Adda247

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TO Adda247

"There is nothing impossible to they who will try."

GATE 2024

प्रचण्ड Batch

PRODUCTION

CASTING

LEC-06

Mechanical Engineering

GATE 2024

GATE

प्रचण्ड Batch

MECHANICAL ENGINEERING

MON/ TUE/ WED- 9PM

THEORY OF MACHINE (TOM)

THUR/ FRI/ SAT- 6PM

PRODUCTION ENGINEERING

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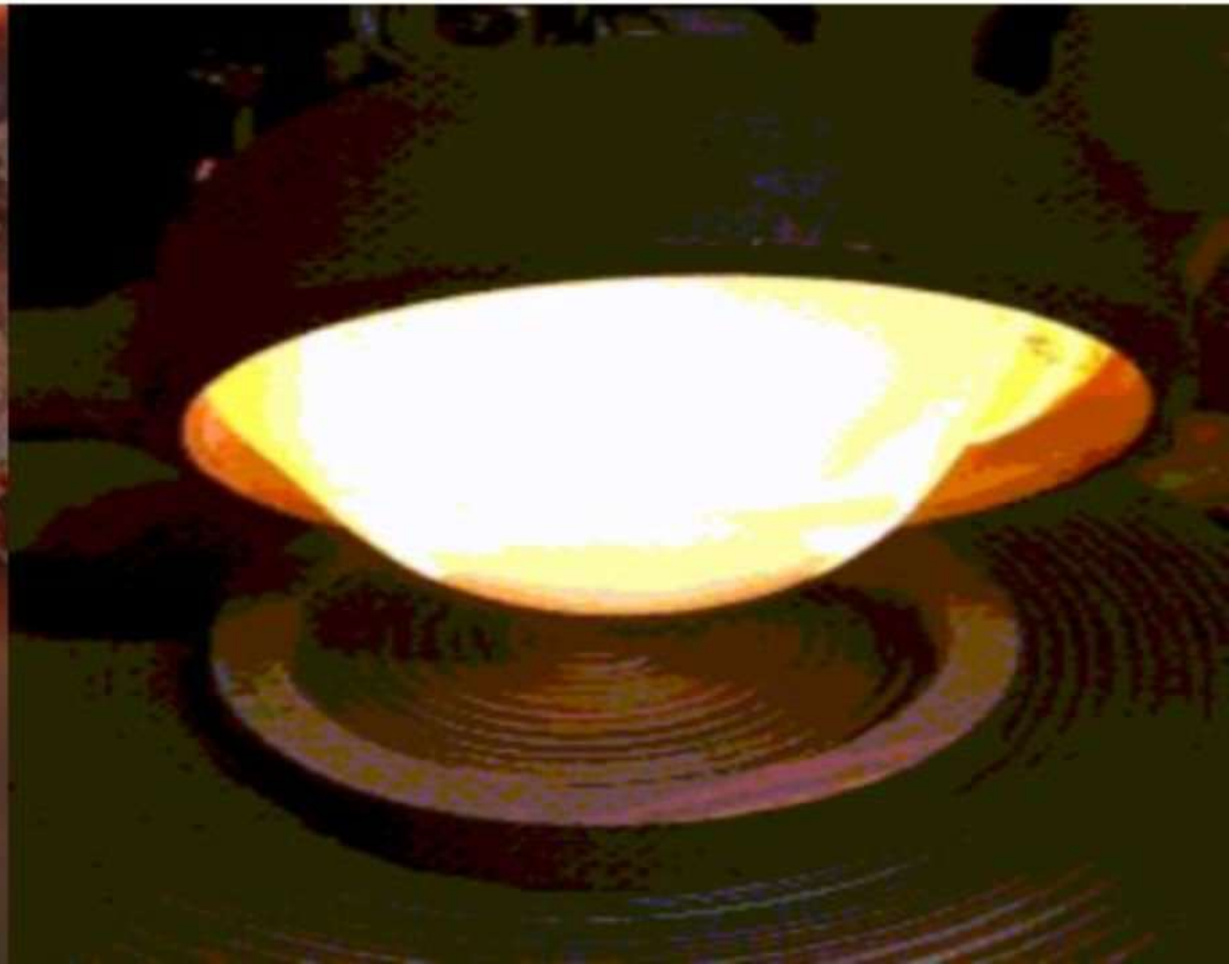
CASTING



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Elements of Gating Design

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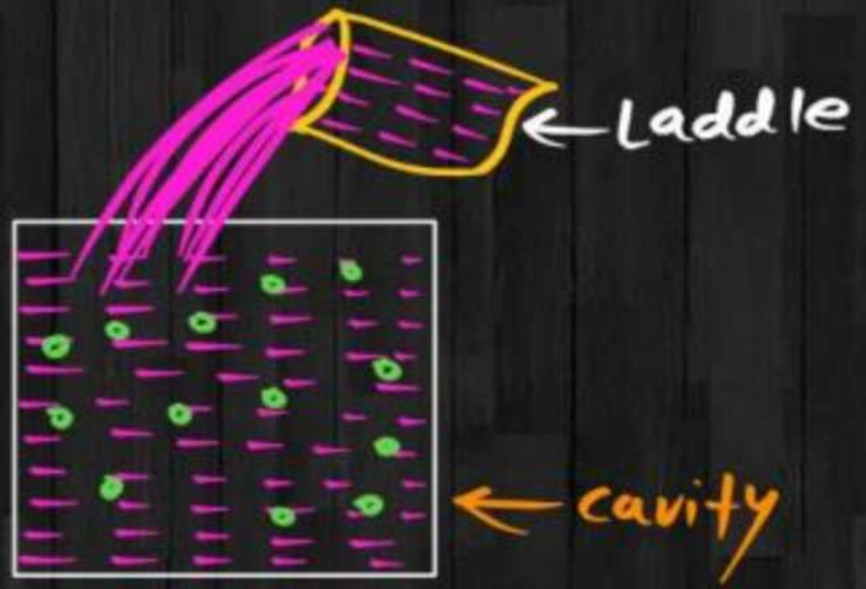
Problem with this Technique



