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Internal Assessment Test 1 – Sept. 2017

Sub:	Metal Casting & Welding					Sub Code:	15ME35A	Branch:	MECH	
Date:	20/09/2017	Duration:	90 min's	Max Marks:	50	Sem / Sec:	3 SEM / A & B		OBE	

Answer any FIVE FULL Questions

		MARKS	CO	RBT
1	Briefly describe the different pattern allowances	[2X5]	CO2	L1
2	Briefly describe the desirable properties of moulding sand	[2X5]	CO1	L1
3	Explain with a neat sketch working of sand slinger machine. List its advantages and disadvantages	[7+3]	CO2	L1
4	Explain with a neat sketch the construction & working of Cupola furnace	[4+3+3]	CO3	L1
5	Explain with neat sketch open riser, top riser and blind riser	[3+3+4]	CO2	L1
6	Explain with neat sketches i) Sweep pattern ii) Match-plate pattern	[5+5]	CO2	L1
7	Explain with the neat sketch investment molding method	[4+6]	CO1	L1

Metal Casting & Welding

Ist - IA - Scheme of Evaluation & solutions

Date:- 26/9/2017.

2017+2018 (ODD)

Sub Code:- 15ME35A.

By:- Sagar M Baligidad.

1) Different types of Pattern allowance

1) Shrinkage allowance

In Casting Process, all the metals will undergo decrease in volume during solidification. This change in volume is called shrinkage. Shrinkage of molten metal takes place in three stages called liquid contraction, liquidous contraction and solid contraction. The contraction of metal during first and second stage is taken care of by providing gating & risering. But contraction of metal during third stage is taken care by providing positive shrinkage allowance to the pattern.

"Shrinkage allowance is an allowance added to the pattern to compensate for the metal shrinkage that takes place while the metal solidifies."

2) Draft allowance -

Draft is meant for taper provided by the pattern maker on all vertical surfaces of the pattern so that pattern can be removed from the sand without tearing away the sides of the sand mold.

Draft allowance varies with complexity of the sand job. The amount of taper varies from 0.5° to 1.5°. It may be reduced to less than 0.5° for large castings.

3) Machining allowance.

For good casting finish, machining of casting is required. The dimensions gets reduces after machining. Hence the size of the pattern is made larger than the required. For machining extra metals are needed. This extra metal is called machining allowance.

4) Distortion allowance

Sometimes casting gets distorted, during solidification due to their typical shape. Ex:- U or C or L shape products. It will tend to contract at the closed end causing the vertical legs to look slightly inclined outward. This can be prevented by making the legs of the U, V, T or L shaped coverage slightly inward so that after distortion it slides vertically.

5) Rapping allowance.

To remove the pattern from the mould cavity, pattern is rapped with the help of draw spikes so that they can be detached from the mold. But do to excessive rapping the size of the cavity gets enlarged. Therefore size of the pattern made smaller than the casting, which is known as rapping allowance.

2) Properties of moulding sand.

1) Refractoriness → It is defined as the ability of moulding sand to withstand high temperature without burning, cracking or fusing thus facilitating to get sound casting.

2) Permeability → It is the ability of the moulding sand to escape of any air, gases or moisture present or generated in the mould when the molten metal is poured into it.

