International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 3.45 (SJIF-2015), e-ISSN: 2455-2585
Volume 4, Issue 4, April-2018

Development and simulation of casting process by using auto cast software

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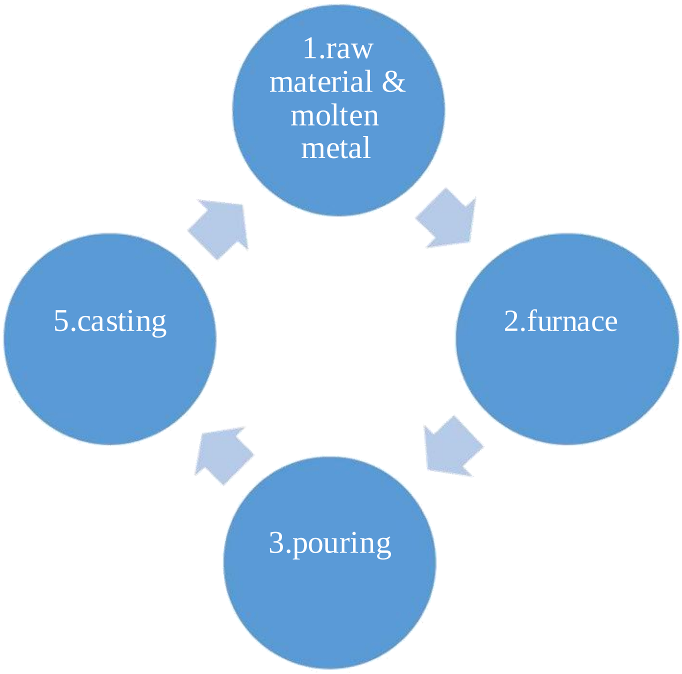
Abstract: The paper is focused on the research of mechanical development and simulation for casting process by using auto cast software. Research is aimed at to analysis pouring position angle in casting process and to development new design and method for efficient casting process.

Key word: Pouring process, auto-cast software, pouring ladle, mould,

I. INTRODUCTION

Casting is a manufacturing process in which a liquid material is usually poured in to mold, which contain a hollow cavity of the desired shape, and then allowed to solidify. The solidified part is also known as casting, which is rejected or broken out of the mold to complete the process. Casting material are usually metal or various cold setting materials that cure after mixing of two or more component together. The overall goal of this project is to develop and evaluate the performance of molten metal pouring system. [1]

[Fig.1 pouring process]



[Figure no.2 casting process flow diagram]

Raw materials: In this project we use S.G.Pig IRON, Si, and Mn.

Furnace: we used most of Indian casting industries Electrical induction furnace.

Pouring: In casting process metal filled in mold this metal filled process is called pouring process. In pouring process molten metal pour in mold to different methods. In which important factor is pouring position.

II. POURING LADLE

The container with a spout used for storing and pouring content in which are liquid in farm. In metallurgy, a ladle is vessel used to transport and pour out molten metals. Ladles are often used in foundries and range in size from small hand carried vessels that resemble a kitchen ladle and hold 20kg (44l b) to large steel mill ladles that holds up to 300 tones. Many nonferrous foundries also use ceramic crucibles for transporting and pouring molten metal and will also refer to these as ladles. Foundry ladles are normally rated by their working capacity rather than by their physical size. Hand-held ladles are typically known as hand shank ladles and are fitted with along handles to keep the heat of the away from the person holding it.

Ladles slag fines cannot used cementinting material along because presents free limes ladles slag. The combination ladles slogs fine siliceous material, silica flour (ground quartz), Can eliminate soundness problem give very high strength? The introduction small amount Portland cement hydrated lime ladle slag fine-silica flour system can increases strength significantly. Lime more effective Portland cement due pressure aluminum Portland cement.

A. *Types of ladle*

Casting ladle: A ladle used to pour molten metal into moulds to produce the casting.

Transfer ladle: A ladle used to transfer larger amount of molten metal from one process to another.

