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Design and Modification of Chaff-Cutter

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Abstract: Agriculture is considered as a foundation of life, since the primary source food and other raw accoutrements is from the husbandry. Agriculture is facing serious challenges like failure of agrarian labour. nearly every pastoral family keeps at least a cow or buffalo for meeting milk demand and to earn some plutocrat for diurnal charges. The milk product is generally affected by cattle feeding. Chaff knife is a hay or straw cutting machine which is used in livery mincing of the fodder for beast or raw material to agro diligence. The colorful types of fodder can be reused in this machine are probe lawn, green lawn, dry sludge straw, and wheat stalk. The final products can be used to feed cattle, scapegoats, deer, and nags. It can also reuse cotton stalk, dinghy, small branches, they can also be used to induce electricity, and to make paper. Coconut is the fruit of a coconut win belonging to area cacae family and it's used in one third of the population in the world. Till date there were numerous ways involved to peel the coconut. These styles are extensively used for removing of the coconut cocoon but the coconut farmers can not go to enjoy an automated machines used in developed countries because of high cost. After considering high cost of the chaff knife and coconut dehusking machine a result is proposed which will allow a planter to use both the operation on a single machine. This will make it easy for the planter who has 4- 5 cattle's as well as coconut trees at their home.

Keywords: husbandry, Chaff knife, Coconut dehusking, machine, High cost

I. INTRODUCTION

A. WHAT IS CHAFF-CUTTER?

A chaff knife is a mechanical tool used to chop grass, sugarcane tops, and other plant materials into small pieces so that they may be mixed with other types of grass and fed to nags and other animals. It enhances animal digestion, stops animals from rejecting any portion of their diet, and also conserves chewing energy. Chaff and work until tractors took their place in the 1940s. Then, brand-new, tractor-driven devices came into being, cutting the probe with ease and collecting it in a cart. Following that, motor-powered chaff-cutting machines were developed to address the issue with tractor-driven equipment. These machines are huge and energy-intensive.

Fig 1 Manually Operated Chaff-Cutter

Fig. 2 Electric Motor Operated Chaff-Cutter

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B. WHAT IS COCONUT DEHUSKING MACHINE?

The dehusking of coconuts is a post-harvest procedure that is essential to preparing the coconut for subsequent use. The dehusking of coconuts is a difficult procedure, and research is still in its early stages in all nations that cultivate coconuts. Additionally, the coconut has religious and cultural importance in several countries, notably It is employed in Hindu ceremonial in India.

The coconut estates, cooperatives, growers, and facilities that process coconuts may all benefit from this equipment. The machine can function more quickly and with fewer interruptions from people. This device should speed up the process of dehusking coconuts. increasing the producers' revenue from coconuts. Since the revolving spiky rollers are designed to increase the force at the coconut's head to apply pressure for dehusking, it doesn't require as much direct human power as with conventional techniques. Additionally, coconuts of any size and shape are simple to dehusk. It is simple to use, doesn't require specialised work, operates quickly and safely, and requires little maintenance. It is portable and simple to construct and disassemble.

Through the use of mechanically controlled dehusking tools known as spiky rollers, this coconut dehusking machine removes the coconut husk to produce a dehusked coconut. It is necessary to add a gear, belt, and sprocket gearbox system to transfer power from the motor to the cylindrical rollers. The dehusking apparatus consists of cylinder-shaped rollers fastened to the surface with cutting pins called tynes. The coconut is positioned halfway between two rolling cylinders. The coconut fibre will be torn off the shell by the rollers' rotational motion. Effective dehusking can be accomplished with correct fibre-to-tyne meshing while taking up less time. When developing the machine, the size and shape of the coconut are taken into account.

Fig. 3 Manually Operated Machine

Fig. 4 Electric Motor Operated Machine

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II. PROBLEM DEFINATION

In India there are approximately 5 million farm families growing coconuts, with a further 10 million people dependants directly or indirectly on coconut for their livelihood through processing and sale of the crop. After studying various research papers, we have observed that more work has been done related to chaff cutter machine and coconut dehusking machine. But very less work has been done on a multitasking machine performing both chaff cutting and coconut dehusking operations. The existing chaff cutting machines are observed and studied properly to detect the problems faced by the user:

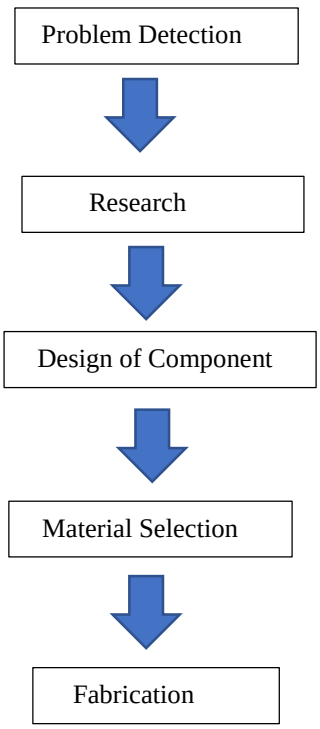
1. It has Less compact design.
2. It Require High voltage for operation.
3. The Machines are Noisy.
4. Only single operation can be performed.