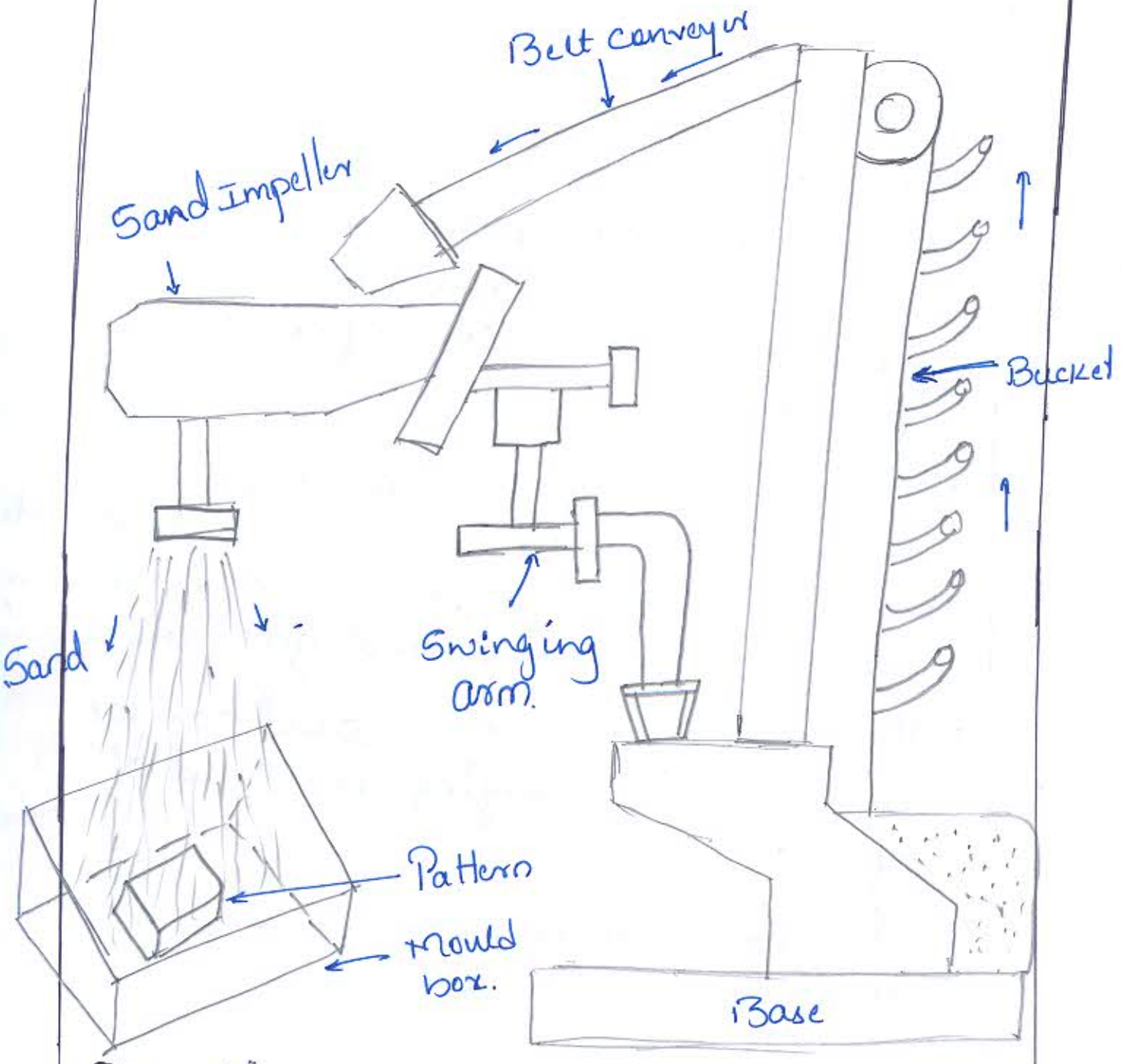
3) Cohesiveness → It is property of sand particle due to which it binds together firmly within the mould sand so that it can easily be withdrawn from moulding box without damage to the mould surface.

4) Flowability → It is the ability of the moulding sand due to which it flows uniformly to all portions of pattern during ramming evenly all around in all directions.

5) Adhesiveness → It is property of moulding sand to get stick with other material to held heavy mass successively in a mould box without any danger of its falling down.

6) Collapsibility → After the molten metal in the mould gets solidified. the sand mould must be easily collapsible to allow free contraction of the metal.

3) Sand slinger



Operation

1) Mould box with pattern is kept below the sand impeller.
2) The pre-mixed sand is damped in the sand bin and is picked by the bucket elevator, carries up to top and delivers to the belt conveyor.

3) The belt conveyor carries the sand to the horizontal hopper containing a screw conveyor.

4) At the end of the hopper there is a rotating impeller having cup shaped blades rotating at high speeds and carries the sand mixture from the screw conveyor and throws it out.

5) The force of the rotor blade imparts velocity to the sand particles and as a result the sand is thrown above the pattern and gets consolidated.

6) The density of ramming sand can be controlled by varying the speed of the impeller.

7) Uniform hardness is obtained in the mould and removal of pattern, cutting gates etc., done automatically.

Advantages

1) Gives smooth surface finish
2) High dimentional accuracy
3) Completely machining is eliminated
4) Casting produces are defect free

Dis-advantages

1) Process is relatively slow
2) Process is expensive

4) Construction of cupola furnace.

