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Design And Fabrication of Shoe Dusting Machine

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***Abstract*—Our project aims at safety, simplicity and comfort for human use. This project deals with both, the clipper of our effort and incorporating shoe sole dust cleaning facility with this machine. This project aims on automation of shoe sole dust cleaning without any human intimacy. This project presents a basic as well as very professional treatment of the subject in a very comprehensive, based on learning effort and understanding cap ability and needs of today as per their requirements and levels. This automatic shoe sole dust cleaning machine significantly better than the old methods and process of cleaning the shoe sole. Then the shoes dusting machine is designed by considering all the various variables with respect to customer need in terms of transferable and economically available to them, thus providing dust and dirt free environment. This shoes dusting machine provides touchless usage which reduces the time required for cleaning the shoe dust and is more effective.**

Keywords: - Shoes dusting machine[1], shoe sole dust cleaning[2].

I. INTRODUCTION

Shoes are very important part of our daily life and our wardrobe. Wearing a clean and neat shoes says a lot about a person, and his personality. Some shoes are very high priced generally made from leather and many other exorbitant material which requires extreme care. This shoes dusting machine is the perfect machine to keep your shoe sole clean and neat. This machine automatically removes the dust particles from your shoe sole and keeps the shoes free from dust and dirt. Nowadays many hospitals, large industries, food industries foundries, offices, museums, research centers, educational institute have a preserved and conserved laboratories and many work centers require a clean and dirtfree surrounding. To keep the surroundings clean and neat we require to clean it multiple tones in a day. Due to this reason we have come up with our shoes dusting machine a device that maintains cleanliness and hygiene and we don't need to clean and check it again and again.

According to some research and studies a shoe may contain approximately 4,00,000 bacteria on its role. These bacteria can serve longer on shoe soles. The plant matter, mud and the soil that your shoes carry up leads micro-organisms and germs and ideal places to grow and which results in number of various health problems. This is the main reason why we need to use shoes dusting machine to have a clean surrounding in a commercial organization. As commercial organization are visited by a lot of people, the damages of infection are higher in this area. Vacuuming and mopping are not enough to remove the harmful germs from your office and institute premises.

We can install this shoes dusting machine near the main door or entrances of offices, malls, houses, hotels foundries and various other places. The dust present on the soles of the shoes are cleaned with the help of rotating nylon brushes which are automatically activated by means of human weight. All you need to do in place your shoe on the brush. This device wipe off all the impurities and dirt present on the shoe sole. The highly efficient shoe dust cleaning machine removes dust from the shoe sole and stores in a container.

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II. SYSTEM CONFIGURATION

Components

- Motor
- Shaft
- Bearing
- Limit switch
- Brush
- Bar
- Belt
- Pulley
- Hinges
- Tube Frame
- Spring

1)Dc Motor: - The main function of Dc motors is to transfer electric ions into physical work and as a result of this, the kinetic energy and potential energy will be generated.

2)Shaft: - A shaft which is usually circular in cross section is the rotating element of machine, where it is mainly used to move energy from one place to another

3)Bearing: - A machine element that restrict relative motion to only the desire motion and reduces the rubbing of one surface on thing against another of moving parts is known as Bearing. Bearing are classified broadly upon the type of various operation, motions permitted or to directions on which the load or forces applied.

4)Limit Switch: - The main function of usage of limit which is our project is to detect the presence or absence of an object or person. This limit switch is electrochemical device which are operated by or gets activated by means of a physical force applied to it by an object.

5)Brush: - In our project we are making used of nylon brush to clean the sole of the shoe. Nylon brushes
are appropriate in wide range of applications such as destiny, cleaning and removing contaminants from shoes and for aggressive scrubbing. Basically thin brushes has a very soft whisker that are mainly used for cleaning off any excers dust and dirt from your shoes.

6)Bars: -A straight circular piece of metal that are longer than its width and all used in various applications like as a support, as for a level, a barrier or fastening. This bars are usually rigid piece of metal mainly used for handle or support.

7)Belt: - This belt are usually an arc of flexible materials which are used to connect numerous spinning physically.

