Design And Analysis of Gas Burner For Different Gating System For High Pressure Die Casting

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Abstract- *Metal casting is a technique that is developed mainly as craft from thousands of years. Castings like bronze statues during ancient civilization in India and other cast items were discovered in different parts of the world. Old foundry technology was based on individual skills which was adequate from meeting demand patterns of primitive civilization.The history of the modern Indian metal casting industry dates back to late 19th century. The growth of the railway system, gradual urbanization, establishment of industries, created demand for castings. As a result, mainly gray iron and a few steel and nonferrous foundries came up in different part of country*

The casting process involve the poring of hot molten metal into the cavity by means of a ladle, due to the presence of human interference in poring, the wastage of material is high due to incomplete mould fill. To avoid this robots are used in current trend, even though in actual process there is flaws due to improper die locking force, design of runner gate etc.

Since modern foundries aim to high degree of mechanization, the role of mechanical and electrical engineers is becoming increasingly important in now days in casting industries. In more recent years use of computer-aided design of casting parts and prototyping techniques have made huge impact on the productivity and efficiency of foundries because it is difficult to find the child holes in the component.

In this study the wastage in mould and time consumption is reduced by properly calculating, designing& validating virtually for different gating systems, which influence in the efficiency of production and using casting software to stimulate for different parameters.

I. INTRODUCTION

Metal casting is a technique that is developed mainly as craft from thousands of years. Castings like bronze statues during ancient civilization in India and other cast items were

Discovered in different parts of the world. Old foundry technology was based on individual skills which was adequate from meeting demand patterns of primitive civilization. The industrial revolution in 19th century created huge demands for casting products, which is turn leads for evaluation of foundry technology on modern development. The real development of foundry occurred in 20th century, the development of metal casting requires a thorough understanding of the principle of physical model and process of metallurgy, fluid mechanics. Since modern foundries aim to high degree of mechanization, the role of mechanical and electrical engineers is becoming increasingly important in now days in casting industries. In more recent years use of computer-aided design of casting parts and prototyping techniques have made huge impact on the productivity and efficiency of foundries because it is difficult to find the child holes in the component.

II. CASTING

Casting is one of the processes in manufacturing, which cast-off to brand intricate forms of metal constituents in mass making and/or discrete manufacture. Around stand dual phases in moulding, one is substantial procedure in addition extra is solidification of troupe. In moulding procedure gating arrangement contains of bucketing mug, racer, sprue, sprue well then ingate or gates, which is intended to leader fluid metallic stodgy into the mould void. Risers remain castoff to reimburse decrease triggered by moulding though solidification of troupe part. On moulding procedure, project sinuous scheme significant for manufacture of superiority and effectiveness of a invention.

It is problematic to evade that numerous diverse flaws happen in moulding, such as setback holes, interior absorbency and indecorous filling. Refining the cast excellence develops significant part. Moulding excellence is contingent on the correct gating/riser

III. OBJECTIVES

The objective of the project is to reduce the wastage of material and design of feed systems based on computer aided design and simulation technology

1. To reduce defects in the product and improving casting quality such as improving the time of fill, reducing internal shrinkage, increase the surface finish and increase yield. To improve the quality of a die casting.

2. To avoid Porosity (A void in the casting, caused by trapped gas or shrinkage)

3. To avoid Flow Defects.

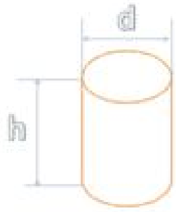
IV. DESIGN AND ANALYSIS OF FEED SYSTEM

4.1 Design of feed system for sample cylinder

Design of a sample cylinder includes the following steps,

- Calculation of mould filling time for Cylinder.
- Calculation of Solidification time for Guide Face.
- Design of Runner bar.
- Design of Ingate.
- Design of overflow

Consider a cylinders



4.1.1 Filling time

It is the time with in which the die casting mould is filled with molten metal. If the filling time is longer, there is more time for the air in the cavity to escape through the die vents. Optimum venting is desirable to obtain a good quality casting.

