

WELCOME
TO Adda247

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

GATE 2024



प्रचण्ड Batch

PRODUCTION

CASTING

LEC-05

Mechanical Engineering



GATE 2024



प्रत्न Batch

MECHANICAL ENGINEERING



MON/ TUE/ WED- 9PM

THEORY OF MACHINE (TOM)

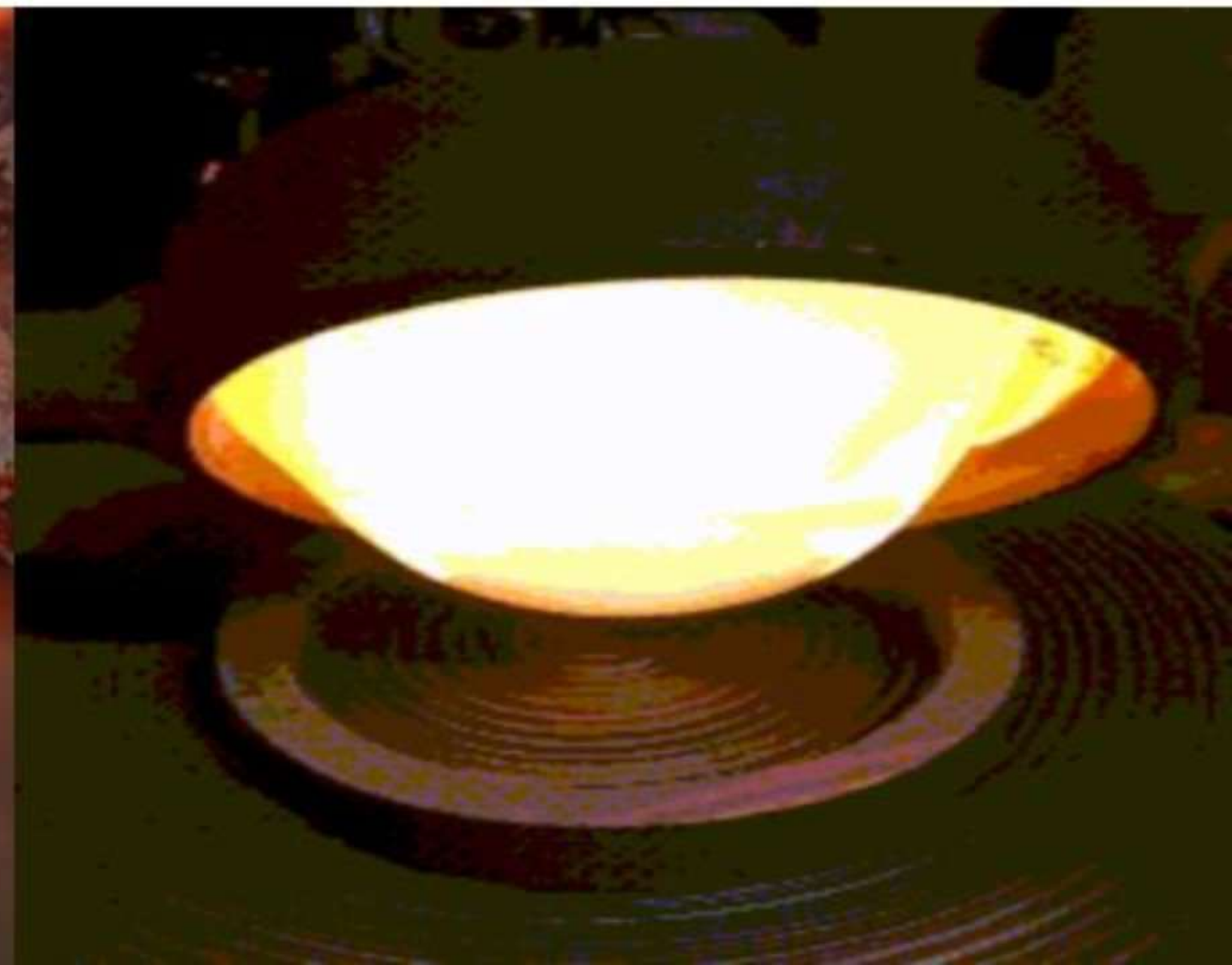


THUR/ FRI/ SAT- 6PM

PRODUCTION ENGINEERING

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CASTING



INDEX

Introduction of Casting

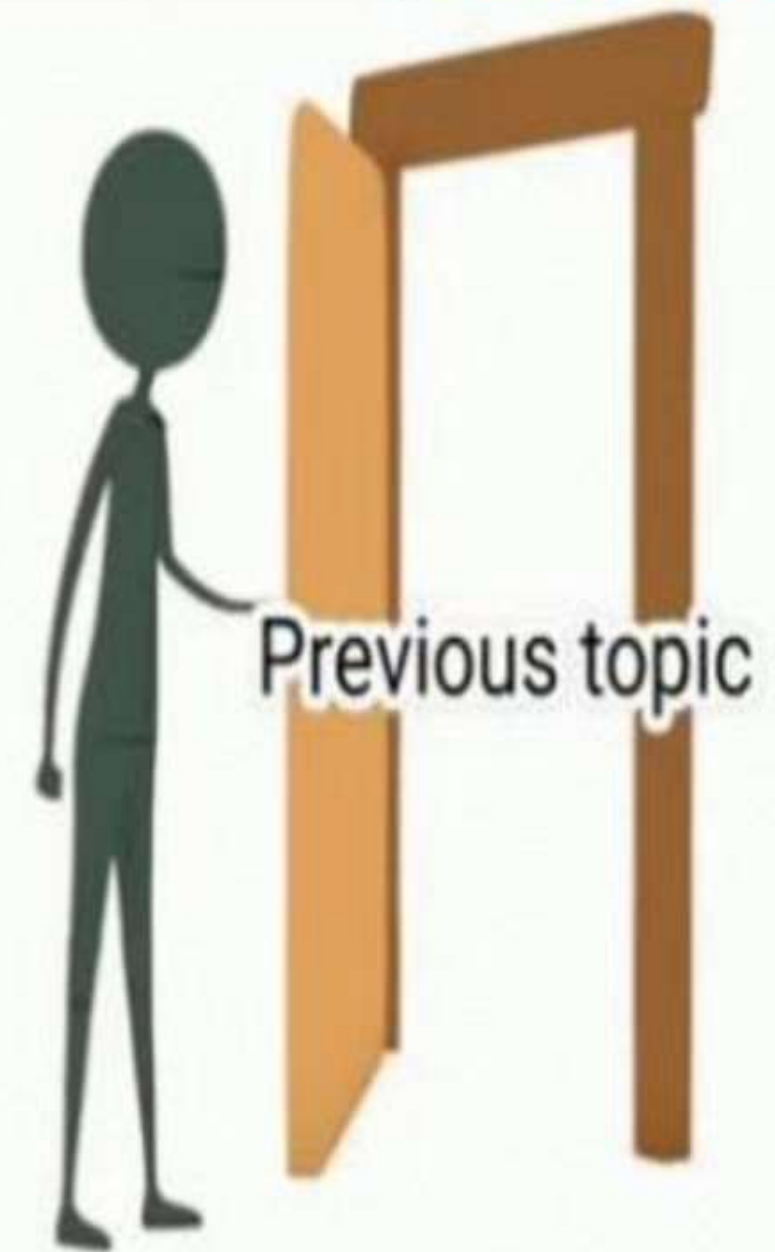
Broad Steps in Sand Casting

Cooling Curve for Sand Casting

Types of allowances

Types of pattern

Moulding sand and its properties





today's
topic



Moulding sand and its properties



Elements of Gating Design

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Flowability

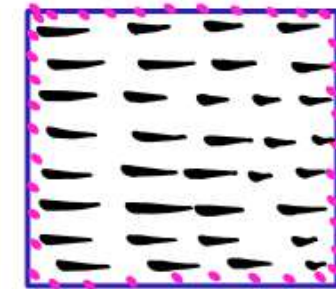
Ability of the moulding sand to flow into all the corners of the mould box due to ramming force.