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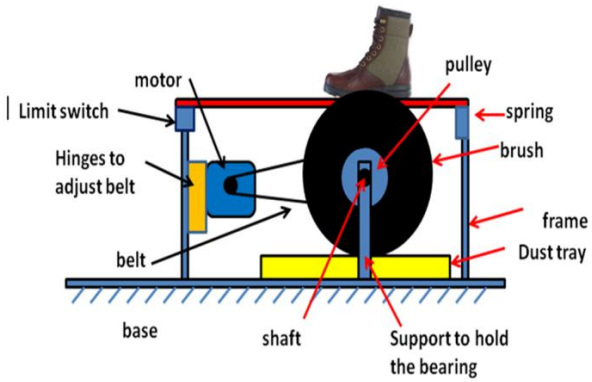
8)Pulley: - A pulley is in the form of a wheel on an axle or shaft that is developed to hold up movement and change of direction of at out cable or belt, or transmit energy between the shaft and cable or belt.

9)Hinges: - A mechanical bearing which is used to connect two solid objects is known as hinges. This hinges typically allows only a restricted angle of rotation between them. Two objects and placed and ideal hinge is connected to it which rotate relative to each other about a fixed axis of rotation.

10)Tubes Frames: - In our project we require different sizes of tube frames. Various tube frames are firmly joined together to make the machine shift exterior.

11)Spring: - A mechanical spring is an elastic or flexible member, a device whose main purpose is to deflect change under the action of load and retrieve, its original position and shape when the load applied is removed. This springs are also used for strong energy.

III. LINE DIAGRAM



IV. METHODOLOGY :

Our model shoe dusting machine works automatically. When we place our shoe bottom over sheet metal surface; the limit switch gets ON automatically. The 12V main supply is provided to DC motor. With the help of belt drive the motor pulley is connected to a main shaft pulley. The RPM of the motor and the length of the pulley is dependent upon spinning of main shaft.

The brush is placed on the rotating shaft. The maximum amount of dirt is removed with the help of brush from the shoe sole. As soon as the dirt is cleaned the person moves forward and the machine gets OFF automatically. The sheet metal comes back to its initial position when the force is removed. It automatically cuts off the main supply when the limit switch gets off.

The dust which is present on the shoe sole is collected in the tray placed below. Once the tray is completely filled with dust, the tray is removed, cleaned and placed again in the same position. This machine is portable and is easy to use

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V. DESIGN AND CALCULATION :

1)Design of member for buckling: -

b=B-t =50-3 =======>b=47mm

d=D-t =25-3 =======>d=22mm

moment of inertia

$I=BD^2-\frac{bd^3}{12}$

$=50*25^3-\frac{47*22^3}{12}$

$I=2.34 \times 10^{-3}m^2$

Buckling load of members

π=3.142

$E=193 \times 10^4$

$I=2.34 \times 10^{-8}m^2$

L=1.2m

$A=216mm^2$

$P_E=\frac{\pi^2 EI}{L^2}$

$P_E=\frac{\pi^2*193*10^9*2.34*10^{-8}}{1.2^2}$

P_E=37.144 KN

critical stress

$\sigma_E=\frac{P_E}{A}=P_E=\frac{\pi^2 E}{(l/K)^2}$

$=\frac{\pi^2*193*10^9}{(l1.2/K)^2}$

σ_E =172MN/m^2

Since the critical stress (σ_E=172MN/m^2) is less than the yield stress (415MN/m^2), therefore the material is safe.

2)Bolt Design:

Standard nominal diameter of bolt is 8mm

Let us calculate the toughness

P=1420 x d N

P=1420 x 8 N

P=11360

Hence, the net force on bolt

P=11360 +500N

P=11860N

As we have used four bolts,

P=11860/4

P=2965N

Also,

$P=\frac{\pi}{4d} \times c^2 \times f_t$

$2965=\frac{\pi}{4}(8 \times (0.84)^2) \times f_t$

f_t=83.59 n/mm^2

It is Safe to use.

3)Design of shaft;

Speed= 75 rpm.

The safe length is 430mm

Maximum bending moment about bearing

BM=300*430 =12900N-mm

Taking power generated to be 0.25Hp=0.18375KW

And torque $T=\frac{P*60}{2*\pi*N}$

$=\frac{183.75*60}{2*\pi*75}$

T=23.397N-m

T=23.397*1000N-m

Equivalent twisting moment

$T_e=(M^2+T^2)^{\frac{1}{2}}$

$=(129000^2+23.397*1000^2)^{\frac{1}{2}}$

T_e=131104.3949N-mm

Taking safe stress f_s=95N/mm^2, for FOS=2

$d^3=\frac{(T*16)}{(3.142*fs)}$

d=19.15mm or 20mm

It is safe to use.

