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DESIGN AND MANUFACTURING OF CORN SHELLING MACHINE

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Abstract— **India depends on agriculture to drive the engine of its economic development. Corn has been cast in the lead role of this ongoing storyline of agriculture success, and without corn, the India farm sector would be just a shell of what is has now become. Corn is grown on small scale, corn's price is growing day by day it has almost became the double of the price of the maize. Corn Sheller is a major problem of corn production, especially in India. The performance of the machine will be evaluated in terms of shelling efficiency, material efficiency, etc. The project describes about the design of various components of corn shelling machine. Overall, this project involves process like design, fabrication and assembling of different components, etc. This project describes the design and development of motorized corn shelling machine.**

Keywords— **Corn, Shelling, Hopper, Shutter, Threshing chamber, collector, wastage, drum**

I. INTRODUCTION

In today's industrial world man's innovative ideas has taken him towards all directions concerning about the production and safety in industrial establishments. Some instruments are of shear excellence where as others are the result of long research and persistent work, but it is not the amount of time and money spends in the invention of device or the sophistication of it operation is important, but its convenience, utility and operational efficiency that are important in considering the device.

De-seeding of corn is the process of removal of its inner layers, leaving only the cob or seed rack of the corn .De-seeding is the process of removing the hulls (or chaff) from beans and other seeds.

The existing methods of corn de-husking in agriculture industry consist of breaking the grains by hand or by using large machinery for deseeding. Both of which are not effective for a developing economy like India where farmers have little money for investment.

II. LITERATURE REVIEW

There are three different types of De-seeding systems that can be used to process soybeans: Hot De-seeding, Warm De-seeding and Cold De-seeding. Hot De-seeding is the system offered in areas where beans are processed directly from the field. Warm De-seeding is often used by processors who import their soybeans. Cold De-seeding is offered to plants that have existing drying and conditioning equipment, but need to add De-seeding equipment to produce high protein meal. The different De-seeding temperature options are for different types of production, beans and preparation equipment.

Anant J. Ghadi and Arunkumar (august 2014, Belgaum)- The existing methods of corn de-husking in agriculture industry consist of breaking the grains by hand or by using large machinery for deseeding, both of which are not effective for a developing economy like India where farmers have little money for investment.

Oriaku E.C, Agulanna C.N, Nwannewuihe H.U, Onwukwe M.CAnd Adiele (2014, Enugu)- Explained that, corn the American Indian word for corn, and means literally that which sustains life. It is, after wheat and rice, the most important cereal grain in the world, providing nutrients for humans and animals and serving as a basic raw material for the production of starch, oil and protein, alcoholic beverages, food sweeteners and, more recently, fuel and explained that One of the most important processing operations done to bring out the quality of maize is shelling or threshing of maize.

III. DESIGN AND CALCULATIONS

Parts-

The device is simple in operation consisting of following parts:

a) Stand
b) Motor
c) Screener
d) Main head
e) Belt
f) Shaft
g) Pulleys

Calculations-

1. Design of shaft-

The corn load and Welded iron road weight = 25 kg = 250N

The screwed dimension or diametric radius = 100mm

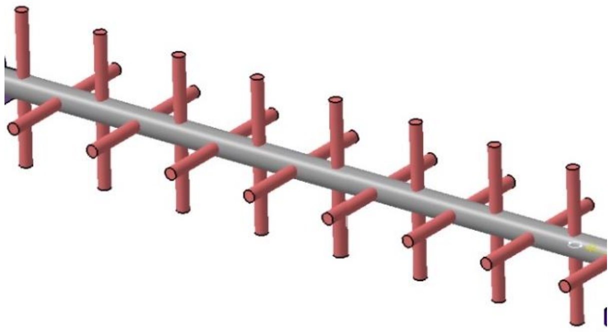

Fig 3.1 Screwed shaft

Total torque on crank = 250 x 50 = 12500N-mm

P = $\frac{2\pi NT}{60}$

Speed required in the range 150 to 300rpm

P = 392 watt

So we have selected 0.5hp motor.

Motor power = 5 watt

Motor speed = 1440 rpm

Motor supply 230 V single phase

T = Max Torque generated to rotating Crank

б = 145 N/ mm2 considering factor of safety = 4

As per Design data book shaft material is selected Carbon steel C40

C40= Sut= 580 N/mm^2

Yield= 435 N/mm^2

σ = 145 N/mm2

As per ASME code

0.3 X Yield strength N/mm2

0.18 X ultimate strength N/mm2} whichever is smaller

0.3 x 330 = 99 N/mm2 .....(a)

0.18 x 580 = 104 N/mm2 .....(b)

From equation (a) & (b)

Allowable stress value will be 99 N/mm2

If key ways will provide to shaft then

τ = 99 x 0.75 = 74.25 N/mm2

WE know that,

$$T = \frac{\pi}{16} d^3 \tau$$

Where T = 12500N-mm

By using above equation drive shaft diameter

d = 9.33mm …..(c)

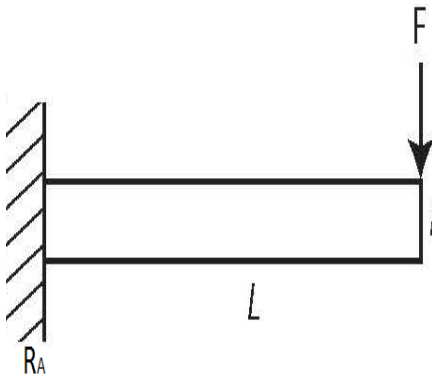

Fig 3.2 Drive shaft loading condition

P = 1000 N

$$\sum F_Y = 0$$

RA = 1000

Calculation of bending moment at loading point P,

BM at M = 1000 x 50 = 50000N-mm

We know,

$$M = \frac{\pi}{32} d^3 \sigma$$

б = 145 N/ mm2 considering factor of safety = 4

By using above equation drive shaft diameter

d = 15.49mm …..(d)

From equation c and d we have selected the diameter of shaft = 20mm considering extra jerk and for safe design.