* Entry of Molten Liquid Metal into Cavity @ Turbulent
* Splashing of liquid → More losses in Molten Liquid Metal
* Mould Errosion

* By Directly falling of Molten Liquid Metal atmospheric Air Enter inside the cavity

Air-aspiration Effect → Defective casting

Activate Win
Go to Settings to

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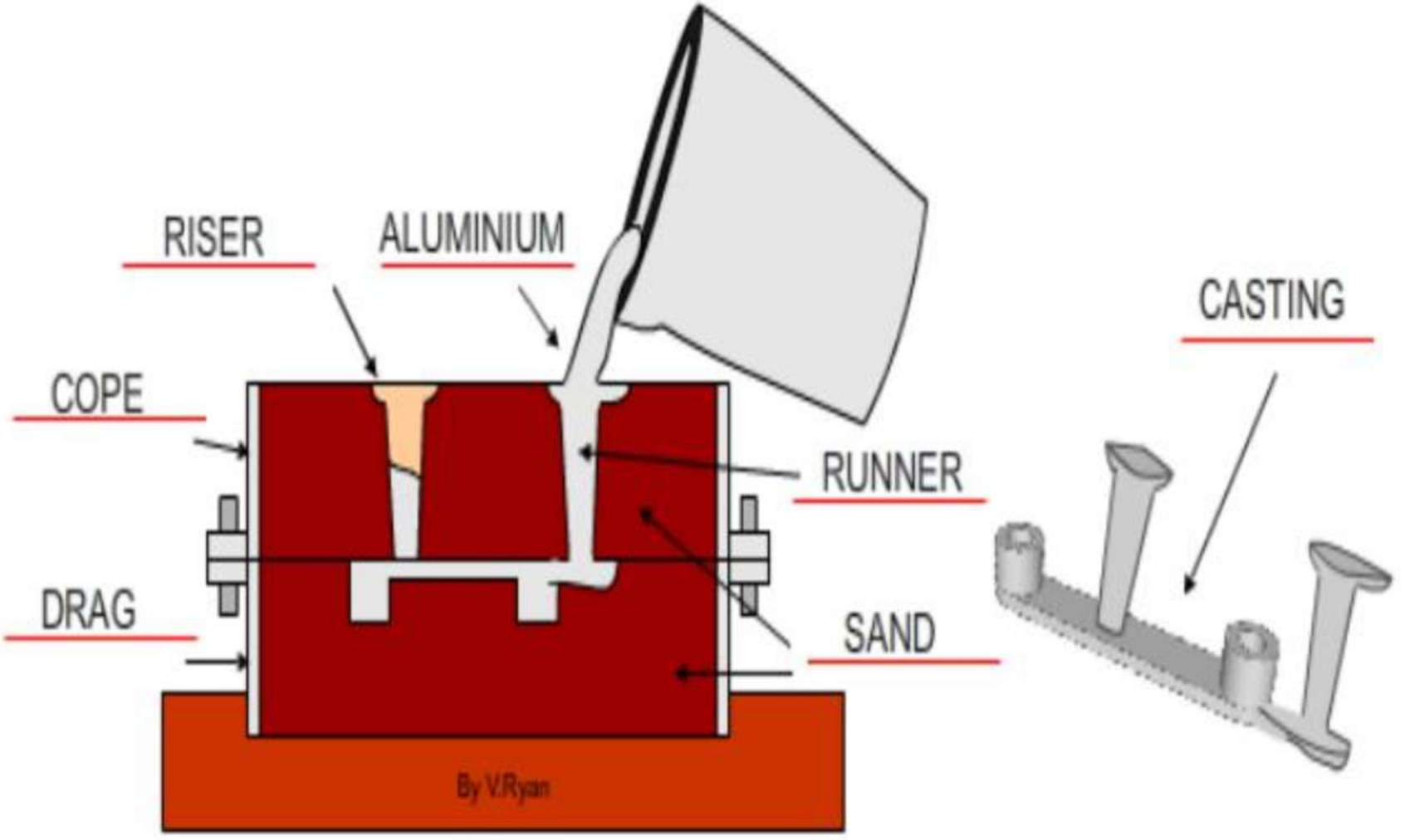
Elements of gating design

