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Design and Development of Machine to Remove Outer Cover of Groundnut

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Abstract

In republic of India, most of the land is used for agricultural purpose that produces semi-finished merchandise or product. Groundnut is additionally one in every of the agriculture semi-finished product. Groundnut is grownup on tiny scale farmers in developing countries like Republic of India. Lack of groundnut process machines, particularly groundnut worker is major downside of groundnut production. In early stages folks accustomed decoct groundnut manually. The output obtained was terribly low by this methodology. The analysis work for style, fabricate and performance of groundnut worker systematically of feed hopper with a rate of flow, management devices, firing unit separating unit and blower system. The machine is supported by a ½ HP motor operational on 720rpm. Falling pods from hopper are stuck by rotating drum, the chaffs are blown out through a window and seeds settle via chute; overall, the outcome involves method like style, fabrication and collection of various part rising potency and reducing the wastage.

Keyword: *Cad, decorticator, fabrication, groundnut,*

INTRODUCTION

The purpose of this project is to know the data of style and fabrication of groundnut worker machine. The design is surrounding friendly and uses straightforward mechanism properties like fire system, blower mechanism and automation separating system etc. In this process, some crushing force is required to crush the groundnut. The design is therefore done so that the data of coming up with, mechanism and forces are exaggerated. This research consists of fabrication of an automatic groundnut worker machine considering numerous vital parameters.

In this project, planning and development of a machine to crush or shell groundnut that the farmers will gain high profit by merchandising groundnut direct in market, still because the study of producing was vital so as to hold out this project to confirm that what is and has to do. This project involves the method of planning and fabrication of various components of this firing machine considering forces and technology issue for folks to use. This project is especially concerning about generating a brand-new idea of groundnut shell (crush) that may build easier to bring at any place and easier to crush groundnut. When the planning has completed, it had been reworked to its real product wherever the planning is employed for guideline.

PROBLEM FORMULATION

The aim is to style and develop a low-priced ground nut barrage machine which is able to facilitate farmer to sell finished (shelled groundnut) rather than unshelled groundnut. Considering top of the issues, we have a desire to fabricate such a machine that may eliminate most of the

issues from antecedent on the market manually barrage machine. Thus human effort is reduced and obtaining a lot of productivity, resulting a lot of profit to farmer.

(1) Presently base method is operated by hand.
(2) Dotty and husk (outer covering of groundnut) is mixed when crushing.
(3) Low productivity & time intense.
(4) A lot of wastage.
(5) Comparatively less potency.

Objective

(1) To cut back wastage thanks to crack or crushed groundnut.
(2) To extend the potency.
(3) To cut back the toil and to reduced time to shell the groundnut.
(4) To develop a low-priced machine which might be employed by farmer to convert their semi- finished (shell groundnut) into finished product (groundnut).

COMPONENT DESCRIPTION

Introduction to Components

Hopper

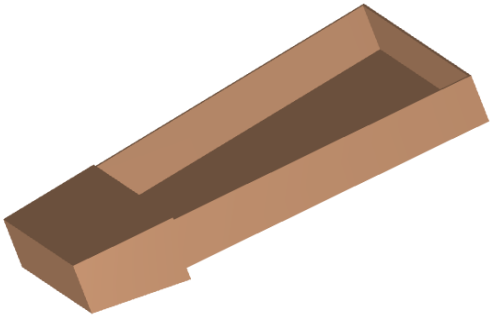

Figure 1: *Hopper.* (Eze, 2017)

A hopper may be a funnel-shaped device accustomed move material from one receptacle to different. It is utilized in industrial processes to carry specific matter that should be collected and transferred to next mechanism. They are used for increase collection quality. Hoppers are of rectangular cross section of 60° angle. Hopper walls are insulated to shield the surface setting and personnel from the discarded contents.

Decorticator

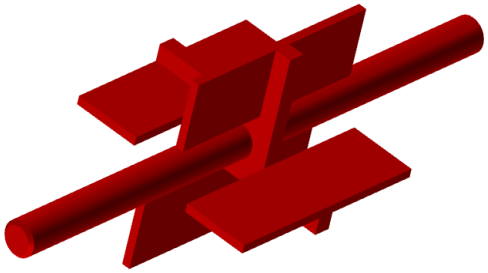

Figure 2: *Decorticator.* (Eze, 2017)

The groundnut decorticator may be an easy rocking kind machine for crushing groundnut pods to separate the kernels. It is used for uncovering the skin, bark, or rind off balmy, wood, plant stalks, grain, etc., in preparation for more process. It consists of a steel frame, arch-shaped perforated grate. The groundnut pods are crushed by rubbing against one another through the action of the crushing shoes. The crushed pods suffer the grate and also the kernels are then separated by motor operated blower. The machine may also be used for decorticating castor by employing an appropriate size Plano-concave grate.