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Strength

To retain the shape and size of the cavity and to withstand forces applied by the liquid metal on the mould surface mould must be having sufficient strength.



Strength



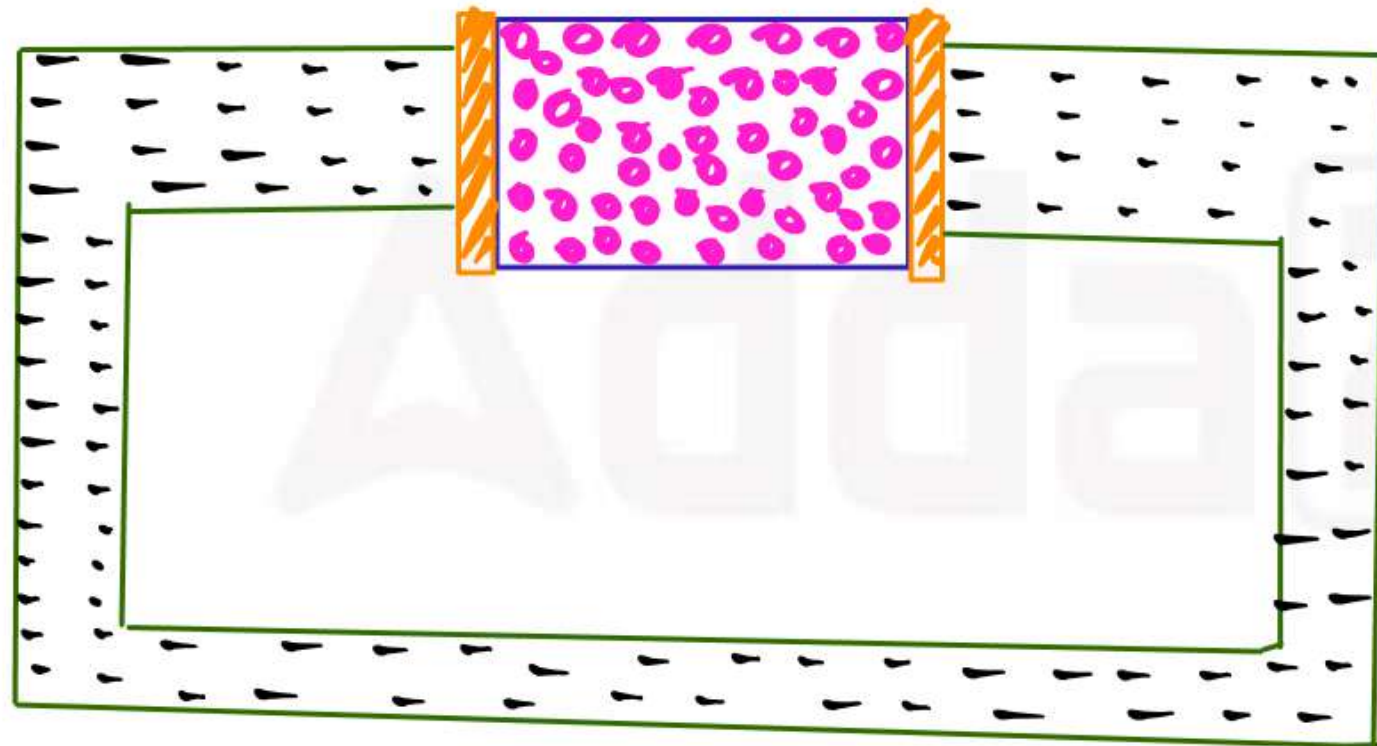
- * compressive
- * Tensile
- * Shear



Moulding Sand
Strength



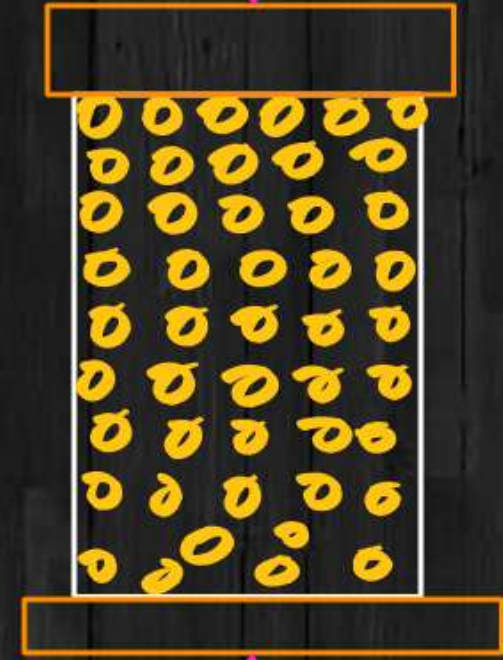
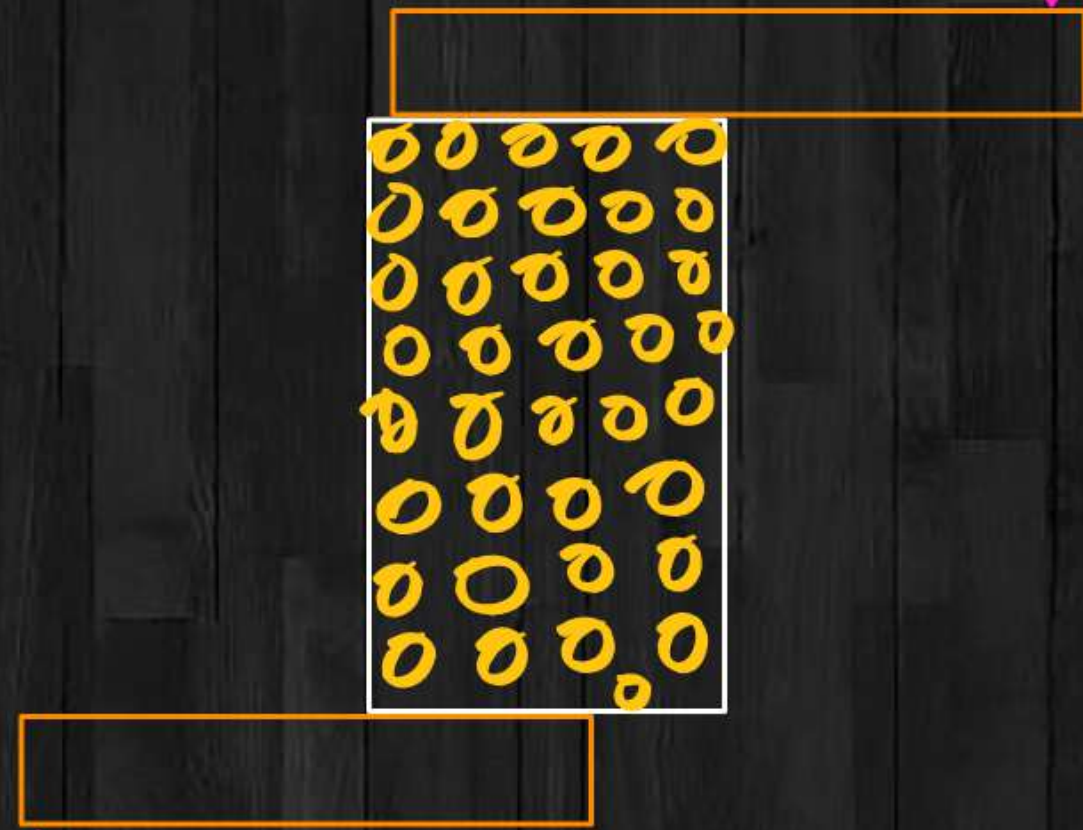
Universal Sand Strength Tester (USST)



