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Design And Fabrication of Road Cleaner

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Abstract: Cleaning is the main basic need for all human beings and it is necessary for daily routine process. The conventional road and floor cleaning machine is most widely used in many applications such as example roads, railway stations, airports, hospitals, bus stands, in multi buildings, colleges etc. also this machine uses human energy for its working operation. It is a user friendly as well as eco-friendly. In our project we are aimed to use easily available material with low cost and it can be easily fabricated and easy to use and control. It is the better alternative for conventional machine. The manually operated eco-friendly road and floor cleaner can work very efficiently with respect to covering area, time and cost of road cleaning process compared with the existing machineries. Also, it is economical to use.

KEYWORDS: Cleaning ,Road , Floor , Conventional, Economic.

1.INTRODUCTION

Cleaning has become a basic need for all human beings and it is unavoidable daily routine process. The conventional road cleaning machine is most widely used in railway stations, airports, hospitals, Bus stands, etc. also this machine needs electrical energy for its operation. It is not user friendly as well as eco-friendly. In summer time there is power crisis and most of the roads cleaning machines are not used effectively due to this problem particularly. In our project we are using easily available materials with low cost. It is the better alternative for conventional Machine Cleaning work can be physically demanding and a need has been identified to developed methods for systematic ergonomic evaluation of new products. In recent years, floor cleaning robots are getting more popular for busy and aging populations due to lack of workers. How ever in India, unemployment is more and hence there is a need to develop less labor oriented cleaning machine.

In recent years, conventional floor cleaning machines are most widely used in airports, railway stations, malls, hospitals and in many commercial places, as cleaning is one of the important perameter for the sanitation and government regulations. For maintaining such places, cleaning the floor is the major task which is necessary. There are conventional floor cleaning machines available to perform floor cleaning operations in above said places. Gen erally a conventional floor cleaning machines requires electrical energy for its operation. In India, especially in summer there is power crisis, in majority of places. Hence cleaning the floor using the conventional floor cleaning machines is difficult without electricity. In this project an effort has been made to develop a manually operated floor cleaning machine so that it can be an alternative for conventional floor cleaning machines during power crisis. A manually operated floor cleaning is developed with major list of objectives, one; to achieve simultaneous dry and wet cleaning in a single run, secondly to make the machine cost effective and thirdly to reduce the maintenance cost of the manually operated floor cleaning machine as far as possible.

Cleaning is a must-have skill for today's generation. In general, the floor in the home must be cleaned on a regular basis. This machine is responsible for the design and manufacture of floor cleaning machines. The major goal is to merge the functions of three separate devices: a vacuum cleaner, a dryer, and a mop. Many different types of floor cleaning machines are available on the market, all with high ranges and weights. As a result, they are not affordable to everyone, both in terms of weight and cost. For this function, a variety of machineries are extensively utilised. As a result, a multipurpose and cost-effective floor cleaning machine must be designed and developed. When it comes to weight criteria, machine assembly, and machine handling, the machine is extremely adaptable. It's straightforward to put together and operate. This machine is simple to run for everyone. The machine's size is also portable, allowing us to move it from one location to another with ease. As a result, brushes [Industrial roller brush] replace the vacuum approach in our project. This system aids in the removal of solid trash (wood, vegetable waste, etc.), plastic objects, and other stuff. This initiative saves money by reducing human labour, time, and energy usage.

A manually operated floor cleaning is developed with major list of objectives: -

- To achieve simultaneous dry and wet cleaning in a single run.
- Lower Maintenance Cost and Time.
- Required less cleaning time.
- Clean more space in less time.

2.METHODOLOGY

Fabrication is an important industry that involves cutting, manipulating and assembling materials to produce desired structures. And while different fabrication companies use different techniques, most rely on three basic processes: cutting, bending and assembling.

a)Cutting

The first process of fabrication is cutting. During this process, the metal fabrication company cuts one or more pieces of raw metal for use in the creation of a new metal structure or product. Whether it's steel, aluminum, iron or any other common type of metal, though, cutting metal requires special tools. Some metal fabrication companies use torches to cut metal, whereas others numerical control (CNC) machines involving lasers or water jets. When finished, the company will have clean, appropriate-sized sheets or sections of metal with which to work

b) Bending

After cutting raw metal, metal fabrication companies must bend it. Again, there are different ways to bend metal after cutting it. Some metal fabrication companies hammer the metal sheets or sections into the desired shape. Hammering can be done by hand, or it can be done using a machine (power hammering). Recently, though, many metal fabrication companies have begun using press brakes to bend their metal. This heavy industrial machine automatically presses metal sheets and sections into a specific shape when engaged. It essentially clamps the metal between a punch die, forcing the metal into the desired shape.

c) Assembling

The third and final process of metal fabrication is assembling. As the name suggests, this process involves assembling the metal sheet or sections into the desired finished product. Assembling is typically performed via welding, though other steps may be included in the process as well. In addition to welding, for example, metal fabrication companies may crimp seams, apply screws or other fasteners, and apply glue. After assembling the metal, the company will finalize the product before shipping and selling it to its customers.

