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Design and Development of Electric Power Weeder

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Abstract
In this paper the design, manufacturing, analysis, control, and experimental activities in which is thought to be an appropriate engineering education. The design for a motor-powered weeder is conducted for house gardening work has been described. In India during the past 20 years, labour saving and efficiency has been demanded because the engagement in agricultural business was decreased to 50%. An electrified powered weeder design is invented, since this is concerned with ecology, agriculture, and engineering. Design and manufacturing is the key of engineering, education for mechanical engineering needs the idea of practical design and manufacturing.The first goal of the designing and production of a weeder through a rotary body and the mechanical part that nails up and down. The second is stress analysis and control experimental confirmation of the weeder.

Keywords: *weeder, rotary blade, shaft*

I. INTRODUCTION-

Weeding process requires huge human efforts and cause increase in crop yields and which decrease cost of cultivation with agricultural operations and compete with crop plants for many inputs like water, nutrients and sunlight[1]. The composition of the land is dependent on soil, climate, cropping and management factors. An infertile land is harmful for crop. It is a plant that emulate with crops for water, nutrients and light. This can reduce crop production[2].Weeding is a significant work-intensive activity of the agricultural system. The agriculture sector currently needs free chemicals to ensure food security. Consumers need high-quality foodstuffs and food safety unique consideration. Weeding is as old as agriculture itself, but the methods and concepts have changed over years to help increasing land fertility[3]. The general weeding processes in India are mechanical. Mechanical methods are characterized by vigorous use of manual labour and animal power. Both of them are in short supply and are increasingly becoming uneconomical.Manual disposal is not only laborious, inefficient and not always practical due to negative soil circumstances. The saplings are more competitive during the initial stages of their growth (2-6 weeks after planting)[4]. Controlling soil fertility during this time is very essential for realizing maximum crop yield. Weeding by mechanical process is more effective because it helps to reduce the human efforts involved in manual weeding[5]. Demand by consumers is high quality food products and pay special attention to food safety[6]. More specifically, in crops like soybean, maize, gram there is no electricity operated mechanical weeding method is available. Therefore, there is need to have a low-cost power weeder for small and medium farmers. In view of above, the present study is proposed to

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design and develop a power-operated rotary weeder for all crops that can be considered[7].

Fig1 shows the design of an electric weeder

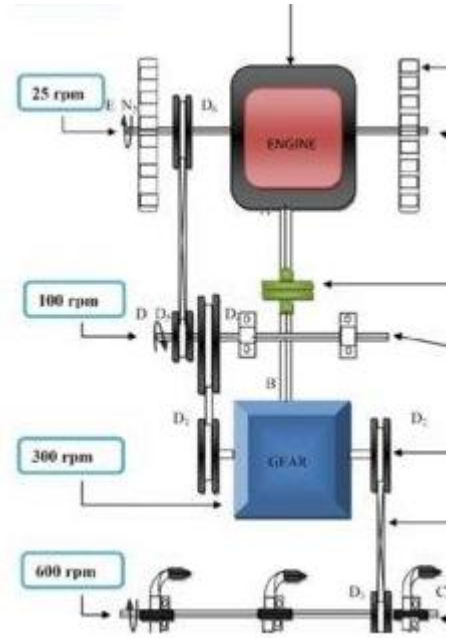

Fig 1 designing of electric weeder

II. WORKING-

Blade is that part of the power weeder which interacts with soil. Generally five types of blades are used in a rotary weeder. These are L shape, C shape, J shape, pick type and straight type to suit various operating conditions. L shape blades are found to be best along all the types of blade for consuming least power requirement. The view of an L-shaped blade is shown

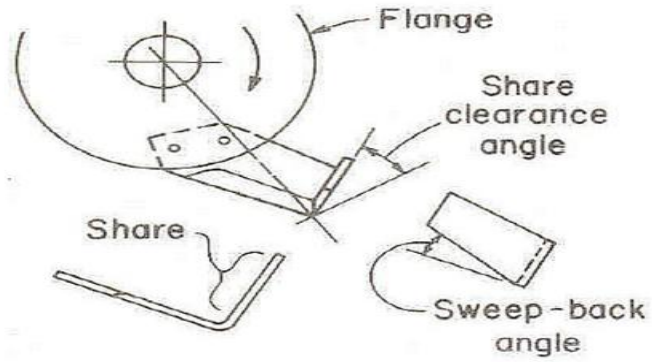

Fig 2 L shaped blade

Based on above considerations, the multipurpose weeder was considered to be consisting of the following main constituents:

- Chassis
- Motor mounting frame
- Drive and supporting wheel
- Shaft
- Power transmission system
- Rotary blades
- Seeder system
- Handle

The proposed model consists of two important functional unit i.e. weeder for major function of removing the weeds from the crop lands and gardens. The second purpose is to spread seed over the cultivated land. To achieve the required function i.e. for the cutting the weeds, L-shape rotary blades were required as L shape blade require optimum power as compared to other types of blades[8].