😊 * Green And Dry sand Strength → Measured by USST

Shear Loading

Compressive Loading



Shear Testing

Compressive Testing

😊 * Green And Dry Sand Strength → Measured by USS T

* Hot Strength of Sand → Measured by "Dilatometer"

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Hardness

Hardness is a surface property to minimize erosion and to withstand forces applied by the liquid metal.

Mould must be having sufficient hardness.



Moulding Sand

☺ Mould Hardness Number (0-100)



60 to 70



Mould Hardness NO (MHN)

Generally \approx (60 to 70)



* If $MHN < 60 \rightarrow$ Problem of Dimensional Stability of Mould.

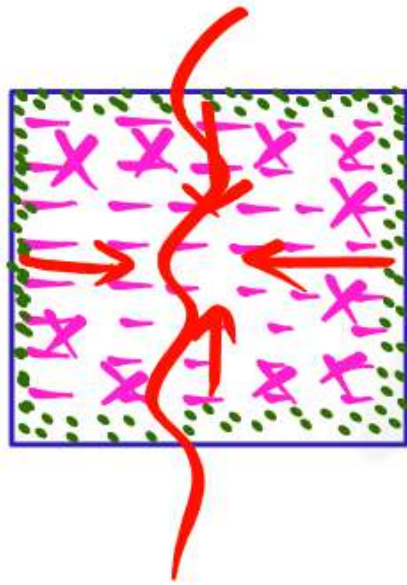
* If $MHN > 70 \rightarrow$ * Hardness of Mould \uparrow

* Permeability \downarrow 

(Problem of Gas defect in casting)

Collapsibility

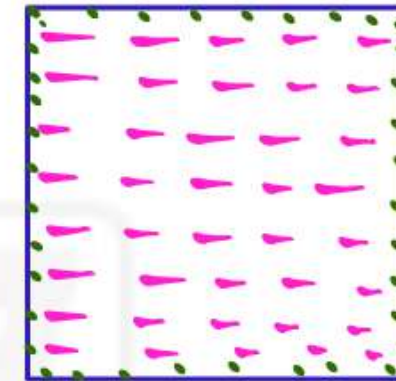
Ability of moulding sand due to which mould surface will not provide any resistance due to solid contraction of the casting.



Adhesive property → Bond b/w different Material

The adhesive property of moulding sand refers to its ability to hold its shape and adhere to itself and other materials during the process of creating a sand mould for casting metal parts.

EX: Bond b/w Moulding Sand And Molten Liquid Metal



Cohesive property → Bond b/w Same Nature of Material

The cohesive property of moulding sand refers to its ability to stick together and hold its shape without collapsing or breaking apart during the moulding process.

EX: * Bonding b/w Same Liquid Metal
* Bonding b/w Moulding Sand



* Moulding Sand is having



→ Thermal conductivity → High

→ Thermal Diffusibility → Low



* Moulding Sand + Additives → 1 to 6%

↑ To improve certain property of Moulding Sand

Additives

Additives are commonly used in moulding sand to improve its properties and enhance its performance during the casting process.

These additives can be classified into two categories: binders and modifiers.

✓ Binders are materials that are added to moulding sand to hold the sand grains together and improve its strength and stability.

✓ The most commonly used binders include clay, water, and synthetic resins such as phenolic, furan, and urea-formaldehyde resins.

Modifiers are materials that are added to moulding sand to improve specific properties, such as flowability, permeability, and thermal stability

Examples of modifiers include coal dust, wood flour, and various types of salts and mineral powders.



Wood flour

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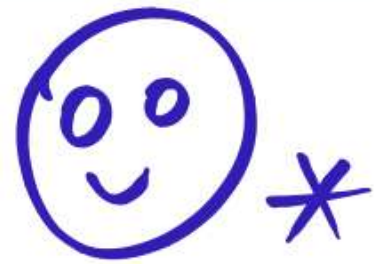
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Molasses



