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Fabrication of Coconut Dehusking Machine

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ABSTRACT

The main objective of our project is to remove the husk of the coconut fruit. Coconuts are of different shape and size not are all the same size. The machine reduces the skilled operator work by replacing the work through automation. Manual de-husking is the conventional process followed widely among farmers. The motor shaft and gear box input shaft were in straight line to minimize the vibration and completely utilize the power of the motor. It also includes time consumption labour cost and injurious caused to the labour during manual de- husking process. The machine provides a good productivity with less human interaction. It is a commercial product which works for various stages. A completely automated machine will yield productivity higher than the manual process.

Keyword*: Skilled Operator, Safe Operation, Commercial Product, Machine, Motor, Productivity, Automation.*

INTRODUCTION

Coconut (*cocosnucifera*) is one of the world most useful and important perennial plants. An individual coconut fruit shown in Figure 1 is made up of an outer exocarp, a thick fibrous fruit coat known as husk; under neat his the hard-protective endocarp or shell. “Eyes” areatone end of the nut. Inside the shell is a thin, white, fleshy layer, about 12.25 mm thick at maturity, known as the “coconut meat”. The interior of the nut is hollow and partially filled with a watery liquid called “coconut milk”. The meat is soft and jelly-like when immature and becomes firm at maturity. The coconut milk is abundant in unripe fruits but it is gradually absorbed as ripening proceeds. The meat of immature coconut fruit can be made into ice cream while that of a mature coconut fruit can be eaten fresh or used for making shredded coconut and livestock feed. Coconut milk is a refreshing and nutritious drink while its oil is use for cooking and making margarine. Coconut oil is also very important in soap production. The shell is used for fuel purpose, shell gasifier as an alternate source of heat energy. The husk yields fibers used in the manufacture of coir products such as coir carpets, coir geo-textile, coir composite, coir safety belts, coir boards, coirasbestos.

OBJECTIVES

To make the machine to De-husk coconuts of all sizes. To make the project cost efficient to the customers. To reduce the de-husking time of coconuts. To prevent injuries caused to workers during de-huskingprocess.

LITERATURE SURVEY

Development of Coconut De-husking Machine [1]. This machine specifically development to remove the husk of coconut fruit. The machine reduces the skilled operator work by replacing the work through automation. Manual de-husking is the conventional process followed widely among farmers. It also incurres time consumption labour cost and injuries causedtothelaboursduringmanualde-huskingprocess.Acompletelyautomatedmachinewill yield productivity higher than the manual process. It is a commercial product which works for variousstages.LITERATURE SURVEY

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DesignandFabricationofanEconomicalCoconutDe-HuskingMachine[2].TheCoconut is used by one third of the population in the world. Coconuts are of different shape and sizes notallarethesame, sothat wecananalyzetheaverageofacoconut shapeandsize.Themotor shaft and gearbox input shaft where in straight line to minimize the vibration and completely utilize the power of motor. The machine provides a good productivity with less human interaction. It can be easily dismantled and carried from one place to another witheasy.

Coconut De-Husking Machine [3]. The Coconut fruit is de-husked through the rotation of rollers in opposite direction effectively toward one another. The interaction of the rollers with the husk will remove the husk by gripping action of the spikes serves to tear away the husk fromthenutleavingthenutintact.Itisaconventionalprocessfollowedwidelyamongfarmers.

DesignandDevelopmentofCoconutDe-huskingMachine[4].Generally,Coconutsarede- husked manually using a hand cutting tool. These methods require skilled labour which is difficult and painstaking process. The reason stated for the partial success of these tools includes unsatisfactory, incomplete de-husking, breakage of the coconut shell. To reduce the human efforts, the power operated machine is designed and developed. The new power operated de-husking machine works on the principle of gear mechanism. Here the labour efforts and the time consumption for the de-husking arereduced.

Design and Fabrication of Low Cost Coconut De-husking Machine [5]. An automated machine for coconut de-husking and crown removal has been developed for the small-scale farmholdersintheagriculturalandruralareas.Theoperationofthe machine issimpleandthe maintenanceofthemachineisalsonotexpensive.Themachinecande-huskanaverageof200 coconuts per hour. The machine can also be integrated along with the further processing steps of the nuts and the production ofcopra.

