**Casting terminology.**

Figure 3 illustrates the cross section of a typical two-part casting mold and incorporates many features of the process. Parting line, cope, drag, mold cavity, riser, gating system, sprue, pouring cup, and many other features are shown.

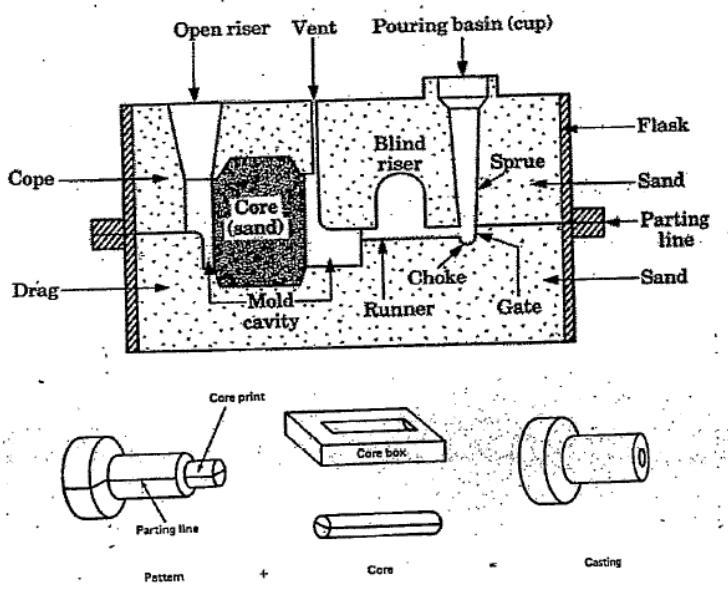
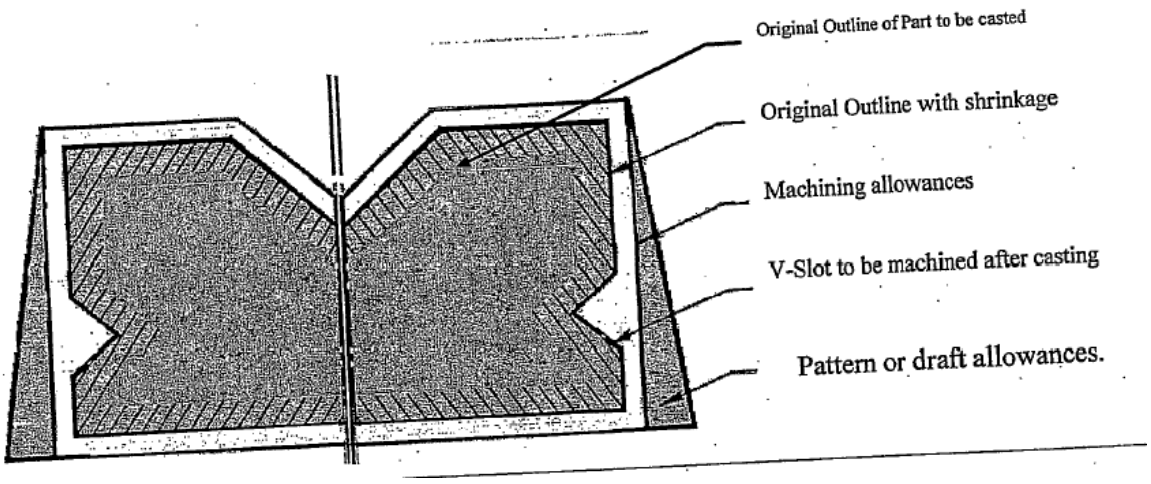



**Figure 3:** Some features of sand mold casting

Name the different components in the figure?

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Describe the different casting allowances?

**allowances for shrinkage, allowances for machining, allowances for the draft, allowances for rapping or shaking, and allowances for distortion**

## Risering System Design

Risers are elements of the gating and feeding system, which are intended for displacing shrinkage cavity and porosity outside of the casting. By the principle of directed solidification. The thinner sections of a casting should preferably be located at the

Why do need risers?

## Modulus Method

The Modulus of a casting M is given by: $M_c = \frac{V_c}{A_C} = \frac{\text{Volume of Casting}}{\text{Surface Area of the Casting}}$

In view of the fact that the shrinkage cavity of a riser can amount to a maximum of 14% of its original volume, the modulus of the riser must be at least 1.2 times the modulus of the casting. To ensure that the riser solidifies later than the casting, (theoretically the solidification of the riser will be about 1.44 times that of the casting) after obtaining the modulus, the size of the riser can be calculated by assuming a suitable height to diameter ratio.

$$M_r = 1.2\, M_c$$

Question: What is the casting modulus?