Linseed oil



Saw dust
OR
Wood Flour

Collapsibility ↑
And
Green Strength ↑



Coal dust

* Linseed oil
OR
Molasses
OR
Dextrin

Hardness And
Strength of mould ↑

* Coal dust

Surface finish of cavity ↑



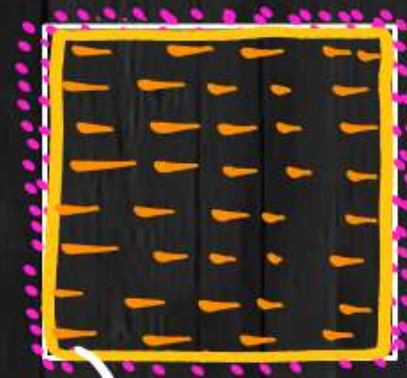
Mould Wash



To apply Thin layer of coal dust paste
on internal surface of cavity



Improve the surface finish of casting



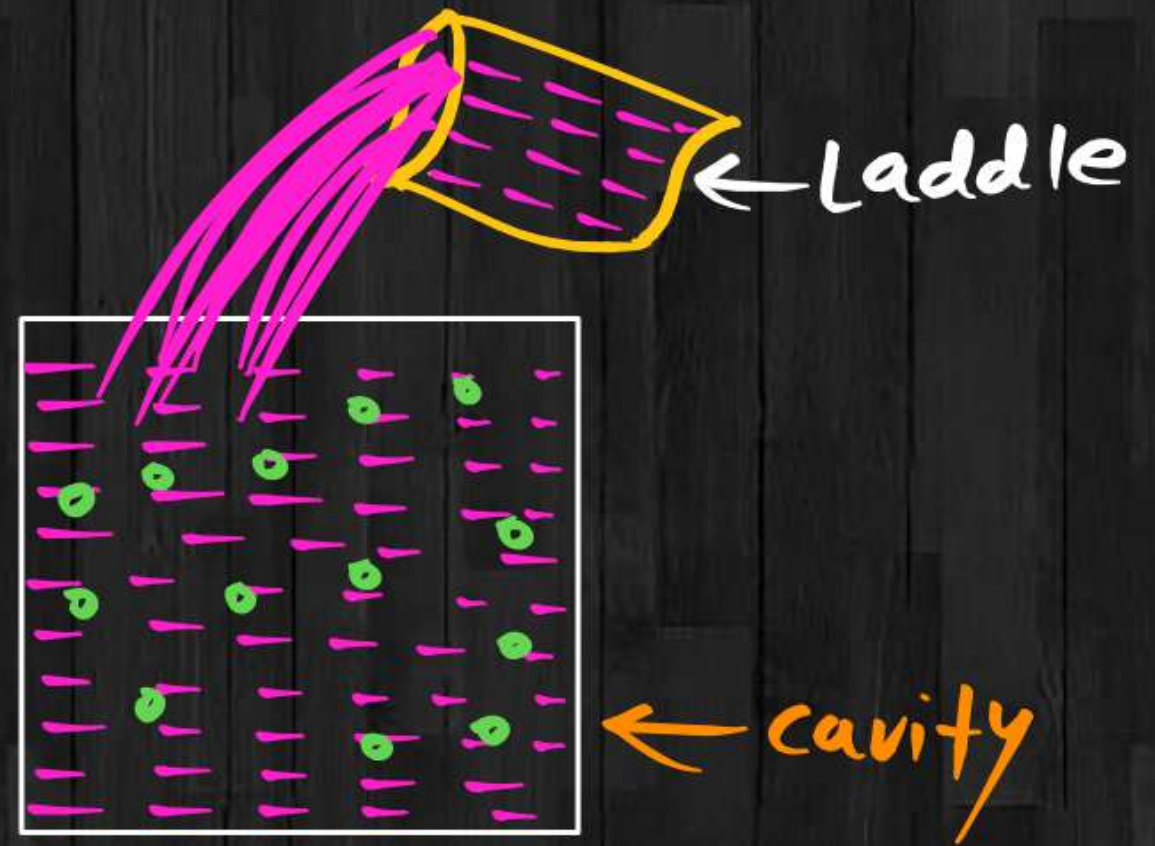
Thin layer of coal dust paste

Problem with this Technique



- * Entry of Molten Liquid Metal into Cavity @ Turbulent
- * Splashing of liquid → More losses in Molten Liquid Metal
- * Mould Erosion
- * By directly falling of Molten Liquid Metal atmospheric Air enter inside the cavity