K=Empirical constant
T1=Ingate metal temperature
Tf=Maximum fill time
Td=Die surface temperature
S=Percent Solids
Z=Solids Conversion Factor
T=wall Thickness

Here we get filling time as, t= 0.2357 sec

4.1.2 Rate of fill

The fill rate 'Q' can be defined as the rate at which the cavities and the overflows are filled with molten metal. Rate of fill was given by the equation,

Q=V/T
Q = Rate of fill (mm3/s)
V = Volume of Casting (mm3)
t = Time of fill (s)
Rate of fill was found to be Q = 60908008.39.

4.1.3 Ingate velocity

The velocity of metal through gate area is called the gate velocity. Ingate velocity is given by the equation,

$$Vg^{1.707} \quad HgJ$$

Where,

H_g = Gate thickness (mm), 1.6 chosen

= Density (kg/m^3) 2700 for aluminium
Vg= Ingate velocity (m/s)
We got ingate velocity, Vg= 24 m/s

4.1.13 Solidification Time

It is the minimum time required to for the molten metal to change its face from liquid to solid it is a function of the volume of casting and its surface area.

In casting solidification of cast takes place from smaller thickness to lager thickness, due to uneven thickness in cast part small thickness portion solidifying before than lager thickness portion, this phenomenon known as directional solidification of casting. [17][18] From solidification recreation of director expression without overflow, it is observed that where hot spot are formed in casting, To eliminate hot spot overflow should be place near to hot spot location. [18][20][21]

$$T= V^{2} /KA$$

Where

T = time of solidification
K= thermal conductivity
V= Casting Volume
A = Casting Area
T= 0.787 sec

4.2 Casting simulation for cylinder

4.2.1 Filling time for cylinder

Flow simulation is done to find the Fill time required without any over flow attaching to it for a simple cylinder. The Mould filling time for cylinder is t= 0.2357 sec by manual calculation. The figure 4.2 to 4.4 shows the simulation of Mould filling in different step of time and 0.31468sec by simulation

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Fig4.2 Fill time of cyclinder

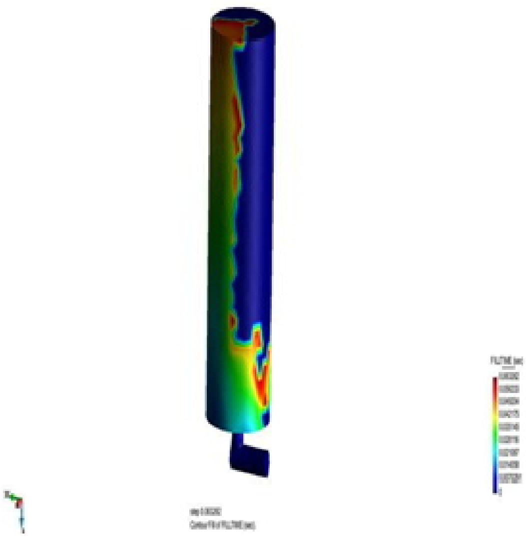

Fig4.3 fill time of cylinder

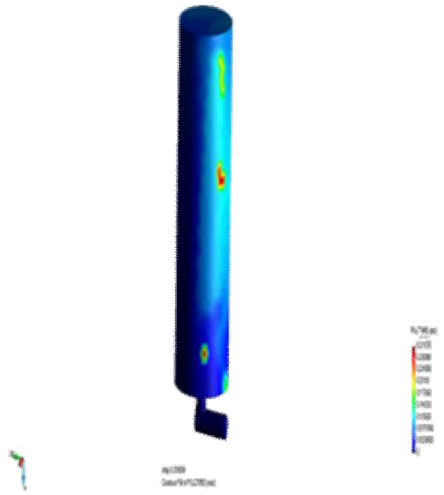

Fig 4.4 Fill time of cylinders

V. RESULTS AND DISCUSSION

5.1 FILLING TIME

The below figures 5.1a and 5.1b and 5.1c shows the time required to Fill the Gas Burner Without overflow, overlapping gate with overflow and Edge gate with overflow respectively.