1) It consists of a vertical cylindrical shell made of 10 mm thick plate. furnace is lined inside with refractory bricks.

2) Diameter of the furnace is 1-2m. and length is ranges from 5-10 m.

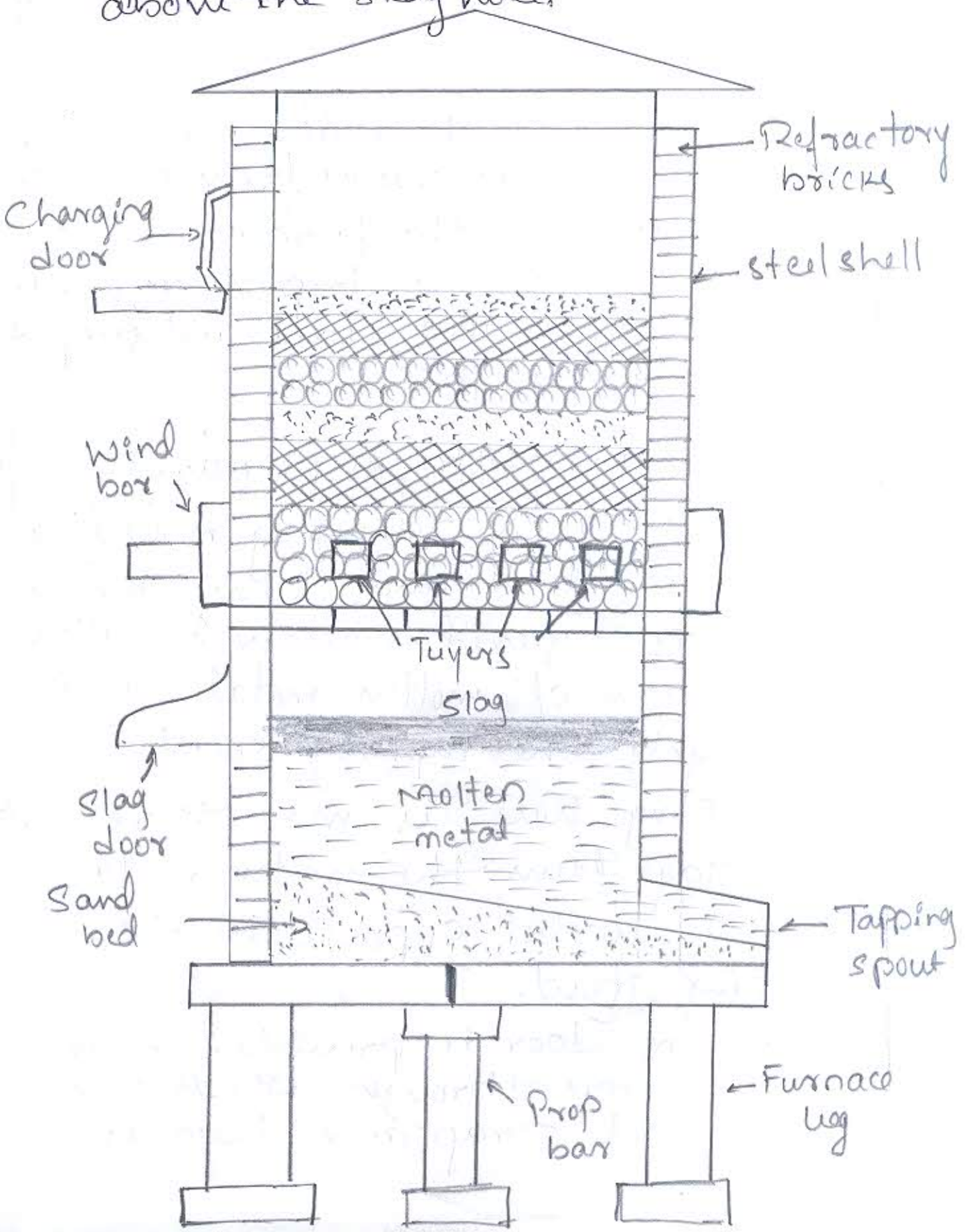
3) The bottom of the furnace is provided with two drop doors, which are hinged on two sides and support vertically by prop.

4) furnace bottom is prepared thoroughly by ramming moulding sand mixture and clay and is made is tapered manner to allow the hollow of molten metal easily thoroughly the tapping spout.

5) A slag hole is made to remove the slag from the molten metal and is located opposite to the tapping spout.