- Pouring Basin
- Sprue
- Runner
- Gate
- Cavity
- Riser



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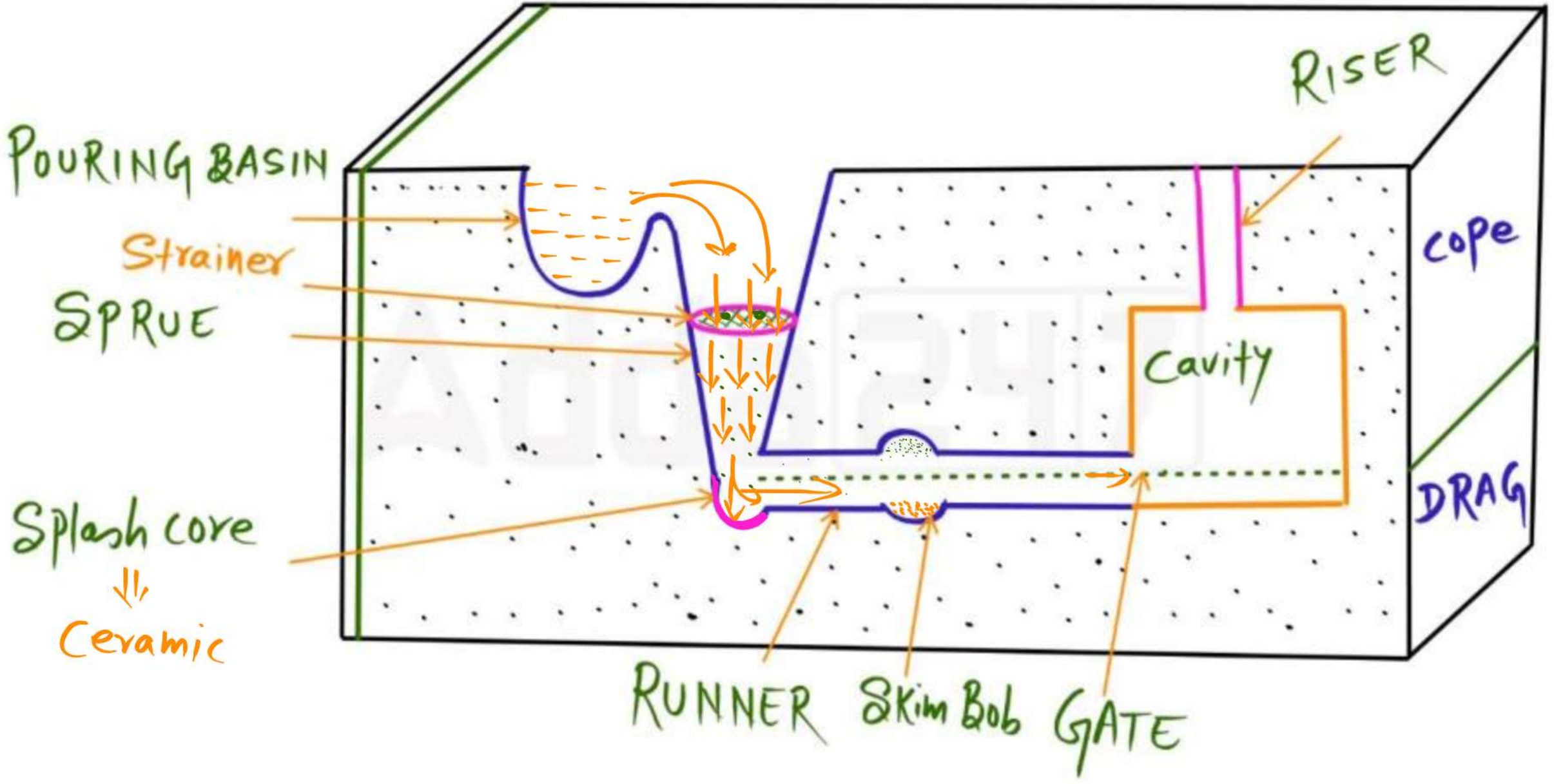
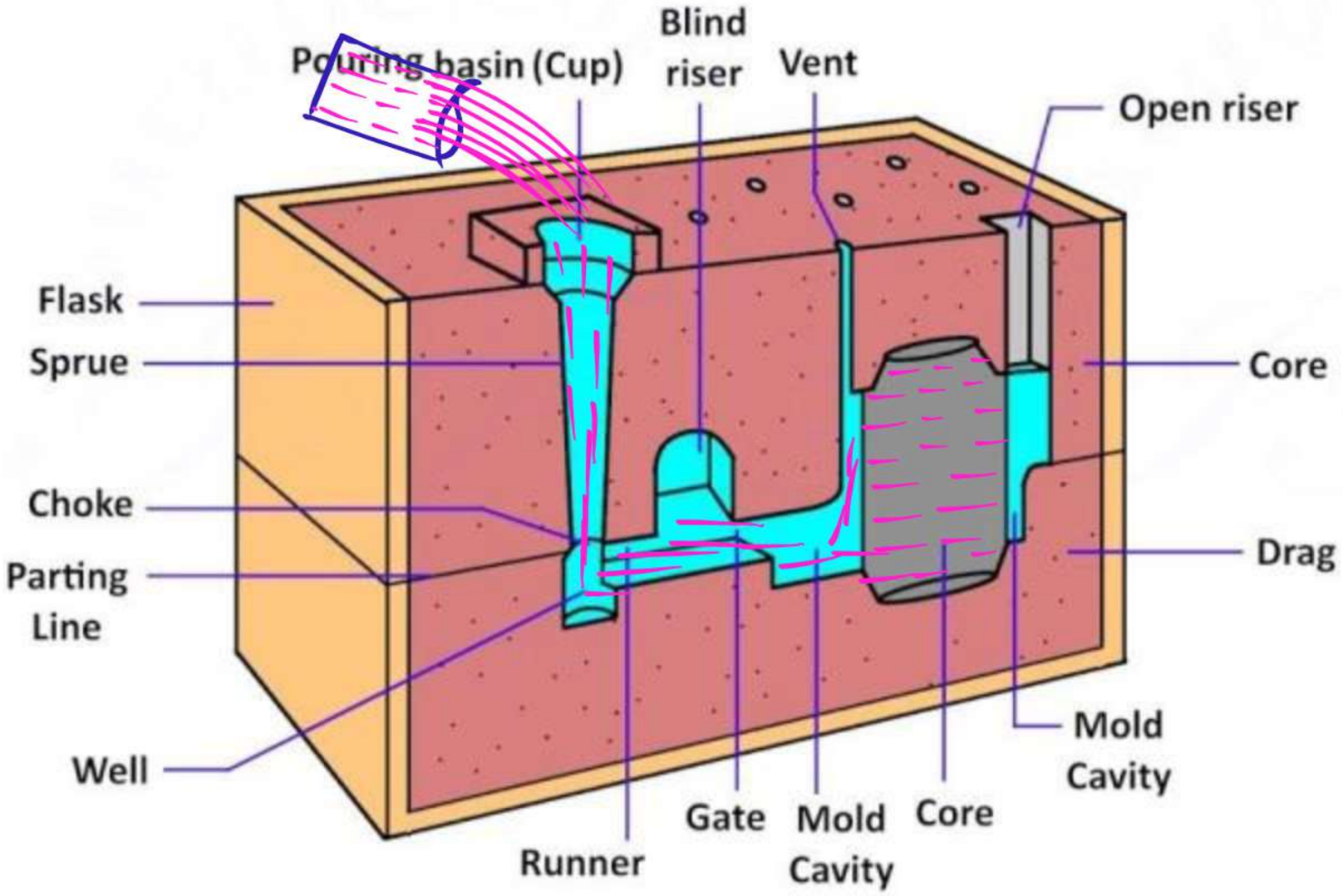
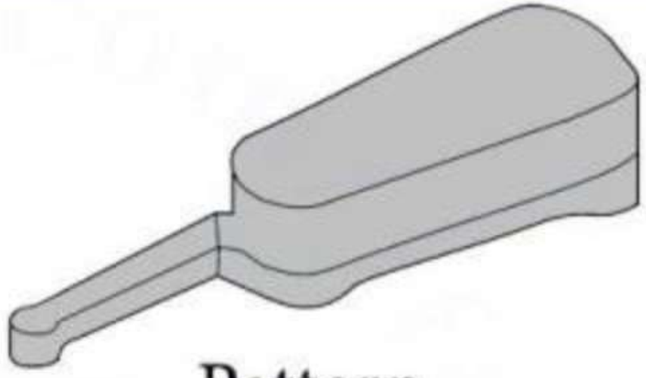
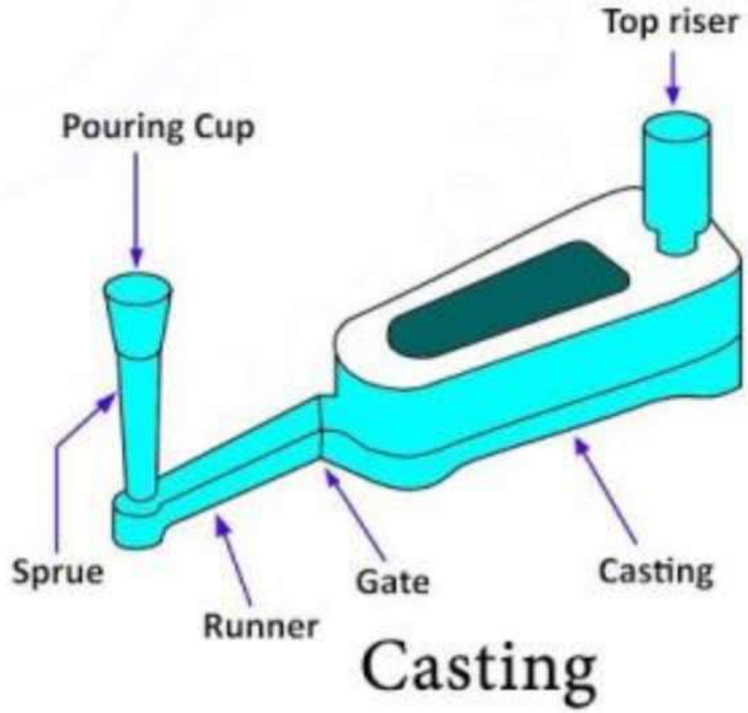