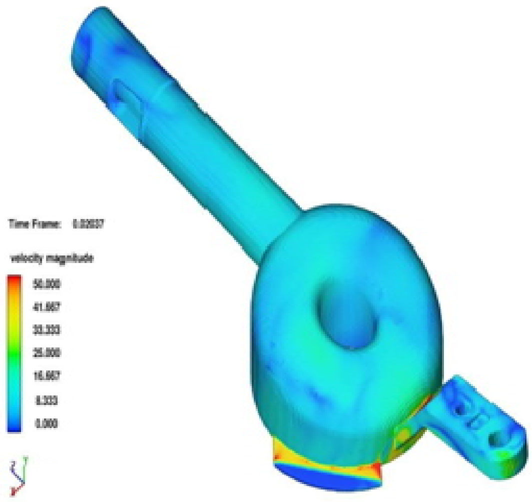

Fig 5.1 Filling time of gas burner without overflow

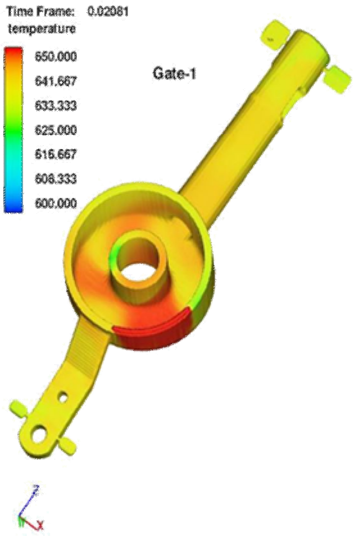

Fig5.2 Filling time with overflow and without overlapping gate

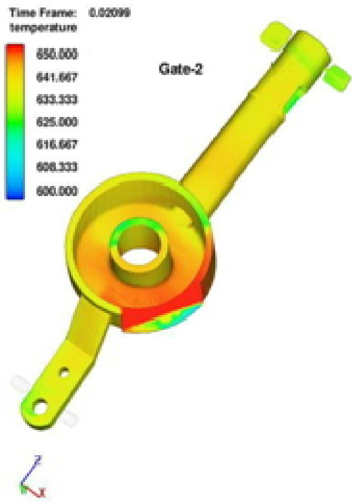

Fig5.3 Filling time with overflow and edge gate

Table 5.1 Fill time of Gas Burner with different design

	Fill Time for a Gas Burner without overflow (In minutes)	Fill Time for a Gas Burner with overflow and with overlapping gate (In minutes)	Fill Time for a Gas Burner with overflow and with Edge gate (In minutes)
Fill time	0.02037	0.02081	0.02099

5.2 Air Entrapment

The below figures 5.2.a and 5.2.b and 5.2.c shows Air entrapped in a Gas Burner Without. overflow, overlapping gate with overflow and Edge gate with overflow respectively.

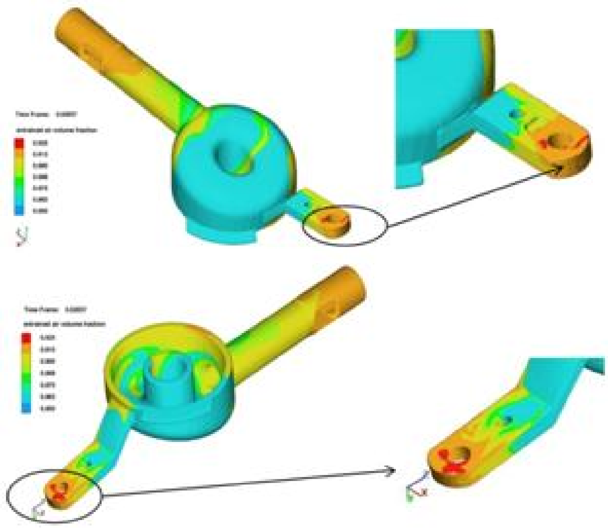

Fig 5.2.a Air Entrapment in a Gas Burner without overflow

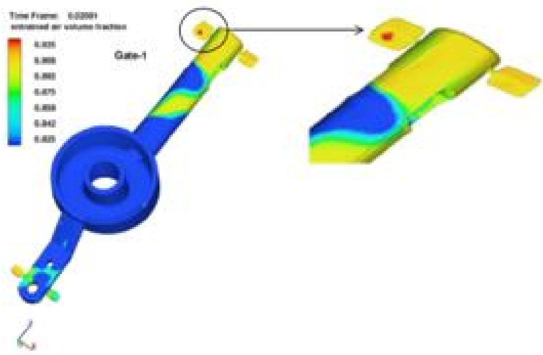

Fig 5.2.b Air Entrapment in a Gas Burner with overflow and overlapping gate

From the above Result we come to know that the places where Air entrapment occurs for different cases. Hence the Air Entrapment in the Gas Burner with overflow and the overlapping gate is the best since there is no air entrapment inside the Gas Burner once the Gas Burner is filled the overflow parts can detached to obtain good yield.

