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Design of Cultivator using a Motor and the Analysis on Tiller Blade

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***Abstract*—Weeds are one of the major causes for the loss of agricultural production. Weeds compete with crops for essential nutrients. In cultivation process, it is a very strenuous job to weed out manually the unwanted shrubs in the farm by the farmer. Although this task is accomplished by the bullock cart equipment, it would lead to damage in the main crops. Almost 40 percent of the cost caused in the horticulture gets redirected to the weeding activities in this manner lessening the benefit offers of the kinsmen. As fuel is the major necessity in the world today and all major equipments run on fuel, making it scarce and priced high which cannot be affordable by the farmer. This can be overcome with the design of small equipment which works on motor as a substitute to an engine. It would help the farmers to extract the unwanted material which is unfavourable to the farm, at cheaper cost.**

***Index Terms*— Cultivator, BLDC Motor, Tiller blade, Weeds, CATIA, Ansys.**

I. INTRODUCTION

A term weed has no natural hugeness because the plant that is a weed in one setting is not a weed when developing in a circumstance where it is the fact needed and where one types of plant is an important product plant, another species in a same variety is a genuine weed, for example, a wild brier developing among developed loganberries. The term weed is additionally connected to any plant that develops or reproduces aggressively. weeds are the plants whose unsuitable characteristics overweigh their great focuses. There are roughly 250,000 types of plants around the world. Of those, around 3 percent or 8000 species go about as weeds. Regardless of negative effects of weeds, a few plants are normally thought of as weeds may really convey a few advantages. A few properties incorporate soil adjustment, Feed for natural life, Nectar for honey bees, Provide hereditary repository, Human utilization and Provide work openings. Controlling weed in scavenge edit creation may include an extensive variety of systems like Preventive weed control, Cultural weed control, Mechanical weed control. The Mechanical weed control technique is mainly used. Out of various Mechanical weed control methods he most commonly used method is “Tillage Method”.

Culturing is performed on little scale with apparatuses, for example, hand pushed revolving tillers or on a huge scale with tractors mounted furrows. Culturing can control the weeds as the dirt is turned and the vegetative parts of the plants are harmed. Generally the more youthful the weed is, the more promptly it very well may be controlled with culturing. For more matured weeds, repeated tillage is required. A cultivator

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tiller is a cultivating apparatus intended for both profound working and delicate development. Since the cultivator tiller can play out various assignments, it kills the requirement for various sorts of cultivating devices. Three main types of cultivator tillers available in the market today, namely the hand cultivator tiller, the rotary type and the heavy-duty type attached to tractors.

Fig 1 . Cultivaor Tiller

Fig 2 . Cultivator with Engine

Cultivator stirs and pulverizes the dirt, either before planting or after the product has started developing. Dissimilar to a harrow which circulates the whole surface of the dirt, cultivators are structured are intended to disperse the dirt in cautious examples, spring the harvest plants however upsetting the weeds. Cultivators are typically either self pushed or drawn as a connection behind either a two wheel tractor or four wheel tractors. For two wheel tractors, they are generally inflexibly settled and fueled by means of couplings to the tractors transmission. For four wheel tractors they are typically appended by methods for a three-point hitch and driven by a power take-off (PTO).

II. Design of the Equipment

The Equipment is designed by using CATIA software.

A. Working principle of the Equipment:

This equipment starts by switching on the battery. As the battery starts, the motor automatically gets started. The battery used in this equipment is the LI-Ion battery and this battery is only used for the motor to give the starting torque and hence even if the battery is switched off the motor will run constantly.
There are two sprockets used in this equipment. One sprocket is attached to the shaft of the motor and the opposite end of the sprocket is associated with the pole of the tiller. The chain drive is used to connect these two sprockets to transmit the power from motor shaft to tiller shaft. When the power is supplied to the motor from battery the motor starts rotating making the sprockets to rotate which in turn sets the chain drive to motion. this chain as it is connected to the shaft of the tiller, therefore the tiller also rotates making the blades to rotate and dig the soil and remove the weeds with ease and the blade cover is used in this equipment to protect the operator and also is used to level the soil after removing the weeds.

B. Chasis and BLDC motor

A chassis is the internal frame work of an artificial object, which supports the object in its construction and use. A brushless DC engine (known as BLDC) is a lasting magnet synchronous electric engine which is driven by direct flow (DC) power and it achieves electronically controlled recompense framework (substitution is the way toward creating rotational torque in the engine by changing stage flows through it at suitable occasions) rather than a mechanically compensation framework. BLDC engines are likewise alluded as trapezoidal changeless magnet engines.