According to maximum shear stress theory

Equivalent torque

$$T_e = \sqrt{(K_b M_A)^2 + (K_t T)^2}$$

For design data book

Equivalent bending moment

$$M_e = \frac{1}{2}\left[M + \sqrt{(K_b M_A)^2 + (K_t T)^2}\right]$$

Te = 116297 N-mm

Me = 83148 N-mm

We know,

$$T_e = \frac{\pi}{16} d^3 \tau$$

$$M = \frac{\pi}{32} d^3 \sigma$$

خ = 73 < 74 N/mm2 and

Ϭ = 105 < 145 N/mm2

By using above equation we have checked the allowable shear stress and allowable bending stress and it is seen that the both values are within limit hence design is safe.

2. Speed Reduction of Motor-

By using Belt and Pulley,

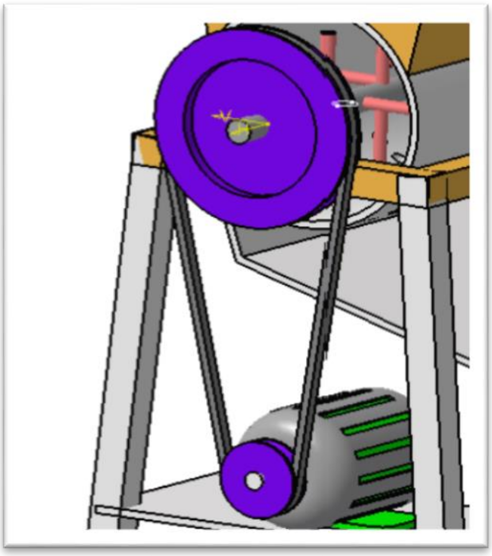

Fig 3.3 Belt and Pulley Drive

Let,

N_1=speed of motor shaft

N_2= speed of Output shaft

D_1=diameter of smaller pulley

D_2= diameter of larger pulley

We know,

$$\frac{N_1}{N_2} = \frac{D_2}{D_1}$$

$$\frac{1440}{N_2} = \frac{200}{50}$$

N_2=360 RPM

IV- COMPONENT DISCRIPTION

a) Motor- The purpose of an electric motor is to develop the necessary power required for a task. The squirrel type motor has its current induced in the motor bars by induction thereby dispensing with commutators. For the purpose of this work, a squirrel induction motor is selected. The rating however will be determined by calculation results.

b) Belt- A belt provides a convenient means of transferring power from one shaft to another. Belts are frequently necessary to reduce the higher rotational speeds of electric motors to lower values required by mechanical equipment. The belt driver relies on frictional effects for its efficient operation.

c) Frame- The main frame supports the entire weight of the machine. The total weights carried by the main frame are weight of the hopper, housing, threshing chamber, the collector, the bearings and pulley.

d) Shaft- A shaft is a rotating or stationary member, usually of circular cross-section having such elements as gears, pulleys, flywheels, cranks, sprockets and other power transmission elements mounted on it. The shaft of this machine has a threshing tool attached to it (by welding) at two opposing sides and a pulley mounted on it. It is supported on bearings.

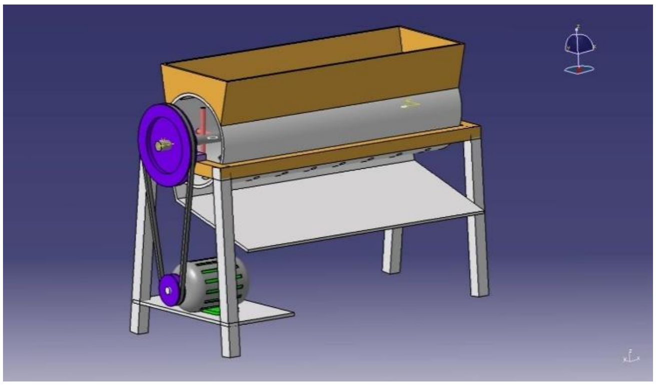

FIG 4.1 ASSEMBLY OF CORN SHELLING MACHINE

V-ADVANTAGES AND DESIGN CRITERIA

General Requirements of Machine Design

a) High productivity.

b) Ability to produce and provide required accuracy of shape and size and also necessary surface finish.

c) Simple in design.

d) Safe and convenience for controlling.

e) Affordable costing.

f) Better Appearance.

VI- FUTURE SCOPE

As the designed corn shelling machine has a higher productivity rate than the existing machines in cost, so definitely it is affordable for small scale farmers and can be used by various industries also as the machine is efficient with respect to machines available in market.

ACKNOWLEDGMENT

With help of this design we can fabricate an automatic Corn Sheller machine to simply achieve high volume of profit as well as to reduce the human fatigue. This machine has been fabricated with the use of locally available materials. The machine is simple, less bulky and effective with its self-cleaning ability.

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