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Design and Fabrication of Cyclone Dust Collector

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ABSTRACT: We all know that oxygen is very important for all of use to live a life. Without air we cannot live. On the next hand we also need a fresh air for breathing. Mostly we prefer that there should be fresh air available for breathing. In industry where is a hazardous environment we cannot breath properly. We try to reduce the hazardous air pollution from the working place. In this project work or main objectives is to reduce the air pollution within the working area. A dust collector is a system used to enhance the quality of air released from industrial 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, dust filter, a filter-cleaning system, and a dust receptacle or dust removal system.

KEYWORDS: Borvel plate, Cyclone Borvel, Cone, Dust Bin, Blower, Blades, Shaft, Motor, Belt, Pulley.

I. INTRODUCTION

Cyclone dust collector belongs to the dust-extraction unit. It is an auxiliary product to cement kiln. The dust-extraction principle is that cyclone dust collector makes dust airflow rotate, then in virtue of centrifugal force split dust from airflow and capture them on the wall. Finally, dust falls into the dust collector because of gravity. The design of parts in the cyclone dust collector is in accordance with a certain dimension scale. Every adjustment of the dimension scale will influence the cyclone dust collector's efficiency and loss of pressure. The main factors are cyclone dust collector's diameter, air inlet size, and exhaust pipe diameter. Have attention when you use it by noticing that after crossing a certain limit, favorable factors can turn into negative factors. Besides, give consideration to all factors because some factors may be good to raise the efficiency of dust collection but it, in turn, adds loss of pressure.

Cyclone dust collectors began to apply in the industry when the year 1885 and it has developed into multiple forms. According to the different entry modes of airflow, cyclone dust collectors can be divided into the tangential entry and axial entry. At the same loss level of pressure, the latter one can propose three times the volume of air than the former with symmetrical airflow distribution.

Cyclone dust collector consists of an entry pipe, exhaust pipe, cylinder body, cone, and dust collector. Cause of its simple structure, easy manufacture, installation, and maintenance, a lower investment fee, and operational fee, cyclone dust collector is been widely used in the technology of splitting solid and liquid ions from airflow or liquid water.

II. LITERATURE REVIEW

Cyclone separator is a method of removing particulate from an air, gas or liquid stream without the use of filters, through vortex separation. Rotational effects and gravity are used to separate mixtures of solids and fluids. The method can also be used to separate fine droplets of liquid from a gaseous stream. A high speed rotating (air) flow is established within cylindrical or conical containers called a cyclone. Air flows in a helical pattern, beginning at the top

(wide end) of the cyclone and ending at the bottom (narrow) end before exiting the cyclone in a straight stream through the centre of this cyclone and out the top.

Dust cyclone research leading to more efficient designs has helped the cotton ginning industry comply with increasingly stringent air quality standards governing particulate emissions.

As computing costs have decreased and model sophistication has increased, the use of computational fluid dynamics to model cyclone performance has grown. There will, however, always be a need for empirical validation in the laboratory and field. Energy cost related to cyclone pressure drop has been and will continue to be an important consideration. The cotton ginning industry continues to proactively respond to increasingly stringent air quality regulations promulgated by federal, state and local regulatory agencies. Research conducted at universities and federal labs in cooperation with the ginning industry has led to innovations in the technology used to control cotton gin particulate emissions. Control technologies developed for or by the ginning industry are emulated by other industries.

III. PROPOSED METHODOLOGY

- Study Of Machines
- Study Of Mechanical & Electrical Drives
- Selection Of Material
- Design And Development Of Frames
- Manufacturing Of Model
- Assembly Of Model
- Testing Of Model

IV. SCHEMATIC DIAGRAM

- Dust –Laden air or gas enters the cyclone dust collector through an inlet hood and is directed into a cylindrical chamber.
- The chamber is designed to cause the incoming air or gas to spin around its axis. This creates a centrifugal force, causing the heavier particles to move towards to outer walls of the chamber and eventually drop out and settle at the bottom of the collector.
- The clean air or gas then exits the collector through an outlet located at the top of the chamber.
- The collected particles are collected in a hopper at the bottom of the collector, when they are typically discharged into a bin or other dust discharged method.

