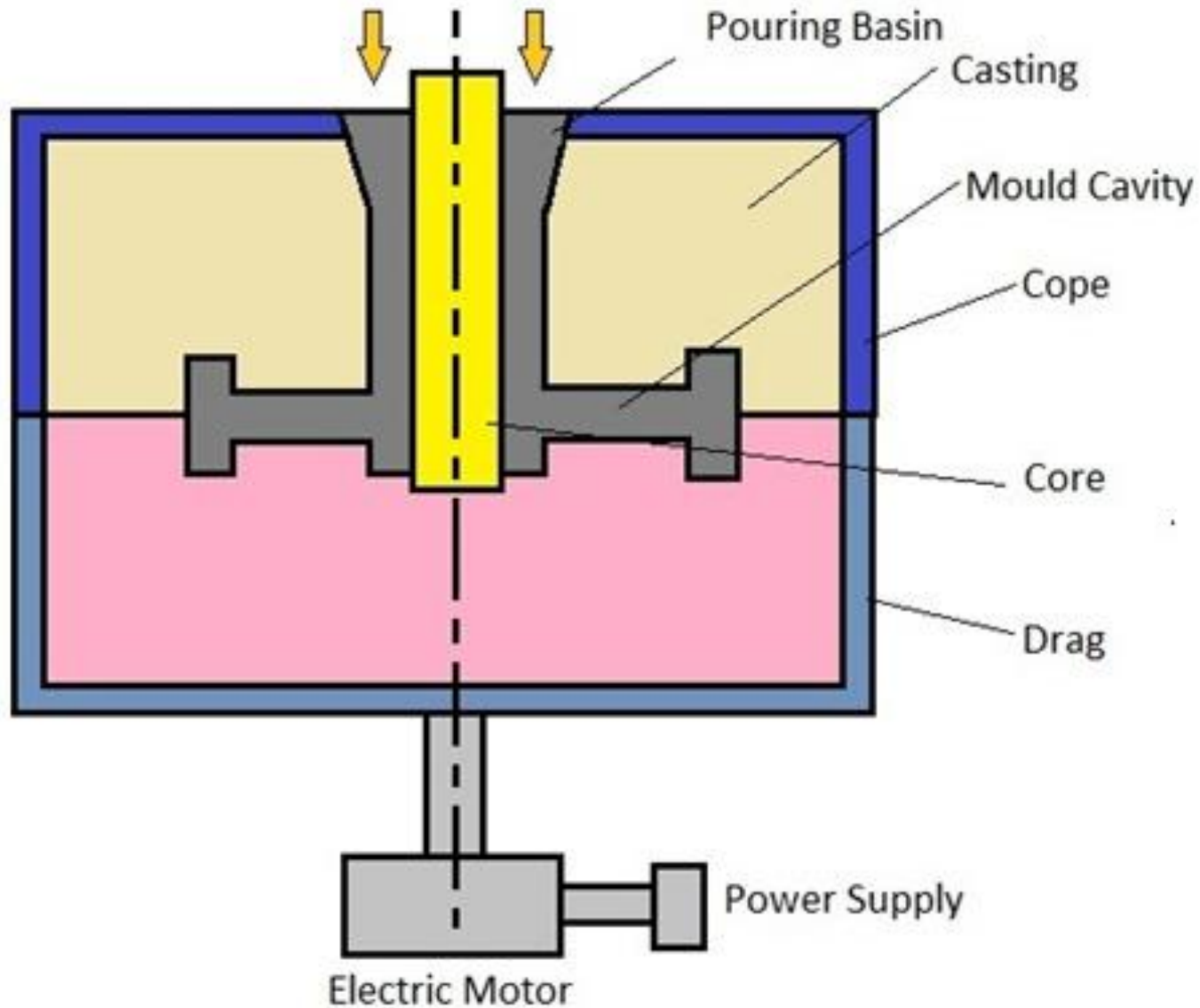
- Formation of hollow interiors in cylinders without cores
- Less material required for gate
- Fine grained structure at the outer surface of the casting free of gas and shrinkage cavities and porosity

Disadvantages

- Contamination of internal surface of castings with non-metallic inclusions
- Inaccurate internal diameter



