iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** VII **Month of publication:** July 2017

DOI:

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 5 Issue VII, July 2017- Available at www.ijraset.com

Design and Development of Hydraulic Coconut Dehusking Machine

Prof. Sharanbasappa[1], Narasimha Murthy C[2], Santosh S Kolli[3]
[1,2,3]*Department of Mechanical Engineering T.John Institute of Technology Bangalore*

Abstract: Generally coconuts are dehusked manually using either a machete or a spike. These methods require skilled labour and are tiring to use. Attempts made so far in the development of dehusking tools have been only partially successful and not effective in replacing manual methods. The reasons quoted for the failure of these tools include unsatisfactory and incomplete dehusking, breakage of the coconut shell while dehusking spoilage of useful coir greater effort needed than manual methods etc.

I. INTRODUCTION

Coconut is the fruit of the coconut palm tree which has the scientific name as “Cocos nucifera”. India is one of the leading producers of this coconut. It is usually grown in coastal areas. Coconuts are large, dry drupes, ovoid in shape, up to 15" long and 12" wide. The coconut is smooth on the outside, yellowish or greenish in color. Within the outer shell is a fibrous husk one to two inches (2.5 to 5cm) thick. The inner shell is brown and hard, surrounding the white coconut meat. Coconut husks are the rough exterior shells of the coconut. This outer shell or husk has to be removed for the usage of coconut.

A. Present Study

We have many methods to dehusk the coconut. It is by manually, mechanically and also by the use of machines. Manual dehusking with knife is a common practice. Need for the improvement in present method is the lack of sufficient manpower. This necessitates the use of appropriate machinery to aid in various tasks in coconut plantation. Traditional devices currently in use, such as the blade and spear are dangerous and minimum productive. Based on this realization we are planning to make the device that simplifies an important process as well as increases the productivity of the coconut industry. This new mechanism will indirectly boost any economy that relies on coconut plantations.

B. Machine Description

This coconut dehusking machine peels off the coconut husk from coconut fruit to obtain dehusked coconut fruit via mechanical controlled dehusking devices. The coconut is placed on the holder in vertical position. The holder is moved up by the foot operation mechanism. The top assembly which comprises the gripper pokers held vertically with link mechanism and is pivoted to the coconut body. The top assembly movement effects the pokers to move in the downward slide to poke into the coconut and at certain depth will make the pokers to move apart at 45 degree by the pusher link mechanism to tear apart the husk with force. The foot operated holder can be adjusted to the required height by the height adjuster. The foot lever is operated to continue the pumping till the mechanism is pulled down to its lowest position till the coconut is de-husked from the fruit. The foot operation is returned to the original position and also the top assembly is lifted back to its original position by the release valve operation of the pump and cylinder facilitating the removal of the coconut.

C. Field of Use and Benefits

This machine is useful to the coconut estates and co-operatives, coconut growers and coconut processing factory. The machine can provide faster work rate and less human interaction. This machine is expected to increase the coconut production, hence an additional income to coconut growers. It is useful to the coconut growers by many ways. It does not require direct human force as in normal methods because in this hydraulic pump and cylinder is used to enhance the force at the head of the coconut to put pressure on poker assembly. Also the coconut of any size and shape can be dehusked easily. It is easy to operate, does not need skilled labour, rapid, safe operation and simple maintenance. It can be easily assembled and disassembled and it can be carried from one place to another.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 5 Issue VII, July 2017- Available at www.ijraset.com

D. Hydraulic Pump

Hydraulic pump supplies fluid to the components in the system. Pressure in the system develops in reaction to the load. Hence a pump rated for 1000psi is capable of maintaining flow against a load of 1000psi. This hydraulic pump has a power density about ten times greater than an electric motor. It has a foot operated pedal for pumping of the oil to the cylinder. Also it has a foot operated pressure relief valve. It has two non return valves to control the flow of oil.