↓
Air-aspersion Effect → Defective casting



Elements of gating design



* Pouring Basin



Sprue



Runner



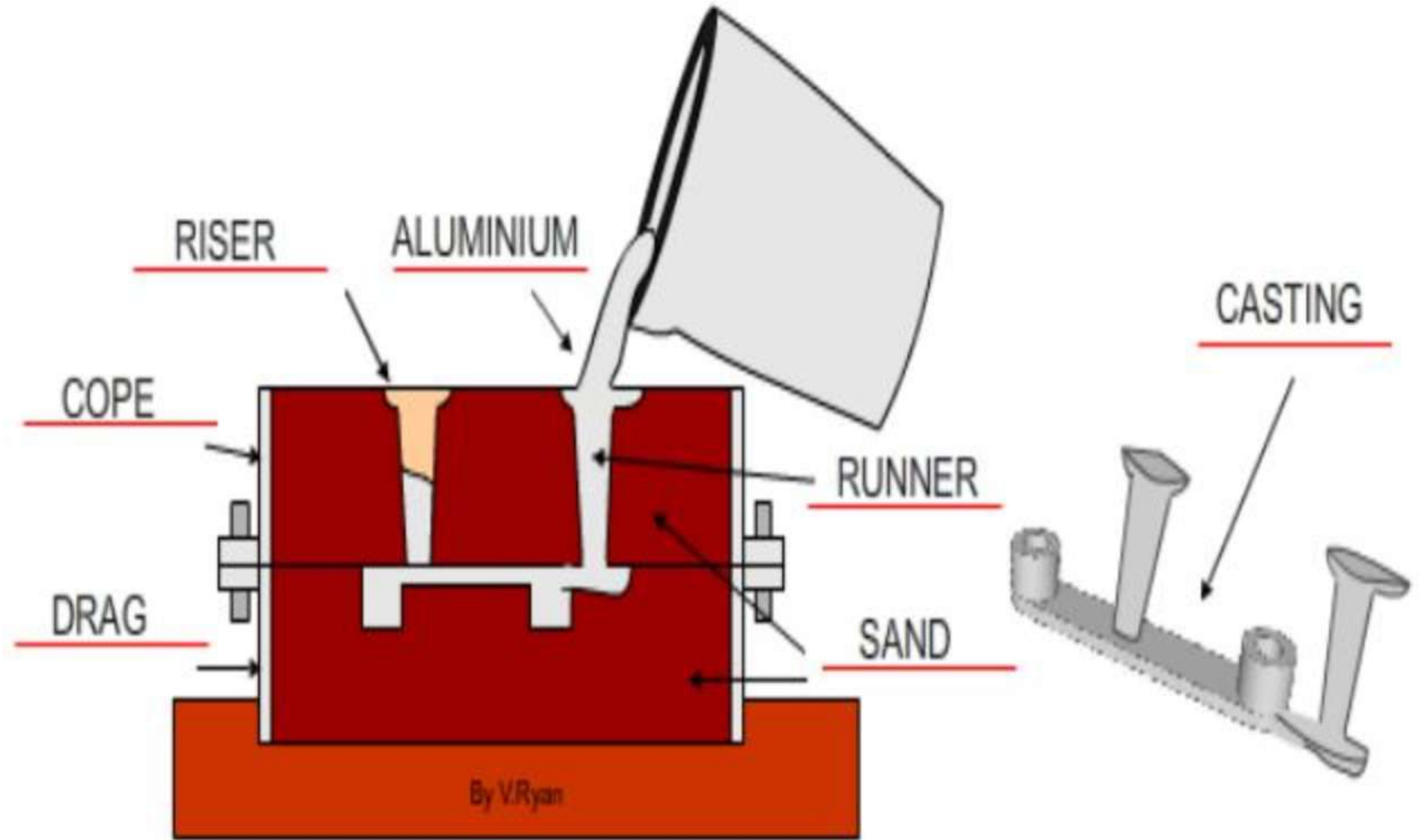
