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Improvements in Centrifugal Casting Machine

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ABSTRACT

Centrifugal casting or rotocasting is a casting process that is used for the casting of thin cylinders or in this case PIPES. It is used to cast materials such as metals, concrete and glass. The operation of centrifugal casting machine is mainly based on the principle of centrifugal force. The mold which is used can be adjusted for different diameters and thickness of pipe with respect to the rotation speed of the mould which is being rotated by the help of motor. To increase the productivity , a Multiple runner mechanism and brake system is introduced.

Keywords : PIPES, Horizontal Centrifugal Casting, VFD

I. INTRODUCTION

Casting is defined as an object made by pouring the molten metal in a particular mould which is being designed as per the requirement and then allowed to cool down for a certain amount of time to allow the molten metal to set in the desired shape.

In today's date casting comes under one of the largest industries in manufacturing. 50% of the total weight of an average tractor consists of casted metal parts & an automobile engine consists of 90% of its total weight as casted parts. The reason for which casting is tremendously carried out lies wholly in its economy & time factor in terms of time it is the quickest method for producing components, as the process is so easy.

The main focus of our project is on centrifugal casting & removing its disadvantages. So the centrifugal casting of number of processes in which the centrifugal force is taken into action to give the shape

of casting by filling the mold & wait till casting is solidified & strengthens.

There are two types of centrifugal casting process.

- 1) Vertical centrifugal casting
- 2) Horizontal centrifugal casting.

Vertical Centrifugal Casting: - It is a pressure casting technique that employs rotation about a vertical axis. It produces good filling of the mold & gives high dimensionally accurate products. This method is used for casting products like gears, piston rings & impellers.

Our project's main focus is on the horizontal centrifugal casting process & it is used for making long & hollow casings such as pipes, gun barrels, sleeves, rods, etc.

Horizontal Centrifugal Casting :- In horizontal type the mould rotates at high speed about the horizontal axis, the molten metal is fed into the interior section

of the mold & distributed uniformly around due to centrifugal action rotation continued until solidification is completed But here even after the product is fully formed & the VFD is closed the mold still rotates for very long time. To reduce this rotating time differential band brake is applied to the system.

II. Proposed System

The proposed system will be an additional of brake system in the traditional horizontal pipe casting mechanism. A differential band brake is used to stop the free-running mold to save 55% of the time. in traditional system, after stopping VFD & even after the pipe is cooled & solidified, the mold rotates for at least 60secs, which after applying differential band brake will stop in half of the time as compared to the original time, which will results in saving of the useful time & increasing the production of pipes.

A band brake consists of a flexible band of leather, one or more ropes, or steel lined with friction material, which embraces a part of the circumference of the drum. A differential band brake issued to control the speed of a drum which rotates at a constant speed. As compared to simple band brake, in a differential band brake neither ends of the band is attached to the fulcrum of the lever. The two ends of the bands are attached to the two points on the opposite side of the fulcrum.

1. Design of Brake

$$M=3000 \times 9.81$$

$$M=29430 \text{ kg}$$

$$\mu=0.3$$

$$D=0.75\text{m}$$

$$R=0.375\text{m}$$

$$w= V/R =1450/0.375$$

$$w=3866.66 \text{ radian /sec}$$

$$K.E=1/2 \times I W_o^2$$

$$K.E=1/2 \times (1/2 MR^2) (W_o)^2$$

$$K.E=1/4 \times MR^2 \times W_o^2$$

$$K.E=1/4 \times 29430 \times 0.375^2 \times 3866.66^2$$

$$K.E=1.547 \times 10^{10} \text{ J}$$

$$E_o=E_f$$

$$W + P_f + K E_o = P_f + K_{ef} + \text{heat loss}$$

$$K E_o = \text{heat loss}$$

$$K E_o = F_f q (2\pi r) (\text{no. of rotations})$$

$$\text{No. of rotations} = 1440/60 \times 15$$

$$\text{No. of rotations} = 363 \text{ rotations to stop}$$

$$\text{No. of rotations} = K E_o / F_{fr} \times (2\pi R)$$

$$363 = 1.547 \times 10^{10} / F_{fr} \times (2\pi \times 0.375)$$

$$F_{fr} = 18.087 \times 10^3 \text{ KN}$$

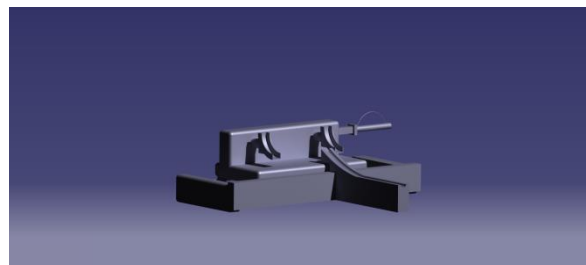
2. Multiple runner system

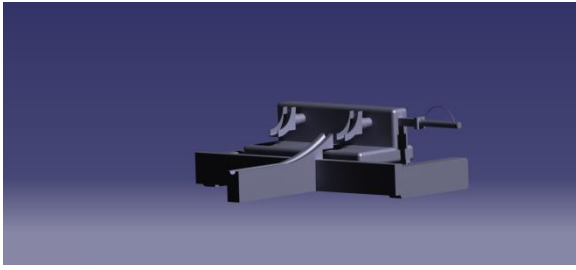
A mechanism consisting of two runners having the allowance of rotation of 180°.

The mechanism would be attached in front of the hopper through which the molten metal is poured in the runner.

The runner is allowed to rotate in such manner so the withdrawal of molten metal which is being accumulated on the surface of the runner gets removed without any human effort.

The mechanism consisting of two runners have guide ways under it. When the first runner is being used and then rotated for removal of the molten metal, the whole mechanism slides and the other runner is ready to use.





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Benefits to the company

The application of brakes in the traditional system is to impart the best uses of mechanical technology available & use it for the betterment of the industry.

- 1) This mechanism of band brake will help in saving production time
- 2) Workers will not have to wait for such a long time, resulting in reducing boredom
- 3) Saved time can be utilized in other productive works.
- 4) The multiple runner mechanism reduces time.
- 5) The runner is now being cleaned itself, hence reducing manpower.

III. Conclusion

Casting of pipes is done in less time as a differential braking system is applied. The efficiency of the machine is increased resulting in increasing the numbers of pipes produced per hour.

IV. REFERENCES

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