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Design and Fabrication of Groundnut Shelling Machine

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Abstract -Groundnut is grown on small scale by farmers in developing countries like India. Lack of groundnut processing machines at affordable cost, especially groundnut Sheller, is a major problem of groundnut production. Numbers of groundnut Sheller machines are available in the market but they are large in size, costly and not suitable for domestic applications, they are best suitable for industrial applications where mass production is required. Hence it is essential to design and fabricate a portable groundnut sheller machine for domestic application. This paper describes about the design of various components of groundnut Sheller machine. Hence in this design of various parts are necessary, and design of various parts due to which the design quality of those parts will be improved. Overall, this project involves processes like design, fabrication and assembling of different components etc.

***Key Words*:** Groundnut, peanut, shell, crushing, hopper.

1.INTRODUCTION -

Groundnut (Arachis hypogaea) is a species in the legume or beans family. It was first cultivated in Peru. Its seed contains about 63% carbohydrate, 19% protein and 6.5% oil. Groundnut is the sixth most important oilseed crop in the world. As the groundnut seed is contained in pod, which is usually developed underground, the pod is harvested by pulling or lifting the plant manually or by using the machine. The pods are stripped from the plant, dried, stored and processed. Shelling is a fundamental step in groundnut processing. Shelling can generally be done by hand or machines. As well as the study of manufacturing was very important in order to carry out this project to ensure that what are needs to do. This project involves the process of designing the different parts of this shelling machine considering forces and ergonomic factor for people to use. This project is mainly about generating a new concept of groundnut shell (crush) that would make easier to bring anywhere and easier to crush groundnut. After the design has completed, it was transformed to its real product where the design is used for guideline..

2. METHODS OF SHELLING

There are two methods of groundnut shelling.

2.1 Manual method

In Manual Shelling method groundnuts are shelled by hand simply. They are wrapped into the cloth and then rubbed onto the surface to decoct it. The cost for shelling is 5 to 6 Rupees per kg foe one person and also this is very time consuming process.

Fig- 2.1.1 Manual Shelling

2.2 Mechanized Shelling Method

In mechanization now we use large machinery for groundnut shelling. These machines are used in the industries where large production is required. They are having shelling capacity of 400 to 3300 kg/hr. But these machines are costly in order to purchase by the farmers.

Fig- 2.2.1 Mechanized Shelling Machine

3. OBJECTIVE -

i. The main and basic objective is to make lowcost groundnut shelling machine.

ii. Another thing is that to shell maximum possible groundnut in shortest possible time.

iii. The machine should not damage the peanuts in according to earn profit.

iv. The cost of a machine should be affordable to the farmers.

v. Space occupied by the machine should not be so large. It should be kept within the land.

vi. The machine should not have excessive weight. It should be such that it can be easily portable.

4. DESIGN

4.1 DESIGN

4.1.1 Design of V-Belt

N1=1440 rpm N2=240 rpm Pd=0.5 HP=372.85 W=0.307285 Kw Droller=14 inch=355.6 mm W=30 kg =30*9.81 =294.3 N

Designation of Belt

At Pd=0.37285 Kw =372.585 w [P.no. 160 Table XV-8] Designation of belt is "A" 1) Width (w) =13mm 2) Thickness (t) =8mm 3) Pulley Dia. =75mm (D1) 4) Tension factor (kc) =2.52

Calculate power per belt [P.no. 161 table no.XV-9 from B.D.Shivalkar]
Power/belt= (Fw-Fc)*(eμΘ/sin (α/2)-1/e μΘ/sin (α/2)*Vp) Where Vp = π*D1*N1/60*1000 =5.65 m/sec μ = coefficient of friction = 0.5 α = cone angle =36 degree α/2 =36/2 =18
Θmean= π-(D2-D1/C) =∏-(450-75/525) = 2.43 rad
Vp = π*D2*N2/60*1000 5.65 = π*240*D2/60*1000
D2 =450 mm
Centre distance
C =D1+D2 =75+450 =525 mm eμΘ/sin (α/2) = e0.3*2.43/sin (18) =10.5
Now, Fw=w2=132=169 Fc= Centrifugal tension (N)= kC*(Vp/5)2 =2.52*(5.65/5)2 = 3.2177 N Power/belt = (169-3.2177)*(10.581-1/10.581)*5.65 Power/belt = 848.146 W/belt

To find number of belt (n) n = Pd/power/belt = 372.85/848.146 = 0.43 ≈ 1 Therefore n=1

To find cross section of belt
For designation A b= 3.3 mm h= 8.7 mm e= 15 mm f=9-12= 10

To calculate length of belt l= π/2*(D1+D2) +2C+ ((D1-D2)2/4C) l= π/2*(75+450) +2*525+ ((75-450)2/4*525) l=1941063 mm

4.1.2 Design for pulley

Ds=19mm Width of pulley= (n-1)*e+2f = (8.7-1)*15+2(10) W=135.5mm

Calculate hub properties
a) Diameter (Dh) = 1.5ds+25 mm = 1.5*19+25
b) (Dh)=53.5mm
c) Length (lh) =1.5ds =1.5*19 Lh =28.5mm PULLEY = 2

