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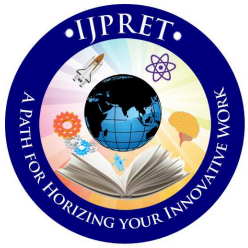

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A PATH FOR HORIZING YOUR INNOVATIVE WORK

DESIGN & DEVELOPMENT OF LOCKING ARRANGEMENT FOR CENTRIFUGAL CASTING MACHINE

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Cover plate

Abstract

During the pipe manufacturing using centrifugal casting machine, hot molten metal may inject from one end and the other end remains closed by a covering plate having standard dimension. This covering plate is locked by a worker. The plate should be opened after completion of casting process for the extraction of the pipe from the mould and again should be locked for next process. If the simple locking unlocking arrangement can be design then it may reduce large amount of time which in turn will increase the productivity & reduce the cost of production and increases workers safety.

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INTRODUCTION

In centrifugal casting, a permanent mold is rotated about its axis at high speeds (300 to 3000 rpm) as the molten metal is poured. The molten metal is centrifugally thrown towards the inside mold wall, where it solidifies after cooling. The casting is usually a fine grain casting with a very fine-grained outer diameter, which is resistant to atmospheric corrosion, a typical situation with pipes. The inside diameter has more impurities and inclusions, which can be machined away.

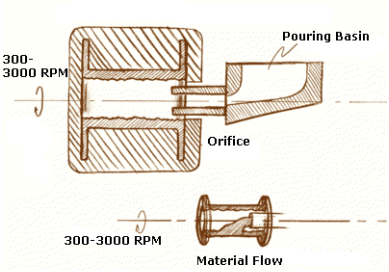

Figure 1.1 General Centrifugal casting process

Only cylindrical shapes can be produced with this process. Size limits are up to 3 m (10 feet) diameter and 15 m (50 feet) length. Wall thickness can be 2.5 mm to 125 mm (0.1 - 5.0 in). The tolerances that can be held on the OD can be as good as 2.5 mm (0.1 in) and on the ID can be 3.8 mm (0.15 in). The surface finish ranges from 2.5 mm to 12.5 mm (0.1 - 0.5 in) rms.

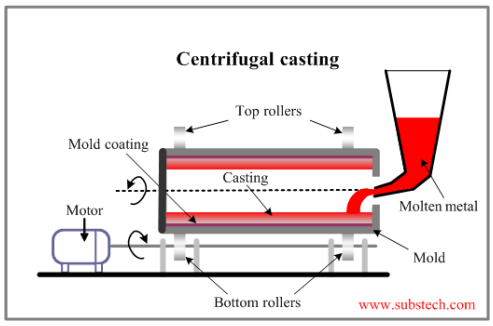

Figure 1.2 Centrifugal casting machines with all arrangement

Typical materials that can be cast with this process are iron, steel, stainless steels, and alloys of aluminum, copper and nickel. Two materials can be cast by introducing a second material during the process. Typical parts made by this process are pipes, boilers, pressure vessels, flywheels, cylinder liners and other parts that are axi-symmetric.

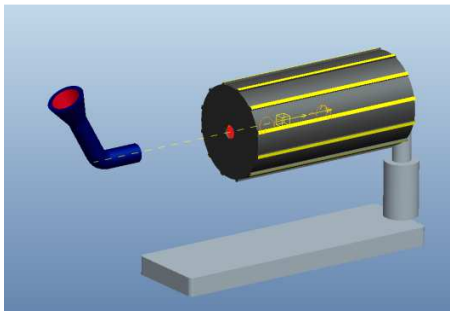

Figure 1.3: Hopper and Casting Machine Arrangement

This whole locking and unlocking of covering takes 5 – 6 min manually.

Centrifugal force acting on a rotating body is, C.F = mv^2/r

Where,

- m – mass (kg),
- V – peripheral speed (m/s),
- r – radius (m).
- Gravitational force, G.

