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Design and Fabrication of Multi Crop Cutter

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ABSTRACT: This title presents the concept for design and fabrication of multi crop cutter. The crop cutting is important stage in agriculture field. Currently in India former used conventional method for crop cutting i.e. the conventional method for crop cutting is as manually cutting using labour but this method is lengthy and time consuming. This project aim is to design and analysis of small field crop cutter machine for small height and small steam crop. It helps to reduce farmer's effort and to increase rate of cutting crop. The machine consist of different mechanisms are used in this machine. When compare to manual crop cutting by using this machine has a capacity to cut the crop in faster rate. This machine is helpful for both the small as well as big farm. This machine is used by poor farmers which are not capable to buy Harvester machine, Ripper binder machine, etc. because of high cost.

KEYWORDS: Manual method, Mechanized method, Peak working, Crop cutting.

I.NTRODUCTION

Agriculture is the backbone of India. In India agriculture has facing serious challenges like scarcity of agricultural labour, in peak working seasons but also in normal time. This is mainly for increased nonfarm job opportunities having higher wage, migration of labour force to cities and low status of agricultural labours in the society. In India two type of crop cutting like as manual method (conventional method) and mechanized type of crop cutter. The crop cutting is important stage in agriculture field. Currently Indian former used conventional method for crop cutting i.e. cutting crop manually using labour but this method is very lengthy and time consuming.

To design and fabrication of multi crop cuter machine which is help to the Indian former which is in ruler side and small farm. It will reduce the cost of crop cutting in field. It will help to increase economical standard in Indian former.

II.RELATED WORKS

Various approaches have been proposed for improving mechanized type of crop cutter in agriculture field. Designing a reaper machine to harvest grains more efficiently. The research work focusing on harvesting operation to the small land holder to cutting varieties of crop in less time and at low cost by considering the factor as power requirement, ease of operation , field condition , time of operation and climatologically condition. By the study Mr. P. B. Chavan, Mr. D. K. Patil, Mr. D. S. Dhondge (1)

To increase the productivity and profit. How to cutting reduce the cost and how to solve the problem comes from workers. It is fabricated for cutting various crop varieties during the time cutting to the "FABRICATION AND PERFORMANCE TEST OF AN ULTRAPORTABLE CROP CUTTER by G Maruthi Prasad Yadav, GMD JaveedBasha (2)

This fabrication model small scale sugarcane harvesting machine consists petrol engine and mechanisms are used in this machine to compare to manual harvesting by using this machine has capacity to cut sugarcane in faster rate and economical. This study done by the Adarsh J Jain, SrinivasRarod, Vinay N Thotad and Kiran (3)

In this research work was made to investigate the cutting energy and force required for the pigeon pea crops. The commercially available blade it has been attached to the lower end of the arm of pendulum type dynamic tester which cut the stalk at 900 to the stalk axis with knife velocity ranging between 2.28m/s to7.23 m/s the diameter of stem at42.6 % (wb) moisture content. The cutting force I directly proportional to cross sectional area "stem cutter was deign and developed by Atul R. Dange, S. K. Thakare, I Bhaskarao and Umar farooq momin. (4)

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III.MULTI CROP CUTTER WORK LAYOUT

The work layout shows the arrangement of various parts of project. It consists of different parts including two big rear wheel & two small front wheel, two pulleys, blades, crank & connecting rod, etc. we classified it into three sections as follows: (1) chassis arrangement (2) Power transmission arrangement (3) Cutting arrangement.

