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AUTOMATIC SHOE SOLE CLEANING MACHINE

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ABSTRACT:

The *Automatic Shoe Sole Cleaning Machine* is designed to clean the soles of shoes without requiring human effort. The machine uses rotating brushes and motors to clean the shoe soles, with dirt being collected in a dust tray. It provides an efficient solution to remove dirt and dust from shoe soles, ensuring hygiene and cleanliness in areas with high foot traffic. The project aims to create a simple, automated system that can clean shoe soles quickly and effectively.

1] INTRODUCTION :

Dirty shoes bring dust and mud into homes, offices, and public spaces. Traditional cleaning methods are manual and often not efficient. The *Automatic Shoe Sole Cleaning Machine* solves this by automating the cleaning process. The machine uses rotating brushes that clean the shoe soles when placed in the machine. This makes it a quicker, more hygienic way to keep shoes clean and reduces the need for manual labor.

2] LITERATURE SURVEY :

A *literature survey* involves looking at existing solutions and research related to shoe cleaning machines. Many shoe cleaning machines today use rotating brushes or other mechanisms to clean shoes, but they may require manual control. Some systems use sensors to detect shoes, while others rely on manual activation. This project focuses on a simpler design without sensors, using only motors and brushes to clean the soles automatically. Existing systems for automatic shoe cleaning are usually found in commercial or public spaces, like malls and airports. Most of these systems use rotating brushes and air jets to clean shoes. However, there is a gap in the market for simpler, low-maintenance machines that do not require advanced electronics or sensors, which is why this project focuses on creating a straightforward cleaning system.

3] Block Diagram:

Shoe Sole Cleaning Machine does not include sensors, we can modify the methodology section accordingly, focusing on the mechanical design and the system's manual or automated features without the need for sensor integration. This section outlines the approach and steps followed to design, fabricate, and test the *Shoe Sole Cleaning Machine*. The methodology includes mechanical design, material selection, the construction process, and the operational principles of the machine. The Block Diagram gives a visual representation of the system, detailing the main components involved and how they work together to perform the cleaning task.

Block Diagram Structure:

- *Power Supply*: Powers the motor and cleaning components.
- *Motor/Drive System*: The primary driver for the rotating brushes or other cleaning mechanisms.
- *Cleaning Mechanism*: Includes rotating brushes, scrapers, and any additional components like spray nozzles for cleaning the shoe sole.
- *User Interface*: Provides manual controls such as on/off switches, speed settings, and other adjustments for the cleaning process.
- *Chassis/Frame*: The physical structure supporting all the components.

4] PROBLEM STATEMENTS :

- **Manual Cleaning**: Traditional methods of cleaning shoe soles are time-consuming and inconsistent.
- **Dirt Spread**: Manual cleaning can spread dirt and germs to other surfaces.
- **Inconvenience**: Cleaning shoes by hand is tiring, especially in busy places.

5] PROPOSED SYSTEM MODEL :

1. **Brushes**: These will rotate and scrub the shoe soles when placed inside the machine.
2. **Motor**: The motor will drive the rotation of the brushes and ensure the cleaning process is quick and effective.
3. **Dust Collection Tray**: Dirt from the shoe soles will be collected into a tray, preventing mess and ensuring cleanliness.
4. **Manual Activation**: Instead of sensors, the system will be activated manually by the user when the shoe is placed in the machine.

6] Correction :

Refers to any adjustments made during the design or testing phases. For example, if the machine's brush is not cleaning effectively, the brush design might need to be corrected by making it softer or changing its speed. Another correction might involve adjusting the motor power to ensure the brushes rotate fast enough to clean the shoe sole effectively.

7] COMPONENTS:

1. Motor:

- **Voltage**: 12V DC (Direct Current), meaning it operates with a 12-volt power supply, such as a 12V battery or adapter.
- **Current**: The motor will consume a certain amount of current depending on its load, ranging from 1 to 5A or more for typical small motors. Higher current is required when the motor is under load.
- **Speed**: The motor speed is often measured in RPM (Revolutions Per Minute), with a typical 12V motor running between 1000 to 10,000 RPM, depending on the motor type and design.
- **Torque**: Torque is the turning force, and for a 12V motor, it can vary from a small amount for light applications to higher torque for heavier loads, often measured in Nm **(Newton-meters)**.
- **Type**: Commonly, these motors are either brushed (simpler design) or brushless (more efficient, longer-lasting), with brushed motors being more affordable and easy to use for beginner projects.
- **Size**: Motors come in different sizes, such as small ones (50mm diameter) for lightweight tasks or larger ones (over 100mm diameter) for higher power applications.
- **Efficiency**: The efficiency of the motor, which determines how much energy is converted into useful work versus how much is lost as heat, varies depending on the motor design.

Fig 5.3.1 Motor.

2. Brush:

In your shoe sole cleaning machine, the brushes are one of the most critical components as they will be responsible for physically scrubbing the dirt, debris, and grime off the soles of the shoes. For this application, you'll want to use brushes that are effective in cleaning but gentle enough not to damage the soles or shoes. Typically, rubber bristle brushes are ideal, as they are durable, resistant to wear, and flexible enough to handle various surfaces without causing harm. The bristles should be soft to medium-hard to ensure they clean thoroughly without scratching or hurting the shoe material. The brushes can be mounted on a rotating drum, wheel, or even an oscillating system powered by the 12V motor, allowing them to scrub across the sole efficiently. The rotation speed and pressure applied by the brush are key factors too fast, and the motor could burn out or damage the shoes; too slow, and the cleaning effectiveness might diminish. Additionally, for better results, you might consider incorporating a cleaning solution directly onto the soles, softening the dirt and making the cleaning process more effective. Over time, the brushes will wear down due to the constant friction against the soles, so ensuring easy brush replacement or adjustable tension for longer life is also essential

Fig 5.3.2 Brush

3. Chanel:

In your shoe sole cleaning machine, the channel is a pathway or guide that directs the shoe into the correct position for cleaning. It helps keep the shoe in place while the brushes rotate and scrub the sole. The channel ensures that only the sole comes into contact with the brushes, protecting the rest of the shoe from damage. It makes sure the cleaning is efficient by keeping the shoe aligned with the brushes. This channel can be a simple track or path that either holds the shoe stationary or moves it through the cleaning area.

