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Design and Fabrication of Multipurpose Agriculture Machine

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Abstract: India is an agriculture based country in which, 70% of people depends on the outcome of farming. But if we observe that with increase in population the farm gets distributed among the family and because of this, farmer in India held averagely only two acre farm. Also economically, farmers are very poor due to which they are unable to purchase costly equipments hence they use traditional method of farming. So We are thinking that human efforts can be replaced by some advance mechanization which will be suitable for small scale farmer from economical and effort point of view. So we are developing this equipment which will satisfy all this need and to solve labour problem.

In this equipment We used induction motor for driving operation. This machine perform four farming operation (chaff cutting, groundnut decorticator, paddy separator, tool grinder) which is used small scale farming. By using above attachments one may perform various farming operations in less time and economically.

Keywords: Chaff cutter, Groundnut sheller, Paddy separator, Tool grinder.

I. INTRODUCTION

Agriculture is the backbone of India. Paddy and Wheat is one of the new targets in agriculture where still, not many researchers and manufacturers participate. This field faces some problems such as how to maximize the profit, how to increase productivity and how to reduce the cost. In India, two types of agricultural equipment are used, manual method (conventional method) and mechanized type. Linear Vibrating Screen is one of the mechanism which we can use for separating paddy from wheat grains at small scale. The chaff cutter was simple but ingenious device for cutting straw or chaff or hay and oats into small pieces before being mixed together with other forage and fed to horses and cattle. Apart from being more economical than previous methods of feeding, this aided the animal's digestion and prevented animals from rejecting any part of their food. Since the chaff cutter was made largely of wood with only a small amount of iron work, it cost relatively little to make and, as a result, few farms, town or country stables were without one by the end of the eighteenth century. To overcome this, a Power Operated as well as manually operated chaff cutter will be used. This is also simple in construction, low cost. Energy and time will not require more than earlier chaff cutter. Groundnut also one of the agricultural semi-finished goods. Groundnut is grown on small scale farmers in developing countries like India. Lack of groundnut processing machines, especially groundnut Sheller, is a major problem of groundnut production, especially in our country India. The peanuts were separated from its shells by the workers. They simply decoct the groundnut by their hands and separate the peanuts from its shell. The output got from this method, was very low and it does not fulfill the market demand because it was very time consuming process. Groundnut decorticator is small machine use for removing shell from peanuts at small scale. This machine uses shearing action for decortication. In this machine we have mounted a grinder which is used to make sickle cutter sharp by grinding operation. The purpose of this paper is to understand the knowledge of design and fabrication mechanism of groundnut Sheller machine. The design is an environment friendly and uses simple mechanism properties such as shelling system.

II. OBJECTIVES

- Design and develop an agricultural model which can be able to perform chaff cutting, groundnut shelling, paddy separating and tool grinding operations in agricultural field.
- Also analyze a real time system for this model to give a solution and propose a machine which can be used in real time field.
- To propose a low cost but effective real time agriculture machine.

III. LITERATURE REVIEW

In this research paper Roshan P Ghodkhande and team(1) has reported that based on the shelling action they can be divided into two category. Hand operated and motor operated, a hand operated groundnut decorticator 50-75 Kg per Hr capacity was evaluated.

Where as a motor operated groundnut decorticator was found to have capacity of 72 Kg per Hr. As the requirement for grains is increasing is day by day Dinesh B. Shinde and group(2) target to create the machine which is affordable to each and every farmer, which is cheaper, efficient and will reduce the total harvesting cost. To achieve this aim, it is decided to follow the following steps: To understand farmer's problem which they are facing about harvesting, for this it is decided to interview the farmers. So as decided we surveyed the farmers who are having land less than 5 acres.

Design of small scale harvester The next paper of Anand Kumar Telang(3) reported that implementation of technology in the field of agriculture has brought a very wide changes in manual procedures are replaced by advanced technical procedures. Here before we used to cut the chaff, grass manually to be feed the animals. When it was in a very large scale it is difficult to cut and time consumes more. Due to in the chaff cutter, chaff can be easily cut in a very least time and helps avoiding injuries because through manual chaff cutter, we can get injuries. So technology has brought a wide change in the field of agriculture.

IV. CONSTRUCTION AND WORKING

The assembly of the agriculture model is built using 1hp AC motor which is use to drive system of different mechanism by using v-belt drive. As the AC motor start to rotate the rotary motion is provided to all mechanism and the operations are carried out.