Introducing an appropriate mechanical way for Coconut De-husking [6]. The operators do not need to have any special skill to operate the machine and it requires the minimal effort of 50kg. Safety of the operators could be assured at 100%, as no casualties were recorded duringtheevaluationprocedure.Retainingofthesoft eyecoveringupperhuskpartisaspecial advantage for the shelf life of a coconut. This mechanism may be further developed to modify thelevertocouplewiththethreepoint linkageofafour-wheeledtractor,to facilitateoperation with hydraulicpower.

PROPOSED DESIGN

The proposed design of our de-husking machine is driven by single phase induction motor. A drivefromthe motoristransmittedtothegearboxforspeedreduction,usingacouplingwhich completelyreducesthetransmissionlosses.Thedrycoconutsareplacedinbetweentworolledrubber belts. The rolling motion of the roller shaft which have spikes welded on them will penetrate the husk and peel them of the nuts. The gearbox and the motor are mounted on the lower part of the frame.

Motor Calculation:

- Single Phase Induction motor with1420rpm
- Shaft Radius =15mm
- Tearing force required =20Kgf
- Power required in tearing : [(20*9.81) (2*3.14*0.015)(100/60)] * 4 =123w
- Power required for driving the coconut : [(20*9.81)(3/60)] =10w
- Total Power required = 123+10 =133w

Shaft Specification:

- Shaft – Mildsteel
- Length of the shaft =305mm
- Number of shaft =2
- Diameter of the shaft =210mm

Bearing Specification:

- Bearing series =6200series
- Bearing Number =6202
- Bearing diameter =200mm

The 6200 series is maintenance free, self-lubricating bearing suits the requirement well.

Gear Specification:

- Gear type – SpurGear
- Number of teeth in driver gear =22
- Number of teeth in driver gear =25
- Diameter of the gear =20mm
- Center distance between gears =90mm

A Spur gear is attached to the other stepped end of the each shaft and they mesh with another to rotate the shafts in opposite direction.

Spike Calculation:

- Total length of the spike =30mm
- Length of the roller =200mm
- Angle of sharpened edge =135degree

Spikes are made from the shaft of 20mm diameter. Sharp edge has been formed and then thespikehasbeenweldedontotherotatingshaft.Thespikesareplacedinanarrayformat substantially equal distance so

Fig.3. Front View of the de-huskerthatit penetrates the husk and peel themoff.

2D AND 3D VIEW OF THE DE-HUSKER:

The 2D and 3D view of the De-husker are generated with the prescribed dimensions in PTC CREO Parametric 3.0 as follows:The design of the proposed machine is shown in figure.

