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AUTOMATIC BOARD DUSTER

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ABSTRACT

In earlier days writing was done on sand slate, walls and chalkboards. As the uses of chalk increase, types of chalk like dustless chalk, color chalks also come up in the market. Nowadays, in order to reduce the price of chalk, factories are mixing cheap products and making it harmful. These harmful substance in Chalk cause certain disease in human body because chalk hold many harmful substances like calcium carbonate ($CaCo_3$) etc. These chalk sticks are also a carcinogenic substance and thus causing the disease like eye irritation, respiratory tract irritation and silicosis. The automatic board duster which works on just a push of switch and erases the dust of the board which leads to the prevention from such diseases. This machine works to and fro motion. This machine also prevent the spreading of chalk dust here and there. This machine works on the basis of Rack and Pinion motion.

Keywords: Automatic Board Duster, Rack And Pinion, Electric DC Motor, Wipe System, Mechanical System.

I. INTRODUCTION

Education is the most important thing in nowadays. Education is the currency of 21st century. Schools mostly use black board which uses chalk. Chalk is the mixture of certain harmful substance which cause many disease. This machine can erase the board without efforts. Also this machine prevents the spreading of chalk dust which cause certain disease like:-

1.1 Eye irritation:-

In this disease our eyes got itchy and teary because of the passage of chalk dust in our eyes. In this disease, our eyes became as given in the figure:-

Figure 1: Redness in eye

Figure 2: Difference between normal and infected eye

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1.2 Respiratory Tract irritation:-

In this, our breathing organs infected because of inhaling the chalk dust. Symptoms are coughing, sneezing and also chalk dust gather in our lungs. The lungs gets as shown in the fugure:

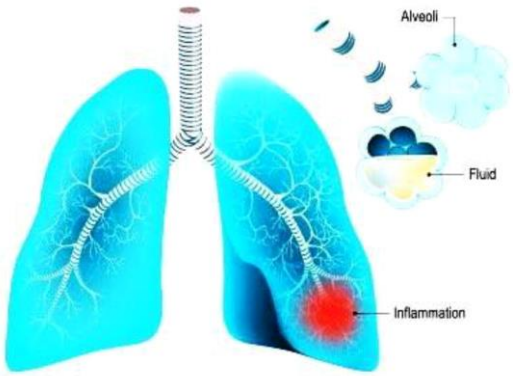

Figure 3: Inflammation in lungs

1.3 Silicosis:-

It is caused due to the presence of chert, flint and diatom in chalk which contribute to the presence of silica in human body. It cause the swelling of lungs due to which the side effects like Tuberculosis, chest infections, pulmonary hypertension, arthritis and lung cancer. It has a death ratio of 1.39% per million. The effect is as shown in figure:

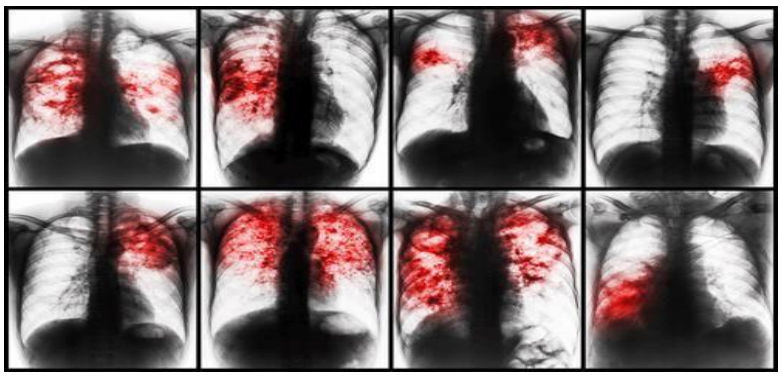

Figure 4: Impact of Silicosis

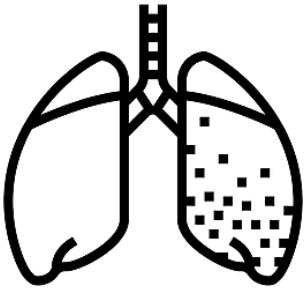

Figure 5: Dust in lungs

II. LITERATURE SURVEY

Automatic white board cleaner [Sumit Chavan, Vishal Shinde, Nikhil Murade, Anjali Jagtap, and Varsha Dongekara (vol.-7, Issue-5 May 2019, E-ISSN: 2347-2693)]:

- Chalk is the composite of calcium carbonate.
- Chalk dust causes extreme nuisance for the people who have asthama, skin irritation and serious health problem.
- Students gets bored in the time require for erasing the board dust. This motivated us to make Automatic board Dust Cleaner.

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Development of new design of automatic blackboard cleaning device [Nraj Saraswat, Nikhil Tyagi (Volume No. 6, Special Issue No. 2 December 2017, ISSN: 2319- 8354)]:

- The Motor will not be changing its direction until it is stopped.
- As smart wipe use less time as compared to manual wipe.

A review on automatic blackboard cleaner [S. Vignesh, K. Vinith, K. Mouleswaran, H. M. Sanjay, M. Logeshwaran (Vol. 4, Issue 4 April 2021, ISSN: 2581-5792)]:

- Our objective is to design a low cost automated duster which is less time consuming compared to manual duster.
- A duster which is set with the gear belt starts reciprocating up and down and cleans the board.
- It prevents the disease caused due to chalk.

Design and fabrication of Smart duster [Manyar Imrankha Ajimkha, Khatik Azad Rashid, Khatik Kazim Hanif, Khatik Mohsin Ahemad, Muhammad Intekhab Aftab, Shaikh Moin Ahmad (Vol. 6, issue 2 April 2018, ISSN : 2320-2882)]:

- Teachers need to erase the black board two-three times which motivated us to make Automatic board Duster.
- Problem of hand erasing affect the human being because of chalk dust.
- Chalk is the mixture of calcium carbonate and calcium sulphate.

Design and fabrication of automated duster for cleaning of whiteboard [Makhan Singh, Vardan Sharma, Deepak Kumar, Vikram Kumar Singh, Nitesh Kumar (Vol. 13, issue 2018, ISSN 0973-4562)]:

- By implementing three-type toggle switch the duster can move to and fro means it can move forward and it can move backward.

III. MODELING AND ANALYSIS

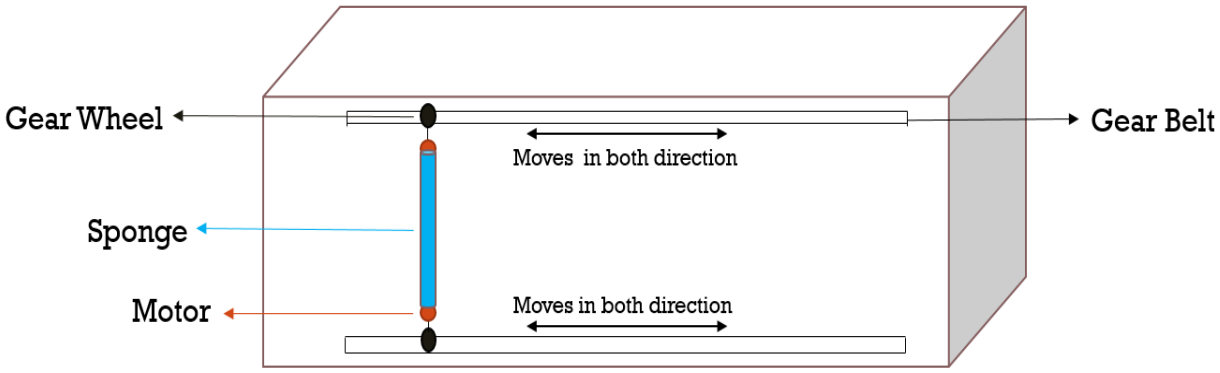

Figure 6: Schematic Diagram of Rack and Pinion motion

12v Battery:-

- Battery is a device that gives energy to the connected device with it.
- 12 volt battery is commonly used in automobile systems.
- It is invented by Alessandro Volta and John Stringfellow.
- This battery provides the current of 11.5amps and power level of battery is 12.4 volt.

