Abstract

Cleaning is a basic service occupation conducted by many worldwide researchers, manufacturers. Designers should work with user groups to improve equipment to ensure good musculo skeletal health, working posture and technique. Cleaning managers, trainers and purchasers should be aware of ergonomic guidelines for equipment selection for safe use at work. Today, great deal of research and effort to unravel the mystery surrounding the subject of deodorizing has been expended, and this model proposes to serve as an overview for professional cleaning and restoration technicians who desire more precise knowledge in this highly specialized field. Feet dust removal and deodorizing machine is developed which follows the engineering rules in designing and provides an insight to the cleaning equipments that are existing. The roller shafts mounted on the primary shaft rotates and the rest is driven through chain drive mechanism. A vacuum pump sucks out all the filth air and a blower blows a stream of fresh air along with the deodorizer. Microcontroller 8051 controls the timing and the relay of process. It is simple and compact in ergonomics which makes it all the more easily to operate and maintain technically. This project also aims at creating a clean and hygienic environment and thus avoids health inequalities and safety concerns with regards to workers as well as common people.
1. Introduction
This project is carried out with a view of designing and developing a working model of a machine that is actuated when the foot is placed on the platform and the rollers with brushes rotate to remove the dust from the feet. It can also be used in various platforms where it could be practically used eventually creating a more hygienic environment and becomes a part of our daily health care. In order to ensure health inequalities are not experienced at work these individual and psychosocial issues should be considered in the design of equipment, training in its use. Foot dust cleaning machine is very much useful in hospitals, houses, auditorium, shops, computer centres etc; it is very simple in construction and easy to operate. Anybody can operate this machine easily. It consists of large number of brush and this brush is used to clean the foot dust. Hence it is very useful in hospitals, houses, etc. The time taken for cleaning is very less and the cost is also very less. Maintenance cost is less. There are several numbers of foot dust cleaning machine and are working under different principles and the cost is also very high.

![Figure 1: Roller bearing mechanism](image)

2. Material Selection
Next was the selection of suitable material for the model. It was important to make the model sturdy, yet light. After comparison and discussion it was finalized to use mild steel material for shafts, frame and enclosure. Mild steel is easily available in the required dimension and is also not expensive. One main advantage of using mild steel is that it is easy to fabricate with it as welding of mild steel is by arc welding process which is cheap compared to other welding methods. Use of other materials like alloys of aluminium was not selected as the availability is less and also the fabrication cost is high.

**Chemical composition**
- Carbon 0.16-0.18%
- Silicon 0.40% max
- Manganese 0.70-0.90%
- Sulphur 0.040% Max
- Phosphorus 0.040% Max

The roller brush bristles are made out of nylon, and are mounted on mild steel shafts. The Nylon brushes are used for the cleaning many surfaces, included stainless steel, plastic, wood, and human skin. The brushes in use have no impact on the environment as they do not have any harsh
chemicals in them that can result in a runoff, either into the water systems. These brushes are also very durable. This material also does not disintegrate rapidly, lasting for a longer time.

3. Design

The model of the foot dust removal & deodorizing machine consists of simple components & a feasible mechanism. An outer chamber made out of mild steel houses the working components and provides an enclosure for an effective deodorizing. The motor, air blower & the vacuum pump are all placed over the chamber. An AC motor coupled to the shaft drives the roller brush. This becomes the primary shaft which drives other shafts through belt drive mechanism. Three rollers below and one above the foot rotate altogether with the help of chain drive. The sprayer or deodorizer is placed in front of the nozzle of air blower so that a stream of air carries the deodorizer along with it. A vent is provided at the sides of the chamber for the vacuum manifold for the vacuum pump to suck in all the impure air. The whole sequence of operations is controlled by a microcontroller 8051. A chamber of dimensions 20"*12"*18" made out of Mild Steel which houses three rollers of 50mm diameter is mounted on independent shafts. An AC motor of 220V, 1440 rpm which runs one of the shafts. The other shafts are Chain driven from the main shaft. Three roller brushes below & one above to support the feet, Vacuum pump of 1600rpm that sucks out impure air and dust.

![Figure 2: CAD model of the machine](image_url)

4. Fabrication

Initially a four legged frame of mild steel of dimensions 12"*30" was constructed to take up the weight and support the entire model and accommodate the fixture of blower, vacuum pump and a sprayer. Four shafts were independently mounted on the ball bearings which were in turn welded to the frame. Nylon roller brushes were mounted on the shafts to provide the cleaning action. Using mild steel metal sheets an enclosure was fabricated around the rollers. The sheet metals were provided with two vents for blower and vacuum. A circuit board was built for the micro controller to control the sequence of operations through relay circuits.
5. Working

The working of the model is semi-automated. Once the foot is placed over the given platform between the rollers, the motor is actuated by a Push-start button rotating at around 500-600rpm. The roller mounted on the main motor shaft becomes the primary shaft. From the primary roller the other rollers are chain driven. These set of rollers brush off the dust for 15secs thus removing any impure particles from most parts of the feet. After the rollers have dusted off, the impure air is sucked out from the chamber creating a partial vacuum inside. This stage of operations not only removes the dust particles but also sucks out all the impure and filth air which is the sole reason for any filthy odour. The impure air suction and dust removal processes happen in tandem. The air not only sucks out the dust & stench from the feet but also from the rollers. The final stage of operation is the blowing of fresh air using the motor driven fan. Along with this stream of air, the sprayer or the deodorizer is actuated that deodorizes the feet and the rollers as well. The whole sequence of operations lasts for about 30 seconds. The brushes keep rolling throughout the stages. A microcontroller controls the sequence of operations at the right time.

6. Conclusions

Given the demographics of the cleaning workforce and the amount of time the equipment was used on a daily basis, it is important to ensure the equipment design is safe and suitable for all users and that appropriate equipment is selected to meet the needs of a particular workforce. The machine
shows some of the following conclusions: Tasks performed- the task or the function of each component in the model was successfully carried out, effective dust removal & deodorizing- the main aim of this project was to eradicate any kind of dust particles & filth causing bacteria, which has been successfully done, machine maintenance & handling- both these actions are quite feasible as the design is simple yet effective.

References
[5] Welds-Static And Fatigue Strength- Ii