III. OBJECTIVE

After studying of various research papers and acquiring knowledge related to the chaff cutting machine and dehusking machine. The objectives of our project are as follows:

a) To perform multiple operation: The proposed model will be able to perform chaff cutting as well as coconut dehusking operation.
b) To reduce human efforts: The proposed model does not require more human efforts as an electric motor will be used.
c) To save electricity: The motor being used will be of 1 HP which will power both chaff cutting as well as coconut dehusking mechanism.
d) To reduce overall cost: If individual chaff cutting machine or coconut dehusking machine is to be purchased, it will be quite expensive. To overcome this problem the proposed model will allow user to perform both the operations on a single machine.
e) To save space: As both chaff cutting and coconut dehusking operations are being performed on a single machine, the space will be saved

IV. METHODOLOGY



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A. Design of Component

1) Design of motor:

Power of motor = 370 watt
Rpm of motor = 1425 rpm
CALCULATION FO FINAL SPEED & TORQUE

$$P = \frac{2\pi NT}{60}$$

$$370 = \frac{2\pi x1425xT}{60}$$

T = 2.479 N-m
T = 2479 N-mm

Fig. 5 Electric Motor

2) Gearbox:

Torque & rpm obtain at gearing
As reduction ratio is 1: 25
So,
Output rpm of gear box is,

$T_3 = T_2 \times 25 = 61975$ N-mm
$N_3 = N_2/25 = 57$ rpm

Fig 6 Gearbox

3) Spur Gears:

spur gear train of 35 and 35 teeth is mounted.

So, ratio: 1: 1
$T_5 = T_4 \times 1 = 206376$ N-mm
$N_5 = N_4/1 = 17.11$ rpm

Fig 7 Spur Gears

4) Force generated by motor at both rollers to pull coconut dehusking process

T = Force × radius of roller
206376 = F × 30
F = 6879 N

$$F = \frac{6879}{9.815}$$

F = 700 Kg

5) Force at chaff cutting blade:

T = Force × radius of chaff blade
206376 = F × 150
F = 1375.84 N

$$F = \frac{1375.84}{9.815}$$

F = 140 Kg

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6) Solid works 3-D Model:

The entire model has been designed with the help of designing software solid works.

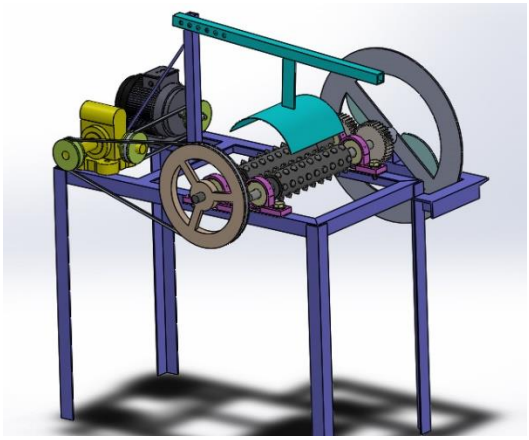

Fig. 8 Isometric View

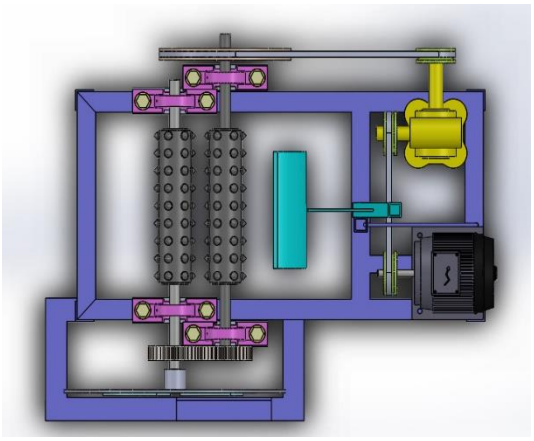

Fig. 9 Top View

B. Material Selection

As the one of our objectives is to reduce cost that's why we choose the material mild steel because it is cost effective than high carbon steel. Following are the basic reasons for choosing the mild steel.

1. Mild steel is readily available in market.
2. It is economical to use.
3. It is available in standard sizes.
4. It has good mechanical properties i.e., it is easily machinable.
5. It has moderate factor of safety, because factor of safety results in unnecessary wastage of material and heavy selection. Low factor of safety results in unnecessary risk of failure.
6. It has high tensile strength.
7. Low co-efficient of thermal expansion.

C. Fabrication

After making a solid model of machine as per the model different components of machine are fabricated. The frame is the main supporting structure upon which the other components are mounted on. The frame is a welded structure constructed with dimensions 770mm in length, 390mm width and 610mm height. The unit comprises of 2 rollers and 2 roller shafts. Each roller shaft is a mild steel rod of 80mm diameterwith length 260mm supported at both ends by ball bearings. The turning operation performed on the shaft and that converted into gear 30mm. Two gears mounted on the shaft with 32 teeth the driver gear rotates driven gear. Spikes welded on the roller.distance between two spikes are76.2mm and 6 spikes welded on periphery of the roller at 60° angle. Total 30 spikes welded on one roller. Motor is Mounted on thr frame. the pulley is and motor are connected by a belt.At the onr shaft the Blades are attached for the cutting of chaff. There is a support is provided for holding the chaff.

V. SCOPE

There are many methods available to cut the chaff and coconut dehusking like for cutting chaff manually and coconut dehusking by traditional tool, pedal operated etc. These methods have many limitations which create difficulties during operations. To overcome these difficulties, we decided to make a multitasking machine which allow farmers or user to perform both operations on a single machine and single power source. This machine is very useful for the farmers in agricultural field who have coconut related business and at least 4-5 animals like cow, buffalo at their field. So, purchasing both machines separately is quite expensive for them. Instead of that they can purchase this multitasking machine which will affordable for them. Scope of this machine is more in coastline region farmers.

VI. CONCLUDING REMARK

1) The machine is designed in such way that it will require minimum space to install.
2) A lower cost machine has been fabricated for small scale farm holders in agricultural and rural areas.
3) The maintenance of the machine is not expensive.

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4) In agriculture the process of coconut dehusking and chaff cutter by manually is very difficult on large scale and even it is more time-consuming process so by using this technology it has brought a wide change in the field agriculture.

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