Gate

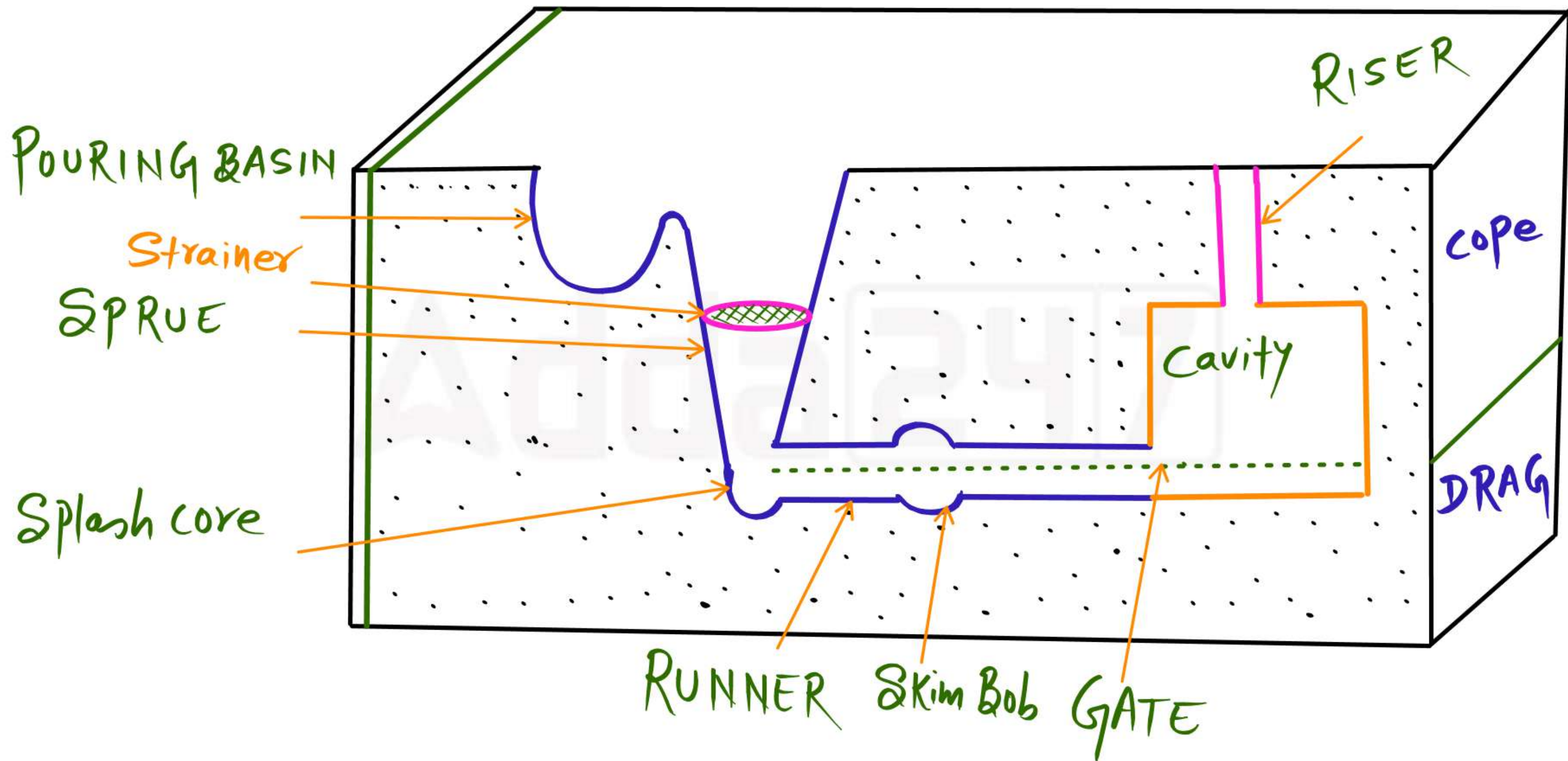


Cavity

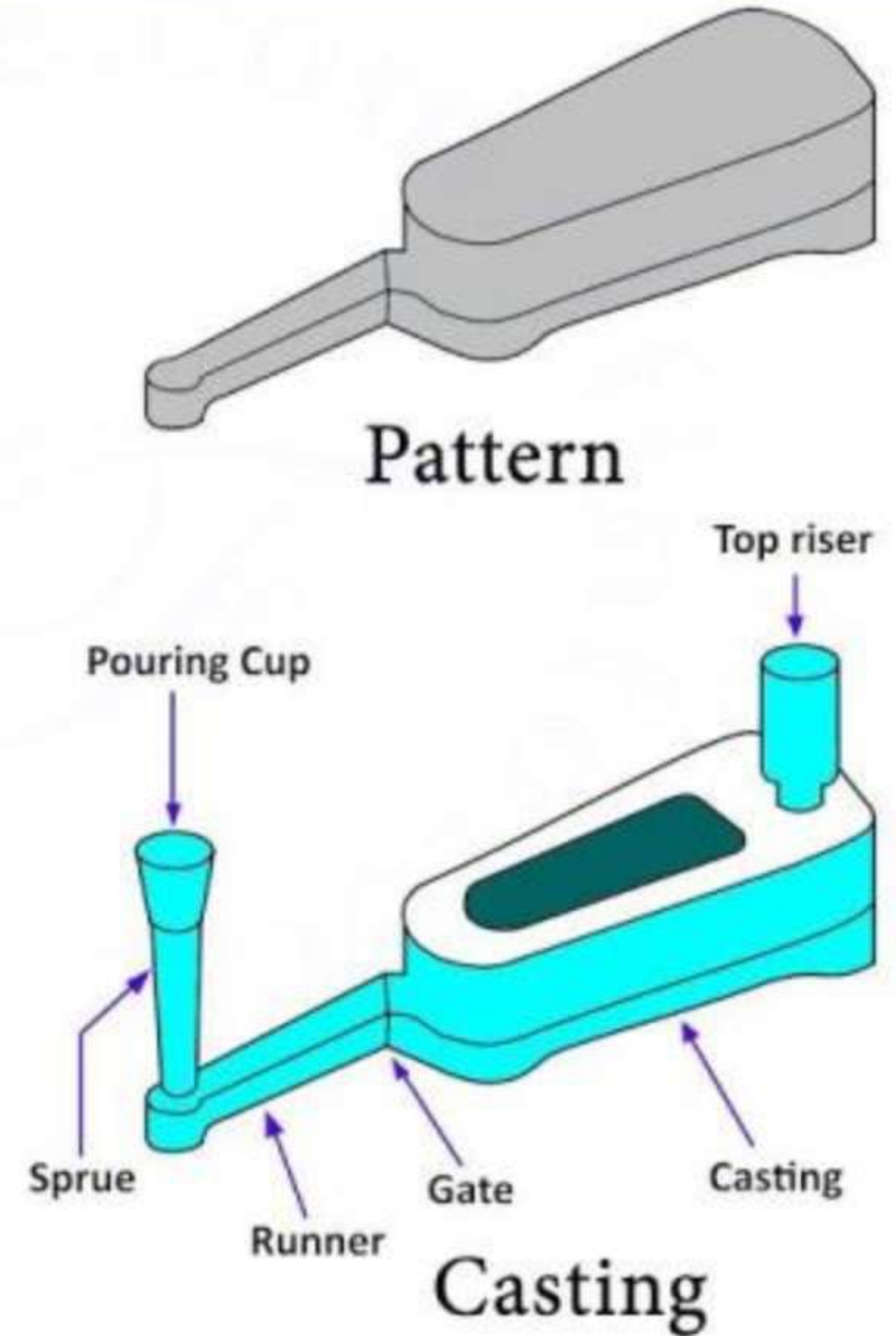
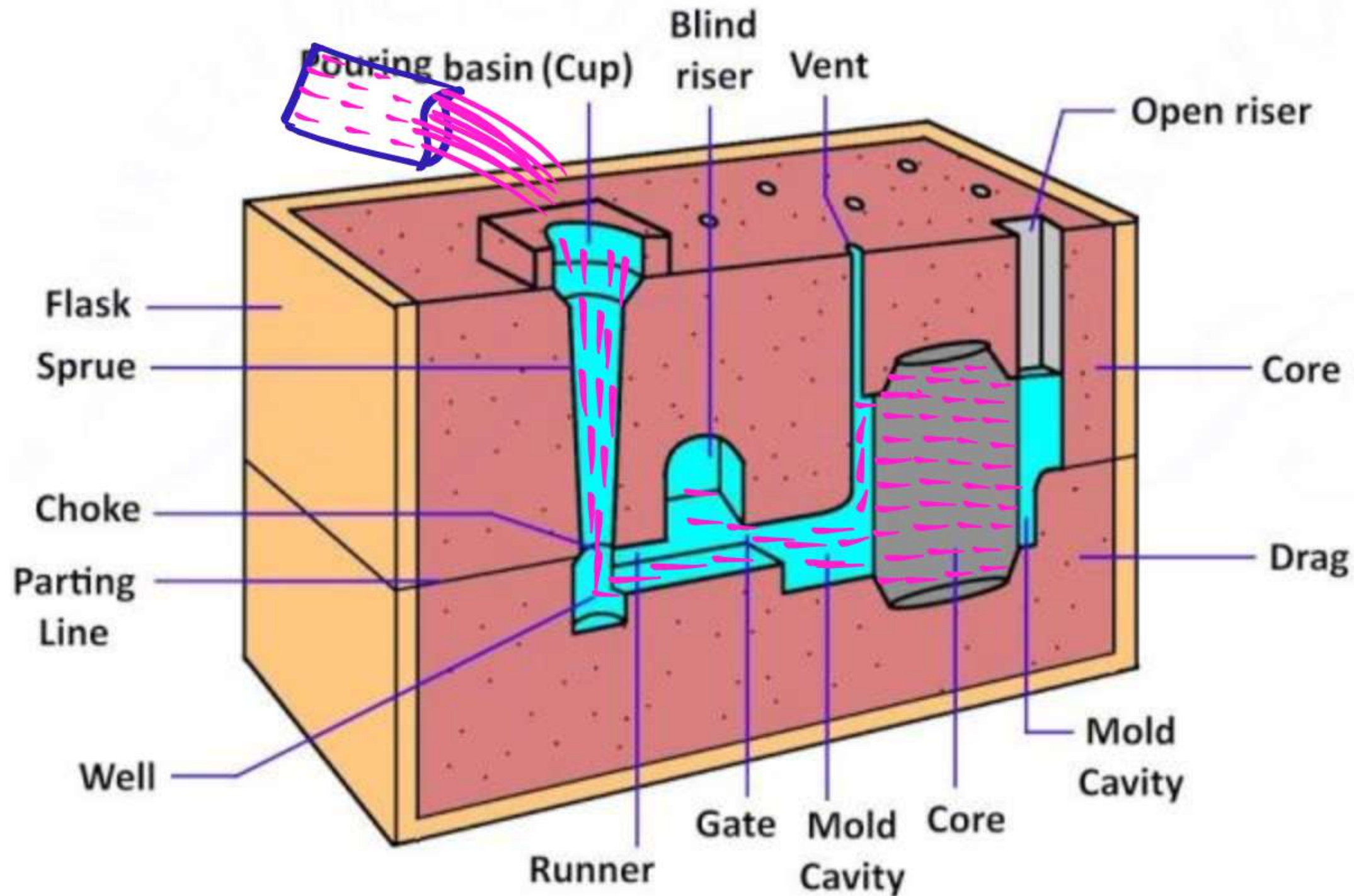