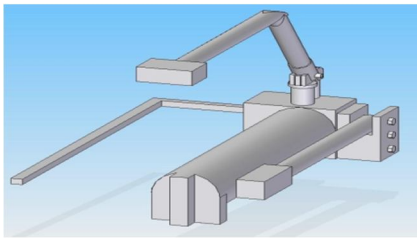


Figure 1.4.1 Model of a hydraulic pump

E. Springs

In this project we have used 5 numbers of springs. In that 3 are tensile and remaining 2 are compressive springs. All the 5 springs are made up of spring steel material. The 2 tensile springs used in the front are of same type and same dimensions and 2 compressive springs used at the top are also of equal dimensions. The dimensions of the springs used are listed below The dimensions of bottom 2 tensile springs are Outer diameter of the spring =39mm, Diameter of the wire = 6mm

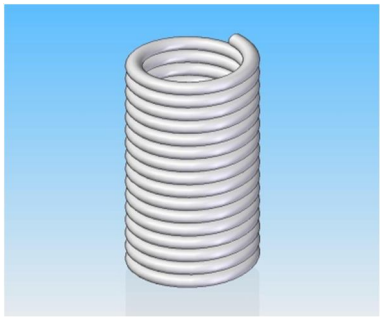


Figure 1.4.2 Model of a spring

Free length of the spring = 280mm
Number of active coils =40
The dimensions of bottom backside tensile spring is
Outer diameter of the spring = 52mm
Diameter of the wire =6mm
Free length of the spring =455mm
Number of active coils =59
The dimensions of top 2 compressive springs are Outer diameter of the spring =47mm Diameter of the wire=6mm
Free length of the spring =220mm
Number of active coils =17

F. Coconut holders

Figure 1.5.3 Model of a coconut holder

These are used to hold the coconut during dehusking. Three coconut holders are used in setup. These holders are made up of mild steel. The holder end is made circular to hold the coconut tightly and the outer shape is in "Y" shape for external lock. The diameters of these circular holders are 40mm each. These holders are connected directly to the cylinder ram through the links.

G. Ram

Ram comes out of the cylinder and it supplies the power produced from the hydraulic pump to the parts of the machine. During the idle position of the machine ram will be inside the cylinder or hone tube. This is made out of EN8 steel (an unalloyed medium carbon steel with good tensile strength) round bar of diameter 52mm cut for the length of 290mm and being rough turned on lathe machine to maintain the diameter as 50.2mm, 49.5mm, 42mm groove for the width of 12mm, 46.8mm step diameter for the length of 35mm. It is then drilled from one side to tap M12 for the depth of 25mm to lock the bolt with the moving jaw. The undercut is done for the diameter of 49.5mm to be convenient for external grinding. This ram is then loaded for external grinding to make the diameter as 49.95mm collar, 49.00mm, 46.4mm, and 44.00 mm.

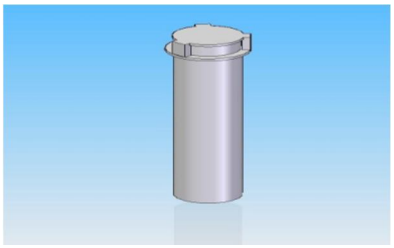


Figure 1.5.4 Model of a ram

H. Reservoir Tube

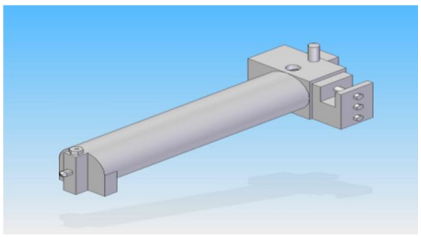


Figure 1.5.6 Model of a reservoir tube

Reservoir tube is used for the storage of the hydraulic oil inside the pump. This is made out of mild steel tube of diameter 76mm with internal diameter of 68mm cut for the length of 110mm and being faced on lathe machine to maintain the length as 150mm and end chamfer is machined for outside diameter as 0.5mmx45degree. It is counter bored for the diameter 70.15mm for the depth of 14mm at both the sides and then counter bored for the size of 3mmx30degree.