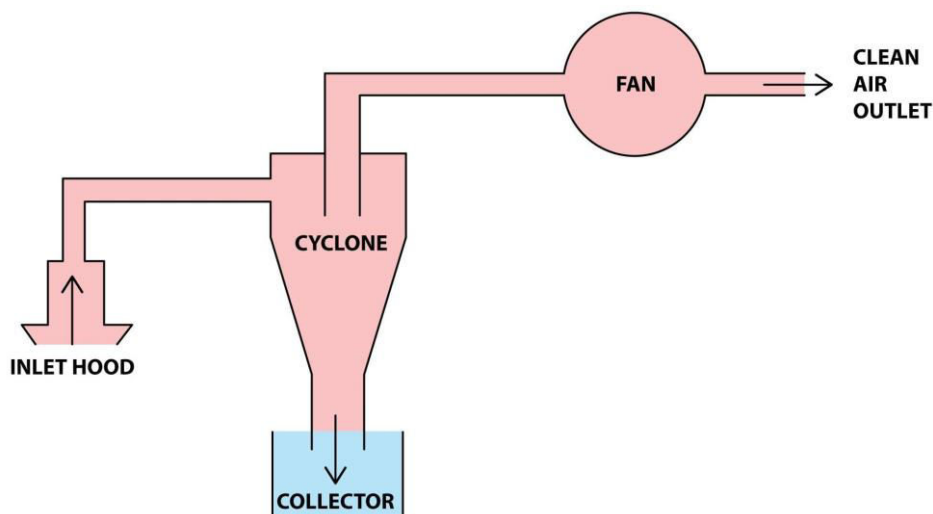


Fig 4.1 schematic diagram of cyclone dust collector

V. DESIGN VIEWS

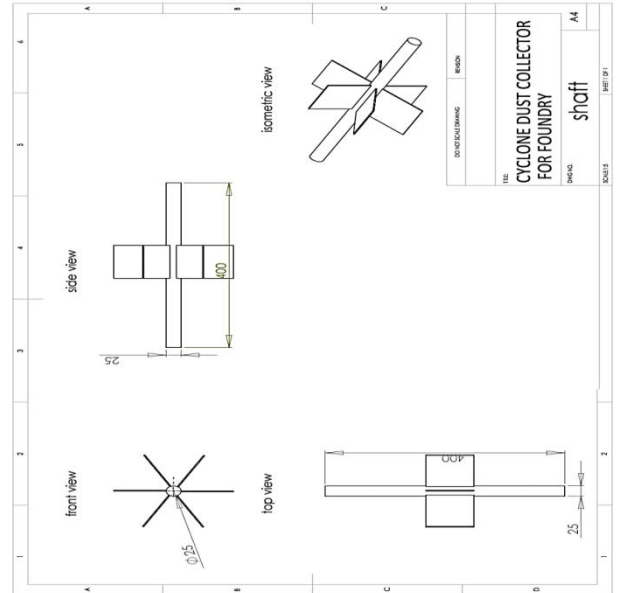
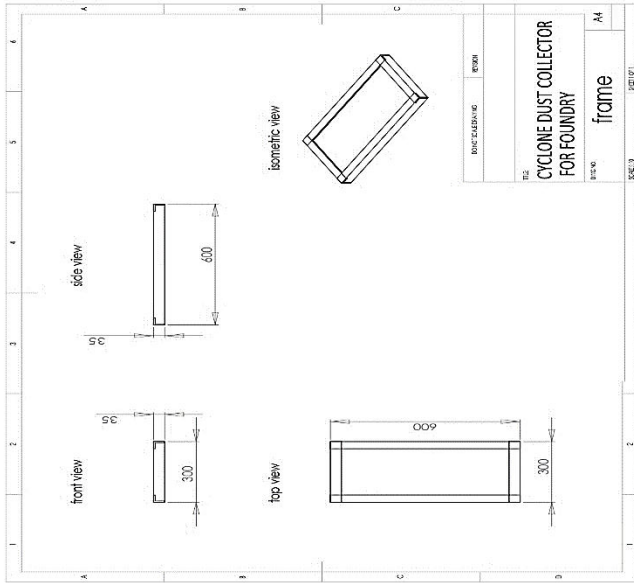