6) Charging door is provided near to the top through which coke, iron, steel scrap and flux is charged.

7) The air blast is blown through the tuyers and wind box. These tuyeres are arranged in one or more row around the periphery of cupola and are placed just above the slag hole.



Operation

1) Preparation:

A sand bottom is prepared sloping towards tap spout. The height of sand bed is about 200 mm. Tap spout is formed and lined with clay. A slag hole prepared.

2) Firing:

Oiled waste and wooden pieces are placed at the bottom and fire is started. Now air is supplied to the ~~bottom~~ furnace, when the wood start burning, coke is charged in several portions, when the coke burns, more coke is added upto the layers level.

3) Charging:

Alternative layers of coke, flux and iron metal is charged through the charging door.

The metal to coke ratio by weight is about 8:1 is maintained. The flux is added upto 25-50% by weight of the coke.

4) Melting:

After charging the cupola with alternative layers of coke, flux & metal charge is allowed to preheat of about

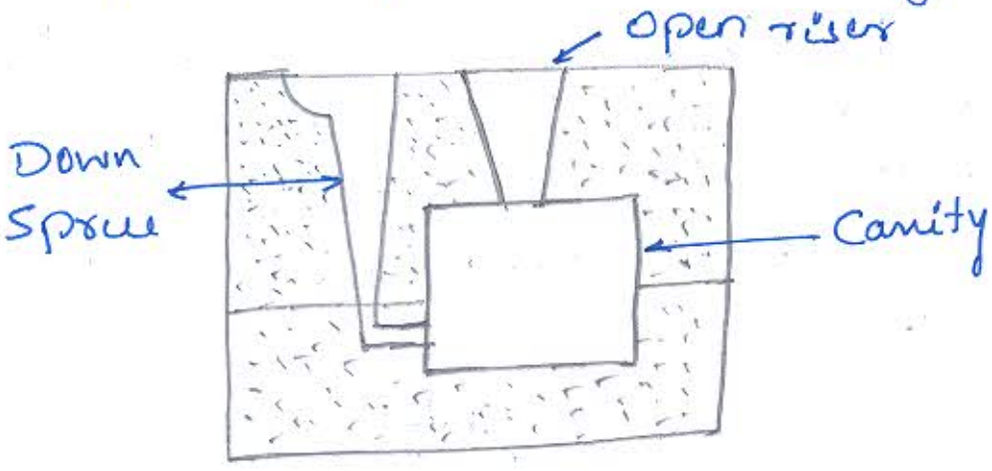
30-45 minutes. and preheating of charge takes place by heat from the burnt coke, which is supplied during firing stage. Once the coke becomes hot, it melts charge. The tap spout is kept closed by a plug. The liquid metal falls down and the coke floats up on top of it. The flux also melts and reacts with impurities of the molten metal forming a slag over a liquid metal.

5) Slagging & tapping

When sufficient amount of molten metal collected, slag formed on the surface is removed out and molten metal is collected at the tap spout.

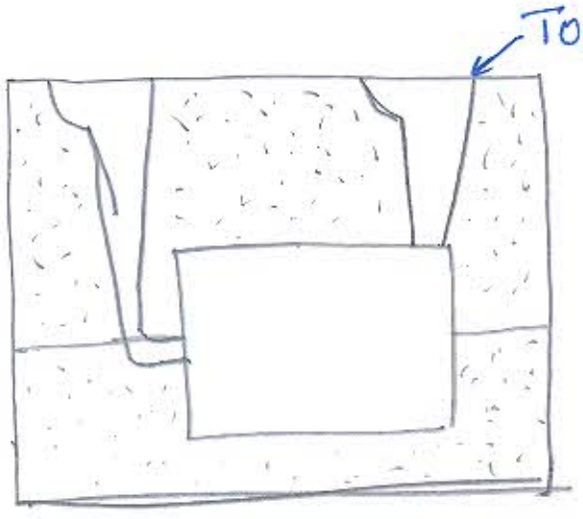
5) Open riser

These risers are open to the atmosphere at the top surface of the mould. In open riser molten metal is subjected to atmospheric pressure directly.



