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Design and Development of Chalk Dust Cleaning Equipment

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ABSTRACT

Till today most of the schools and colleges are using traditional methods for teaching with help of chalk. The traditional duster eraser chalk dust is a common problem. Prolong breathing of chalk dust which spread over entire class may cause serious respiratory health problems. In this project a cleaning equipment is designed and developed to suck chalk dust particles from the duster eraser by vacuum technology in an eco-friendly way.

Keywords: Dust, Vacuum, Cleaning Equipment

I. INTRODUCTION

A vacuum cleaner, otherwise called a sweeper or may be a Hoover, is a gadget that utilizes a pneumatic machine, to make a halfway vacuum to suck up residue and soil from floors and from different surfaces, for example, upholstery and draperies. The soil is gathered by either a residue sack or a typhoon for later transfer. Vacuum cleaners, which are utilized in homes just as in industry, exist in an assortment of sizes and models—little battery-fueled hand-held gadgets, wheeled canister models for home use, residential focal vacuum cleaners, gigantic stationary modern apparatuses that can deal with a few hundred liters of residue before being exhausted, and self-moved vacuum trucks for recuperation of huge spills or evacuation of debased soil. Particular shop vacuums can be utilized to suck up both residue and fluids.

Towards the finishing of the nineteenth century the world was presented with the controlled cleaners, albeit early sorts utilized some variety of blowing air to clean rather than suction. One showed up in 1898 when John S. Thurman of St. Louis, Missouri presented a patent for a "pneumatic floor covering renovator" which blew dust into a container. Thurman's framework, controlled by an interior ignition motor, headed out to the client's living arrangement on a pony drawn wagon as a component of a way to entryway cleaning administration. Corrine Dufour of Savannah, Georgia got two licenses in 1899 and 1900 for another blown air framework that appears to have highlighted the principal utilization of an electric engine.

In 1901 controlled vacuum cleaners utilizing suction were designed autonomously by British architect Hubert Cecil Booth and American designer David T. Kenney. Corner likewise may have instituted "vacuum more clean". Corner's pony drawn burning motor fueled "Puffing Billy", perhaps got from Thurman's blown air configuration," depended upon simply suction with air siphoned through a fabric channel and was offered as a major aspect of his cleaning administrations. Kenney's was a stationary 4,000 lb. steam motor fueled framework with funnels and hoses venturing into all pieces of the structure.

Figure 1: Vacuum Cleaner

II. EXPERIMENTAL EQUIPMENT AND INSTRUMENTS

Figure 2: Fabrication of Experimental Setup

The experimental setup (figure 2) consists of the following parts;

A. Frame

A frame is often a structural system that supports other components of a physical construction and/or steel frame that limits the construction's extent. The frame is of made up of wood. [270mm X 148mm X 168mm]

Figure 3: Fabrication Of The Frame

B. Vacuum pump

Figure 4: Vacuum Pump

Vacuum siphon is of 400watt which creates a suction of 0.3 bar.

C. Suction blades

These are sharp edges inside the siphon packaging which turn to deliver the suction.

Figure 5: Suction Blades

D. Dust collector

Regularly known as pack houses, texture authorities use filtration to isolate dust particulates from dusty gases. They are a standout amongst the most productive and practical sorts of residue gatherers accessible, and can accomplish an accumulation proficiency of over 99% for extremely fine particles. To guarantee the channel packs have a long use life they are regularly covered with a channel enhancer (pre-coat). The utilization of synthetically latent limestone (calcium carbonate) is most normal as it boosts proficiency of residue accumulation (counting fly fiery remains) by means of development of what is known as a dust cake or covering on the outside of the channel media. This snares fine particulates as well as gives insurance to the sack itself from dampness, and slick or sticky particulates which can tie the channel media. Without a pre-coat the

channel pack enables fine particulates to seep through the sack channel framework, particularly amid start-up, as the sack can just do some portion of the filtration leaving the better parts to the channel enhancer dust cake Is set beneath the suction opening, made up of small scale fiber containing pores of size < 800nm.And is a removable piece of the device.[dia-82mm, tallness 45mm .]