Chaff Cutter Mechanism:

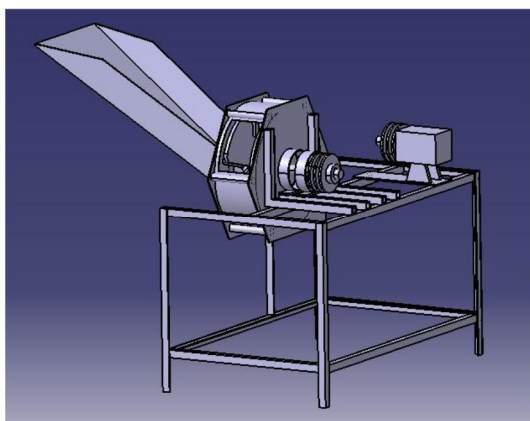


Fig.No.1 chaff cutting model

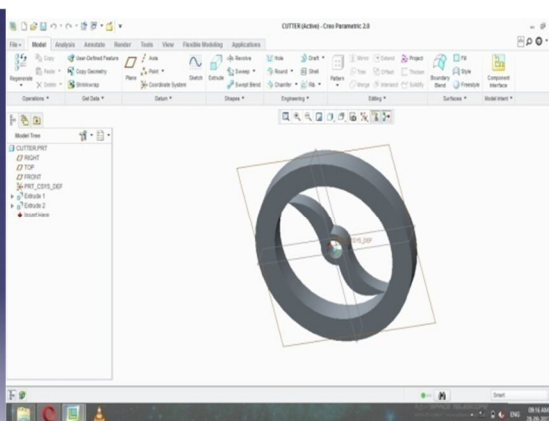


Fig.No.2 chaff cutter

Chaff cutter machine for feed is powered by electric motors, drive main shaft from main shaft to the cutter wheel. The material enter the compression roller and then cut into cutting institutions at a certain speed enter the cutting part, approved by high speed rotating cutter cut up after the through the material outside. A flat or v-belt (leather) is connected to fly wheel and motor pulley through which the fly wheel will rotate, it will helpful for cattle.

Ground Nut Decorticator:

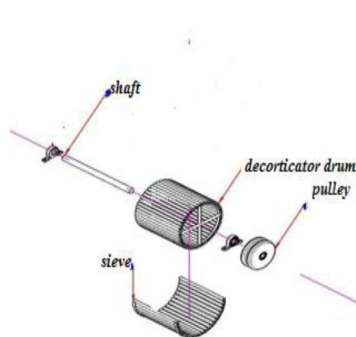


Fig.No.3 Ground Nut Decorticator Mechanism

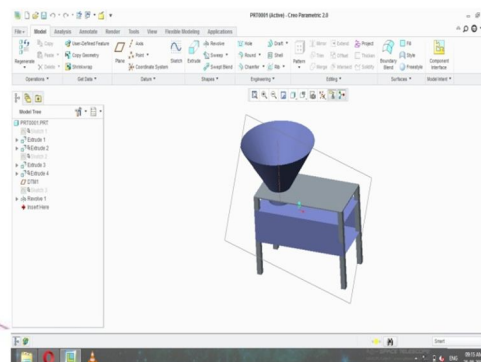


Fig.No.4 Ground Nut Decorticator

Groundnut decorticator is operated on the shearing action. The inputs i.e. the groundnut are fed to the machine. Then groundnuts come in contact with the two members, one is semi-circular net and another is roll shaft having soft wooden core. Semi-circular net is a stationary member while the roll shaft of wood is rotating member. When the groundnut comes in contact with these two members then the shearing action takes place there. Due to shearing action (crushing) the groundnuts gets shelled and divided into

two parts. i.e.in the kernels and outer shell of the groundnuts. There clearance is provided between the net and roll shaft. The clearance provided is depends upon the size of the groundnuts which is to be decorticate.