Type of Construction
At d2=450 N2=240 W=135.5mm
So, arm construction N=4 no. of arm No. of sets=1

Moment of each arm M= (T1-T2)*(D2-DH)/H
Now tension in belt Belt tension (T1&T2) (T1-T2) = Pd/RP = 327.85/58.65 (T1 -T2) = 6.29 ----
But, Belt tension ratio T1/T2 = euθ = e0.35*2.34 T1 = 2.34T2
Put in equation at(A) 2.34T2-T2 =65.99 T2 =49.24N
Then, T1=65.99+T2 = 65.99+49.24 T1=115.23N M = ((115.23-49.24)*(450-53.5))/4 M = 6541.258
But, α = M/Z
Assume α = 15 MPa Z = M/α Z = 6541.258/15 Z = 436.08
Now, Z = πb 3 /8 436.08 = πb 3 /8 b = 10.36 mm

Face width, w =1.1b = 1.1*10.36 w = 11.39mm

Rim thickness, t
t = 0.375*D1/2 + 3 t = 0.375*4501/2 + 3 t = 10.95 mm

5. CONSTRUCTION-

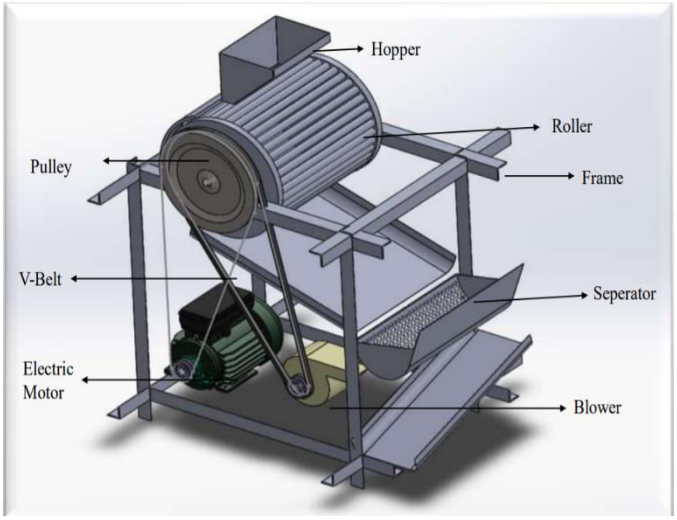

Fig- 5.1 Groundnut Shelling Machine

5. COMPONENTS AND SPECIFICATIONS

- Frame
- Electric motor
- Roller
- V-Belt
- Pulley
- Hopper
- Blower

5.1 Frame:
The frame is used to support all the components. Material of frame is cast iron

5.2 Electric Motor:
This motor is used to rotate the roller by using belt and pulley. Output = 230 volt Current =3.5 amps Power =0.37kw/0.5 HP

Fig- 5.2.1 Electric Motor

5.3 Roller:
Roller is made up of hollow cylinder of 1ft dia. And 1ft length with the rods welded on its periphery

Fig- 5.3.1 Roller

5.4 V-Belt:
V-Belt is used to transmit rotary motion of shaft of motor to the shaft of roller

5.5Pulley: Pulley is used to transmit the torque of motor to the roller. One pulley is directly mounted over the motor shaft and another pulley mounted on the shaft of roller. And both the pulleys are connected with the help of V-belt.

5.6 Hopper: Hopper contains groundnuts before and during shelling process. It is use to continuous supply of the groundnut to the crushing unit.

Fig- 5.6.1 Hopper

5.7 Blower:
Blower is mounted on the shaft of the pulley just in front of pulley at some distance. This blower separates the shell and the peanuts.

Fig- 5.7.1 Blower

5.8 Semi-Circular Net:
This semicircular net is fitted beside the roller at very small distance so that shell of groundnut should be easily cracked and peanuts remain uncracked.

6. ADVANTAGES:

1. Shelling time will be less
2. Efficient work is done by using machine
3.Limited number of labour are required
4.Cost of shelling is comparably less as manual shelling
5. High efficiency.
6.Reasonable design.
7. Non – pollution.
8. Affordable for farmers
9.The space required by the machine should be less.

7. CONCLUSIONS

The cost of the machine is less and if the farmer buys this machine, farmer can recover the invested money back. By using this machine problem of the labor crises can be reduced. Comparing with manual harvesting only 1 labor is required. It makes the process faster hence reduces most of the shelling time and labor cost .This machine is helpful for both small and big farms. Proper evaluation of the design will be performed and created something even better instead of simply manually operated operations. Finally we conclude that automising machines is a better option to use farmer instead of manually operated. The demands atomize shelling machine of farmers & other customers will be also considered while designing machine.

8. FUTURE SCOPE:

1. The agriculture is the basic profession of vast of population world-wide .Some modifications can be done in this machine and it will be used over long scale.
2. This machine provides better help to farmers so that they can get proper income of their crop. The scope in agricultural field is tremendous.
3. It will definitely be a vast sector to work on to minimise man power and improve efficiency of operation, decrease cost of operation, decrease efforts.

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