Riser





Gating System (Metal Casting Process)



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".





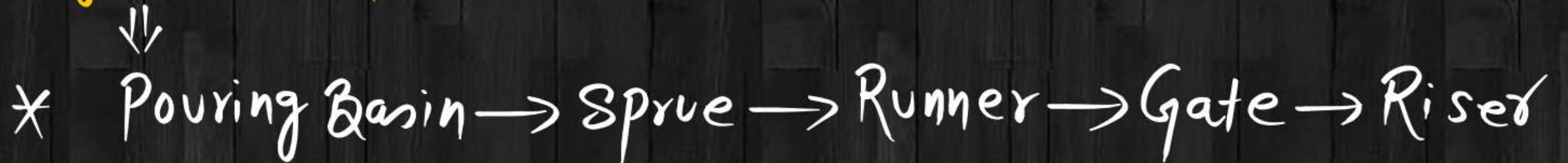
* casting yield = $\frac{\text{Vol of casting}}{V_c + \text{Vol of gating Element}}$

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

(Note: In the original image, V_g is circled in pink and has a pink arrow pointing down to it.)

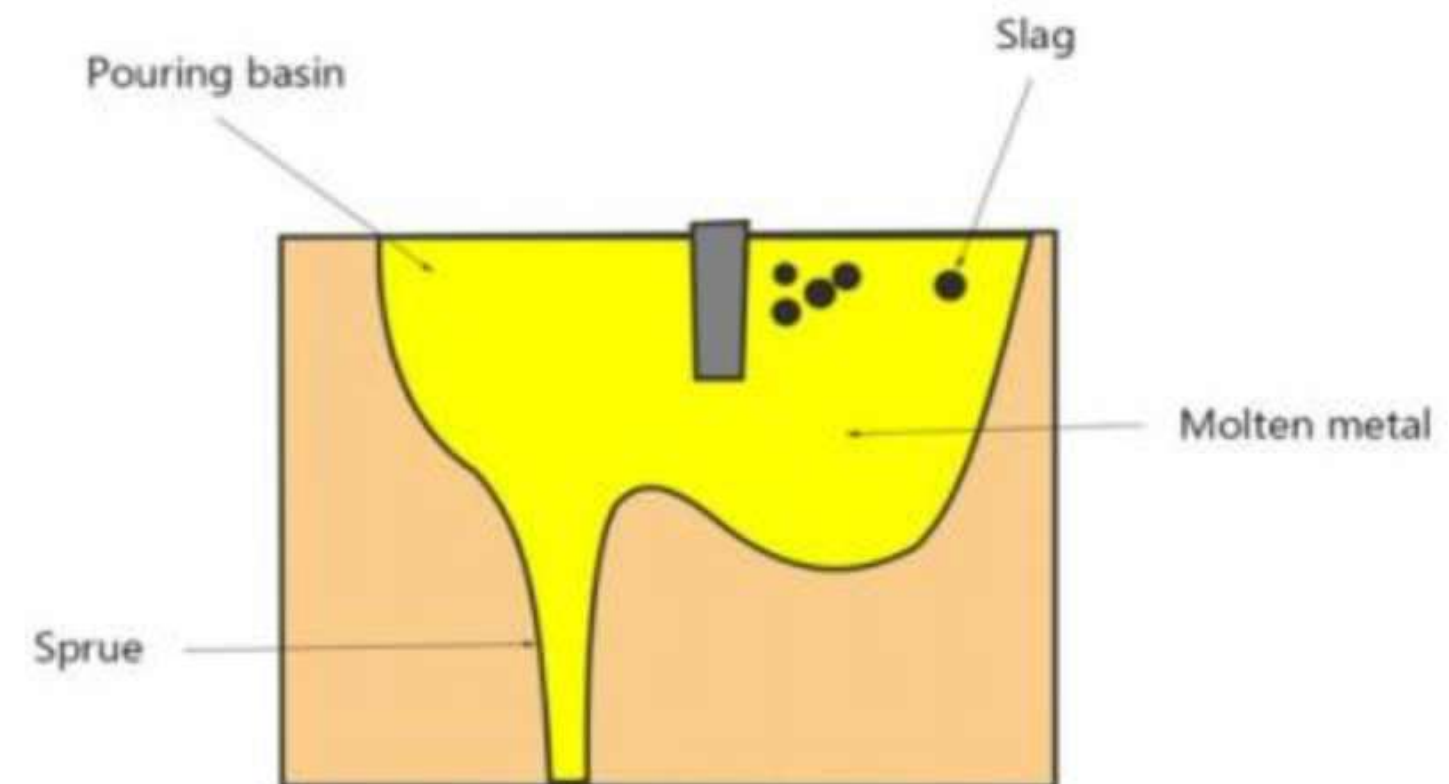
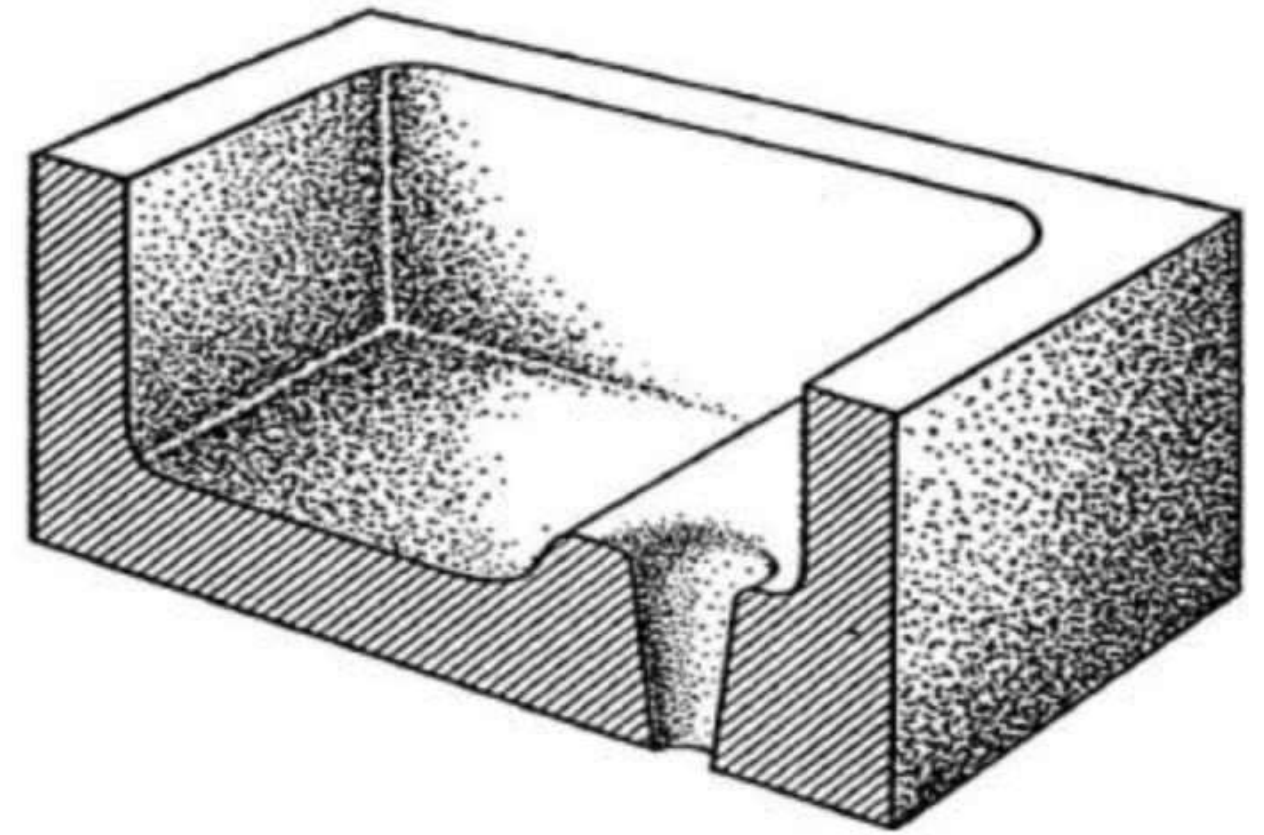