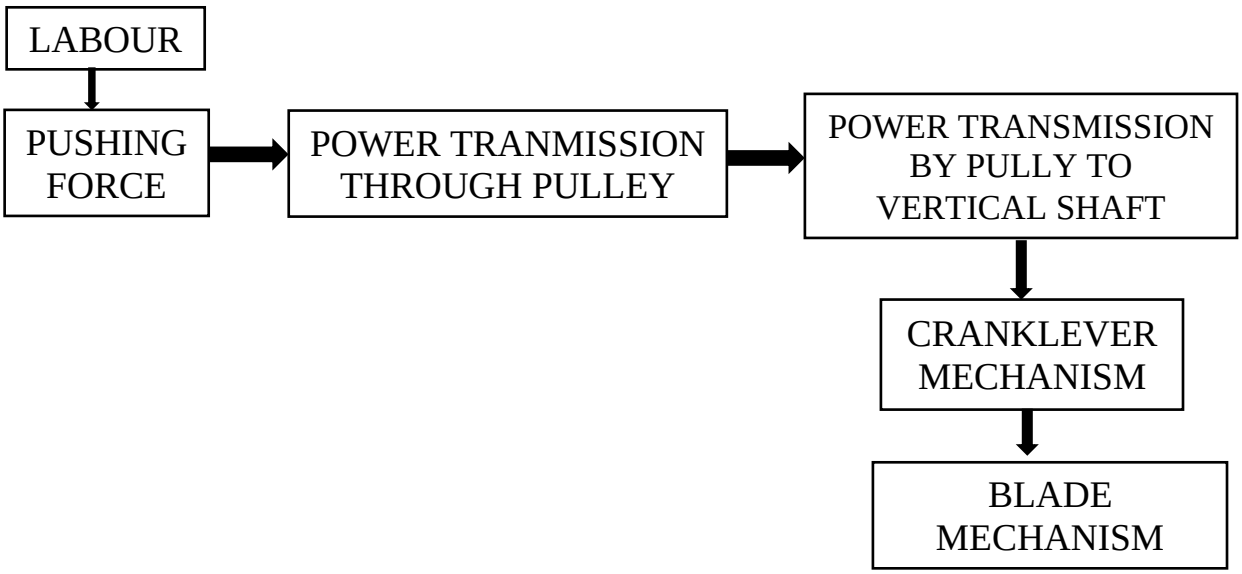

Fig1 Working layout of practical arrangement

The above three sections of this project can easily describe the project function. The input is given to the pushing force of labour to the handling .The output of 1st section is then given to the input of power transmission section which includes 1st shaft having large pulley. Then output of the power to the 2nd shaft having small pulley and it transmit to crank shaft, which have crank lever mechanism (2nd inversion of single slider mechanism), which is power transmit to the blade mechanism.

IV.MATERIAL SELECTION

Many shafts of our machine is made from cold drawn, low carbon, or hot-rolled steel Alloy steel: Nickel, vanadium and chromium are some of the common alloying materials. However, alloy steel is comparatively costly. Shafts of cutting mechanism usually don't need to be surface hardened until and unless they serve as the actual journal of a bearing surface. Hardening of surface of shaft (wear resistant): case hardening, carburizing, cyaniding and nitrating.

V.SPECIFICATION OF MULTICROP CUTTER MACHINE

Weight of machine:-20 Kg.

Sr. No.	Name of Components	Dimensions	Material
1.	2 large wheels (Rear)	Diameter - 18"	
2.	2 small wheel (Front)	Diameter - 8"	
3.	Large pulley	Diameter – 12"	Mild steel
4.	Smaller pulley	Diameter – 3"	Mild steel
5.	Blade	Ripper binder	Stainless steel
6.	Shaft		Mild steel

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VI.WORKING PRINCIPLE OF MULTI CROP CUTTER MACHINE

The machine is used for cutting stems of the cereal crops. The machine is operated with help of the manual power. Machine has 2 shaft that are driven by the rear wheel, when machine gets started shaft on rear wheel is rotated and since it is coupled with the successive vertical shaft by pulley arrangement , the shaft also rotates. The crank lever arrangement set up between blade and shaft and thus blades will move reciprocate.

The speed of cutter is varying with the help of speed of the cutter machine (Pushing speed) for which handle provided on the Chassis. Then we grip the machine handle and take the Cutter Machine into the actual field of crops where we want to cut the cereal stem then we select a row of crop stems and machine move on this row. After cutting of stems they are taken by worker and are separated from the field. So our machine is fully manual due to that we can adjust the cutting feed of the machine manually.

