Design & Fabrication of Groundnut Sheller 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.

Keywords: Groundnut, peanut, shell, crushing, hoppe

1. INTRODUCTION
Groundnut (Arachis hypogaea) is a species in the legume or beans family ([1], [2], [3]). It was first cultivated in Peru [9]. Its seed contains about 63% carbohydrate, 19% protein and 6.5% oil [1]. 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 [1]. 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 guiding.

1.1 METHODS OF SHELLING
There are two methods of groundnut shelling.

1.1.1 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 for one person and also this is very time consuming process.

1.1.2 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.

2. OBJECTIVE
- The main and basic objective is to make low cost groundnut shelling machine.
- Another thing is that to shell maximum possible groundnut in shortest possible time.
- The machine should not damage the peanuts in according to earn profit.
- The cost of a machine should be affordable to the farmers.
- Space occupied by the machine should not be so large. It should be kept within the land.
- The machine should not have excessive weight. It should be such that it can be easily portable.

3. DESIGN AND CALCULATIONS
A. DESIGN OF V-BELT

\[ N_1=1440 \text{ RPM} \quad N_2=240 \text{ RPM} \quad P_0=0.5 \quad HP=372.85 \]
\[ W=0.307285 \text{ KW} \quad D_{\text{roller}}=14 \text{ INCH}=355.6 \text{ MM} \]
\[ W=80 \text{ KG} \quad 30*9.81 = 294.3 \text{ N} \]


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**DESIGNATION OF BELT**

AT $P_0=0.37285$ 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 ($D_1$)  
TENSION FACTOR ($k_t$) =2.52

**CALCULATE POWER PER BELT [P.NO. 161 TABLE NO.XV-9 FROM B.D.SHIVAKAR]**

\[
\text{POWER/BELT} = \left( F_w - F_c \right) \times (E' \sin (A/2) - 1/E' \sin (A/2)) \times V_F
\]

WHERE  
$V_w = \Pi \times D_1 \times N_1 / 60 \times 1000 = 5.65$ M/SEC  
$\mu = \text{COEFFICIENT OF FRICTION} = 0.5$  
$A = \text{CONE ANGLE}=36\,\text{DEGREE}$  
$A/2 = 36/2 = 18$  
$\Omega_\text{mean} = \Pi - (D_2 - D_1 / C) = |\Pi - (450 - 75 / 525)| = 2.43$ RAD  
$V_c = \Pi \times D_2 \times N_2 / 60 \times 1000$  
$5.65 = \Pi \times 240 \times D_2 / 60 \times 1000$  
$D_2 = 450$ MM

CENTRE DISTANCE  
$C = D_1 + D_2 = 175 + 450 = 525$ MM  
$E' \sin (A/2) = E' \sin (A/2) = 10.5$

NOW,  
$F_w = W^2 = 13^2 = 169$  
$F_c = \text{CENTRIFUGAL TENSION} (N) = K_c \times (V_c / \Pi)^2 = 2.52 \times (5.65 / 5)^2 = 3.2177$ 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)**

$N = P_0 / \text{POWER/BELT} = 372.85 / 848.146 = 0.43 \approx 1$  
THEOREF 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**

$L = \Pi / 2 \times (D_1 + D_2) + C \times ((D_1 - D_2)^2 / 4C)$  
$L = \Pi / 2 \times (75 + 450) + 2 * 525 + (75 - 450)^2 / 4 \times 525)$  
$L = 1941063$ MM

**WIDTH OF PULLEY**

$= (N-1) \times E + 2F$  
$= (8.7 - 1) \times 15 + 2 (10)$  
$W = 135.5$ MM

**B. DESIGN FOR PULLEY**

$D_p = 19$ MM

**CALCULATE HUB PROPERTIES**

A) DIAMETER ($D_h$) = 1.5DS + 25 MM  
$D_h = 1.5 \times 19 + 25$  
($D_h$) = 53.5 MM

B) LENGTH ($L_h$) = 1.5DS + 28.5MM  
$L_h = 1.5 \times 19 + 28.5$  
PULLEY = 2

**TYPE OF CONSTRUCTION**

AT  
$D_2 = 450$  
$N_2 = 240$  
$W=135.5$ MM  
SO, ARM CONSTRUCTION  
N=4 NO. OF ARM  
NO. OF SETS=1

**MOMENT OF EACH ARM**

$M = (T_1 - T_2)^* (D_2 - DH) / H$  
NOW TENSION IN BELT  
BELT TENSION ($T_i, T_2$)

$(T_1, T_2) = P_o / R_p = 327.85 / 58.65$  
$T_1 - T_2 = 6.29$  
\text{(A)}$ BUT, BELT TENSION RATIO  
$T_1 / T_2 = 2.34$  
\text{(B)}$  
PUT IN EQUATION AT (A)  
$2.34 T_2 - T_2 = 65.99$  
$T_2 = 49.24$ N

THEN,  
$T_1 = 65.99 + T_2$  
$= 65.99 + 49.24$  
$T_1 = 115.23$ N

**FACE WIDTH.**

$w = 1.1B = 1.1 \times 10.36$  
$w = 11.39$ MM

**RIM THICKNESS, T**

$T = 0.375 \sqrt{D} = 3$  
$T = 0.375 \sqrt{450} = 3$  
$T = 10.95$ MM
4. CONCLUSION

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.

5. REFERENCES


[5]. Designed data book by B.D.SHIVLKAR