Fabrication of Crop Residues Removal Machine for food crops such as corn

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Abstract: In this project, Crops residues (CRs) are roughages that become available as livestock feeds after crops have been harvested. They are distinct from agricultural by-products (such as bran, oil cakes etc).Which are generated when crops are processed. Generally any plant materials that remain after food crops have been harvested are classified as a crop residue. Apart from being a source of animal feed, residues are used as building, roofing and fencing materials, as fuel or surface mulch in crop land. Farmers use crop residues mainly in two ways, e.g.: for fuel as firewood and minor constructions, especially maize and sorghum stovers; for roofing local houses, in the case of wheat, oath or barley straws; as building material for walls of local houses, especially teff straw. But the major use is for livestock feed particularly for draught oxen during dry season.

Index Terms – Residues Remover, Blower, Lever Operated, Discharge spout

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. India is presently is in need of technology in the agricultural field. The farmers need to do all the segregating processes manually which is a cumbersome task for them and also this increases the cost of the final products. Here is a device which is based on scientific principles of machines. It is simple, cheap and maintenance free that is produced as result of this project work. The corn de-seeding machine can use in areas like mills etc. This device can cut the grains and separates the cub.
The existing methods of corn husking in agriculture industry consists of breaking the grains by hand the pieces, both of which are not effective and time consuming expose. Safety being a prime consideration, an innovative idea such as this would go long way in solving this simple but serious problem. As for as cost aspects is concerned it works much cheaper as compared to human labor, since the major component is rotating drum and casing arrangement. The size of machine is important feature in considering the capacity of the device. The operating cost of the device is low as it requires only a single person to operate as compared to manual method. Its maintenance cost is almost negligible as it requires only periodic lubrication.

Basically there are machines for De-seeding the corns but they are costlier enough so that small scale farmers can't afford it. To overcome this, we thought of developing a machine for the same purpose with minimum cost as far as possible and later we got the idea of making it automatic using the Robotic Arm. This Machine with the cylindrical rotating drum with spikes welded to it, removes the corn through the shearing action between the Maize & spikes and Maize & casing. Robotic arm, which is automatically controlled through microcontroller, is used to feed the corn to the De-seeding machine at regular intervals of time.

II. LITERATURE REVIEW

Grinding of foodstuffs can be said to have started from Adam. Records however show that during the Stone Age (About 6700BC) man ground grains of wheat with rocks to make flour. By 5500 BC came the mill stone which consists of two large individual stones between which the wheat is ground to flour. (MILLING AND BAKING INFORMATION SHEET V (2010). The industrial revolution ushered in the Buhrstone mill and the Roller mill. The buhrstone mill is probably the oldest type of grinding machine still in use today. This consists of one stationary disc of stone. Much like the millstone, though the stones grind at the interface of their mating faces. Modern Buhrstone mills have stones constructed in cast iron with faces cut in grooves and ridges. Modern horizontally shafted buhrstone mills are the conventional domestic mills used to grind tomatoes and foodstuffs. Crushing of crop residues is on the increase with the global quest for sourcing of renewable energy through pre-processing of bio-masses.

Maize, known in many English-speaking countries as corn, is a grain domesticated by indigenous peoples in Mesoamerica in prehistoric times. The Aztecs and Mayans cultivated in numerous varieties throughout central and southern Mexico, to cook or grind in a process called nixtamalization. Later, the crop spread through much of the Americas. Between 170 and 1250 BC, the crop spread to all corners of the region. Any significant or dense populations in the region developed a great trade network based on surplus and varieties of maize crops. After European contact with the Americas in the late 15th and 16th centuries, explorers and traders carried maize back to Europe and introduced it to other countries through trade. Maize spread to the rest of the world due to its popularity and ability to grow in diverse climates. Maize is the most widely grown crops in the Americas with 332 million metric tons grow annually in the United States alone (40% of the crop – 130 million tons – used for corn ethanol. Transgenic maize made up 85% of the maize planted in United States in 2009. While some maize varieties grow to 12 meters (39ft) tall, most commercially grown maize has been bred for a standardized height of 2.5 meters (8.2 ft). Sweet corn has shorter than field-corn varieties.

III. MATERIALS/COMPONENTS REQUIRED

Machine Description: the designed machine consists of the following components namely:

- Bearings
- Barrel cover
- Inlet hopper
- Maize discharge spout
- Cob discharge spout
- Blower
- Structural frame work
- Electric motor
- Pulleys
- V-belts
- Belt cover
- Bolts and nuts

The shaft carrying the spikes is suspended on two ball bearings. The spikes are arranged in spiral form (like a screw conveyor) with a uniform pitch. The bearings carrying the shaft are mounted on the structural frame work. The barrel cover carrying the inlet hopper houses the de-cobbing cylinder. The throat of the inlet hopper fits into a square hole created at one end of the de-cobbing cylinder. Both the barrel cover and decobbing barrel are static. The barrel is split into two halves but held at one side with hinges so that it can be opened and closed. The free end of the cover is provided with a locking device. The electric motor is mounted at one lower end of the structural frame. The assembled blower is mounted opposite to the electric motor. The air exit channel of the blower is connected against the maize exit spout. V-belts are used to connect the shaft carrying the spikes, the blower shaft to electric motor shaft via pulleys. All the components of the machine are mounted on a rigid structural frame work. The surface area of the de-cobbing barrel is perforated with a 12mm hole so that the de-cobbed maize grains and chaff can escape through them and fall to the collector that channels them to the maize exit spout. The assembled machine has the following dimensions: overall length = 1.28m; width = 0.92m; height = 1.39m; diameter of barrel cover = 0.32m; length of barrel cover = 1m; diameter and length of de-cobbing barrel = 0.21m and 0.95m respectively

IV. CALCULATIONS

4.1. 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

Torque T = (P) x (60) / (2 x π x N)

= (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.