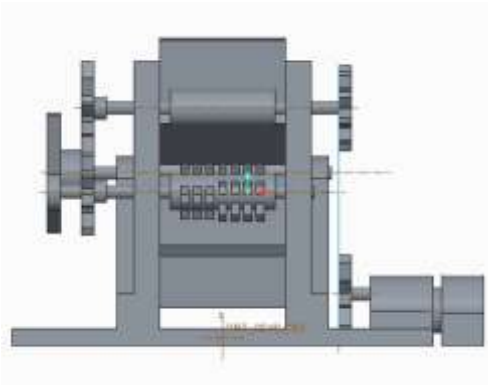

Fig.1. Top View of the de-husker

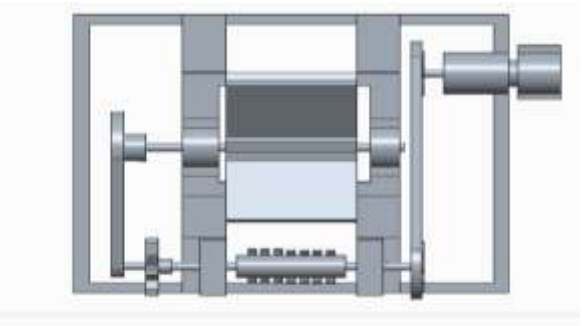

Fig.2. 3D View of the de-husker

Fig.3. Front View of the de-husker

FABRICATION

TheFrameofthecoconutde-huskingmachinewasconstructedbywelding.Themotorand gear box have been placed on the bottom of the frame. The bolts and nuts are used to fix the motor and gear box on the frame. On the top of the frame the shaft is connected to the motor, the output of the shaft is connected to the spike roller using gearengaged. The shaft consists of more spikes for removing the husk of the coconut. The spikes are placed at equal distance to grip the coconut to remove the husk. By applying lower rpm, we can produce high torque using rotating shaft. The gear box transmits the reduced speed to the shaft using chain and sprocket. After connecting the drive, the coconut will be placed between the shafts for de- husking.The below Table.1 shows the components included in the de-huskeras:

S.NO	DESCRIPTION	MATERIAL	DIMENSIONS
1	Frame	Mild Steel	1770*765*1290mm
2	AC Motor	1 Motor	1420 rpm ; 1.5hp
3	Shaft	Mild Steel	L=305mm,D=150mm
4	Chain	Mild Steel	L=1070mm
5	Gear	Mild Steel	D=20mm
6	Bearing	Mild Steel	D= 200mm
7	Bolts & Nuts	Mild Steel	1.5inch
8	Bolts & Nuts	Mild Steel	2 inch
9	Spike Roller	Mild Steel	D=200mm
10	Flat Belt	Rubber sheet	L=350mm,B=310mm,t=10mm
11	Sheet metal	Mild steel	t=1mm

Table 1. Components of the de-husker

WORKING PRINCIPLE

The working of the de-husking machine mainly depends on the speed of the motor. The coconutsareplacedonthetopoftherollersheets.Whenthemachineisoperated,thecoconuts arerollingbetweentherollersandsoduetothepressureimpartedonthesurfaceofthecoconut will peel the husk while contacting with spikes in the roller shaft. As soon as the husk is removed, the coconuts will come out of the machine in bottom tray while the removed husk will come on the front tray on the machine side. This machine can be operated by unskilled labours and also the risk factor of the injury to the laboursiseliminated.and the coconut dehusking process in very simple,place the coconut, in between the two rolling cylinders,rotating in opposites directionas and press it by manual operated by mechanical linkage.as the cylinder rotate ,tynesprovided .

The spikes are welded around the shaft in multiple positions in such a way to peel the husk. The sharpened spikes are spaced at a substantial equal distance. The patterned array positions of the spikes are positioned to grip the coconut and penetrate the husk and tear them off. High torque is attained by rotating the shafts at lower rpm. The spikes provide a tearing action on the husk, once penetrated into the outer layer of the coconut. The

motor and the gear box are coupled together using a love jaw coupling. The reduced speed drive is transmitted to the shafts from the gear box using chain and sprocket. The shafts are interlinked using a pair of spur gear mounted on the stepped end of the shafts

COST ESTIMATION

The cost incurred during the fabrication and construction of this de-husking machine is listed below in the table as :

S.NO	NAME OF THE COMPONENTS	QUANTITY	COST
1	Belt (3-ply)	2	700
2	Sheet metal	2	2,450
3	L angle steel	-	800
4	Bolts & Nuts	As req	200
5	Motor Service	1	1500
6	Painting Expenses	As req	360
7	Fabrication Charges	-	2500
8	Machining charges	-	750
9	Crank pin	2	100
		Total	9,360/-

Table 2. Cost Estimation

ADVANTAGES

- De-husking process requires less time for de-husking thecoconut.
- The developed machine has the ability to de-husk all size ofcoconuts.
- Our project reduces risks involved in de-husking of coconuts and injuries to the operator.
- The developed machine reduces maximum effort incurred byoperators.
- Here, we use a/c motor with gear box to reduce load involved duringde-husking.

CONCLUSION

The main motive of the de-husking machine is to increase the productivity and to reduce the requirement of skilled manpower. And also, the cost of de-husking machine has been a barrier forfarmerstoadaptthistechnology.Thesizeofthespikeshasbeenimplementedtoreducethe costofthecoconutde-huskingmachine.Thedevelopedmachineisveryusefulforfarmersand also for small scaleindustries.

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