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Design Development and Fabrication of Soil Drilling Machine for Plants – Review

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Abstract: *Today's era is marching towards the rapid growth of all sectors including the plantation of trees to a large extent and the agricultural sector. Conventionally digging deep holes or larger diameter holes requires more work. So to reduce these losses we are planning to design a soil drilling machine for the plantation. A soil drilling machine is used to reduce the man's work and time for digging holes. These holes can be used for fixing engines and different plantations such as rubber plants, coconut, sugar cane, etc. The Project aims to Design Development and Fabrication of Soil Drilling Machine for plants which would be modified to overcome all the shortcomings of the existing Digging Machine. The project will be useful in providing a solution for a low-cost and comparatively safe auger that can be completely used by one person. This project will be provided with a safe and cost-efficient alternative to use for plantation or other purposes. This project will help understand the shortcomings of manual and power-operated Digging machines and provide possible solutions. Hence, this project will reduce the chances of auger-related injuries and also increase the stability and usability of the same. This project will help people to use Soil Drilling Machines comfortably and work will be done smoothly and efficiently. Our project aims to reduce the cost of the machine and make it portable for easy carrying. So due to these reasons, we are using a petrol engine instead of a diesel engine and we attach a steel frame to it to make it portable. This project involves the design and fabrication of a soil drilling machine. The design of the soil drilling machine is done by SOLIDWORKS and the fabrication is completed employing various fabrication techniques.*

I. INTRODUCTION

The interest of people towards the plantation of saplings is increasing due to global warming, the rise in global temperature, and many such factors, so plantation is being done at a faster rate through many of the N.G.O' S as well as people. In the case of planting saplings in a huge number, it is difficult to use levers, and hand link mechanisms for the same it makes the process harder and takes a very long time.

Here the main purpose of this project is to reduce the digging time. This machine is designed with a preliminary aim of avoiding the use of shovels & axes in the plantation of saplings thereby enhancing the plantation process. The machine is formed automatically by employing a D.C motor which is an influence source for digging the soil. The greater advantage of this machine is that it digs only the required area and also does the same in very minimum time. This makes the auger drill a hole in the soil and return to its original position.

This machine is meant for a preliminary aim of avoiding the utilization of shovels & levers in the plantation of saplings thereby enhancing the plantation process by making it facile. Soil drilling machines can cover vast areas efficiently, allowing for the rapid establishment of green cover. Whether it's reforestation, afforestation, or urban tree planting, these machines enhance our ability to combat environmental degradation. The conventional Soil Drilling Machine does not have any frame around the body. We have provided a frame around the body which will not only provide strength to the model but also will make it easy to operate even by a single operator. By considering safety factors during fabrication, the provided frame will minimize risks of equipment malfunction, and injuries while working on a soil drilling machine. The frame will also reduce the vibrations that are produced while working on the auger.

A. Problem Identification

- 1) It is hard to dig large numbers of holes in the soil for the plantation to a large extent with human effort.
- 2) Soil Variability: Different types of soil (e.g., clay, sand, rock) can pose challenges.
- 3) Depth Control: It is hard to obtain the desired depth we need, especially in uneven terrain.
- 4) Stability: The vibrations generated during digging operations by the soil drilling machine.
- 5) Safety: The conventional Soil Drilling Machine does not have any frame around the body.

II. LITERATURE REVIEW

- 1) Amle Kishore E., Lohote Shiram T., Ghule Vaibhav M., Bahirat Sagar S., Jahind Polytechnic, India, Tractor Operated Auger, IJSRD – In this paper Journal describes the methodology used for the manufacturing of Auger machine and material and used for the manufacture. It also describes the design of the auger which includes calculations like power, the torque required, determination of shaft diameter based on strength, resistance to the twisting method, and transmission of torque approach. In this regard, the project's main objective is to meet the needs of small-scale farmers and reduce operating time and manufacturing costs.
- 2) Vaibhav Shinde, Akshata Goankar, Mayuri Gavankar, Siddhnath Shetkar, Prof. M.T.Sawant., S.S.P.M College of Engineering, Kankavli, Solar Powered Soil Digging Machine, IJTRE- this journal describes about the problems faced by the farmers using agriculture tools. It tells that before the auger machine was used with the help of petrol powered. The engine burdens the farmers with the increasing price of petrol. So the main objective is, therefore, to replace the petrol engine with a rechargeable electric battery and also to reduce the cost of the machine used to dig planting holes.
- 3) Suyog Thakare, P. R. Pote (Patil) College of Engineering, Amravati, India, Research on design and manufacture of a machine to drill holes for tree planting, IJAITE- This journal deals with the different hole drilling methods and tree planters and machine design and its components and applications of the earth drilling machine.
- 4) Auger blade (1952-02-08): The invention deals with a blade structure of the character defined, wherein the teeth of the blade are so constructed and positioned as to form a series of circumferential v-cuts. in the soil and to simultaneously and intermittently lift and break the raised I-portions of the soil intermediate the formed grooves, thus facilitating and expediting the drilling operation.
- 5) Expanding boring head for earth auger (1968-05-28): This invention relates to a new and improved expanding boring head for earth This invention relates to a new and improved expanding boring head for earth auger. More particularly, the present invention comprises a tooth and tooth holder pivotally mounted on a boring head about an axis substantially parallel to the axis of rotation of the boring head but displaced outwardly relative thereto so constructed that the tooth moves between a retracted or inoperative position to a projected or operative position.
- 6) Van R. Cox (1978) invented earth drills. An earth auger arrangement wherein a power source is mounted on wheels for moving the power source over the earth's surface with means connected to the power source for relaying power to a transmission with which an auger is connected. Handle means are connected to a transmission for manually positioning the auger about the earth's surface to penetrate it at a desired angle with throttle means on the handle means to control the power source. Shaft means are pivotally connected to and external between the power source and the handle means to reduce counter rotation or counter torque from being exerted on the operator when the auger is rotated to penetrate the earth.
- 7) Huang Wei (2013) studied the work principle and structure analysis of the walking-type digging machine for planting trees. Based on the principle of the protected environment and the shortcomings of the traditional digging machine, this paper designs a kind of new digging machine that is high quality, fast, safe, reliable, low labor intensity, low cost, and can adapt to different requirements of pit depth, topography, and soil conditions. This paper analyzes the new type of digging machine's working principle, force analysis of cutter discs. The main parts of the digging machine are established by the APDL parameter design language. The results show that the main transmission chain of way can meet the job requirements of the loader and the main parts can satisfy the intensity and rigidity requirements.
- 8) Kannan et al (2014) converted the tractor movement into ground wheel rotation is transmitted to the metering mechanism through the power transmission system depending upon the nature of the seeds; we can change the metering mechanism arrangement. The flax blades are used in making holes in the soil. These flax blades serve well in removing the soil and throwing it out so that a hole is made in the zone of the plantation so that saplings can be easily planted in the soil. The plantation needs only a 1.5" inch diameter hole so the auger drill is also made of such specification. This avoids making larger holes more than the requirement. On surveying the field of our project it was found that flax blades along with rotating hand wheels and springs are used which requires again a manual operation. One method uses a driller-type machine which makes just a hole in the ground and also requires in minimum of two members to handle the machine.