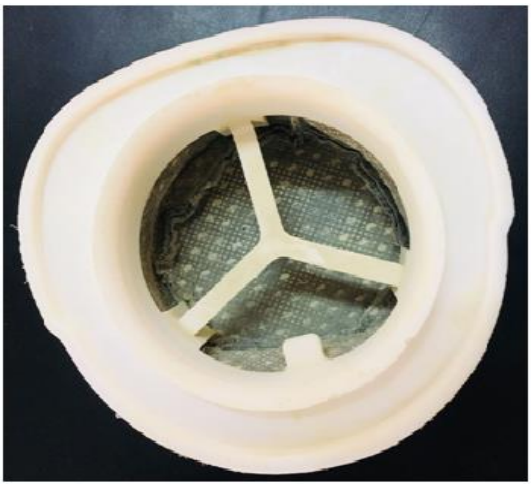

Figure 6: Dust collector

E. Duster

Is a material which is used to dust the blackboard by the means of a cotton bed stuck on a wooden piece and remove the unwanted chalk or the writings which are there on the blackboard? [145 × 45 × 35mm]

Figure 7: Duster

F. Opening plate

Is made up of wood, and is used to clear out the dust collected in the collector. [305 × 115] mm.

Figure 8: Opening plate

(g) Air tight padding: -

This is placed below the suction slot, which helps in preventing the loss of suction pressure.

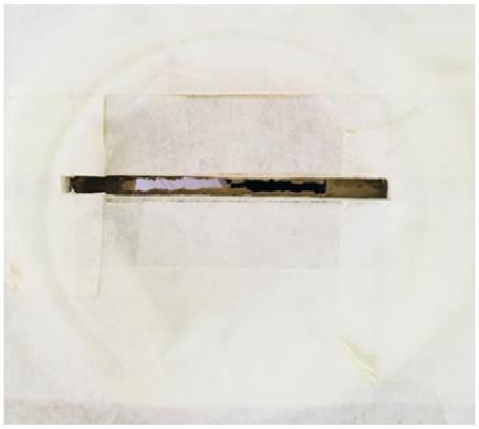

Figure 9: Air Tight Padding

H. Slot

This is placed on the opening plate, where the suction takes place along which the dust gets enters the device. [45 × 5mm]

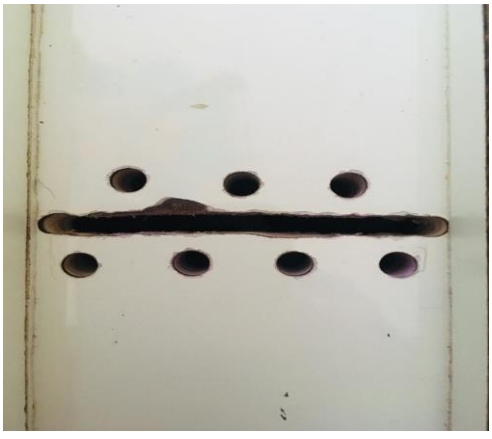

Figure 10: Suction Slot

I. Conveyor belt

A transport line is the conveying mechanism of a belt transport framework. A belt transport framework is one of numerous kinds of transport frameworks. A belt transport framework comprises of at least two pulleys, with an unending circle of conveying medium the transport line that pivots

about them. Either of the pulleys are fueled, moving the belt and the material on the belt forward. The controlled pulley is known as the drive pulley while the unpowered pulley is known as the idler pulley.

Figure 11: Conveyor Belt

III. CAD MODELS

Followings are the cad model for various parts of the experimental setup.

