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Design of a Corn Shelling Machine with an Elastic Collision System Using Iron Chains

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ABSTRACT: Corn is an agricultural product that is in great demand among farmers, because the process and care methods are not too difficult and the lifespan of corn from planting to post-harvest is 2 months. In the general production process, during shelling, many farmers still use the method of shelling using their hands or simple tools, so it requires quite a long production time. The reason people still shell them using their hands or tools is because the price of the machines is too expensive and they don't even know about corn shelling machines. The machine designed to develop a simple corn sheller for use by farmers in Merauke Regency has a capacity of ± 300 kg/hour. The impact system is used in this shelling machine to reduce the impact on the corn kernels. For this reason, in corn shelling, iron chains are used that can move elastically and flexibly.

KEYWORDS: Corn Sheller Machine, Impact System, Iron Chain

INTRODUCTION

Merauke Regency is a district that is synonymous with agriculture, both food and horticultural crops, such as corn and secondary crops. According to literacy results from the Merauke Regency BPS, many people work as farmers, one of the crops planted is corn, the corn which the people plant is quite extensive, up to approximately 300 Ha. At harvest time, there are still many people who shell corn manually, namely by hand or by using simple tools such as TPI type corn shellers and rotating iron shellers.

As business technology develops in the agricultural industry, which is increasingly developing and sophisticated, farmers no longer use conventional tools to carry out shelling. Corn is the second staple food after rice. Apart from being a substitute for rice, corn can also be used as animal feed and industrial raw materials. Corn is an agricultural product that has a low sugar content, so corn products are widely used to produce products such as flour, oil, sugar and so on. To obtain these processed products, the production system requires more effective and efficient tools or machines to improve quality and speed up work for the corn shelling process.

There are many conventional corn shelling machines on the market that use the TPI type, tire type and semi-mechanical type. Inefficient results were obtained and the corn kernels were damaged (broken). Therefore, the impact system used in this research can reduce the level of damage to the corn kernels and improve the quality of shelling. The differences between the machines are as follows: the machine blade uses an iron chain so that the processing and maintenance process is easier, the blade uses an iron chain so it is more flexible in the processing process, has a separation

Stage between the corn kernels and the corn cobs so that the corn kernels come out clean and not there are weevils, the

Corn kernels are not damaged, and the process of operating the equipment saves more human energy.

THEORETICAL BASIS

1. Bearing

Bearings are one of the machine element components with the function of supporting the shaft so that it can rotate with as little friction as possible.[5] Bearings are classified into 2 parts, namely:

a. Rolling Bearings

Through rolling elements such as balls, rollers and round rollers, rolling friction occurs between the rotating and stationary parts.[5]

b. Based on the direction of the load on the shaft

Radial Bearing Perpendicular to the axis is the direction of the load supported by the radial bearing. Meanwhile, the Axial Bearing of the shaft axis is the direction of the axial bearing load.

2. Shaft

The shaft is a part of the material that transmits rotating motion and power. Usually round in cross-section. This shaft planning is a basic problem, where the shaft will receive bending loads, tensile loads, compressive loads, or torsional loads whether they work alone or in combination with one another. In shaft planning, conditions that need to be taken into account are shaft load, shaft strength, critical rotation and corrosion.[5] torsional loads and bending loads

or a combination of twisting and bending loads can be experienced by a shaft. The calculations are as follows:

1. Calculate the design power
   Pd = Fc . P (KW)
   Where
   Pd = design power (KW)
   Fc = correction factor
   P = nominal power (KW)
2. Calculate the moment that occurs on the shaft

$$T = 9{,}74 \times 10^5 \frac{P_d}{n_1}$$

   Where
   T = design moment (kg.mm)
   n_1 = shaft rotation (rpm)
3. Calculate the shaft diameter

$$d = \left[\frac{5{,}1}{\tau_a}\sqrt{(K_m M)^2 + (K_t T)^2}\right]^{1/3}$$

where shaft diameter (mm) (d), bending moment correction factor (km), bending moment (kg.mm) (M), twisting moment correction factor (Kt), twisting moment (kg.mm) (T).

The blade for designing this corn shelling machine uses a ship's anchor chain measuring 8 mm.