Gating System (Metal Casting Process)





Pattern



Casting

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Objectives of gating design

* Design the Gating so that Molten Liquid Metal Enter into cavity with optimum velocity without causing Turbulence, Splashing and Mould Errosion. With a given Time.
* Design the gating elements so that pure liquid Metal will enter into the cavity without Any Air-aspiration Effect.
* Produce the Gating Element for Maximum "casting Yield".

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* casting yield = $\frac{\text{Vol of casting}}{V_c + \text{Vol of gating element}}$

* $\uparrow C_y = \frac{V_c}{V_c + V_g \downarrow}$

Gating Elements

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* Pouring Basin → Sprue → Runner → Gate → Riser

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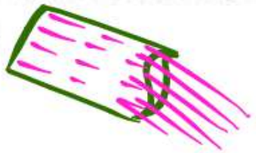
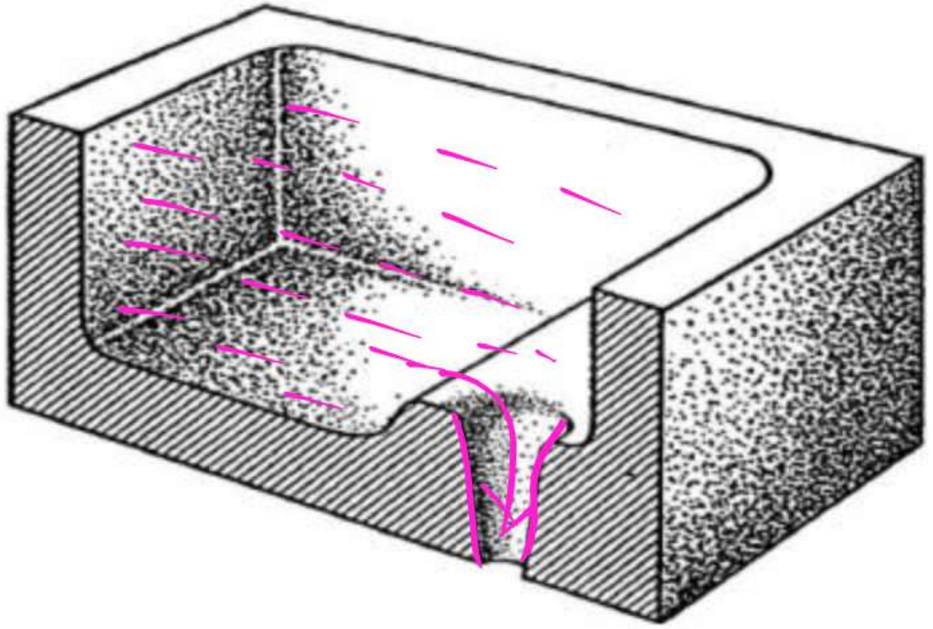
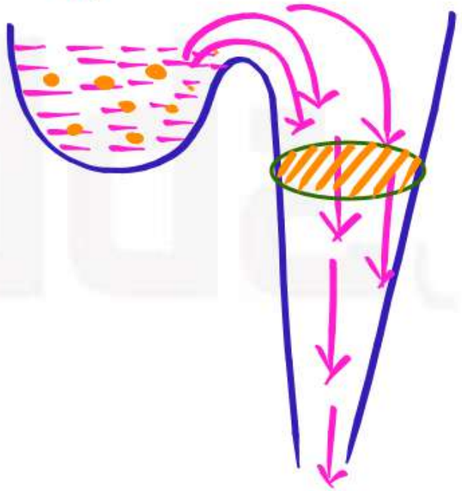
Pouring Basin

