DESIGN AND FABRICATION OF AUTOMATIC CORN SEPARATOR MACHINE

Onkar kale , Sachitanand Kolhe , Avinash Kumar, Yogesh Patle , Hanmant Gotamwad, Pranay Kadam, Mayur shelke .

1) sachitanand kolhe , Mechanical engineering,KDKCE Nagpur Maharashtra , India
2)Onkar kale , Mechanical engineering,KDKCE Nagpur Maharashtra , India
3) Avinash kumar, Mechanical engineering,KDKCE Nagpur Maharashtra , India
4) yohesh patle, Mechanical engineering,KDKCE Nagpur Maharashtra , India
5) hanmant gotamwad Mechanical engineering,KDKCE Nagpur Maharashtra , India
6) pranay kadam Mechanical engineering,KDKCE Nagpur Maharashtra , India
7) mayur shelke , mechanical engineering, KDKCE Nagpur Maharashtra, India

ABSTRACT

Corn has very old history scientist believe corn is developed by people from Mexico 7000 years ago .it was started from wild grass. now a day's corn is very important crop in Indian as well as other countries it is very affordable crop, it can grow in any un favoured climate hence we have manufactures Corn separator machine which run by Handle i.e manual and by a machine i.e automatic, which is portable and affordable to Indian Farmers. 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. Hence there is a need for an innovative idea or product that is feasible, safe, cost effective and productive for the Indian farmer.

The electric motor provides the primary motion required to power the machine. The motion and torque are transmitted via pulleys, v-belt and bearings to the shaft carrying the spikes and blower shaft connected to the impeller. Both the de-cobing spikes and blower impeller rotate in a clockwise direction. The whole maize (together with the cobs) are introduced into the machine through the inlet hopper. They reach the rotating spikes inside the de-cobing barrel by gravity. The spikes give continuous impact force on the whole maize, thereby removing the grains and chaff. Because the spikes are arranged in a spiral form, the whole maize moves along the length of the barrel in the forward direction until they reach the cob exit spout.

Before the whole maize reaches this point, almost all the grains (seeds) are removed thereby letting the cob go out of the machine clean. Due to the impact of the spikes some of the cobs may be broken, though both broken and whole exit through the exit spout. The air generated by the blower impeller is channeled to flow against the maize grain exit spout via a wire mesh. The air blows off unwanted chaff that exit together with the maize grains thereby keeping the maize Grains very clean.

1. TITLE-1

1.Introduction

In era of automation everyone wants continuous, effort free production, to improve productivity. Men is running behind automation and developing new ideas, artificial intelligence is one of the example of it, In which Robot can do his work i.e it can take own decision according to situation . Agriculture is one of the field where automation can help to enhance production rate and to remove animal efforts of plowing by an animal. Corn separator machine is one of the example of automation to separate corn from maze it is quite difficult job for human but by using this machine corn seeding is very simple 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. This is sometimes done using a machine known as a huller. To prepare the seeds to have oils extracted from them, they are cleaned to remove any foreign objects. Next, the seeds have their hulls, or outer coverings, or husk removed.

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.

2. Description

The design consideration of this machine is based on three principles namely:

The gravitational dropping of the whole maize through the inlet hopper to the rotating spikes and exit of the grains to the receiver.

The impact force delivered by the rotating spikes to the whole maize and motion of this whole maize along the length of the de-cobing barrel

The air generation and supply by the blower

The dropping of the whole maize through the hopper to the rotating spikes is governed by gravitational force (fg) which is given as; (Ryder and Bennet, 1982) F= mg Where: m = mass of whole maize g = acceleration due to gravity The impact principle and air generation by the blower is achieved through the dynamics of the machine components namely: pulleys, belt, bearings and shaft. Circular motion of these components and gravitational motion of the whole maize through the inlet hopper and exit of grains through the exit spouts are employed to achieve the desired result.

3.Design Calculation

3.1 Design of Shaft

A solid shaft rotating at 1450 rpm is assumed to be made of mild steel. The shaft here is subjected to both bending moment and torsion stresses. The ultimate shear stress of a mild steel shaft from design data is 265Mpa. The safe load is 300N (Approx 30Kg). The shaft of length 170mm is subjected to bending moment and torsion stresses.

Maximum Bending moment about bearing

BM = 300 x 170 = 51000 N-mm

And torque T = (P) x (60) / (2 x π x N) … (5.1)

= (186.5 x 60) / (2 x 3.14 x1450)

= 1.22 N-m = 1.22 x 1000 T

=1220 N-mm

The diameter of shaft taken is 25 mm which is safe.

3.2 Design of Pulley

Length of belt between driving shaft and driven shaft

d=diameter of driving pulley=50.8mm

D=diameter of driven pulley=203.28mm

C=central distance between driving & driven

Pulley =500mm

Length of belt

L=л(r1+r2)+2X+$(r2-r1)^2$/2 …(5.2)

L=л(25.4+101.6)+2 x 500 +$(152.4-25.4)^2$/2

L=1117.6 mm.

