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ELECTRIC MOTOR POWRED MULTI GRAIN CUTTER

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Abstract - *Agriculture is considered as a foundation of life, since the primary source food and other raw materials is from the agriculture. Agriculture is facing serious challenges like scarcity of agricultural labor, in peak working seasons. Presently, the agricultural industry has come up with vast range of equipments for efficient farming. At the same time, the main drawback is that it is not affordable by farmers with poor economical background. This paper represents the project work carried on development of electric motor powered multigrain cutter. We have planned to develop a compact mechanism for harvesting of crop powered by electric motor so that we can an easily harvest in minimum period of time. This set up is used to cut the multi-crops, which help the small scale formers. . It has cutting blades which cut the crop in a scissoring type of motion .This cutter is been invented because of low cost, high compatibility and use for rough cutting. This harvester might be the solution to the problems faced by a small scale farmer regarding cost and labor implementation.*

Key Words*: *Crop Cutting, Scissoring Action, AC Motor, Blades

1. INTRODUCTION

We are proposing a Electric Motor Powered multi grain cutter; this machine targets the small scale farmers who have land area of less than 5 acres. This machine is compact and can cut up to two rows of wheat crops, soya and other. It has cutting blades which cut the crop in a scissoring type of motion. It runs on Electric motor of 2HP, this power from motor, is provided through coupling shaft and slider mechanism to the cutter. This compact harvester is manufactured using locally available spare parts and thus, it is easily maintainable.

1.1 Objectives

1. To design and fabricate a low cost multi crop cutting machine: - Based on the need of small farmer a cheapest multi grain cutting machine is developed.

2. To minimize time of harvesting:- As machine will take less time to cut the crop compare to manually work done by labour. So it will reduce the time of harvesting.

3. To minimize the human effort: - the labour if the work is done manually it requires a lot of efforts by the labour and consumes time. By use of this machine, we can reduce the labour required for harvesting.

1.2 LITERATURE SURVEY

Dr. U. V. Kongre and et al Vol. 3, Issue 4 , April 2016;

Harvesting is the important part in the agricultural industry. Modern harvesting technology is increasing day by day. But the cost of the harvesting machines is high. So, these can be only limited and suitable for the farmers having large agricultural land area i.e., more than two hectares. So, the farmers having less cultural area cannot rent (or) buy these harvesters for cutting of crops. So, the main aim of our project is to fabricate "Low Cost Manual Crop Harvesting Machine" which is efficiently suitable for the farmers having less area i.e., less than two hectares for cultivation.

Mr. P. B. Chavan, Mr. D. K. Patil, Mr. D. S. Dhondge

This title presents the concept for design and analysis of crop cutter. The crop cutting is important stage in agriculture field. Currently in India former used conventional method for the crop cutting i.e. the conventional method for crop cutting is as manually cutting using labor 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 crop. To analysis cutting roller and horizontal cutting blade by using Pro-e and anises software. The machine consists of petrol engine to operate cutting roller and blade. When compare to manual crop cutting by and this machine has a capacity to cut the crop in faster. This machine to helpful for both the small as well as big farm..

2. METHODOLOGY

It is a Multi Crop Cutter Powered by Electric Motor. This machine is compact and can cut up to two rows of wheat crops, soya and other. It has cutting blades which cut the crop in a scissoring type of motion. It runs on Electric motor of 1HP, this power from motor, is provided through pulley and gear box arrangement to the cutter. When we give electric supply to the electric motor (1H.P 1500 rpm) it starts to transmit the power to the gear box with the help of V-belt, drive power is transmitted to gearbox. As the required rpm at cutter is as less as 200 rpm, spur gearbox is used. Here high torque Johnson type motor is used to collecting the crop cut by cutter blade. One end of this output shaft is connected to slider crank mechanism which converts rotary motion of shaft into reciprocating motion of cutter blade. Reciprocating cutter blade slides over fixed blade and creates scissoring action responsible for cutting the crops.

2.1 Components used

1. Single phase Induction motor (0.5 Hp, 220v.3A1440rpm)

2. Variac

3. Coupling shaft

4. Cutting blades

5. Crank and Slider mechanism

6. Pulley with v belts

7. Iron pipes for body frame

2.2 Block diagram

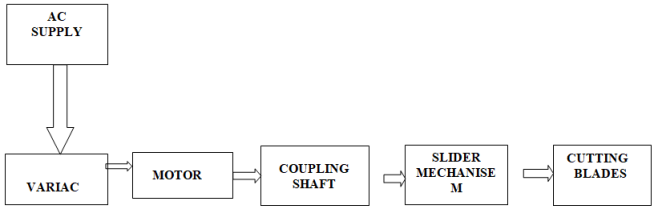

Figure 2.2 Block Diagram

When an ac supply is connected to the variac, variac is nothing but single phase auto transformer and it is used for regulating the voltages. The voltage regulated by variac is applied to the motor. This is connected to the coupling shaft. The coupling shaft is connected to the cutting blades in between that, slider mechanism is present.

