

MINI PROJECT PRESENTATION
ON
A STUDY ON INVESTMENT CASTING OF FLANGED TEE PIPE FITTING

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INTRODUCTION :

- Investment casting is an industrial process based on and also called “lost wax casing” Investment casting is one of the oldest manufacturing processes.
- 5000 years old.
- Investment casting can make use of most metals, most commonly using aluminum alloys, bronze alloys, magnesium alloys, cast iron, stainless steel, and tool steel .
- The process is generally used for small castings, but has produced complete aircraft door frames, steel castings of up to 300 kg and aluminium castings of up to 30 kg.

PROCESS OVERVIEW :

Investment casting involves various steps to manufacture a component .The below mentioned steps are in sequence

- Wax injection
- Pattern ejection
- Pattern assembly
- Slurry coating
- De-wax /Burnout
- Preheating
- Metal pouring
- Shell Knock off
- Cutting and Finishing

Process of investment casting:

WAX PATTERN CREATION:

- The first step of the Investment casting process is to produce a replica of the final casting using conventional wax.
- In today's manufacturing world, wax patterns are typically made by injecting wax into a metal tool or "die".
- Wax can be recycled for a certain number of cycles until the level of dirt and other contaminated particles reaches a certain limit.
- The most desirable properties of wax are low viscosity.



Wax injection

Pattern ejection:

- The solid wax replica is ejected from the die with the help of ejector pins.
- Then, they are stored in an air-conditioned environment until the execution of the next step.



wax pattern

TREE ASSEMBLY

- It is typically uneconomical to make small parts one at a time, so wax patterns are typically attached to a wax “sprue”.
- The sprue serves two purposes.
 1. Provides a mounting surface to assemble multiple patterns into a single mold, which will be later filled with alloy .
 2. Provides a flow path for the molten alloy into the void created by the wax pattern .
 3. The wax between the pattern and the sprue are called “Gates”.



Tree Assembly

SHELL MAKING :

- The next step in the process is to build a ceramic shell around the wax tree.
- To build the shell, the tree is dipped into a ceramic bath or “slurry”.
- After dipping, fine sand or “stucco” is applied to the wet surface



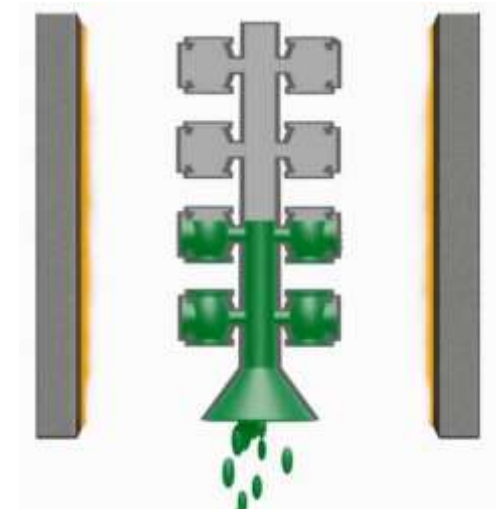
Shell making by dipping in slurry and stocco

DE-WAX :

- The wax pattern inside the mould is removed by heating the shell.
- This is typically done using a steam-dewax autoclave, which is like a large, industrial pressure cooker, Another method is the use of a flash fire oven, which melts and burns off the wax
- Autoclave removes the majority of the wax, which can be reconditioned and reused.