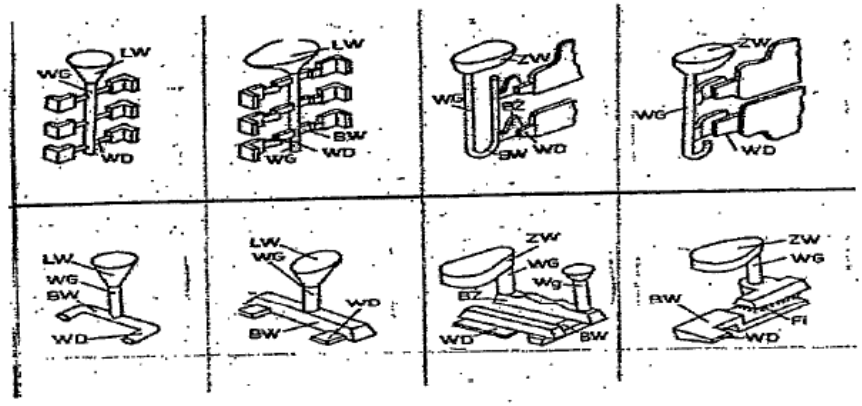
Question: what is the relation between risers modulus and cavity modulus? And why?

**Design of Gating System.**

The ideal optimum gating system should:

1. Fill the mold quickly.
2. Fill a mold with a minimum of turbulence.
3. Establish thermal gradients, which promote soundness.
4. Avoid reoxidation of metal in the gating system.
5. Remove slag and dross from the metal as it flows through the gating system.
6. Not distort the casting during solidification.
7. Maximize casting yield.
8. Be economical to remove.
9. Be compatible with the pouring system used.

Gating systems with various schemes of metal feeding showed below:

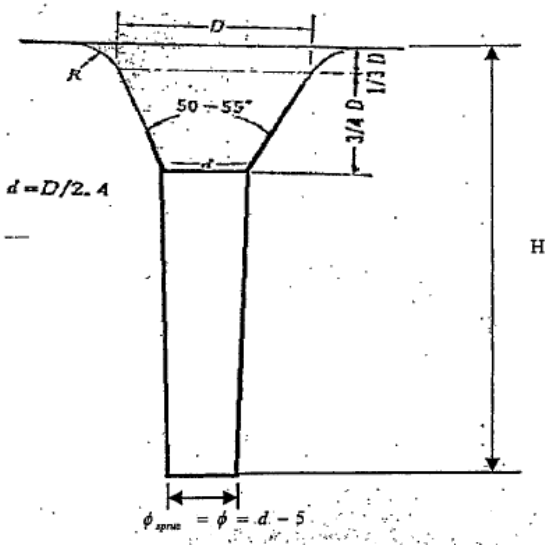



Why do we need a gating system?

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**Sprue.**

Circular cross sections are being used most commonly. Tapering the sprue downwards is always a good practice. Straight or nearly straight sprues may be used in all pressurized systems. Chocked at the bottom (or sprue basin) of the sprue must be used in a non-pressurized gating systems.




What is a sprue?

**Runner.**

A straight runner is the best choice of space permits it. If bending the runner is unavoidable, it should be done with as large radius as space permits, because curvatures introduce additional turbulence. A minimum distance of 4 inch between the end point of the runner and the next gate us recommended. The cross section of the runner is almost always rectangular with thickness to height ratio of 1:2 in a pressurized system.

What is a runner ? why should it be with less curvatures?

**Gates.**
Gates are the most delicate members of the system, Gates should be thin and correspondingly wide, and should be easy to removed. The optimum gate cross section is rectangular with a little draft as condition permit.

**Runner-gate Junction.**
A gate must never be placed in straight continuation of the runner. Gates must branch off the side(s) of the runner at near right angles.

**Gate-Casting junction**
The gates need to join the thinnest sections of the casting as much as layout limitations permit. The aim is to equalize cooling rate between the different segments of the casting. If delicate cores or soft mold wall would be damaged by the impact of entering stream of iron, gates may be flared out or their cross section increased nearing the casting. Such precaution is seldom used because it increases cleaning room cost, and the reduction in linear velocity is not significant.

**Classifications of Gating Systems.**
According to the hydrodynamics of flow of metal Gating system are divided into open and closed.

***Closed or pressurized gating system*** are characterized by gradually decreeing cross-sectional areas of the sprue, slag traps and runners:

$$SA_{sprue} > SA_{runner} > SA_{gate}$$

Describe the Runner gate junction condition?

Not in a straight continuation

Where should be gate interfaced to the casting? Thinnest section

Better separation of slag, the metal enters the mold cavity with a high linear velocity, which can lead to splashing and oxidation of the molten metal, capture of air, and washout of the mould walls. Closed gating systems are especially popular in the manufacturing of iron castings.

***Open or non-pressurized gating system*** are characterized by gradually increasing cross-sectional areas of the sprue, slag traps and runners:

$$SA_{sprue} < SA_{runner} < SA_{gate}$$

Open gating systems are used in casting of steels, aluminum, magnesium and other easily oxidable alloys and are coming into use in iron casting.

$$SA_{sprue} > SA_{runner} > SA_{gate}$$

$$SA_{sprue} : SA_{runner} : SA_{gate}$$

$$1.2 : 1.1 : 1.0$$

Describe the cross sectional relation for the sprue, runner, gate