VII.MACHINING PROCESS FOR FABRICATION OF MULTICROP CUTTER MACHINE

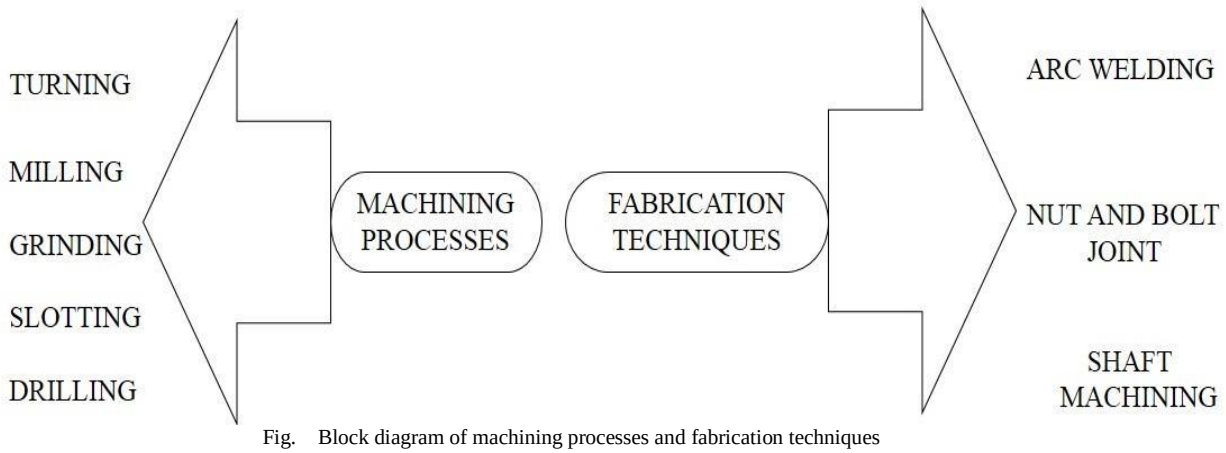

Fig. Block diagram of machining processes and fabrication techniques

Fabrication is the process of making the machine or structure by using the various machining methods and fabrication techniques.

Turning is used to reduce the radius of the work piece, usually to a specified dimension, and to produce a smooth finish on the metal. Milling can be done with a broad range of machine tools. The original class of machine tools for milling was the milling machine (often called a mill). Grinding is used to finish work pieces that must show high surface quality (e.g., low surface roughness) and high accuracy of shape and dimension. Drilling is machining method is used to produce the circular holes in the machining component, to produce the holes in jobs various drill bits are used. A machine tool with a vertically reciprocating planning tool used for making a mortise or shaping the sides of an aperture. Welding is a fabrication or sculptural process that joins materials, usually metals. There are also special-purpose closing devices, nuts and bolts. For the drive shaft we choose the EN8 (medium carbon steel) material, it is economical and having the required strength for the equipment.

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VIII.DESIGN ANALYSIS

A. Theory

The shearing force of most cereal and staple crop stem and grasses found on most crops is usually between 9.24N - 11.61N (Young and Chow, 91).Force required by cutting blade to shear the grass is given by:

Force = Torque/Radius (Khurmi-Gupta, 2003)
Where, T = Shaft torque, R = Radius of Crank rod

But shaft torque is given by

$T = P/2\pi N$ (Khurmi-Gupta, 2003)
Where, P = Power developed by shaft in kW, T = Torque required in Nm, N = Shaft speed in Rev/min

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B. Design of Shaft

The expected rotation of the shaft is 1498 rpm. The shaft is subjected to both transitional and bending stresses.Hence the diameter of the shaft is given by Hall, (1980) as

D3 = 16(M2+T2)1/2/3.14rmax

Where, D = diameter of shaft in m, T= twisting moment acting on the shaft Nm, rmax = maximum shear stress in m.

For shaft Transmitting power in kW at a rotational speed in rpm the transmitting torque is given as
Transmitting Torque = Speed/Power

C. Design of Pulley and belt

$$\frac{F1-Fc}{F2-Fc}=e^{\left(\frac{\mu\theta}{\sin\beta}\right)} \quad \text{or} \quad \frac{F1-Fc}{F2-Fc}=e^{(\mu\theta\csc\beta)}$$

Where, F1 - belt tension at tension side (N), F12 - belt tension at slack side (N),
Fc – tension due to centrifugal effect (N) ($Fc=mv^2$)
μ – coefficient of friction between belt & pulley
θ – angle of contact (rad)

$$P=(F1-F2)v$$

$$P=T\omega \quad \text{and} \quad T=(F1-F2)r$$

Where, P - Power transmission, T – Tension

Length of belt(L)=$2C+\pi(D_{2+}D_1)/2+(D_{2+}D_1)^2/4C$

Where, L- length of belt, C- Center ditance of pulley, $D_{1\&}D_{2-}$ dia of pulley

D. Design of Handle

The handle is made of a square steel pipe which is folded to a length of 2.74 m and 0.76 m orientation toward the machine frame at an angle of 45 degree which is welded for the operator's Convenience. The handle is subjected to both bending and axial forces due to the inclined position as given by Khurmi (2011)

IX.CONCLUSION

In this way the design of multi crop cutter is safe, such human powered machine systems will help to a great extend to improve the economic condition and employability of such countries. A new type of mechanism is fabricated which is different from other crop cutting machines will work on non-conventional energy source and purely human operated. Such systems are of very importance in Asian countries as almost all Asian countries are facing electricity and power scarcity which results in twelve to fourteen hours load shedding in rural areas especially in India.

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