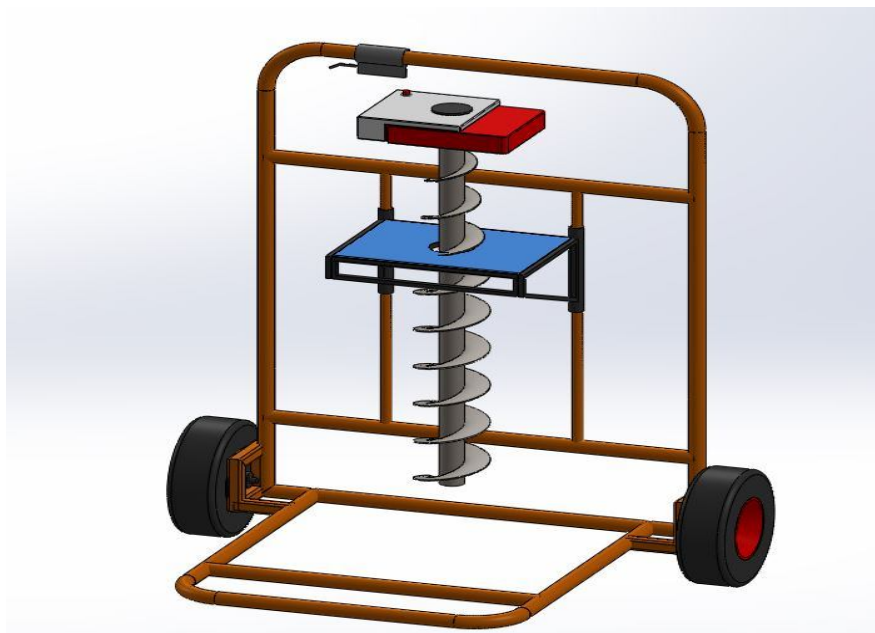
III. OBJECTIVES

The objectives of the project are to design and make a portable Soil Drilling Machine.

- 1) To improve simplicity.
- 2) Minimize the time required by using simple mechanical mechanisms.

- 3) Develop a machine that will require less labor and which can be operated with unskilled operators.
- 4) To obtain the required depth and radius of the hole by selecting the necessary drill bit and attaching it to the auger.
- 5) To make an efficient Soil Drilling machine.
- 6) To make the machine that can be transportable/portable.
- 7) To reduce repetitive tasks using the Soil Drilling Machine.

IV. DESIGN



V. WORKING

- 1) The soil digging machine is used for plantation to a large extent. This machine uses the principle of an auger drilling machine which is used for the plantation of Plants on a large scale.
- 2) The soil drilling machine consists of a Petrol Engine, Auger Drill bit, Wheels, Chain, Bearings, and Steel frame.
- 3) The auger drill is made of the required size by scaling down its original size as per the requirement. The machine is made automatic by employing a D.C motor which serves as a power source for digging the soil.
- 4) First of all start the engine with the help of the switch. After starting the engine the shaft gets rotated in a clockwise direction. The engine speed is controlled by an accelerator.
- 5) The drill bit speed (RPM) is based on the engine speed. When the shaft gets rotated which is connected to the engine due to its motion the auger drill bit also rotated.
- 6) The motor can be rotated both in clockwise and anti-clockwise direction. This makes the auger to drill a hole in the soil and the return back to its original position.

VI. CONCLUSION

The following modifications are done while redeveloping the earth auger.

- 1) Based on the overall performance of the machine we can say that the project will satisfy the need for plantation on a large scale.
- 2) The machine can be operated by a single person and takes less time compared to traditional methods.
- 3) Ease in transportation- The wheels will be provided for ease of transportation.
- 4) Stability during operation- For minimizing vibrations supporting frame or trolley and wheel of rubber will be provided. So that during operation they would support the machine, maintain the stability, and minimize vibrations.
- 5) Safety of operator – Improvements to ensure operators' safety are installed in the modified Earth auger, such as a frame for increased stability during drilling, etc.



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