F = mg

Where,

- g = acceleration due to gravity (m/s^2)

G factor = $mv^2/ r.mg = v^2 /rg$

1.1 Dimensions Available From Industry

- Internal Dia of mould = 275mm;
- Outer dia of plate = 278 mm;
- Thickness of plate = 20 mm;
- Bore diameter = 80 mm;
- Max speed = 1550 rpm;
- Average speed = 1300 rpm;
- Surface thickness = 19.5 mm;
- Molten metal temp = 1500-1700ºC;
- Temp on covering plate = 1400ºC.(max)

Figure 1.4: Poring of Moleten metal into centrifugal casting machine.

Figure 1.5: Extraction of pipe from machine.

The cavity must be closed down so that molten metal should not come out and the hazard to worker is reduced. Conventionally this locking and unlocking is done manually; which also increases chances of accidents to workers as it is at very high temperature.

ALTERNATIVE ARRANGEMENT FOR EXISTING LOCKING SYSTEM

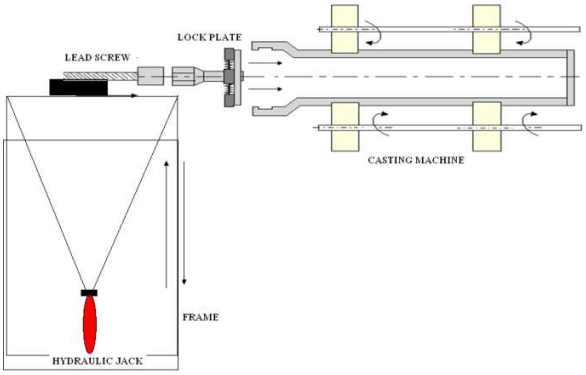

Figure 2.1: Conceptulfure model

Base plate

- 275 mm dia thickness 20 mm
- Mild Steel material
- Any shape/ any material as per requirement can be used.

Figure 2.2 Base plate

Total Assembly of Lock plate

The existing locking plate is not very firm and handy to operate due to open surfaces

Figure 2.3 Exisitng Lock Plate which is failing.

Figure 2.4 Front View of Lock Plate with magnet for attachment and deattachment of plate into machine new design.

Hydraulic Jack

- Lifting capacity 2.8 tonnes

Figure 2.5 Hydraulic jack position below top frame

Top Assembly to lift Up with lead screw

Figure 2.6 Total assembly

CALCULATIONS

- Centrifugal Force

Thickness of pipe =10 mm,

Diameter of pipe =152 mm,

So, Radius of pipe ,r = 76 mm,

Mass of Molten metal =15 kg,

Velocity of the molten metal =1200rpm

Centrifugal Force = $m.v^2 / r$

= $(15 \times 20^2) / 76$

= 45 N

Keeping tolerance of 50%, for our design safety,

Centrifugal force = 70 N

COMPARISON WITH NEW AND OLD PROCESS

OLD PROCESS	NEW SUGGESTED PROCESS
Time consumed for locking and unlocking of old covering plate is 5-7 mins.	Time consumed for locking and unlocking is 30 secs.
Time consumed for production of one pipe is 10 mins.	Time consumed for production of one pipe is 6.5 mins.
Total pipe produced in 24 hrs is 144 pipes. (assuming no idle time)	Total pipe produced in 24 hrs 221 pipes. (assuming no idle time and number of worker is constant)

CONCLUSION

By the modification of the covering plate, the productivity of the company is increasing by a considerable amount. Due to the modifications around 77 pipes more, the company is producing in one day. Moreover due to the Simplicity of the mechanism the company can shift from keeping skilled labour for that particular operation. Also same locking arrangement can be used for any centrifugal casting machine with different diameter of opening . Only they have to change the covering plate according to diameter and material of pipe. The cost of a skilled labour can be saved by the company which was required in the previous mechanism.

Moreover installation of this new covering plate can be done at a minimal cost of Rs 9400. Hence the recovery of this investment by the company can be done in a very short number of days. Thus it can be said that the modifications suggested in the

present research work wouldl be quite economical for the company.

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