Design and Fabrication of Compact Shoe Sole Cleaning Machine

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Abstract: In this research paper, we have focused on different processes and techniques for shoe sole cleaning. This paper consist of literature that propose and suggest to style a shoe sole cleaning machine, incorporating disinfection facility with quality cleaning. As all the professionals require to wear clean shoes before entering their workplaces and offices, in order to maintain discipline and cleanliness. Moreover special places like laboratories have highly precise instruments, sensors etc. and also the air inside should be very clean so the entry person should obey the law of cleanliness. The processes for shoe sole cleaning with disinfection treatment is meant, considering all the parameters with relevancy customer need in terms portability and also the process should be economically available to them, thus providing this research paper with implementation of engineered, designed and fabricated compact shoe sole cleaning machine.

Index Terms **– Shoe sole, sole cleaning, nylon brushes, UV light, disinfection.**

I. INTRODUCTION

There is a famous proverb "Cleanliness is next to godliness". The machine which we have got designed and fabricated implicates this, called as "Compact Shoe Sole Cleaner with Disinfection Machine", here the shoes sole is cleaned in much less time with no effort. Most of the industries, hospitals and academic institutions having the foremost preserved laboratories like computer labs, instrumentation labs operational theatre and various production, assembly sites in chemical, pharmaceutical industries etc., must be free from dust and dirt which could be carried through the shoe of the workers to the work area, causing untidy environment and also sometimes hazardous to the working environment.

As prime importance given to the shoe selection nowadays, its maintenance is additionally being taken care and in some regions or areas tidy environment is preferred, hence cleaning of shoe, upper and lower an element of it and also to possess an elegant look to the human, polishing of the shoe is very important, considering of those factors wide array of machines for shoe sole cleaning machine and disinfection machine has been evolved from the earlier centuries and also the research introduces a spread of concepts of the merchandise and helps in selecting an improved model for shoe sole cleaning machine.

1.1 Types of Condition for Getting Sole Dusty

Shoes are Perfect Breeding Ground for Bacteria

Your shoes are an ideal home for harmful bacteria and other viruses to thrive. In line with some researchers, a shoe may contain approximately 400,000 bacteria. The plant matter and soil that your shoes devour provide these microorganisms a perfect place to grow and result in variety of health problems.

Fig. 1. Bacteria Affected Shoes

Shoes Easily Pick Up Toxins

Shoes can easily acquire toxins, which are transferred to your home and cause health problems. Whether or not you practice grass, there are chances that your shoes are covered with lawn fertilizer or weed killer. Additionally, your shoes also devour chemicals from the tar used on roads. Once you don't clean your shoes, the chemicals spread within the indoor environment and result in variety of health problems.

Fig. 2. Toxin Affected Shoes

Sole Grips Easily Pick Up Mud and Dirt

When you run or walk, the grips under the sole comes into direct contact with the land surface. This causes dirt particles to adhere in between the gaps of the designed gripes under the sole. Adhered mud contains numerous microorganisms which is unhygienic.

Fig. 3. Mud and Dirt Affected Shoes

1.2 Methods of Cleaning Sole

Table 01: Methods of Sole Cleaning

Sr. No.	Method	Description
1.	Rubbing the sole on floor mat 	This process of sole cleaning is done manually. This is the most economical process. The quality of sole cleaning is moderate.
2.	Washing in water 	In this process, cleaning is carried out manually using water. Water is wasted in this process. This is an economical process of sole cleaning. The quality of sole cleaning is good.
3.	Washing in detergents 	In this process, cleaning is carried out manually using detergent water. Water is wasted in this process. This is also an economical process of sole cleaning. The quality of sole cleaning is better.
5.	Using Sole Cleaners 	In this process, cleaning is carried out mechanically using electric power. Electricity is consumed in this process. This can be an economical process of sole cleaning. The quality of sole cleaning is better than the rest processes. Cleaning equipment used for this process are costly and less time consuming.

1.3 Limitations of Shoe Sole Cleaning

- Rubbing the sole on floor mat isn't enough effective in 100% cleaning of sole. Mud stocked in between the gaps of the grips aren't cleaned using this method.
- After washing in water it is very necessary to leave the shoes for drying. This is very time consuming process.
- Washing in detergents can affect the quality of material of shoes.
- Brushing may tear the material of the shoes.

