International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 08 | Aug - 2021 ISSN: 2582-3930

MAGNETIC AND NON-MAGNETIC PARTICLE DUST COLLECTOR

Dhairyasheel Patil
* Mechanical Department, JSPM Rajashri shahu college of Engineering*
Design Department Dr.V.T.Tale sir,Prof.Dr. A.M.Badadhe sir

Abstract- 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. It is distinguished from air purifiers, which use disposable filters to remove dust. In this project we are going to design unit modular dust collector, also called as bag filter.

Index Terms- vacuum cleaner, Electromagnet, DPDT Switch

INTRODUCTION

In this project, MAGNETIC AND NON-MAGNETIC PARTICLE DUST COLLECTOR which is fully equipped by automatic system. It is a genuine project which is fully equipped and designed for cleaning and Separate the scrap. This improves the dust collection system separates both magnetic and non-magnetic particles.

There are various types of Vacuum Cleaners such as Upright Vacuum Cleaners, Stick Vacuum Cleaners and Hand-held Vacuum Cleaners. And all these Vacuum Cleaners generally use Electrical Energy as a source of Power. This paper suggests the use of Battery Operated Vacuum Cleaner using Axial Flow Fan for Suction Pressure generation.

It consist of following parts:

1. Electromagnet
2. Dpdt Switch
3. Battery
4. DC Motor

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.

LITERATURE REVIEW

Reference [1], [2] show a method to set up the market position of the product through the image scale and subsequently by 5W1H and tree diagram method, and clarifies the problems and the direction of the design goals. The following step, accordingto Morphological Analysis and Finite Structure method (FSM), arranges the positions of the major components of the product, and shapes the forms for developing the possible alternatives. Then, it is the most suitable for the consumers that using
pug several times to choose the final solution.

Reference [3] demonstrates the predicted performance for power, flow rate, pressure, and efficiency using the present method agreed well with the experimental results obtained for an equivalent system within 2% difference at best efficiency point. Three models of the fan-motor assembly (S1, S2 and S3) were analyzed at the component level and the decrease in efficiency produced by flow resistance was estimated to be 1% (S1 and S3 models) or 4.7% (S2 model) using the developed method.

Reference [4] shows the Pro-Endurance indicators are applicable to investigate the durability of products in several different scenarios and they are robust and flexible since the assessment based on a large number of parameters and different scenarios. These indicators can be used to assess product at the design stage or to support policy measures to promote more durable products.

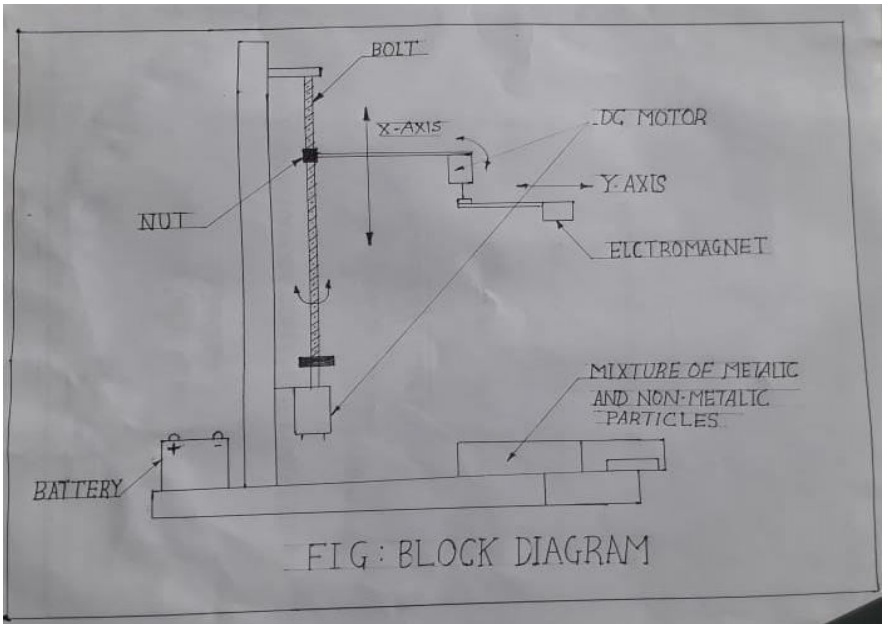
Reference [5] show the developed robot can perform sweeping and mopping task. RF modules have been used for wireless communication between remote (manual mode) and robot and having range 50m. From the results of experiments, it is found that a cleaning robot system which works through interaction with equipment in the home and does not disturb humans can become a reality.