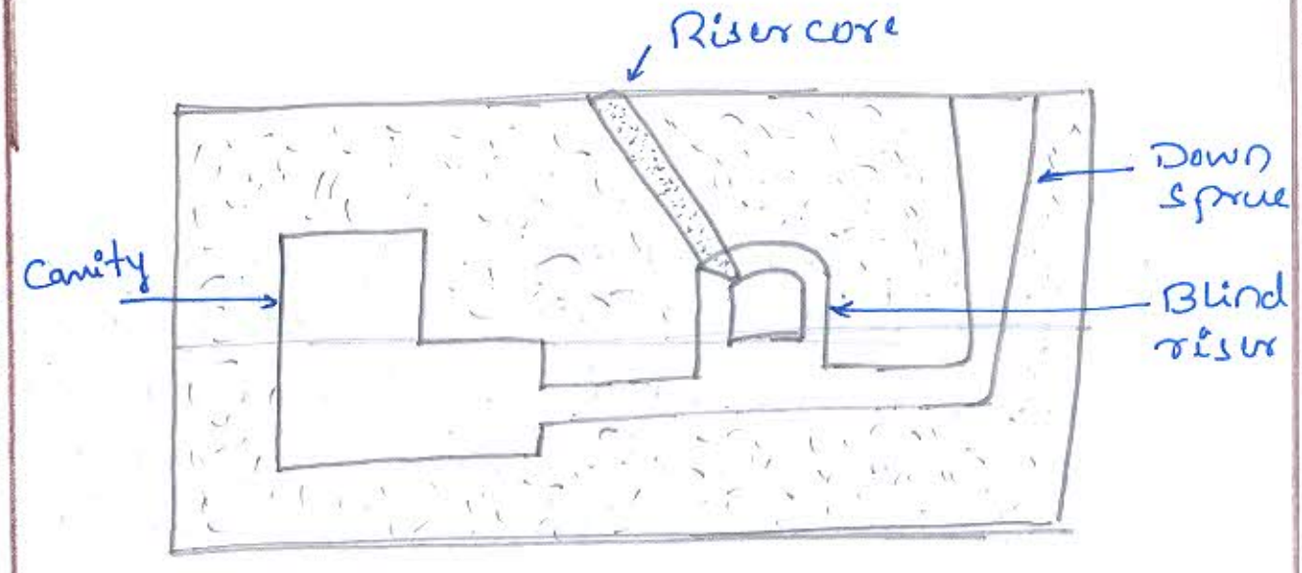
Top riser

It is located at the top of the casting and has the advantage of additional pressure head. It is placed adjacent to the casting. Top risers are more extensively used since its efficiency is high.



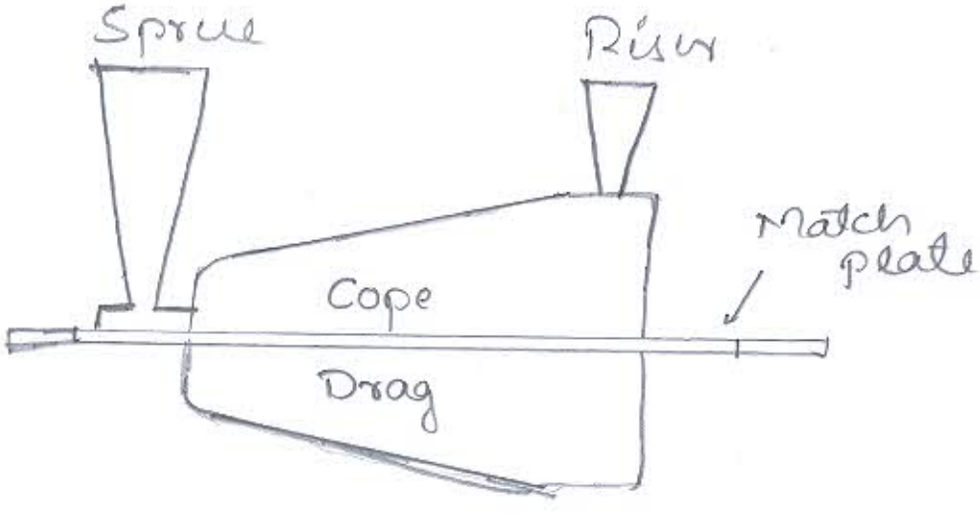
Blind riser

These risers are not exposed to atmosphere directly and are completely surrounded by moulding sand. The height of the riser will be smaller than the height of the casting as shown in figure. Core is used in the blind riser, which allows the molten metal to receive atmospheric pressure to force the molten metal into the mould.