II. Component Selection

The major parts of 'Sole Cleaner' are described below:

(1) Nylon brush	(2) DC motor	(3) UV light
(4) Toothed V belt	(5) Ball bearing	(6) Pulley
(7) Shaft	(7) Channel	(8) Steel plate

2.1 Component Technical Specifications:

2.1.1. SPECIFICATION OF NYLON ROLLER BRUSH

- Material – Nylon
- Roller length – 1 feet
- Bristle length – 25 mm(from surface)
- Internal Diameter – 25 mm
- Outer Diameter – 45 mm

2.1.2. SPECIFICATION OF STEEL PLATE

- Material – Hardened steel
- Thickness – 5 mm
- Cross-section – 400×400 mm²

2.1.3. SPECIFIATION OF BALL BEARING

- Material - Cast Iron
- Housing Type - Rhombus Flange
- Bore diameter – 20 mm
- Temperature Limit – 300 °F
- Hardness (HRC) – 58

2.1.4. SPECIFICATION OF SHAFT

- Material – Mild Steel
- Length - 500 mm
- Diameter – 20mm(machined)

2.1.5. SPECIFICATION OF UV TUBE LIGHT

- Length – 302.5 mm
- Diameter – 16mm
- Use Life – 11000hrs
- Application – Disinfection
- Lamp Wattage – 8W
- Lamp Voltage – 56 V
- Lamp Current – 0.15A
- Mercury Content – 4.4mg
- UV Radiation – 2.4W

2.1.6. SPECIFICATION OF DC MOTOR

- Model – DC Series Motor
- Make – Tachometric Controls
- Power – 1/6HP
- RPM – 1500 RPM
- Armature Voltage – 220V
- Armature Current – 0.6A
- Field Voltage – 220V

