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DESIGN AND DEVELOPMENT OF PEDAL OPERATED MAIZE DESHELLER- A REVIEW

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ABSTRACT
Lack of Corn processing machines, especially Maize Sheller, is a major problem of Corn production, especially in our country India. In this paper basic review of research-work for design, fabricate, and performance evaluation of a Corn Sheller consisting of feed hopper, shelling unit, separating unit and power system is carried out .The performance of the machine was studied in terms of throughput capacity, shelling efficiency, material efficiency and mechanical damage. Regression models that could be used to express the relationship existing between the Sheller performance indices, pod moisture content and feed rate were establish. This paper describes about the design of various components of Maize Sheller machine using different methodology. The machine could be operated continuously for a comparatively long time with high shelling rate without causing damage to kernels. Four shelling units can be provided for shelling of maize cobs and operated with the chain and sprocket arrangement. The results revealed that the machine was easy to operate with an average kernel shelling rate of 110 kg/hr when operated by two persons with no any kernel damage. Overall, this paper involves study of different processes like design, fabrication and assembling of different components etc.

KEYWORDS: Maize, Sheller Machine, Design, Efficiency, Fabrication, Cost, Pedal Power, Bicycle chain, Maize Desheller

INTRODUCTION

In our country, most of the farmers shell maize by mainly three methods namely shelling cob grain by hand; hand operated maize Sheller and beating by stick method were carried for removing corn kernel from the cob. There are several electrical operated Corn shelling machines for mass shelling. Mostly farmers used to take their unshelled Corns to such industries were they get their final product that is shelled Corn and then they used to sell this product to the market. This incurred the cost of transportation between farms to machine industry increase the cost of product. This concept of a technology more appropriate to the needs of developing countries can be applied equally well to agricultural Mechanization. Shelling has previously been accomplished either by rubbing the maize cobs against one another by hand or by direct removal of kernels with low shelling rate. This project is mainly about generating a new concept of Maize shell (thresh) that would make easier to bring anywhere and easier to thresh Maize.

The sole purpose of this paper is to understand the fundamental knowledge of design and mechanism of machine. The design is an environment friendly and uses simple mechanism properties such as shelling system, and automation separating system etc. In this, some threshing force is needed to thresh the Maize. The design is so done that the knowledge of designing, mechanism and forces are increased. This paper consists of designing and fabrication of an automatic Corn Sheller machine considering various important parameters. In this paper, designing & development of a machine to shell Corn so the farmers can gain high profit by selling Corn direct in market. This involves the methodology of designing the different parts of this shelling machine considering forces and ergonomic factor for people to use.

The Pedal Operated Energized Flywheel Motor has been adopted for many design of rural Applications in the last two decades In recent past a pedal powered process machines has been developed for wood turning (Modak and Bapat, 1993), washing (Dhakate,1995), brick making (Modak and Moghe, 1998). The main objective to design and develop a machine, which uses the Pedal, operated energized flywheel motor as an energy source, consisting of a bicycle mechanism, use of non-conventional energy as source Non availability of power in Interior areas and large scale unemployment of semi-skilled worker. In the context of the present condition in India of Power shortage and exhaustion of coal reserves and unemployment, it is felt that "Pedal Operated Maize Thresher" for Maize Threshing is very necessary. This machine is environment friendly i.e. non-pollutant. It will bring innovation and mechanization in agricultural engineering. Unskilled women may also get employment. Development of such energy source which has tremendous utility in energizing many rural based process machines in places where reliability of availability of electric energy is much low.

The average work rate of a Any manufacturing process requiring more than 75W and which can be operated intermittently without affecting end product can also be man powered. Such man powered manufacturing process can be based on the following concept. In this processes a flywheel is used as a source of power. Manpower is used to energize the flywheel at an energy input rate, which is convenient for a man. After maximum possible energy is stored in flywheel it is supplied through suitable drive (Gupta, 1997) and gearing system to a shaft, which operates the process unit. The flywheel will decelerate at a rate dependent on load torque. Larger the resisting torque larger will be the deceleration. Thus theoretical a load torque of even infinite magnitude could be overturn by this man- flywheel system. Pedal driven Maize Thresher operates on the basis of above principle. If such machine is developed it will be great help to farmers of rural area because it does not need conventional energy. It is environment friendly machine.

