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Design & Modification of Chaff Cutting Machine

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Abstract-*Chaff cutter is a hay or straw cutting machine which is used in uniform chopping of the fodder for livestock or raw material to agro industries. The various types of fodder can be processed in this machine are forage grass, green grass, dry corn straw, and wheat stalk. The final products can be used to feed cattle, goats, deer, and horses. It can also process cotton stalk, bark, small branches, they can also be used to generate electricity, and to make paper.Chaff cutters have developed gradually from the basic machines into commercial standard machines that can be driven at various speeds so as to achieve various lengths of cuts of chaff with respect to animal preference type. New chaff cutter machines consists of portable tractor driven chaff cutter - where chaff cutter can be in the field and load trolleys*

Keywords *– Chaff, Uniform chopping, Fodder, Tractor driven chaff cutter*

1.INTRODUCTION

A chaff cutter is a mechanical device used to cut the straw or hay into small pieces so as to mix it together with other forage grass and fed to horses and cattle. This improves the animal's digestion and prevents animals from rejecting any part of their food. Chaff and operations until they were replaced by tractors in the 1940s. Chaff cutters have developed gradually from the simple machines to commercial standard machines that can be driven at various speeds so as to achieve various sizes of chaff with respect to animal preference type. New chaff cutter machines include portable tractor driven chaff cutters in which cutting of chaff is done in the field and loaded in trolleys. The present green fodder cutting machine features a single, only rod-shaped cut green fodder, green fodder cannot cut block. Whether peasant family, tribunal or farms and sales markets are in urgent need of a new, practical, functional and greener fodder cutter.The population of cattle in India in 1987 was 274 million. For such kind of population traditional human powered fodder cutting machines were used, but due to this the efforts for running the machine was physically demanding. And as per today's scenario the population of cattle is drastically increased. So to increase the productivity and reduce the physical effort required for running the machine the motorized machineries came into existence.

2.OBJECTIVE

To modify the design of chaff cutting machine which can allow the farmer to not only cut the sugarcane in a form which can be utilized as a fodder for animal but can also grind various feeding materials such as dry corn straw, grass, soyabean, wheat stalk, with ease and thus reducing the manual work of farmer and increases the fodder production.

3.METHODOLOGY

1)**Problem detection in chaff cutting process** –The existing machines are observed and studied properly to detect the problems faced by the user.

2) **New cutting technology –** The research work in this domain was studied and new methods were developed to achieve desired goal.

3) **Single phase operation –** The power supplied to machine is single phase so to make it easy to operate at any location.

4) **Safety –** Highest priority is given to safety of the operator.

4.Construction& Working of Chaff Cutting Machine

4.1 Components

A. Power Source – Electric Motor

Fig –1: Electric Motor

Electric motor is an electrical machine that is used to convert electrical energy into mechanical energy. For smaller loads as in household application in fans. Although traditionally used in fixed-speed service, induction motors are increasingly being used with variable-frequency drives (VFDs) in variable-speed service. VFDs offer especially important energy savings opportunities for existing and prospective induction motors in variable-torque centrifugalfan, pump and compressor load applications.

B. V belt drive

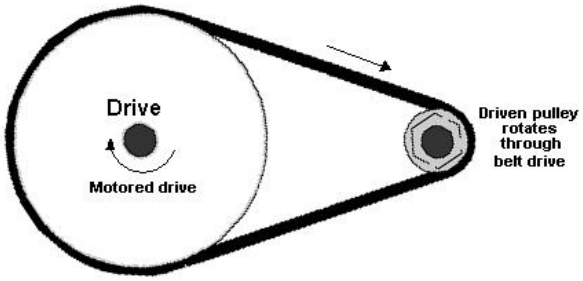

Fig –2: V belt drive

The V-belt has been in existence since the early 1920's. Through the years, many modification are done in the use of material of V-belt construction and in cross sectional shape as well. Originally, V-belts came into existence to replace the flat and round belts on automotive drives to ensure greater reliability. V belt drive arrangement is used to transmit power from motor to shaft which is connected to cutter mechanism.The use of V-belts in multiple, allowed drives with a much variable range of horsepower capacity than ever before obtainable using single belt drives.

Significant advantages include–

- Operates smoothly .
- Permit a wide range of driven speeds, using standard electric motors.
- Can transmit power around corners or out of plane drives.
- Clean require no lubrication.
- Highly efficient.
- Noise generation is very less.
- Long service life.
- Easy installation.
- Can be used as an effective means of clutching.
- They act as a "safety fuse" refusing to transmit severe power overload, except for a very brief period.
- V-belts and sheaves wear gradually-making preventive corrective maintenance simple and easy.

C. Shaft

A Shaft is a rotating element, usually circular in cross section, line shaft is used to transmit power from one shaft to another, or from the machine which produces power, to the machine which absorbs power. The various members such as pulleys, gears etc. are mounted on it.

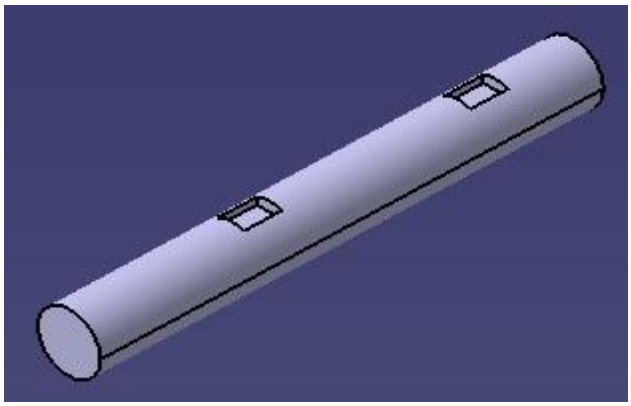

Fig –3: Shaft

D. Chaff Cutter

This is the main section of the chaff cutting machine. The fine and uniform chopping of the chaff is done in this section.

Chaff cutter consist of following parts -

Hopper, cutter (main blade and centrifugal bade), Housing, Frame stand

1. **Hopper**

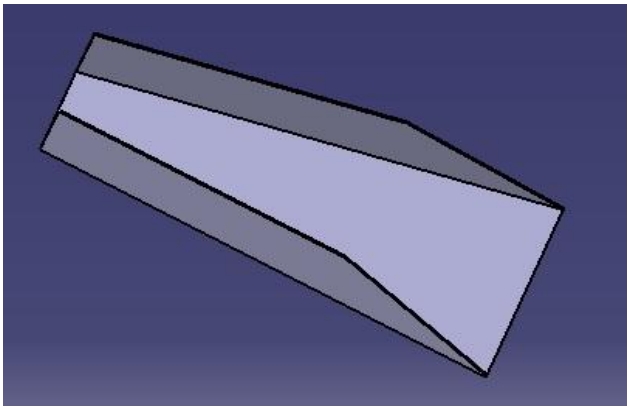

Fig – 4: Hopper

- Trough is used to feed food material such as sugarcane, cutting grass.
- Feeding trough decides capacity of feed choppers
- Its function is provide direction to grass,corn straws & bring contact with chaff cutting blade

2. Cutter Blade (main blade and centrifugal blade)

Cutter blade is main part in chaff cutter machine which has consists of two sub blades and they are as follows-

a) Main blade
- They have sharp edge, they used to cut grass into number of small steps .So that they can easily rotated in chaff cutting housing & get crushed in powder form by centrifugal blade

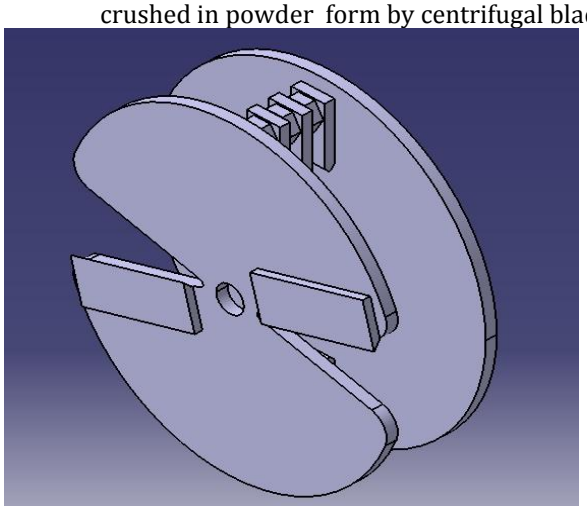

Fig – 5: Cutter Blade

b) Centrifugal blade
- Used to crush grass in powder form
- Throws powder at exhaust with high speed

3. Housing

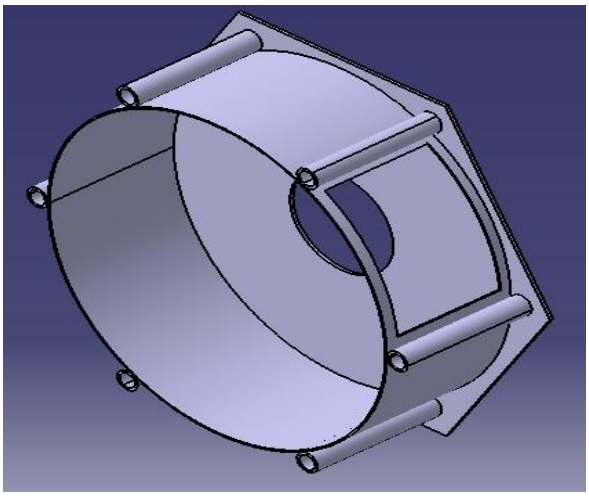

Fig – 6: Housing

Housing covers the cutting blade. Whatever chopping or grinding action is done it takes place within the housing. Housing protects the worker from not touching the blades accidentally.

4. Vee Pulley

To transmit power from motor to cutter blade shaft this vee pulley is used.A belt and pulley system is characterised by multiple pulleys in common to a belt. This allows for mechanical power, torque, and speed to be transmitted across axles. If the pulleys are of differing diameters, a mechanical advantage is realized.

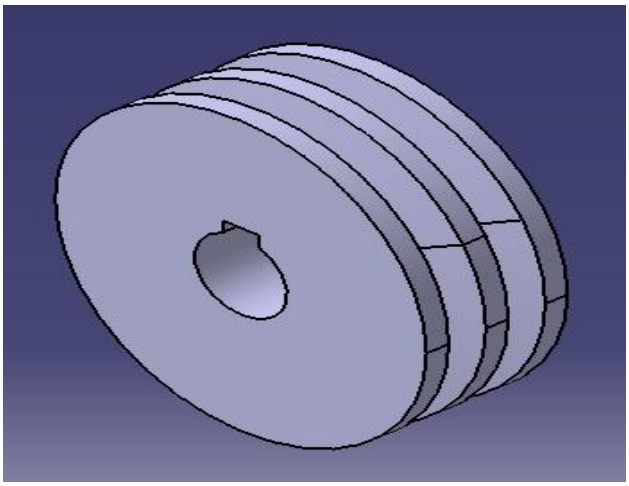

Fig – 7: Vee pulley

5. **Supporting frame**

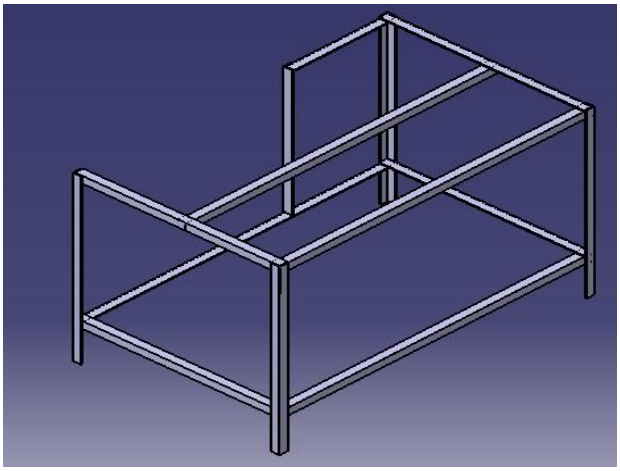

Fig – 8: Supporting Frame

The whole assembly is mounted on this frame. The complete frame is made up of mild steel.

4.2 Assembly

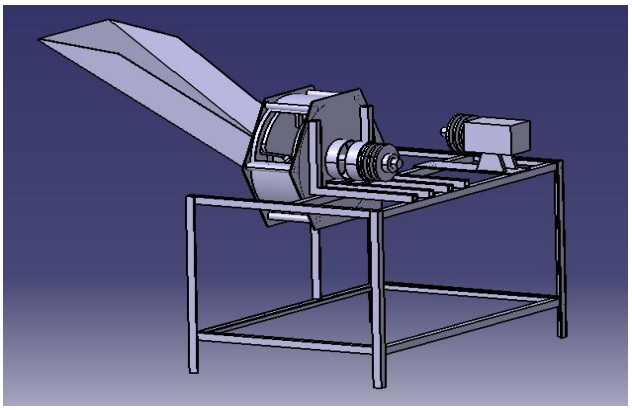

Fig – 9: Assembly

Procedure-

1. Supply power source to Electric motor-

Here we are using single phase 1 H.P motor so we require single phase power supply.Input speed of our electric motor is 1425 rpm .In order to rotate chaff cutting blade we have to rotate them by using power drives.

2. Power transmission through belt-pulley drive which are mounted on shaft

For transmitting power we choose belt & pulley as power drive .This belt pulley arrangement is coupled to cutting blades by using coupling shaft. Hence rotation of cutting blades occur.

3. Feeding of food material

We feed fodder through hopper .As feed trough has large opening & high length this provides guide way to grass & other fodder material like dry corn straw, grass, soyabean, wheat stalk, with ease and thus reducing the manual work of farmer and increases the fodder production.

4. Collect fodder from output tube

After rotation of cutting blades cause cutting of supplied feed material like grass dry corn straw into powder form. This light weight particles thrown away by centrifugal force of cutting blade towards outlet tube .So, place container for collecting fodder

5.CONCLUSION

1. We have replace different sources of chaff cutter by 1 H.P single phase which require low electricity & easily available anywhere so it's beneficial to farmer.
2. By using different types of blades we can obtain different types of chaff for animal.
3. By using this machine we can cut the sugarcane waste so that it can be utilized as a fodder for animal as well as grind various feeding materials such as dry corn straw, grass, soyabean, wheat stalk, with ease and thus reducing the manual work of farmer and increases the fodder production.

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