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Design and Analysis of Auger in KAMCO Power Tiller

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Abstract :- *The objective of this paper was to design and analyse of auger in KAMCO power tiller. An auger is a drilling device, or drill bit, that usually includes a rotating helical screw blade called a "flighting" to act as a screw conveyor to remove the drilled out material. The rotation of the blade causes the material to move out of the hole being drilled. The problem faced in KAMCO is that there is no attachment of auger to that of the tiller. Our project aims in providing multi-use to the tiller by attaching an auger arrangement with less cost. In our project we have designed an auger attachment to the present model. We have also included design, analysis (deformation, buckling and natural frequency analysis) in our project work. By constructing a structure consisting an auger on the tiller the advantages can be increased without any considerable increase in the cost. As a result the sales of the tillers can be increased in KAMCO.*
Keywords: - *Tillers, Augers, Flighting, Buckling.*

I. INTRODUCTION

In this challenging world, most of the industries are looking forward to produce their products with more profit without losing its quality and uses. An attachment of the auger to the tiller will lead to the multipurpose of the simple tiller of the industry. The installation of the auger to the tiller lead to several criteria in designing and analysis of the same have a major importance.

A tiller-auger attachment has been attracting much attention because it can be used for both applications by a single assembly. Today auger attached to the tiller works on hydraulic mechanism, it is costly. Since it is costly small scale land farmers faces difficult in buying those machines. So auger attached to the tiller using rack and pinion, bevel gear mechanism cost can be reduced upto fifty percentage comparatively. The scope of this work is to design an auger attachment in KAMCO power tiller.

The surveys of the literature regarding the tiller auger attachments are listed:

F.A. Adamu et al. **[1]** the Power Tiller speeds was measured using stopwatch and a measuring tape, width of cut of the machine was measured using measuring tape, soil moisture content was obtained using a laboratory oven drier and the depth of cultivation and fuel consumption was measured using a graduated dip stick. The results obtained were from the following field parameters: effective field capacity, field efficiency, fuel consumption, speeds of operation, depth and width of cut. The fuel consumption was 1.3L/hr. and 1.6L/hr. for ploughing and rotovating at a depth of 9cm and 5.5cm when the soil moisture contents were 6.3 and 8 percent respectively. The result shows that the machine is suitable for small scale farmers.

Shuo Hung Chang et al. **[2]** this paper presents a computer-aided design procedure for generating bevel gears. The development is based on examine a perfectly plastic, cone shaped gear blank rolling over a cutting tooth on a plane crown rack. The resulting impression on the plastic gear blank is the envelope of the cutting tooth. Equations represent the locus of the points on tooth surface. The same procedure is then extended to stimulate the generation of the spiral bevel gear. The analysis presented herein can form a basis for numerical design studies as well as for stress and deformation studies.

G. K. Ananthasuresh et al. **[3]** the general procedure for synthesizing the rack and pinion mechanism up to seven precision conditions is developed. To illustrate the method, the mechanism has been synthesized in closed form for three precision conditions of path generation, two positions of function generation, and a velocity condition at one of the precision points. This mechanism has a number of advantages over conventional four bar mechanisms. The method of solution developed in this work uses the complex number method of mechanism synthesis. A numerical example is included.

Tanya Niyamapa et al. **[4]** the effect of shape of prototype rotary blades on the performance of rotary power tiller was investigated in this study. Three sets of rotors, i.e. 14-blade rotor of the Japanese C-shape blade were used. For all rotors, experimental results showed that the mean soil clod diameter decreased and soil inversion increased with increasing rotational speed of the rotor. The mean soil clod diameter decreased at pass 2. Soil inversion during pass 2 was higher than pass 1. However, the three sets of rotors showed no significant difference on mean soil clod diameter and soil inversion. The shape of blade prototype rotary blade no. 1 and the decreasing number of prototype rotary blade no. 2 did not affect the tillage performance as compared with the Japanese C shaped blade.

Dong Yang et al. **[5]** Isometric modification is proposed as a new method of axial modification of spur bevel gear. Based on the gear geometry theory and the normal meshing motion equation of gear pairs, changes of meshing points and angles are analyzed and the effect of axial modification on meshing movement of gear pairs is discussed. After that, a method of drawing spherical involute with the aid of Solid Works software is achieved, by which the accuracy of solid modeling of spur bevel gear is improved. After solid modeling, bevel gear analysis is carried out by ANSYS/LS-DYNA software so that the contact stress and acceleration changes of driven wheel during the meshing process which was used to guide the modification of spur bevel gear can be calculated. The simulation results show that the stress distribution of gear surface is controlled by tooth modification. The load concentration, agglutination and pitting of the gear can be avoided effectively.

This study aims to design and analyse of auger in KAMCO power tiller and to investigate its functions analytically.

II. ANALYTICAL SETUP

II.1. Design

The design of auger attachment in KAMCO power tiller mainly consists of three parts. These mechanisms are designed with the help of solid works software.

(1) Bevel gear mechanism

(2) Rack and pinion arrangement

(3) Shaft

II.2.1 Buckling Analysis

In science, buckling is a mathematical instability, leading to a failure mode. Theoretically, buckling is caused by a bifurcation in the solution to the equations of static equilibrium. At a certain stage under an increasing load, further load is able to be sustained in one of two states of equilibrium: a purely compressed state (with no lateral deviation) or a laterally-deformed state.