For cost evaluation purposes, the following table presents in the cost list of material of this project modification and possible construction or fabrication this design's Pedal Operated Maize Threshing Machine.

Sr.no	Description	Unit	Rupees/-
1	L-shape beams of iron	7	4000
2	Chain drives	1	1000
3	Sprockets and pedal	1	1000
4	Chain	1	1500
5	Flywheel	1	1000
6	Threshing Unit	1	3500
7	Seating chair	1	500
8	Handle	1	500
9	Manufacturing cost	1	2000
	Total		15000/-

Although the cost of fabrication of this proposed design (standing at 15000 Rs) is less than the cost of purchase of above maize shellers described earlier, the ease of operation of the machine at an average torque presents an added advantage in terms of the Cumbersomeness and fatigue that come along with the above named Sheller's. The force input Capacity to initiate the threshing process is also very low at an average speed such that both Male and female rural farmers can operate the machine.

CONCEPT

Introducing low cost automation was to overcome problems with the current manual traditional method. In mechanism there are a numbers of uncertain shelling machine such as hand operated corn. The concept of the work is,

1) Observe the manual methods to identify the important process variables.
2) Quantify the important method.
3) Develop a prototype automation system which could control over all of the process.
4) Investigate all areas of automated forming.
5) Produce a specification for a low cost automated system.
6) Refined design of the machine & fabricate the machine, as this plays a major role in rural area. The above considering point we design the semi-automated machine which replace manual process.

OBJECTIVE

The main aim of this project is to overcome the traditional method

1) To increase the efficiency.
2) To reduced the hard work.
3) To reduced time to shell the CORN.
4) To develop a low cost machine which can be used by farmer to convert their semi-finished (CORN) into finished product (Corn).
5) Save electricity.
6) Reduce human effort.
7) Ease of Handing.

DESIGN METHODOLOGY

The manually threshing machine is made up of threshing unit, pedal, handle seat, chain and sprocket drive system and machine stand. The threshing unit is made up of zinc alloy (stand casting) which involves the following parts; mainframe, press, chamber, shelling spike-disc and cobs outlet member mounted at one side of machine stand. The machine is operated by a set of chain and sprocket drive system, the length of the chain is 174cm while the pitch circle diameter of sprocket is 7cm and 20 teeth.

Bicycle Chains are generally categorized into two types: 1/2 × 1/8 and 1/2 × 3/32. The first number (1/2) is the chain pitch; the latter numbers (1/8 and 3/32, respectively) indicate the inner width in inches.

Number 1/2 × 1/8 chain is used for simple transmission without speed shifting; it has the same construction as Standard Roller Chain. Number 1/2 × 3/32 chain is used with a derailleur. There are two types of Construction—standard roller and bushing less . In the bushing less chain, the inner link plates are extruded so that the inner plates also serve as the bushings. In most derailleur transmission chains, the link plates are bent or cut so that the chains can change smoothly on the front or rear sprockets.

Applications of Bicycle Chains

Nominal Number	Pitch	Inner Link Width	Construction	Application
1/2 × 1/8	12.7	3.30	Roller Chain	Simple drive General purpose
1/2 × 3/32	12.7	2.38	Roller Chain Bushing less Chain	With derailleur Sports Racing

DEVELOPMENT OF MAIZE DESHELLER

The pedal operated maize shelling machine consist of frame, power transmission system, shelling unit, extension to shelling unit, kernel collection tray, sitting arrangement for operator, safety guards and bearings .The main frame was made of MS angles and C channels, it was made heavy to have better balance and stability during pedaling. The simple bicycle chain drive mechanism was used for transmission of power. The bigger sprocket connected with the two pedals acted as driver and drives two equal size smaller sprockets were mounted on the 20 mm diameter shafts of the shelling unit.