I. Plunger

This is made out of EN8 round bar of diameter 25mm being cut for the length of 100mm and turned on lathe machine to make the diameter as 24.6mm and step diameter of 20.8mm length of 60mm and undercut is made of diameter 17mm and the end radius is made with radius 13mm to end of the diameter as13.5mm at 20.8mm side diameter. This is then ground on cylindrical grinding machine to make the diameter as 20.00mm.

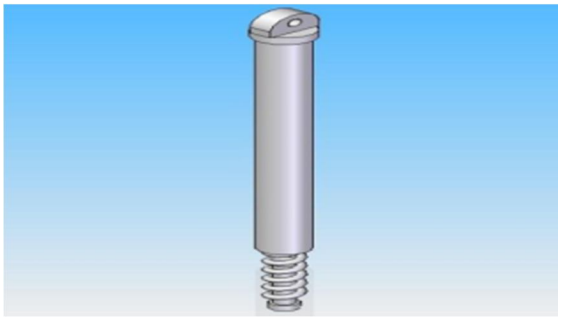


Figure 1.5 Model of a plunger

J. Poker Arm

The poker is a part used to peel the coconut husk. This is made up of the mild steel material. The tip of the poker is made sharper to pierce into the coconut husk. The other end of the poker is fitted to upper assembly by using bolt and nut, which gives provision for oscillation of the poker. The middle portions of these pokers are connected to the movable ring by the links. There are 6 numbers of pokers which are fitted in a radius of 65mm to upper assembly and the poker is about200mm long. Another link connects the poker to the holding ring which is of 80mm and it is connected to the poker at a distance of 110mm from the tip of the poker. The thickness of the poker is 10mm. The holes are drilled in the poker to fit to the assembly by using the nuts and bolts.

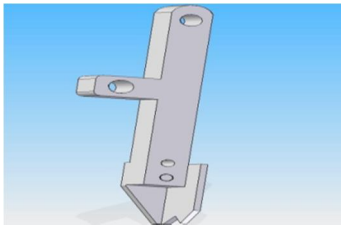


Figure 1.5.8 Model of a poker arm

II. METHODOLOGY

Most of the parts in this project are prepared by the lathe operation. Various operations like cutting, sanding, knurling, drilling are done by the use of lathe. The shafts are turned on the lathe to get smooth and good surface finish. The height adjusting knob is also turned to get good surface finish. Along with this drilling, milling and shaping machines are also used for many operations. The coconut base holder assembly is cut and shaped by using milling and shaping machines. Different types of drilling machines are used to drill many holes for the seating of bolts and nuts. The drills are done on the links to connect different links each other. The holes on the height adjuster are made by using drilling machine. Most of the parts are given good and smooth surface finish by using shaping machine and by polishing. The links and poker arms are made for required shape and length by forging operations. The sharper ends for the poker are cut and fixed to the poker by welding. Casting is done to obtain many parts. The top poker holding ring, coconut base holder, top “H” shaped rigidly fixed poker holder are prepared by casting process. The main operation done on this machine is the welding. All the parts are joined together by welding process. The welding methods used here are arc welding and gas welding. All the separate parts are assembled together by arc welding process. And some spot welding is also done by spot welding process. The links and some other parts are joined by the bolts and nuts.

III.RESULTS

A. Design and Calculations

1) Hydraulic Pump Design : Maximum working pressure= 600bar.

Diameter of the plunger= 20mm.

Diameter of ram/cylinder at the vice= 50mm.

The pressure put on the piston of the pump is to be calculated considering the pressure arm length and the pressure applied on the arm pedal, say approximately 30kg. Considering the leverage the approximate force on the piston may be 90kg which is to be termed as the pressure on piston. Calculating the area of the piston of the pump with force, we will get the working pressure of the fluid which is to be used for the clamping force resulted at the vice jaws, considering the diameter of the ram as 36mm. Diameter of the pump piston= 2 cm. Area of master cylinder= 3.143/4 × (2)2= 3.141cm2

Pressure arm of foot pedal= 30cm.

Force arm of foot pedal = 10cm.

Assuming pressure applied on foot pedal = 30kg.

Pressure arm x pressure= force arm × force.

30 × 30 = 10 × force.

