

“DESIGN AND DEVELOPMENT OF DUSTLESS DUSTER”

Sanjaykumar Keche¹, Jarina Shaikh², Audumber Pawal³

Under Graduate Student, S.M.S.M.P.I.T.R.AKLUIJ.

Mr. Amit A. Jadhav⁴

⁴Assistant Professor, S.M.S.M.P.I.T.R.AKLUIJ.

Abstract: The traditional duster eraser chalk dust is a common problem. It is generally known that erasers for cleaning the black boards in school rooms soon become saturated with chalk dust and have to be cleaned. In the past, this has usually been done by clapping the erasers together. In short, swallowing a piece of white chalkboard chalk won't kill a person, but breathing in the dust for a number of years can create or trigger respiratory problems. Therefore, it is necessary to have the provision for cleaning of the duster eraser and also the provision for collecting the dust so that it cannot permit to fly in the atmosphere for health problem. For this reason, the design is based on the traditional duster-eraser for cleaning the blackboard duster with the help of the driver wheel. Roller will run the driver wheel. Thus roller clean the blackboard and wiper remove the chalk dust on roller. Thus dust collect in dust tank.

Keywords - Duster eraser roller, gear mechanism, adjustable wiper, dust collecting tank etc.

1. INTRODUCTION

From the time when the concept of classroom teaching came into existence Blackboard chalk and duster eraser is its integral part. With the passage of time Blackboard were replaced by green boards but no alternative of chalk and duster eraser were found. Even in this age of mechanization and automation and advanced electronics, they are not being replaced even in the developed countries like United States and United Kingdom. These days we are using projectors in the class rooms but till today no such a device has been made which has the ease and the simplicity of the blackboard and chalk. Writing on the board is very easy job and erasing is still easier one the main problem arises when the task of cleaning the duster eraser comes. After quite some time the duster eraser becomes saturated and it doesn't clean the black board efficiently.

Then it needs cleaning. Cleaning the duster eraser is very simple job just rub it or bangs it against the wall, similar to rug beating, and most of the dust falls off. Generally the teacher needs to clean the blackboard while he is teaching.

Hence looking at the above disadvantages, we design modern dustless duster. It is System works on rolling process for cleaning the blackboard, in that when duster moving condition wheel are contact with black board surface, wheel roll on black board surface, this rolling motion transmit to the wheel shaft to driver gear. This driver gear run the driven gear, the driven gear mounted on a roller shaft, so roller brush erase & clean the black board surface. The chalk dust attach on rolling brush & comes to contact in wiper, wiper remove dust on rolling brush & this dust collecting in dust tank.

2. METHODOLOGY:

In our discussion Design and development of dustless duster following process we follow them.

i. Selection of material:

Firstly we discuss rolling brush material, body frame material & gear mechanism. Choose cotton brush material & acrylic sheet material for frame.

ii. Design:

Design and development of dustless duster for making design on CATIA drawing with all correct dimension

iii. Manufacturing:

Design and development of dustless duster for manufacturing, making internal drill & taper on drilling machine for fitting body & rolling brush. Also take cutting plate for body & collecting tank of acrylic material, also make adjustable wiper.

After that make different size drill on acrylic sheet for fitting roller brush, rod and gear mechanism. Then make two equal size of bush for fitting purpose.

iv. Assembly:

Then lastly assembly of component & fitting of design and development of dustless duster. After that complete of assembly take testing on dustless duster. Then it comparison of domestic duster & design and development of dustless duster.

v. Conclusion:

Finally make conclusion on its working efficiency, advantage, all over available of different duster, domestic duster and effectiveness.

3. DESIGN:

Mechanical design phase is very important from the view of designer as whole success of the project depends on the correct design analysis of the problem. Many preliminary alternatives are eliminated during this phase Designer should have adequate knowledge about physical properties of material, loads stresses, deformation, and failure. Theories and wear analysis. He should identify the external and internal force acting on the machine parts.

Selection of factors of safety to find working or design stress is another important step in design of working dimensions of machine elements. The corrections in the theoretical stress value are to be made according in the kinds of loads, shape of parts & service requirements.

3.1 Design component:

i. Wheel -

The wheel is made by aluminum material & cover by rubber. Wheel diameter = 38mm, weight of wheel = 40 gram. Thickness = 5mm, internal diameter = 2mm

ii. Gear –

We choose the material mild steel. There have a two gear driver & driven gear.

Driver gear- no of teeth = 47, diameter = 25mm,

Module = $D/Z = 0.5319$

Driven gear – no of teeth = 30, diameter = 10mm.

Module = $D/Z = 0.333$

Gear ratio = 1.567

iii. Wiper –

It is mild steel material. Having length = 200, width = 20mm, thickness = 1mm

iv. Rolling brush –

Material – cotton, diameter – 38mm, length = 200mm.

$$\text{Friction (f)} = \mu * R_n$$

$$= 0.768 * 5 = 3.84$$

v. Body casing –

Material- acrylic sheet

Total weight of duster = 1 kg

$$\text{Force (F)} = W * g$$

$$F = 9.81 \text{ N}$$

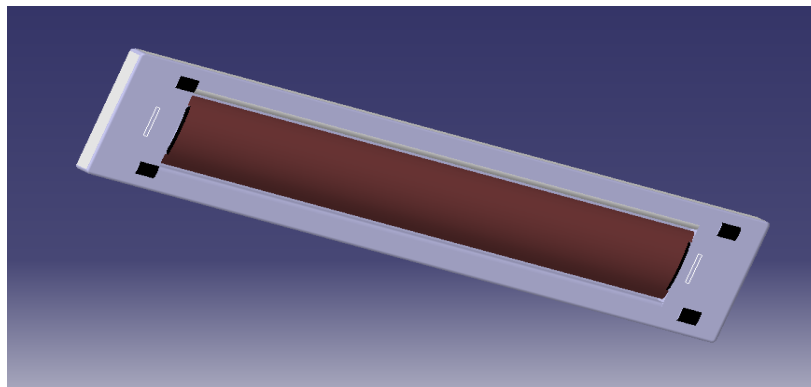


Fig.1 CATIA drawing of Bottom view of dustless duster.

4. Manufacturing of Dustless Duster**i. Manufacturing of fitting rod:**

The fitting rod easily available in market, so it purchases .we select material mild steel having size 6mm diameter. By using vertical drill machine both ends of fitting rod drills with 2.50 mm drill and 3 mm taper.

ii. Manufacturing the brush rod:

We take 6 mm solid mild steel rod. The both ends of solid rod reduce the diameter from 6 mm to 2mm for the length of both side 8mm, by using the lathe machine. The total length of brush rod is 116mm.

iii. Manufacturing of bush:

We take the two solid rod having 6mm diameter and 6mm length. This solid rod mounted on drill machine and internally drill for 2mm on both solid rod.

iv. Manufacturing the gear:

As we discussed earlier that we are selecting mild steel material for the spur gear .The standard size spur gear is already in market so we purchases. Power transmitted done by the spur gear. They have a two spur gear i.e. driven and driver gear. Number of teeth of driven gear is 47 and diameter is 25 mm. number of teeth of driver gear is 30 and diameter 10 mm.

v. Manufacturing the wiper:

For the purpose of removing the dust particles on the brush, we manufacture the adjustable wiper. Make two bush with 6mm internal diameter and attach to the wiper plate by using welding process .this wiper

plate mounted on 6mm fitting rod with adjusted screw. It is mild steel material. The wiper plate is 1 mm thick, 100 mm length, and 20 mm height.

vi. Manufacturing the body frame:

As we discussed earlier that are we selecting acrylic sheet material for the fabrication of the frame as its earlier available Acrylic is a transparent plastic material with outstanding strength, stiffness, and optical clarity. Acrylic sheet is easy to fabricate, bonds well with adhesives and solvents, and is easy to thermoform. It has superior weathering properties compared to many other transparent plastics.