III. DESIGN

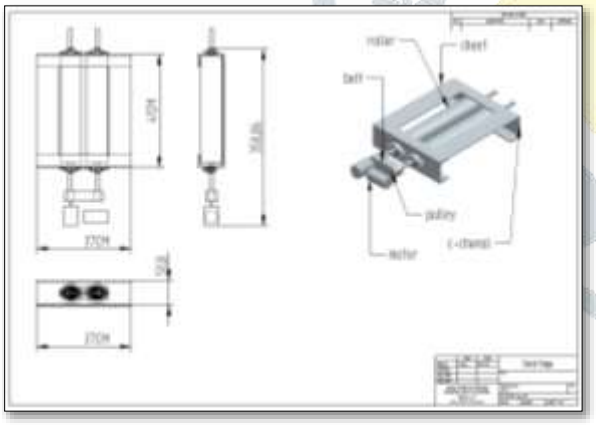

Fig. 4. Final 2D & 3D Design of Machine

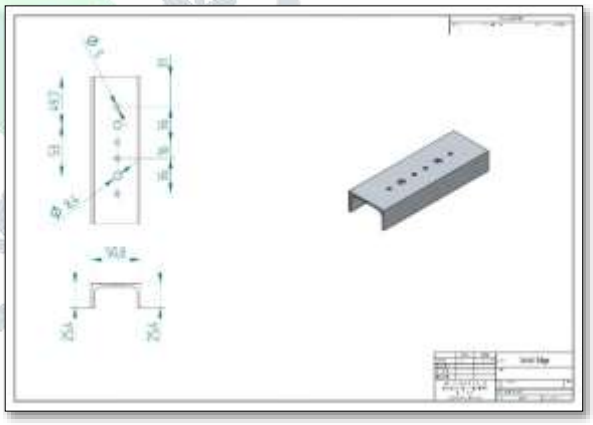

Fig. 5. 2D & 3D Design of Steel Channel

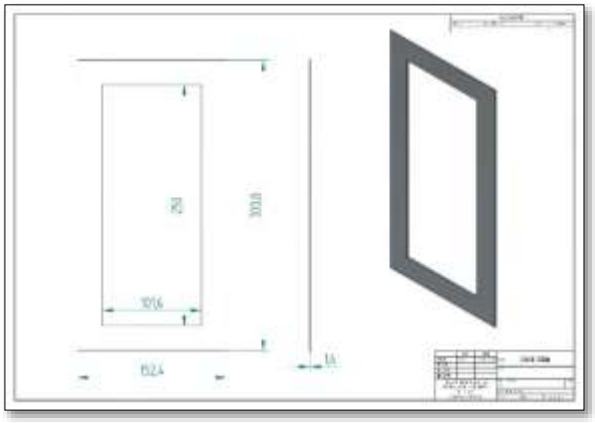

Fig. 6. 2D & 3D Design of Steel Plate

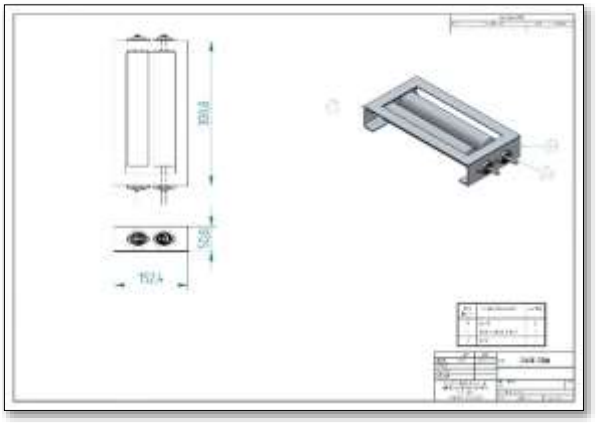

Fig. 7. 2D & 3D Design of Nylon Brush

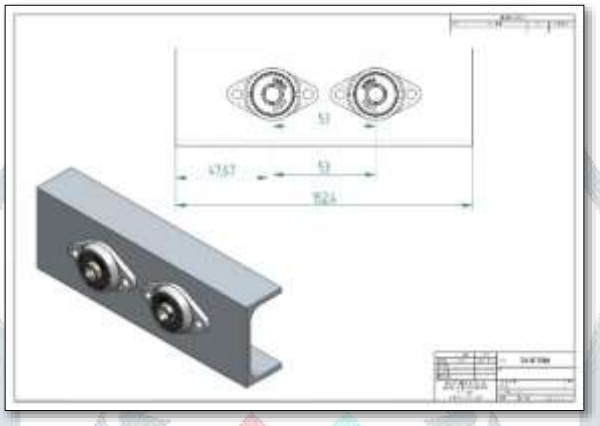

Fig. 8. 2D & 3D Design of Ball Bearing

IV. IMPLEMENTATION OF FABRICATION

4.1 Equipment Functioning

The experimental setup consists of 2 nylon brushes. The nylon brushes square measure given drive by victimization motor pulley-block setup; the pulley-block is connected with motor victimization the toothed v-belt. The ball bearings used helps to allow even rotation from motor to the brushes. The entire setup is carried by the channels, the plate on the channels provides the area to square thereon. The lightweight ultraviolet tube light base is mounted at all-time low of the channels.

4.2 Process of Fabrication

Table 02: Process of Fabrication

Sr. No.	Process of Fabrication	Description
1.	Step 1: Marking on raw material.	

2.	Step 2: Cutting of marked raw material by hand hacksaw cutter.	
3.	Step 3: Developing of frame structure by using electric arc Welding.	
4.	Step 4: Grinding on welded part for surface finishing.	
5.	Step 5: Drilling in frame structure by using hand drill.	
6.	Step 6: Assembling of parts to unite the final research.	
7.	Step 7: Inspection of final research model by using measuring equipment.	

4.3 Process Chart

Table 03: Process Chart

Sr. No.	Component Name	Material	Tool Used	Machines Used	Process	Instrument Used
1.	Shaft	MS	Turning Tool	Lathe	Turning, Facing	Vernier Calliper
2.	Plate	MS	Cutting Tool, Grinding Tool	Hacksaw Cutter, Grinding Machine	Cutting, Grinding	Measuring Tape
3.	Channel	CI	Cutting Tool, Drilling Tool, Grinding Tool	Hacksaw Cutter, Drill, Grinding Machine	Cutting, Drill, Grinding Machine	Vernier Calliper, Measuring Tape

V. TESTING AND RESULT

5.1 Testing Procedure

When a person come and stand on the system, the system will start the roller which will generate friction between sole of shoes and roller brush. Due to friction, the dust particles which have low bonding with the sole of shoes will get removed.