Buckling is characterized by a sudden sideways failure of a structural member subjected to high compressive stress, where the compressive stress at the point of failure is less than the ultimate compressive stress that the material is capable of withstanding. Mathematical analysis of buckling often makes use of an "artificial" axial load eccentricity that introduces a secondary bending moment that is not a part of the primary applied forces being studied. As an applied load is increased on a member, such as a column, it will ultimately become large enough to cause the member to become unstable and is said to have buckled. Further load will cause significant and somewhat unpredictable deformations, possibly leading to complete loss of the member's load-carrying capacity. If the deformations that follow buckling are not catastrophic the member will continue to carry the load that caused it to buckle. If the buckled member is part of a larger assemblage of components such as a building, any load applied to the structure beyond that which caused the member to buckle will be redistributed within the structure.

II.2.2 Deformation Analysis

In materials science, deformation refers to any changes in the shape or size of an object due to:-

- An applied force (the deformation energy in this case is transferred through work) or
- A change in temperature (the deformation energy in this case is transferred through heat).

As deformation occurs, internal inter-molecular forces arise that oppose the applied force. If the applied force is not too great these forces may be sufficient to completely resist the applied force and allow the object to assume a new equilibrium state and to return to its original state when the load is removed. A larger applied force may lead to a permanent deformation of the object or even to its structural failure. In the figure it can be seen that the compressive loading (indicated by the arrow) has caused deformation in the cylinder so that the original shape (dashed lines) has changed (deformed) into one with bulging sides. The sides bulge because the material, although strong enough to not crack or otherwise fail, is not strong enough to support the load without change, thus the material is forced out laterally. Internal forces (in this case at right angles to the deformation) resist the applied load.

II.2.3 Natural Frequency Analysis

Natural frequency is the frequency at which a system tends to oscillate in the absence of any driving or damping force. Free vibrations of any elastic body is called natural vibration and happens at a frequency called natural frequency. Natural vibrations are different from forced vibration which happens at frequency of applied force (forced frequency). If forced frequency is equal to the natural frequency, the amplitude of vibration increases manifold. This phenomenon is known as resonance.

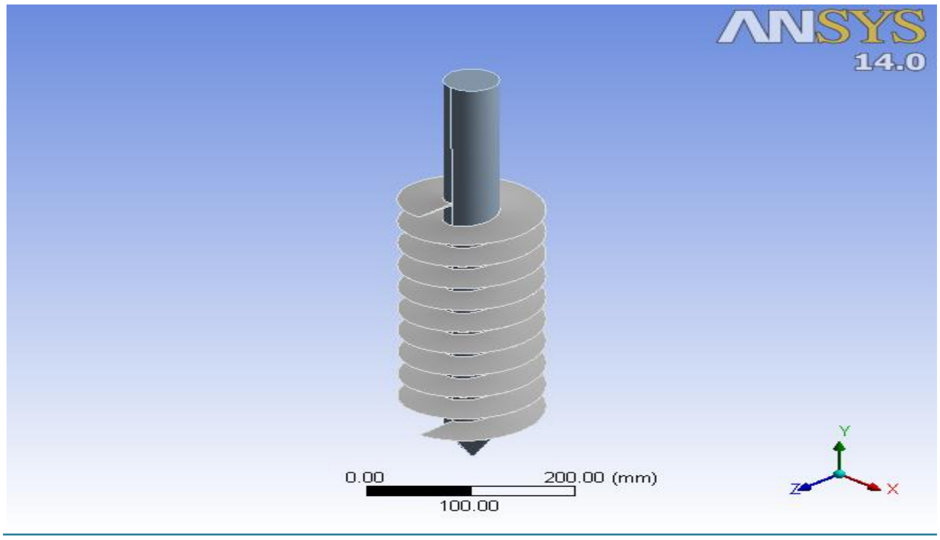

Figure 1: Natural Frequency Analysis

III. RESULTS AND DISCUSSIONS

Figure 1. shows the natural frequency analysis. It is observed from the various analysis that the auger which was designed will resist the applied load.

IV. CONCLUSIONS

The advantages of using tiller auger attachments were investigated analytically. The main conclusions are listed as follows:

1) The installation of auger to that of the tiller can increase the applications and sales of the powered tillers of KAMCO, by only a slight increase of the cost.

2) With this installation we will be able to increase the demand of the KAMCO tillers in the market.

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REFERENCES

[1] F.A. Adamu, B. G. Jahun and B. Babangida, “Performance Evaluation of Power Tiller”, IISTE Journal of Biology, Agriculture and Healthcare Volume.4, No.9, (2014).

[2] Shuo Hung Chang, “Computer-Aided Design of Bevel Gear Tooth Surfaces” IBM T.J. Watson Research Center Yorktown Heights, New York NASA Technical Memorandum 101449 (2009).

[3] G. K. Ananthasuresh, S. N. Kramer, “Kinematic Synthesis and Analysis of the Rack and Pinion Multi-Purpose Mechanism” Journal of Mechanical Design Vol. 114 /431. (2002).

[4] Sirisak Chertkiattipol, Tanya Niyamapa, Wanwisa Jantaradach and Kridsada Saensuwan, “The performance of rotary power tiller using prototype rotary blades in dry-land field” Mj. Int. J. Sci. Tech. 1(Special Issue), 17-26.(2008).

[5] Dong Yang, Huanyong Cui, Xijie Tian, Qingping Zhang and Pengfei Xu, “Research on Tooth Modification of Spur Bevel Gear” The Open Mechanical Engineering Journal, 5, 68-77,(2011).

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