C. Construction and working principle of BLDC motor

BLDC engine chips away at the rule like that of a customary DC engine, i.e., the Lorentz drive law which expresses that at whatever point a current conveying conductor set in an attractive field it encounters a power. As an outcome of response compel, the magnet will encounter an equivalent and inverse power. In the event that BLDC engine, the current conveying conductor is stationary while the changeless magnet moves.

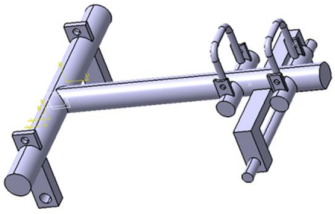

Fig 3 . Chasis of he Equipment

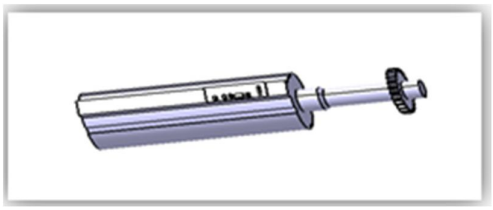

Fig 4 . BLDC Motor

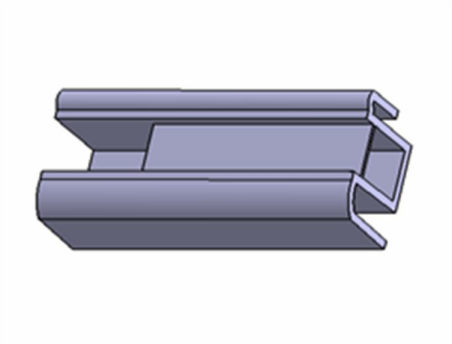

Fig 5 . BLDC Motor Support Cover

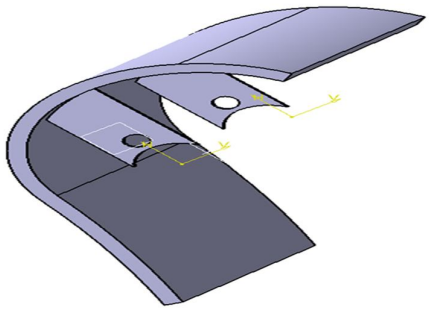

Fig 6 . Blade Cover

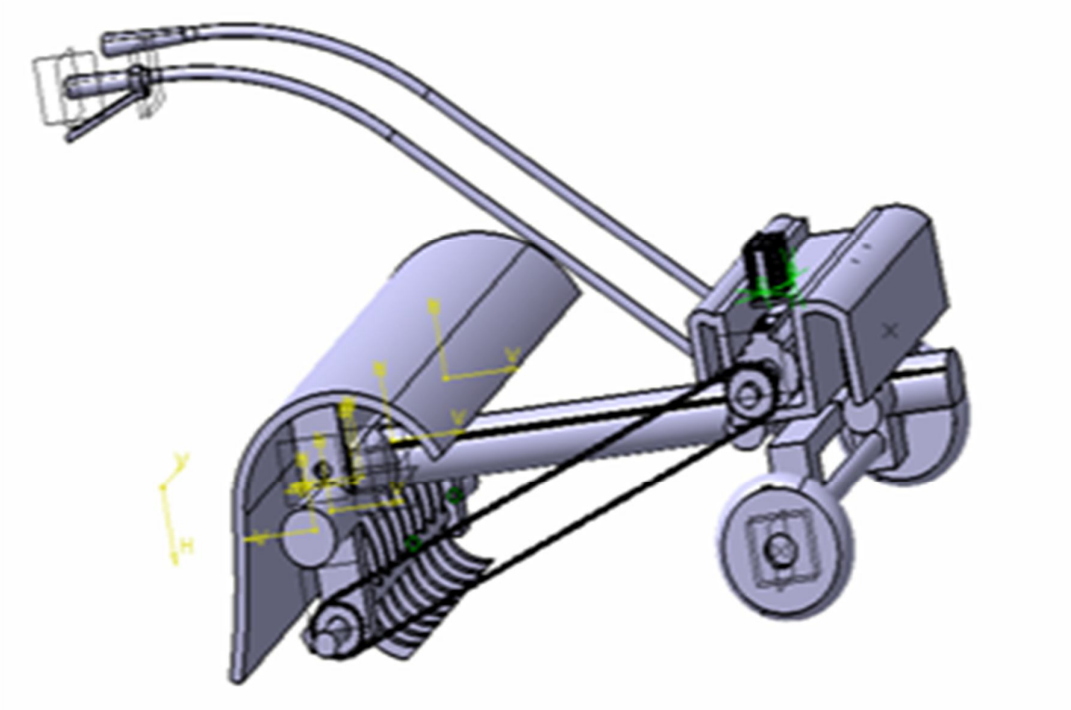

Fig 7. Cultivator Designed in CATIA

III. Analysis on Tiller Blade

The finite element method is based on representation of the body by an assemblage of subject divisions called “finite elements”. These elements are considered interconnected at the joint which are called “nodes”. In order to approximate the distribution of the actual displacements over each finite element, simple functions

are chosen. Such assumed functions are called displacement functions. The unknown magnitudes of these displacements functions are the displacements at the nodes. The displacement model /functions can be expressed in various