Treatment ladle: A ladle used for a process to take place within the ladle to change some aspect of the ladle to change some aspect of the molten metal.

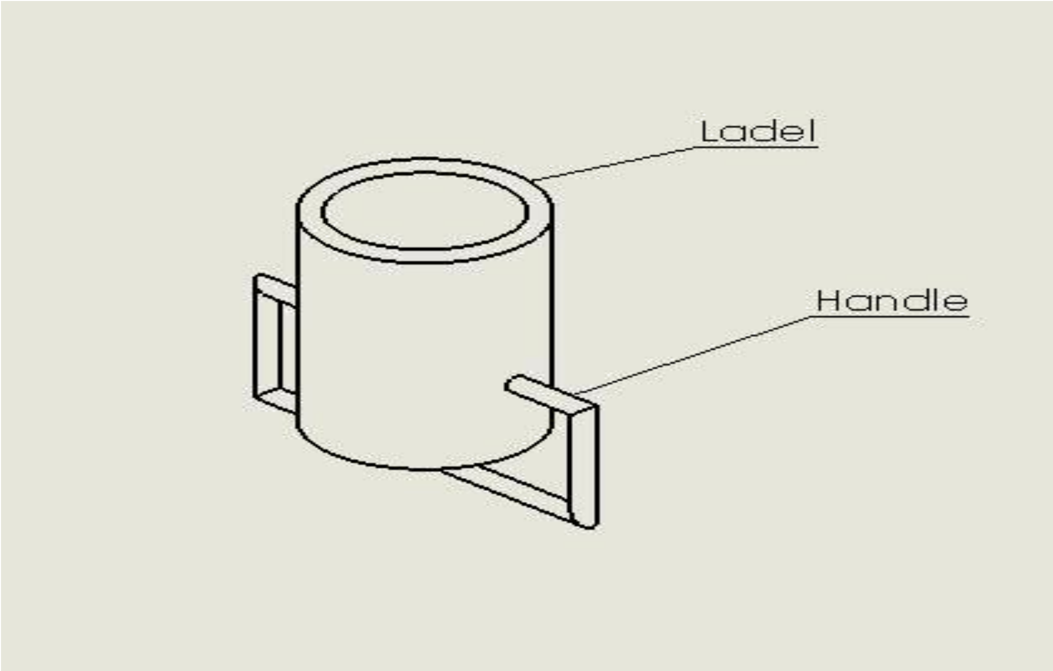


Figure: 3 Line diagram of simple ladle

III. Design Procedure of Pouring ladle

Width of the mould (m) W_m	=0.762
Height of the mould (m) H_m	=0.3048
Acceleration due to gravity (m/sec^2) g	=9.8
Pattern plat utilization factor PPU	=0.75
Average metallostic height(m) H_a	=0.049
Density of metal(kg/m^3) ρ_m	=7000
Coefficient of friction µ	=0.25
Volume utilization factor V_u	=4.3
Density of squeezed moulding sand(kg/m^3) ρ_s	=1500
Factor of safety S	=1.2

A. Design materials for components

MATERIAL	WEIGHT (kg)
Scrap	=480
S.G.Pig Iron	=50
Carbo.	=18.9
Fe-Si	=6.3
%C	=3.68
%Si	=1.08
%M.N.	=4.04

IV. Calculation

A. Horizontal Metallostatic Force

W_m = Width of the mould (meter) = 0.682

H_m = Height of the mould (meter) = 0.3048

PPU = Pattern plate utilization factor = 0.75

g = Acceleration due to gravity (m/sec^2) =9.81

H_a = Average metallostatic height (meter) =0.049

ρ_m = Density of the metal (kg/m^3) =7000

$$F_H = \rho_m\, g\, (Wm \times Hm \times PPU)\, H_a$$

F_H = 7000*9.81(0.682*0.3048*0.75)0.049

F_H =524.5945N

B. Friction force between mould string and AMC

μ = Coefficient of Friction between mould string and AMC = 0.25

W_m = Width of the mould (meter) = 0.762

H_m = Height of the mould (meter) =0.3048

L = Length of mould string between moulding machine =?
And pouring position (meter)

