Design and Manufacturing of Sunflower Threshing Machine

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Abstract :- This paper describe new machine how reduce human effort for extraction of seeds from sunflower, to removes from sunflower they are dried in sun light after rubbed over each other, the seeds that with which west material are collected and separated wind over which is manual operation .The separation of seeds from sunflower held in manually beating with stick, bullock trampling and tractor treading these processes are cumbersome time consuming process ant total process are cumbersome time consuming and total losses are high which directly affects quality of produce . So we can develop a new machine which reduces human effort and loss of the product. The aim of the project is to fabricate a machine which will separate s seeds from the sunflower.

Introduction

The main component required the fabricate the machine are extracting teeth shaft, pulley, tray, mesh, motor, v belt, pedestal bearing, spring etc.The sunflower is threshed in closed threshing unit by extracting teeth which are attach to rotating shaft where the seeds separated from flower and husk of the flower is removed. Finally clean seeds are collected in a tray this machine convenient for threshing process and reduce human effort as well as time.

Problem Statement

We discussed the regional farmers about the current method of the sun flower seeds extraction. The present manual methods are beating the sunflower by stick, rubbing the sun flower bullock trampling and automatic threshing machine. The manual methods are time consuming required more efforts while the cost of threshing machine is high so we decide to design and fabricate such a machinery which will reduce above disadvantage in best possible way.

Methodology

After theanalyze the problem statement we decide to manufacture the covenant machine. This machine consist seeds extracting teethes which are mounted on shafts and there are three shafts which are placed horizontally with equal distance. These shafts are mounted on frame with the help of bearing. The first shaft is rotated with the help of AC motor. The power transmission is done by pulleys and V belt. This mechanism is mounted on frame due to variation in the size of sunflower and gap between teeth and mesh is maintained by compression spring. The seeds are extracted by flower and then remaining impurities is removed with the help of fine mesh and finally seeds are collected in collecting tray

Design & Manufacturing

Seeds Extracting Teeth

The seeds extraction teeth made up of mild steel L angle. The teeth are made by cutting of chop saw machine. The height of teeth 25mm, width 12mm, gap between two Teeth 3 mm. The angles are placed in front of each other they mounted on shaft assembly. $120^0$to each other.

Frame

The all assembly mounted on fame to sustained load and vibration. To selecting the material MS steel (50 x50 x 5 mm) this structure is fabricated by arc welding.

V belt and Pulley

The selection of v belt is as per requirement. We required high power transmission and distance between two pulleys are less, due to groove in the pulley more grip is obtain and slipping is less. The v belt works better between sped range of 300 to 1500 m/min. The select size and type and capable of transmitting any amount of load power.

Pulley

Speed of motor shaft 1440 rpm, Diameter of pulley - 70mm–0. 91KW=1. 2HP.
So we selected 70mm diameter driver pulley.
Assume required operation speed=N=300350 rpm.
Let the Driver pulleyrpm=1440 rpm=N1
Driven pulley rpm=350 rpm=N2
Driver pulley diameter = 70mm= D1
Velocity ratio N2/N1 = D1/D2
350/1440 = 70/D2
D2 = 300 mm
D 1=70mm.
D 2=300mm.

Motor

The Power drive unit of the machine consists of 1HP single phase AC Induction motor which rotates at 1400 rpm. The pulleys are designed to transmit 350 rpm to the threshing rotor. The motor is mounted on bottom of machine the motor is attached to 20 mm thickness plywood. This plywood is fixed to angle by nut bolt arrangement.
The bulk load is about 25.4 kg.
Therefore mass = 200 kg
W = mg
= 25.4 x 9.81
W= 249.17 N
Correction factor Fa = 1.1
Force acting on rollers is,
F = 249.17 x 1.1
= 274.09 N
The required torque is,
T = 274.09 x 500
T = 137.04 NM
The minimum Hp requirement of motor for threshing the sun flower is
P = 2πNT / 1000
P = 2π X 350 X 137.04 / 1000
P = 301.36 Watts
P = 301.36 / 746
P = 0.439 HP
To select the higher power motor to 1 HP

Spring

The purpose of compression spring in our machine is to maintain the gap between teeth and mesh. When we insert the various sizes of sunflowers the gap is occurred between mesh and teeth thus it can maintain this variation then after trial and error method we select the compression spring (25 x 100 mm & wire diameter 2 mm). Which is capable for sustain the load. This spring's is mounted around the studs

Pedestal bearing

After selection diameter of shaft which is 25 mm a suitable bearing is selected.
Shaft dia. = 25 mm
Housing width = 38 mm
Housing length = 40 mm
Mounting slot length = 19 mm
Mounting hole center to center = 105 mm.
Pedestal is used to support pipe shaft assembly. There are 6 bearings are used to support 3 pipe shaft assembly. These bearings are mounted on frame structure. bearing can sustain moment load and low drag with excellent smoothness.

Mesh

In this machine there are two types of mesh. Which one of them is used at the threshing process &another one is used at before the seeds collector which works as a separator to remove the impurities from the seeds

Result and Discussion

A. Machine Productivity (Pth)

To determine productivity of the machine the following relationship is used P th = Pw/ t
Where P w=mass of total seeds in kg,
t= time consumed in threshing sunflower
1gram=20sunflower seeds(approximately)
As, our machine threshes 10 sunflowers perminute, therefore
60* 10=600
Sunflowers per hour
Seeds extracted from1 sunflower=130 gram
Aswecan thresh two sunflowers simultaneously insinglepass,
There fore, (600* 130) * 2=1, 56, 000gram
=156kg.
P th=Pw/t
=156/ 1
P th=156kg/ hr.

B. Cleaning Efficiency

The cleaning efficiency is calculated as per1000 gramofseeds
1gr am=20sunflowerseeds(approximately)
seeds extracted from1sunflower=130gr am
we observed visually that10gm impuritiesare present
130/ 10=13,
so 1000/13 = 76.92 gram.

ηcl=ms-ma*100
ms
whereηcl=cleaningefficiency
ms=totalseedmassingram ma=massofimpurities
ηcl=ms-ma*100
ms
= 1000-76.92* 100
1000
ηcl = 92.30%

C. Threshing Efficiency

we observed visually that 3gm
unthreshedseedsarepresent, so
130/3 =43.33
thethreshingefficiencyiscalculatedasper1000gramofseeds
1000/43.33=23.07gm
ηth=ms-mth*100
ms

where ηth= threshing efficiency
ms=totalseedmassingram

ηth=ms-mth*100
ms

= 1000-23.07* 100
1000

ηth =97.69%

specific energy consumption

sec= consumedpower*time
productivity

= 0.746*1
156

sec= 4.78*10-3 kw.hr/kg

BeforeThreshing

AfterThreshing

Discussion

Themachineproductivitywasobservedtobe156Kg/hr.

Byweighingthemassofoutputcollecteditwasobservedthatout of1000gms.
ofoutputseedstherewas76.92gmsofimpurities(huskoftheflower).
ThereforetheCleaningefficiencyofthemachineis92.30%.

Thethreshingrotorrunsat350rpmwherethepowerconsumptionis0.746 kWand

Specific energy requirement is 4.78*10-3 KW.hr/kg.

PerKWrateofdomesticelectricityisRs.3,
So,perhourthreshingrate=4.78*3

= 14.34 ≈ Rs.14

Threshingefficiencywasdeterminedbymeasuringthemassofunthreshedseedsintheflower.Itwasfoundtobe97.69

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