For cutting the weeds, the blades needed rotary power because the rotary action will give more weeding performance. The rotary power is obtained from the electric motor. Then the power is transmitted to the rotary unit through belt-pulley transmission system.

Apart from the rotary unit and the power transmission system we will also require a seeder mechanism which will be motorized with the help of a servo motor while the vehicle moves forward. Manual power will be given to the vehicle at its handle to move the traction wheel or ground wheel[9].

Fig 3 shows the power flow diagram of the weeder

The electric power multipurpose weeder used for increasing the fertility of soil a grip attached with handle used for reducing vibration effect during the movement of electric weeder.A frame used for supporting the machinery parts of the electric weeder.At least two weeder wheels and a support

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wheel connected with frame for movement of the electric weeder[10]. Plurality of ball bearing placed inside the weeder wheel for reducing the friction effect in the weeder wheel.A switch connected with motor for operating an electric motor. The electric motor connected with drive shaft for transmitting power to the drive shaft.A 'V' shaped pulley belt system connected with drive shaft of motor for driving the pulley.A shaft connected to pulley for rotating a rotary shaft[11].A chain interconnected with the shaft and rotary shaft for transmitting the rotational motion from shaft to rotary shaft.The Rotary shaft connected with chain for rotating the rotatory blades.

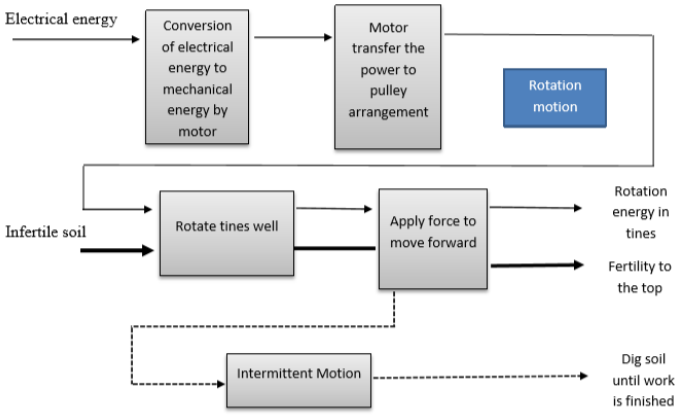

Fig 3 power flow of diagram of weeder

A systematic method for this assembly and continued idea creation is known as morphological analysis or charting. It is a tool that provides a structured search and combination of concepts in product design.

Table: 1 describes Initial Morphological Chart for electrified power weeder

Assembly name and sub function	Current
Starting	Switching on motor
Power transmission from motor to shaft	Motor shaft and pulley
Power transmission from shaft to pulley	Shaft rotation
Through V belt power is transferred to driven pulley.	Belt + Pulley
Tines start to rotate	Tines rotation
By providing some force move forward to dig the soil	Translational motion

For calculating power requirement of the weeder, maximum soil resistance was taken as = 0.0686 $Nmm{-}2$.

The speed of operation of the weeder was considered as 0.4 m/s. and the total width of coverage of cutting blade = 300mm. Also the depth of operation was considered as = 50mm. Also the transmission efficiency is given as 70%.

$$Power = \frac{Work}{Time}$$

$$P_b = \frac{Draft\ Force \times Distance}{Time}$$

$$P_b = SR \times d \times w \times v$$

Where

P_b = power required by the electric motor for the blade, SR = soil resistance,$N\ mm^{-2}$,d = depth of cut, mm, w = effective width of cut, mm, v = speed of operation, $m\ s^{-1}$

The torque obtained at the main shaft was calculated by using following formula:

$$T = \frac{P \times 60}{2\pi N}$$

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$$T = \frac{1118.55 \times 60}{2\pi \times 1400} = 7.62\text{Nm} = 7629.54\ \text{N mm}$$

The rotary unit consists of rotary blades, blade flanges and the rotary tine shaft. For design point of view, we have to design the rotary shaft diameter[12]. After determining the diameter we can further proceed with the design of blade and the forces acting on the blade.The power is transmitted from electric motor to rotary unit. Power is first transmitted from motor pulley to 1st intermediate shaft through V-belt and pulley system and then from 1st intermediate shaft to rotor shaft through timing belt pulley system. Belt and pulley drive were selected for transmitting the power from electric motor to the belt. V- Belt and timing belt mostly used, where the two pulleys were very near to each other and great amount of power to be transmit. In V-belt, drive was very smooth because these belts were endless and had no joint which offer trouble[13]. It give positive drive, slip was negligible in this belt. It provides longer life 3 to 5 year .V-belt was used where speed of belt less than 30 m/s. V-grooved pulley and A-type belt were selected for transmit the power through belt drive and then timing belt drive was chosen.

Length of handle and angle of inclination with the horizontal Surface are interdependent. Angle of operation was based on functional design and geometry of tool. The recommended handle grip diameter is 30 to 35 mm. Length of handle based on average standing elbow height of male and female worker. The average elbow height of male and female worker is 1027 mm and 960 mm respectively[14].