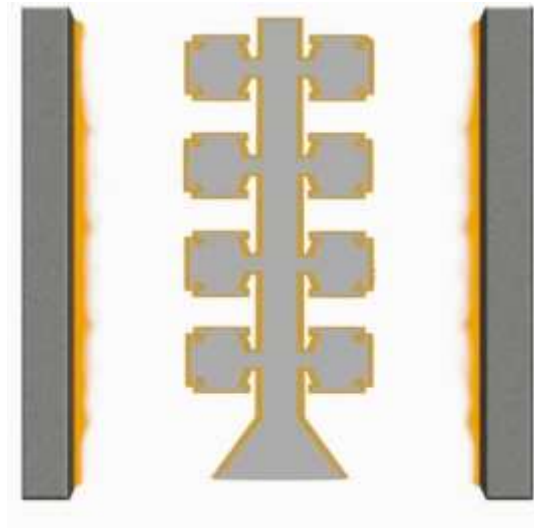
Industrial steam Autoclave



De-waxing

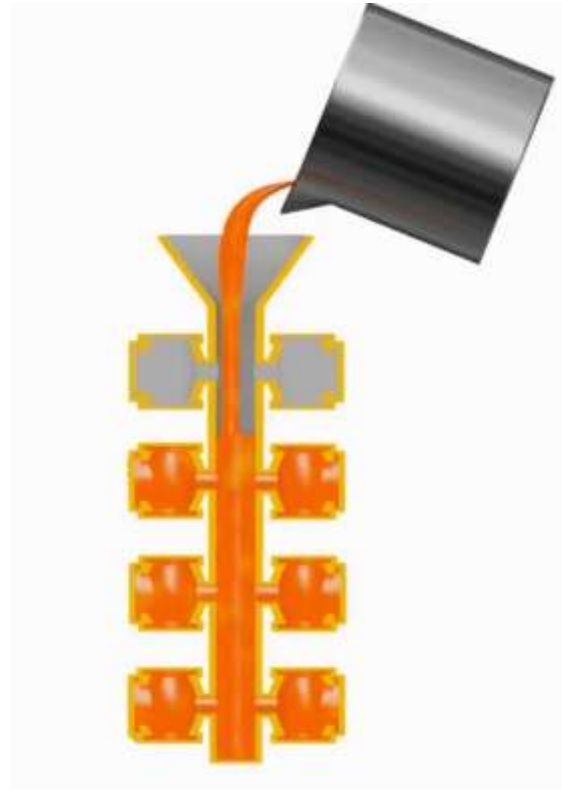
PREHEATING :

- Baking or preheating is a process where molds are baked at a temperature of approximately 950 to 1100C in a diesel/ electric furnace for 25–40 min to improve the hot strength of ceramic molds
- Baking is a process used for increasing the strength of the mold.



METAL POURING :

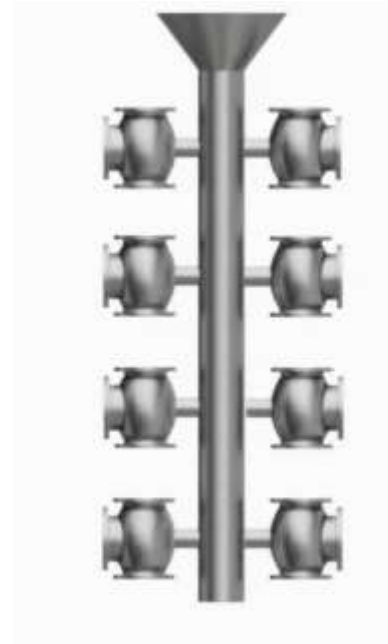
- Immediately after baking of the ceramic mold, molten metal is poured inside the cavity and allowed to solidify
- The pouring temperature should not be too high because it might crack the ceramic shell.



Pouring of Metal into the Mould Cavity

SHELL BREAKING / KNOCKOUT :

- Once cool, the shell material is removed from the metal .This is typically done via
 - Hammer
 - High Pressure Water Blast
 - Vibratory Table



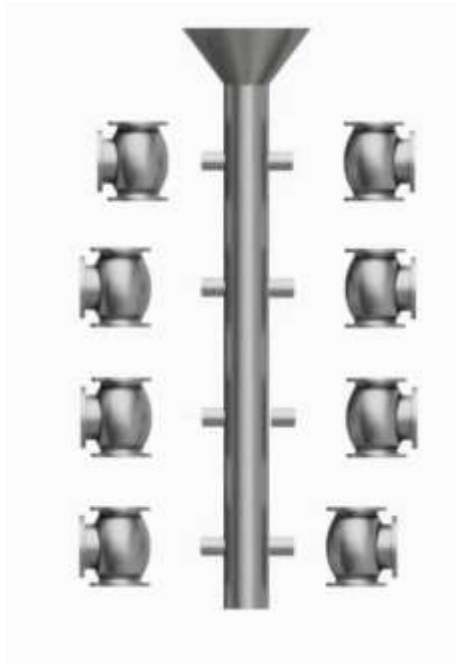
Casting knocking(left) and casting finished(right)