4.2. DESIGN OF PULLEY

Length of belt between driving shaft and driven shaft,

d=diameter of driving pulley=50.8mm

D=diameter of driven pulley=304.8mm

C=central distance between driving & driven pulley=500mm

Length of belt L=л(r1+r2)+2X+$(r2-r1)^2$/2

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

L=1591.07 mm.

4.3. 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

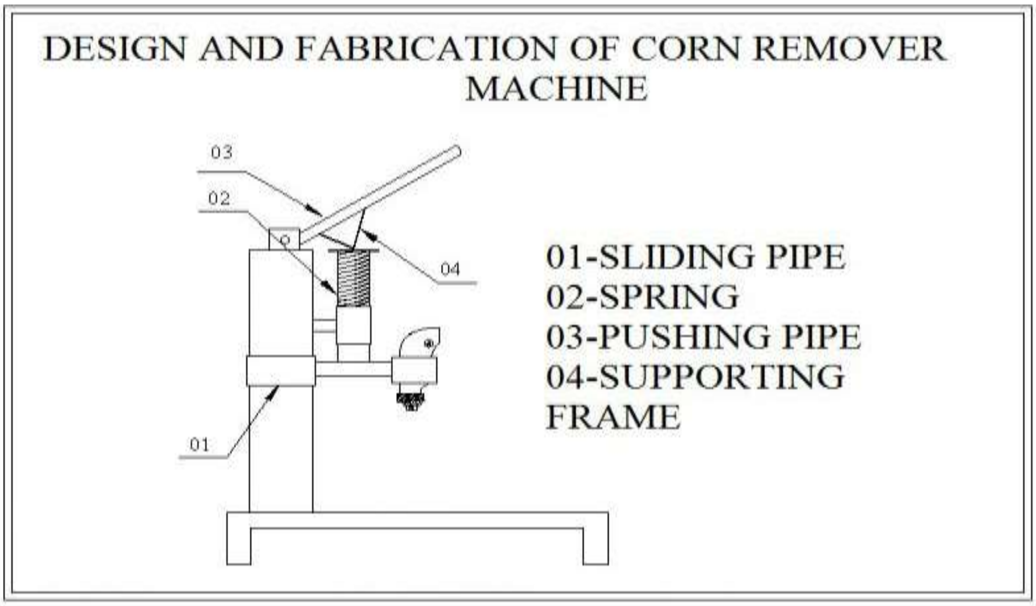

Fig.1. 2D Drawing of Corn Remover Machine

V. WORKING PRINCIPLE

Before proceeding to the process of manufacturing, it's necessary to have some knowledge about the project design essential to design the project before starting the manufacturing. Maximum cost of producing a product is established originally by the designer. General Design procedure for a product: When a new product or their elements are to be designed, a designer may proceed as follows: 1. Make a detailed statement of the problems completely; it should be as clear as possible & also of the purpose for which the machine is to be designed 2. Make selection of the possible mechanism which will give the desire motion

VI. ADVANTAGES

- The machine is in compact size.
- Reliable to operate.
- Less time consuming.
- Maintenance cost is less.
- High Production in less time (Capacity 100 to 150 kg per Hr)
- Any size of corn can be De-seeded.
- Simple in Design and Fabrication.
- No need of any safety device.
- Benefit for small and medium scale farmers.
- The machine is also used as "Mould Breaking Machine".
- There is no damage of the corn grains.

VII. CONCLUSIONS

The de-seeding machine has been designed, developed and fabricated keeping in mind the constraints and requirements of the Indian farmers. The deseeding machine was tested in the machine shop and later taken to the field. It worked well in the field conditions and gave an output of 45 Kg/hour. The maneuverability of the device is quite good and the handling is quite simple. The seed discharging mechanism is effective and corn seeds can be discharged off very easily. For commercial purpose one can improve the efficiency of the device effectively by increasing the size of the device and providing it with multiple heads. Additionally, the deseeder is a multifunctional machine that can de-seed various types of food item such as rice, chilly powering, potato past, corn de-husking etc. This can be done by changing the drum and teeth.

REFERENCES

[1] Design for a pedal driven power unit by David Weightman,Lanchester polytechnic, United Kingdom
[2] Gite, L.P. and Yadav, B.G. 1989. Anthropometric survey for agricultural machinery design, An Indian case study. Applied Ergonomics. 20: 191-196
[3] Kumar, V.J.F. and Parvathi, S. (1998). Ergonomic studies on manually operate maize Sheller, Agricultural. Engineering Journal, 7(1): 37-45.

[4] Oriaku E.C, Agulanna C.N, Nwannewuihe H.U, Onwukwe M.C and Adiele, I.D "Design and Performance Evaluation of a Corn De-Cobbing and Separating Machine" Volume-03, Issue-06, pp-127-136

[5] Akubuo, C.O. (2003) Performance Evaluation of a Local Maize Sheller: Unpublished B.Sc Thesis; Department of Agricultural Engineering, University of Nsukka

[6] Avallone, E.A, and Baumeister, T. (1997). Mark's Standard Hank book for Mechanical Engineers 11th Edition. McGraw Hill International: Mechanical Engineering Series. pp 132-137.

[7] Pratima Pandey, Jwala Bajrachrya and S Pokhare "Influence of corn seed processing with a locally produced sheller on seed quality and their damage"