Fig 5.3.3 Chanel

4. Bearings:

1. **Reducing Friction**: Bearings are used to reduce the friction between the rotating parts (like the motor shaft or brush mechanism) and their supporting structures. By allowing parts to rotate smoothly, bearings help the motor and brushes spin with less effort, preventing wear and overheating.
2. **Support and Stability**: Bearings help stabilize the rotating shafts and brushes, ensuring they stay aligned while spinning. This is important for consistent cleaning and for preventing wobbling or misalignment, which could cause uneven cleaning or damage to the components.
3. **Durability and Longevity**: By reducing friction, bearings help prevent excessive wear on the motor and brush parts. This means that your machine will last longer without needing frequent repairs or replacements.
4. **Placement**: Bearings can be placed in the motor housing to support the motor's rotating shaft and in the brush mechanism to support the brush's rotation. They ensure that the motor's power is efficiently transferred to the rotating brushes while minimizing energy loss.

Fig. Bearing

5. Tray:

- *Purpose*: The tray serves as a collection area where all the dirt, dust, and other debris removed from the shoe soles are gathered. This keeps the cleaning process tidy and prevents the dust from spreading around the machine or the workspace.
- *Positioning*: The tray should be placed directly beneath or around the area where the brushes are cleaning the shoe soles. As the brushes scrub the soles, the dirt and debris will fall off and collect in the tray below. You can design it with a slight slope or angle to encourage debris to slide into the tray.
- *Material*: The tray should be made from durable, easy-to-clean materials, such as *plastic* or *metal*, that can withstand the impact of dirt and cleaning materials. It's also important that the material is non-corrosive, especially if any cleaning solutions are used.
- *Capacity*: The size of the tray should be sufficient to hold a significant amount of debris, so it doesn't need to be emptied too frequently during operation. For small machines, a shallow tray might be enough, while larger machines might need a bigger tray with a higher capacity.
- *Removable or Easy-to-Clean*: To make maintenance easier, the tray should be removable or designed to be easily cleaned. This will allow you to dispose of the collected debris and keep the machine operating efficiently.

Fig 5.3.6 Tray

6. Wire:

- *Motor Connections*: Wires can be used to connect motors that rotate brushes or scrapers. These motors would drive the cleaning mechanism and could be powered by electrical energy.
- *Heated Elements*: If your machine involves any form of heat (such as heated brushes or surfaces to help remove dirt or grime), wires could be used to supply power to heating elements.
- *Power Supply*: Wires are necessary to bring power to all of the machine's components, such as motors, lights, or any other electrical elements.
- *Control Circuitry*: Wires would also connect any control systems (like switches, relays, or microcontrollers if you're using electronics to automate or control the process).
- *Conveying Mechanism*: If your machine involves any sort of belt or conveyor to move the shoes through the cleaning area, wires could be used to power the motors for that system.

Fig 5.3.7 Wire

7. Shaft:

- *Transferring Rotational Motion*: The *shaft* connects the motor or pulley system to the brush mechanism. When the motor spins, the shaft rotates, transferring that motion to the brushes. This allows the brushes to scrub the shoe soles.
- *Supporting the Brush Mechanism*: The shaft provides structural support to the rotating brushes or other moving parts. It helps keep everything aligned, ensuring that the brushes rotate smoothly without wobbling or misalignment.
- *Material and Durability*: Shafts are usually made from strong, durable materials like *steel* or *stainless steel*. This ensures that they can withstand the forces generated during operation, especially when there is friction between the shaft and other components like bearings or brushes.
- *Mounting*: The shaft is typically mounted on bearings at both ends, which allow it to rotate freely while supporting the brushes. The design and size of the shaft depend on the size and power of the motor and the type of brush system used.

- *Speed and Torque Control*: The shaft, along with pulleys (if used), can help control the rotational speed and torque delivered to the brush mechanism. A larger shaft diameter can support higher torque, while smaller shafts may be used for lighter-duty tasks.

Fig 5.3.5 Shaft

8] ADVANTAGES :

- **Time-Saving**: The automatic cleaning process takes less time compared to manual cleaning.
- **Consistent Cleaning**: The brushes clean all areas of the shoe sole evenly.
- **Hygiene**: Helps keep areas clean by preventing dirt from being spread around.
- **Simplicity**: No sensors or complicated electronics are required, making the system easier to operate and maintain.
- **Low Maintenance**: The machine is simple, reducing the need for frequent repairs or complex adjustments.

9] CONCLUSION :

The *Automatic Shoe Sole Cleaning Machine* offers an effective and efficient solution for cleaning shoe soles automatically. By eliminating the need for manual cleaning, this machine saves time and ensures that shoe soles are cleaned consistently and hygienically. Its simple design, which relies on motors and brushes instead of sensors, makes it easy to operate and maintain. This project demonstrates the potential for automated cleaning systems in everyday tasks, making life more convenient and hygieni