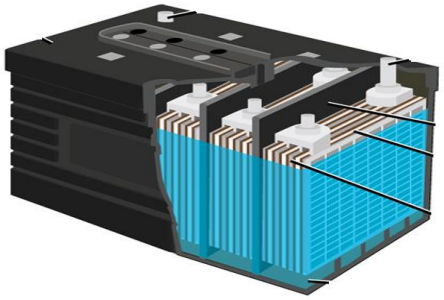

Figure 7: 12v Battery

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12 volt DC motor:-

- Motor relies on a fact that an unlike poles of magnet attract each other and like poles repeal each other.
- A coil of wire is attached with it, which generate electromagnetic field allied with the center of the coil.
- By switching the current on or off in a coil, its magnetic field can be on or off due to which the motor rotated.
- Motor is invented by Michael Faraday, Thomas Devanport, William sturgeon and Emily Devanport.
- This motor produces the current of 8amps and power level of battery lies between 4-volt to 12 volt.

Figure 8: 12v DC Motor

Toggle Switch:-

- There are many types of switch including 3 type, 2 type etc.
- Use 3-type toggle switch so that duster can move forward as well as backward.
- It was invented by John Henry Holmes in 1884.

Figure 9: 3-Type Toggle Switch

Sponge:-

- Sponge is a soft material that has many pores in it.
- It has air present in its pores
- It is commonly used in the sofas of house and to erase the dust of board.

Figure 10: Sponge

PVC pipe:-

- PVC is a plastic material that have been used here as a shaft material.
- It was invented by Waldo Semon and Eugen Baumann.

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Figure 11: PVC Pipe

Gear belt with gear wheel:-

- A belt holding a gear spikes same as the spikes in wheel is called the gear wheel and gear belt of rack and pinion motion.
- It was invented by the great Greek mechanic Alexandria.
- Its angles lies between the general ranges of angle 30-40 degree.

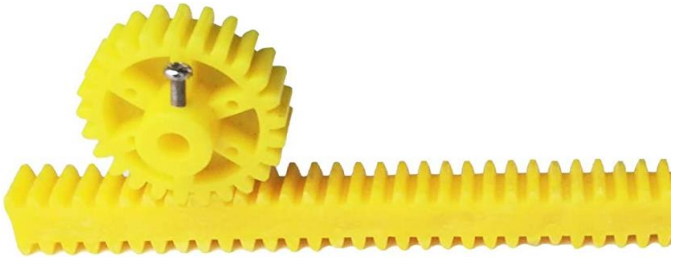
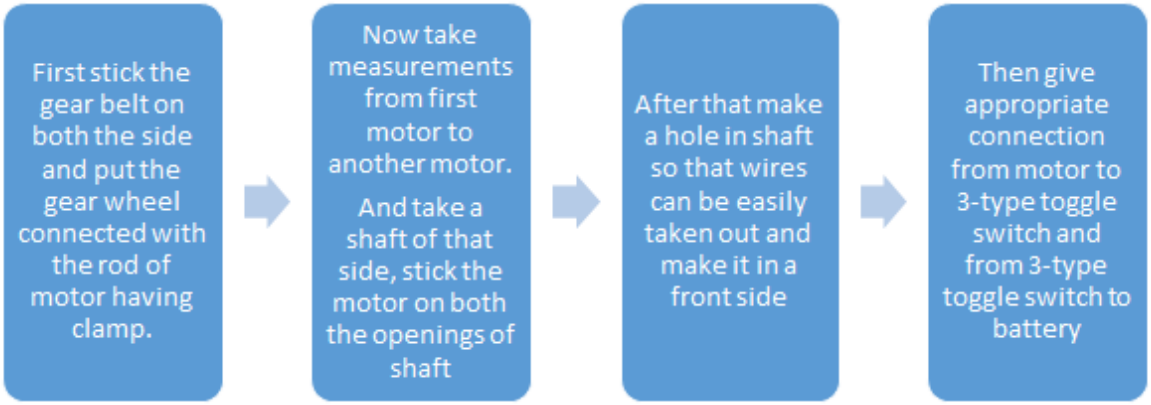


