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Design and Fabrication of Power Operated Soil Stirrer for Home Gardening

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Abstract: The gardening sector is facing problems with capacity issues, shrinking revenues, and labor shortages and increasing consumer demands. A manually power operated soil stirrer was made with a driller, shaft and Gardening in India is a traditional affair, involving sticking to the same old equipment and techniques. The machine consists of three detachable blades of about 10cm, 7.5cm and 5cm. The rpm of the driller is about 0 to 2800. The drill chuck is about 1.5 to 13mm and half to 20UNF. The driller can rotate in both directions i.e., forward and reverse. The driller has speed control system also. It can be used for weeding operation which makes the soil fertile. It mixes the inner soil and outer soil for good growth of the plant. There are three different blades made of mild steel with three different radii. The size of the machine is about 30cm. The weight of the machine is 2kgs. With this soil stirrer machine time is reduced to a great extent. It attempts to design a smart technology that reduces gardening efforts in cultivating. It aims to provide this at a cost affordable to everyone. The cost of the machine is about Rs.5, 000.

I. INTRODUCTION

Gardening has undergone a great evolution in last 50 years. Out of the various reasons involved for this evolution is control of various diseases on plants. During initial days there was only hand spraying people use to do. Then slowly there has been development of various methods to spray out chemicals and dusts. Though these devices were highly efficient, there is a need to have certain changes. Chemicals are widely used for controlling disease, insects and weeds in the crops. They are able to save a crop from pest attack only when applied in time. They need to be applied on plants and soil in the form of spray, dust or mist. The main objective of the project is to design and fabricate a power operated soil stirrer for home gardening purpose. The machine is used to increase the soil porosity and to reduce the time for the gardeners for plantation and to increase the aeration for the inner soil. The project "POWER OPERATED SOIL STIRRER FOR HOME GARDENING" finds huge application in gardening.

II. SELECTION OF MECHANICAL AND ELECTRICAL COMPONENTS

A. Mechanical Components

- 1) Driller
- 2) Outer covering
- 3) Blades
- 4) Drill key
- 5) Drill holder
- 6) Cleaning brush

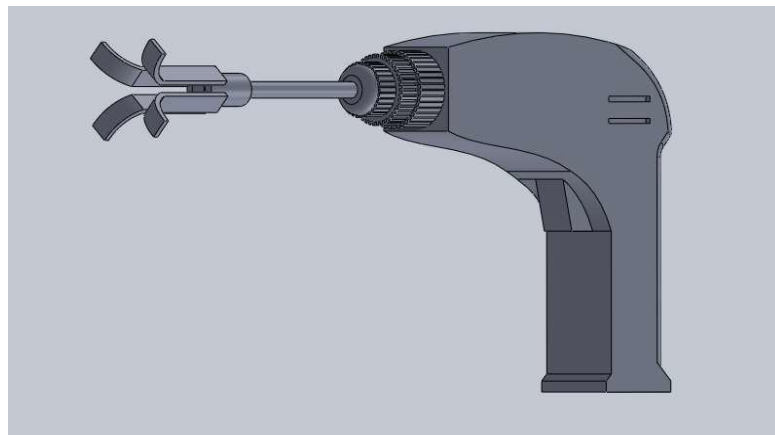
B. Electrical and Electronics Components

- 1) Power cables
- 2) On / off switch
- 3) Reverse switch

C. Design and Fabrication of Power Operated Soil Stirrer for Home Gardening

The various models of the project were designed using the software solid works version 2013. The fabrication of the prototype was done with good and industrial practices. The prototype was designed such that it will have better performance while in operation. The fabrication prototype of the conceptual design is shown in the figure. When the arrangements are successfully done by this project, Furrow ridge or cultivator arrangement is mounted at the front of the drill machine. The fabrication prototype of the

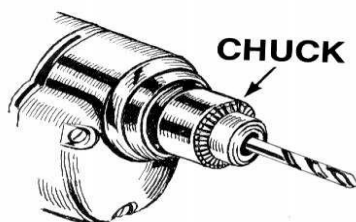
conceptual design is shown in the figure. When the arrangements are successfully done by this project, Furrow ridge or cultivator arrangement is mounted at the front of the drill machine. Then the cultivator is attached and operated by the drilling machine into the shaft. When the drill chuck is rotated the cultivator will cultivate the soil automatically. The isometric view of the conceptualized design of power operated soil stirrer is shown in the fig



Conceptual view

D. Drill Chuck

A chuck is a specialized type of clamp. The drill chuck is about 1.5 to 13mm and half to 20UNF .It is used to hold an object with radial symmetry, especially a cylinder. In drills and mills it holds the rotating tool whereas in lathes it holds the rotating work piece.