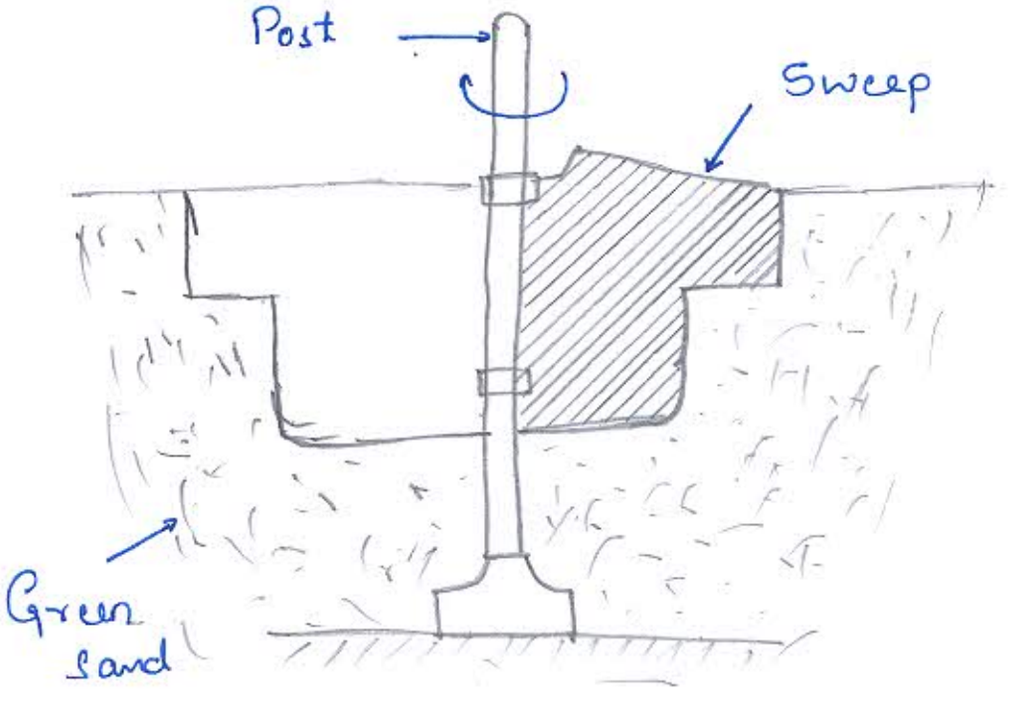
Match plate pattern

Match plates provide substantial mountings for pattern and are widely used with machine moulding. It consists of flat plate to which pattern is permanently fixed on either side of the plate. Gates & runners are also fixed at proper positions on the plate. On either end of the plate, there are holes to fit into a standard flask. So when match plate is lifted from the mould, pattern is also withdrawn. The risers & runners are also formed in one operation.



6) Sweep pattern

It can be used for preparing mould of large size and symmetrical in shape particularly of circular sections can be easily prepared. The sweeping equipment consists of a base suitably fixed on sand mass, the vertical spindle with sweep board or wooden board is connected to base. A sweep is a template of wood which has contour corresponding to the shape and size of the casting. The plate is rotated about the spindle to form the cavity. Then sweep along with spindle are ~~mounted~~ removed from cavity, filling and patches the hole of spindle.



7) Investment casting.

Pattern making :- Wax pattern with desired shape is prepared by injecting molten wax into the metallic mould and allows cooling for some time. After solidification the wax takes the shape of the cavity.

Assemble the wax pattern

Multiple wax patterns may be created and then assembled into one complex pattern so that they can all be cast at once. These multiple patterns are attached to a common wax sprue, gating system which forms the cluster or tree of pattern.

Investment

The ceramic mould, known as investment, is produced by three repeating steps: coating, stuccoing and hardening.

* The first step involves dipping the cluster of pattern into slurry of fine refractory material and then letting any excess drain off, so a uniform surface is produced.

* In the second step, the cluster of stuccoed with coarse ceramic particle by dipping it into a fluidized bed, placing it in a rainfall-sander or by applying by hand.
* Finally, the coating is allowed to harden.

These steps are repeated (6-8 times) until enough layers (5-15 mm thickness) must be formed.