5.3 Surface defects

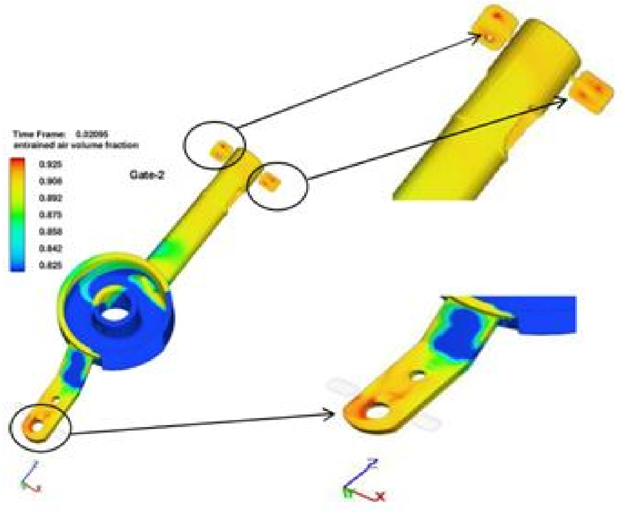

Fig 5.3.a Surface Defects in a Gas Burner without overflow

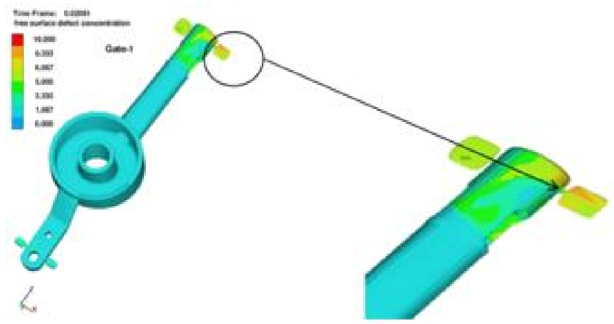

Fig 5.3.b Surface Defects in a Gas Burner with overflow and overlapping gate

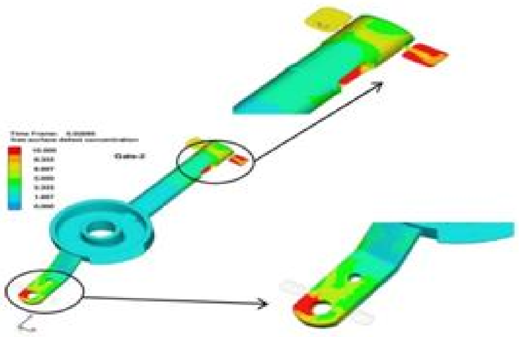

Fig 5.3.c Surface Defects in a Gas Burner with overflow and Edge gate

From the above Result we come to know that the place where Surface is damaged occurs caused for different cases. Hence the Surface Defects in the Gas Burner with overflow and the overlapping gate is the best since there is no much Surface defects on the Gas Burner once the Gas Burner is filled the overflow parts can detached to obtain good yield.

VI. CONCLUSION AND FUTURE SCOPE OF WORK

Conclusion

From this work it is conclude that, selection of proper overflow and the proper gating system is important factor in die casting, bigger the Gate and more the overflow leads to wastage of material and time required to machining is high. Proper selection of Gate and overflow save material cost and machining cost, which is directly, reduces the cost of product and results in good yield.

Casting simulation is best way to reduce casting product development time, by using casting simulation, feed system design and optimization of casting can be done effectively; it also assistances to analyze solidification of casting, mould filling, and predicting solidification related defects such as internal shrinkage porosity. Casting simulation also helps to element shop floor trials, which is required lot of material, tooling, labour, and money.

By proper Gate design and selecting appropriate number of overflow and die locking force required can helps to improve casting yield. Overlapping Gate in casting leads to improvement in yielding. Location of overflow is important in casting and overflow should be placed near to the air entrapment location so that it escapes into the overflow region living the burner location.

Future scope

Further, cost reduction may be achieved by omitting machining area where actually machining is not required.

Heat distribution analysis of mould may be done to find cooling rate of casting. Further Casting yield may be improved by two components in single Mould. Further analysis on die casting can be done to improve the quality of casting

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