Gating Elements

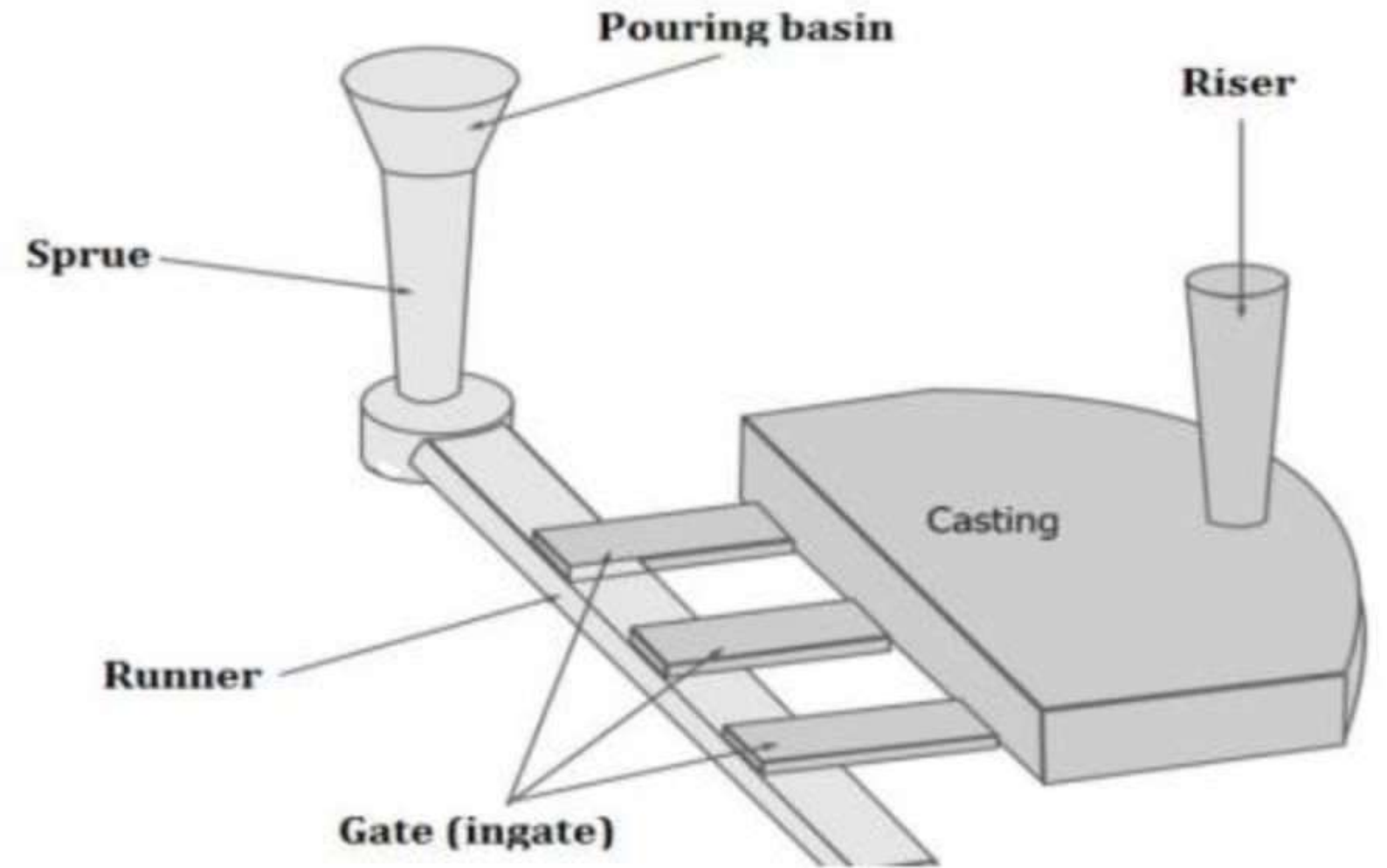


Pouring Basin

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



sprue



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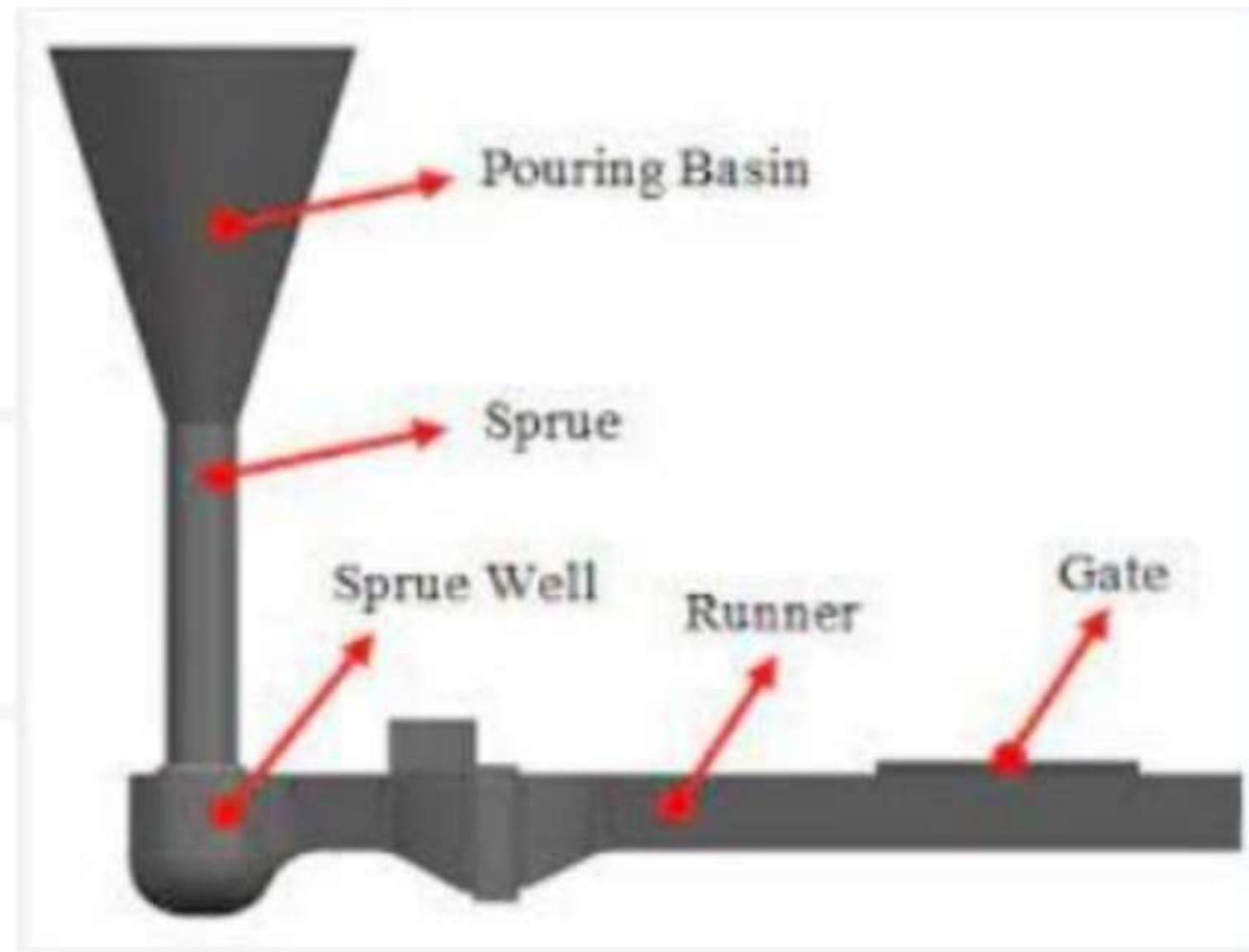
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Design a sprue to avoid air aspiration effect and to feed the liquid metal at a rate of 20kg/sec take density of the liquid metal as 7800kg/m³. Take height of the sprue as 20cm and height of the pouring cup as 5cm.

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Runner

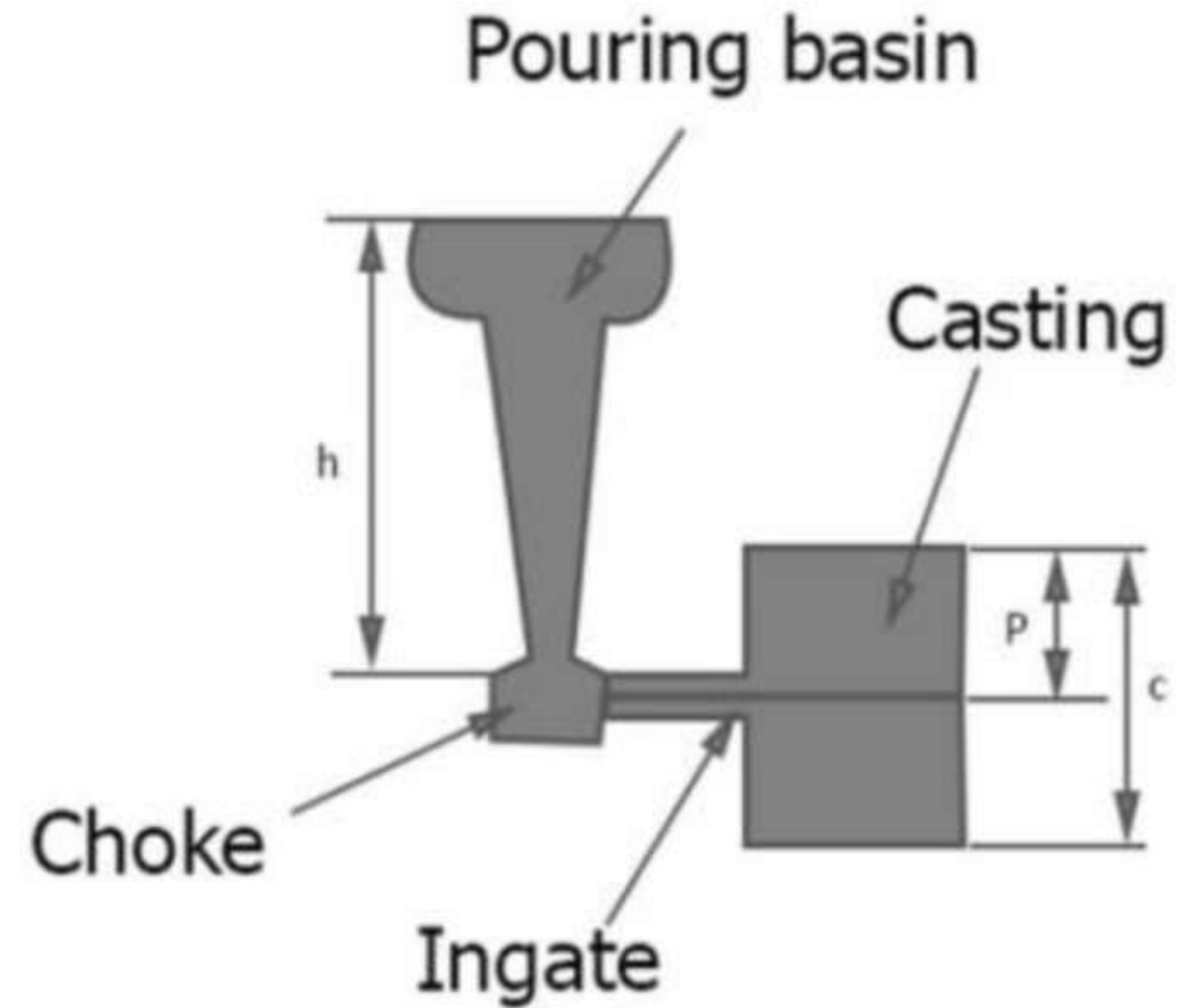


Gate

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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