Chaff Chute

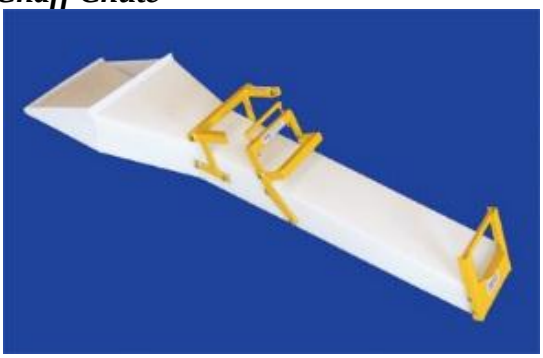

Figure 3: *Chaff chute.* (Eze, 2017)

Chaff chute is that part of decorticator which supplies the waste of the bottom, i.e., the husk of the groundnut, once it is been decorticated. Basically, it's the output system which supplies the husk as output. It may be justly same that it's a key part of the separating system. It's supported by a blower that helps the waste half to induce separated from the groundnut.

Seed Chute

Figure 4: *Seed chute.* (Eze, 2017)

It shares the identical mechanism because of the chaff chute, however during a totally different prospective. It's the productive part of the machine because it offers output (the seed of the groundnut). It's located at the lower most part of the machine, when the husk or the waste is separated from the crushed mixture. the seed of groundnut are obtained there.

Bush

Figure 5: *Bush.* (B.bhandari, 2010)

Bushings, conjointly referred to as sleeve bearings, slide over swish rods and supply a very low friction motion that minimizes power consumption, noise, and wane components. Bushings seem like plain metal tubes; they're sometimes made up of a bronze powder. The powder is united along such small pours are gift within the metal. The bushings are then fertilized with oil (about twentieth oil by volume). Then, because the bushing contacts a shaft, the oil is drawn to the surface of the bushing via surface tension in order that the bushing perpetually deposits a skinny film of grease onto the shaft. In alternative words, bronze bushings are self-lubricating.

Blower

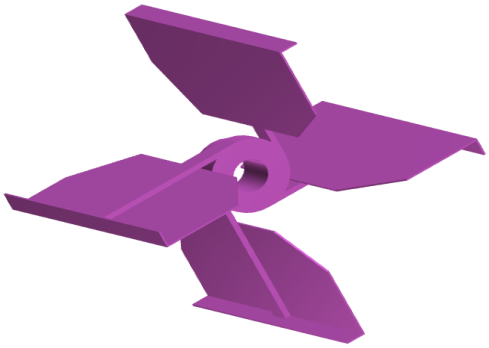

Figure 6: *Blower.* (Eze, 2017)

Blowers are machining whose primary operation is to supply and accommodate an oversized flow of air or gas. It's made to separate lighter material from significant. This can be achieved by rotating variety of blades connected to hub and a shaft and driven by motor or rotary engine. A blower is another name for a disciple that operates wherever there is a need of forced flow of air.

DESIGN AND SELECTION

To make style calculations easy and simple, we have a tendency to create some concerns as per the need of the sponsor. The common thought is about the capability of machine outlined and size and weight of machine ready into limits. We have a tendency to think of height of machine for straightforward operating purpose. Whereas style, we have a tendency to think about the thickness in keeping with out their machines and compare the required parameters. We created all those concerns to change the planning calculation and set limit to our machine. It helps to style machine at intervals limits and safe for operating.

CAD MODEL

As per project required, development is critical to boost machine potency and optimize the planning. We have a tendency to work on existing machine styles and scope of improvement. We have a tendency to plan a CAD model and

mentioned the planning with our project guide and mill connected folks for feedback. As per feedback, we have a tendency to work on ideas and created improvisation in our style and eventually factory-made it.

After the planning is final, checked for safety and calculations are at intervals limits, we have a tendency to begin getting the material and additionally the brought-out half that are readymade in market. Once we get needed material, we have a tendency to fix the manufacturer for fabrication of assembly product components. We have a tendency to look for manufacturer at intervals, our neck of the woods to avoid expenditure of cash on travel and will see the method of fabrication.