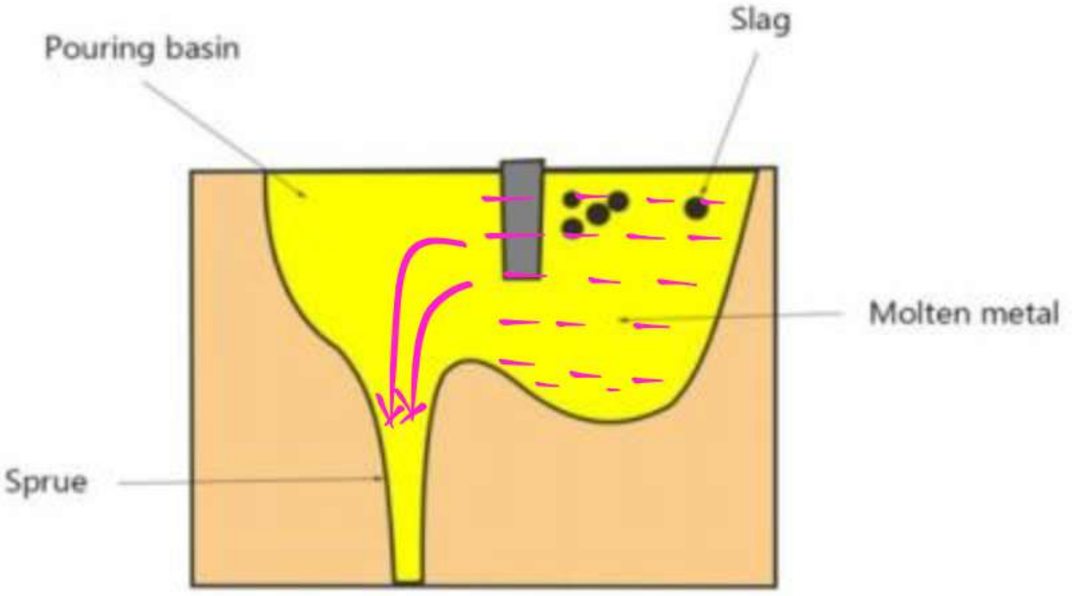
Pouring basin is designed to reduce the velocity of liquid metal which is enter into the sprue







Reseviour shape of Pouring Basin



Strainer

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Ceramic Material

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It will trap the Large Size impurity

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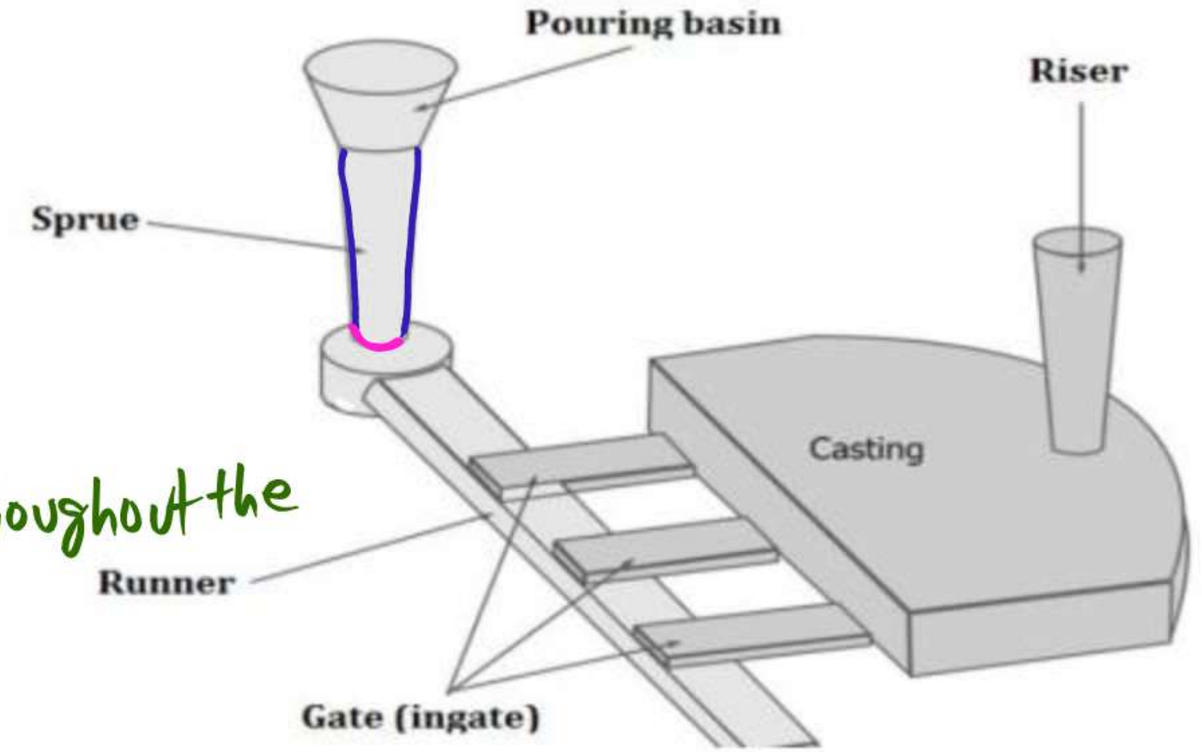
sprue



To avoid air-aspiration Effect

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The Shape of Sprue will not uniform OR constant c/s Area thoughout the height

⇓

The Shape of Sprue will be varying c/s Area i.e Converging passage

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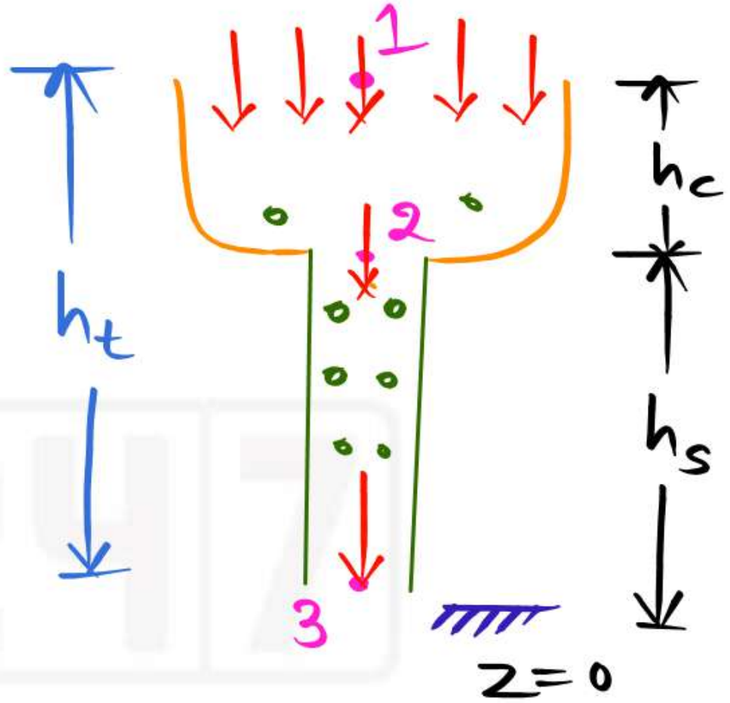
Shape of Sprue :-