A. Paddy Separator Mechanism

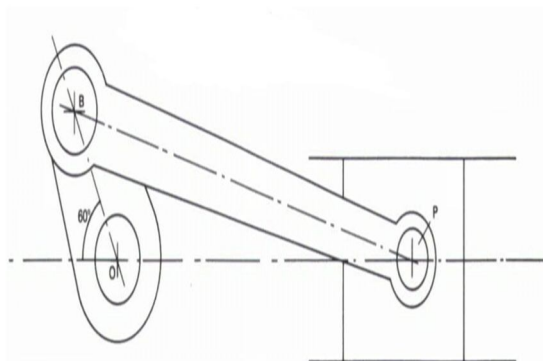


Fig.No.5 Paddy Separator Mechanism

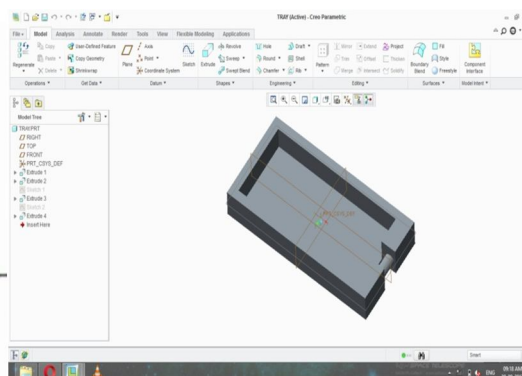


Fig.No. 6 slider mesh

When we switch ON the machine. The motor start to rotate the cam arrangement. Here the rotary motion is converted in to the reciprocate motion of wheat cleaner block. Thus the cleaning process is carried out through this machine. Here the mesh is fixed in slider block which isolate the paddy and wheat.

V.CALCULATION

Breaking force dry groundnut pod using a falling mass

Mass of falling body = 400g = 0.4kg

Average force required to break one pod (without crushing the seeds) may be obtained thus:

Employing Newton's law of linear motion $s = ut + 0.5gt^2$

where t and s = time taken to hit the ground and height of fall respectively, and

g = gravitational acceleration.

Thus for a mass (m) of 400g to take the time t = 0.8 seconds to fall freely from a height

s = 0.75metres to hit the nut, the force generated by the falling body is 0.94N.

The diameters of the motor and decorticator sheaves according to are related to their revolutionary speeds as $n_1/n_2 = d_2/d_1$

Where n_1 = motor sheave speed = 1000rpm

n_2 = decorticator drum sheave speed = 100rpm

The centrifugal force possessed by the spiral spikes of the decorticator rods $F_c = (mv^2)/r$

where m = mass of decorticator drum + mass of maximum number of groundnut pods in it

v = linear velocity of spikes on drum since decorticator pulley speed $n_2 = 100$ rpm

and $v = \omega r = 1.3$ m/s

r = distance from axis of shaft rotation to the top edge of the 2 mm thick spiral spikes of the drum. This is radius of drum (R_s) + height of spike (H_s).

$T_d = m\alpha r$

Where mass of decorticator drum + maximum number groundnut pods = m

α = tangential component of the angular acceleration of the decorticator drum

Torque T_d from equation = $r \times (mv^2)/r = 33.8$ N-m

Force required to cut the chaff

Shear strength of wheat stem is in between 3.5-10N

Centrifugal force required to cut the chaff

Similarly, $F_c = (mv^2)/r$

Torque T_d from equation = $r \times (mv^2)/r = 11.83$ N-m

Torque required $T = 33.8 + 11.83 = 45.63$ N-m

Power $P = 2 \times 3.14 \times 100 \times 45.63 / 60 = 477.836$ W

Hence we considered 1HP AC Motor

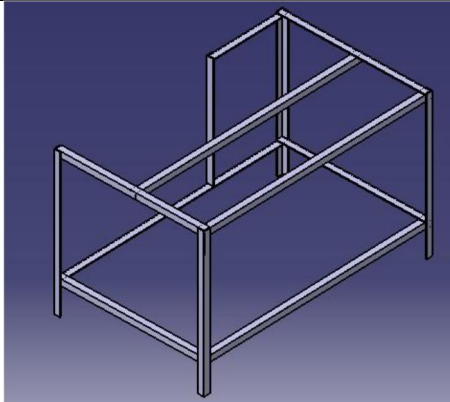
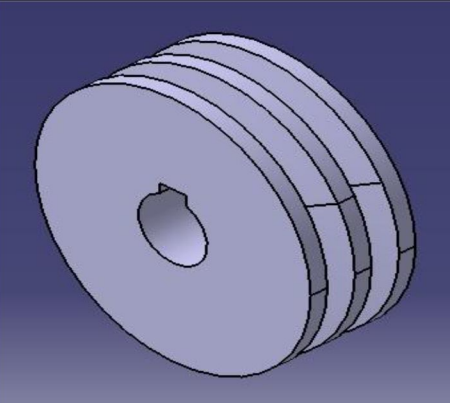
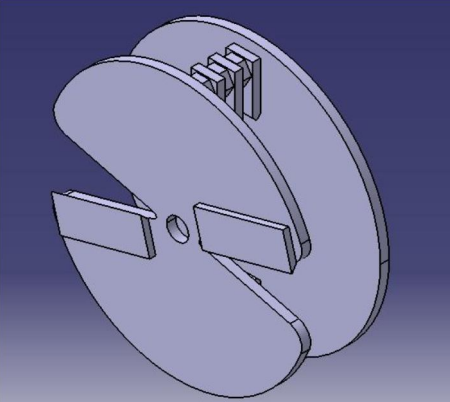
Torque $T = 3.14/16 \times d^3 \times \text{shear stress}$