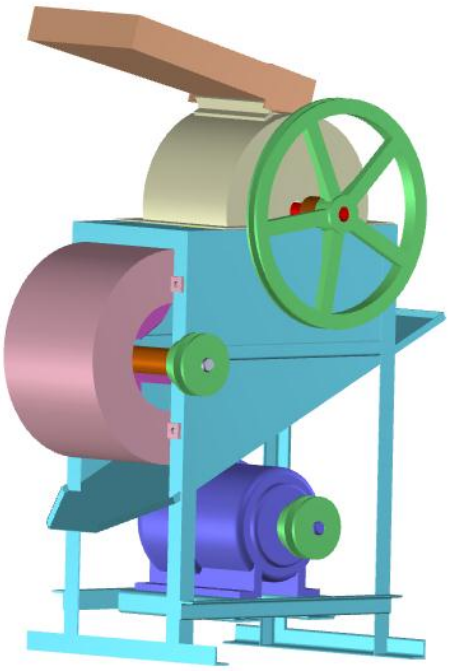

Figure 7: *Cad model.*

CALCULATION

Hopper design-

As hopper is of the shape of a pyramidal frustum

Therefore,

of frustum hopper, $V_h = \frac{1}{3}(a^2 + ab + b^2)h$

$= \frac{1}{3}\left((21.6^2) + 21.6 \times 12.5 + 12.5^2\right) * 29$

$= 8630.4cm^3$

Weight of unshelled groundnut = 2gram

Production rate = 20kg/hr.

Area of groundnut without decortication, $A_g = \pi r^2 l$

$= \pi \times (0.7^2) \times 4$

$= 6.15cm^2$

No of groundnuts that can be poured in the hopper,

$$N = \frac{volume\ of\ hopper}{volume\ of\ single\ groundnut}$$

$$= \frac{8630.4}{6.15}$$

$= 1403.31$

Weight of groundnut that can be poured one in the hopper

= No of groundnuts that can be poured in the hopper x Weight of unshelled groundnut

= 1403.31X 2

= 2806.6 grams

= 2.806kg

Approximately 2.8kg

Decorticator drum

Length of decorticator cylinder =12.5 cm

Diameter of decorticator drum =14 cm

Mass of decorticator drum (measured without groundnut pots) = 0.5kgs

Calculation of blower pulley

By using tachometer, we find rpm of bigger pulley

N_2=160rpm

$N_1D_1=N_2D_2$

$1425\times4=160\times(D_2)$

D_2= 36cm

Belt efficiency = 0.85

Motor rpm to be transferred = 0.85×1425

=1211.25rpm

$N_1 = N_2+N_3$

$1211.25 = 160 + N_3$

N_3=1051rpm

$N_2D_2=N_3D_3$

$160\ (36) = 1051(D_3)$

D_3=5cm
Diameter of blower pulley =5cm

Force possessed by revolving decorticator
Centrifugal force acting on the decorticator drum,
$F_c=\frac{mv^2}{r}$
$V=\frac{2\pi nr}{60}$
$=\frac{2\pi\times160\times0.1}{60}$
= 1.67m/s
$F_c=\frac{mv^2}{r}$
$=\frac{0.5\times1.67^2}{0.7}$
= 1.99N
Torque possessed by decorticator drum,
$T_d = mv^2$
= 0.5X1.67
= 1.394Nm

Power developed decorticator drum = $\frac{2\pi NT}{60}$
$=\frac{2\pi\times160\times1.394}{60}$
= 91.23 W
Power developed to drive blower,
$P_2=\frac{Qair\ P1}{17.4em\times eb}\left[\left(\frac{P2}{P1}\right)^{0.283}-1\right]$
$=\frac{7\times(0.3)}{17.4(0.76)(0.78)}\left[\left(\frac{0.35}{0.3}\right)^{0.283}-1\right]$
= 9.2 W

Crushing force,
$F_c=\frac{2ms}{t^2}$
$=\frac{2\times2.354\times0.5}{0.064}$
= 3.678 N

Motor torque,
$T_m = Pt\frac{9.554}{n}$
$=375\frac{9.554}{1425}$
= 2.514Nm
Calculation for electricity bill,
Output power = 0.373 kw
Electric input = output / efficiency
= 0.373/0.85
= 0.43kw
Units consumed
= power in kw X no. of hours of operation
= 0.43 X 8
= 3.44
For 8 hr of operation = 3.43 X 8
= 27.52 Rs

Tension in V- belt decorticating shaft,
$e^{f\alpha/\sin\theta} = e^{0.2x2.94/\sin20}$
= 5.57
$\frac{P1-Mv2}{P2-Mv2}$ = 5.57