Dewaxing

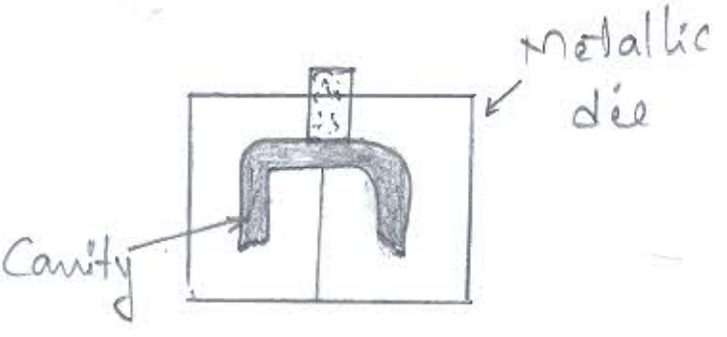
The investment then allowed to completely dry, which take 16-48 hours. Drying can enhanced by applying a vaccum or minimizing the environmental humidity. The coated wax assembly is inverted and the shell is heated around 1000°C to 1200°C to remove wax as well as to improve the strength of shell.

Mould preparation

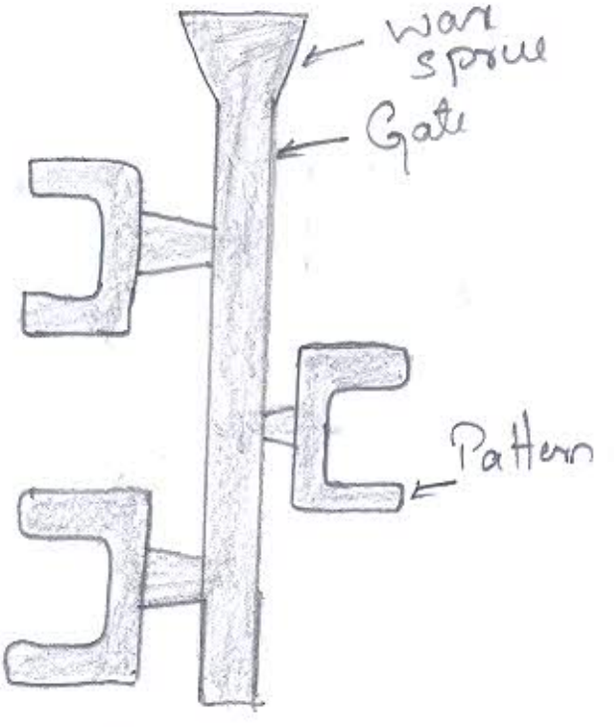
The prepared mould shell is placed in a flask and the backing sand material is rammed around the shell to give support in a flask. Now the mould is completely ready to receive the molten metal.

Pouring

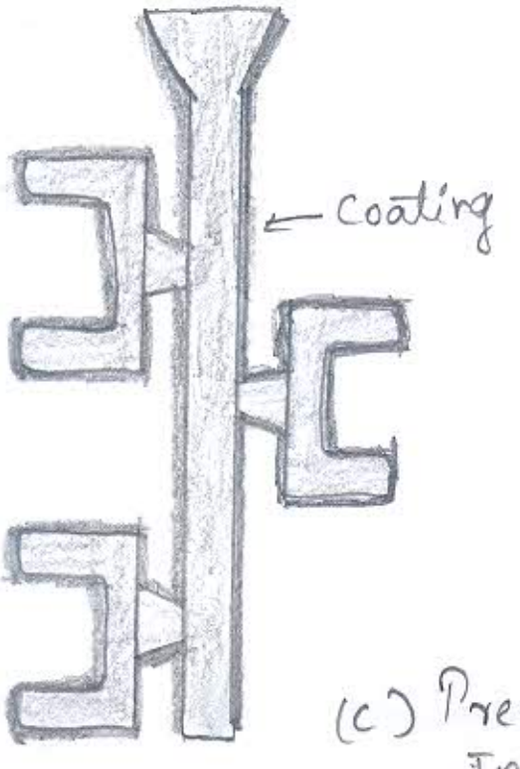
The molten metal is poured into the shell through a funnel-shaped pour cup and flows down by gravity, through the gates and into the part cavities. As the metal cools, the parts, gates, sprue and pouring cup become one solid casting. After the casting has cooled, the ceramic shell is broken off and the parts are cut from the sprue.