Sprue → 2 to 3

* 1 And 3 → At Atm pressure
* $\rho_2 A_2 V_2 = \rho_3 A_3 V_3$
* $A_2 V_2 = A_3 V_3$ $(\because A_2 = A_3)$
* $V_2 = V_3$

☺ Apply BE b/w ② And ③

* $\frac{P_2}{\rho g} + \frac{V_2^2}{2g} + h_s = \frac{P_3}{\rho g} + \frac{V_3^2}{2g} + 0$

* $\frac{P_2}{\rho g} + h_s = \frac{P_3}{\rho g}$ → 0

* $\boxed{P_2 = -\rho g h_s}$

* $P_1 = P_{atm}$

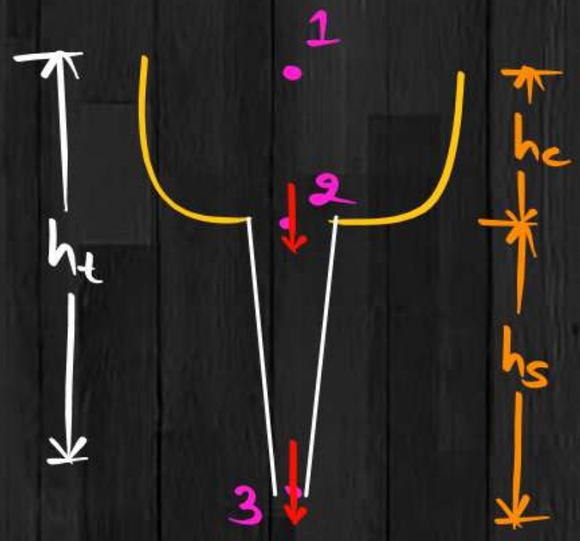
☺ * $P_1 > P_2 \Rightarrow$ Air- Aispiration Effect

So that Shape of sprue will not be uniform OR constant c/s

Shape of Sprue

Sprue → 2 to 3

* $\rho_2 A_2 v_2 = \rho_3 A_3 v_3$
* $A_2 v_2 = A_3 v_3$
* $\frac{A_2}{A_3} = \frac{v_3}{v_2}$
* $\frac{A_2}{A_3} = \frac{\sqrt{2gh_t}}{\sqrt{2gh_c}}$
* $\boxed{\left(\frac{A_2}{A_3}\right)^2 = \frac{h_t}{h_c}}$ → Equation of Parabola



* $v_2 = \sqrt{2gh_c}$
* $v_3 = \sqrt{2gh_t}$

* Shape of Sprue

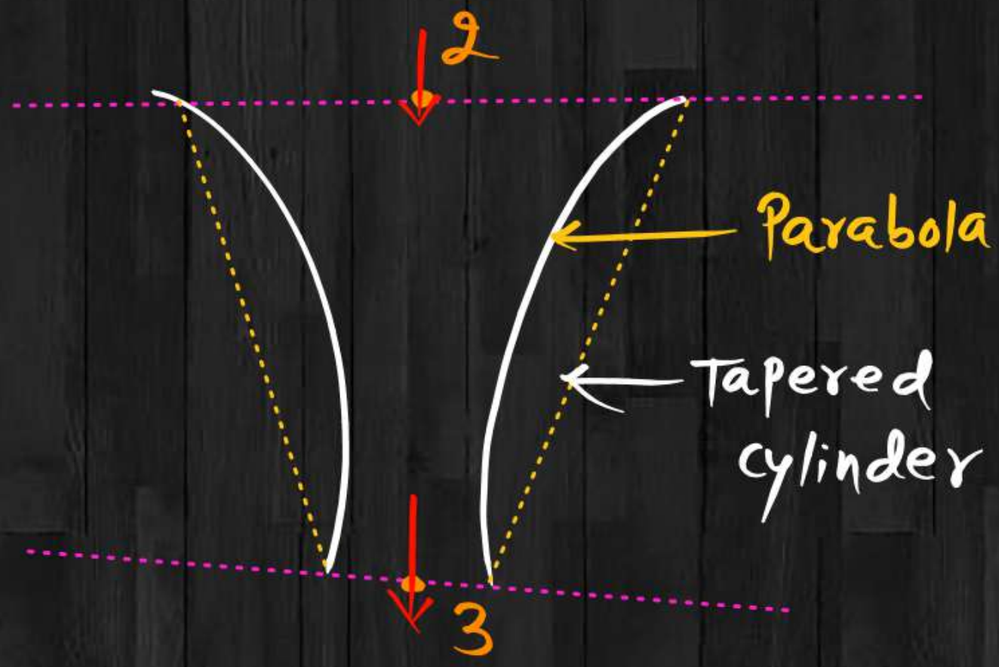
⇓

Parabola (Idea Shape of Sprue)