Since initial velocity is zero, therefore V = 0
P_1= 5.57 P_2 (1)
Since power, $P=\frac{P1-P2}{1000}v$
$0.375=\frac{P1-P2}{1000}2.6$
P_1- P_2 = 144.23 N (2)
By solving equation 1 and equation 2
P_1 = 175.7 N,
P_2 = 31.56 N
Initial tension in belt P_1=103.26N
Design of shaft for decorticator drum
Point load at A= 73.56N
Point load at B = 14.17 N

$R_a + R_b = R_c$
73.56 +14.71 =R_c
R_c=88.27N

SFD @ A=73.46N
SFD @ B=88.27N
SFD @ C= 0

BMD @ B=345.7N-cm
BMD @ C=2478.9N-cm
BMD @A=2486.29N-cm

$M_t=\frac{60\times10^6(kw)}{2\pi N}$
$=\frac{60\times10^6\times0.37}{2\pi\times1425}$
=2479.46N-cm
M_c= 24.52(3) (29+1.5) + 14.76(1) (16)
= 2478.91N-cm
$D^3=\frac{16}{\pi\mathrm{T}max}\sqrt{(Mb\times Kb)^2}+\sqrt{(Mt\times Kt)^2}$
$=\frac{16}{54\pi}\sqrt{(2478.91\times1.5)^2}+\sqrt{(2486.9\times1.5)^2}$
D=1.52cm

TESTING

Sr. No.	Tests and cases	Description
1	Test 1 (with decorticator drum)	Production rate has been increased up to 20-22 kg/hr. Wastage due to crushing between decorticator almost around 20%. Wastage could not be reduced up to zero.
2	Test 2 (with decorticating blades)	Inspired or motivated from a wheat threshing machine. Blade like structure in rectangular shape. 4 metal blades having better alternative for decorticating drum.
3	Case 1 (increasing productivity but decreased separation)	Design of pulleys assigned in such a way that both pulleys run on decided level. Production of ground increased up to 25 kg/hr. Separation was less. Hopper was redesigned so limited groundnut could be poured.
4	Case 2 (increased separation but decreased productivity)	Input was decreased but separation increased. Production rate is 20 kg/hr. which is less than previous case. Confirmed design with blades not with drum.

CONCLUSION

The objective of this project was to form a groundnut decorticating machine. And after all, the planning, issues and calculation we can say that this is what we were expecting. Also, our objective was to cut back the loss and wastage of the machine and we have achieved that. The aim was to form it compact so it would be reasonable for farmers. This is often, wherever we've got place, our efforts in reducing size and maintaining the output of the machine, for this a reduced ½ horsepower motor is usually recommended. Additionally, because of its compact size currently it's reasonable, simple to use additionally easy to take care of. It also can be used for little scale industries. We all know that in an exceedingly country like Asian nation, electricity may be a major drawback. So, if throughout operating the electricity fails, it's additionally supplied with a handle, which suggests that it can also be operated by manual power. Hence, we were able to conclude as we are able to compact the scale, scale back the value, increase the potency and reduce the wastages.

REFERENCES

1. J.C. Aririguzo (2017), "Evaluation of performance of an indigenous bambaranut Decorticating machine", Volume 6, Issue 7. (Aririguzo, Evaluation of performance of an indigenous bamaranut decorticating machine, 2017)
2. Dr C.C. Handa (December 2014), "Design and fabrication of ground nut Sheller machine", Volume 1, Issue 7. (Handa, 2014)
3. C.C. Eze , (October 2016), "Design and development of a groundnut Decorticating and separating machine", *Micheal okpara university of agriculture,* Volume 3, Issue 10. (Eze, 2017)
4. Darshan Gowda C P (July 2018), "Automatic groundnut decorticator", Volume 3, Issue 7. (P, 2018)
5. Rohit Chougle (March 2017), "Design and manufacturing of cashew nut shelling machine", ISSN no.2454-7875. (Chougle, 2017)
6. Nagesh S B (2018), "Design and development of mobile groundnut decorticator", NCTRD -18. (B, 2018)
7. Roshan P. Ghodkhande (2015), "Design and modification of ground nut decorticator", Volume 3, Issue 12. (Ghodkhande, 2015)

8. Ghadge Rohit (October 2017), "A Review and design and fabrication of groundnut shelling and separating machine", Volume 4, Issue 10. (Rohit, 2017)
9. Nilesh Balki (2017), "Design and fabrication of economical ground nut decorticating machine for Indian farmers", Volume 5, Issue 9. (Balki, 2017)
10. V. B Bhandari, "Design of machine element", *THM publication third edition* (B.bhandari, 2010)

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