Selection of motor

A Single phase motor of 0.5 hp running at 1450 rpm is chosen based on the load conditions.

To calculate the power

$P = (2\pi NT / 60)$ …(5.3)

$(0.25 \times 746) = (2\pi \times 1450 \times T / 60)$

$T = (186.5 \times 60 \times 1000 /2\pi \times 1450)$

$T = (186.5 \times 60 \times 1000 /2\pi \times 1450)$

T = 1228.23 N-mm

3.3 Design of Angles:-

Due to the load of plate, job and filing force, the angle-link may buckle in two planes at right angle to each other. For buckling in the vertical plane (i.e.in the plane of the links), the links are considered As hinged at the middles and for buckling in a plane perpendicular to the vertical plane, it is considered as fixed at the middle and the both the ends.

Here, The maximum load due to above factors = 50 kg (including friction)

F= 50kg = 50 x 9.81 = 490.5 N.

We know that t he load on each link,

F1 = 490.5/4 = 122.625 N.

Assuming a factor of safety as 3, the links must be designed for a buckling load of

Wcr = 122.625 x 3 = 367.875 N

Let t1= Thickness of the link

b1= width of the link

So, cross sectional area of the link = A = t1x b1

Assuming the width of the link is three times the thickness of the link, i.e.b1= 3 x t1

Therefore

A= t1x 3 t1 = 3 t12

And moment of inertia of the cross section of the link,

I = 1/12 t1b13

= 2.25 t14

We know that I = AK , where k = radius of gyration.

K 2 = I/A = 2.25 t14 / 3 t12 = 0.75 $t1^2$

Since for the buckling of the link in the vertical plane, the ends are considered as hinged,

Therefore, the equivalent length of the link

L = l = 600 mm.

And Rankin's constant, a = 1/ 7500

Now using the relation,

Wcr … (5.4)

With usual notation,

Here stress-f = 100 N / mm2

367.875 =

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300 t14 – 367.875 t12 –64 x 367.875 = 0

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$t1^2$ = 26.20

t1 = 5.1 mm

b1 = 3 x t1 = 3 x 5.1 = 15.35 mm

But the standard angle available of 24x 24 x 3 mm.

Hence considering the safety aspect it has been selected. This can bear the impact loading. Hence the design is safe.

3.4 Design of Bearing

Depending upon the nature of contact the antifriction bearing has been chosen

Fig no. 3.1 Bearing used

4. METHODOLOGY

Principle of design

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4.1 Methods of sepration of Corn

1) Manual Method
2) Automatic

1) Manual Method

The corn needs to be cured or dried for an additional four to six weeks after you harvest it if you plan to use it for popcorn. The kernels need to be partially dry with only a little moisture in them. Manual method of separating corn from maze is very time consuming and required human effort And at a time u can cobb one or two corns.

2) Automatic Method or by using machine

It utilizes high-speed rotating emery blade to cut and rub the corn bran and damage the bonding strength between the corn and the endosperm and the germ so as to make the corn bran, wheat bran or bean bran separated. It can also separate the corn germs and black spots during peeling process. The internally installed effective air draft chamber can collect the bran from the peeling process.

Automatic method is like that insert corn into drum and corn kernel will come from one side and cobb from one side it is very efficient method it also required less labor work

Fig.4.4 manual method of corn separation

5. Fabrication of Model

Basically during fabrication of the model the The following parts were fabricated using the material and process shown below.