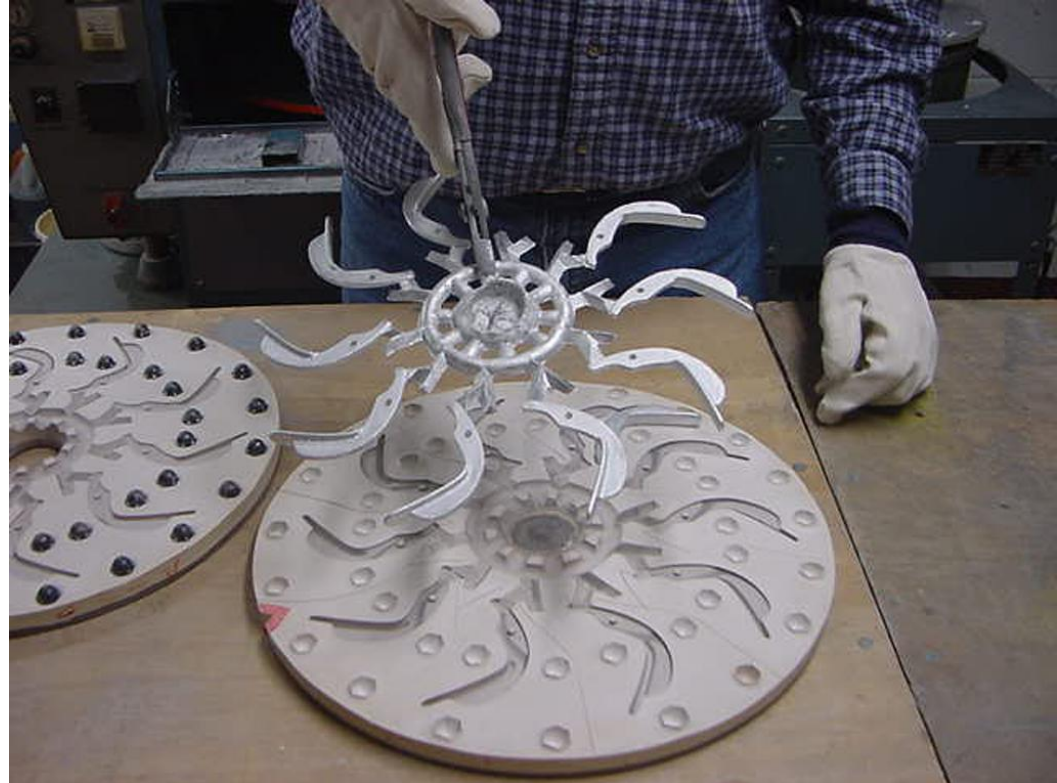
SEMI CENTRIFUGAL



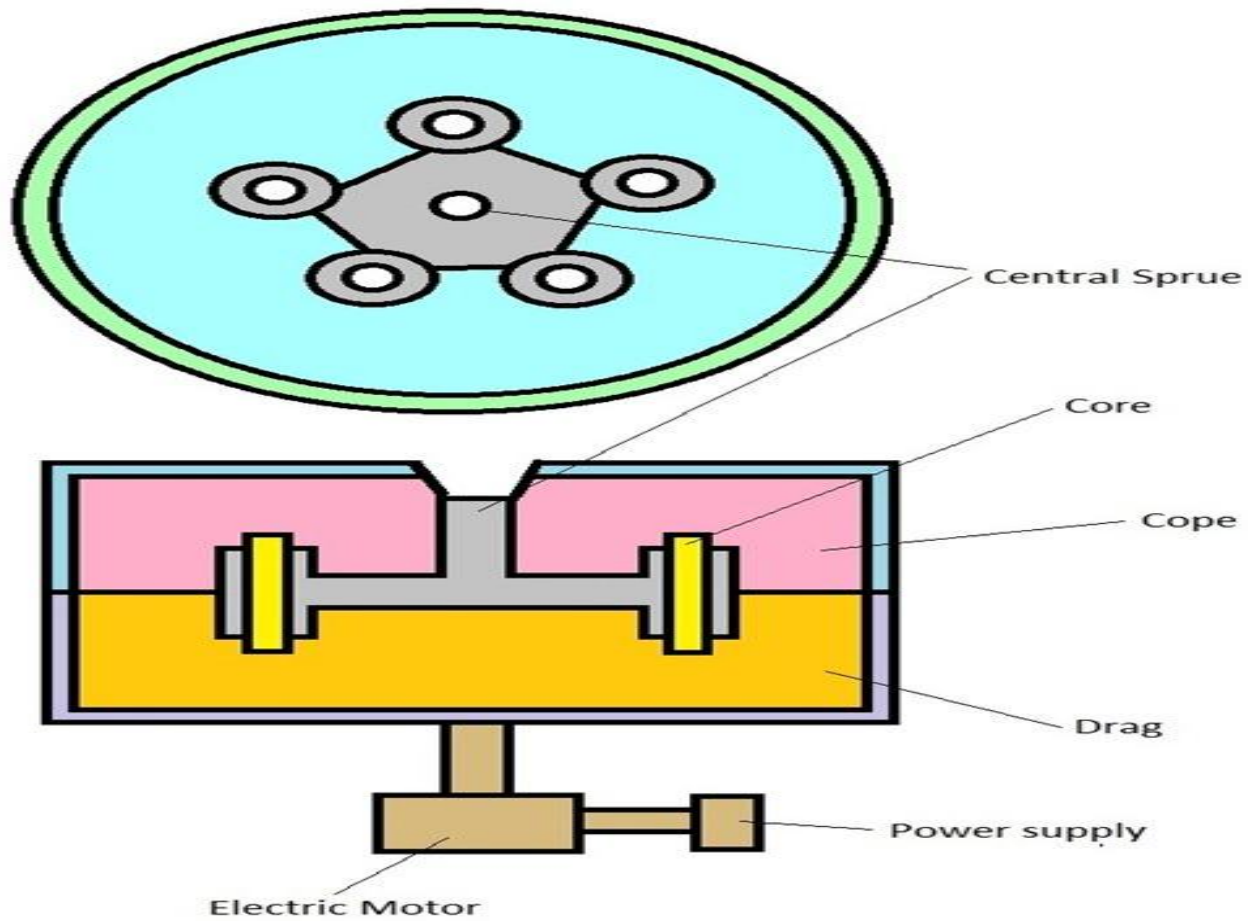




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CONTINUOUS CASTING