The practical implementation of electric weeder shown in fig 4

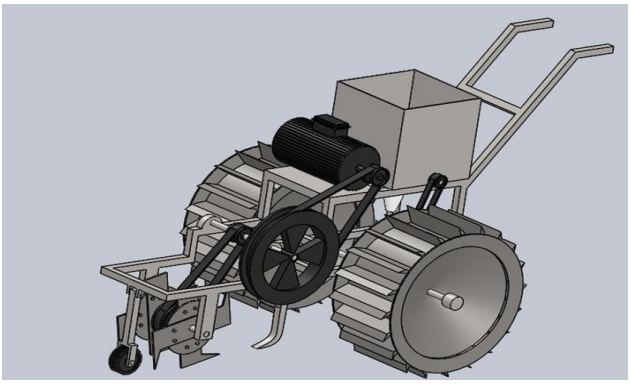

Fig 4 shows the practical implementation of weeder system

The proposed model consists of two important functional unit i.e. weeder for major function of removing the weeds from the crop lands and gardens. The second purpose is to spread seed over the cultivated land. To achieve the required function i.e. for the cutting the weeds, L-shape rotary blades were required as L shape blade require optimum power as compared to other types of blades.

III. CONCLUSION-

The machine can be utilized to burrow soil just as sow seeds. The wellbeing of the client is the fundamental need. We haven't utilized any kind of petroleum or diesel motor; it absolutely works with the assistance of a powerful electric engine. The segment must be utilized for planting little piece of land. The client of this item can be anybody as it is condition amicable and no need of any additional source. It can likewise be utilized for multi-reason work, for example, water system and levelling the dirt bed. The segment is anything but difficult to utilize and can without much of a stretch move starting with one spot then onto the next. It has heaps of removable connection. It would be an incredible lift to the innovation of weeder due to its security measures and multireason.

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IV. REFERENCES-

[1] M. R. Alizadeh, "Field performance evaluation of mechanical weeders in the paddy field," *Sci. Res. Essays*, 2011.

[2] G. Pavesi and G. Pesole, "Using Weeder for the Discovery of Conserved Transcription Factor Binding Sites," *Curr. Protoc. Bioinforma.*, 2006.

[3] 4Mr. V. A. Mane 1Ms. YadavRutuja A., 2Ms. ChavanNayana V., 3Ms. Patil Monika B., "Automated solar grass cutter 1," *Autom. Sol. Grass Cut.*, 2017.

[4] M. H. Ali, N. A. Azmir, M. I. Ghazali, M. N. Yahya, and J. I. Song, "Predicting Hand Grip Strength of Hand Held Grass Cutter Workers: Neural Network vs Regression," *Procedia Manuf.*, 2015.

[5] N. A. Azmir, M. I. Ghazali, M. N. Yahya, M. H. Ali, and J. I. Song, "Effect of Hand Arm Vibration on the Development of Vibration Induce Disorder Among Grass Cutter Workers," *Procedia Manuf.*, 2015.

[6] M. B. R. Patil and S. S. Patil, "Solar Based Grass Cutter : a Review," *Int. Conf. Recent Trends Eng. Sci. Manag.*, 2017.

[7] P. Abhinav Deep, C. Akash Babu, and M. Siva Kumar, "Fully Automatic Solar Grass Cutter Using Arduino," *Int. J. Mod. Trends Sci. Technol.*, 2018.

[8] "Solar Grass Cutter With Linear Blades By Using Scotch Yoke Mechanism," *Int. J. Eng. Res. Appl.*, 2014.

[9] S. Ohkawa, Y. Takita, and H. Date, "Development of the autonomous brush-cutting robot using articulated steering vehicle," in *Proceedings for the Joint Conference of ISR 2014 - 45th International Symposium on Robotics and Robotik 2014 - 8th German Conference on Robotics, ISR/ROBOTIK 2014*, 2014.

[10] V. Kubendran, S. George Fernandez, K. Vijayakumar, and K. Selvakumar, "A fully automated lawn mower using solar panel," *J. Adv. Res. Dyn. Control Syst.*, 2018.

[11] J. Y. Humbert, J. Ghazoul, and T. Walter, "Meadow harvesting techniques and their impacts on field fauna," *Agriculture, Ecosystems and Environment*. 2009.

[12] M. Pande, "Design of Grass Cutter," *Int. J. Res. Appl. Sci. Eng. Technol.*, 2018.

[13] M. Mudda, "Automatic Solar Grass Cutter," *Int. J. Res. Appl. Sci. Eng. Technol.*, 2018.

[14] R. Charles D'souza, K. Shenoy, K. Royston D'silva, R. Antony, and D. ' Souza, "Design and Fabrication of Crop Cutter for Multipurpose Application," *J. Mech. Eng. Autom.*, 2017.