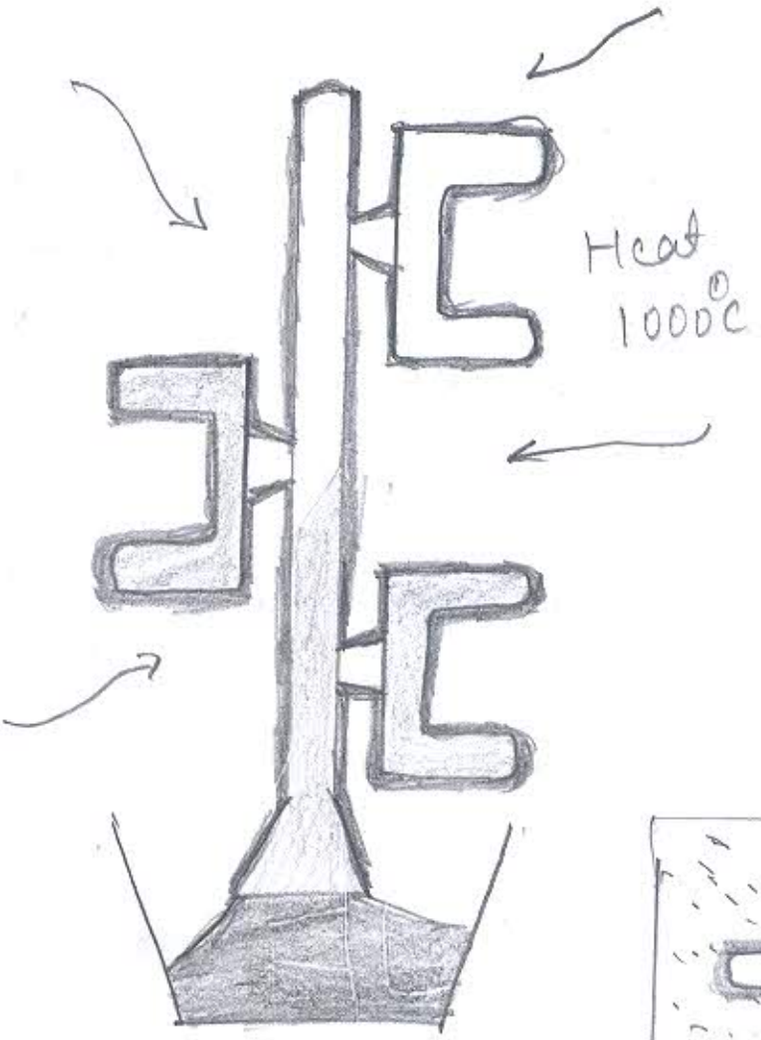
(a) Wax pattern



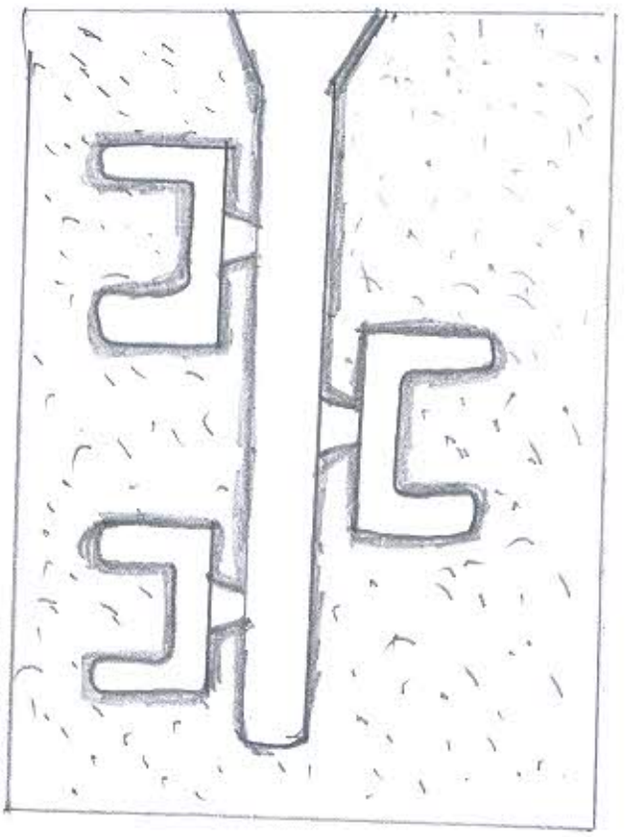
(b) Pattern tree



(c) Pre-coating and Investment



(d) De-waxing



(e) Mould preparation