Figure 12: Gear Belt with Gear Wheel
(Rack and Pinion Motion)

IV. PROCEDURE AND METHODOLOGY



- First stick the gear belts of appropriate size on both the sides of the board.
- Then put a gear wheel over both the gear belts of appropriate size.
- Now take an appropriate DC motor having a clamp fitted with the rod of motor.
- Now connect that rod of motor with gear wheel and that clamp will be fitted in little space between the gear belt and board.
- Now, after that measure the distance between the motors, make sure that measurement has been taken from the rod of 1st motor to the rod of 2nd motor.
- Now take the PVC pipe of the same diameter as of the motor, so that the motor can be easily fitted in the opening on both the side of the PVC pipe.
- After sticking both the motor on both the opening of PVC pipe, make a hole in the pipe so that the wires of motor can be taken out easily.
- Now take out wires through the hole and roll the sponge on PVC pipe and stick it with Sellotape so that it can be remove easily.
- Now give the connection of wires from motor to switch and from switch to battery.

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V. AIM

Our main aim is to make an automated duster which works in just push of switch and erases the board quickly. One of our aim is also to prevent the dust of chalk going here and there. Adding to these, reduce the discomfort and breaking of conceptual linkbetween teachers and students is also one of the aim.

VI. RESULTS AND DISCUSSION

By applying this technology, we are able to erase the board efficiently without wasting our time. The sprinkling of dust is very less as compared to that manual board. The machine erases the whole board which can be very beneficial for maths and science faculty as they have to erase each and every corner of board to plot graphs and writing equation. The board is erased in uniform manner due to which scratches can be prevented. Here are some details that is obtained after applying this machine in practical life:

Table 1: Comparison between Manual and Automated board

Size of the board	Distance travelled by chalk dust in manual board (while erasing)	Distance travelled by chalk dust in automated board (while erasing)	Time require for erasing the manual board	Time require for erasing the automated board
2m 96cm by 1m 28cm	2m 45cm	65cm	15 seconds	6 seconds
2m 68cm by 1m 17cm	2m 50cm	98cm	8 seconds	5 seconds
2m 14cm by 1m 21cm	2m 46cm	82cm	8 seconds	8 seconds
2m 72cm by 1m 17cm	2m 49cm	44cm	9 seconds	9 seconds
2m 68cm by 1m 17cm	2m 15cm	53cm	12 seconds	7 seconds

While going through certain researches we found that chalk dust spread more in erasing as compared to writing. The information for the same is given in the chart below:

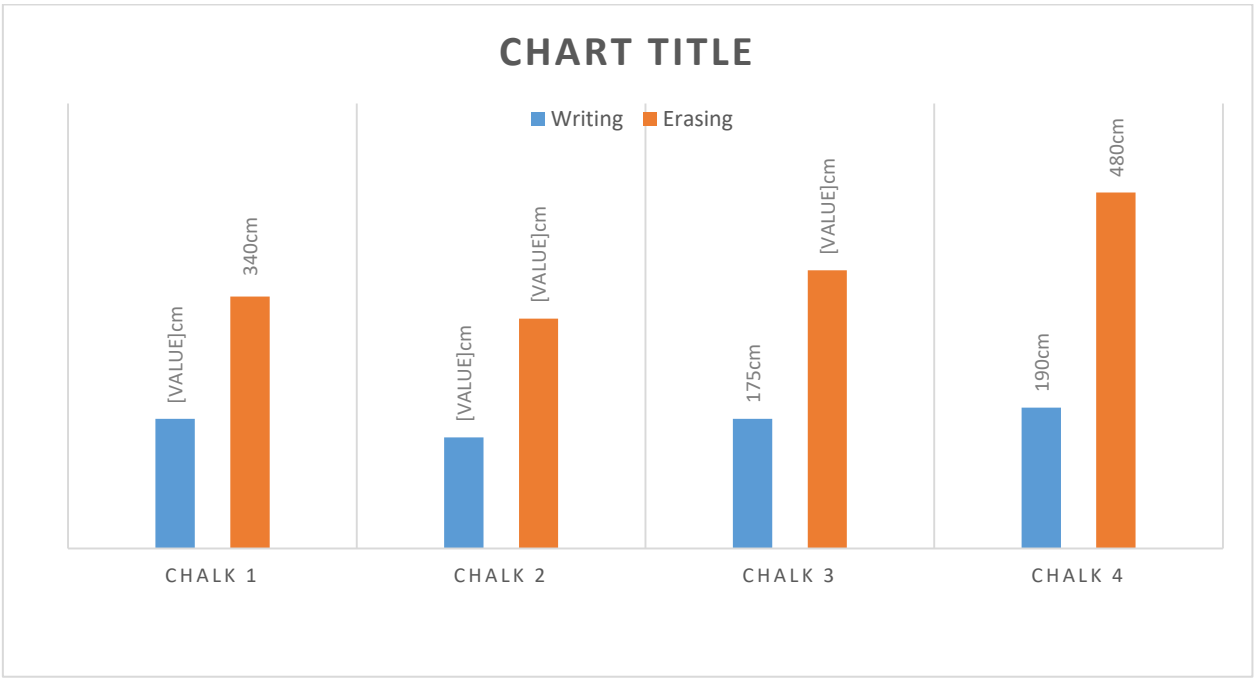

Figure 13: Comparison between spreading of chalk dust while writing and erasing

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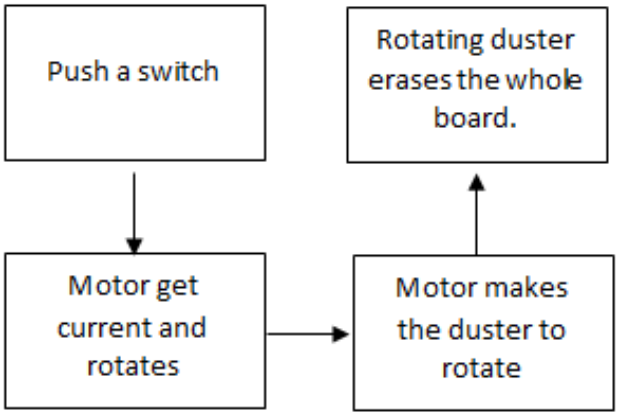
VII. WORKING



VIII. RACK AND PINION

Rack and Pinion was invented by Arthur Ernest Bishop in 1870s. A Rack and Pinion is a type of linear actuator that comprises a circular gear engaging a linear gear. Together, they convert rotational motion into linear motion. Rotating the pinion causes the rack to be driven in a line. Conversely, moving the rack linearly will cause the pinion to rotate. A rack and pinion drive can use both straight and helical gears

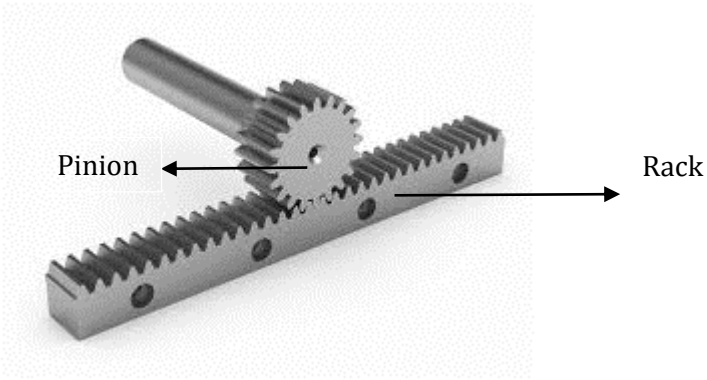


Figure 14: Rack and Pinion

IX. ADVANTAGES

- The machine reduces the manual work of teacher and also saves the time of teachers.
- The machine also prevents the spreading of the dust and erases the board in a uniform manner which prevents the scratches in the board.
- As the duster is stick on gear belt and sponge cannot be removed, no one can steal this machine duster.

X. CONCLUSION

After trying this machine, we found that the board can be erased easily and effortlessly without wasting time and efforts of the teachers by this automatic board duster. We can apply this machine in any of the bigger board by just enlarging the length of the gear belts.

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