simple forms such as polynomials and trigonometric functions since polynomials offered ease in mathematical manipulations, they have been employed commonly in finite element applications. MSC Nastran has been used for the creation of F.E. model and Eigen values analysis which is carried out.

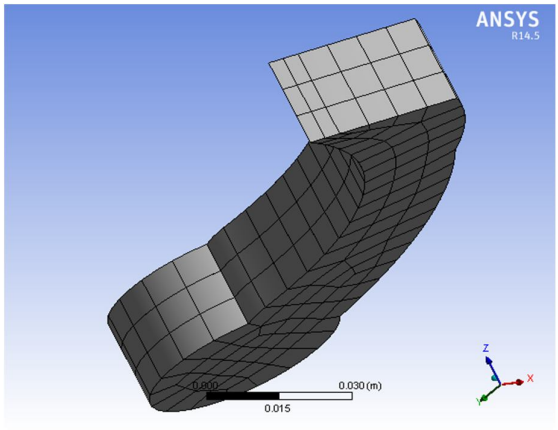

Fig 8. Meshing of the single blade Tiller

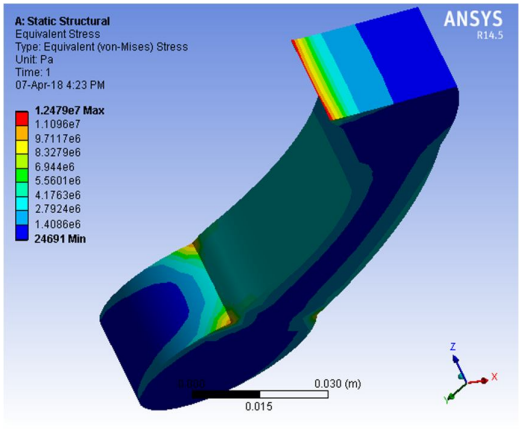

Fig 9. Equivalent stress on the Tiller blade

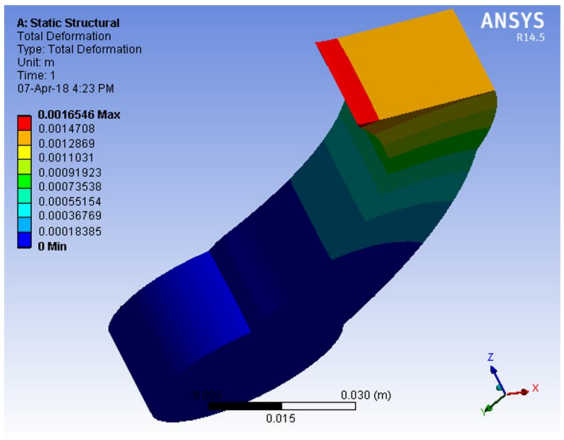

Fig 10. Deformation on tiller blade

In total deformation the minimum deformation is 0 m and the maximum deformation is 1.6546e-003 m. In Equivalent(von-Mises) stress the minimum stress is 24691 Pa and the maximum equivalent stress is 1.2479e+007 Pa.

IV. Conclusion

Cultivators mix and pummel the dirt, either before planting (to circulate air through the dirt and set up a smooth, free seedbed) or after the harvest has started developing (to slaughter weeds—controlled unsettling influence of the topsoil near the product plants executes the encompassing weeds by removing them, covering their leaves to upset their photosynthesis, or a blend of both). In contrast to a harrow, which aggravates the whole surface of the dirt, cultivators are intended to bother the dirt in cautious examples, saving the harvest plants however disturbing the weed.

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