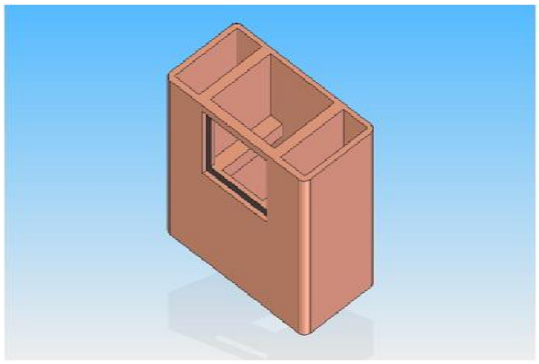

Figure 12: Body

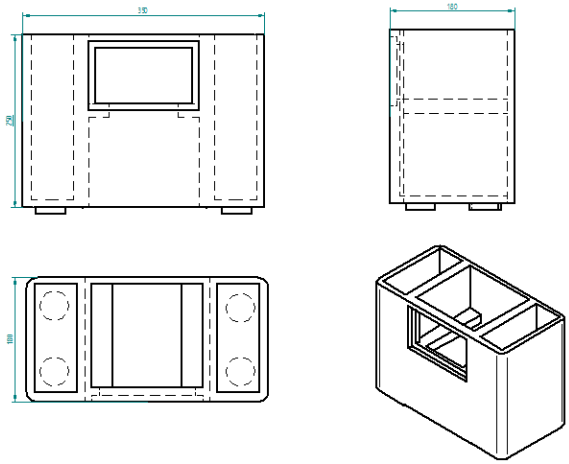

Figure 13: Front View, Top View & Isometric View of Body

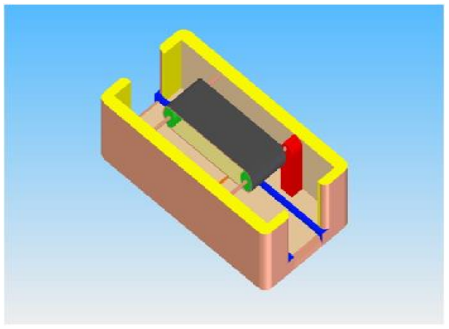

Figure 14: Conveyor system

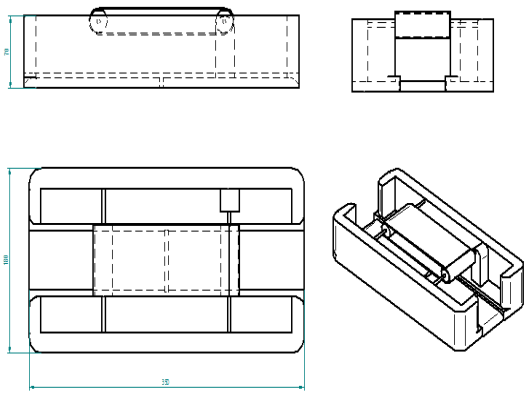

Figure 15: Front View, Top View & Isometric View of Conveyor System

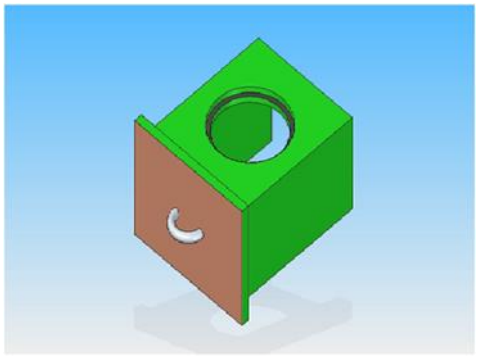

Figure 16: Dust Collecting Chamber

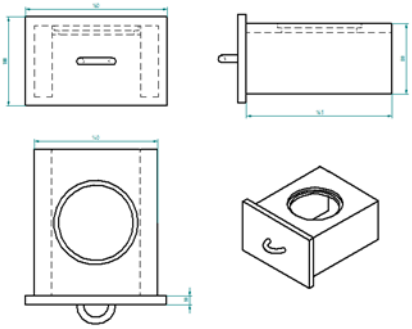

Figure 17: Front View, Top View & Isometric View of Dust Collecting Chamber

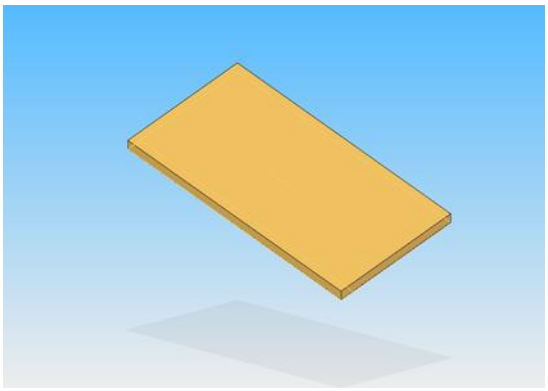

Figure 18: Top Plate

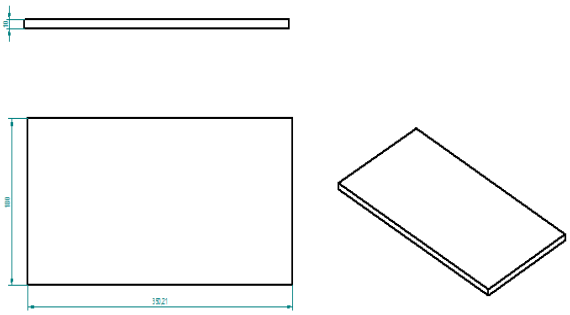

Figure 19: Front View, Top View & Isometric View Of Top Plate

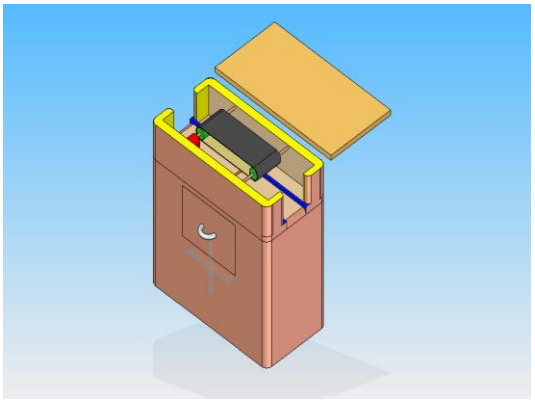

Figure 20: Final 3D View

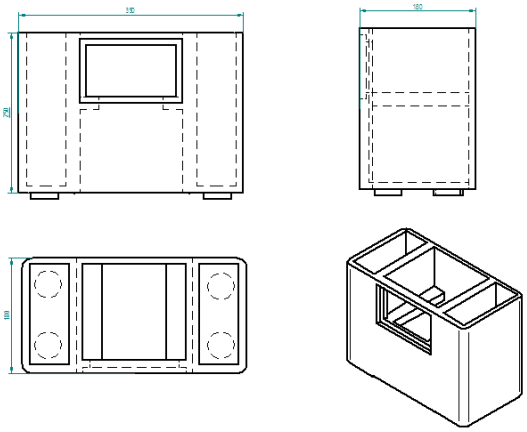

Figure 21: Front View, Top View & Isometric View Of Final Product

IV. EXPERIMENTAL METHODS

i. System works on vacuum process for cleaning the blackboard duster with the help of the vacuum motor.

ii. Motor will run the vacuum pump. A simple on/off switch is also going to play minor role in this system for stopping the motor and thus the vacuum pump.

iii. A vacuum dust collection system is used to collect and trap the dust found on the eraser.

iv. When the duster is placed in the slot the hook-and-loop conveyor system pulls the duster inside the machine.

v. When this is done the duster is wiped against the slot where in the vacuum process takes place and collects the dust from the duster.

vi. Thus avoiding the chalk dust entering into the classroom atmosphere.

V. EXPERIMENTAL CALCULATIONS

1. Electricity consumption: - E = W × n kW/hr. ---------- (i)

2. Average cost of consumption: - C = E×8.2 ×D Rs/month. ---------- (ii)

Where,

E=Electricity consumption.

n=No. of hours used.

W=Operating Watts of the pump.

C=Average cost of consumption.

D=No. of days used.

Rs.8.2 = Cost per kWh in Karnataka.

Calculations