V_u= Volume Utilization factor of moulds =4.3

Pm = Density of Squeezed moulding sand (kg/m3) =1500

$$F_R = \mu\, (W_m \times H_m \times L \times V_U)\, \rho_S\, g$$

F_R = 0.25(0.762*0.3048*L*4.3)1500*9.81

F_R=3673.99588L

Expression for optimum poring position to avoid separation of moulds in the mould string the resistive frictional force between the mould and automatic mould conveyor should be greater than or equal to horizontal pushing force due to metallostatic pressure of liquid metal in the poured mould **$F_r \geq S \times F_h$** ,where S is a factor of safety. So, putting all values in above relation and find out L

$$F_r \geq S \times F_h$$

3673.99588L ≥ 1.2*524.5945

L ≥ 0.1713m

To avoid mould opening by pouring operation optimum pouring position should be taken into consideration. [2]

V. Conclusion

This above all calculation and discuses then we decided that in casting process most important of pouring position angle. We recommended them to install this newly concept equipment at the started position. After using this concept, the efficiency and safety of the system will increase. By use perfect pouring position angle then defects of the components is mostly decreases and accuracy is good. By using automatic molten metal pouring ladle use then less human effort.

To create new ladle design as show below at 3D:

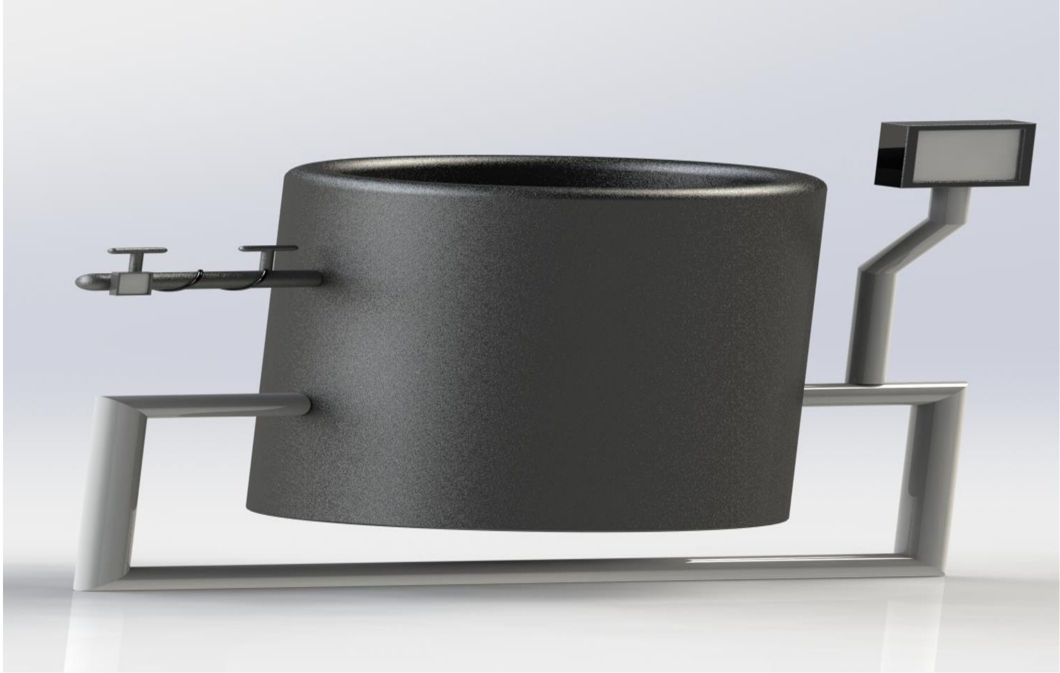


Figure: 4 Automatic pouring ladle

VI. Reference

[1] Variation of green sand molding, Flaskless molding, www.engineershandbook.com

[2] Kumar V Proprieter of Tara sree engineering and investment casting consultant. Awarded as emerging foundry man of India.