* To minimize the manufacturing difficulties the Shape of Sprue

⇓

Tapered cylinder



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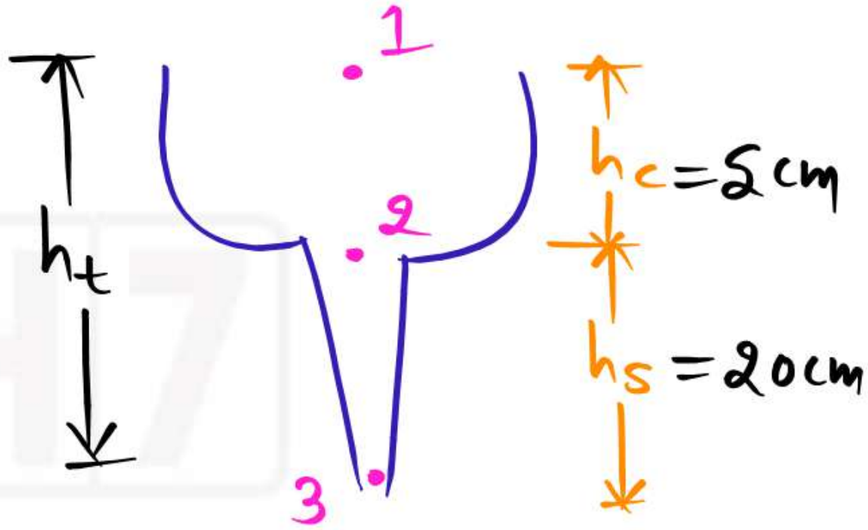
Q Design a sprue to avoid air aspiration effect and to feed the liquid metal at a rate of 20kg/sec take density of the liquid metal as 7800kg/m3.Take height of the sprue as 20cm and height of the pouring cup as 5cm.

Given Data :→

* $\dot{m} = 20\ kg/sec$
* $\rho = 7800\ kg/m^3$
* $h_s = 20\ cm$
* $h_c = 5\ cm$



Design of Sprue → * A_2 = Inlet Area of Sprue
* A_3 = outlet Area of Sprue

* $Q_1 = Q_2 = Q_3 = Q$

* $A_2 = \frac{Q}{V_2}$

* $A_2 = \frac{2564.1 \rightarrow cm^3/s}{99.04 \rightarrow cm/s}$

* $A_2 = 25.88\ cm^2$

$\downarrow$

* $\frac{\pi}{4} d_2^2 = 25.88$

* $\boxed{d_2 = 5.74\ cm}$

* $g = 9.81\ m/s^2 \Rightarrow 981\ cm/s^2$

* $V_2 = \sqrt{2gh_c} = \sqrt{2 \times 981 \times 5} = 99.04\ cm/s$

* $\dot{m} = \rho A V = \rho Q$

* $Q = \frac{\dot{m}}{\rho} = \frac{20 \rightarrow kg/s}{7800 \rightarrow m^3/kg} = 2.564 \times 10^{-3}\ m^3/s$

* $Q = 2564.1\ cm^3/s$

* $A_3 = \frac{Q}{V_3}$

* $A_3 = \frac{2564.1 \rightarrow cm^3/s}{221.47 \rightarrow cm/s}$

* $A_3 = 11.57\ cm^2$

↓

* $\frac{\pi}{4} d_3^2 = 11.57$

* $\boxed{d_3 = 3.83\ cm}$

* $V_3 = \sqrt{2gh_t} = \sqrt{2 \times 981 \times 25} = 221.47\ cm/s$

* $Q = 2564.1\ cm^3/s$

Function of Splash core

⇓

Ceramic

⇓

To avoid Mould Erossion

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Runner

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Horizontal passage

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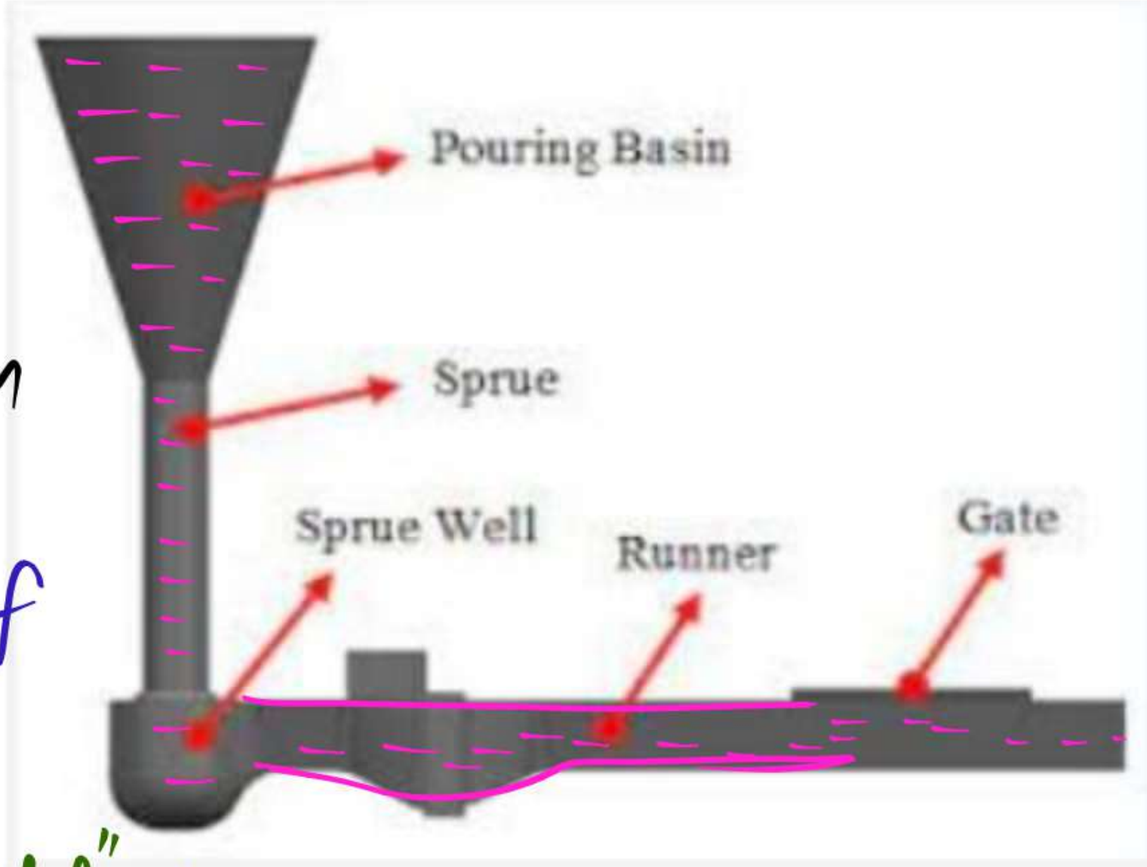
It will transfer the molten liquid from Sprue exit to inlet of Gate.

