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CYCLONE DUST COLLECTOR FOR FOUNDRY

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Abstract: The foundry industry generates a considerable amount of dust and particulate matter during various manufacturing processes, such as casting, molding, and sanding. These particulates can be harmful to the environment and pose a health hazard to workers. In this study, a cyclone dust collector was designed and developed to capture and remove the dust generated in the foundry.

The cyclone dust collector was designed based on the principles of centrifugal force and was fabricated using mild steel sheets. The collector was equipped with an inlet duct, a cyclone chamber, and an outlet duct, and was installed in a foundry to evaluate its performance. The collected dust

The results showed that the cyclone dust collector was able to effectively capture and remove the dust generated in the foundry. The collected dust was also found to be non-hazardous, and can be safely disposed of in a landfill.

The developed cyclone dust collector can provide a cost-effective and efficient solution for dust collection in foundries, thereby reducing the health risks associated with the exposure to dust and particulate matter. The design can also be modified and scaled up for use in larger industrial settings**.**

Keywords: Dust collector, Air pollution control, Cyclone, Abrasive.

I. INTRODUCTION

A cyclone dust collector is an important piece of equipment used in foundries to remove airborne dust and debris from the work environment. Foundries are places where metals are melted and poured into molds, and as a result, generate a lot of dust, smoke, and fumes that can be harmful to workers and equipment. A cyclone dust collector works by using centrifugal force to separate the dust and debris from the air. As the dirty air enters the cyclone, it is spun around at high speed, causing the heavier particles to fall to the bottom of the collector while the clean air is released back into the atmosphere. Cyclone dust collectors are highly effective at removing large particles and can be used in conjunction with other types of air filtration systems to provide complete dust and fume removal. They are an essential piece of equipment for any foundry, as they help to improve the air quality and protect the health of workers while also keeping equipment running efficiently by reducing the amount of dust and debris that can cause damage or wear over time.

II. LITERATURE REVIEW

A literature review is a written document that provides background information on the subject area and details previous research that is relevant. A literature survey is conducted to ensure to have a thorough understanding of the topic, to identify potential areas for research and also to identify similar work done within the area.

Sahu[1], the use of cyclone dust collectors in foundries has been found to be effective in reducing dust levels and improving air quality. The study showed that cyclones can capture up to 90% of airborne particles larger than 5 microns, which are the most hazardous to human health.

Kockova, S, Stevulova [2], It is evaluated the performance of a cyclone dust collector in a small foundry. The study found that the cyclone was effective in removing large particles, but less effective at capturing smaller particles. The

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authors recommended using cyclones in combination with other types of air filtration systems, such as bag filters or electrostatic precipitators, to achieve higher overall dust removal efficiency.

Sharmin [3] examined various types of dust collectors used in foundries, including cyclones, fabric filters, and wet scrubbers. The authors concluded that cyclone dust collectors are effective for capturing large particles, but may not be sufficient on their own to provide complete dust removal. The authors recommended using a combination of dust collectors to achieve higher overall efficiency.

III. METHODOLOGY

A cyclone dust collector is a machine used in foundries to remove large dust particles from the air. It works by spinning the air and dust particles around in a circle, which forces the heavy dust particles to separate and fall into a container at the bottom. The clean air is then passed back into the environment. This process helps keep the air clean and healthy for the workers in the foundry.

IV. DESIGN AND CALCULATION

COMPONENTS OF MACHINE

Motor

Motor is a device that converts electricity into a mechanical motion. A three phase 1HP motor having 1440rpm is used in the "cyclone dust collector".

Pulley

Two pulleys are been used out of which one is smaller other is bigger one. They are been used for the transmission of the power from the motor to the required shaft as described in the working. The two pulleys carry the rubber belt.

V-belt

V-belt is the one of the main components in the "cyclone dust collector". A V-belt is a loop of flexible material used to link between two or more rotating shafts mechanically, Belts may be used as a source of motion to transmit the power efficiency, or track relative movements.

Shaft

Shaft is a rotating machine element, usually circular in cross section. A shaft is used to transmit power from one part to another. The various members such as pulleys and gears are mounted on it.

Frame

The frame structure is the combination of beams, column, and slab. The use of frame is to resist the moments which developed during the applied loading.