Metal fabrication is a driving force behind the country's ever-growing manufacturing sector. Although there are countless machines and techniques used by metal fabrication companies, must rely on a three-step process that consists of cutting, bending and assembling. These three processes allow metal fabrication companies to transform raw metal materials into new products.

3.Selection of Components:

a) CHASSIS:

The chassis serves as a pivotal structural element upon which an array of components, including shafts, bearings, brushes, containers, and others, are securely mounted. It bears the weight imposed by these components as well as the load of accumulated dust particles during operation.

Figure: chassis

b) WHEELS:

When the machine is propelled forward, the tire's friction material interacts with the ground, facilitating the transmission of rotational motion and torque to the machine. The selection of the cycle's tire is crucial, as it distributes the chassis weight onto the soil, dampens vibrations, and maintains balance loads for the machine.

Figure: Wheels

c) BRUSH:

The brush assembly comprises the brush tool, ring, and brush support. The brush support securely holds the brush in place within a groove. Welding affixes the brush support to the ring, ensuring stability. The ring, crafted from flat bar material, forms a circular structure, with a central bar featuring a bore for attachment to the rotating shaft responsible for the brushing action

Figure: Brush

d) SPROCKETS:

Sprockets of varying diameters are employed to transfer power, functioning akin to spur gears to adjust speeds and torque, subsequently transmitting them to additional shafts via chain drives. The rickshaw's sprocket was specifically chosen, while the smaller sprocket was sourced from a cycle shop.

Figure: Sprockets

e) CHAIN:

The chain drive serves as a mechanism for power transmission between shafts, particularly effective for larger center distances between them. Operating akin to a simple gear train or an open belt drive, it transfers rotation in the same direction as the driven shaft. Comprising internal and external components, the chain is engaged with the sprockets, fitting into the groove between successive teeth to facilitate smooth operation.

Figure:Chain

f) **SPUR GEAR:**

The primary purpose of the gear is to transfer power from the rear tire shaft to another shaft while altering the direction of rotation, necessary for driving the brush in an anticlockwise direction from the initial clockwise rotation.

Figure: Spur Gear

4.DESIGN CONSIDERATION:

Shaft Length: 1.75 feet = 525 milli meters

Roller Length: 450 milli meters

Approximate Load (P): 200 Newtons

Factor of Safety (FOS): 3

Maximum Bending Moment: 625 Newton-milli meters

Diameter of shaft:

$= \sqrt[3]{\frac{625}{\pi/32}}$: 18.53 mm

Spur Gear:

I. Outer diameter (OD) = 170 mm

II. Inner diameter (ID) = 19 mm

III. Number of teeth (N) = 33

Pinion Gear:

I. Outer diameter of pinion gear = 100 mm

II. Inner diameter of pinion gear = 19 mm

III. Number of teeth on pinion gear = 20

Speed Increment:

Increment = Number of teeth on Sprocket / Number of teeth on Freewheel

= 44 / 18

= 2.44

5. FABRICATION TECHNIQUES USED:

a) WELDING:

By utilizing intense heat to melt the components together and then allowing them to cool, which results in fusion, welding is a fabrication method that unites materials, typically metals or thermoplastics. Welding is separate from lower temperature processes that don't melt the base metal.

Figure: welding

b) GRINDING:

A grinding wheel or grinder is used as the cutting tool in this abrasive machining technique. Given that grinding is a genuine metal-cutting operation, grinding is a subset of cutting.Grinding is used to finish work-pieces that must show high surface quality and high accuracy of shape and dimension. It has some roughing applications in which grinding removes high volumes of metal very rapidly.

Figure: Grinding

c)DRILLING:

A drill bit is spun to create a circular cross-sectional hole in solid materials during the drilling process. The drill bit is often a multi-pointed, rotating cutting instrument. While rotating at speeds ranging from hundreds to thousands of revolutions per minute, the bit is forced against the work piece.