WORKING

In the magnetic and non-magnetic dust collector are consist of a axial flow fan, electro magnet, brush, dust container, battery etc.

When the motor is switched ON, the Fan blades turn, the air is forced forward towards the exhaust port.

As the air moves forward, the density of air increases in front side of the Fan and density decreases behind the Fan.



The processing material enters the top of the magnetic drum separator and flows across the surface of the drum.
The rotator drum in the magnetic field captures the ferrous tramps whereas non ferrous falls free from the drum into the cleaned material flow. As the drum rotates, the ferrous metal so captured is carried past the diverter and released outside of the magnetic field.

COMPUNUNTS OF DUST COLLECTOR

A. Electromagnet:
This DC 12V KK-P30/25 15KG Lifting Solenoid Electromagnet consists of an iron core and a coil to attract magnetic substances, using the magnetic action induced by electric current, only while the current is applied. This compact functional device offers high power with high reliability. The structure and design to release the residual magnetism left after de-origination is also one of its unique features.

Specifications
1. Model DC 12V KK-P30/25
2. Holding/ Suction Force 15 Kg (≅150N)
3. Operating Voltage 12V
4. Operating Current 0.3 A
5. Power Consumption 3 W
6. Operating Temperature Range -20 ~ 120°C

B. DPDT Switch:
The DPDT Rocker Momentary Switch is generally used to make the Clockwise as well as the anti-clockwise motion of the motor, by changing the polarity of supply. This switch is generally used for “Polarity Reversal” DPDT. It has momentary action where the switch can toggle to two poles on Press & Hold action and returns to the middle (OFF) position with it spring action and hence you can quickly change the polarity of your application like a motor to rotate them in both directions.

Material	Plastic
Color	Black
Switch Type	DPDT Momentary
Length (mm)	34
Width (mm)	24
Height (mm)	32
Weight (gm)	13
Shipment Weight	0.115 kg
Shipment Dimensions	6 × 5 × 4 cm

C. Battery:

An Amaron quanta is preferred 12v same vela battery brand of most of the online ups manufacturers and users. Amaron quanta ups same batteries will not release any hydrogen and oxygen gases and there is no acid leakage.
They are inherently safer than conventional lead acid battery. Amara raja has been behind some of the best innovation in technology that india has seen.

Key Features of Amaron Quanta Smf Batteries

- Heavy duty corrosion –resistant alloy
- Superior high-discharge performance.
- L shaped terminal with rugged flappon.
- Stringent quality.
- Design float life of 10 years.

D. Dc Motor:

A DC motor is any of a class of rotary electrical motors 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 DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

Operating Voltage(VDC)	6 to 18
Nominal Voltage (V)	12
Rated Torque(kg-cm)	7.5
Stall Torque(Kg-Cm)	30
No-Load Current	300 mA
Load Current(A)	900 mA
Shaft Diameter (mm)	6
Shaft Length (mm)	30
Gearbox Diameter (mm)	37
Motor Diameter(mm)	27
Motor Length(mm)	65
Weight (gm)	164
Shipment Weight	0.275 kg
Shipment Dimensions	10 × 4 × 4 cm

Experimental Set Up

Unit modular dust extractor machine is extremely useful in controlling the dust generated during the processes of granular solid. This equipment are used to remove excess of electrode from the rod. These Dust Extractor Machine is not only ensure a dust free end product for use but also health and safety of people coming in contact with mechanical processing machines. Extracting hazardous dust at the point of origination and conveying them to the correctly designed filtration system is necessary to protect both personnel as well as the plant. This Dust Extractor Machine successfully captures dust with the air stream and conveys it to the dust collector.

In pneumatic conveying systems handling fine or dusty material, the method of filtration that has become almost universally adopted is a bag type filter. These filters are commonly called bag houses. Most bag houses use long, cylindrical bags (or tubes) made of woven or felted fabric as a filter medium. Dust laden gas or air enters the bag house through hoppers by suction (normally) or positive pressure and is directed into the bag house compartment. The heavier dust particles fall off at the entry itself, while the lighter dust particles along with gas get carried upward to the bags. The gas is drawn through the bags, either on the inside or the outside depending on cleaning method, and dust accumulates on the filter media which increases the resistance to gas flow. Due to this, the filter must be cleaned periodically when sufficient pressure drop occurs. During cleaning, dust that has accumulated on the bags is removed from the surface and deposited in the hopper for subsequent disposal. Depending on the type/construction of bag house, cleaning can be carried out while the bag house is online (filtering) or is off-line (in isolation). If gas enters into the bag house tangentially at the bottom of the casing, it gives the dust laden gas a circular motion which helps in removing the heavy and coarser particles that are present in the gas stream in a manner similar to a cyclonic collector. These collected particles are directly discharged into the hopper. It is only the very fine particles that get carried to and collected by the bags. Thus the total dust load on bags is reduced.