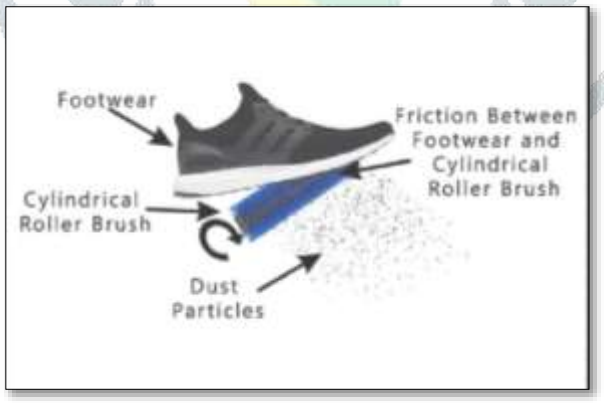

Fig. 9. Testing Procedure

Table 04: Testing Parameters

Sr. No.	Measuring Equipment	Parameter
1.	Measuring Tape	Sole Size (cm)
2.	Stopwatch	Time (sec.)
3.	--	Cleaning Quality

5.2 Steps Followed during Testing of Sole Cleaning Machine

Step 1: Switched ON the machine.

Step 2: Measured size of the sole using measuring tape.

Step 3: Measured duration of sole cleaned.

Step 4: Inspection of sole cleaned quality.

Fig. 10. Step 1

Fig. 11. Step 2

Fig. 12. Step 3

Fig. 13. Step 4

5.3 Result

Table 05: Result

	Manual	Sole Cleaner	Remark
Cleaned Quality	Moderate	Better	Circular rotating nylon brush are more effective.
Time Taken	600 sec + drying time*	120 sec	Machine cleaning better than manual.
Power Consumption / Cost	NA	Moderate	Cost consumption is worth.

5.4 Final Compact Shoe Sole Cleaner after Assembling Components

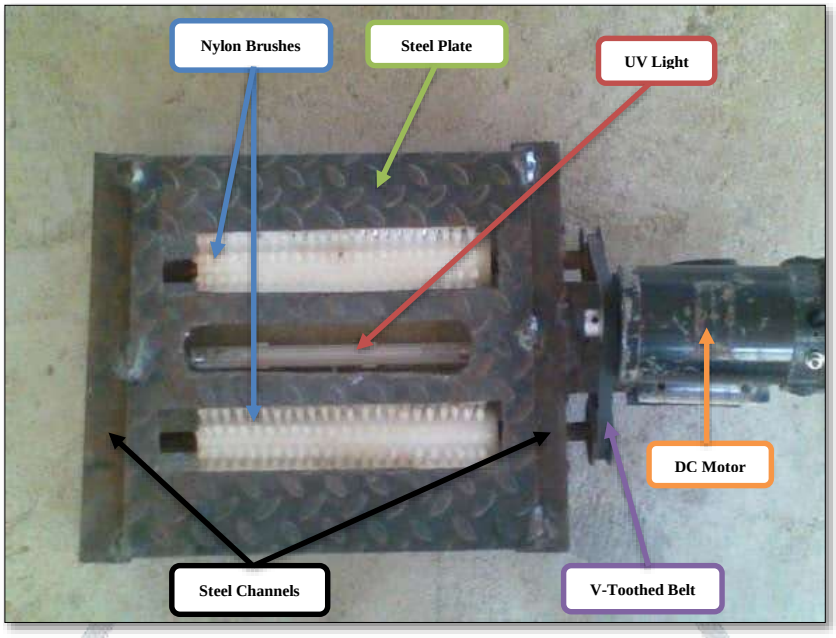

Fig. 14. Final Compact Shoe Sole Cleaner

5.5 Technical Specifications

Parameter	Specification
Material:	Mild Steel
Dimension(mm):	370 x 410 x 70 mm
Clean Zone(mm):	210 x 240 mm
Operation:	Electrical
Voltage:	220V/50Hz
Brush Rotate Speed:	100 RPM
Start Mode:	Switch ON/OFF Based

VI. Conclusion

The high-speed rotation of the roller helps in improvement the only real of the shoe effectively and UV tube light connected at very cheap of the only real cleaner helps in removing the bacteria's from the shoe. Thence the Compact Shoe Sole Cleaners square measure extraordinarily helpful in places wherever the mud because of the footwear could be a major drawback. The shoe sole improvement with disinfectant could be a complete got wind of created for improvement the shoe so as to take care of mud free surroundings and conjointly germ-free shoe to grant a sublime look to the shoe yet on the user. Therefore, we are able to conclude from the higher than that the usage of shoe sole improvement machine could be a 'should' for all the industries (chemical, food process etc.) and establishments wherever cleanliness and dirt-free surroundings could be a primary demand.

VII. Acknowledgment

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