Force = 30×(30%10) = 90kg.

*2) Pressure in the Pump :*Fluid pressure = force/area = 90/3.141 = 28.65 kg/cm2

Force at the ram coming out of the cylinder = pressure × area of vice ram.

Area of cylinder=10.18 cm2

8.65×10.18=291.65kgf

3) Design of Front Lower Spring: Deflection of a spring, y= 100mm
Total force on the spring, W= 2855N
Force on the individual spring, W= 1427.5N
We have space limit, D_O= 40mm
But D= D_O –d
Assuming the material as high carbon steel,
We get ultimate tensile strength= 1380 M N/m^2
Shear stress, f_S =1380 N/mm
^{2}=690 N/mm^2
Modulus of rigidity, G= 0.07845×10^6 N/mm^2
= 78.45× 10^3 N/mm^2
For safer design, we have taken i= 40
Spring scale or rate,
F_O = 14.06 N/mm
66We have, spring index C= 5.66
We get, x = 0.15
Clearance in mm, a= d × x × i
=6 × 0.15 × 40
= 36mm
Free length of the spring, l_O= (i+2)d + y + a
= (40 + 2)6 + 100 + 36
=388mm

4) Design of Back Side Lower Spring: Deflection of a spring, y= 100mm Total force on the springs, W= 2855N
Force on the individual spring, W=952N
We have Space limit, D_O= 55mm
But D= D_O – d
Assuming the material as high carbon steel,
We get ultimate tensile strength= 1380 M N/mm^2
= 1380 N/mm^2
= 690 N/mm^2
D= D_O –d
D= 49mm
We have,
Modulus of rigidity, G= 0.07845×10^6N/mm^2
= 78.45×10^6N/mm^2
We get,
x= 0.19
Clearance in mm, a= d × x × i
= 6×0.19×59
= 67.26mm
Free length of the spring, l_O = (i + 2)d + y + a
= (40 + 2)6 + 100 + 67.26
= 533.26mm

The coconut dehusking machine prepared by us is operated by hydraulic pump. This hydraulic pump exerts the force ten times