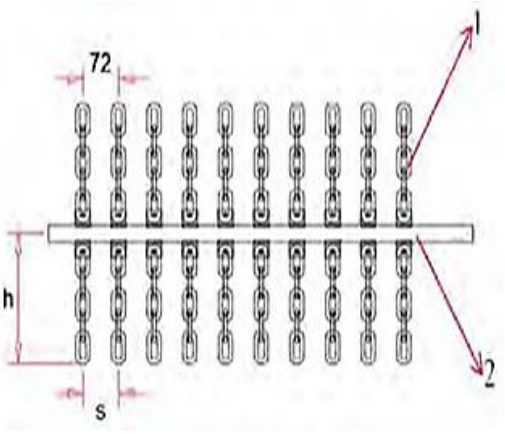

Figure 1. Corn sheller thresher eye

METHODOLOGY

The implementation procedure is the initial process in working on or forming a tool after the materials and tools have been provided. The implementation procedures are as follows:

1. Preparation of tools and materials used.
2. Formation of the machine frame or legs of the machine using angle iron.
3. Cutting the cylinder or shelling chamber for the inlet channel (hoper) and exhaust channel for the corn cobs, as well as the outlet channel for the results of shelling the corn kernels.
4. Formation of a funnel for the outlet of the shelling products using plate iron.
5. Formation of the hopper using plate iron.
6. Combine components by welding, and paint the machine.

Corn Sheller Machine Specifications: Engine speed 1400 rpm, Drive motor power 1 HP, Pulley diameter (1) = 101.6 mm, Pulley diameter (2) = 304 mm, V-belt circumference length 919.3 mm, Machine dimensions 100 cm x 50 cm x 130 cm, and uses 2 bearings as fulcrum.

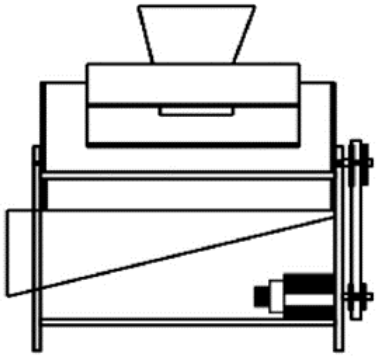

Figure 2. Sketch of Modified Machin

RESULTS AND DISCUSSION

Results Test results at 460 rpm

Table 1: Shelling Results

No	Number of corn cobs (m^3)	Time (menit)	Amount of corn shelled (kg)	The amount of corn has not been shelled (kg)
1.	0,05 m^3	1	6.5	0,05
2.	0,05 m^3	1	6.4	0,1
3	0,05 m^3	1	6.4	0,05
4.	0,05 m^3	1	6.5	0,1
5	0.05 m^3	1	6.5	0.05
Average	0.05 m^3	1	6.46	0.05

DISCUSSION

From the results of testing this corn sheller, the results of shelling within 1 minute were 6.46 kg of shelled corn. So that in 1 hour of operation, 6.46 x 60 = 387.6 kg of shelled corn is obtained. Meanwhile, corn that has not been shelled is 0.07 kg. For this reason, it takes more time to open the exit of the corn cob ejection funnel so that the unpopped corn can be completely shelled. This can be done because even with higher rotation the level of corn damage is almost non-existent.

CONCLUSION

The conclusions drawn from the results of designing the corn sheller tool are as follows:

Dimensions of the corn sheller:

1) Length = 100 cm
2) Width = 50 cm

3) Height = 130 cm
4) Bearing = UCP 212
5) Shaft = S45C
6) Shaft Speed = 456rpm
7) Capacity = 387.6 kg / hour

Even though the design of this corn shelling machine has met expectations, there are still many shortcomings. Therefore, improvements still need to be made and require ideas or thoughts from various groups of students and lecturers, so that the system of this machine operates more effectively and efficiently than what I have done. The suggestions that the author conveys are as follows:

a. When planning machine components, you are expected to know and study the sciences related to machine elements.
b. Carry out various considerations in selecting the materials and machine components that are planned.
c. Economic considerations so that machine manufacturing costs are cheaper should not limit the level of design creation and innovation.

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