Figure: Drilling

6.WORKING PRINCIPLE:

Eco friendly road cleaning machine is an advanced type of machine used for the roads or streets.We manufacture environmentally friendly road cleaning equipment without the need of motors, fuels, or power sources. The machine is powered or operated by human labour. A pair of wheels that are joined by a shaft hold the system in place. The shaft connects the wheels to each other. With the use of a manual force that can manage it, the wheels are shifted to the proper position. On one side of the wheel, there is a chain drive.The wheel and gear determine how the chain is moved. The brush sweeps the trash on the road and puts it into the trash cans while travelling in the opposite direction of the wheels. Rewrite it

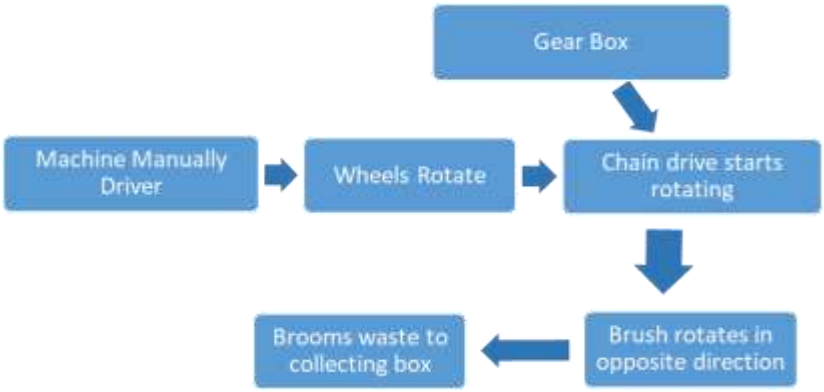

Figure:Working

Figure: Road cleaner

7.ADVANTAGES:

1. The process takes less time.
2. There are less staff needed.
3. This road cleaning machine was created primarily to clean plane, smooth surfaces like cemented, tile, and mosaic surfaces.
4. The machine is easy to operate.
5. Machines can also be used by unskilled workers.

8.DIS-ADVANTAGES:

1. Human labour is necessary
2. Slower than an electric road sweeper equipment in terms of operation.
3. It only functions on flat surfaces.

9. APPLICATIONS:

1. Cements Factories
2. Steel Factories
3. Food Industries
4. Engineering Industries
5. Highways
6. Electronic Industries
7. Municipal Corporations
8. Ports
9. Airports
10. **FUTURE SCOPE:**

The resulting product performs the required motion and is completely functional. In the testing environment, it passes the test. The concept has a lot of potential, and mechanical part growth is enormous Up until the best outcome is obtained, the optimization process will continue. Overall, the project was successful in meeting its objectives and is undoubtedly changing how floors are cleaned. Floors are cleaned more successfully as a result of this product's capacity to move in the direction of dust. This is a well-made object that might be used in contemporary Indian homes.

11.TESTING CALCULATION

Quantitative testing						
			For man		For machine	
S.N	Area taken (sq cm)	Mass of dust spread (kg)	Time taken(s)	Mass collected(kg)	Time taken(s)	Mass collected(kg)
1	20600	1.2	43	0.638	09	0.6559
2	51000	1.5	104	0.99	24	1.2
3	90000	2.1	178	1.29	44	1.33

A machine-cleaned area produced more clean and dust-free surface than a human-cleaned area using a simple broom, according to examination and observation of the area we made an effort to clean. The machine, however, is likely to blow some dusts more forcefully than a regular broom because of the fast brush speed.

12.CONCLUSION

A novel solution has been devised, analyzed, and implemented for road cleaning: a manually operated, environmentally friendly road cleaner. This innovative approach not only saves on costs, time, and labor but also serves as a dependable backup during power outages when automatic cleaners are rendered ineffective. Unlike conventional equipment that relies on fuel and diesel, this cleaner mitigates pollution and noise, addressing environmental concerns. Moreover, manual operation minimizes health risks associated with direct dust exposure and reduces strain on workers, alleviating shoulder issues caused by repetitive sweeping. This eco-friendly cleaner demonstrates impressive efficiency in terms of coverage, time, and cost, particularly outperforming conventional methods on broken or uneven roads. Additionally, its manual operation offers employment opportunities to individuals who may lack formal education but possess the physical capabilities required for such tasks.

Future Project Modifications

The project was unable to operate at 100% efficiency due to a number of limitations, including technical, financial, environmental, material availability, etc. To enhance the functionality of the machine, someone can continue to work on our project.

The following are potential future changes that could be made to our project:

a) Proper value analysis can be performed to choose the right materials. lowering costs and weight while boosting effectiveness.

b) Vertical brushes can be used to stop dust from spreading, and vacuums can be used to collect micro dusts.

c) Manual drives can be replaced with motor drives to increase efficiency in areas with abundant electricity, and advanced mechanisms can be added to collect both organic and inorganic waste.

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