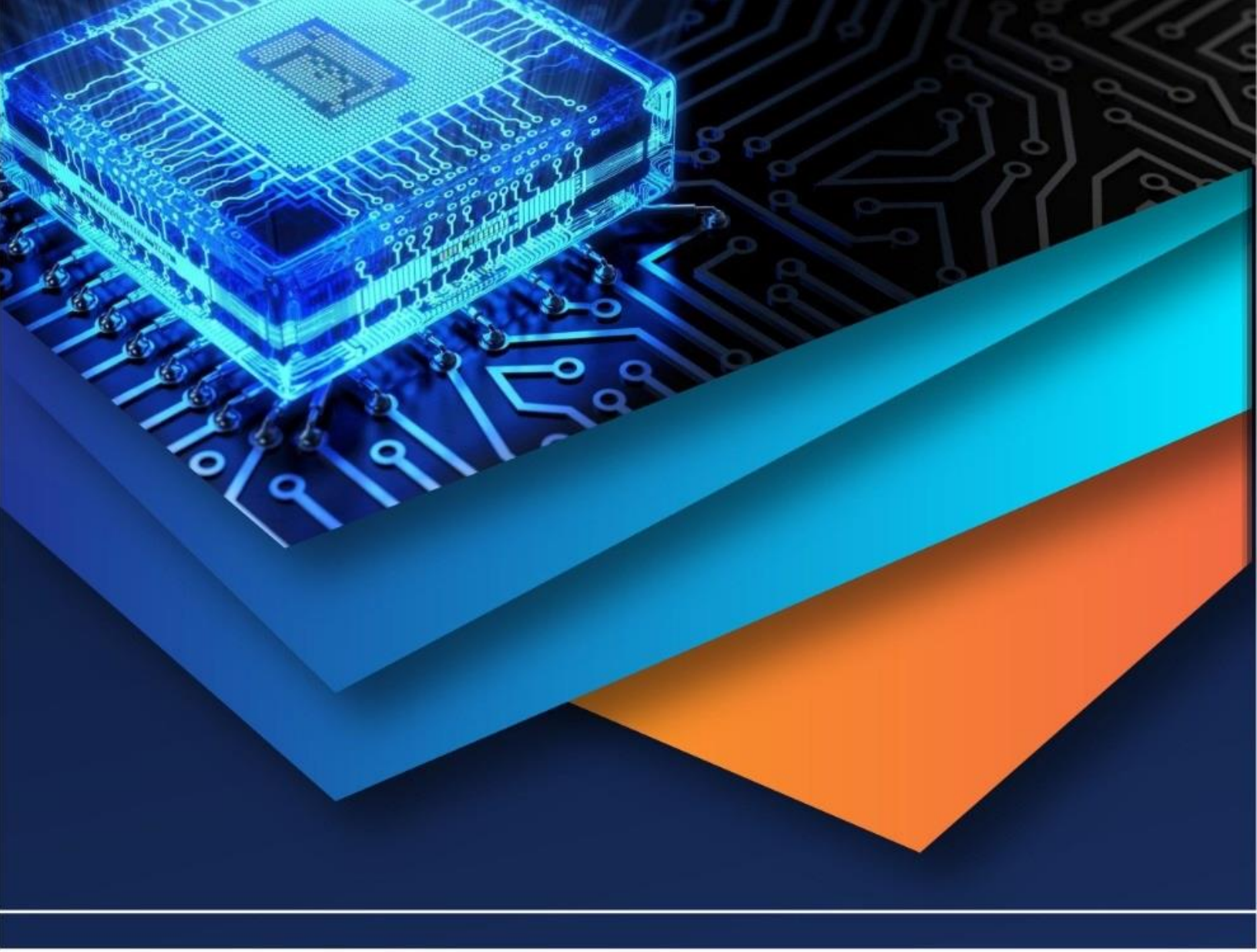
more than the force applied on the foot lever. The machine is of 1 feet breadth, 1 feet width and 4 feet height. The whole weight of the machine is about 70 kg. The materials used in this machine are of good quality and durable. And the parts are painted to prevent from rusting. Most of the parts are made from mild steel material and springs are made of spring steel material. The machine has the capacity to dehusk the coconut of any shape and size. Also the coconut shell of different thickness and hardness can be easily removed by this with a less force. The manually applied force is very less on the foot pedal and the force produced to peel the coconut husk is very high. For a single operation it is taking nearly 1 minute. The machine can dehusk about 50 to 60 coconuts per hour. But if the stroke length is increased it can dehusk about 120 coconuts per hour.

IV. CONCLUSION

In this modern world the time and cost has more weight age for each and every operation. So to overcome this concept we have designed and fabricated the machine named "Coconut dehusking machine" to reduce the cost and to save human energy. By viewing many types of machines like manual, traditional, electronic and other, so we conclude that hydraulic machines is using less human effort. This machine has many advantages over other machines. The cost is less compared to other types of machines and the human power used is also very less. The time consumed by this machine is little more. If we increase the stroke length by external mechanisms we can dehusk quickly about minimum three to four coconuts per minute. Machine can be operated efficiently unskilled labors. In this project we have used very heavy and strong machine parts so as to eliminate the regular maintenance. We conclude that this machine is more useful to the large scale coconut growers and the coconut industry where the large numbers of coconuts are to be dehusked.

REFERENCES

[1] Chandra Dinanath, coconut dehusking machine, US patent US4708056, 28th Jan. 1987.
[2] Gillesh Durand, Apparatus for Dehusking coconuts, FP0188949, coconut breking machine, US patent US3605834, 20th Sep. 1971.
[3] Coir Machines, Coir fibre extraction machinery, http://www.coirmachines .net/coir-fibre-extraction-machinery,html
[4] B.N. Nankwojike, O. Onuba, U. Ogbonna, Development of coconut De-husking machine for rural small scale farm holders, Vol.2 No.3, March 2012
[5] Cecil P. Waters, Fort Lauderdale, Fla, coconut husk removal tool, US patent No. 674305.1949.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY