

## Design and Modification of Chaff Cutting Machine

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**Abstract** - The chaff cutter was very old idea which was developed to reduce the human effort to cut the forage. Which can cut the straw, sugarcane top and other forage which are essential to the animals. i.e for easy digestion. The process of cutting the forage into small pieces before being mixed together with other forage by a mechanical device called as chapping. From old to now there is huge change in chaff cutting machines due to tremendous requirements innovation is going on that. Means power operated as well as hand operated chaff cutters are used to do that work. But again it requires more electricity which is not available in rural areas as well as more manual effort to achieve our goal and basically it is not so much affordable to a small farmer to pay that much amount.

To overcome that problem we have design and modify the chaff cutter which do not require electricity as well as less man power than previous one. It is totally manually working machine which consist of torsion spring which stores the energy and give it to the flywheel by chain drive and fodder coming out from the machines is uniform in size. Which will helpful for digestion and there is no any wastage of forage due to that milk production will increases. The chaffed food also save the chewing energy which will increase the ruminant process. So this machine is really affordable and beneficial for small farmers.

**Key words:** Spring, Uniform, Affordable, Digestion, chain drive.

### 1. INTRODUCTION

A chaff cutter is a mechanical device used to cut the grass, sugarcane top, hay into small pieces so as to mix it together with other forage grass and fed to horses and another animals. which improves the animal's digestion and prevents animals from rejecting any part of their food and also save the chewing energy. Chaff and operations until they were replaced by tractors in the 1940. After that new machines exists which were tractor driven which easily cuts the forage and collect it into trolley. After that motor operated chaff cutting machines are come to overcome the problem of tractor driven machines. those machines requires fuel and large in size. 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 milk productivity and reduce the physical effort required for running the machine the motorized machineries came into existence but it requires

electricity so it is not affordable to small farmers. To overcome that problem we have design and modify the chaff cutter which do not require electricity as well as less man power than previous one. It is totally manually working machine which consist of torsion spring which stores the energy and give it to the flywheel by chain drive and fodder coming out from the machines is uniform in size.

### 2. OBJECTIVE

To modify the design of chaff cutting machine which can allow the farmer to cut various feeding materials such as sugarcane top, grass, wheat stalk, with ease and thus reducing the manual effort of farmer and save electricity consumption.

### 3. METHODOLOGY

**1. Detection of problem in chaff cutter-** 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 part was studied and new methods were developed to achieve desired goal.

**3. Implementation of mechanism -** Instead of using electric motor we were using torsion spring to rotate the flywheel by using chain drive.

**4. Performance testing-** After implementation of mechanism trials was taken to check the performance of machine. we were detect the errors and correct it.

### 4. CONSTRUCTION & WORKING OF CHAFF CUTTING MACHINE

#### 4.1 Components

##### A. Torsion Spring

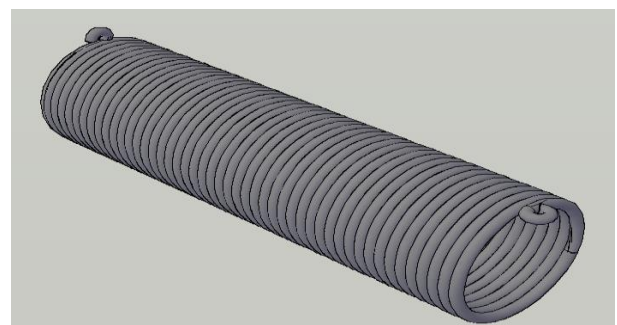
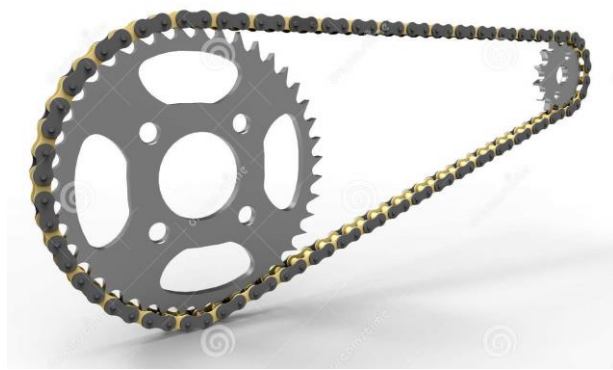


Fig1-Torsion spring

A torsion spring is a spring that works by torsion or twisting; that is, a flexible elastic object that stores mechanical energy when it is twisted. When it is twisted, it exerts a force (actually torque) in the opposite direction, proportional to the amount (angle) it is twisted. There are two types. A torsion bar is a straight bar of metal or rubber that is subjected to twisting (shear stress) about its axis by torque applied at its ends. A helical torsion spring, is a metal rod or wire in the shape of a helix (coil) that is subjected to twisting about the axis of the coil by sideways forces (bending moments) applied to its ends, twisting the coil tighter.

**B.Chain Drive**



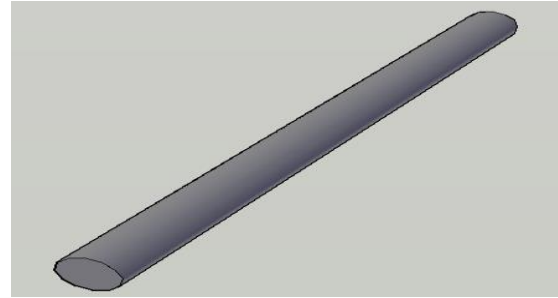
**Fig-2:** chain drive

Significant advantages include-

- Operates smoothly
- Relatively inexpensive.
- Virtually any length chain can be obtained (splicing).
- Positive drive provides synchronization of two shafts.
- Bearing loads are generally lower than for belts (no slack side tension).
- Chain drives are 95-99% efficient.
- Simplicity of design and selection of components.
- Versatile - large variety of attachments can be adapted.
- Tends to be self-cleaning.

**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 sprocket, gears, free wheel etc. are mounted on it.



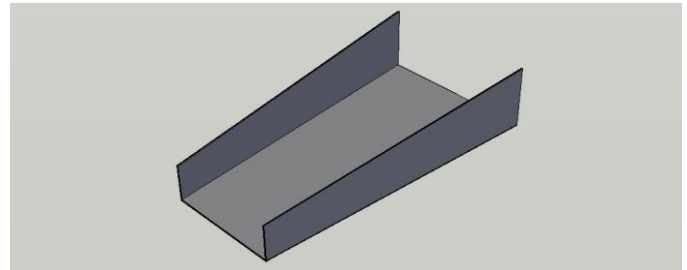
**Fig3-Shaft**

**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 part.

Chaff cutter consist of following parts -Hopper, cutter , Frame stand ,Feed roller.

**1.Hooper**



**Fig 4:** Hopper

- Trough is used to feed food material such as sugarcane, cutting grass.
- Feeding trough decides capacity of feed choppers
- Its basic function is provide direction to grass, sugarcane top & push it towards the feed roller.

**2.Blade**

Cutter blade is main part in chaff cutter machine which is used to cut forage into small pieces and as per requirements. which is made from mild steel so no more tear and wear and also it is corrosion resistant.



**Fig 5-Cutter Blade**

### 3.Feed Roller

Feed roller is the device which is used to pull the forage from hopper and fed it to the cutting blades and after it cuts into small pieces and roller is driven by worm and worm wheel which is connected to the flywheel shaft.

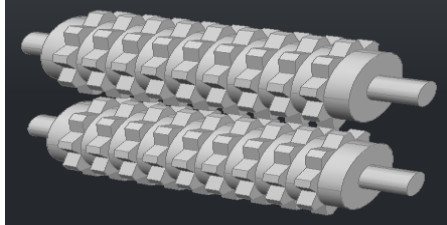


Fig 6 –Feed Roller

### 4. Supporting Frame

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



Fig7- Supporting Frame

### 4.2 ASSEMBLY AND MECHANISM



Fig8-Assembly

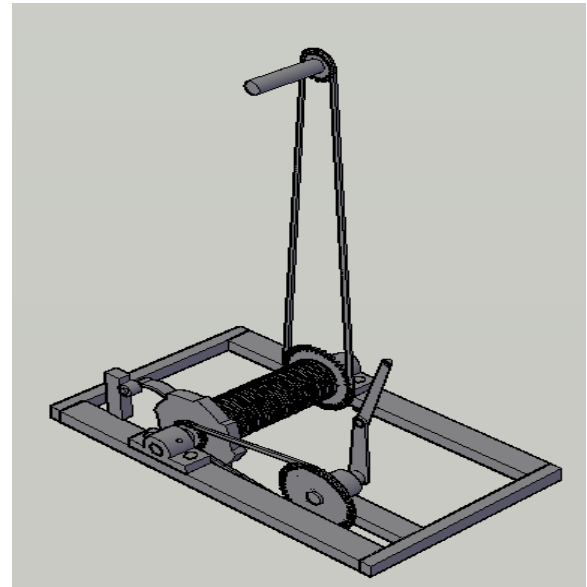


Fig 9- Spring Mechanism

### 5. PROCEDURE-

#### 1.Twisting of spring by pedal:

Initially lock the flywheel by stopper and press the pedal by leg 15 times which will twist the spring and that twisting energy is stored inside the spring which is fixed between freewheel and ratchet.

#### 2.Power transmission through chain drive which is mounted on shaft:

For transmitting power we choose chain drive as power drive. Then the motion is transmitted from spring shaft to flywheel shaft on which flywheel is mounted.

**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 grass, wheat stalk, sugarcane top with ease and thus reducing the manual work of farmer and increases the fodder production.

**4. Collect fodder from output :**After rotation of cutting blades cause cutting of supplied feed material like grass dry corn straw into small pieces. This light weight particles thrown away by centrifugal force of cutting blade towards outlet. So, place container for collecting fodder.

### 6. RESULT

- ▶ Time required for pedaling - 15 sec
- ▶ Time required for cutting - 20 sec
- ▶ Size of cut pieces - 1inch
- ▶ Production rate - 2kg/min
- ▶ No. of pedal required - 14-15

## 7. CONCLUSION

1. We have replace the electric motor by spring mechanism, so that we require less effort and spring will easily available anywhere, so it is beneficial to farmer.
2. A rough measure done on the grass cutter shows that it has ability of cutting 144Kg/hr.
3. The objective of this project is to run a machine with zero percentage fossil fuel and also it works by manual effort.
4. It cuts the fodder uniformly, which is ideal for the livestock and it is durable, long lasting and low maintenance requiring machine.

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