vii. For the meshing gear and brush:

The acrylic sheet material cuts by hand cutter machine in four equal size plates having dimension 70mm length, 50 mm height with thickness 5mm. as we discussed we measure the clearance between brush and ground surface. We drill on two acrylic plate having drill 6mm. the bush is fit on 6mm drill hole. We know that the bush integral diameter is 2mm. brush is fit on internal diameter of bush as 2mm. Then small spur gear mounted on brush rod on both side and attach to large gear.

viii. Manufacturing the wheel:

The wheel is made by aluminum material with help of lathe machine and cover by rubber. Wheel diameter is 38mm. Thickness is 5mm, internal diameter is 2mm.

ix. For the collecting tank:

The acrylic sheet cuts by hand cutter machine. cutting dimension of acrylic plate is 100 mm length.

5. Working:

To increase rolling speed with help of driver wheel or gear. Motion transmit of driver gear to driven gear and then driven gear transmit motion to rolling. There are different teeth of gear used in mechanism, so with help of this mechanism we increased the speed of the roller. The chalk dust stuck on rolling brush comes to contact in wiper, wiper removes dust on rolling brush & this dust is collected in dust tank.



Fig: 2 Actual project bottom side view

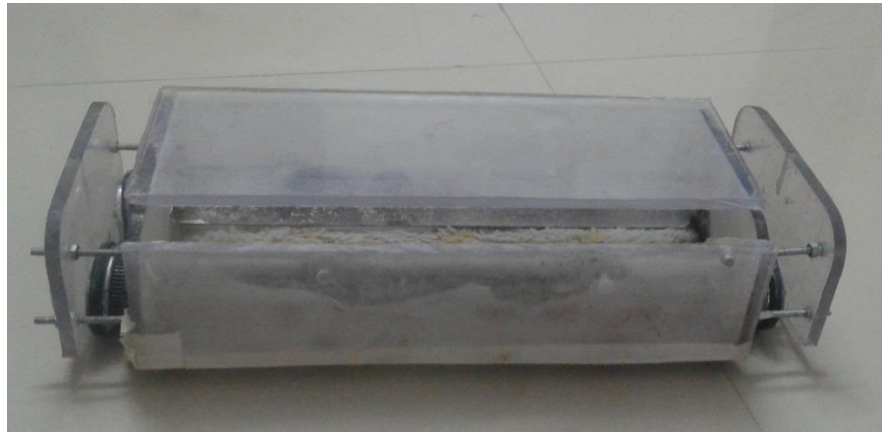


Fig: 3 Actual dustless duster.

4. Conclusion:

Dustless duster erasing mechanisms have been studied and implemented for erasing the blackboard. This designed duster device will be of great help to the teachers, this duster mechanism cleans the dust from the blackboard. Collect the chalk dust which was getting into the class room atmosphere and causing suffocation to the people. Duster cleans the dust more effectively and efficiently. The duster gives the basic idea for selecting duster material.

5. References:

1. K Pavan Prabhakar, H N Vignesh, 'Design and fabrication of vacuum operated chalk dust collector', international journal of scientific & engineering research volume 09, issue 05, may-2018
2. Dr. N.P. Mungle, Siddhant Shambharkar, Sumit Ramteke, 'Eco-friendly duster cleaning machine' international research journal of engineering and technology (IRJET) volume 04, Mar-2017
3. Mr. Sunil R. Kewate, Mr. Vivek R. Gandhewar, 'Development of intelligent type design to escape the chalk dust from the duster eraser used for classroom blackboard in schools/colleges', IOSR journal of mechanical and civil engineering (IOSR-JMCE)
4. Mr. Amit Tiwari "Design and fabrication of automatic blackboard duster" international journal of emerging technology and innovative engineering volume I, issue 02, Feb 2015
5. S. Joshibaamali, K.Geetha Priya. 'Automatic duster machine'. International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE). 2015.
6. Ren, Z. G. (2002). Chalk dust on the health hazards of teachers (in Chinese). Chinese Journal of School Health, 2, 189