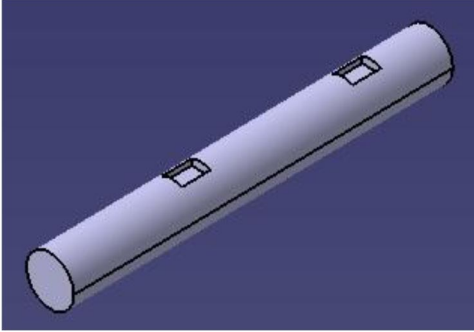

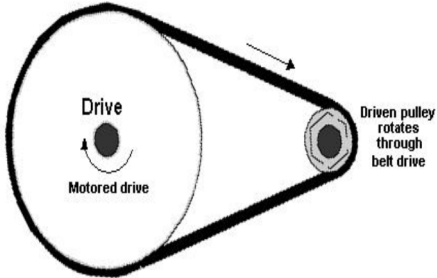
D-diameter of shaft

Length of belt $L = 3.14/2 \times (d_1 + d_2) + 2c_1 + (d_2 - d_1)^2/4c$

Selection of bearing for shaft diameter of 30mm, $N = 100\text{rpm}$, $L_{10} = 60 \times n \times (1/1000000)$

VI. COMPONENT DESCRIPTION

<p>1. Table: Length = 1200mm , Width = 900mm , Height = 775mm</p>	
<p>2. Pulley: No Of Pulleys =3, Diameter =250mm, Weight = 6kg Of Each Pulley</p>	
<p>3. Chaff Cutter :Diameter = 250mm ,Weight = 7kg</p>	

<p>4.Shaft :Diameter = 28.6 mm, Weight=5kg</p>	
<p>5.Motor: Power = 1 HP</p>	
<p>6. No Of Belt = 3 ; V-Belt (C – Type)</p>	
<p>7..Bearing: No Of Bearing = 6 ,1 inch Ball Bearing</p>	
<p>8..Motor Pulley: Diameter = 100 mm</p>	
<p>9.Ground Nut Wheel:Diameter = 250 mm,Weight=20 Kg</p>	
<p>10. Grinder Wheel: Diameter= 40mm</p>	

VII. ASSEMBLY

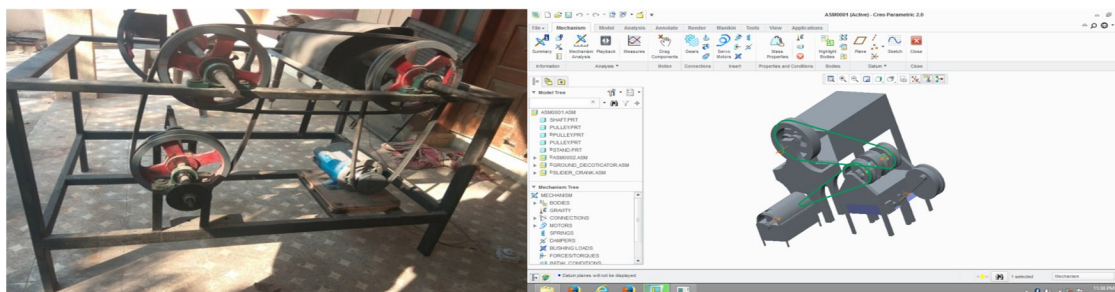


Fig. No.7 Assembly Of Multioperation Agriculture Machine

VIII. ADVANTAGES

It is one of the latest and sophisticated system which control whole system automatically and requires less maintenance. It is Affordable and simple in working.

IX.CONCLUSION

Implementation of technology in the field of agriculture has brought a very wide changes in manual procedures are replaced by advanced technical procedures. In this project we made an effort to overcome some problems in agriculture. The rapid growth in the industries is influencing the labours who are situating in the villages to migrate to the cities. This creating the labour problem for the agriculture. The wages for the labour is also more.

X. ACKNOWLEDGEMENT

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