Bag houses are very efficient particulate collectors. They collect particles with sizes ranging from submicron to several hundred microns in diameter at efficiency of 99 percent or better. The layer of dust, called dust cake or cake, collected on the bag is primarily responsible for such high efficiency. The cake is a barrier with tortuous pores that trap particles as they travel through the cake. Typically, inlet concentrations of pollutant to bag houses are 1 to 23 grams per cubic meter (g/m3) [0.5 to 10 grains per cubic foot (gr/ft3)], but in extreme cases, inlet conditions may vary between 0.1 to more than 230 g/m3 (0.05 to more than 100 gr/ft3).Extracting hazardous dust at the point of origination and conveying them to the correctly designed filtration system is necessary to protect both personnel as well as the plant. This Dust Extractor Machine successfully captures dust with the air stream and convey it to the dust collector.

DESIGN

Suction Capacity (Q) = $\pi \frac{D}{60} 1N$

$$\text{Velocity of vanes (u1)} = \frac{\pi * 0.120 * 2800}{60}$$

u1 =17.58 m/s

Now

θ =20

Velocity of air (V) = u1tanθ

V= 17.58tanθ =17.58*tan20

V=6.39 m/s

Now

$Q = \pi * v * D1 * B$

=3.14*6.39*0.120*0.05

=430.69 m^3/hr

=7.178 m^3/m

Q=240 CFM

Filtration Area

Dia of Filter Hole=100 mm

Length of Filter bag=350 mm

n=No. of hole Filtration Area

=3.14*0.100*0.350*4

=0.4396 m^2

Dust Storage Capacity

Cs=Length(l)*Width(w)*Height(h)

=285mm*275mm

=4310625 mm

ADVANTAGES

- Magnetic and non magnetic particle get separated.
- The iron or scrap particles separately collected that's why this saves this particles from waste.

- Running cost is low.
- Reliable and easy to maintain.
- Easy Handle higher.
- Reduces time of waste collection.
- Suitable for high small and large industries.

APPLICATIONS

- Dust collection in shop floor
- To separate dust as magnetic and non magnetic particles
- Dust collect
- Source capture extractor arms
- Collects burrs and waste magnetic particles

CONCLUSION

The problem stated to us was a fascinating one though we as engineers had to solve it by using our expertise. We were able to counter the problems raised and the dust is collected by dust collector is in the form of magnetic and non-magnetic particles separately.

This will provide the separate magnetic and non-magnetic dust or west. This system also gets some advanced options like wireless system due to this will move freely on shop floor.The dust is collected by dust collector is in the form of magnetic and non-magnetic particles separately.

REFRANCES

1. Hsiao, SW (Hsiao, Shih-Wen) and Yeh, TA (Yeh, Ting-An), 'Application of Collaborative Design Strategy on Redesign of the Cordless Household Vacuum Cleaner', International Conference on Organizational Innovation(ICOI 2017), Vol. 131, pp. 211-222, 2017.
2. Hsiao, SW (Hsiao, Shih-Wen) and Chen, YC (Chen, Yi-Chin), 'Concurrent Design Strategy in Vacuum Cleaner Development', International Conference on Organizational Innovation (ICOI 2017), Vol. 131, pp.234-241, 2017.
3. Park, C (Park, Changhwan); Jun, S (Jun, Sangook);Park, K (Park, Kyunghyun); Lee, S (Lee, Sangjong) andChang, K (Chang, Kyoungsik), 'Methodology for System-Level Analysis of a Fan-Motor Design for a Vacuum Cleaner', Part C-Journal of Mechanical Engineering Science, Vol. 231(20), pp. 3840-3854, October 2017.
4. Bobba, S (Bobba, Silvia); Ardente, F (Ardente, Fulvio)and Mathieux, F (Mathieux, Fabrice), 'Environmental and Economic Assessment of Durability of Energy-using Products: Method and Application to a Case-Study
5. vacuum cleaner', Journal of Cleaner Production, Vol.137, pp. 762-776, November 2016.