1. L angle (35 x 35 x 5 mm) Material: Mild steel Operation: Cutting, welding & Drilling.

2. Shaft Material: Mild steel Operation: Facing, Planning, steeping,

3. Metal plate: Material: Mild steel Operation: Marking, Cutting & Welding

4. Base Support Material: Mild steel Operation: Marking, Bending & Cutting.

5. Bearing Support Material: Wood Operation: Marking, cutting, and drilling.

6. Pulleys Material: Grey Casting Operation: Boring, Fitting.

7. Bearing Material: Grey Casting Operation: Fitting.

8. Motor Plate Material: wood Operation: Marking, Cutting, and Drilling.

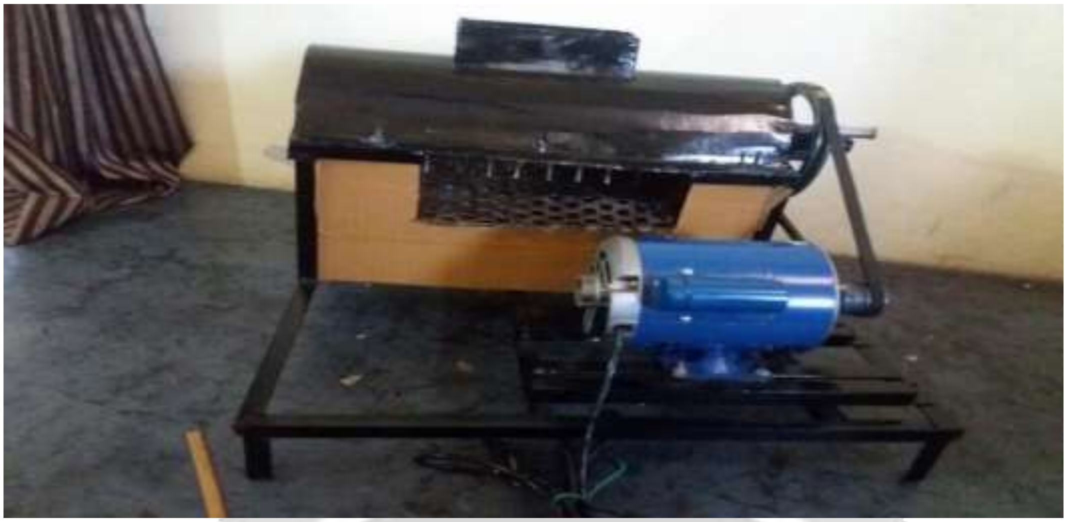

Fig no. 5.1 fabricated model

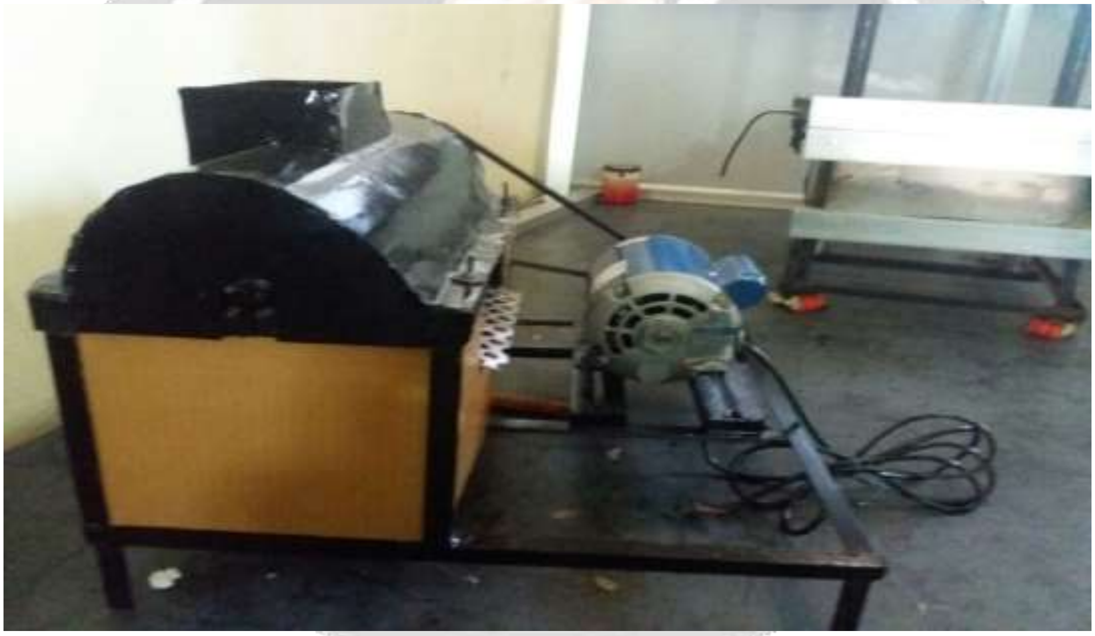

Fig. no. 5.2 side view

6. Results and discussion

The results obtained from the experiment was recorded and. The feed rate and threshing rate were obtained as a function of time while the separation efficiency was found by subtracting the weight of cobs collected at the exit spout form total sample collected and multiplying by 100 %. Threshing efficiency was obtained using the equation. All the results obtained were analyzed to obtain their best fit .

Testing Results

Sr. No.	Weight	Time (sec)
1.	0.5 Kg	60
2.	1 Kg	125
3.	2 Kg	200

Table no. 6.1 testing result

7. Advantages

a) Easy to operate and Portable
b) We can use it in load-shading area

8. Application

a. Agriculture (Farmers)
b. Small scale industry

9. Conclusion

a. The AUTOMATIC corn separator machine is portable as well as low cost Indian farmer can purchase it easily
b. Performance of Sheller machine is depend upon mechanical properties of Corn
c. Automatic corn separator machine can be run by manually by handle as well as automatically by motor

10. Cost Estimation

Cost Estimation Sr. No	Particulars	Material	Quantity	Cost in Rs
1	Motor	-	1nos	4000
2	L-angle (30kg)	MS	1nos	1560
3	Main Head	MS	1nos	170
4	Big Pulley	CI	1nos	420
5	Small Pulley	CI	1nos	70
6	Belt	-	1nos	320
7	Nut, bolt & studs	MS	-	470
9	Teeth	MS	8nos	500
10	Shaft	MS	1nos	390

11	Pedestal Bearing	CI	2nos	340
12	Screener	MS	1nos	500
13	Electricals	-	-	4000
14	Other	-	-	500
Process Cost				
1	Machining	-	-	500
2	Drilling	-	-	150
3	Welding	-	-	500
4	Painting	-	-	100
5	Miscellaneous	-	-	2000
Total cost				17000/-

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