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Improvement In Centrifugal Pipe Casting Machine

Prof. Naushad Alam, Mujahid Baig, Ujwal Suke, Shanawaz Ansari, Saquib Anwar
Mechanical Engineering, Anjuman College of Engineering & Technology, Nagpur, Maharashtra, India

ABSTRACT

As the name suggested, the operation of a centrifugal casting machine is mainly based on the principle of centrifugal force. The mold which is rotated at a moderate speed based on the diameter of the pipe to be casted. A large diameter of pipe requires high speed. The action of rotation of mold or machine forces the molten metal against the inner periphery of the mold. This machine is used for casting pipes of various dimensions. This machine operates on such a mechanism in which even if it stops, the mold rotates freely for a large amount of time as compared to the time in which the pipe is casted. To tackle this disadvantage, a brake system is applied to the machine.

Keywords : Casting, Centrifugal Pipe Casting Machine , Differential Brake

I. INTRODUCTION

Casting can be defined as the process of producing metal shapes by pouring hot molten metal into redeveloped molds where it is allowed to get solid & cool down in the required time. The solid metal output product is called as cast. Casting is an old technique it is as old as the Roman Empire. The roman craftsman started casting by making two half molds, that was wedge together & the molten bronze carefully poured inside it. This molten bronze solidified on cooling & the solid cast was removed from the mold. This method was taken into action to make swords in large numbers. Casting hence has been a method by which important metal parts are made in large quantities cheaply.

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 mold 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. MATERIAL AND METHODS

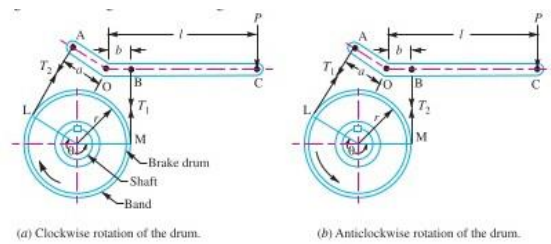
The previous system installed fails to provide efficiency in production. The efficiency can be achieved by applying braking system on the machine . In our new system with the help of differential braking system we are going to increase the rate of production.

III. 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 fulc



IV. Design of Brake

$$M=3000 \times 9.81$$

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

$$u=0.3$$

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

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

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

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

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

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

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

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

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

$$E_o=E_f$$

$$W + P_f + KE_o=P^f + K_{ef} + \text{heat loss}$$

$$KE_o=\text{heat loss}$$

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

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

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

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

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

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

V. BENEFITS TO THE COMPANY

The main purpose of applying brakes in the traditional system is to inculcate the best uses of mechanical technology available to humankind & get it in use 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.

VI. RESULT AND DISCUSSION

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.

VII. CONCLUSION

Casting of pipes now in a horizontal pipe casting machine 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 without applying the brake, the production rate was 12-14 pipes per hour, but after applying the brake system the production rate is increased up to 14-17 pipes per hour.

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