View of Drill chuck

E. Shaft

A shaft is a rotating machine element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque (or twisting moment) set up within the shaft permits the power to be transferred to various machines linked up to the shaft. In order to transfer the power from one shaft to another, the various members such as pulleys, gears etc., are mounted on it. These members along with the forces exerted upon them causes the shaft to bending. In other words, we may say that a shaft is used for the transmission of torque and bending moment. The various members are mounted on the shaft by means of keys.

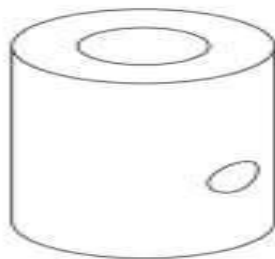


3D view of Shaft

F. Outer Cover

This is made of mild steel material. The whole parts are mounted on the frame structure with the suitable arrangement. Boring of bearing sizes and open bores done in one setting so as to align the bearings properly while assembling. Provisions are made to cover the bearings with grease.

The outer covering is drilled with a small hole of very minimum radius which is used to catch the detachable blades with help of bolt and nut. It is made adjustable so that different types of blades with different outer diameter can be used.



3D views of Outer cover

G. Detachable Blades

The blades are made detachable so that it will be easy to remove and use the blade. The blades must be surface grinded regularly and the material used is mild steel. The blade should have high strength to withstand the high torque produced by the driller



3D views of Blade

III. EXPERIMENTAL PROCEDURE

The fabrication was started with a good industrial practice. When the arrangements are successfully done by this project, Furrow ridge or cultivator arrangement is mounted at the front of the drill machine. Then the cultivator is attached and operated by the drilling machine into the shaft. When the drill chuck is rotated the cultivator will cultivate the soil automatically. According to the size of a pot the detachable blades should be changed. It is found that the machine works well for the combination of red soil cum sand. The figure shows the working prototype.

IV. POWER OPERATED SOIL STIRRER FOR HOME GARDENING



Power operated soil stirrer for home gardening



Working

V. RESULT AND DISCUSSION

A. Discussion

Overall specification with economic analysis, cost estimation of fabricated Power operated soil stirrer is dealt here.

Table 5.1 Parts of the machine

S. No.	Part Name	Quantity (Nos)
1.	Driller	1
2.	Shaft	1
3.	Outer covering	3
4.	Blades	4
5.	Power cables	1
6.	Drill key	1
7.	Drill holder	1
8.	Cleaning brush	1

The fabrication process of power operated soil stirrer for home gardening has three parts and their fabricated in a well-established workshop. The fabrication process of each component is explained in table 5.2

Table 5.2 Fabrication Process

Part number	Part name	Operation	Machine
1	Shaft	Turning Facing	Lathe
2	Outer cover	Turning Facing	Lathe
3	Blade	Milling	Milling machine

B. Cost of Project

The cost of the prototype is listed in the table 4.3. The cost is based on the MRP rate fixed on the local old market. It may vary from place to place and market to market. So, don't pursue of fix the price as standard and it may also with size and dimension. The total cost of the project accounts to about Rs 5000.

VI. CONCLUSION

Thus the manufactured prototype was placed for observation by fellow students and staff members. The prototype explains how a combination of components that are seen in day to day life can create a very effective and necessary product. The main task is to promote this technology and to have availability for gardeners at an affordable price

A. Achievements of the Project

By introducing this project we can reduce manual work and work time. We have increased the accuracy, work speed and efficiency. More work is done in lesser time as a result of this project. The time consumption of manually done inter cultivation is about 80 sec for a sq.ft, whereas with design and fabrication of power operated soil stirrer we can cultivate a sq.ft within 10 seconds. This project increases the porosity and increases the aeration of the inner soil.

B. Benefits of the Project

- 1) Portable
- 2) Time consumption is less
- 3) Occupies less space
- 4) It reduces the manual work.
- 5) Quick operation is achieved.
- 6) Accuracy is more
- 7) Increases the porosity of the soil
- 8) Increases the aeration of the soil

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