1. n = 6/60hrs
2. E= (400×6/60)/1000
   E=0.04 kWh
3. C= 0.04×8.2×26
   C=8.528 Rs/month
4. Conveyor speed = 45rpm

VI. CONCLUSION

The model has been designed to collect the chalk dust which was getting into the class room atmosphere and causing suffocation to the people. By using the vacuum principle and the microfiber, this machine can successfully collect the complete dust from the duster and avoid the dust getting into the classroom atmosphere.

REFERENCES

[1] S. Joshibaamali, K.GeethaPriya. Automatic duster machine. International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE). 2015; 13(1).

[2] Mr. Sunil R. Kewate, Mr Inzamam T. Mujawar, Mr. Akash D. Kewate et al. Development of new smart design to erase the classroom blackboard of schools/colleges. IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE).

[3] Alfred E. Smalley, Joseph C. Gundlach. Internal Conveyor System. United States Patent Office.[Jan. 30, 1991]

[4] Horst Fabian, Heinz Thus. Portable Belt Conveyor Particularly A Plate Belt Conveyor For Crushing Plants. United States Patent Office.[Aug. 19, 1981]

[5] David J. Lapeus Michael Ballash .Magnetic conveyor system. United States Patent Office.[Jul. 14, 1995]

[6] Peter R. Southworth, Gregory R. Baxter. Conveyor System. United States Patent Office.[Nov. 16, 1984]

[7] David V. Hall .Accumulating conveyor and control system. United States Patent Office.[Nov. 23, 1992]

[8] Timmy Sin Hok. Yin.Flexible plastics vacuum cleaner core. United States Patent Office.[Feb. 20, 1996]

[9] Shai Abramson, Shalom Levin, Ran Zaslavsky. Robotic Vacuum Cleaner. United States Patent Office [Dec. 4, 2001].

[10] Jen Chen, Hong Chen. Remote-control radio vacuum cleaner .United States Patent Office.[Apr. 13, 1981]

[11] Ronald D. Bourgeois. Conveyor storage system. United States Patent Office.[Feb. 2, 1979]

[12] Raymond A. Hanson. Movable Belt Conveyor Assembly. United States Patent Office.[Feb. 21, 1978]