Fig 5.1 Frame Fig 5.2 Shaft

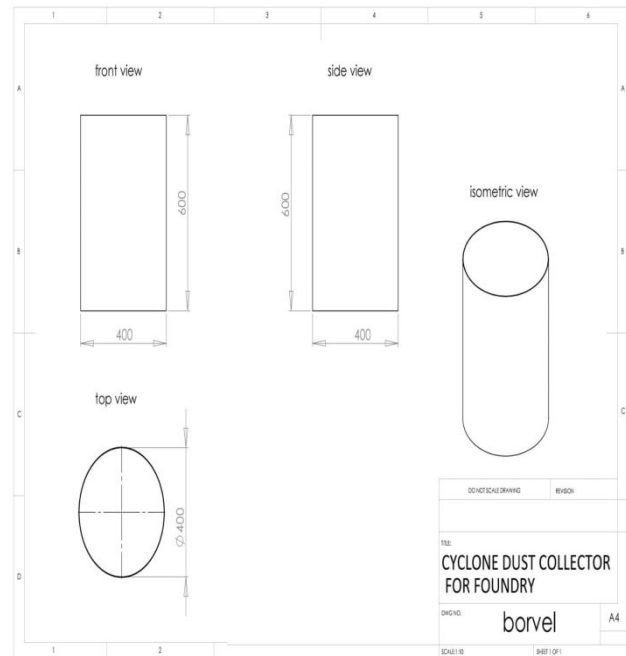
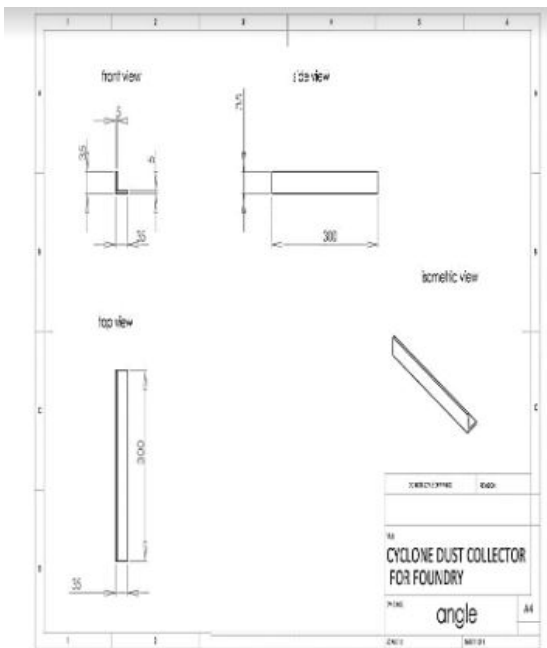


Fig5.3 Angle Fig 5.4 Separator

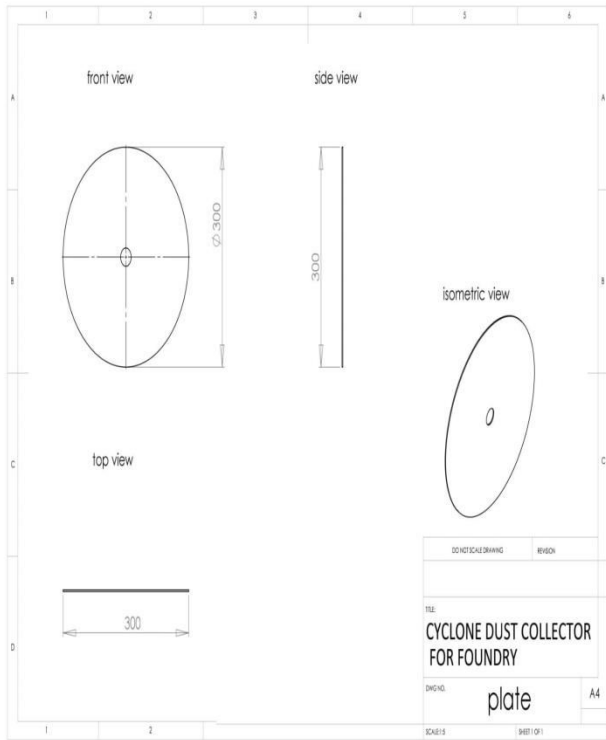


Fig 5.5 Blower side plate

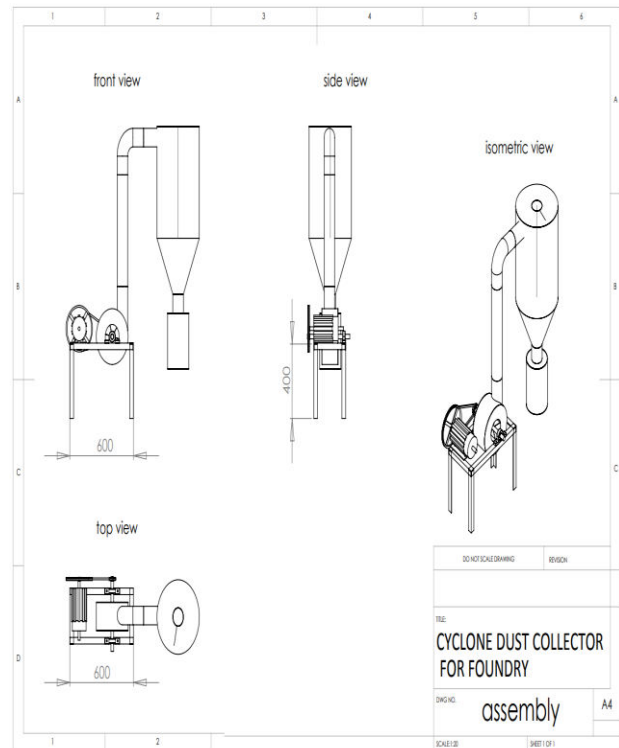


Fig 5.6 Assembly

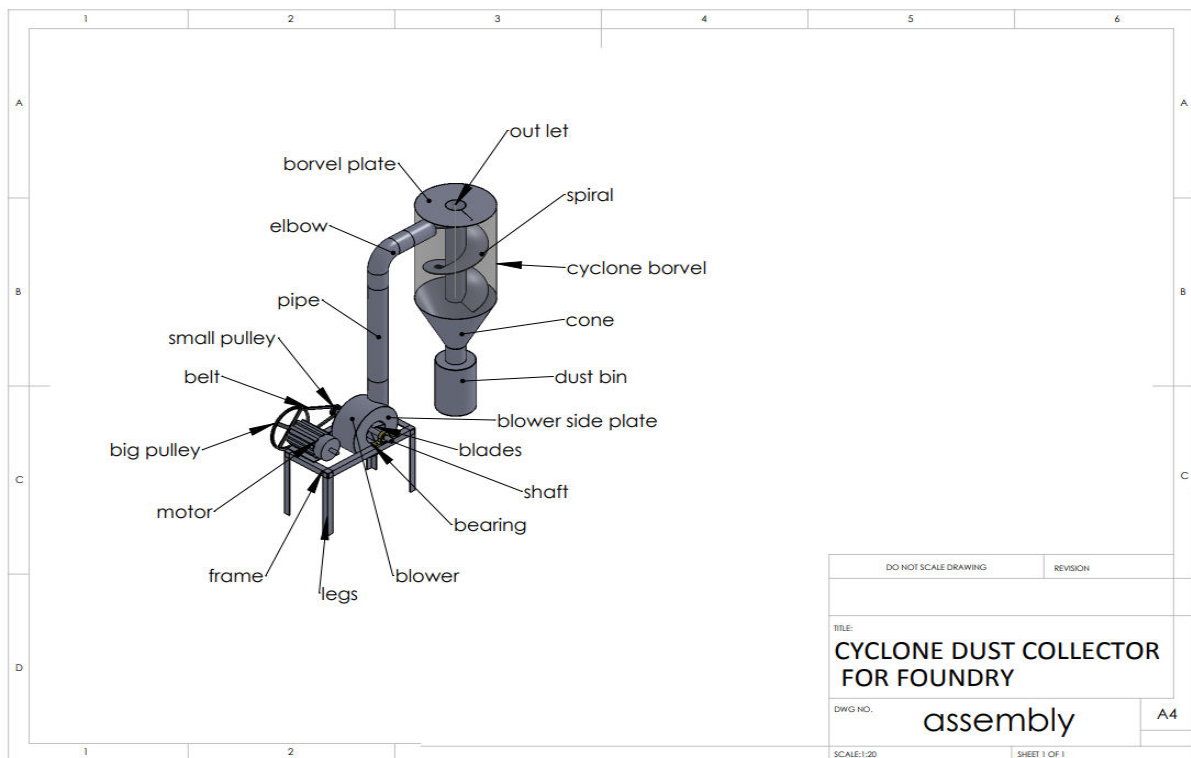


Fig 5.7 Assembly with labeled parts

VI. COMPONENTS REQUIRE

A. AC MOTOR



Fig 6.1 AC motor

A AC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of AC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor.