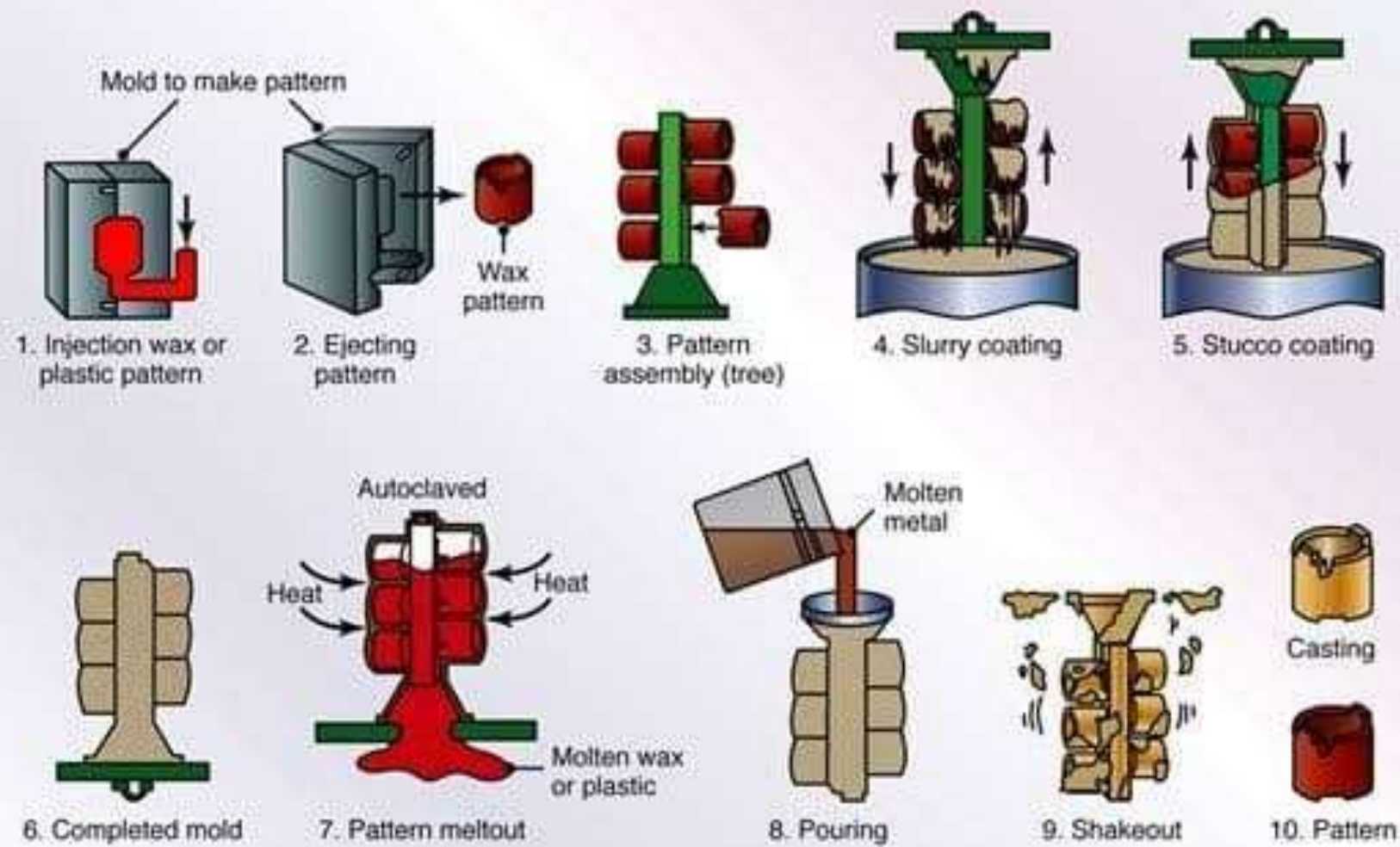
Knockout of shell using water jet

CUT OFF AND POST PROCESSING:

- Once the shell material has been removed, the parts are cut off the sprue and the gates are ground off
- The surface can be finished via a number of means Vibratory/Media finishing ,Belting or hand grinding ,Polishing
- Finishing can be done by hand, but in many cases it is automated.



Cutting of individual components



ADVANTAGES :

- Smooth surface finish.
- Wax can usually be recovered for reuse.
- High dimensional accuracy.
- Almost any metal can be cast.
- Freedom of design.
- Less casting defects.

Disadvantages :

- Many processing steps are required.
- Relatively expensive process.
- Skilled labour and high employment costs.
- Requirement of Chill Room or Airconditioned Room for storing wax patterns is very costly and has high maintenance.

APPLICATIONS :

- Aerospace and Defense
- Power Generation
- Oil and Gas
- Medical
- Agriculture
- Construction
- Commercial and Consumer products
- Automotive

CONCLUSION

Investment Casting process is capable of fabricating intricate shapes with high accuracy, fine impressions, and tight geometrical tolerance. However, it research is still necessary to resolve the high tooling costs, long production cycles, ceramic waste generation, treatments for recycling wax materials, and other issues.

REFERENCES

- Youtube source
- Wikipedia
- Google