DESIGN OF MACHINE

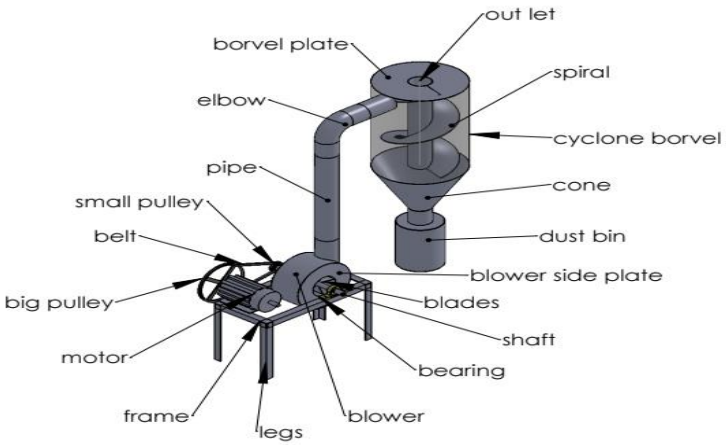

FIG 1: ISOMETRIC VIEW OF MACHINE

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CALCULATION

TO CALCULATE TORQUE

The device is incorporated with 1 HP motor, then

1HP = 0.735KW

= 0.735 $X10^3$ w

= 735 w

The belt is mounted on the motor shaft on one end and pulley on the other end.

Motor shaft has v groove on which the belt is mounted. The size of the motor shaft as per the specifications

Using Hindustan motors catalog for 1 HP motor, N =1440rpm

P = 2ΠNT / 60

0.735$X10^3$ = (2Π x 1440 x T) / 60

T = (0.735 $x10^3$ x 60) / (2Π x1440)

T = 4.874 N-m

T = 4.874 $X10^3$ N-mm

T = 4874 .120132 N-mm

TO CALCULATE THE BELT LENGTH

The belt is inserted on a V groove on the motor running at 1440 rpm.

The motor shaft diameter is 18 mm

Speed of motor = N_1 =1440 rpm

Motor pulley diameter = d = 50 mm

Whereas the pulley diameter on the other side

D = 320 mm

The Belt having dimensions

Centre Distance = C = 340mm

N_2 = Speed of the pulley =?

d =50 mm D =320 mm

N_1= 1440 rpm N_2 =?

Using velocity ratio

$$\frac{D}{d} = \frac{N_1}{N_2}$$

$$\frac{320}{50} = \frac{1440}{N_2}$$

$$N_2 = \frac{(50 \times 1440)}{320}$$

N_2= 225 rpm.

To calculate the length of the belt, this is considered as open belt drive

$$L = 2C + 1.57(D + d) + \frac{(D-d)^2}{4C}$$

Centre Distance = C = 340 mm

Diameter of larger pulley = D = 320mm

Diameter of smaller pulley = d = 50 mm

$$L = 2(340) + 1.57(320 + 50) + \frac{(320 - 50)^2}{4(340)}$$

L = 1314.503 mm

L = 1.314m

The length of the belt is approximately taken as **1.3 m**

DESIGN OF BOLT

The bolts are used for fixing the connections which can be used as temporary joints. Bolts are been used as they can be removed and properly adjusted as per the requirements.

Bolt is to be fastened tightly also it will take load due to rotation.

Stress for C-25 steel f_t =120 N /mm^2, std nominal diameter of bolt is 8 mm.Let us check the strength:

Also initial tension in the bolt when belt is fully tightenedP = 1420 d N

P = 1420 x 8NP = 11360 N

Therefore the total load on bolts

F.O.S (Additional load) = 500 NP = 11360 + 500 N

P = 11860 N

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Being the four bolts the load is shared as P = 11860/4
P = 2965 N.
Also,
$2965 = (\Pi /4\ dxc^{2)} \times f_t$
$2965 = (\Pi /4)\ (8x\ (0.84)^{2)}) \times f_t$
$f_t = 83.59\ N / mm^2$
The induced f_t 83.59 N / mm^2 is less than the maximum ft 120 N /mm^2 hence our design is safe.

FABRICATION

FABRICATED MACHINE

WORKING PRINCIPLE

A dust collector is a system used to enhance the quality of air released from foundry and commercial processes by collecting dust and other impurities from air or gas. Designed to handle high volume dust loads, a dust collector system consists of a blower and dust removal system.

A dust collection system is an air quality improvement system used in industrial to improve breathable air quality and safety by removing particulate matter from the air and environment. Dust collection systems work on the basic formula of capture, convey and collect. It separate dust from air streams using a combination of forces, such as centrifugal, gravitational, and inertial.

The fan is fitted at the inlet hood so the air is allowed to pass through the cyclone.

The chamber is made in order that the cyclone is formed the spiral plate is made in the chamber which allows the air to form the cyclone due to gravity the particles goes and settles at the bottom of the cone and can be extracted air then passes at the centre pipe from which the exhaust take place all the heavy particles are collected and thus the air is filtered from the dust.

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Result:

SL NO	INPUT	OUTPUT
01	500 gram .	420 gram .

V. CONCLUSION

A cyclone dust collector is a highly effective solution for removing particulate matter from the air in a foundry environment. By utilizing centrifugal force, cyclone dust collectors are able to separate dust and debris from the air stream and deposit it into a collection bin, reducing the amount of airborne contaminants and promoting a safer and healthier workplace for foundry workers.

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