4)Bearing design:

D=20mm

F_a=100N

F_r=250N

N_d=150rpm

Span life=1000hours

Basic static load rating capacity C_{or}=7800N

Basic load rating capacity C_{rc}=14000N

$\frac{Fa}{Cor}=\frac{100}{7800}$ =0.01282

K_t=1 from table 24.29 for minor shock load application factor k_a=1.5

Therefore, $F_e=F_r$ x K_a x K_t

=250 x 1 x 1.5

=375

Dynamic load rating $Cr=F_e\{(\frac{Ld}{Lr})(\frac{Nd}{Nr})\}^{1/m}$

$14000=375\{(\frac{Ld}{500})(\frac{150}{33.33})\}^{1/3}$

Ld=1605.98 hrs

It is Safe to use.

5)DC motor:

The motor of 12 volts and 50 watts power is been used.

Since the motor of 50 watts and from battery it requires the power of 50 watts hence the battery can deliver the power to the motor if it charged completely for 90 mins approximately to rotates the motor.

Motor speed N=75-76rpm

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Power=50 watts

P= $\frac{2\pi NT}{60}$

T=$\frac{P*60}{2\pi N}$ =$\frac{50*60}{2*\pi*76}$

T=6.282 N-m or T=6.282 x 10^3N-m

The material being used for the shaft is mild steel.

Yield stress σ_y= 380 Mpa for MS material.

Shear stress f_s=$\frac{\sigma y}{2*FOS}$=$\frac{380}{2*2}$

F_s=95 Mpa

$\frac{T}{J}=\frac{G\theta}{L}=\frac{fs}{R}$ =====>$\frac{T}{J}=\frac{G\theta}{L}=\frac{\tau}{r}$

f_s=$\frac{Tc}{J}$ =$\frac{16T}{\pi d^3}$ for solid shaft

T= (π/16)*f_s*d^3

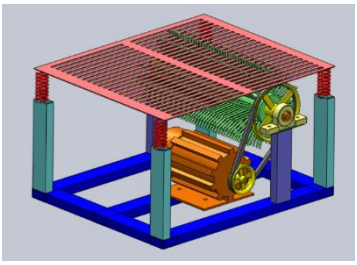
6.282 x 10^3 = (π/16)*95*d^3

$\frac{6.282\ x\ 10^3}{18.6532}$=$d^3$

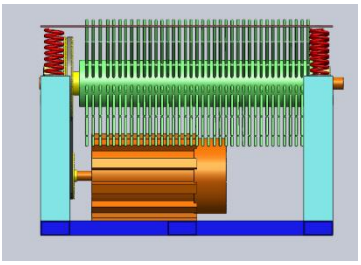
d3=336.775

d=6.9574mm

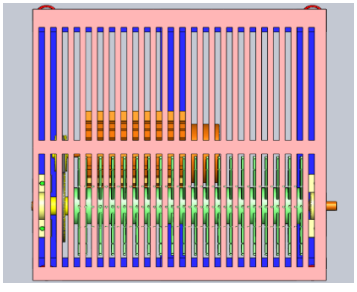
d=18mm --------> from table 3.5(a) standard shaft size in mm for motor hence the design of motor shaft is safe.

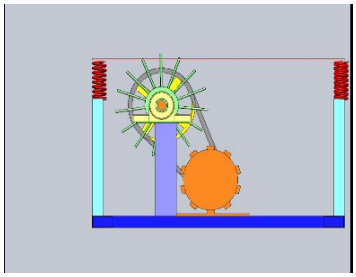


VI. SOLID DIAGRAM



Assembly back view





Top view side view

VII.CONCLUSIONS :

As we had visited Foundry industry, we noticed that lot of workers are carrying the dust on their shoes while entering the administration sector. Due to this many workers are facing the health issues and organization surrounding is getting dirty. So we have came up with this idea of making shoe dusting machine.

After the project has been completed ,we have succeeded as per our requirements and we have also implemented this project at our college premises in order to avoid the dust particles entering the college premises.

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