In this setup we used a 1HP AC motor, which is attached to the frame, in this cyclone dust collector we used a belt drive mechanism. The Driver pulley is connected to AC motor and Driven pulley is connected to Centrifugal Blower.

The device is incorporated with 1 HP motor, then

$$\begin{aligned} 1\text{HP} &= 0.735\text{KW} \\ &= 0.735 \times 10^3 \text{ w} \\ &= 735 \text{ w} \end{aligned}$$

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, $N = 1440\text{rpm}$

$$\begin{aligned} P &= 2\pi NT / 60 \\ 0.735 \times 10^3 &= (2\pi \times 1440 \times T) / 60 \\ T &= (0.735 \times 10^3 \times 60) / (2\pi \times 1440) \\ T &= 4.874 \text{ N-m} \\ T &= 4.874 \times 10^3 \text{ N-mm} \\ T &= 4874 .120132 \text{ N-mm} \end{aligned}$$

B. CENTRIFUGAL BLOWER



Fig 6.2 Centrifugal blower

The centrifugal blower use high speed impellers or blades to impart velocity to air or other gases. They can be single or multi-stage units. Like fans, centrifugal blowers offer a number of blade orientations, including backward curved, forward curved, and radial. Blowers can be multi- or variable speed units. They are usually driven by electric motors, often through a belt and sheave arrangement, but some centrifugal blowers are directly coupled to drive motors. Fan speed can be changed to vary flow rates by resizing sheaves, using variable speed drives, etc., but dampers are even more common as a means of adjusting flow.

C. CYCLONE SEPARATOR



Fig 6.3 Cyclone separator

Cyclone separators provide a method of removing particulate matter from air or other gas streams at low cost and low maintenance. Cyclones are somewhat more complicated in design than simple gravity settling systems, and their removal efficiency is much better than that of settling chamber. Cyclones are basically centrifugal separators, consists of an upper cylindrical part referred to as the barrel and a lower conical part referred to as cone. They simply transform the inertia force of gas particle flows to a centrifugal force by means of a vortex generated in the cyclone body. The particle laden air stream enters tangentially at the top of the barrel and travels downward into the cone forming an outer vortex. The increasing air velocity in the outer vortex results in a centrifugal force on the particles separating them from the air stream. When the air reaches the bottom of the cone, it begins to flow radially inwards and out the top as clean air/gas while the particulates fall into the dust collection chamber attached to the bottom of the cyclone.

D. BEARING



Fig 6.4 Bearings

Bearings perform the function of preventing damage from being done by this force to the part that supports the rotation, and also of maintaining the correct position of the rotating shaft. This function of bearings is what allows us to use our machines over and over again for an extended period of time.

E. PULLEY



Fig 6.5 Pulley

Belt drives transmit power between two or more rotating shafts, usually with parallel axes of rotation. The belts are looped over pulleys attached to the driver and follower shafts. The pulleys are placed at a measured distance to create tension on the belt.

F. ASSEMBLED MODEL



Fig 6.6 Assembled model

VII. WORKING PROCESS

1. Dust-laden air or gas enters the cyclone dust collector through an inlet and is directed into a cylindrical chamber.
2. The chamber is designed to cause the incoming air or gas to spin around its axis. This creates a centrifugal force, causing the heavier particles to move towards the outer walls of the chamber and eventually drop out and settle at the bottom of the collector.
3. The clean air or gas then exits the collector through an outlet located at the top of the chamber.
4. The collected particles are collected in a hopper at the bottom of the collector, where they are typically discharged into a bin or other dust discharge method.

VIII. CONCLUSION

We have taken up this project as real challenge, as we were not experience in the field. We started our work on this project facing new hurdles initially.

The maneuverability of the device is quite good and the handling is quite simple. For commercial purpose one can improve the efficiency of the device effectively by increasing the size of the device.

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