(1) To minimize the Turbulent loss of Molten Liquid Metal

⇓

Shape of Runner ⇒ "Trapezoidal" 4s



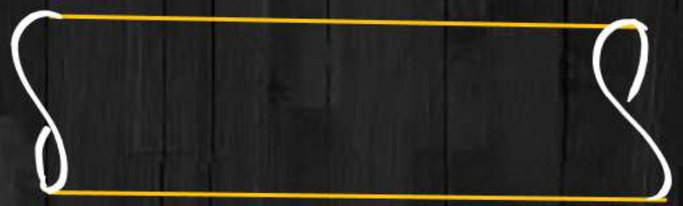
* To minimize the heat transfer losses

⇓

Shape of Runner

⇓

cylindrical



function of Skim bob

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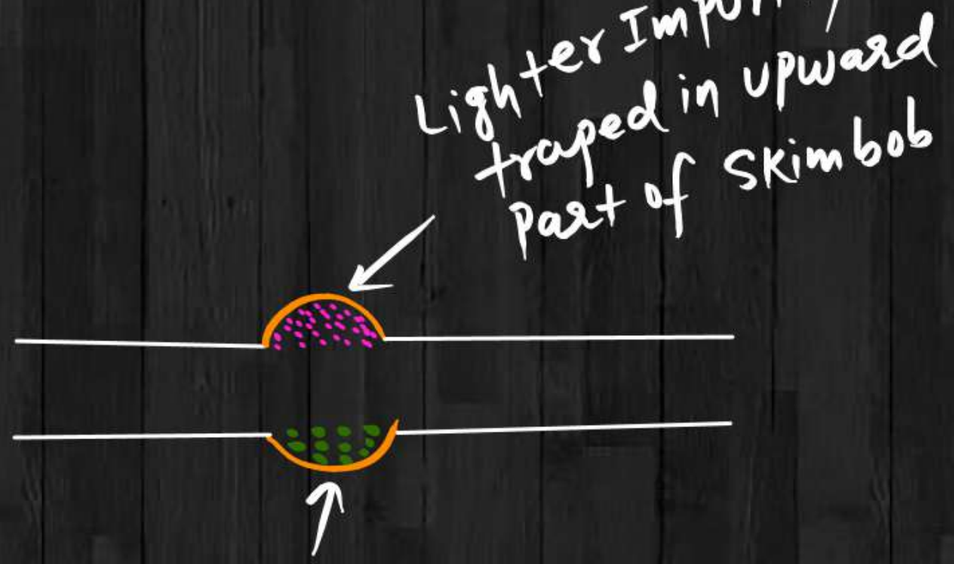
To filte the Lighter And Heavy impurity present in Molten Liquid Metal.



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Gate

It is the actual entry point through which liquid metal can be enter into the cavity.

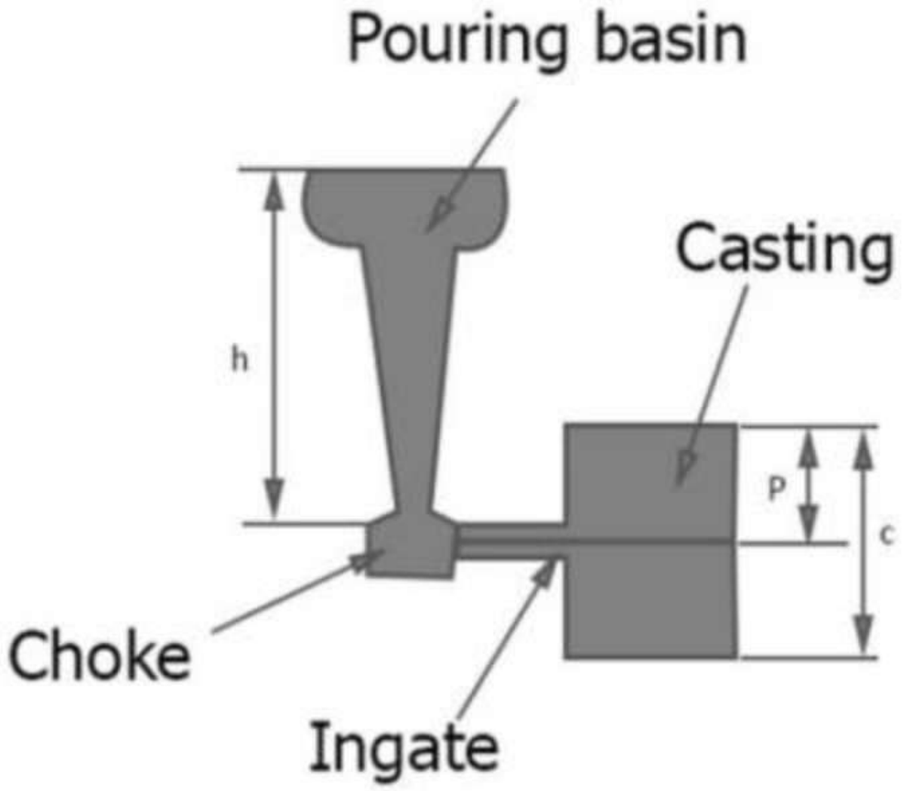
Types

1 Top gate

2 Bottom gate

3 Parting line gate

4 Step gate



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Top gating

Bottom gating

Parting line gating

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Top Gate

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USE CODE Y662 to Join ADDA247 Paid Classes and GET Max Discount

Bottom Gate

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Relation between Top and Bottom Gate when

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Relation between Top and Bottom Gate when

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In a gating design dimensions of the cavity is 50cm,25cm and 10cm.it will be filled by providing gate on the top of the cavity with the pouring height of 15cm.Area of the gate is 5cm2.Determine time taken to fill the cavity.

By using top gate

By using bottom gate

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In a gating design the mould dimensions are 50cm,25cm and 15cm the height of liquid metal above the gate is 15cm area of the gate is 5cm2.Determine time required to fill the mould cavity by using Bottom gate.

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