The pedaling can be easily done by the operator by sitting on the well cushioned seat of size 305×350 mm and the pedaling power gets transmitted to the shelling unit through the chain. The shelling unit actually shells out the kernels from the maize cob when rotated by pedal. The shelling was made up of MS round pipe of length 75 mm and diameter of 65 mm. The pipe consists of four kernels detaching strips welded along the length of pipe at equal distance (900 degree apart from one another) from inside of the pipe. Eight holes of 18 mm diameter were drilled on the surface of shelling unit to facilitate easy dropping of detached kernels from shelling unit preventing chocking of shelling unit with shelled kernels of maize.

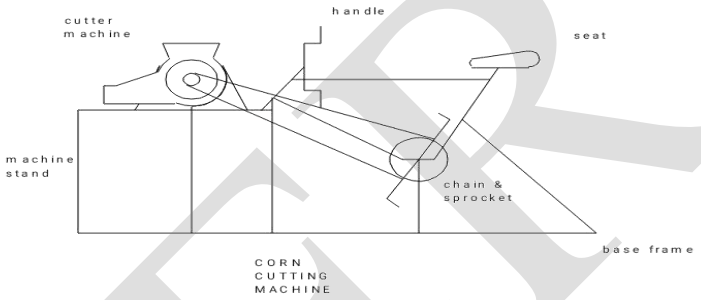

fig. Working skeleton diagram of maize desheller.

In this project we are using cycles base frame on which the corn cutting assembly is mounted. For cutting feed is given to cutter with the help of chain drive. And motion is created with the help of pedal. Material used in this project M.S pipe, angle, chain and cutter with help of this we are making assembly. There is no alternative source of this kind of work which is cut the corn seed form corn. In this project when we using pedal the motion is transmitted to shaft the though the chain wheel and chain mechanism. On that shaft the cutter is fixed which cut the corn seed.

EXPERIMENTAL ANALYSIS

SHELLING RATE

The pedal operated maize sheller when operated with two persons at a time, the kernel shelling rate varies from 100 kg/ hr to 120 kg/hr with different pair of operator with an average shelling rate of 110 kg/hr. Where as, in case of hand operated maize sheller the kernel shelling rate varies from 20 kg/hr per person to 25 kg/hr per person with an average of 23 kg/ hr per person.

SHELLING EFFICIENCY

The shelling efficiency of both pedal operated and hand operated maize sheller was almost same. The shelling efficiency of pedal operated maize sheller varied from 98 per cent to 99 per cent with an average value of 98.5 per cent. Whereas, in case of hand operated maize sheller it varied from 98 per cent to 100 per cent with an average of 99 per cent.

ADVANTAGE OF MAIZE DESHELLER

1) The power consumption is less.
2) Easy in operation.
3) Low cost.
4) Simple construction.
5) Good performance.
6) Easy to setup.
7) Light weight.
8) Easy maintenance.

CONCLUSION

The average rate of throughput of pedal operated maize sheller per person was 150 kg/hr which was 5.5 times more than hand operated maize sheller. The pedal operated maize sheller possesses the ability to shell the dehusked four maize cobs at a time easily and safely and no special skills required to operate it. The average kernel shelling rate, shelling efficiency, collection efficiency and rate of throughput of pedal operated maize sheller with two persons at a time was 110 kg/hr, 98.5 per cent, 94 per cent and 150 kg/hr, respectively as well as there was no damage to the detached kernels by pedal operated maize sheller. There is a lack of automatic operated, efficient and cheap Maize Sheller machine in market, which can be afforded by poor and marginalized farmers in developing countries. Performance of Sheller machine depends on moisture content in Maize, material feed rate and speed of blade. Sheller is design based on physical and mechanical properties of Maize. The above design procedure is been adopted for the fabrication of Automatic Corn Sheller machine which will make the product durable for long time as well as make it efficient also helps to understand the concept of design. Thus, with help of this design we can fabricate an automatic Maize Sheller machine to simply achieve high volume of profit as well as to reduce the human fatigue. After all process has been done, shelling operation may help us to understand the fabrication and designing that involved in this project.

FUTURE SCOPE OF THE PROJECT

1) Pedal operated corn deshelling machine work output will depend on the operator as well as on the machine its self. So there is lot of scope of improvement and future scope to increase the overall machine efficiency using different methodology.
2) This specific design therefore focuses on energy consideration to improve man machine system efficiency.
3) Maize desheller technology can be more cost effective when we use lesser parts so there is a scope of product development and design.

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