Sliding mechanism is an arrangement of mechanical parts designed to convert straight line motion to rotary motion. The motor will run and power is supplied to the cutting blades. In that cutting mechanism one is stationary blade other is reciprocating blade. The sliding cutter blades allow to sliding over stationary blade plate, so the scissoring action takes place.

3. Design of crop cutter

Cutting mechanism consists of two cutting blades namely sliding cutter blade and stationary cutter blade. Both cutter blades are supported by 4mm plate. Stationary cutter blades are directly welded to frame. Sliding cutter blades allows to sliding over stationary blade plate, so the cutting action takes place.

Figure 3.1 Design of Crop Cutter

A single phase induction motor of 0.5 HP is placed on the frame. Motors running at 1000rpm. This speed are sufficient to cut the crop. Scissoring action is created when reciprocating cutter blade slides over fixed blade which is responsible for cutting the crops. Cutting mechanism consists of two cutting blades namely sliding cutter blade and stationary cutter blade. Both cutter blades are supported by 4mm plate. Stationary cutter blades are directly welded to frame. Sliding cutter blades allows to sliding over stationary blade plate, so the cutting action takes place.

3.1 Design of crop cutting machine shaft

Parameters of shaft design

Power 1Hp = 746KW

Speed N= 3000rpm

Approximate length of the shaft = 2feet = 610mm

Approximate load on the shaft = 0.5N

Torque = 2piNT/60

T = 2.37N-m = 2.37*10^3N-mm

Bending moment for cantilever beam:

Mb = F*L = 500*610 = 30500N-m

Where,

Mb = Bending moment

Kb = 1.7

Kt = 1.25

Where,

Kt = stress concentration factor

Kb = Maximum bending factorFor mild steel

E = 210gp

G = 78gpa

Ted = 34N/mm2

Jed = 68N/mm2

Diameter of shaft for mild steel

D={16/pi*68[1.75*30500+{(1.75*30500)^2+(1.25*2.7*10^3)2}^1/2]}^1/3

D = 20mm

D=[16/pi*34{(1.75*30500)^2+(1.25*2.37)^2+(1.25*2.37)^2}^1/2]^1/3

D = 30mm

Standard diameter of shaft is 25mm or 30mm

D= 30 mm is used.

Figure 3.1 Pulley with V-belt

4. Fabrication of Mechanical parts

The mechanical components like cutting blades, shaft and pulleys are assembled on iron frame.

A square steel pipe used to make the frame with dimensions with length of 37.5 inches and breadth of 32 inches and handle which is folded to a length of 24 inches and 32 inches width orientation toward the machine. Iron pipes are welded by used lap joint welding method. With the help of V-belt, drive power is transmitted from the motor to the shaft of length 40 inches Rotary motion of shaft converted into reciprocating motion of cutter blade with the help of one end of this output shaft is connected to slider crank mechanism.

Figure 4.1 Crop Cutting machine

A pulley with one wheel allows you to reverse the direction of your lifting force by pulling down on a rope (that's looped over the wheel), lifting your weight. With a two-wheel pulley, you reduce the effort you exert to lift the same amount of weight. You lift the weight with half the force.

Figure 4.2 Electrical Power Multi Grain Cutter

5. Result

The calculation of torque, speed in rpm and power out are tabulated below.

Power:-

The output power is calculated by P=VI CosØ**.**

Where, V is supply voltage

I = Current drawn by the motor

Power factor cos Ø= 0.8

Full load Torque

T = 5252 Php / Nrpm

Where

Php = rated horsepower

Nrpm = rated rotational speed (rev/min, rpm)

The speed is calculated by using tachometer

Observations:

Sl no	Supply voltage (V)	Supply Current (I)	Speed rpm	Output power watt	Power loss
01	100	3.2	1000	256	117
02	112	3.4	1050	304	69
03	200	2.1	1120	336	37

The power loss observed which is due to the friction loss occurs in the coupling shaft and cutting blades. Compare to manual harvesting process time and labour cost required is reduced.

6. Advantages, Disadvantages and Application

Advantages

1. High compatibility

2. Low cost.

3. It requires less time

4. Easy to operate and maintenance

5. Reduce dependency of labour

6. Can be operated by unskilled person.

7. It does not require high maintenance cost.

DISADVANTAGES:

1. Power loss occurs due to friction.

2 .The system produces noise.

APPLICATION:

1. It is used in agricultural fields for cutting the crops.

7. Future Scope and Conclusion

7.1 Future scope:

1. The design of the machine can be improved by using portable components.

2. The Collecting mechanism consist of flat belt with collecting plates can be bolted and it can simply carry and cut crop sideway.

3. The complete system can be designed with solar power which will further reduce the maintenance cost.

6.2 Conclusions:

Electric motor powered multi-crop cutter has been designed, fabricated and analyzed for its performance. This project was an attempt to achieve three main objectives. First is to make it an economical and efficient crop cutter. Second objective is to reduce the cost involved in maintenance and the third objective is to overcome the lack of availability of skilled laborers. He use of this machine makes harvesting process faster, hence reduces most of the cutting time and labor required to operate the machine is also less. This machine is very helpful for farmers having small farm land.

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